Town of Westlock

PROCEDURES AND DESIGN STANDARDS FOR DEVELOPMENT

October 2009

FOREWARD

This Procedures and Design Standards for Development document is intended to provide information and guidance with respect to the design, preparation, and submission of plans and specifications for the construction of municipal improvements in the Town of Westlock. These standards are intended for use by Developers, Engineering Consultants, Utility Companies, and the Town.

These standards may be purchased from the Town of Westlock.

Town of Westlock
10003 – 106th Street
Westlock, Alberta
T7P 2K3
Phone: 780-349-4444 / 1-866-349-4445
Fax: 780-349-4436
E-mail: info@westlock.ca
Website: www.westlock.ca

Section 1 – General Conditions and Procedures for Installation of Municipal Services

Section 2 – Preparation of Engineering and Landscape Drawings

Section 5 – Stormwater Management System

Section 6 – Potable Water and Sanitary Sewer Service Connections

Section 7 – Urban and Rural Roads

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1.1 Introduction

1.1.1 Scope

.1 These Procedures and Design Standards for Development shall apply to the design and installation of municipal services and utilities within the Town of Westlock. These municipal services and utilities include watermains, sanitary sewers, storm sewers, service connections, landscaping, fencing, and roads as well as all associated appurtenances that are also required for each municipal service and utility. The Town also has Master Plan documents for Stormwater, Water Distribution, Sanitary Collection, and Roads that shall be reviewed in conjunction with this document.

.2 These Procedures and Design Standards for Development do not cover the design or installation of street lighting, ornamental lighting, electric power, natural gas, telephone and cable services, but do include standards for their respective alignments.

.3 The standard drawings, as referenced throughout this document, shall form an integral part of these Procedures and Design Standards for Development.

1.1.2 Procedures and Design Standards for Development

.1 The Procedures and Design Standards for Development shall apply to their respective municipal services and utilities:

- Section 1 - General Conditions and Procedures for Installation of Municipal Services
- Section 2 - Preparation of Engineering and Landscape Drawings
- Section 3 - Water Distribution System
- Section 4 - Sanitary Sewage System
- Section 5 - Stormwater Management System
- Section 6 - Potable Water and Sanitary Sewer Service Connections
- Section 7 - Urban and Rural Roads
- Section 8 - Lot Grading and Landscaping
- Section 9 - Franchise Utilities
- Section 10 - Manufactured Homes Subdivision
- Section 11 - Recreational Vehicle Park
- Standard Drawings

.2 All municipal services shall be designed and installed as detailed in the above mentioned standards and according to the procedures established in this section. These standards also apply to re-development projects.

.3 No departure from these Procedures and Design Standards for Development shall be permitted without prior written approval from the Town Engineer or Town Representative. The Town Engineer may give verbal approval to revisions that are considered to be minor in nature. A Change Order shall be issued by the Developer and approved by the Town to formally record such revisions.

.4 The performance and responsibilities of all parties and persons carrying out the installation of municipal services shall be as described in this Section.

.5 The Procedures and Design Standards for Development outlined herein are intended to serve as the minimum standards that are to be followed by the Developer and the Developer's Engineer. Where conditions dictate, and good engineering practice requires higher standards than those indicated, the higher standards shall be incorporated into the design of the proposed development. It shall be the Developer's responsibility to ensure that this practice is followed. If a relevant government authority or approval agency has approved standards which exceed the Town's minimum standards, the higher standards shall prevail in all cases. Generally, however, there will be no departures from the standards put forth in this document without prior written approval of the Town Engineer.

1.1.3 Definitions

In these Procedures and Design Standards for Development, unless the context otherwise requires, the following words shall have the meaning hereinafter assigned to them.

.1 "Applicant" shall mean a person or corporation who has applied for approval of a proposed subdivision or to service an existing parcel of land, whether as the owner or an agent for the owner of the land included therein.

.2 "Town" shall mean the Town of Westlock.

.3 "Town Engineer" or his/her authorized representative shall mean a Town of Westlock employee who for the time being is acting for the Town or any person engaged by the Town to act on behalf of the Town.

.4 "Consulting Engineer" shall mean the Professional Engineer retained by the Applicant to be responsible for the design, layout and supervision of installation, preparing record drawings and performing those duties in connection with the provision of municipal services as set out in these procedures and design standards. The Consulting Engineer must be licensed to practice in the Province of Alberta.

.5 "Contractor" shall mean any person, persons or corporation which shall undertake the installation of municipal services on behalf of either the Applicant or the Town.

.6 "Developer" shall mean the person or entity that has entered into a Development Agreement with the Town, in which the Developer has undertaken to comply with the specified technical standards and requirements of the Town.

.7 "Developer's Responsibilities" shall mean any specification statement referring to acts to be performed or materials to be furnished by the Applicant, Consulting Engineer or Contractor and shall be construed to be directed to the Developer, who shall in turn ensure that the acts are performed or materials are furnished by the Applicant, Consulting Engineer or Contractor. The Developer shall be responsible to the Town for compliance with the Design Specifications as implemented.

.8 "Municipal Improvement" shall mean any addition or modification or proposed addition or modification to a service or facility that the Town of Westlock will ultimately be responsible for. These include, but are not necessarily limited to, watermains, sanitary and storm sewers, roadways, walkways, park areas, signs, street lights and fencing.

1.1.4 General

1.1.4.1 Current Land Use Bylaw

This document is to be read in conjunction with the current Land Use Bylaw as well as the Water and Sewer Utility Bylaw that are in effect. In the event that there is a conflicting statement made in either of the Bylaws and this document about a particular subject, the Bylaws shall govern.

1.1.4.2 Consulting Engineer

The Developer shall engage a qualified Professional Engineer to undertake all phases of engineering including: the development brief, conceptual development proposal, detailed engineering design, general engineering, construction inspection, preparation of record drawings for the proposed development, and overseeing the Construction Completion and Final Acceptance inspections and signing and stamping the associated certificates. The Consulting Engineer shall design these services in accordance with accepted engineering practices to meet or exceed the minimum standards as set out in these Procedures and Design Standards for Development or established by government authorities. All plans and documents shall utilize the Standard Metric System of Units (SI).

1.1.4.3 Review and Construction Costs

The Developer shall be responsible for any review costs incurred by the Town as a result of the review process related to the proposed development. Costs include, but are not limited to the following:

- Specialized consulting expertise required by the Town to review development briefs, conceptual development proposals, detailed engineering designs and specifications, and proposals for deviations from these Procedures and Design Standards for Development.
- Review of re-submissions resulting from errors, omissions, or lack of sufficient information provided.
- Failures to follow the procedures as established in these standards.
- Specialized consulting expertise during and after construction to conduct periodic site inspections and participate in the Construction Completion and Final Acceptance process.

The anticipated review costs will be incorporated into the Development Agreement and agreed upon by the Developer and the Town.

The Developer shall also be responsible for all costs associated with design and construction of the works for the proposed development to meet these

standards. Further, the Developer shall also be responsible for all costs associated with the restoration of existing infrastructure impacted by the proposed development.

1.1.5 Submission and Approval Procedure

1.1.5.1 Development Brief

.1 Development of new areas requires the subdivision of land in accordance with procedures and requirements set out in the Municipal Government Act as well as the Subdivision and Development Regulations. The Town is to be kept informed with respect to all proposed developments. To this end, the Developer must present his/her Development Brief to the Development Officer at an early stage so that the proposal can be reviewed and commented on prior to giving approval in principle of the proposed development and completing the required application form. The Development Brief may require the approval of Council before proceeding to the Conceptual Development Proposal stage.

.2 A Development Brief is a document related to a proposed development that explains the following: how the proposed development meets the requirements of established land use planning for the area being considered, the development concept, proposed layout, and any identified constraints.

1.1.5.2 Conceptual Development Proposal

.1 After the conclusion of the preliminary discussions regarding the Development Brief and prior to any construction taking place, the Developer shall submit a Conceptual Development Proposal to the Town. The proposal should include all pertinent information as to standards of construction, anticipated types of development, requirements for capacity of watermains, sanitary and storm sewer mains, roadways, street patterns, utility easements and other significant aspects relating to the proposed development.

.2 The Conceptual Development Proposal shall include drawings at a scale of 1:1000 meters or 1:2000 meters. These drawings shall outline the proposed concept for the layout of all lots, blocks and roads, as well as site services and landscaping improvements. The plans will be accompanied with detailed calculations supporting the means by which the development will be serviced. The following information shall be included on the drawings or submitted as supplemental information:

- Preliminary subdivision/development plan
- Preliminary Lot grading plan
- Contours of existing land surface relative to geodetic elevation datum
- Location and size of watermains complete with hydraulic network analysis
- Location and size of sanitary sewer mains and lift stations (if

required) complete with hydraulic capacity analysis
- Location and size of storm sewer mains, stormwater management facilities and outlet details complete with stormwater modelling calculations (major and minor systems)
- Proposed road widths
- Traffic impact analysis (if required)
- Impact(s) of servicing requirements on existing facilities
- Conceptual landscape plans
- Proposed rights-of-way (ROW's), easements, and utility lots
- Other information that the Town considers necessary to facilitate the proper assessment of the proposed development
- Phase 1 Environmental Site Assessment (if required)
- Hydrological and/or Geotechnical Soils Investigation reports

1.1.5.2.1 Overall Layout

.1 Overall Design

Overall designs for proposed developments shall conform to the Master Water, Sanitary Sewer, Stormwater Drainage, and Transportation Plans of the Town, as well as the General Municipal Plans and the Land Use Bylaw.

.2 Overall Development

The proposed development shall be designed in such a manner that proper consideration is given to the overall development of the Town. In the designs, the proposed development shall adequately account for future expansion of adjacent areas. Connections to existing infrastructure shall not create overloads on existing services and systems.

The inclusion of oversized services to provide sufficient capacity for future developments shall be carried out at the Developer's expense or as specially agreed to in the Development Agreement.

.3 Layout Concepts

Lot sizing, widths of rights-of-way for traffic and other services, park reserves, densities and zoning concepts should be approved in principle by the Town prior to submission of detailed plans. This allows for the incorporation of any necessary or desirable revisions without requiring major changes at the detailed plan submission stage.

.4 Rights-of-way and Easements

Rights-of-way and/or easements shall be provided for all municipal utilities that are not located within roads, lanes, or utility lots. These rights-of-way and/or easements include, but are not limited to, those provided for back/side of lot drainage, ditches or watercourses accommodating surface runoff, and shallow utilities.

1.1.5.2.2 Municipal Services

.1 Servicing Regulations

The type and extent of servicing shall be in accordance with the Development Agreement and the approved engineering plans, specifications, and regulations for each municipal improvement.

.2 Service Connections

Potable water, sanitary sewer, and storm sewer (where applicable) service connections will be extended 1.85 meters into the lot beyond the property line. Electric power, telephone, and cable service connections shall be installed underground and shall extend 0.15 meters into the utility easement at the front of the lots.

.3 Municipal Service Upgrades in Developed Areas

For new developments, or re-development projects that are proposed for previously developed and serviced areas of Town (i.e. in-fill), the Developer shall be responsible for all costs associated with all off-site potable water, sanitary sewer, and storm sewer (where applicable) extensions that are required to properly service the development. The Developer shall also be responsible for all costs associated with any off-site upgrading that is required for the existing potable water, sanitary sewer, and storm sewer systems as a result of the development and extensions of all shallow utilities to and within the site as well as restoration of existing roads, public walkways, and landscaping that are impacted by the development.

.4 Canada Post Community Mailbox Units

The Developer shall co-ordinate the proper location of Canada Post's Community Mailbox units with Canada Post. The proposed locations shall be subject to approval by the Town Engineer. The Developer is encouraged to contact Canada Post early in the planning process

1.1.5.2.3 Existing Utilities

.1 Available Capacity of Existing Utilities

The Town of Westlock makes no guarantees respecting the capacity, depth, size, condition or suitability of any of the existing utilities that currently service the Town. Available record information shall be provided by the Town's Engineers to assist with the initial assessment of these items. However, if the available information is insufficient, it shall be the Developer's responsibility to properly investigate and ascertain these design conditions, as required, to understand how best to service the proposed development.

.2 Connections to Existing Utilities

The Developer shall file a request for a connection(s) to existing utilities with the Town at least 48 hours prior to starting work on the connection(s). In the event that existing utilities will require their services to be disrupted, the Developer will notify all affected customers of the disruption. The Developer must have all necessary materials, equipment, and labour on hand at the start of the work so that the connection(s) will be made to the existing utilities in the shortest amount of time possible. Depending upon the length of the service disruption, the Developer may have to provide temporary services to affected customers at its sole expense. Only Town delegates can operate existing boundary valves.

.3 Interference with Existing Utilities

The installation of new utilities shall be done in such a manner as to minimize any interference with the proper operation of existing utilities. Any additional costs incurred by the Town related to the installation of new utilities by the Developer shall be the sole responsibility of the Developer.

.4 Temporary Road Closures

In the event that an existing road must be partially or fully closed due to construction activities, the Developer shall provide all necessary detour routes, traffic control signs, flagmen, and barricades to provide for the orderly and safe control of traffic around the construction area. The Town must be notified at least 48 hours in advance of any anticipated road closures or disruptions and appropriate permits must be obtained by the Developer from the Town.

.5 Road Crossings

Any existing infrastructure disturbed during construction activities shall be returned to proper operational condition as soon as practically possible. Where it is necessary to excavate an existing road or lane for the purpose of providing an open trench crossing for utility installation(s), such excavations must be backfilled with compacted fillcrete, sand and/or gravel material to the satisfaction of the Town Engineer. Compaction shall be 98% of Standard Proctor Density (SPD) as a minimum. As appropriate, the surface will be reinstated with a minimum of 100 mm of surface HRA. The Developer shall be responsible for all necessary repair work needed to correct any deficiencies that result from trench settlements or surface deterioration for a period two years from the time that the installation of the utilities was completed.

.6 Materials

All installed materials associated with the development shall comply with the most recent and applicable standards belonging to the American Water Works Association (AWWA), American Society for Testing and Materials (ASTM), or Canadian Standards Association (CSA).

1.1.5.3 Development Agreement

Prior to the detailed engineering design approval and authorization to proceed with construction, the Developer and the Town will enter into a Development Agreement. The general guidelines for the preparation of the Development Agreement are as follows:

1. The Town will secure and engage legal counsel to prepare a Draft Development Agreement. The legal costs associated with the preparation of this agreement will be the responsibility of the Developer.
2. The Draft Development Agreement will be issued to the Developer for review.
3. Once agreement is reached between the Developer and the Town on the content and requirements of the Draft Development Agreement, a final version will be prepared by legal counsel for execution by both parties.
4. The Final Development Agreement, once signed by the Developer, will be reviewed in a closed session of Council for approval. Exceptions to this may be granted for smaller scale in-fill and redevelopment projects where Town administration may approve the Final Development Agreement without the requirement of Council review and approval first.

5. If approved, the Final Development Agreement will be executed by the Town and a copy of the fully signed document will be issued to the Developer.
6. No construction can commence until the Final Development Agreement has been endorsed and the necessary securities lodged with the Town.

1.1.5.4 Detailed Engineering Design

.1 The Consulting Engineer shall be responsible for the design and preparation of drawings and specifications for all municipal services and utilities (including lighting, telephone, natural gas, electric power, and cable) as required by the Town. These municipal services and utilities shall be designed to meet (as a minimum) or exceed the Procedures and Design Standards for Development put forth in this document.

.2 The Design Drawings shall show all relevant existing and proposed municipal services and utilities. The Consulting Engineer shall be responsible for coordinating construction activities with the appropriate utility companies in order to properly establish the location of any existing and proposed municipal services and utilities. Power, gas, telephone, and cable service must be shown as part of the detailed engineering drawing set.

1.1.5.5 Submission of Detailed Engineering Design

.1 Upon completion of the Detailed Engineering Design Drawings, the Consulting Engineer shall submit the following to the Town Engineer for review:

a) Two (2) complete sets of Design Drawings and Specifications.
b) Detailed sanitary and storm sewer capacity and pipe loading calculations.
c) Revised water distribution system network analysis as specified in Section 3 if different than the one submitted in the Design Brief.
d) Traffic impact analysis (if required).
e) Landscape design.
f) Copies of all required regulatory approvals from provincial and federal authorities. No construction shall commence until all approvals are received from all applicable statutory authorities. These authorities may include, but are not limited to; Alberta Environment under *EPEA*, Drainage License(s) for stormwater management, Phase 1 Environmental Site Assessment, Biophysical Report, Wetland Assessment Report, and the like.
g) Print(s) of any registered plan(s) of the subdivision/development (if not previously supplied by the Applicant).

.2 All proposed roads on the drawings shall be named. Existing road names shall also be shown on the drawings for reference. Proposed road names must be approved by the Town prior to submission of drawings.

.3 The Consulting Engineer shall bring to the attention of the Applicant, and the Town, the need for any rights-of-way outside of the proposed development which the Applicant may have to obtain.

.4 The Consulting Engineer shall bring to the attention of the Applicant, and the Town, the need for any oil/gas pipeline or other utility/service crossing agreements/relocations which the Applicant may have to obtain.

1.1.5.6 Preliminary Detailed Engineering Design Review

All Design Drawings, Specifications, and relevant data shall be reviewed by the Town Engineer prior to final design review. Any revisions or modifications to the design that are requested by the Town Engineer shall be incorporated into the Final Detailed Engineering Design Drawings.

1.1.5.7 Final Detailed Engineering Design Review

.1 Upon completion of all revisions and modifications, the Consulting Engineer shall submit four (4) sets of Final Detailed Engineering Design Drawings and Specifications to the Town Engineer for review. The purpose of the Town's review of the Detailed Engineering Drawings is to review the compliance with the Town's Procedures and Design Standards for Development as detailed in this document. Review certification by the Town does not, in any manner, imply approval of the technical aspects of the reviewed design.

.2 Upon completion of final design review, the Town Engineer shall signify they have been reviewed and are considered satisfactory for construction via signature on the drawings. One set of the signed drawings will be returned to the Consulting Engineer.

.3 No construction activities will be started within any parcel of land or on any of the municipal services or utilities to be provided by the Applicant until the Town has approved the Final Detailed Engineering Drawings and Specifications, the subdivision/development plans are approved, all regulatory approvals are in place, the Development Agreement has been signed by both parties, and security requirements have been lodged in full with the Town.

1.1.5.8 Right-of-Way Documents

Where easement or right-of-way documents are deemed necessary, they shall be prepared and registered at Land Titles by a registered Land Surveyor at the Applicant's expense. Detailed Engineering Drawings shall identify all rights-of-way and easements as required by the Town for registration purposes.

1.1.5.9 Existing Utility Crossing Agreements

.1 Where existing utility crossing agreements are deemed necessary, they shall be obtained from the appropriate utility at the Developer's expense prior to construction.

.2 It is the responsibility of the Developer to complete a title search to determine the existence of any operational or abandoned utilities within the boundaries of the proposed development. Relocation or reinstatement/rehabilitation costs are those of the Developer.

1.1.5.10 Engineering Design Revisions After Approval

Whenever it is necessary, for any reason, to make changes to the Detailed Engineering Design Drawings and Specifications after they have been approved, two (2) copies of each original drawing or specification affected shall be submitted to the Town Engineer with the proposed changes shown in red ink. The drawings and specifications shall be accompanied by a letter outlining the reasons for the requested changes. If the changes are accepted, one (1) copy of the requested changes will be signed and returned along with a letter authorizing that the proposed changes are acceptable. It should be noted that changes are not to be made to any accepted drawings or specifications without following this procedure.

1.1.5.11 Construction Approval

.1 Upon receipt of approved Final Detailed Design Drawings and Specifications from the Town, the Developer may proceed with the construction of the proposed municipal services and utilities subject to the following:

a) Satisfactory execution of the required Development Agreement.
b) Subdivision/Development approval.
c) Applicant has obtained all required Municipal, Provincial and Federal Regulatory Approvals, and the like (crossing agreements etc.).
d) All required fees have been paid to the Town.
e) Security has been provided to the Town in accordance with established policy.

.2 A clean copy of all accepted drawings and specifications shall be maintained at the construction site during the installation of the municipal services and utilities.

.3 Underground municipal services and utilities shall not be permitted to operate as part of the existing systems until such time as the respective services and utilities have been properly inspected, tested, and approved in writing by the Town Engineer. Formal approval shall be in the form of an approved Construction Completion Certificate issued to the Developer by the Town (see Section 1.1.4.12).

1.1.5.12 Engineering Supervision

.1 The Consulting Engineer shall be responsible for the layout, inspection, approval of materials, and the supervision of the installation of all municipal services and utilities which are the responsibility of the Applicant. The Consulting Engineer or his authorized representative shall have a presence on site during the installation to the extent necessary for the Consulting Engineer to sign and stamp the Construction Completion Certificate and the Final Acceptance Certificate.

.2 In addition to supervision carried out by the Consulting Engineer, the Town Engineer may periodically review the work. The Town Engineer shall bring to the attention of the Contractor and/or the Consulting Engineer, the use of any unacceptable materials, practices, or safety concerns. If remedial action is not taken to the satisfaction of the Town Engineer, he/she may order a stoppage in the work.

.3 If the Consulting Engineer wishes to make any changes in the design of the proposed development and associated infrastructure, either before or during the execution of the work, he/she shall first submit a marked drawing showing the proposed revisions to the Town Engineer. If approval of the revised design is granted, the original drawing(s) shall be immediately revised and new drawings issued.

1.1.5.13 Survey Control System

.1 The Developer shall provide a survey control system within, and adjacent to, the proposed development. The survey control system shall consist of survey monuments that are of a design that is mutually acceptable to both the Town and Alberta Sustainable Resource Development (SRD). The survey monuments shall be placed so that the distance between adjacent pairs is approximately 300 meters. Measurements shall be made between monuments and connections shall be made to existing geodetic monuments to not less than third order specifications as defined by the Geodetic Survey of Canada, to establish vertical and horizontal coordinates based on a three degree transverse mercator projection. The Town and Alberta Sustainable Resource Development shall be provided with the survey measurements, to the satisfaction of the Director of Surveys, Alberta Sustainable Resource Development, for the survey control system.

.2 The Developer shall ensure that all existing and new monuments are properly preserved. Should it be necessary to destroy a monument, the Developer shall establish a new one in lieu of the lost monument and provide the Town and Alberta Sustainable Resource Development with survey measurements for its proper location to the satisfaction of the Director of Surveys.

.3 Any legal pins disturbed or removed during construction must be replaced prior to Final Acceptance by the Town. The Developer shall supply certificates from a registered legal land surveyor, who is registered with the Province of Alberta, that all lot and corner pins are intact and in their proper locations.

1.1.5.14 Testing

It shall be the responsibility of the Consulting Engineer to ensure that the Contractor properly disinfects and pressure tests all watermains and tests all sanitary sewers prior to acceptance by the Town. The Town Engineer shall be advised at least 48 hours prior to any testing so that he/she may make arrangements to witness the testing. The results of all tests shall be submitted to the Town for review.

1.1.5.15 Record Drawings

Within a six (6) month timeframe after the date of Construction Completion of all construction works is obtained, the Consulting Engineer shall submit Record Drawings to the Town Engineer. The Record Drawings shall be in AutoCAD and PDF format submitted on CD-Rom or DVD plus one full set of mylar prints.

1.1.5.16 Municipal Acceptance and Maintenance Period

.1 Upon Construction Completion of the project, and after all the deficiencies have been corrected, and supporting documentation received (water pressure, microbiological testing results, materials testing, CCTV inspection results of sanitary and stormwater services and the like), the Town Engineer shall issue a Construction Completion Certificate(s) to the Developer, notifying the Developer of the following:

a) Acceptance of the work by the Town.
b) Commencement date of maintenance period for all constructed municipal services and utilities.

.2 The Development Agreement shall contain the specified maintenance periods for various aspects of the development. The Developer shall be responsible for, at his/her own expense, all remedies to correct any defects, faults, or deficiencies in the completed works during the identified maintenance period(s). The maintenance period(s) shall commence on the date of issuance of the appropriate Construction Completion Certificate(s).

.3 Upon completion of the identified maintenance period(s), and after final inspection and correction of all deficiencies thereof, a Final Acceptance Certificate will be issued by the Town Engineer.

1.1.5.17 Building Permits

Generally, Building Permits shall not be issued until the subdivision/development plan is registered, all essential municipal services and utilities have been provided and inspected as specified in the Development Agreement, and all Record Drawings have been submitted to, and accepted by, the Town Engineer. Exceptions may be made to these requirements for the construction of "show homes". The Town will make a decision on these types of situations on a case by case basis.

1.1.5.18 Approval Procedure for In-fill/Redevelopment Service Connections

For smaller scale in-fill and redevelopment projects where new service connections for potable water and sanitary services are required, the Developer shall submit the following information in support of their permit application prior to any excavation and construction work related to the services being approved:

a) Scaled drawings showing how the service connections will be made including dimensional information referenced to the property lines and depth information referenced to the finished surface grades. For large scale or complex projects/developments, the Town may require that the drawings be stamped and signed by a Professional Engineer licensed in the Province of Alberta.
b) A listing of all materials to be used to make the service connections (pipe materials, special fittings, insulation if required, other appurtenances).
c) Trenching details in relation to backfill materials and methods of compaction.
d) Restoration details in relation to describing how concrete curb/gutter, asphalt road, gravel road, and landscaped areas will be restored to the Town's standards and what materials will be used.
e) Itemized listing of costs for trenching (including excavation, backfill, and compaction), materials, and surface restoration complete with quantities and unit rates.
f) Itemized listing indicating which of the following standard drawings are applicable to the project:
    I. 3-1 Typical Trenching Detail
    II. 3-2 Standard Hydrant Connection Detail
    III. 3-3 Buried Valve Detail
    IV. 3-4 Thrust Block Detail
    V. 4-1 Standard 1200mm Manhole
    VI. 4-2 Standard 1200mm Perched Manhole
    VII. 6-1 Standard Sanitary Service Connection
    VIII. 6-2 Standard Water Service Connection
    IX. 7-12 Straight Faced Curb and Gutter
    X. 7-13 Rolled Faced Curb and Gutter
    XI. 7-14 Separate Walk and Driveway Access
    XII. 7-15 Rolled Monolithic Curb and Gutter
    XIII. 7-16 Straight Faced Monolithic Curb and Gutter
    XIV. 7-17 Paraplegic Ramp

It shall be noted that the security deposits required by the Town for these service connections will be based on the costs provided under item “e” above for the portion of the works that impact public/municipal infrastructure only. Costs for works within private property will not be factored in the security deposit requirements.

END OF SECTION 1

2.1 Engineering and Landscape Drawings

2.1.1 Scope

.1 Section 2.1 of these Procedures and Design Standards for Development shall govern the preparation of Detailed Engineering, Landscape and Fencing, and Shallow Utility Drawings for all municipal services, utilities, and landscaping.

2.1.2 Drawing Size, Material, and Basic Layout

.1 "ANSI D" (558.8 mm x 863.6 mm or 22 inches x 34 inches) drawing sizes shall be used for all Engineering and Landscape Drawings

.2 Original Engineering and Landscape Drawings shall be prepared in printed ink on bond paper.

.3 Plan/profile drawings shall be used for roads and utilities with the profile located at bottom of the drawing. The plan views shall not extend onto the profile section of the drawings. All profile views must be located on the profile section of the drawing.

.4 Proper title blocks and legends shall also be included on all drawings. All title blocks shall contain the following information:

- The Town of Westlock logo (on cover sheet only)
- Project name or name of development
- Descriptive drawing name and number
- Legal description of development (only on cover sheet and on plan showing Tentative Plan of Subdivision and Utility Right-of-way Plan)
- Name of responsible consulting firm
- Name of developer on every drawing and cover sheet
- Consulting firm's permit to practice stamp
- Professional engineer's stamp
- Draftsperson and designer identification
- Design reviewer identification
- Submission and revision list
- Legend (if not on a separate plan)
- Scale
- Date of latest revision

2.1.3 Recommended Drawing Scales

The following drawing scales are recommended for use with respect to the Engineering and Landscape Drawings. Alternate drawing scales may be used with the ultimate goal of adequately presenting the design information in a clear and concise manner.

- Key Plans – 1:5000 meters
- Overall Plans – 1:1000 meters
- Plan/Profile Drawings – Horizontal at 1:500 meters, Vertical at 1:50 meters
- Cross Section Drawings – Horizontal at 1:100 meters, Vertical at 1:50 meters
- Landscaping Plans for Subdivision – 1:1000 meters
- Landscape Planting Plans – 1:500

2.1.4 Drawing Technique

.1 The following items shall be adhered to when preparing the Engineering Drawings:

a) Ensure a balanced distribution of details throughout the drawings.
b) Letters and figures shall be clearly legible, 2 mm size or larger, well spaced, properly formed, and properly proportioned.
c) Line work shall be uniform in weight and density.
d) Dimensional information should be referenced to an established survey control point or any other reference that can be readily established. All dimensions shall be in SI units (Standard Metric System Units to 2 decimal places).
e) Drawings shall be prepared in AutoCAD format and must be compatible with the version currently being used by the Town.

2.1.5 General Requirements for all Engineering Drawings

.1 Elevation data shall be relative to the Alberta Survey Control system (geodetic datum). References to Alberta Survey Control Monument (ASCM) and elevations shall be shown on the Engineering and Landscape Drawings.

.2 Where more than one profile drawing is being used, clearly identify each. Continuous stationing shall be used whenever possible.

.3 A north arrow, adjacent lot and plan numbers, road names, and the legal description of the parcel of land being subdivided shall be shown on the applicable Engineering Drawings. North arrows shall be orientated towards the top of the drawings wherever possible.

2.1.6 Engineering Drawing Set

The following drawings shall form a complete Engineering Drawing Set.

2.1.6.1 Cover Sheet

Cover Sheets shall show the following information:

- The Town of Westlock Logo
- Overall location of the development within the context of the Town
- Name of subdivision or project
- Stage of development (if more than one stage is planned)
- Name of the Developer
- Name of consulting engineering firm
- Name of consulting landscaping firm
- Description of the submission type and listing of previous submissions
- Date of issue
- List of drawings

2.1.6.2 Location Plan and Index Plan

The location plan and index plan may be combined into one drawing or shown on separate drawings depending on the size of the development or project. The following information shall be shown:

- Index plan shall be a copy of the legal plan indicating reference locations for each plan/profile drawing
- A complete ordered list of all drawings shall be provided
- Street names shall be provided
- Phasing/staging boundaries shall be provided

2.1.6.3 Topography and Land Use Plans

Topography and land use plans shall include the following information:

- Existing contours at 1 m intervals or less
- Existing features
- Street names, lot numbers, and block numbers
- All existing rights-of-way (ROW's) and easements including widths and alignments and above ground features

2.1.6.4 Road, Sidewalk, Walkway, and Street Furniture Plans

Road, sidewalk, and walkway plans shall include the following information:

- Road, sidewalk, and walkway widths and alignments dimensioned to the property line
- Road cross section designs by road classification
- Road structure design elements and details
- Sidewalk and walkway cross section designs by classification
- Sidewalk and walkway design elements and details
- Catch basin and drainage swale locations
- Other topographical features (i.e. ditches)
- All rights-of-way (ROW's) and easements including widths and alignments
- Adjacent roadways, existing/proposed street names
- Lot and block numbers
- Traffic markings and signage information
- Limits of construction
- Driveway locations
- Curve data information

2.1.6.5 Stormwater, Water Distribution, and Sanitary Sewer Plans

Stormwater, water distribution, and sanitary sewer plans shall include the following information:

- Label all pipe diameters and materials
- Location of all pipes and appurtenances shall be dimensioned to the property lines
- Numbering of all hydrants, valves, manholes, and catchbasins in accordance with the Town's numbering system
- Lot servicing locations, dimensions, and details
- Driveway locations
- Hydrant coverage (fire fighting)
- Lot and block numbers
- Identify easements as required
- Street names
- Lot service chart (to be completed for record drawings)
    - Includes lot and block number of each lot
    - Sanitary service invert elevation at stub
    - Sanitary service location from nearest manhole to in-line tee
    - If applicable, stormwater service invert elevation at stub
    - If applicable, stormwater service location from nearest manhole to in-line tee

2.1.6.6 Stormwater, Sanitary Basin, and Calculation Plans

Stormwater, sanitary basin, and calculation plans shall include the following information:

- Major overland flow directions of proposed and future lands
- Stormwater calculation spreadsheet
- Stormwater contributing areas, boundaries, and all future flow contributions from adjacent areas
- Stormwater pipe sizing
- Sanitary calculation spreadsheet
- Sanitary contributing areas, boundaries, and all future flow contributions from adjacent areas
- Sanitary pipe sizing

2.1.6.7 Lot Grading Plan

Lot grading plans shall include the following information:

- Original contours
- Proposed lot types and details
- Proposed front, back, and midlot elevations as well as property line elevations at distances of 10 m and 8 m from the back and front corners respectively as noted in the Standard Drawing.
- Proposed sanitary sewer and stormwater (if applicable) connection inverts at property lines
- Direction of surface drainage flows along lot lines
- Drainage easements and swales
- Ponding depths
- Hydrant locations and inverts
- Street lighting standards, pedestals, and transformers
- Storm sewer catch basins and manholes
- Canada Post Community Mailbox Unit locations (if applicable)
- Street names, lot numbers, and block numbers
- Total lot area in square meters
- Outline of the building pocket

Individual lot grading plans in 215.9 mm x 279.4 mm (8.5 inches x 11 inches) format, summarizing the above mentioned information for each proposed lot, shall be required prior to issuance of a Building Permit for that lot. See Standard Drawing No. 8-1 for required format.

2.1.6.8 Landscaping and Fencing Plans

Landscape plans shall be prepared using the appropriate road, sidewalk, and walkway plans as a base. Landscape plans shall include the following information:

- Proposed contours at 0.5 m intervals
- Identification of areas that are to receive grass seed and/or sod
- Location, number, and proper name of all trees and shrubs to be planted
- Location and number of any planting beds and materials to be planted
- Location and name of any park furniture, playground equipment, retaining walls, buildings, or other furniture being installed
- Fencing requirements
- Signage requirements
- Locations of existing and proposed utilities
- Clear delineation of all paved and landscaped surfaces
- Locations of existing vegetation or plantings
- Street names, lot numbers, and block numbers

2.1.6.9 Overall Franchise Utility Plan

Overall franchise utility plans shall include the following information:

- Alignments for proposed electric power, natural gas, telephone, and cable servicing
- Locations of existing electric power, natural gas, telephone, and cable servicing
- All rights-of-way (ROW's) and easements including widths and alignments
- Street lighting standards, pedestals, and transformers
- Locations of lot services
- Driveway locations
- Other pertinent surface infrastructure (hydrants, landscaping etc.) that may result in conflicts
- Any other existing underground or above ground utilities (including pipelines)

2.1.6.10 Detailed Plan/Profile Drawings

All underground utility and surface improvement profiles that have matching alignments shall be shown on the same drawing.

- Location, elevation, and size of all hydrants, valves, tees, crosses, and other appurtenances
- Hydrants and valves shall be properly numbered and identified to conform to the Town's numbering system
- Location of all catch basins and manholes
- Types of all catch basins and manholes (and barrel types if different than 1200mm diameter)
- Indicate invert elevations inlets and outlets of all manholes
- Catch basins and manholes shall be properly numbered and identified to conform to the Town's numbering system
- Indicate the size, type, and class of pipe for each pipe as well as the class of the pipe bedding required for proper installation
- Profiles of all pipes shall show pipe slopes, lengths, and invert elevations at all grade change locations
- Indicate the pipe capacity and calculated design flows for all pipes
- Indicate offsets of all pipes, curb and gutter, and separate walk from appropriate property lines
- Properly identify locations where and how connections must be made to existing utilities
- When watermains, sanitary sewer mains, and storm sewer mains are to be installed in a common trench, detail a typical cross section showing distances between pipes, class of each pipe, class of bedding for each pipe, and backfill specification
- All rights-of-way (ROW's) and easements including widths and alignments
- Street names, lot numbers, and block numbers
- All existing infrastructure including pipelines, powerlines, and the like (include diameter, invert, and material, identify minimum depths of cover or clearence)

- Cross-references to adjacent plan/profile drawings
- All license and agreement references including contact names and numbers for pipelines and other utilities
- References to the cadastral coordinate system with appropriate ties to Alberta Survey Control Monuments (ASCM's) for layout purposes
- Indicate road and right-of-way (ROW) widths as well as curb offsets (if applicable) measured from an appropriate property line to the curb face
- Show the Beginning of Curve (BC) and End of Curve (EC) data and locations for horizontal curves along with the delta angle, radius, tangent length and arc length for each curb
- For vertical curves, show the percent grade to two decimal places, survey coordinates and elevations of Beginning of Vertical Curve (BVC), End of Vertical Curve (EVC) and Point of Vertical Inflection (PVI), K value, and length
- Centreline elevations at lip of gutter
- True centreline chainages
- Location of catch basins and catch basin leads
- Cross sections showing road structures for each specific design and type of road being proposed
- Label road/curb slopes and curb returns

2.2 Record Drawings and Related Documents

2.2.1 Scope

This section of the Procedures and Design Standards for Development deals with the Record Drawings and Related Documents that shall be produced for all of the municipal services and utilities constructed in association with the proposed development. These drawings will cover all of the infrastructure associated with the water distribution system, sanitary sewage system, stormwater management system, road networks, and landscaping and fencing works.

2.2.1.1 General

.1 Record Drawings shall be of the same format as the approved detailed engineering and landscape drawings.

.2 The following information shall be included on each Record Drawing:

a) Date of completion of constructed works shown.
b) Name of Contractor responsible for construction.
c) Date on which record details were added to the drawing.
d) Record Drawing stamp.

.3 Record Drawings and Related Documents shall be submitted to the Town Engineer within a six (6) month time period that begins at the date of the Construction Completion Certificate when the installations are complete and all deficiencies have been corrected. Note that for every month that the record drawings are late, the date for the end of the maintenance period shall be adjusted accordingly. Four (4) copies (one redline construction drawing, two sets of prints, and one mylar set) of each Record Drawing shall be submitted. As well, record drawings shall be submitted in AutoCAD and PDF formats on CD-Rom or DVD.

2.2.1.2 Underground and Surface Construction

.1 On completion of the water system, sanitary sewer system, storm sewer system, lot services, and surface construction the Developer shall submit two (2) sets of record drawings to the Town's Engineer. The record drawings shall also be provided in AutoCAD format. Record drawings must have service connection schedules fully completed.

.2 The Consulting Engineer shall submit copies of all testing and inspection reports to the Town Engineer in electronic PDF format.

.3 The Consulting Engineer shall certify via signed letter that all of the underground work has been completed in accordance with the accepted detailed engineering drawings and specifications and that all testing results were satisfactory and that all deficiencies have been corrected.

.4 The Construction Completion Certificate will be issued only upon receipt of all satisfactory materials testing reports, water pressure and microbiological testing results, and stormwater and sanitary CCTV inspection reports.

2.2.1.3 Individual Lot Plans

Individual lot plans, as shown in Standard Drawing No. 8-1, shall be submitted to the Town Engineer for each lot developed prior to the building permit being issued. Lot plans shall be in 215.9 mm x 279.4 mm (8.5 inches x 11 inches) format and must contain all of the information required in Section 2.1.6.7.

2.2.1.4 Seasonal Conditions

Should seasonal conditions not permit the inspection of the constructed works, the issuance of the Construction Completion Certificate will be delayed until appropriate conditions exist to complete the inspection. Alternatively, a Conditional Construction Completion Certificate may be granted based on the Consulting Engineer's written certification via signed letter.

END OF SECTION 2

3.1 General

.1 The design of the Water Distribution System shall conform to Sections 1.0 and 2.0 of the *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems* as published by Alberta Environment (latest edition thereof) and as amended by these Procedures and Design Standards for Development.

.2 The current version of the Town of Westlock – Water Distribution System Master Plan shall be reviewed by the Developer and their Consulting Engineers to understand any identified system constraints and future servicing strategies that have implications for the proposed development.

.3 The Contractor may be required to tie into an existing water distribution system, or to temporarily shut off the existing water supply, in order to undertake construction activities related to the proposed development. When these situations are required, the Contractor shall take the following actions at his/her own expense:

a) Notify the Town of the proposed work and anticipated schedule.
b) Supply all water needed for the work. If the required water supply is withdrawn from the existing water distribution system, an arrangement that details compensatory requirements shall be made between the Contractor and the Town.
c) Obtain written permission from the Town prior to operating any of the Town's water valves, hydrants, or other appurtenances associated with an existing water distribution system. The Contractor shall be held responsible for any damage to existing appurtenances or the surrounding area that result from the construction activities. The Town may require their own personnel to operate the existing water valves, hydrants, or other appurtenances.
d) Provide 24 hours written notice to all customers affected by disruptions in the existing water distribution system.
e) Supply an alternate source of potable water to all customers affected by water distribution system disruptions greater than 4 hours in duration.
f) Provide an alternate continuous source of potable water to all customers that require an uninterrupted source for their daily operations.

3.2 Design Requirements

.1 The minimum sizing of distribution mains shall be as follows (note that in certain situations, oversizing of watermains may be required by the Town):

- 150 mm diameter for short single family cul-de-sacs.
- 200 mm diameter for single family residential developments
- 250 mm diameter for multi-family developments
- 300 mm diameter for industrial or commercial developments

.2 Polyvinyl Chloride (PVC) Pipe shall be used for all watermains.

.3 The Hazen-Williams equation shall be used for hydraulic calculations involving pressure pipe systems. The equation is as follows (for SI units):

$V = 0.85CR^{0.63}S^{0.54}$ where V = velocity of flow (m/s)
C = 130 (for PVC pipe)
R = hydraulic radius (m)
S = slope of energy gradient (m/m of length)
Note: nominal pipe diameters shall be used

.4 Computer modelling software shall be used for all Water Distribution System Network Analyses. Acceptable computer models are *WaterCAD* by Haestad Methods and *EPANET* by the United States Environmental Protection Agency (U.S. EPA). The requirement to complete a network analyses for the water distribution system will be given in writing to the Developer by the Town. The decision to do so will be based on the overall size of the proposed development and the scope of the work involved with respect to any modifications that need to be made to the existing water distribution system. All relevant information related to the network analyses shall be submitted to the Town in support of the proposed design.

.5 Per capita water consumption values shall be:

- Average Daily Demand (ADD) = 360 L/person/d
- Residential Maximum Daily Demand (MDD) = 2.0 x ADD
- Non-Residential Maximum Daily Demand (MDD) = 1.5 x ADD
- Residential Peak Hour Demand (PHD) = 3.0 x ADD
- Non-Residential Peak Hour Demand (PHD) = 2.0 x ADD

.6 The commercial/institutional and industrial water consumption values shall be:

- Commercial/Institutional Water Consumption = 6500 L/ha/d
- Industrial Water Consumption = 4000 L/ha/d

.6 The design population shall be the ultimate population for the area under consideration. Population numbers shall be based on the approved zoning by-law requirements.

.7 An analysis shall be made for Peak Hour Demand and mains shall be sized such that there will be a minimum residual pressure of 275 kPa (40 psi) at ground level at any location in the system.

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

.9 Fire Flow requirements shall be in accordance with the Insurer's Advisory Organization Standards (latest edition thereof).

3.3 Watermains

3.3.1 Watermain Materials and Installation

.1 Pipe material shall be Polyvinyl Chloride (PVC), Pressure Class 150 psi, Dimension Ratio (DR) 18, and shall conform to American Water Works Association (AWWA) standard C900 (latest edition thereof) for watermain diameters of 100 mm to 300 mm.

.2 Pipe material shall be Polyvinyl Chloride (PVC), Pressure Class 150 psi, Dimension Ratio (DR) 25, and shall conform to American Water Works Association (AWWA) standard C905 (latest edition thereof) for watermain diameters of 350 mm to 1200 mm.

.3 High density polyethylene (HDPE) watermains may be used for water distribution and transmission. Approval must be obtained from the Town Engineer. HDPE watermains shall be Dimension Ratio (DR) 11 and shall conform to American Water Works Association (AWWA) standard C906 (latest edition thereof) for watermain diameters of 100 mm to 1600 mm.

.4 Ductile-Iron and Gray-Iron fittings shall only be permitted when the desired fitting is not readily available in moulded PVC material. All Ductile-Iron and Gray-Iron fittings shall be cathodically protected against corrosion. All Ductile-Iron and Gray-Iron fittings shall conform to the latest edition of AWWA standard C110/A21.10.

.5 PVC moulded fittings shall conform to the most stringent of AWWA standard C907 or Canadian Standards Association (CSA) standard B137.2 (latest editions thereof).

.6 The installation of all PVC pipe and associated fittings shall conform to the latest edition of AWWA standard C605 unless amended or stated otherwise in this document.

3.3.2 Watermain Location

.1 Watermains shall be installed to provide a minimum depth of cover of 3.0 m measured from the pipe obvert to the final finished surface grade.

.2 Watermains shall be located within the road right-of-way in accordance with Standard Drawing No. 7-1 through Standard Drawing No. 7-10.

.3 A minimum 2.5 m horizontal separation shall be maintained between all watermains and any sanitary or storm sewer mains.

.4 The minimum requirement for pipe beddings shall be in accordance with the Class "B" Bedding detail shown in Standard Drawing No. 3-1.

3.4 Hydrants

3.4.1 Hydrant Materials

.1 Hydrants shall be of the "Dry-Barrel" type and shall conform to the latest edition of AWWA standard C502. Each hydrant shall include the following supplementary requirements:

a) Four-section breakaway flange.
b) Stainless steel trim (nuts and bolts).
c) Compression type shut off.
d) Design working pressure of 1035 kPa (150 psi).
e) Two 63 mm diameter hose nozzles with Alberta Mutual Aid Thread.
f) One steamer port with an outside major diameter of 146 mm, thread pitch diameter of 142 mm, inside diameter of 114 mm, and 4 threads per inch.
g) Size 12 pentagon operating nut and caps, 33 mm from tip to midpoint of flat base.
h) Hydrants shall be self draining.
i) Minimum 0.5 m^3 gravel drainage pit shall be provided at the bottom of the hydrant to allow for water draining.
j) Gate valves shall be provided on each hydrant lead.
k) Hydrant barrels shall be painted chrome yellow.
l) Tops and nozzle caps shall be painted in accordance with the National Fire Protection Association (NFPA) colour coding system as outlined in Table 3.1.
m) Hydrants shall have a 150 mm diameter riser barrel with a 125 mm bottom valve.

3.4.2 Hydrant Locations and Installation

.1 The maximum allowable spacing between fire hydrants shall be 150 m in single family residential areas, and 90 m in multi-family residential, school, and industrial/commercial areas. Additional hydrants shall be installed in high value (commercial, industrial, institutional, multi-family) property areas if deemed necessary by the Town.

.2 Hydrant locations shall be such that the distance to any building shall be not greater than 75 m. For multi-family and/or commercial structures with standpipes, the hydrant shall be located at a distance that is not greater than 45 m (unobstructed driving distance) from the standpipe.

.3 Hydrants located on the distribution mains shall be installed at the projection of the property lines but not between driveways, except:

a) Hydrants installed at intersections shall be installed at the beginning of curb returns.
b) Hydrants installed at cul-de-sacs shall be installed at the intersection of the cul-de-sac and adjacent roadway.
c) Where hydrants and sanitary manholes fall on the same property line projection, the sanitary manhole will be moved a minimum of 5 m away from the hydrant location.

.4 Hydrants shall conform with curb and sidewalk designs and shall be located as follows:

a) Areas with no sidewalk - hydrant to be no more than 2.5 m from back of curb.
b) Areas with monolithic sidewalk - hydrant to be no more than 1.4 m from back of walk.
c) Areas with separate sidewalk - hydrant to be no more than 2.5 m from back of curb.

.5 Additional hydrants shall be installed at high value (commercial, industrial, institutional, multi-family) properties if deemed necessary by the Town.

.6 All hydrant leads shall have a minimum diameter of 150 mm. Hydrant leads shall have a maximum length of 7.5 meters. If longer lengths are required larger diameter hydrant leads shall be considered and approved by the Town Engineer.

.7 Hydrants shall be installed in accordance with Standard Drawing No. 3-2 along with the following supplementary requirements:

a) Hydrant numbers, if required, to be painted in 100 mm high block lettering.
b) Signs shall be placed on hydrants to indicate if they are operational or not.

.8 Hydrant and valve to be cathodically protected with 5.5 Kg zinc anodes.

3.5 Gate Valves

3.5.1 Gate Valve Materials

.1 Gate valves shall conform to the latest edition of AWWA standard C509 (latest edition thereof) along with the following supplementary requirements:

a) Valves shall have an iron body and be bronze mounted.
b) Valves shall be resistant to corrosion.
c) Operating pressure shall be 1,200 kPa (174 psi).
d) Valves shall have a 51 mm square operating nut.
e) Valves shall have a grade 304 stainless steel stem for valves 250 mm and larger. 150 mm and 200 mm valves may be supplied with either bronze or grade 304 stainless steel stems.
f) Valves shall have an o-ring stem seal.
g) Valves shall turn counter clockwise to open.
h) Valves shall have a non-rising stem.
i) Valves shall be double-disc or solid wedge type.
j) Valves shall have a resilient seat.
k) Valves shall have an external epoxy coating.
l) Valves shall have all internal surfaces epoxy coated.
m) Valves shall have stainless steel trim (nuts and bolts).

3.5.2 Valve Boxes

.1 Valve boxes shall be two sections, bituminous coated, Type A, cast iron adjustable type complete with a cast iron lid. An internal operating rod shall be included which will extend to within 150 mm of the finished final surface. The operating rod shall include a top operating nut and rock disc.

.2 Valve boxes shall be of sufficient length to provide for adjustments of up to 300 mm in the up or down directions.

.3 Valve box extensions shall be epoxy coated cast iron, suitable for use with the valve boxes to be installed.

.4 All valve boxes located in roads shall be left flush with the base course asphalt or gravel. Immediately prior to the final lift of asphalt or gravel, the valve boxes shall be raised so that they are flush with the final grade elevation of the road.

3.5.3 Gate Valve Locations and Installation

.1 Gate valves on the distribution watermains shall be installed:

a) At the projection of property lines at mid-block.
b) At the projection of property lines at intersections.

.2 Distribution watermain gate valves shall be located such that during a shutdown:

a) No more than one hydrant is taken out of service.
b) No more than three valves are required to affect a watermain shutdown.
c) No more than one standard municipal property block is without potable water service during a shutdown.

.3 Gate valves shall be installed in accordance with Standard Drawing No. 3-3.

3.6 Trenching and Backfilling

.1 Trenching and Backfilling shall be done in accordance with Occupational Health and Safety Guidelines.

.2 Minimum trench width - outside diameter of pipe plus 600 mm. Trench walls shall be vertical to 300 mm above the top of the pipe.

.3 The minimum requirement for pipe beddings shall be in accordance with the Class "B" Bedding detail shown in Standard Drawing No. 3-1.

.4 Backfilling shall be carried out with suitable excavated native backfill material in 300 mm maximum, uniform lifts. Compaction shall be in accordance with the Standard Proctor Densities (SPD) shown in Standard Drawing No. 3-1.

.5 Backfilling in existing hard surfaced (travelled) areas shall be carried out with suitable imported granular backfill material in 300 mm lifts compacted to a minimum of 100% SPD.

.6 Compaction (density) testing shall be performed by a qualified professional at the minimum rate of 1 test per lift of backfill per 100 m of linear trench length. Additional compaction testing may be required in the vicinity of valve boxes and hydrants as requested by the Town Engineer. All compaction testing results shall be provided to the Town Engineer for review once complete and shall be properly referenced to engineering drawings to facilitate comprehension of where the test was performed. Costs related to compaction testing and retesting are the responsibility of the Developer.

3.7 Thrust Blocks

.1 Thrust blocks shall be provided at bends, tees, crosses, wyes, reducers, plugs, caps, hydrants, and valves in accordance with Standard Drawing No. 3-4.

3.8 Cathodic Protection

.1 All buried fittings and valves shall be cathodically protected against corrosion with a 5.5 Kg zinc anode.

.2 All hydrants shall be cathodically protected against corrosion with a 5.5 Kg zinc anode.

.3 Zinc anodes shall conform to ASTM International standard B418-01.

.4 Lead wires shall be No. 10A WG/7 and be 2 m in length. Wire shall be connected to fittings, valves, and hydrants with cadwelds.

.5 A minimum of 3 L of water shall be poured on each anode to initiate the galvanic reaction.

3.9 Disinfection and Hydrostatic Testing

3.9.1 Disinfection

.1 All the watermains shall be disinfected in accordance with the latest edition of AWWA standard C651.

.2 The Town shall be notified at least 24 hours prior to disinfection testing so they may witness the residual chlorine test and the sampling protocol for the bacteriological test.

.3 Minimum residual chlorine level in disinfected watermains shall be in accordance with the latest edition of AWWA standard C651 and the method of disinfection utilized.

.4 The disinfected watermain shall be flushed prior to being put into full active service. Dechlorination of the test water with neutralizing chemicals may be required prior to discharge to meet the regulatory requirements of Alberta Environment. Dechlorination activities shall be in accordance with the latest edition of AWWA standard C651.

.5 The chlorine residual and bacteriological test results must be reviewed and approved by the Town Engineer prior to the watermain being put into full active service.

.6 The Developer shall be responsible for obtaining the necessary supply of test water for the watermain disinfection process as well as all associated costs.

3.9.2 Hydrostatic Testing

.1 Hydrostatic testing of watermains shall be done only after all construction activities are complete and the trench has been either partially or completely backfilled. The watermains to be tested shall be filled with test water a minimum of 24 hours prior to the test under normal operating pressures.

.2 No hydrostatic testing will be permitted until at least 36 hours have elapsed since the last thrust block was cast using high early strength cement. If standard cement was used for the thrust blocks, hydrostatic testing will not be permitted until 7 days have elapsed since the last thrust block was cast.

.3 Hydrostatic test pressures shall be 1035 kPa (150 psi) or 2 times the normal operating pressure (whichever is greater) based upon the elevation of the lowest point in the watermain and corrected for the elevation of the test gauge.

.4 The maximum length of watermain to be tested at one time shall not exceed 365 m.

.5 For PVC watermains, the maximum allowable leakage rates for each hydrostatic test shall not exceed the leakage rates specified in Table 3.2 for a test duration of two (2) hours. The allowable leakage calculation shall be based upon the following formula:

$L = [ND(P^{0.5})]/128{,}320$ where L = allowable leakage (L/hr)
N = number of joints
D = nominal pipe diameter (mm)
P = test pressure (kPa)
Note: 1 psi = 6.9 kPa

.6 For HDPE watermains, the hydrostatic test procedure consists of two stages; the initial expansion stage and the test stage.

.1 Initial Expansion Stage

a) Pressurize the test section to test pressure and add sufficient make-up water at each hour for three (3) hours to return the section of HDPE watermain to the test pressure.
b) The make-up volume of water is not recorded and does not factor into the leakage test.
c) Initial expansion stage should be complete after four (4) hours and the section of watermain should be holding the test pressure.

.2 Test Stage

a) Test stage shall have a duration of either one (1), two (2), or three (3) hours.
b) Allowable leakage rates shall be those specified in Table 3.3 for the required test duration.

c) Under no circumstances shall the total time under test exceed eight (8) hours at the required test pressure. If this total time limit is going to be exceeded (due to unsuccessful tests etc.), the HDPE watermain must be depressurized to normal operating pressure and allowed to relax for an additional eight (8) hours before repeating the test procedure.

Table 3.1: NFPA - Recommended Colour Coding for Hydrants

Hydrant Component		NFPA Colour Code
Barrel		Chrome Yellow
Tops and Nozzle Caps	Class AA (Flow > 90 L/s)	Light Blue
	Class A (60 L/s < Flow < 90 L/s)	Green
	Class B (30 L/s < Flow < 60 L/s)	Orange
	Class C (Flow < 30 L/s)	Red

Table 3.2: Maximum Allowable Leakage Rates for Hydrostatic Testing of PVC Watermains

		Test Pressure								
		345	515	690	860	1,035	1,380	1,550	1,724	kPa
		50	75	100	125	150	200	225	250	psi
Pipe Diameter (mm)	100	1.46	1.77	2.00	2.28	2.46	2.90	3.07	3.28	Max Allowable Leakage (L/100 Joints/hour)
	150	2.17	2.65	3.07	3.43	3.76	4.34	4.60	4.82	
	200	2.90	3.54	4.09	4.57	5.02	5.79	6.14	6.46	
	250	3.62	4.42	5.12	5.71	6.27	7.34	7.67	8.10	
	300	4.34	5.30	6.14	6.86	7.52	8.69	9.20	9.70	
	350	5.07	6.19	7.16	8.00	8.77	10.13	10.74		
	400	5.79	7.07	8.19	9.14	10.03	11.58	12.27		
	450	6.51	7.96	9.21	10.28	11.28	13.03	13.80		

Table 3.3: Maximum Allowable Leakage Rates for Hydrostatic Testing of HDPE Watermains

		Test Duration			
		1.0	2.0	3.0	Hours
Pipe Diameter (mm)	100	1.61	3.11	4.97	Max Allowable Leakage (L/100 m of pipe)
	150	3.73	7.45	11.18	
	200	6.21	12.42	18.63	
	250	9.94	16.15	25.67	
	300	13.66	28.57	42.24	
	350	17.39	34.78	52.17	
	400	21.12	40.99	62.11	
	450	24.84	53.42	80.75	

END OF SECTION 3

4.1 Design Requirements

.1 The design of the Sanitary Sewage System shall conform to Sections 3.0, 4.0, and 5.0 of the *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems* as published by Alberta Environment (latest edition thereof) and as amended by these Procedures and Design Standards for Development.

.2 The current version of the Town of Westlock – Wastewater Collection System Master Plan shall be reviewed by the Developer and their Consulting Engineers to understand any identified system constraints and future servicing strategies that have implications for the proposed development.

.3 The sanitary sewage system shall be of sufficient capacity to carry peak flows plus an inflow/infiltration allowance. The following factors shall be used in the design of sanitary sewage systems:

.4 The Manning Equation shall be used to size gravity sanitary sewer mains. The equation is as follows (for SI units):

$Q = (1/n)AR^{2/3}S^{1/2}$ where Q = quantity of flow (m^3/s)
n = roughness coefficient
A = cross sectional area of flow (m^2)
R = hydraulic radius (m)
S = slope of energy grade line (m/m)
Note: n=0.013 shall be used for the roughness coefficient

.5 Acceptable velocity of sewage flows shall be between 0.61 m/s (min) and 3 m/s (max).

.6 Minimum pipe slopes shall conform to Section 4.1.1.2 of the *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems* as published by Alberta Environment (latest edition thereof).

.7 Minimum size of sanitary sewer mains shall be 200 mm for residential areas and 250 mm for commercial and industrial areas.

.8 Sanitary sewer mains may have to be oversized to conform to the Town's Master Sanitary Sewer Plan(s).

.9 An inflow/infiltration allowance of 0.20 L/s/ha shall be used irrespective of the land use classification.

.10 Roof leaders and weeping tile systems shall not be connected to the sanitary sewage system.

.11 The maximum design pipe capacity shall be flowing at 86% of full flow.

4.1.1 Residential

.1 Population densities shall be in accordance with the zoning established in the current Land Use Bylaw.

.2 Per capita average daily design flow shall be 350 L/person/day.

.3 The Peak Flow for a residential population may be determined by the following formula (if existing data is not available):

$Q_{PDW} = (G \times P \times Pf)/86.4$ where Q_{PDW}=peak dry weather flow rate (L/s)
G=per capita average daily design flow (L/d)
P=design contributing population in thousands
Pf=peaking factor

The peaking factor should be the larger of 2.5 or Harmon's Peaking Factor.

Harmon's Peaking Factor = $1 + 14/(4 + P^{1/2})$, where P equals the tributary population in thousands.

4.1.2 Commercial, Industrial, and Institutional

.1 Average daily design flows shall be 40,000 L/ha/day for commercial areas and 20,000 L/ha/day for industrial areas.

.2 The peak flow shall be 3.0 x average daily design flow.

.3 Institutional daily design flows may be taken from Table 5.1 of the *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems* as published by Alberta Environment (latest edition thereof).

4.2 Sanitary Sewer Materials

4.2.1 Sewer Mains

.1 Sewer main material shall be Polyvinyl Chloride (PVC), Dimension Ratio (DR) 35, for pipes 200 mm in diameter to 900 mm in diameter. PVC pipes shall conform to the latest edition of ASTM standard D2729-03.

.2 Reinforced concrete pipe may also be used for diameters of 525 mm and larger. Reinforced concrete pipes shall conform to the latest edition of CSA standard series A257.

4.2.2 Manholes

.1 Manhole material shall be precast reinforced concrete conforming to the latest edition of ASTM standard C478-03a and CSA standard series A257.

.2 Manholes shall be 1200 mm inside diameter for all pipe 900 mm in diameter and less. For pipes exceeding 900 mm in diameter, manhole diameters shall be pipe diameter plus 600 mm or a Tee-Riser shall be used.

.3 Manhole frames and covers shall be cast iron and shall conform to the latest edition of ASTM standard A48/A48M-03. Manhole frames and covers to be type NF-39 in landscaped areas, type NF-80 in paved areas, and type NF-90 (complete with plugs and gaskets) in sag locations. All manhole covers to be clearly stamped with the label “Sanitary Sewer”.

.4 Manhole steps shall be standard safety type, hot dipped galvanized iron or epoxy coated extruded aluminum.

.5 Manhole bases shall be precast slabs, poured concrete bases, precast vaults, or precast tees. Pre-benched manholes shall be used whenever possible.

.6 Manholes shall conform with the requirements shown in Standard Drawing No. 4-1 and Standard Drawing No. 4-2.

.7 Concrete for manholes and appurtenances shall utilize Type 50 sulphate resistant cement with a 28 day strength of 25 MPa. The maximum allowable slump shall be 75mm.

4.3 Sanitary Sewer Locations and Installation

.1 Sanitary sewer mains shall be installed to provide a minimum depth of cover of 3.0 m to the pipe obvert below final finished surface grade. If the minimum depth of cover cannot be provided, the sanitary sewer main shall be adequately insulated to the satisfaction of the Town Engineer.

.2 Sanitary sewer mains shall be installed to provide adequate sewer service connection depth at the property line (see Section 6).

.3 Sanitary sewer mains shall be located within the road right-of-way in accordance with Standard Drawing No. 7-1 through Standard Drawing No. 7-10.

.4 The minimum requirement for pipe beddings shall be in accordance with the Class "B" Bedding detail shown in Standard Drawing No. 3-1.

4.4 Sanitary Sewer Manhole Locations and Installation

.1 Manholes shall be located at the end of each line, at all changes in pipe size, grade, or alignment, and at all junctions.

.2 The maximum distance between manholes shall not exceed 120 m along the length of the sanitary sewer main.

.3 Inverts in manholes at changes in direction shall have at least 60 mm of fall across manhole. Inverts in manholes on straight sections of sanitary sewer mains shall have at least 50 mm of fall across the manhole. To maintain a continuous energy gradient through manholes, the obvert elevation of the lowest upstream sewer main shall be equal to or higher than the obvert of the downstream sewer main.

.4 Interior drop manholes shall be used whenever the invert elevations of the inlet and outlet sanitary sewer mains differ by more than 750 mm.

.5 Manholes shall be installed in accordance with Standard Drawing No. 4-1 and Standard Drawing No. 4-2.

.6 All joints shall be watertight through the use of gaskets. Non-shrink grout shall also be used on all exterior and interior joints and rings for concrete pipe.

.7 Compact backfill around manholes with mechanical tampers to at least 98% of the Standard Proctor Density.

.8 Safety platforms at intermediate elevations within manholes are required when the depth of the manhole is greater than 5 m, measured from the top of the manhole frame to the lowest sewer main invert elevation.

.9 All new sanitary sewage manholes shall not be located in roadway "sags".

4.5 Curved Sanitary Sewer Mains

.1 Curved sanitary sewers will be permitted, subject to the following restrictions:

a) Sanitary sewer main 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.
b) Manholes shall be located at the beginning and end of the curve.
c) Manholes shall be located at intervals not greater than 90 m along the length of the curve.
d) Sanitary sewer main shall run parallel to the curb or centreline of the road.
e) Minimum grade for sanitary sewers on curves shall be 50% greater than the minimum grade required for straight runs of sanitary sewers.

4.6 Trenching and Backfilling

.1 Trenching and Backfilling shall be done in accordance with Occupational Health and Safety Guidelines.

.2 Trench widths shall be in accordance with Standard Drawing No. 3-1 with the following modifications:

a) Minimum trench width for sanitary sewer mains less than 750 mm in diameter shall be the equal to the outside diameter (O.D.) plus 600 mm.
b) Minimum trench width for sanitary sewer mains equal to or greater than 750 mm in diameter shall be the equal to the outside diameter (O.D.) plus 600 mm.

.3 Trench walls shall be vertical to 300 mm above the top of the pipe.

.4 Backfilling shall be carried out with suitable excavated native backfill material in maximum, uniform 300 mm lifts. Compaction shall be in accordance with the Standard Proctor Densities (SPD) shown in Standard Drawing No. 3-1.

.5 Backfilling in existing hard surfaced (travelled) areas shall be carried out with suitable imported granular backfill material in 300 mm lifts compacted to a minimum of 100% SPD.

.6 Compaction (density) testing shall be performed by a qualified professional at the minimum rate of 1 test per lift of backfill per 100 m of linear trench length. Additional compaction testing may be required in the vicinity of manholes and pipe crossings as requested by the Town Engineer. All compaction testing results shall be provided to the Town Engineer for review once complete and shall be properly referenced to engineering drawings to facilitate comprehension of where the test was performed. Costs related to compaction testing and retesting are the responsibility of the Developer.

4.7 Inspection and Testing

.1 Prior to issuance of the Construction Completion Certificate and Final Acceptance Certificate, all sanitary sewer mains shall be flushed, inspected, and tested to ensure proper performance.

4.7.1 Closed Circuit Television Inspection

.1 All sections of sanitary sewers shall be inspected with closed circuit television camera equipment at both and prior to CCC and FAC. A written report and a digital record of the inspection, in CD-Rom or DVD format, shall be submitted to the Town for approval and record purposes.

4.8 Low Pressure Sanitary Sewer Systems

4.8.1 General

.1 Low pressure sanitary sewer collection systems are normally installed in situations where there is inadequate grade to economically install gravity collection systems.

.2 Low pressure sanitary sewer collection systems have increased operation and maintenance costs above those of comparable gravity collection systems. These costs are associated with the septic tanks and pumps that are required. Due to these increased costs, gravity collection systems are strongly preferred as the collection system of choice for the Town.

.3 Low pressure sanitary sewer collection systems consist of two major components; the onsite pressurization facility and the pressurized sewer main. The pressurization facility may consist of a grinder pump system or a septic tank and effluent pumping system. Grinder pump systems have higher operational and maintenance costs. As a result, septic tank systems are the preferred option. The pressurized sewer mains normally range in size from 30 mm to 100 mm depending upon the number of residences connected to the system.

4.8.2 Design Criteria

4.8.2.1 Septic Tanks

.1 Dual compartment septic tanks with access manholes shall be used.

.2 Minimum recommended total storage volume is 3,000 litres for a single family dwelling.

.3 Septic tanks shall provide effective solids settling and grease removal capabilities as well as providing adequate storage volumes to ensure reasonable pump cycle times.

.4 Septic tanks shall be installed in accordance with Standard Drawing No.4-3.

.5 Septic tank proposals for non-residential applications will be reviewed on a case by case basis.

4.8.2.2 Sanitary Sewage Pumps

.1 Sanitary sewage pumps shall be either submersible (installed in the liquids chamber of the septic tank) or centrifugal (installed in the basement of the residence). Grinder pumps may also be used if septic tanks are not employed as the collection system; however, septic tanks are preferred.

.2 The maximum head for economical operation of low pressure sanitary sewer systems is 24 m (35 psi). Pumps with higher discharge pressures should not be utilized unless detailed engineering design calculations recommend higher operating pressures. All pumps and collection mains within the system shall be designed to accommodate higher pressures if necessary.

.3 Small (40 residences or less) collection systems shall have all the discharge pumps designed for the same maximum discharge head.

.4 Low pressure sanitary sewer systems with large elevation differences across the system may require pumps with different discharge pressures to achieve economical operation. Systems such as this shall be designed by a qualified Professional Engineer to ensure that the collection system operates properly and as designed.

4.8.2.3 Fittings

.1 All pump discharge lines shall incorporate double check valves and a gate value as detailed on Standard Drawing No. 4-3.

.2 All fittings shall be polyethylene (PE), PVC, brass, or stainless steel.

4.8.2.4 Discharge Lines

.1 Discharge line material shall be polyethylene (PE), dimension ratio (DR) 21, series 60 with a minimum diameter of 30 mm. Discharge lines with higher pressure capabilities (DR 17, series 80 or greater) may be required in systems with long discharge lines or large elevation differences.

.2 Curb stops (shut-off valves) and service boxes shall be installed at the property line to allow for isolation of the system during maintenance activities.

.3 Connections to the main collector sewer line shall be made with an in-line service tee or saddle tee. All fittings shall be polyethylene (PE), PVC, brass, or stainless steel.

4.8.2.5 Main Collector Sewer

.1 Main collector sewer material shall be polyethylene (PE), minimum dimension ratio (DR) of 21, and shall be series 60. Main collector sewer lines with higher pressure capabilities may be required in systems with long collector sewer lengths or large elevation differences.

.2 The following main collector sewer diameters may be used as a guideline (based on the maximum number of contributing residences):

- 40 residences or less – 50mm diameter
- 41 to 70 residences – 75 mm diameter
- 71 to 120 residences – 100 mm diameter

.3 Main collector sewers shall not be oversized to reduce frictional head loss.

.4 Minimum depth of cover on main collector sewers shall be 2.7 m in untravelled areas and 3 m in travelled areas, measured from the top of sewer to the final finished surface.

END OF SECTION 4

5.1 Level of Service

The Town of Westlock stormwater management goal is to provide adequate drainage for urban areas that preserves and promotes the general health, welfare, security, and economic well being of the public and protects and enhances the water quality of receiving watercourses. To meet this goal, the stormwater management system must include facilities that meet the following level of service objectives:

.1 Avoid all property damage and flooding and minimize any inconveniences to the general public due to runoff from 1:5 year and more frequent rainfall events.

.2 Avoid property damage from 1:100 year rainfall events.

.3 Avoid loss of life and injuries and minimize damage to property through the control of runoff during unusual or infrequent storm events with high intensity rainfall and large runoff volumes.

.4 Avoid degradation of receiving watercourses.

5.2 Design Requirements

.1 The design of the Stormwater Management System shall conform to Section 6.0 of the *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems* as published by Alberta Environment (latest edition thereof) and as amended by these Procedures and Design Standards for Development.

.2 The current version of the Town of Westlock – Stormwater Master Plan shall be reviewed by the Developer and their Consulting Engineers to understand any identified system constraints and future servicing strategies that have implications for the proposed development.

.3 Storm sewers shall be designed as an independent system from the sanitary sewer system. Storm sewers shall be of sufficient capacity to adequately manage the stormwater runoff generated by the ultimate contributing area of the proposed development. Stormwater management systems shall be designed utilizing the major/minor storm drainage system concept.

.4 The minor stormwater management system is designed to provide positive drainage and is composed of all the storm sewer piping, manholes, catch basins, and outfall structures. The minor stormwater management system shall transfer runoff from 1:5 year return period rainfall events to a receiving water body (river, stream, lake, or pond). Where required by the Town Engineer, high value commercial areas shall have their minor stormwater management systems designed to adequately accommodate the 1:10 year return period rainfall event or they may have to provide on-site detention facilities for rainfall volumes greater than the 1:5 year event.

.5 The major stormwater management system is designed to provide flood control and is composed of the roadway systems, detention/retention facilities, parks and open space, and any other land required to manage the runoff generated by rainfall events from 1:100 year return period rainfall events. The major stormwater management system shall provide sufficient storage volumes so that all properties located within, and adjacent to, the proposed development are protected from flood damage during the 1:100 year rainfall event.

.6 Sanitary sewer effluent, as well as any drainage/effluent streams from industrial, agricultural, or commercial operations that may potentially be contaminated, shall not be discharged to the stormwater management system. Roof drainage downspouts from residential buildings shall not be directly connected to the storm sewer system.

.7 Roof drainage downspouts from single and dual family dwellings shall be discharged to grassed or pervious areas. The point of discharge shall be a minimum of 1.2 m away from the building to ensure positive drainage. Roof drainage downspouts from multi-family buildings, commercial areas, and industrial areas are encouraged to be discharged to grassed or pervious areas, but may be allowed to directly discharge to the storm sewer collection system subject to approval by the Town Engineer.

.8 On-site detention strategies that utilize building roofs, parking lots, or landscaped areas to attenuate peak rainfall runoff rates are encouraged, but must be approved by the Town Engineer.

.9 Properly graded and surfaced roads/lanes, landscaping, and sediment control structures at storage facility inlets and outlets shall be used to minimize sediment discharge into the stormwater collection system and receiving water body.

.10 Foundation drain (weeping tile) sump pumps shall discharge collected water to the surface for overland flow.

.11 Post-development runoff rates shall not exceed the pre-development runoff rate for a given contributing area. When pre-development runoff rates are considered to be excessive, the Developer shall consider alternative stormwater management system designs. These alternatives shall reduce the allowable discharge rate to a level that is acceptable to both the Town and Alberta Environment.

.12 The Developer shall provide all detailed design calculations concerning the stormwater management system to the Town for approval.

5.2.1 Minor Stormwater Management System

.1 For areas less than 65 hectares (ha) in size, computer modelling techniques are encouraged. However, the Rational Method may also be used to develop design flows for the minor stormwater management system. For areas greater than 65 ha, computer modelling shall be used to determine the design flows. The Rational Method formula is as follows:

$Q = 2.78\ CiA$ where Q = design peak flow rate (L/s)
i = rainfall intensity (mm/hr)
A = contributing area (ha)
C = runoff coefficient
Note: rainfall intensity corresponds to the time of concentration

.2 For areas of uncontrolled discharges greater than 30 ha in size, Rational Method design flows must be increased by a factor of 25%, or computer modelling must be used.

.3 The five (5) year Intensity Duration Frequency (IDF) design intensities shown on Table 5.1 shall be used. Runoff coefficients shall be according to those shown in Table 5.2.

.4 A weighted average of pervious and impervious area runoff coefficients shall be used when the surface characteristics for a specific contributing area are not uniform and of one type. The weighted average runoff coefficient can be computed using the following calculation:

$C_{WA} = (C_P A_P + C_i A_i)/(A_P + A_i)$ where P = pervious surface
i = impervious surface
Note: $C_P = 0.15$ and $C_i = 0.90$

.5 The duration of rainfall used to determine the corresponding rainfall intensity is equal to the time of concentration (Tc). The time of concentration is equal to the time for the overland runoff flows from the furthest point in the contributing area to reach the storm sewer inlet plus the time of travel in the sewer.

a) Overland runoff flow times, to curbs, shall not exceed 10 minutes in residential and commercial areas (specific overland flow times shall be computed separately for industrial and undeveloped areas).
b) Gutter flow times shall not exceed 5 minutes.
c) Time of travel in sewer shall be based on the pipe flow velocity and length of sewer.

.6 When using computer modelling techniques, the minor stormwater management system shall be designed to convey the runoff from the 1:5 year, 4 hour Chicago design storm shown in Table 5.3.

.7 The minimum velocity of flow in storm sewer mains shall be 1 m/s. Where velocities in excess of 3 m/s are possible, special provisions shall be made to protect the storm sewer main against displacement by erosion or impact.

.8 Storm sewer main sizing shall be determined by utilizing the Manning Equation. The equation is as follows:

$V = (1/n)R^{2/3}S^{1/2}$ where V = velocity of flow (m/s)
R = hydraulic radius (m)
S = slope of energy grade line (m/m)
n = coefficient of roughness
Note: n=0.013 shall be used for the roughness coefficient

.9 Storm sewer mains shall be designed to flow full when conveying the required design flows. The hydraulic gradeline shall be located at the crown of the sewer main. All storm sewer main crown elevations shall match at manhole junctions.

.10 Minimum pipe slopes shall conform to Section 6.2.2.2 of the *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems* as published by Alberta Environment (latest edition thereof).

5.2.2 Major Stormwater Management System

.1 Computer modelling techniques shall be used to determine design flows for the design of the major stormwater management system. For areas less than 65 ha, the Rational Method may be used to determine design flows for surface conveyance elements only and may not be used to size stormwater management facilities.

.2 The selection of an appropriate computer model shall be based on a solid understanding of the principles, assumptions, and limitations of each model and methodology in relation to the system being designed. Acceptable computer models are SWMM and OTTHYMO.

.3 Wherever possible, the computer model shall be calibrated. In all analyses, the parameters used, the drainage boundaries, and the storm sewer collection network shall be clearly identified on an overall drawing. Computer printouts and a design summary report shall be provided to the Town Engineer for review.

.4 4-hour design storms using the Chicago distribution, as shown in Table 5.3, shall be used to design major stormwater management system conveyance elements.

.5 24-hour design storms using the Huff distribution, as shown in Table 5.4, shall be used to design major stormwater management system storage elements.

.6 Overland flows shall not be permitted to travel a distance greater than 250 m along local roadways without provision for interception by catch basins. Overland flows on collector and arterial roadways shall not travel a distance greater than 150 m without interception by catch basins.

.7 Overland flows shall be intercepted with a sufficient number of catch basins such that the total inlet capacity provided is sufficient enough to receive the design stormwater flow rates. Catch basin capacities shall be in accordance with those given in Table 5.5.

.8 The minimum slope of roadway gutters shall be 0.6% in the longitudinal direction. For cul-de-sacs and curb returns, the minimum slope of the gutter shall be 0.8% in the longitudinal direction.

5.2.2.1 System Analysis

.1 The major stormwater management system shall be analyzed using the 1:100 year design storm event and the following design criteria:

a) The lowest building opening shall not be inundated with flood waters at any time.
b) Continuity of overland flow routes between adjacent developments shall be maintained.
c) Arterial roads shall have at least two lanes which are free from flood waters at all times. Where major drainage routes cross arterial roads, the depth of flow shall be less than 0.05 m.
d) Collector roads shall have at least one lane free from flood waters at all times. Where the major drainage routes cross collector roads, the depth of flow shall be less than 0.10 m.
e) Local roads shall have a depth of water no more than 0.05 m above the crown at all times. Where major drainage routes cross local roads, the depth of flow shall be less than 0.15 m.
f) The depth of water at the curb shall be less than 0.50 m for all types of roads.
g) The velocities and depths of overland flow in the major stormwater management system shall not exceed the values contained in Table 5.6.

.2 Lot grading shall meet the following design requirements:

a) Minimum slope in back and front yards shall be 2%.
b) If the back yard slopes towards the house, provisions must be made to keep the stormwater runoff at least 3 m from the house and direct it to the road for subsequent collection.
c) Reverse (back sloping) driveways shall not be permitted.
d) Lot grading must not direct drainage flows onto adjacent properties.

5.3 Storm Sewer Materials

5.3.1 Storm Sewer Mains

.1 Minimum diameter of storm sewer mains shall be 300 mm.

.2 Acceptable storm sewer main materials are as follows and shall conform to the latest edition of the referenced standards:

- reinforced sulphate resistant concrete pipe (ASTM standard C76-05)
- PVC pipe, minimum class DR 35 (ASTM standard F794-03 and ASTM standard F679-03 for large diameter pipe)
- “Ultra-Rib” PVC pipe, minimum class DR 35, up to 600 mm diameter (ASTM standard F794-03)

.3 Storm sewer pipe joints shall be rubber ring gasket type conforming to the latest edition of the following referenced standards:

- concrete pipe joints (ASTM standard C443M-05)
- PVC pipe joints (ASTM standard F1336-02)

.4 Storm sewer pipe classes shall be selected so that the pipes are able to withstand the required superimposed loadings. There are various factors affecting the pipe class selection and they shall be taken into account. The pipe class selection shall be evaluated against standard acceptable engineering practices.

5.3.2 Manholes

.1 Manhole material shall be precast reinforced concrete conforming to the latest edition of ASTM standard C478-03a.

.2 Manholes shall be 1200 mm inside diameter for all pipe 900 mm in diameter and less. For pipes exceeding 900 mm in diameter, manhole diameters shall be pipe diameter plus 600 mm or a Tee-Riser shall be used.

.3 Manhole frames and covers shall be cast iron and shall conform to the latest edition of ASTM standard A48/A48M-03. Manhole frames and covers to be type NF-39 in landscaped areas, type NF-80 in paved areas, and type NF-90 (with gaskets) in sag locations. All manhole covers to be clearly stamped with the label “Storm Sewer”.

.4 Manhole steps shall be standard safety type, hot dipped galvanized iron or epoxy coated extruded aluminum.

.5 Manhole bases shall be precast slabs, poured concrete bases, precast vaults, or precast tees. Pre-benched manholes shall be used whenever possible.

.6 Manholes shall conform with the requirements shown in Standard Drawing No. 5-1 and Standard Drawing No. 5-2.

.7 Concrete for manholes and appurtenances shall utilize Type 50 sulphate resistant cement with a 28 day strength of 25 MPa. The maximum allowable slump shall be 75mm.

5.3.3 Catch Basins

.1 Standard 900 mm catch basin barrels with precast bases and slab tops shall be as follows and shall conform to the latest edition of the ASTM standard C478-03. 900 mm catch basins shall be in accordance with Standard Drawing No. 5-2.

.2 Standard 1200 mm catch basin manholes shall be used when the catch basin lead exceeds 30 m in length. 1200 mm catch basin manholes shall be in accordance with Standard Drawing No. 5-1.

.3 All joints shall be watertight through the use of gaskets and non-shrink grout.

.4 All catch basins shall have 500 mm deep sumps.

.5 Catch basin frames and covers shall be:

a) Standard inlet for rolled curb and gutter shall be equal to Norwood F-35A.
b) Standard frame, grate, and side inlet for straight faced curb and gutter shall be equal to Norwood F-51. Shall be used with 900 mm catch basin barrels.
c) For swales or lanes, standard round top inlets shall be used that are equal to Norwood F-38 grates.
d) For landscaped areas, standard round top inlets shall be used that are equal to Norwood F-39 grates.

.6 Catch basin leads shall be:

a) Class 3, non-reinforced concrete pipe that conforms to the latest edition of ASTM standard C14M. PVC pipe may also be used and shall conform to the latest edition of ASTM standard D3034.
b) Minimum size of catch basin leads shall be 250 mm diameter pipe.
c) Catch basin leads shall have a minimum slope of 1.5%.
d) When two (2) catch basins are connected in series, the catch basin lead that connects them to the storm sewer manhole shall be 300 mm in diameter and shall have a minimum slope of 1.5%.
e) Maximum length of catch basin leads shall be 30 m.
f) Catch basin manholes shall be used at the upstream end when the catch basin lead length required is greater than 30 m.
g) Catch basin leads shall have a minimum depth of cover of 1.5 m to the pipe invert.

5.4 Storm Sewer Locations and Installation

.1 Storm sewer mains shall be installed to provide a minimum depth of cover of 2.7 m to the pipe obvert below final finished surface grade. Storm sewer mains with depths of cover between 1.5 m and 2.7 m may be accepted provided the mains are adequately insulated and approved by the Town Engineer.

.2 Storm sewer mains shall be located within the road right-of-way in accordance with Standard Drawing No. 7-1 through Standard Drawing No. 7-10.

.3 The minimum requirement for pipe beddings shall be in accordance with the Class "B" Bedding detail shown in Standard Drawing No. 3-1.

5.5 Storm Sewer Manhole Locations and Installation

.1 Manholes shall be located at the end of each line, at all changes in pipe size, grade, or alignment, and at all junctions.

.2 The maximum distance between manholes shall not exceed 150 m along the length of the storm sewer main. Manhole spacing on storm sewer mains greater than 750 mm in diameter may exceed 150 m subject to approval by the Town Engineer.

.3 Inverts in manholes at changes in direction shall have at least 60 mm of fall across manhole. Inverts in manholes on straight sections of sanitary sewer mains shall have at least 30mm of fall across the manhole. To maintain a continuous energy gradient through manholes, the obvert elevation of the lowest upstream sewer main shall be equal to or higher than the obvert of the downstream sewer main.

.4 If an inlet storm sewer main is greater than 525 mm in diameter and is located on a bend that is greater than 45° (degrees), or if the outlet storm sewer main velocity exceeds 1.5 m/s, then minor losses shall be considered in the design calculations.

.5 Interior drop manholes shall be used whenever the invert elevations of the inlet and outlet sanitary sewer mains differ by more than 750 mm.

.6 Manholes shall be installed in accordance with Standard Drawing No. 5-1 and Standard Drawing No. 5-2.

.7 All joints shall be watertight through the use of gaskets.

.8 Compact backfill around manholes with mechanical tampers to at least 98% of the Standard Proctor Density.

.9 Safety platforms at intermediate elevations within manholes are required when the depth of the manhole is greater than 5 m, measured from the top of the manhole frame to the lowest sewer main invert elevation.

5.6 Curved Storm Sewer Mains

.1 Curved storm sewers will be permitted, subject to the following restrictions:

f) Storm sewer main 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.
g) Manholes shall be located at the beginning and end of the curve.
h) Manholes shall be located at intervals not greater than 90 m along the length of the curve.
i) Storm sewer main shall run parallel to the curb or centreline of the road.
j) Minimum grade for sanitary sewers on curves shall be 50% greater than the minimum grade required for straight runs of storm sewers.

5.7 Trenching and Backfilling

.1 Trenching and Backfilling shall be done in accordance with Occupational Health and Safety Guidelines.

.2 Trench widths shall be in accordance with Standard Drawing No. 3-1 with the following modifications:

c) Minimum trench width for storm sewer mains less than 750 mm in diameter shall be the equal to the outside diameter (O.D.) plus 450 mm.
d) Minimum trench width for storm sewer mains equal to or greater than 750 mm in diameter shall be the equal to the outside diameter (O.D.) plus 600 mm.

.3 Trench walls shall be vertical to 300 mm above the top of the pipe.

.4 Backfilling shall be carried out with suitable excavated native backfill material in 300 mm lifts. Compaction shall be in accordance with the Standard Proctor Densities (SPD) shown in Standard Drawing No. 3-1.

.5 Backfilling in existing hard surfaced (travelled) areas shall be carried out with suitable imported granular backfill material in 300 mm lifts compacted to a minimum of 95% SPD.

.6 Compaction (density) testing shall be performed by a qualified professional at the minimum rate of 1 test per lift of backfill per 100 m of linear trench length. Additional compaction testing may be required in the vicinity of manholes and pipe crossings as requested by the Town Engineer. All compaction testing results shall be provided to the Town Engineer for review once complete and shall be properly referenced to engineering drawings to facilitate comprehension of where the test was performed. Costs related to compaction testing are the responsibility of the Developer.

5.8 Inspection and Testing

Prior to issuance of the Construction Completion Certificate and Final Acceptance Certificate, all sanitary sewer mains shall be inspected and tested to ensure proper performance.

5.8.1 Closed Circuit Television Inspection

All sections of storm sewer mains shall be inspected with closed circuit television camera equipment. A written report and a digital record of the inspection, in CD-Rom or DVD format, shall be submitted to the Town for approval and record purposes.

5.9 Stormwater Management Facilities

5.9.1 General

.1 Stormwater management facilities shall be designed as an integral part of both the minor and major stormwater management systems. These facilities shall attenuate the peak post-development runoff flow hydrograph for the 1:100 year return period storm event to the peak flow calculated under pre-development conditions for the same contributing area.

.2 The high water level shall be established based on the runoff, less the outflow, from the 1:100 year, 24-hour Huff storm event.

.3 All stormwater management facilities, and the entire area of land inundated by flood waters during the 1:100 year event, shall become property of the Town (Public Utility Lot).

.4 In assessing the need for a stormwater management facility to be included as part of a proposed development, the applicant must consider the impacts of uncontrolled stormwater drainage on the development itself and the surrounding environment as well as any potential impacts on receiving watercourses. The type of facility to be used shall be based on the principles of Best Management Practices (BMP's) for end of pipe treatment of stormwater runoff and shall be subject to approval by the Town Engineer.

.5 Soils investigations, specific to the type of stormwater management facility being considered, shall be undertaken to determine the appropriate design factors and field conditions. If a stormwater management facility is to be located above a shallow aquifer, the potential for groundwater contamination must be considered and the necessary measures shall be taken to minimize the potential impacts.

.6 The design of any stormwater management facility shall consider the aesthetic implications of shape, size, grading, and required landscape features.

.7 High water level elevations in the stormwater management facilities shall be considered in the design of both the minor stormwater management system and lot grading. Hydraulic Grade Line (HGL) elevations for the minor stormwater management piping systems shall be based on the maximum water level elevation calculated for the 1:5 year design storm event. Whenever feasible, obvert elevations of the minor system pipes located in the first manhole upstream of a stormwater management facility shall be at, or above, the maximum water level elevation achieved in the storage facility during the 1:5 year design storm event.

.8 Outlet capacity shall be of sufficient size so that 90% of the active storage volume is recovered after 96 hours. The time requirement is based on the flood waters reaching the HWL during the 1:100 year design storm event. Private property lines and building openings shall be at an elevation equal to, or above, the elevation achieved at the top of the freeboard depth.

.9 Emergency overflow provisions (overflow channels and overland drainage route) shall be provided, where feasible, for stormwater management facilities. If provided, a freeboard depth of 0.3 m shall be required. If emergency overflow means cannot be provided, a freeboard depth of 0.5 m shall be required.

5.9.2 Wet Ponds

.1 The maximum water level fluctuation for wet ponds in residential areas during the 1:100 year storm event shall be 2 m measured from the Normal Water Level (NWL) to the High Water Level (HWL).

.2 The design of wet pond stormwater management facilities shall incorporate the following:

a) Private property lines and building openings shall be located at or above the freeboard level.
b) Invert of the upstream minor system pipe in the inlet manhole of the wet pond and the invert of the downstream pipe in the outlet manhole of the wet pond shall be at, or above, the NWL elevation to ensure that the NWL elevation can be maintained.
c) A minimum horizontal distance of 6 m shall be maintained from all basement walls to the freeboard level.
d) Minimum wet pond surface area at the NWL shall be 2 ha.
e) Minimum water depth below the NWL (permanent pool) shall be 2 m, the maximum depth shall be 3 m.
f) Wet pond bottom and side slopes shall be constructed of impervious materials or properly lined to minimize water losses during dry weather

periods. Intruding silt or sand deposits shall be properly sealed off to prevent contamination.

g) Wet pond inlets and outlets shall be located so that short circuiting of the flow through the pond is minimized. A semi-annual pond turnover rate shall be used in the design of the permanent pool based on average annual precipitation data.
h) Slope erosion protection measures shall be used when required by the Town Engineer.
i) Submerged inlets and outlets shall be used. Obverts of each inlet and outlet pipe shall be a minimum of 0.6 m below the NWL.
j) Length to width ratio of the permanent pool shall be from 2:1 to 5:1.
k) Sediment traps, pre-treatment sumps, or forebays shall be provided at each inlet.
l) Minimum detention time of the full pond volume shall be 24 hours.

.3 Wet ponds shall be in accordance with Standard Drawing No. 5-3.

5.9.3 Dry Ponds

.1 The maximum water level fluctuation for dry ponds during the 1:100 year storm event shall be 2 m.

.2 The design of dry pond stormwater management facilities shall incorporate the following:

a) Stormwater flow bypass provisions shall be provided for minor storm events that are less than the 1:5 year design event in magnitude.
b) Minimum longitudinal slope of pond bottom shall be 2%.
c) Minimum lateral slope of pond bottom shall be 1%.
d) French drains (pond underdrain system) shall be provided in the pond bottom where longitudinal slopes are less than 2%.
e) Maximum horizontal to vertical side slope shall be 7:1.
f) Minimum effective length to effective width ratio shall be from 2:1 to 5:1.
g) Pond bottoms and side slopes shall be grass covered (seed or sod). Slope erosion protection measures shall be used when required by the Town Engineer.
h) Inlets and outlets shall utilize trash racks and proper security measures to limit human access into the structures.
i) Sediment traps, or hard bottom pre-treatment sumps, shall be provided at each inlet.
j) Minimum detention time of the full pond volume shall be 24 hours.

.3 Dry ponds shall be in accordance with Standard Drawing No. 5-4.

5.9.4 Alternative Stormwater Management Facilities

.1 Underground stormwater storage tanks may be used when designs that involve the use of wet ponds or dry ponds as storage facilities are not feasible.

.2 Parking lot and rooftop storage of stormwater may be permitted in certain instances but must be approved by the Town Engineer.

.3 Infiltration and evaporation detention facilities may be used in developments where a suitable receiving water body cannot be found or the location of the water body makes construction of a proper outfall improbable. These types of facilities require detailed field investigations that involve site specific measurements of infiltration rates and a solid understanding of the local groundwater hydrology and what effects the detention facility would have on existing condition.

5.10 Stormwater Outfalls

.1 Proper outfall structures shall be placed at the end of all stormwater outfall pipes that discharge to open channels or receiving water bodies. The outfall structures shall provide a means for reducing the velocity of the discharge flow and dissipating the associated energy. As well, these structures shall incorporate the necessary design features to prevent erosion of the surrounding environment.

.2 Outfall structures must receive written approval from the following federal and provincial regulatory authorities if applicable (Developer shall obtain all necessary regulatory approvals and permits at their own expense):

Federal

- Transport Canada (Coast Guard) - *Navigable Waters Protection Act*
- Department of Fisheries and Oceans – *Fisheries Act*

Provincial

- Alberta Environment – *Water Act*
- Sustainable Resource Development – *Public Lands Act*

Note that the government departments listed above are responsible for the noted legislation at the time of printing and may be subject to change.

.3 Outfall structures may be a chute, spillway, stilling basin, or plunge pool with headwall. Cut off walls are required at the end of the outfall apron to prevent undermining support structure.

.4 Obverts of outfall pipes shall be at least 150 mm above the 1:5 year flood level for the receiving water body. Inverts of outfall pipes shall be above winter ice level or submerged below the winter ice level. Stormwater outfalls shall be protected against damage from moving ice during spring break-up.

.5 Outfall structure aprons shall be 150 mm to 225 mm above the invert of the receiving water body to prevent the collection of debris on the apron.

.6 Weeping tile shall be placed under the structure to reduce the effects of water pressure on the headwall of the outfall structure.

.7 Safety railings and trash screens shall be installed in the outfall structure to prevent human access.

.8 Stormwater outfall structures shall be properly landscaped and finished so that they may blend in with the existing topography as much as possible.

5.11 Receiving Water Bodies

.1 Necessary measures shall be incorporated into the design of proposed developments to limit, or prevent, increases in the amount of downstream erosion experienced by receiving water bodies as a result of the development.

.2 Preservation of receiving water body aesthetics and wildlife habitat shall be a high priority for all erosion protection and bank stability work.

5.12 Culverts and Bridges

If culverts and bridges are required for proposed developments that cross existing water bodies, the designs shall incorporate allowances for backwater effects over a range of flows. The design of culverts and bridges require assessment of both the nominal design capacity and the performance of the structure during 1:100 year flood events. Design calculations shall be performed by qualified Structural and Hydrological Engineers and submitted to the Town Engineer for approval.

5.13 Surface Runoff Drainage Swales

.1 All surface runoff drainage swales shall be fully constructed prior to any development of subdivision lots. Drainage swales located between adjacent lots shall be concrete.

.2 Detailed drainage swale calculations and designs shall be submitted to the Town Engineer for approval.

.3 All surface runoff drainage swales shall be contained within Public Utility Lots and shall become the property of the Town.

.4 Concrete drainage swales shall be in accordance with Standard Drawing No. 5-5.

5.14 Stormwater Quality and Best Management Practices

.1 The design of all Stormwater Management Systems shall adequately address the issue of stormwater quality. Specifically, Best Management Practices for stormwater management shall be followed as described in Section 6.3 of the *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems* as published by Alberta Environment (latest edition thereof).

.2 The use of constructed wetlands for further water quality enhancement is encouraged prior to discharge to a receiving water body.

.3 Dry ponds are utilized as a means of attenuating the peak stormwater runoff rates that are experienced in the collection system immediately after a rainfall event. Dry ponds do not address the quality of the stormwater runoff. Best Management Practices shall be used downstream of all dry ponds to properly address the quality of the stormwater being produced by the stormwater management system.

Table 5.1: Intensity Duration Frequency (IDF) Design Storm Data

Duration (minutes)	Rainfall Intensity (mm/hour)		
	1:5 Year	1:10 Year	1:100 Year
10	67.8	82.5	129.0
11	64.2	78.1	122.0
12	61.0	74.3	116.0
13	58.3	70.9	110.0
14	55.8	67.9	106.0
15	53.6	65.1	101.0
16	51.5	62.7	97.6
17	49.7	60.4	94.0
18	48.0	58.4	90.8
19	46.5	56.5	87.9
20	45.1	54.8	85.2
21	43.7	53.2	82.6
22	42.5	51.7	80.3
23	41.4	50.3	78.1
24	40.3	49.0	76.1
25	39.3	47.8	74.2
26	38.4	46.6	72.4
27	37.5	45.5	70.7
28	36.7	44.5	69.1
29	35.9	43.6	67.6
30	35.1	42.6	66.2
60	22.7	27.5	42.5
120	14.5	17.6	27.1
360	7.13	8.6	13.2
720	4.54	5.46	8.36
1440	2.89	3.47	5.29

Notes:

1. Based on AES data from Edmonton Municipal Airport for a period of 63 years (1914 to 1995).
2. Maximum initial Time of Concentration is 10 minutes.

Table 5.2: Recommended Minimum Runoff Coefficients

Land Use	Rainfall Event		
	1:5 Year	1:10 Year	1:100 Year
Residential	0.40	0.40	0.60
Multi-Family[2]	0.70	0.70	0.80
Downtown Commercial[2]	0.85	0.85	0.90
Neighbourhood Commercial[2]	0.65	0.65	0.80
Light Industrial[3]	0.60	0.65	0.70
Lawns, Parks, Playgrounds	0.20	0.20	0.30
Undeveloped Land	0.10	0.15	0.20
Paved Roads	0.90	0.90	0.95
Gravel Roads	0.30	0.35	0.65

Notes:

1. Values recommended for use with the Rational Method.
2. Where specific land uses are known, the runoff coefficients may be determined from the ultimate developed conditions.
3. Runoff coefficients must be determined from the ultimate developed conditions.

Table 5.3: 4-Hour Design Storm, Chicago Distribution

Time (min)	Design Storm		
	1:5 Year	1:10 Year	1:100 Year
0	1.64	1.97	2.99
5	3.40	4.07	6.18
10	3.55	4.26	6.47
15	3.73	4.48	6.80
20	3.94	4.72	7.17
25	4.17	5.00	7.61
30	4.45	5.33	8.11
35	4.77	5.72	8.71
40	5.16	6.19	9.43
45	5.64	6.78	10.30
50	6.26	7.52	11.50
55	7.09	8.52	13.00
60	8.26	9.93	15.20
65	10.10	12.10	18.60
70	13.50	16.30	25.00
75	23.60	28.50	43.90
80	68.10	82.90	129.00
85	68.10	82.90	129.00
90	22.20	26.80	41.30
95	16.40	19.80	30.40
100	13.30	16.10	24.60
105	11.40	13.70	21.00
110	10.00	12.10	18.50
115	9.02	10.90	16.60
120	8.24	9.91	15.10
125	7.60	9.14	14.00

Table 5.3: 4-Hour Design Storm, Chicago Distribution (Continued)

Time (min)	Design Storm		
	1:5 Year	1:10 Year	1:100 Year
130	7.08	8.50	13.00
135	6.63	7.97	12.20
140	6.26	7.52	11.50
145	5.93	7.12	10.80
150	5.64	6.77	10.30
155	5.38	6.46	9.84
160	5.16	6.19	9.42
165	4.95	5.94	9.05
170	4.77	5.72	8.70
175	4.60	5.52	8.39
180	4.44	5.33	8.11
185	4.30	5.16	7.84
190	4.17	5.00	7.60
195	4.05	4.86	7.38
200	3.94	4.72	7.17
205	3.83	4.59	6.98
210	3.73	4.47	6.80
215	3.64	4.36	6.63
220	3.55	4.26	6.47
225	3.47	4.16	6.32
230	3.39	4.07	6.17
235	3.32	3.98	6.04
240	1.64	1.96	2.97

Notes:

1. Based on AES data from Edmonton Municipal Airport for a period of 63 years (1914 to 1995).
2. Maximum initial Time of Concentration is 10 minutes.

Table 5.4: 24-Hour Design Storm, Huff Distribution

Time (min)	Time (hours)	Design Storm		
		1:5 Year	1:10 Year	1:100 Year
0	0	0.00	0.00	0.00
15	0.25	0.516	0.619	0.945
30	0.50	1.03	1.24	1.89
45	0.75	1.55	1.86	2.83
60	1.00	2.06	2.48	3.78
75	1.25	2.75	3.30	5.04
90	1.50	4.12	4.96	7.56
105	1.75	5.50	6.61	10.10
120	2.00	6.87	8.26	12.60
135	2.25	8.25	9.91	15.10
150	2.50	9.17	11.00	16.80
165	2.75	9.42	11.30	17.30
180	3.00	9.66	11.60	17.70

Table 5.4: 24-Hour Design Storm, Huff Distribution (Continued)

Time (min)	Time (hours)	Design Storm		
		1:5 Year	1:10 Year	1:100 Year
195	3.25	9.91	11.90	18.20
210	3.50	10.20	12.20	18.60
225	3.75	10.00	12.00	18.30
240	4.00	9.58	11.50	17.60
255	4.25	9.17	11.00	16.80
270	4.50	8.75	10.50	16.00
285	4.75	8.33	10.00	15.30
300	5.00	7.89	9.49	14.50
315	5.25	7.45	8.95	13.70
330	5.50	7.01	8.42	12.80
345	5.75	6.57	7.89	12.00
360	6.00	6.13	7.36	11.20
375	6.25	5.76	6.92	10.60
390	6.50	5.39	6.48	9.88
405	6.75	5.02	6.03	9.20
420	7.00	4.65	5.59	8.53
435	7.25	4.31	5.17	7.89
450	7.50	4.04	4.85	7.39
465	7.75	3.77	4.52	6.90
480	8.00	3.50	4.20	6.41
495	8.25	3.23	3.88	5.91
510	8.50	3.02	3.63	5.53
525	8.75	2.91	3.50	5.33
540	9.00	2.80	3.36	5.13
555	9.25	2.69	3.23	4.93
570	9.50	2.58	3.10	4.72
585	9.75	2.47	2.97	4.53
600	10.00	2.36	2.84	4.33
615	10.25	2.26	2.71	4.13
630	10.50	2.15	2.58	3.94
645	10.75	2.04	2.45	3.74
660	11.00	1.95	2.34	3.57
675	11.25	1.85	2.23	3.39
690	11.50	1.76	2.11	3.22
705	11.75	1.67	2.00	3.05
720	12.00	1.57	1.89	2.88
735	12.25	1.52	1.82	2.78
750	12.50	1.46	1.76	2.68
765	12.75	1.41	1.70	2.59
780	13.00	1.36	1.63	2.49
795	13.25	1.30	1.57	2.39
810	13.50	1.25	1.50	2.28

Table 5.4: 24-Hour Design Storm, Huff Distribution (Continued)

Time (min)	Time (hours)	Design Storm		
		1:5 Year	1:10 Year	1:100 Year
825	13.75	1.19	1.43	2.18
840	14.00	1.13	1.36	2.08
855	14.25	1.08	1.29	1.97
870	14.50	1.04	1.25	1.90
885	14.75	1.02	1.23	1.88
900	15.00	1.01	1.21	1.85
915	15.25	1.00	1.20	1.83
930	15.50	0.984	1.18	1.80
945	15.75	0.972	1.17	1.78
960	16.00	0.961	1.15	1.76
975	16.25	0.949	1.14	1.74
990	16.50	0.938	1.13	1.72
1005	16.75	0.926	1.11	1.70
1020	17.00	0.914	1.10	1.68
1035	17.25	0.902	1.08	1.65
1050	17.50	0.890	1.07	1.63
1065	17.75	0.878	1.06	1.61
1080	18.00	0.866	1.04	1.59
1095	18.25	0.854	1.03	1.56
1110	18.50	0.842	1.01	1.54
1125	18.75	0.830	1.00	1.52
1140	19.00	0.818	0.983	1.50
1155	19.25	0.802	0.964	1.47
1170	19.50	0.772	0.928	1.42
1185	19.75	0.742	0.892	1.36
1200	20.00	0.712	0.856	1.31
1215	20.25	0.683	0.820	1.25
1230	20.50	0.658	0.791	1.21
1245	20.75	0.643	0.772	1.18
1260	21.00	0.627	0.753	1.15
1275	21.25	0.611	0.734	1.12
1290	21.50	0.595	0.715	1.09
1305	21.75	0.574	0.690	1.05
1320	22.00	0.550	0.661	1.01
1335	22.25	0.525	0.631	0.963
1350	22.50	0.501	0.602	0.918
1365	22.75	0.476	0.572	0.873
1380	23.00	0.452	0.543	0.828
1395	23.25	0.427	0.513	0.783
1410	23.50	0.403	0.484	0.738
1425	23.75	0.378	0.454	0.693
1440	24.00	0.353	0.425	0.648

Notes:

1. Based on AES data from Edmonton Municipal Airport for a period of 63 years (1914 to 1995).
2. Maximum initial Time of Concentration is 10 minutes.

Table 5.5: Catch Basin Capacities (L/s)

Catch Basin	Flow Condition	
	Continuous Slope	Sag Condition
F-35A	10	23
F-38, F-39	20	38
F-51	40	80

Notes:

1. For 1:100 design storm events, catch basin capacities can be doubled.

Table 5.6: Permissible Depths of Flow in Channels

Flow Velocity (m/s)	Permissible Depth of Flow (m)
0.5	0.80
1.0	0.32
2.0	0.21
3.0	0.09

Notes:

1. Based on a 20 kg child standing in the flow. Channel is lined with concrete.
2. Larger persons may be able to withstand greater depths of flow.

END OF SECTION 5

6.1 Service Connection Requirements

.1 The current version of the Town of Westlock – Water and Sewer Utility Bylaw shall be reviewed by the Developer and their Consulting Engineers.

.2 Minimum size of service connections for single family residences shall be as follows:

- sanitary sewer service = 100 mm diameter
- potable water service = 25 mm diameter

.3 Services of size larger than those indicated in 6.1.1may be required by the Town Engineer where the length of service connection or other conditions warrant.

.4 Storm service connections may be provided if directed by geotechnical reports. They will have a minimum size of 150 mm.

.5 Minimum slope for sanitary sewer service connection shall be 2%.

.6 Connections to sewer mains shall be made with an in-line tee connection.

.7 Where bends are involved with the service connection piping, long radius type or a combination of 22.5^0 (degree) bends and straight pipe shall be used.

.8 Potable water service connections shall be tapped at the 2 to 3 o'clock or 9 to 10 o'clock position on the distribution main.

.9 Water mains shall be tapped under pressure if in service. No dry taps will be permitted.

6.2 Potable Water Service Materials

.1 Potable water service pipe shall be one of the following:

a) Copper pipe, Type K, conforming to the latest edition of ASTM standard B42-02e1.
b) Blue Kitec (Pex-Al-Pex) pipe, conforming to the latest editions of ASTM standard F1281 and CSA standard series B137.
c) Couplings shall be standard brass compression type.

.2 Water service fittings shall be:

a) Corporation cocks shall be compression type, Ford or approved equal, tapered thread.
b) Curb stops shall be Ford or approved equal, copper to copper, ball valve with a drain. Curb stops 38 mm or larger shall be ball bearing type.
c) Service boxes shall be epoxy coated, extension type (maximum extension of 3.5 m) complete with stainless steel operating rod, brass clevis, and key. Service box shall be supported on a cast iron foot piece that is fashioned to a pressure treated preserved wood plank.
d) Service clamps shall be double strap type and shall be either bronze or stainless steel.

6.3 Sanitary Sewer Service Materials

.1 Sanitary sewer service pipe shall be:

a) PVC, Dimension Ratio (DR) 35, building service pipe conforming to the latest edition of ASTM standard D3034-04a.

.2 Service fittings shall be either in line service tees or saddle tees complete with gasket and stainless steel straps, nuts, and bolts.

6.4 Service Connection Installation Requirements

.1 If the potable water service connection is 50 mm in size or smaller, the water and sanitary services shall be installed in a common trench to the side of the lot opposite the driveway, considering the location of other street furniture such as hydrants and power apparatus.

.2 Services shall be installed so that, when facing the lot being served, the potable water service is on the right of the sanitary service.

.3 Minimum depth of cover over the potable water and sanitary services at the property line shall be 2.8 m and shall be in accordance with Standard Drawing No. 6-1 and Standard Drawing No. 6-2. If the minimum depth of cover cannot be achieved due to existing constraints, the services shall be properly insulated to protect them from freezing.

.4 Where the sanitary sewer service is required to connect to a sanitary main that is in excess of 4.5 m deep, risers shall be installed. The risers shall be installed so that the sanitary service connection is in accordance with Standard Drawing No. 6-1.

.5 Corporation stops and curb stops shall be installed in accordance with Standard Drawing No. 6-2. These must be accessible at all times and are not to be buried under asphalt or concrete driveways or walkways.

.6 Where a copper service is installed, there shall be a horizontal bend near the corporation stop. Potable water services are NOT to be goose necked. Service pipes shall be snaked in the trench to allow for thermal expansion and contraction.

.7 Curb stops shall be installed 150 mm from the back of the property line or easement line and within the utility right of way, as shown on Standard Drawing No. 6-2 and Standard Drawings No. 7-1 to 7-10.

.8 Sanitary sewer services shall be extended to the property line or easement line as shown on Standard Drawing No. 6-1 and shall be properly capped.

.9 All services shall be laid on 75 mm of granular bedding. Bedding material shall be placed up to a level of 300 mm above the crown of the highest service in the trench.

.10 Blue/Green painted stakes, 50 mm x 100 mm in size, shall be extended from the end of the service connections to a height of 1 m above ground level.

6.5 Requirements for Abandoning Service Connections

.1 If a potable water service connection is to be abandoned, the main stop at the distribution watermain shall be exposed through vertical excavation and closed. Further, the water service pipe shall be cut and severed immediately downstream of the main stop to physically separate the watermain from the service pipe. The abandoned service pipe shall be left in place after it has been severed from the watermain. Excavation and removal of the water service pipe from the watermain to the property line is not required.

.2 If a sanitary sewer service connection is to be abandoned, the service pipe shall be removed up to the property line from the private landowner side (upstream). At the property line, the sanitary service pipe shall be cut and a proper plug shall be installed. Excavation and removal of the sanitary service pipe from the property line to the sanitary collection main is not required.

END OF SECTION 6

7.0 General

.1 The current version of the Town of Westlock – Transportation Master Plan shall be reviewed by the Developer and their Consulting Engineers to understand any identified system constraints and future servicing strategies that have implications for the proposed development.

7.1 Geometric Design Standards

.1 Road classification and designation shall be in accordance with the classification system outlined in the Roads and Transportation Association of Canada (RTAC) Manual - Geometric Design Standards for Canadian Roads and Streets.

.2 The following are general minimum requirements to be used in the design of roads:

a) Road cross-sections shall be as defined in Tables 7.1 and 7.2 as well as Standard Drawing No. 7-1 through Standard Drawing No. 7-10.
b) Concrete curb and gutter shall be in accordance with Standard Drawing No. 7-12 and Standard Drawing No. 7-13.
c) Sidewalks shall be 1.2 m wide and shall be in accordance with Standard Drawing No. 7-14.
d) Monolithic curb, gutter, and sidewalks shall have a 1.2 m sidewalk width in accordance with Standard Drawing No. 7-15 and Standard Drawing No. 7-16. Sidewalks shall be clear of all obstructions including surface utilities.
e) Sidewalk locations shall be in accordance with Standard Drawing No. 7-1 through Standard Drawing No. 7-10. Wider sidewalks may be required in areas of high pedestrian activity, as determined by the Town Engineer.

.3 Rear lanes (alleys) in residential areas shall have a surfaced width of 4.2 m for gravel or a 4.0 m surfaced width for asphalt within a 6.0 m right-of-way (R.O.W) and a minimum longitudinal grade of 0.6%. Rear lanes in commercial areas shall have a surfaced width of 6.0 m within a 6.0 m (R.O.W) and a minimum longitudinal grade of 0.6%. If rear lanes are to have a gravel surface, the lane shall be cross sloped to one side at a grade of 3.0%. If the rear lane is to be paved, the lane shall have a centre swale and cross slopes of 2.5%. Where rear lane traffic activity is expected to be high, wider surfaced widths and rights-of-way may be required by the Town Engineer.

.4 Curb Ramps shall be in accordance with Standard Drawing No. 7-17.

.5 Driveways shall have a minimum horizontal clearance of 1.8 m from any structure (hydrant, light standard, service pedestal etc.) and shall be in accordance with Standard Drawing No. 7-14 and Standard Drawing No. 7-18.

7.2 Vertical Alignment

.1 Minimum gutter grades around all curves and along all tangents shall be 0.5%. Minimum gutter grades on curb returns shall be 0.6%.

.2 Maximum gradients shall not exceed those defined in Table 7.1.

.3 All roadways shall have parabolic crowns as shown in the applicable standard drawing.

.4 Maximum superelevation values shall be in accordance with those shown in Table 7.1.

.5 All vertical curves shall be designed to meet or exceed the minimum requirements shown in Table 7.3.

7.3 Horizontal Alignment

.1 Minimum radius shall be in accordance with Table 7.2.

.2 Horizontal curves shall be designed to meet the design requirements shown in Table 7.2 as a minimum.

.3 Minimum edge of pavement radius for residential cul-de-sacs is 11 m. For industrial cul-de-sacs, the minimum edge of pavement radius shall be 14 m.

.4 Maximum cul-de-sac lengths shall be 100 m.

7.3.1 Curb Returns

.1 Residential local road intersections shall have curb returns with a radius of 7.5 m.

.2 Residential collector road intersections shall have curb returns with a radius of 12.5 m.

.3 Industrial and commercial road intersections shall have curb returns with a radius of 15 m to accommodate truck turning movements.

.4 For arterial road intersections, curb returns shall be designed to properly accommodate the design vehicle type and expected volume of traffic. Two and three centred curves with or without islands may be required.

.5 Curb ramps are required at all intersections which have sidewalks.

7.4. Pavement Structure

.1 Roads, other than rear lanes (alleys), shall be paved with hot mix asphalt if required by the Town Engineer. A geotechnical investigation shall be conducted by an independent Professional Engineer. A final report based on the geotechnical investigation work shall include recommended pavement designs. The report shall be submitted to the Town Engineer for review prior to any detailed design related activities.

.2 Paved roadways shall be designed in accordance with the Asphalt Institute method of pavement design that uses minimum design loadings of 8,165 kg (18,000 lb) axle loads for local roads and 10,886 kg (24,000 lb) axle loads for collector roads.

.3 All industrial/commercial roads shall be designed using a minimum design loading of 10,886 kg (24,000 lb) axle loads. Design parameters shall be submitted to the Town Engineer for review. The Town reserves the right to request the Developer to engage a geotechnical engineering agency to carry out CBR tests on the road subgrade prior to paving to confirm the adequacy of the design.

.4 Minimum pavement structure design requirements are contained in Table 7.4. Independent pavement designs are required for all developments. Pavement structure design requirements may be increased in areas with poor subgrade materials.

.5 Alternative pavement designs may be approved by the Town Engineer. Approval of alternate pavement designs must be obtained in writing from the Town Engineer prior to submission of design drawings.

.6 Gravel surfacing is permitted on rural roads and may be permitted on urban roads. Road structure designs must be approved by the Town Engineer prior to submission of design drawings.

.7 Gravel surfacing may be permitted on rear lanes and will be evaluated on a case by case basis. If permitted, aggregate base material shall have a minimum depth of 225 mm which is to be placed in 2 lifts (150 mm placed during initial construction and 75 mm subsequently placed during the second year of the maintenance period).

7.5 Granular Base Course

.1 Granular base course gradations shall be within the limits specified below. Testing shall conform to the latest editions of ASTM standards C136-05 and C117-04. Test results shall yield a smooth curve without sharp breaks when plotted on a semi-log grading chart.

20 mm Minus Gravel

Sieve Size	% Passing By Weight
20.0 mm	100
12.5 mm	60 - 92
5.0 mm	37 - 62
2.00 mm	26 - 44
0.40 mm	12 - 27
0.80 mm	2 - 10

.2 60% of particles 5 mm and larger shall have at least one freshly fractured face.

.3 All granular materials shall be compacted to 100% Standard Proctor Density (SPD).

7.6 Asphaltic Concrete Pavement

7.6.1 Description

.1 Asphaltic concrete pavements shall consist of mineral aggregate, filler and asphaltic binder. Pavement shall be laid and compacted to the specified thickness and shall conform to the approved lines, grades and typical cross sections.

7.6.2 Minerals

.1 Aggregates in Mix

When tested by means of laboratory sieves, the combined aggregates in the mix shall conform to the following gradation:

Sieve Size	Cumulative % Passing by Weight	
	Light Duty	Heavy Duty
12.5 mm	100	100
10.0 mm	78 - 94	83 - 90
5.0 mm	53 - 80	55 - 70
2.5 mm	42 - 67	40 - 60
0.63 mm	24 - 44	18 - 38
0.315 mm	16 - 32	12 - 30
0.16 mm	8 - 22	8 - 18
0.08 mm	4 - 10	2 - 6

For both light and heavy duty asphaltic pavement designs, a minimum of 70% of the particles retained on 5 mm sieve shall have at least two fractured surfaces.

For heavy duty asphaltic pavement designs, the fine aggregate mass shall have a minimum manufactured fines content of 75%.

.2 Asphaltic Binder

Asphaltic binder shall be uniform in composition and shall not foam when heated to 177 degrees Celsius (°C) and shall conform to the following requirements:

Requirement	Value
Designation	150 - 200 (A)
Penetration at 25°C, 100 gm, 5 sec.	150 – 200
Min. flash point (C.O.C.)	205°C
Ductility at 25°C	100 cm
Min. solubility in carbon tetrachloride	99%
Min. penetration after thin film oven test at 25°C	40% of original
Min. kinematic viscosity at 135 °C	150 Centistokes

7.6.3 Mix Design

.1 Mix designs shall be based on the Marshall Method and shall conform to the following requirements:

Requirement	Light Duty	Heavy Duty
Compaction blows on each face	50	75
Min. Marshall stability at 60°C	4,500 N	6,700 N
Flow	2 to 4 mm	1.5 to 3 mm
Air voids (total mix)	3% to 5%	3.5% to 4.5%
Min. voids in mineral aggregates	15%	15%
Asphalt content (total mix)	5% to 7%	5% to 8%
Min. retained stability	75%	75%

The mix design shall be carried out by an accredited testing agency and shall be submitted to the Town Engineer for approval at least two weeks prior to commencement of work. Alternative mix designs may be used, subject to approval by the Town Engineer.

7.6.4 Final Density Requirements

.1 Asphaltic concrete shall be compacted to a Marshall density of 98%. Specimens shall be prepared from the asphaltic mixture being used.

.2 Asphaltic concrete pavements that are found to be deficient in density will be corrected to the satisfaction of the Town Engineer at the Developer's expense. Alternatively, the Town may elect to receive monetary compensation for the areas of deficient ashpaltic concrete pavement. Monetary compensation shall be in accordance with the pay factors outlined in Table 7.5 based on the contract pricing for the work.

.3 No adjustments to the contract price shall be made for asphaltic concrete pavements found to have excess densities beyond the values stipulated by the contract documents for the work.

.4 Monetary compensations for deficient asphaltic concrete pavements paid to the Town by the Developer do not relieve the Developer of the maintenance requirements stipulated in the contract documents for the work.

7.6.5 Asphalt Thickness Tolerances

.1 Asphaltic concrete pavements shall have a thickness conforming to that specified on the approved design drawings.

.2 Asphaltic concrete pavements that are found to be deficient in thickness will be corrected to the satisfaction of the Town Engineer at the Developer's expense. Alternatively, the Town may elect to receive monetary compensation for the areas of deficient thickness. Monetary compensation shall be in accordance with the pay factors outlined in Table 7.6 based on the contract pricing for the quantity of hot mix in the specific mat area.

.3 No adjustments to the contract price shall be made for asphaltic concrete pavements found to have excess thickness beyond the values stipulated by the contract documents for the work.

7.7 Prime Coats and Tack Coats

7.7.1 Description

.1 Prime coats shall be the application of bituminous material to a subgrade or previously prepared gravel base course. The application shall be prior to placing any bituminous surfacing materials.

.2 Tack coats shall be the application of bituminous material to a previously constructed paving surface of any type.

7.7.2 Prime Coat Over Granular Base Course

.1 Prime coats over granular base courses shall be liquid asphalt.

.2 Prime coat types may vary from M.C. 30 to M.C. 250. The prime coat type may also vary from SS-1 to special emulsified primers (S.E.P.1) so that the prime coat properly suits the conditions of the granular base course.

.3 Prime coat application rates may vary from 0.50 to 1.50 L/m^2 based on the condition of the granular base course materials. The application rate shall permit good prime coat penetration into the granular base course without causing ponding of the prime coat on the surface.

.4 Excess prime coat materials that remain after 6 hours have elapsed from the time of initial application shall be absorbed and removed with sand blotter material.

.5 Prime coat temperatures at the time of application shall fall within the following limits:

Medium Curing Asphalt	Temperature Range Limit
M.C. 30	51°C to 68°C
M.C. 70	74°C to 88°C
M.C. 250	100°C to 110°C

Emulsified Asphalt	Temperature Range Limit
SS-1	24°C to 54°C

Special Emulsified Primer	Temperature Range Limit
S.E.P.1	15°C to 50°C

7.7.3. Tack Coat Over Asphalt Base

.1 Tack coat types may vary from SS-1 to SS-1H. The tack coat type may also vary from R.C. 30 to R.C. 250 so that the prime coat properly suits the conditions of the asphalt base material.

.2 SS emulsions shall be diluted by adding an equal amount of water prior to application.

.3 Tack coat application rates shall be 0.25 to 0.90 L/m^2 based on the condition of the asphalt base material. The application rate shall ensure that uniform coverage is achieved and that the tack coat provides a good bond after curing.

.4 Tack coat temperatures at the time of application shall fall within the following limits:

Rapid Curing Asphalts	Temperature Range Limit
R.C. 30	51°C to 68°C
R.C. 70	74°C to 88°C

Emulsified Asphalt	Temperature Range Limit
SS-1	24°C to 54°C
SS1H	24°C to 54°C

7.8 Concrete Flatwork

.1 Curbs, gutters and sidewalks shall conform to the approved lines, grades and typical cross sections.

7.8.1 Minerals

.1 Portland cement shall conform to the latest editions of ASTM standards C150-04ae1 or CSA Standard A5.

.2 Concrete aggregates shall conform to the latest edition of ASTM standard C33-03.

.3 Air-entraining admixtures shall conform to the latest edition of ASTM standard C260-01.

.4 The use of calcium chloride admixtures will normally not be permitted. Their use during cold weather conditions may be approved by the Town Engineer. Under these circumstances, the maximum calcium chloride admixture content shall be 2% by weight of cement in Type 10 concrete only.

.5 Curing compounds shall be resin based impervious liquid membrane forming compounds that conform to the latest edition of ASTM standard C309-03. The use of curing compounds shall not profoundly change the colour of the concrete. The curing compound shall produce a film on the concrete that is distinctly visible for a period of at least four (4) hours after application.

.6 Maximum fly ash content shall be 10% by mass of cement. The use of fly ash in concrete will not be permitted after September 1st.

7.8.2 Mix Design

.1 Concrete used for curbs, gutters, and sidewalks shall meet the following requirements:

Requirement	Value
Min. compressive strength at 28 days	30 MPa
Max. size coarse aggregate	20 mm
Slump	25 mm to 75 mm
Entrained air content	6% to 8%

.2 All concrete shall achieve a compressive strength of 30 MPa in 7 days when placed after September 30th.

7.8.3 Concrete Placement

.1 For curbs, driveways, and swales in travelled areas, the subgrade shall be compacted to 100% Standard Proctor Density (SPD) as a minimum. For separate sidewalks, the subgrade shall be compacted to 95% SPD as a minimum.

.2 Concrete shall be poured and subsequently vibrated to form curbs, gutters and sidewalks in accordance with the standard drawings.

.3 Backfilling behind curbs, gutters, and sidewalks shall be carried out immediately after the formwork has been removed. The backfill shall be compacted to a minimum SPD of 95%.

7.8.4 Cold Weather Placement of Concrete

.1 When the mean average ambient environmental temperature falls below 5°C, suitable means shall be employed to maintain the concrete temperature at, or above, 10°C. This temperature shall be maintained for a period of seven (7) days following concrete placement.

7.9 Inspection and Testing

.1 The Developer shall employ a professional materials testing firm, licensed to practice in the Province of Alberta, to complete the tests outlined in Table 7.6. The Developer shall submit one (1) copy of all test results to the Town Engineer for review.

7.10 Traffic Control Devices, Roadway Signs, and Pavement Markings

.1 Engineering drawings shall be provided to the Town Engineer which outline the proposed locations and details of all traffic control devices, roadway signs, and pavement markings.

.2 All traffic control devices and pavement markings shall conform to the standards established in the manual entitled "Uniform Traffic Control Devices for Canada" as issued and revised by the Transportation Association of Canada.

.3 All guide and information signage shall conform to standards established in the "Urban Guide and Information Sign Manual" as issued and revised by the Government of Alberta.

7.10.1 Materials

.1 All roadway signs shall be standard aluminum, white on green, with a minimum vertical dimension of 150 mm.

.2 All roadway signs shall utilize high intensity reflective materials.

.3 All roadway sign posts shall be 50 mm diameter schedule 40 galvanized steel posts.

.4 All pavement markings shall be permanent and inlaid with the final asphaltic concrete surface course for arterial roads and intersections. Painted pavement markings are acceptable for use with non-arterial roadways and intersections.

7.10.2 Installation

.1 All roadway signs shall be installed so that 2 m of vertical clearance is provided from the ground to the bottom of the sign.

.2 All roadway signs shall be installed so that a minimum of 0.3 m of horizontal clearance is provided from the face of the adjacent curb.

.3 Roadway signs shall be installed in accordance with Standard Drawing No. 7-19.

7.11 Roadway Lighting

7.11.1 General Requirements

.1 The following standards are applicable to all types of development within the Town except industrial developments. Standards for industrial developments shall be determined by the Town during the initial planning stages of the proposed industrial development.

.2 All roadway lighting cables shall be installed underground.

7.11.2 Design

.1 All roadway lighting posts and fixtures shall be steel.

.2 The minimum lighting levels outlined in Table 7.7 shall be provided by the roadway lighting design.

.3 All roadway lighting fixtures shall utilize high pressure sodium lamps.

.4 Roadway lighting designs shall be approved by the Town Engineer prior to installation.

7.11.3 Location

.1 Roadway lights shall be located in such a way that they do not interfere with other utility alignments or driveways.

.2 Roadway lights shall be offset 2.5 m from the projection of common property lines between two adjacent lots.

.3 Roadway lights shall be offset from roadways and sidewalks in accordance with the values outlined in Table 7.2.

.4 Lights shall be provided for park areas that are not adjacent to a lighted roadway. Lights shall be located at the points where pedestrian walkways enter into the park area.

.5 All roadway light standards shall be painted to conform to any existing standards within the area.

7.11.4 Costs

.1 The Developer shall be responsible for all capital costs associated with the provision and installation of all roadway lighting and associated appurtenances.

.2 The Developer shall be responsible for all of the utility charges that are necessary for the proper operation and maintenance of roadway lighting within a development until such time as the occupancy level for that development reaches 50%. At that time, the Town will assume payment of operation and maintenance costs charged by the utility company.

Table 7.1: Recommended Design Standards for Roads (Part A)

Classification	Traffic Volumes (vpd)	Design Speed[a] (km/h)	R.O.W Width (m)	Pavement Width (m)	Travel Lanes[b]	Parking Lanes	Max. Gradient (%)	Max. Superelevation (m/m)
Undivided Arterial	5,000 - 12,000	60 -70	30	14.8	4 at 3.7m	n/a	5	0.04 - 0.06
Divided Arterial	12,000 - 30,000	60 - 90	33[c]	20.3	4 at 3.7m	n/a	4	0.04 - 0.06
Major Residential Collector	2,500 - 5,000	0	23	12	2 at 3.5m	2 at 2.5m	7	0.025 - 0.04
Minor Residential Collector	1,000 -2,500	60	20	11	n/a	n/a	7	0.025 - 0.04
Local Residential	Up to 1,000	60	18.5[d]	9	n/a	n/a	8	0.025
Local Industrial	n/a	60	18.5[e]	11.5	n/a	optional	6	0.025
Industrial Collector	n/a	60 - 70	23	13	n/a	optional	6	0.025

Notes:

a. Posted speed to be 10 km/h less than design speed

b. Additional travel lane width may be required to accommodate cyclists

c. Land for noise attenuation will be in addition to the road R.O.W requirement

d. R.O.W may be narrowed to allow for short cul-de-sacs or restricted access areas

e. Additional R.O.W required where rural roadway cross-section is used for intial stage

Table 7.2: Recommended Design Standards for Roads (Part B)

Classification	Min. Radius of Curvature (m)	Min. Intersection Spacing (m)	Min. Corner Cuts at Intersections (m)	Sidewalks	Obstruction Locations	Parking	Access
Undivided Arterial	170	150	30	separate, 1 or 2 sides	2.5 m min. from f.o.c. or behind sidewalk	restricted	restricted[a]
Divided Arterial	190	200	30	separate, 1 or 2 sides	2.5 m min. from f.o.c. or behind sidewalk	prohibited	restricted[a]
Major Residential Collector	150	60	10	separate or mono, both sides	2 m min. from f.o.c.	permitted	permitted[b]
Minor Residential Collector	150	60	10	separate or mono, both sides	2 m min. from f.o.c.	permitted	permitted[b]
Local Residential	90	60	6	mono, both sides	2.2 m min. from f.o.c.	permitted	permitted
Local Industrial	90	60	6	optional	1.65 m min. from f.o.c.	optional	permitted
Industrial Collector	150	60	10	optional	2.25 m min. from f.o.c.	optional	some restrictions

Notes:

a. Prohibited for residential land uses

b. Rear lane (alley) access preferred

Table 7.3: Vertical Curve Design Data

K Value			
Design Speed (km/h)	**Crest**	**Sag***	**Minimum Length (m)**
50	7	6	50
60	15	10	60
70	22	15	70

Notes:

1. K = L/A
2. L = length of vertical curve in meters
3. A = algebraic difference in grades percent

* based on comfort control and assumes road lighting

Table 7.4: Minimum Pavement Structure Design Requirements

Road Classification	Residential Use	Industrial & Commercial Use
Local	150 mm subgrade prep. to 100% SPD	300 mm subgrade prep. to 100% SPD
	250 mm aggregate base course	300 mm aggregate base course
	90 mm asphaltic concrete surface (light duty, 2 lifts - 50mm base & 40 mm final*)	100 mm asphaltic concrete surface (heavy duty)
Collector	150 mm subgrade prep. to 100% SPD	300 mm subgrade prep. to 100% SPD
	300 mm aggregate base course	350 mm aggregate base course
	100 mm asphaltic concrete surface (heavy duty)	100 mm asphaltic concrete surface (heavy duty)
Arterial	300 mm subgrade prep. to 100% SPD	300 mm subgrade prep. to 100% SPD
	350 mm aggregate base course	350 mm aggregate base course
	225 mm asphaltic concrete surface (heavy duty)	225 mm asphaltic concrete surface (heavy duty)

Notes:

* Final 40 mm lift of asphaltic concrete shall be placed in the second year of the maintenance period

Table 7.5: Asphalt Density Pay Factors

Actual Density (%)	Pay Factor (%)	Actual Density (%)	Pay Factor (%)
98.0	100.0	96.4	91.1
97.9	99.9	96.3	89.8
97.8	99.8	96.2	88.5
97.7	99.6	96.1	87.1
97.6	99.4	96.0	85.5
97.5	99.1	95.9	83.8
97.4	98.7	95.8	82.0
97.3	98.3	95.7	80.0
97.2	97.8	95.6	77.7
97.1	97.2	95.5	75.4
97.0	96.5	95.4	73.0
96.9	95.8	95.3	70.3
96.8	95.0	95.2	67.2
96.7	94.2	95.1	63.7
96.6	93.3	95.0	60.0
96.5	92.3	<95.0	Reject

Table 7.6: Asphalt Thickness Pay Factors

Thickness Deficiency (%)	Pay Factor (%)
10.0	100.0
11.0	97.0
12.0	93.7
13.0	90.0
14.0	85.5
15.0	80.5
16.0	75.0
17.0	68.0
18.0	60.0
19.0	50.0
>19.0	Grind and resurface

Table 7.7: Minimum Roadway Lighting Requirements

Classification	Area	Average Illuminance (lux)	Maximum Avg./Min. Ratio	Maximum Max./Min. Ratio
Arterial	Downtown	22	3 to 1	6 to 1
	Commercial	17	3 to 1	6 to 1
	Residential	12	3 to 1	6 to 1
	Industrial	9	3 to 1	6 to 1
Collector	Downtown	17	3 to 1	6 to 1
	Commercial	13	3 to 1	6 to 1
	Residential	10	3 to 1	6 to 1
	Industrial	6	3 to 1	6 to 1
Local	Downtown	12	3 to 1	6 to 1
	Commercial	10	3 to 1	6 to 1
	Residential	6	6 to 1	12 to 1
	Industrial	6	6 to 1	12 to 1
Lane	Downtown	6	6 to 1	10 to 1
	Commercial	6	6 to 1	10 to 1
	Residential	4	6 to 1	12 to 1

Table 7.8: Minimum Materials Testing Requirements

Component	Type of Test	Min. Test Frequency	Remarks
Trenching, Backfilling, and Compaction	Density Test (Trench length > 15 m)	2 tests per 600 mm of trench depth for every 100 m of trench length	Testing will vary with project location and trench settlement
	Density Test (Trench length < 15 m)	3 tests per trench	Testing will vary with project location and trench settlement
Roadway Excavation, Backfilling, and Compaction	Grading/Fill Compaction Test	1 test per 2,000 m^2 of compacted lift	
	Subgrade Compaction Test	1 test per 1,000 m^2 of compacted lift	
	Proof Rolling	Entire project	
Aggregates	Source Sieve Analysis	1 test per 500 tonnes (250 m^3) of ashpalt aggregate	Required 2 weeks prior to commencing work
		1 test per 2,500 tonnes (1,250 m^3) of base course and sub-base aggregate	Required 2 weeks prior to commencing work
	Compaction Test	1 test per 1,500 m^2 of compacted lift	
	Proof Rolling	Entire project	
Lime Stabilization	Source Sampling		Required 2 weeks prior to commencing work
	Proof Rolling	test 400 m^2 at completion of curing period	
Soil Cement	Source Sieve Analysis	1 test per 2,500 tonnes (1,250 m3)	Required 2 weeks prior to commencing work
	Mix Design		Required 2 weeks prior to commencing work
	Thickness Test	1 core sample test per 1,000 m^2 of soil cement in place	To be done on areas suspected of having inadequate thickness
	Compaction Test	1 test per 1,000 m^2 of soil cement in place	
	Strength Test	1 7-day test per 1,000 tonnes of soil cement	
Topsoil	Analysis report	1 L sample per source	Required 4 weeks prior to commencing work
Asphaltic Concrete Paving	Mix Design		Required 2 weeks prior to commencing work
	Thickness Test	3 cores per 6,000 tonnes of asphaltic pavement (5,000 m^2 for a 50 mm lift)	
	Density Test	1 Marshall core per 6,000 tonnes of asphaltic mix, minimum of 1 test from each day's production	
Watermain	Hydrostatic Leakage Test	Test section not to exceed 365 m in length	Provide Engineer with 24 hours notice as a minimum
	Bacteriological Test	Test section not to exceed 365 m in length	Provide Engineer with 24 hours notice as a minimum
Storm/Sanitary Sewer	CCTV Inspection	Upon completion prior to backfilling	
Forcemains	Hydrostatic Leakage Test	Test section not to exceed 365 m in length	Provide Engineer with 24 hours notice as a minimum
Concrete Work	Mix Design		Required 2 weeks prior to commencing work
	Slump Test	1 per 20 m^3 for each class of concrete poured, minimum 1 test per day	Requied for every truck load until consistency is established
	Entrained-Air Test	1 per 20 m^3 for each class of concrete poured, minimum 1 test per day	Requied for every truck load until consistency is established
	Strength Test	1 per 20 m^3 for each class of concrete poured, minimum 1 test per day	

END OF SECTION 7

8.1 Lot Grading

8.1.1 Subdivision Grading

8.1.1.1 Plans

.1 The Developer shall submit plans containing the following information:

a) Existing contours.
b) Front, back, 8 m from front, 10 m from back.
c) Location of all proposed surface concrete or grass drainage swales.
d) Direction of major overland drainage routes.
e) Proposed elevations and grades for all public lands.
f) Depth of ponding on streets during major storm events.
g) Elevations of service connections for each lot.
h) Driveway locations.
i) All lots where fill exceeds 0.5 m.

.2 Grading plans shall be used to consolidate this information as much as possible.

8.1.1.2 Design

.1 Overall grading designs shall consider the functionality of both the minor and major stormwater management systems.

.2 Lots shall be graded in such a manner as to eliminate surface runoff that will be conducted onto adjacent properties.

.3 All surface drainage swales shall be contained within registered easements.

.4 All public lands shall be graded to drain towards developed roadways and/or stormwater catch basins.

.5 Boulevard areas shall be graded to provide a minimum slope of 2% from the property line to the top of curb.

.6 The minimum overall lot grade for a single family development will be 2%, with a maximum lot grade of 10%.

8.1.2 Lot Grading

8.1.2.1 Plans

.1 The Developer shall submit plans containing the following information:

a) Proposed top of curb elevation at each lot corner.
b) Existing and proposed lot corner elevations.
c) Location and invert elevation of sanitary sewer and water services.

d) Direction of drainage arrows.
e) Areas of ponding

.2 The Developer shall also submit individual lot plans in accordance with Standard Drawing No. 8-1.

8.1.2.2 Retaining Walls

.1 Retaining walls may be required on lots with a slope greater than 10%.

.2 Retaining walls shall be shown on the proposed grading plans.

8.1.2.3 Design

.1 Lots shall be graded to achieve a minimum slope of 10% away from any building for a minimum of 3 m. Minimum slope along lot lines shall be 2%.

.2 In cases where the backyard slopes towards the building, provisions shall be required to keep the surface runoff at least 3 m away from the building.

.3 All public lands shall be graded to drain towards developed roadways and/or stormwater catch basins.

8.1.2.4 Surface Drainage

.1 Where surface drainage swales are required, they shall be in accordance with Section 5.12.

8.2 Landscaping

8.2.1 Scope

.1 Work under landscaping includes the following:

a) Site preparation.
b) Seeding and/or sodding.
c) Planting.

8.2.2 Landscaping Plans

.1 The Developer shall submit landscaping plans detailing the proposed improvements. Plans shall be drawn to a scale of 1:1000 and shall identify areas to be seeded or sodded, Plans shall also identify the locations and names of all trees and shrubs, locations of planting beds, locations and type of fencing, and any park furniture or playground equipment being installed. These plans shall utilize the overall road, sidewalk, and walkway plans as a base.

.2 The Developer shall submit detailed drawings of proposed park furniture and playground equipment for approval by the Town Engineer.

.3 No landscaping shall commence until the landscaping plans have been approved by the Town Engineer.

8.2.3 Landscape Design Requirements

8.2.3.1 General Requirements

.1 Trees shall be set back a minimum of 1 m from the back of curb, sidewalk, or verge.

.2 Shrubs shall be set back a minimum of 450 mm from the back of curb, sidewalk, verge, or back of turf landscape edging.

.3 All plant materials shall be as specified on the approved landscape plans.

.4 Planting bed layouts shall be designed in such a way as to facilitate the access of large turf maintenance and cutting equipment.

.5 Uniform or screen fences shall be located wholly on adjacent private properties and shall meet the standards as specified herein.

.6 Landscape furniture provided by the Developer shall be placed at predetermined locations in consultation with the Town Engineer. The following set back limits apply:

a) Benches shall be 1 m from the back of any walkway.
b) Waste receptacles shall be 250 mm from the back of any walkway.
c) Picnic tables shall be located in “clusters” to the satisfaction of the Town Engineer.

.7 All landscape furniture shall meet the Town’s standards and shall be anchored to concrete bases.

.8 Annual plantings shall not be used in planting beds to be maintained by the Town.

8.2.3.2 Residential Roadway Boulevards

.1 Residential roadway boulevards shall be graded, topsoiled, and sodded between the back of curb and the sidewalk.

.2 Boulevards shall be designed with a minimum boulevard tree spacing as specified in Table 8.1.

.3 Minimum deciduous tree calliper shall be 60 mm.

8.2.3.3 Collector Roadway Boulevards

.1 Collector roadway boulevards must be graded, topsoiled, sodded, and landscaped.

.2 Minimum tree spacing for boulevards shall be one (1) tree every 8 to 10 linear meters depending on tree species used. See Table 8.1 for additional tree spacing requirements.

.3 Deciduous trees shall be used in boulevards. Minimum deciduous tree calliper shall be 60 mm.

.4 Boulevard designs may include planting beds, shrubs, and ground cover.

.5 Minimum shrub size shall be five (5) gallon potted. Shrubs shall be planted using a spacing of 1 m on centre. Minimum shrub height and spread shall be 600 mm, subject to availability.

8.2.3.4 Major Entrance Route Boulevards

.1 Major entrance route boulevards shall be designed with a minimum tree spacing of one (1) tree every 8 to 10 linear meters depending on tree species used. See Table 8.1 for additional tree spacing requirements.

.2 Boulevards shall be designed to include continuous large planting beds that contain trees, shrubs and ground cover.

.3 Deciduous trees shall be used in major entrance route boulevards. Minimum deciduous tree calliper shall be 60 mm.

.4 Minimum shrub size shall be five (5) gallon potted. Shrubs shall be planted using a spacing of 1 m on centre. Minimum shrub height and spread shall be 600 to 1,200 mm, subject to availability.

8.2.3.5 Development Permit Landscaping

.1 In the event the Developer is redeveloping existing facilities or previously serviced lands, the Development Officer may require the landscape plans to be approved by the Town prior to the issuance of a development permit.

8.2.3.6 Medians and Entry Features

.1 Landscaped roadway islands, medians, and entry features shall be topsoiled, sodded, and planted with trees and/or shrubs and ground cover. All roadway island, median, and entry feature designs shall be low maintenance.

.2 Minimum deciduous tree calliper shall be 60 mm.

.3 Tree and shrub planting designs shall consider vehicular traffic sight lines.

.4 Shrubs shall be massed within planting beds. Minimum shrub size shall be five (5) gallon potted. Shrubs shall be planted using a spacing of 1 m on centre. Minimum shrub height and spread shall be 600 mm, subject to availability.

.5 Planting beds shall incorporate weed liners and landscape edging. All planting beds shall have a wood chip mulch topping, decorative crushed granular rock topping, or shale topping. Topping depth shall be 100 mm minimum.

.6 If sodded areas are to be contained within road islands and medians, the total consolidated sodded area shall be greater than 75 m^2. Sodded areas within islands and medians are typically discouraged due to maintenance and associated safety issues.

.7 Sodded areas shall be free from standing architectural features such as signs, sculptures, light poles, and entrance gates.

.8 Special hard surfaced verges or walkways that incorporate paving stones or concrete shall be subject to approval by the Town Engineer prior to installation.

.9 Planting cross section details for roadway islands and medians shall be drawn at an appropriate scale and shall show all underground utilities within 3 m of the planting root zones. Details shall also show the limits of the road base and sub base as well as the limits of the compacted verge base materials in relation to the organic soils, mulches, and root zones of the trees and shrubs.

.10 Planting details for roadway islands and medians shall be drawn at an appropriate scale showing and shall show all underground utility alignments within 3 m of the road island and mediam. Details shall also show the curb face, back of curb, verge or walkway, tree and shrub set backs, proposed planting and spacing, landscape edging, mulches, and freestanding features.

.11 Planting cross section details and planting details shall be cross referenced to the engineering and landscape plans.

.12 Lighting, if provided, shall be to the satisfaction of the Town Engineer.

8.2.3.7 Walkways

.1 Walkway rights-of-way shall be graded, topsoiled, seeded or sodded, and planted with trees and ground cover to the satisfaction of the Town Engineer.

.2 Walkways (asphalt trails) shall be in accordance with Standard Drawing No. 8-2.

.3 Minimum tree spacing shall be four (4) trees per 35 lineal meters of walkway right-of-way. Trees and ground cover shall be as specified in Table 8.2.

.4 Where possible, trees shall be set back a minimum distance of 1 m from adjacent private property lines.

.5 Trees shall be placed and grouped in rows. Tree groupings shall be positioned on the either side of the walkway in staggered arrangement.

.6 Minimum deciduous tree calliper shall be 60 mm. Minimum coniferous tree height shall be 2.5 m. A tree species mix of 60% coniferous and 40% deciduous is preferred.

.7 Ground cover will be massed within planting beds. Minimum ground cover size shall be three (3) gallons potted. Ground cover shall be planted using a spacing of 750 mm on centre.

.8 Planting beds shall incorporate weed liners and landscape edging. All planting beds shall have wood chip mulch topping with a minimum depth 100 mm. Decorative crushed granular stones will not be approved as a substitute for wood mulch.

.9 Landscape furniture provided by the Developer shall be placed at predetermined locations in consultation with the Town Engineer.

.10 Uniform or screen fences shall be located wholly on adjacent private properties and shall meet the standards as specified herein.

.11 The following design issues shall be considered by the Developer when recommending alternative plant materials:

a) Maintain adequate year round sight lines through the walkway rights-of-way for pedestrian safety and security.
b) Suggested minimum branching height of 2.4 m (8 ft.) for all trees to allow adequate pedestrian clearance beneath tree branches.
c) Low maintenance hardy plant species common to northern Alberta shall be used.
d) Consideration shall be given to alternative plant materials that have a limited horizontal root growth potential.
e) Alternative plant materials with sucker-type root systems shall not be permitted to avoid encroachment into adjacent private property.
f) Pyramidal/columnar tree forms shall not have branches that overhang into adjacent private property.

8.2.3.8 Major Utility Corridors and Rights-of-Way

.1 Utility corridors shall be graded, topsoiled, seeded or sodded, and landscaped by the Developer to the satisfaction of the Town Engineer.

.2 Plantings shall be in accordance with Tables 8.3 to 8.6.

.3 Trees shall be planted in major utility corridors with a minimum of 30 trees per acre designed and massed into major groupings.

.4 Minimum deciduous tree calliper shall be 50 mm. Minimum coniferous tree height shall be 2 m. A tree species mix of 60% coniferous and 40% deciduous is preferred.

.5 Shrubs may be substituted for trees at a substitution ratio of 5 shrubs to 1 tree. The maximum number of trees that can be substituted per acre shall be 15.

.6 Shrubs shall be massed within large planting beds. Minimum shrub size shall be five (5) gallon potted. Shrubs shall be planted using a spacing of 1 m on centre. Minimum shrub height and spread shall be 600 mm, subject to availability.

.7 Minimum widths of sodded areas between planting beds shall be 2 m. There shall be no requirement for landscape edging.

.8 Planting beds shall incorporate weed liners. All planting beds shall have wood chip mulch topping with a minimum depth 100 mm. Decorative crushed granular stones will not be approved as a substitute for wood mulch

.9 Existing healthy or vigorous trees within, or abutting the utility corridor, shall be preserved wherever possible.

.10 Landscape furniture provided by the Developer shall be placed at predetermined locations in consultation with the Town Engineer.

.11 Uniform or screen fences shall be located wholly on adjacent private properties and shall meet the standards as specified herein.

.12 Walkways, if provided within the utility corridor, shall be approved by the Town Engineer prior to installation.

.13 Lighting, if provided within the utility corridor, shall be approved by the Town Engineer prior to installation.

8.2.3.9 Stormwater Management Facilities

.1 Stormwater management facilities shall be graded, topsoiled, seeded or sodded, and landscaped by the Developer to the satisfaction of the Town Engineer.

.2 Consideration shall be given to the hydrological and soil saturation characteristics of the stormwater management facility when selecting planting materials.

.3 Public lands associated with stormwater management facilities shall have a minimum of 30 trees planted per landscaped acre above the normal water line. Trees shall be massed into major groupings.

.4 Minimum deciduous tree calliper shall be 60 mm. Minimum coniferous tree height shall be 2.5 m. A tree species mix of 60% coniferous and 40% deciduous is preferred.

.5 Shrubs may be substituted for trees at a substitution ratio of 5 shrubs to 1 tree. The maximum number of trees that can be substituted for per acre shall be 15.

.6 Shrubs shall be massed within large planting beds. Minimum shrub size shall be five (5) gallon potted. Shrubs shall be planted using a spacing of 1 m on centre. Minimum shrub height and spread shall be 600 mm, subject to availability.

.7 Minimum widths of sodded areas between planting beds shall be 2 m. Landscape edging may be required in formal shrub beds.

.8 Planting beds shall incorporate weed liners and landscape edging. All planting beds shall have a wood chip mulch topping, decorative crushed granular rock topping, or shale topping in flood prone areas. Topping depth shall be 100 mm minimum. Use of weed liners for planting beds located in flood prone areas is strongly recommended.

.9 Major stormwater outlets/inlets shall be landscaped with plant materials and rock.

.10 Dry ponds shall be designed in such a manner as to encourage active recreational uses.

.11 Landscape furniture provided by the Developer shall be placed at predetermined locations in the dry pond in consultation with the Town Engineer.

.12 Lighting, if provided within the utility corridor, shall be approved by the Town Engineer prior to installation.

.13 Special architectural and structural features (artificially pumped dry streams, special play courts, bridges etc.) shall be designed by accredited professionals.

8.2.3.10 Natural Areas

.1 The Developer shall be responsible for contacting all Provincial and Federal authorities that have jurisdictional interest in any natural areas that are affected by the proposed development. The Developer shall be responsible for securing all required approvals and permits prior to any construction activities in natural areas.

.2 Existing natural areas shall be protected. Any natural area that is impacted by construction activities must be renaturalized with native planting materials and restored to the satisfaction of the Town Engineer.

.3 The Developer shall be responsible for the design of an appropriate mix of native trees, shrubs, ground cover, and wild seed mixes to rehabilitate impacted natural areas. The design shall be approved by the Town Engineer prior to implementation.

.4 The Developer shall be responsible for the design of any required subsurface drainage, surface drainage, or erosion control measures for the rehabilitation of natural areas.

.5 The Developer shall, if required, coordinate rehabilitation work with other consultants and professionals to ensure proper restoration.

.6 Landscape plans shall identify all planting communities to be established and all other information necessary to implement the proposed rehabilitation work. Landscape plans and specifications shall be designed and produced by a Landscape Architect.

.7 The Developer shall specify all tree, shrub, and ground cover sizes. Minimum or maximum sizes to be used in natural area restoration work are not specified in these standards. A tree species mix of 60% coniferous and 40% deciduous is preferred.

.8 Forestry stock, seedlings, deciduous tree whips, and propagated/rooted cuttings are acceptable for use.

.9 All plant materials shall be nursery stock. Other sources of materials may be considered by the Town Engineer.

.10 Approved herbicides may be used to eradicate nuisance vegetation on natural slopes prior to planting trees and shrubs. Herbicides shall be applied by a licensed applicator and their use shall be approved by the Town Engineer prior to application.

8.2.4 Site Preparation

8.2.4.1 Materials

.1 Fill materials, where required, shall be free of stones, clods, sticks, roots, concrete, any other deleterious material or substance. Any deleterious materials and substances shall be properly removed from the site and disposed of in an acceptable manner.

.2 Topsoil shall be natural fertile agricultural soil, capable of sustaining vigorous plant growth. The topsoil shall be weed free and shall be approved by the Town Engineer prior to use.

8.2.4.2 Subgrade Preparation

.1 All subgrade preparations shall be completely free of live quackgrass roots.

.2 Subgrade shall be graded and rolled to a firm even surface.

.3 Final subgrade shall be 150 mm below the adjacent top of curb and/or sidewalk.

.4 Final surfaces shall be sloped so that surface runoff flows from one property do not flow onto any adjacent properties. Surface runoff ponding is not acceptable.

8.2.4.3 Existing Utility Appurtenances and Features

.1 All existing utility appurtenances shall be adjusted to properly match final finished grade elevations.

.2 All existing features such as trees, shrubs, monuments, curbs, sidewalks, and landscape furniture shall be protected against any damage.

8.2.5 Placing of Topsoil

.1 Topsoil shall be compacted to a firmness sufficient to show a heel imprint of not more than 3 mm deep. The upper 50 mm of topsoil shall be of fine texture and free of stones or lumps that are 6 mm or larger. Sufficient allowance shall be made for any settlement. Minimum depth of topsoil shall be 150 mm.

.2 Finished topsoil elevations for boulevards shall conform to the adjacent curb and sidewalk elevations and shall provide adequate surface drainage.

.3 Finished topsoil elevations for buffer strips shall slope uniformly from the property line towards the back of the sidewalk at a minimum grade of 2%.

.4 For sidewalks, a swale shall be provided at a distance of at least 1 m from either side of the sidewalk. Finished topsoil grades shall be sloped away from the sidewalk at a minimum grade of 1%.

.5 Finished topsoil elevations for median strips and traffic islands shall establish a constant grade from top of curb to top of curb.

.6 Parks and environmental reserves shall be rough graded to required elevations that are ready to receive necessary surface treatments. Slopes shall be blended into adjacent level areas. Contours shall be uniform.

.7 Prepared seed beds shall be inspected and approved by the Town Engineer prior to seeding.

8.2.6 Seeding

8.2.6.1 Seeding Materials (General)

.1 Fertilizer shall be 27-14-0.

.2 Grass seed shall be a certified seed composed of the following species of grasses:

a) Kentucky Blue Grass 35%.
b) Creeping Red Fescue 65%.

.3 Crested Wheat Grass seed may also be used subject to approval by the Town Engineer prior to application.

.4 Grass seed shall be applied at a rate of 3 kg/100 m^2.

8.2.6.2 Seeding Materials (Roadsides)

.1 Fertilizer shall be 27-14-0.

.2 Grass seed shall be a certified seed (Canada #1) composed of the following species of grasses:

a) Fall Rye 60%.
b) Creeping Red Fescue 16%.
c) Brome 12%.
d) Timothy 5%
e) Alsike Clover 7%

.3 A zero (0) tolerance for Sweet Clover shall be enforced by the Town.

.4 Grass seed shall be applied at a rate of 3 kg/100 m^2.

.5 Certified documentation verifying the seed mixture composition shall be submitted to the Town Engineer for approval prior to application.

8.2.6.3 Seeding Procedures

.1 The area to be seeded shall be fine graded to a smooth uniform grade with a loose textured surface free of stones, branches, and roots that are 20 mm or larger in diameter. All areas shall ensure positive drainage away from buildings.

.2 Fertilizer shall be applied to the area to be seeded at a rate of 3 kg/100 m^2.

.3 Seeding shall be done immediately thereafter, provided the bed has remained in good, friable condition and has not become muddy or hard. If the bed has become hard, it shall be tilled to friable condition.

.4 Seed shall be applied at 3 kg/100 m^2 or area to be seeded.

.5 The seed may be sown by one of the following methods:

a) Hand application using a cyclone type seeder. Seed shall be applied in two directions in equal amounts.
b) Mechanical application using a calibrated grass seeder and compaction roller. This is the preferred method for parks and other large level areas.
c) Hydro seeding by applying an approved turf-fibre at a rate of 1,350 kilograms (dry matter) per hectare.
d) Hydro seeding shall be used exclusively on sloped areas where the slope is equal to or greater than 3:1.

8.2.7 Sodding

8.2.7.1 Sodding Materials

.1 Fertilizer shall be 27-14-0.

.2 All sod shall be certified and composed of the following varieties of grass:

a) Kentucky Blue Grass 35%.
b) Creeping Red Fescue 65%.

.3 Sod shall be well rooted, vigorous and healthy, free from disease, insect pests, weeds or other grasses, stones or other extraneous material.

.4 Sod shall be machine stripped to a uniform thickness of 25 mm (+/- 5 mm). The thickness shall be determined at the time of stripping and shall exclude top growth and thatch.

.5 Wooden pegs, if necessary, shall have dimensions of approximately 25 mm x 50 mm x 300 mm. Metal pegs will not be accepted.

8.2.7.2 Sodding Procedures

.1 The area to be sodded shall be fine graded to a smooth uniform grade with a loose textured surface free of stones, branches, and roots that are 20 mm or larger in diameter. All areas shall ensure positive drainage away from buildings.

.2 Fertilizer shall be applied to finished topsoil preparation by mechanical distributor. Fertilizer shall be thoroughly and evenly incorporated into the soil to a maximum depth of 75 mm.

.3 Fertilizer shall be applied to the area to be sodded at a rate of 3 kg/100 m^2.

.4 Sodding may be done immediately thereafter, provided the bed has remained in good, friable condition and has not become muddy or hard. If the bed has become hard, it shall be tilled to friable condition.

.5 Sod shall be laid such that the long dimension is parallel to the direction of the slope. Joints shall be alternated.

.6 Sod shall be fitted tightly together with no visible joints or gaps. The finished surface of the sodded area shall be true to line and grade, firm, and free of irregularities and voids.

.7 Sod laid on slopes, where the slope is 2:1 (H:V) or greater, shall be held in place by wooden pegs. Pegs shall be installed so that they are flush with the sod.

8.2.7.3 Sod Maintenance

.1 Sod maintenance shall include all measures necessary to establish and maintain all seeded and sodded areas into a healthy, vigorous growing condition.

.2 First cutting shall occur when the grass is a minimum of 75 mm high and covers 100% of the seeded or sodded areas. Grass shall be cut as required to maintain grass at a minimum height of 65 mm.

.3 When required, sufficient amounts of water shall be applied to the seeded or sodded areas to ensure germination and prevent grass and the underlying soil from drying out.

.4 Initial and subsequent fertilizer applications shall be required as necessary to establish a vigorous growing stand of grass.

.5 Weed and nuisance vegetation control shall be carried out as required to maintain the seeded and sodded areas in a reasonably weed free condition. When herbicides are used, they shall be applied in accordance with manufacturer's recommendations and must be approved by the Town Engineer. Any damage resulting from the Contractor's use of herbicides shall be remedied at their expense.

.6 Areas which are deteriorating, bare, burned out, or thin, shall be re-seeded or re-sodded. All damage resulting from erosion and wash-outs shall be remedied at the Contractor's expense during the maintenance and warranty period for the work.

.7 At the time of final inspection, all seeded or sodded areas shall have a healthy, even, vigorously growing stand of grass that is free of disease and weeds.

.8 Sod maintenance shall include the erection and removal of all temporary protection fences, barriers and signs, and all other work incidental to proper maintenance.

.9 All damaged grass resulting from Contractor negligence, shall be replaced at the Contractor's expense.

.10 The maintenance period for seeded or sodded areas shall be two (2) years from the date of issuance of a Construction Completion Certificate. The maintenance period shall end when the Contractor has been issued a Final Acceptance Certificate by the Town for the works that encompass the seeded or sodded areas.

.11 The Town Engineer reserves the right to reject the seeded or sodded areas if he/she is not satisfied with the appearance. The Contractor must remedy the deficiencies, at his/her own expense, by removing all parts of the rejected work and by supplying all new topsoil, seed, sod, fertilizer, and labour necessary to do so.

.12 The Town Engineer shall inspect the landscaped areas upon written request by the Contractor. The request shall be received at least ten (10) days prior to the anticipated date of inspection.

8.2.8 Trees and Shrubs

8.2.8.1 Tree and Shrub Materials

.1 The Developer shall furnish and plant all planting materials agreed to in the Development Agreement. All planting material shall conform to the horticultural standards of the *Canadian Nursery Landscape Association*.

.2 The Town may request greater planting requirements than those contained in these standards depending upon the location and type of development proposed.

.3 All trees and shrubs shall be healthy and vigorous, well branched, and densely foliated when in leaf. They shall be free from disease and insect pests, eggs, or larvae. All trees and shrubs shall have healthy well-developed root systems.

.4 All plants shall be nursery grown unless specifically authorized by the Town to be collected from native stands or established wood lots.

.5 Substitutions for the approved plantings shown in the landscape plans or contained in the Development Agreement will not be permitted without approval of the Town Engineer.

.6 Bare root (B/R) shrubs shall have their root systems adequately protected at all times.

.7 Balled and bur lapped (B/B) plants shall be dug with firm natural balls of earth of sufficient diameter and depth to include most of the fibrous roots.

.8 Container growth stock shall have well developed root systems. Plant materials that are loose in their containers will not be accepted.

.9 Trees and shrubs with undersized root systems will be rejected. All trees and shrubs are subject to the approval of the Town Engineer.

.10 All planting materials shall be delivered to the project site and stored in the proper manner with all labels intact. All planting materials shall be handled in a proper manner and all damaged, sick, or diseased plants must be removed from the site immediately and replaced.

.11 Tree stakes shall be 2.1 m in length and be of the steel U-bar or T-bar type. Tree ties shall be ten (10) gauge galvanized wire. 200 mm lengths of 10 mm diameter polythene plastic tubing shall be used to protect the tree from the tree tie wire. Wire for tree guying shall be a double strand of nine (9) gauge galvanized wire.

.12 Mulch shall be wood chips, ground bark, bark peelings, peat, hay, or straw.

8.2.8.2 Site Preparation

.1 At least 24 hours notice shall be given to the Town Engineer prior to the commencement of planting activities. The Contractor shall stake and identify the location of all plantings for approval by the Town Engineer.

.2 Boulevards shall be excavated to the required depth and made ready to receive topsoil for tree and shrub planting.

.3 Topsoil filling of boulevards and medians shall not be permitted until tree and shrub locations have been approved by the Town Engineer.

.4 Contractor shall be responsible for ensuring that all plantings are at the correct elevations and alignments.

.5 Planting and boulevard construction work may be carried out in phases.

8.2.8.3 Planting Operations

.1 Individual tree pits shall be 300 mm greater in diameter than the size of the tree bulb or root spread. Tree pits shall also be sufficiently deep to allow for a 150 mm layer of planting mixture beneath the bulb or roots.

.2 Individual shrubs shall be planted in pits that are 300 mm greater in diameter than the spread of the roots. Shrub pits shall be dug to a depth of 450 mm below the finished grade or as necessary to properly set the shrub to the required finished grade.

.3 Shrubs shall be installed in accordance with Standard Drawing No. 8-3.

.4 Minimum depth of planting mixture beneath all bulbs and roots in planting beds shall be 225 mm.

.5 All pits that are prepared and backfilled with planting mixture prior to planting shall have their locations marked by 25 mm x 50 mm stakes.

.6 Plants shall be placed in the centre of pits, plumb and straight, and at such a level that after settlement the crown of the plant will be 25 mm lower than the surrounding finished grade.

.7 No plantings, except ground cover, vines, and herbaceous plant material, shall be placed closer than 600 mm to the edge of shrub beds, hard surfaces, or building foundations.

.8 When 2/3 of the plant pit has been backfilled with soil mix, 8-24-24 fertilizer shall be applied at the following rates:

a) Shade Trees - 0.5 kg per 25 mm of calliper.
b) Small Trees - 0.25 kg per 25 mm of calliper.
c) Shrubs - 0.06 kg per 300 mm of height.
d) Coniferous Trees - 0.03 kg per 300 mm of height or spread.
e) Vines, Ground cover, Herbaceous Plants - 0.03 kg per plant.

The fertilizer shall be distributed evenly over the pit area. The pit shall be filled with water and the soil allowed to settle around the root system.

.9 When trees are first set in the pits, the soil mixture shall be compacted around the base of the tree bulb to fill all the voids. All burlap, ropes, and wires shall be removed from the tops of the bulb.

.10 Trees with bare root systems shall have their roots properly spread out and the topsoil mixture carefully worked in. Any broken or frayed roots shall be cleanly cut off.

.11 Plant pits shall be filled with soil mix after the initial water has been absorbed. Immediately after the plant pit is backfilled, a shallow basin that is approximately 100 mm deep and slightly larger than the pit, shall be formed with a ridge of soil to facilitate water retention.

.12 After the surface of the tree pit has sufficiently dried, the top of the pit shall be spaded to a depth of approximately 25 mm to avoid evaporation.

.13 Any requirements for water shall be arranged by the Contractor at his/her expense.

8.2.8.4 Staking and Guying

.1 For deciduous trees less than 1 m in height, the following procedure shall be used:

a) Each tree shall be supported with a tree stake.
b) Tree stakes shall be driven into the ground 450 mm to 600 mm below grade in a vertical position.
c) All stakes shall be placed at a distance of 150 mm from the tree on the northwest side.
d) Trees shall be supported with one (1) tree tie. Tree tie shall be placed around the tree and the stake, as close as possible to the top of the stake.
e) Tree stakes and ties shall be in accordance with Standard Drawing No. 8-4.

.2 For coniferous trees less than 2.45 m in height, deciduous trees greater than 1 m in height, and with callipers less than 75 mm, the following procedure shall be used:

a) Each tree shall be supported by two (2) steel U or T-bars driven securely into the ground without injury to the root bulb.
b) Trees shall be fastened at the top of the stakes with two (2) tree ties.
c) Tree stakes and ties shall be in accordance with Standard Drawing No. 8-4.

.3 For deciduous tree over 75 mm in calliper, and coniferous trees exceeding 2.45 m in height, the following procedure shall be used:

a) Trees shall have three (3) guy wires installed that are equally spaced around each tree.
b) Each guy wire shall be attached to the tree trunk at an angle of 60° and anchored to the ground by means of a wooden stake.
c) Wooden stakes shall be 50 mm x 50 mm x 450 mm and shall be driven securely into the ground.
d) Guy wires, tree stakes, and ties shall be in accordance with Standard Drawing No. 8-5.

.4 For deciduous tree over 100 mm in calliper, and coniferous trees exceeding 4.3 m in height, the following procedure shall be used:

a) Trees shall be staked with a wooden stake 50 mm x 100 mm x 750 mm in length.
b) Trees may also be staked with 15 mm diameter steel reinforcing bars that are 760 mm in length.
c) Guy wires, tree stakes, and ties shall be in accordance with Standard Drawing No. 8-5.

8.2.8.5 Pruning

.1 Plantings shall be pruned after planting to remove dead or injured branches.

.2 Pruning shall be done in such a manner as to preserve the natural characteristics of the plantings.

.3 Leaders shall not be removed. Only clean sharp tools shall be used and all cuts shall be clean and flush, leaving no stubs.

.4 Cuts, bruises, or scars on the bark shall be traced back to living tissue and removed. The affected areas shall be shaped so that they do not retain water and painted with an approved tree paint.

8.2.8.6 Digging of Plants

.1 All plants shall be dug and delivered to the site as specified on the approved landscape plans.

.2 Plants specified "B/R" shall be moved with bare roots. They shall be dug and moved to the site while dormant, with a major portion of the fibrous root system included. Immediately after digging, the root system shall be wrapped or puddled and kept moist until planting.

.3 All plants specified "B/B" shall be moved with solid bulbs wrapped in burlap.

.4 Plants shall not be used when the bulb has been cracked or broken during planting operations. Plants shall not be used when the burlap, staves, or ropes, have been removed prior to planting.

.5 Minimum root bulb sizing for trees shall be in accordance with Tables 8.7 and 8.8. Minimum root bulb sizes shall be adjusted according to the growth habits of the individual trees and shall be sufficiently large so that they contain at least 75% of the root system.

.6 All plant materials shall conform to the specifications established in the landscape plans. Plant materials larger than those specified may be used if prior approval is obtained from the Town Engineer and the bulb size is increased in proportion to the size of the plant material.

.7 All plants shall be measured when their branches are in their normal position. Calliper measurements shall be made at a location on the trunk that is 300 mm above the ground.

.8 For deciduous trees with a calliper greater than 250 mm, the root bulb diameter shall be increased by 150 mm for every additional 25 mm of calliper dimension.

.9 For coniferous trees over 2.75 m in height, the root bulb diameter shall be increased by 150 mm for every additional 300 mm in height.

8.2.8.7 Tree and Shrub Maintenance

.1 Maintenance of trees and shrubs shall include protective or preventative spraying when required.

.2 Maintenance of trees and shrubs shall include the repair and/or replacement of all deficient materials. Deficiencies shall be corrected as soon as possible after they are discovered and the weather permits.

8.2.8.8 Tree and Shrub Warrantee Period

.1 The warrantee period for all planted materials shall be two (2) years from the date of issuance of the Construction Completion Certificate.

.2 Any planting material that is not in satisfactory condition or as specified shall be removed from the site. The Contractor may elect to allow defective planting materials to remain through another complete growing season, upon approval by the Town Engineer, in an attempt to re-establish the plant. Should the plant material not re-establish, it shall be replaced by the Contractor at his/her own expense.

8.2.9 Fencing

.1 Screen, uniform, and solid fences, if required by the Town, shall be designed to complement adjacent architectural and urban amenities in conjunction with the proposed land use. All designs and finishes shall be approved by the Town Engineer.

.2 Screen, uniform, and solid fence designs and construction detailing shall be shown on the landscape drawings. In the event that there are no landscape drawings, the designs and construction detailing shall be shown on the engineering drawings where appropriate.

.3 Landscape and/or engineering drawings shall show the following information related to the proposed fencing:

a) Alignment of all fences.
b) Construction details, cross sections, and elevations at appropriate scale.
c) Specifications for all fence material.
d) Specifications for all fastening hardware.
e) All anchoring, foundation, and piling details and specifications.
f) Specifications for all coatings, paints, and stains.
g) All critical dimensions.
h) All utilities within 3 m of any portion of the fence.

.4 Screen, uniform, and solid fence designs shall meet the following objectives as a minimum:

a) Safety and security.
b) Delineation of private and public lands.
c) Effective pedestrian barrier.
d) Visual continuity.

.5 Screen, uniform, or solid fencing shall be constructed adjacent to, and at the following locations:

a) Arterial roadways.
b) Parks and playfields.
c) Public walkways and utility lots.
d) School sites.
e) Town property.
f) Multi-family sites.
g) Commercial sites.
h) Institutional sites.
i) Other areas as required by the Town.

.6 Screen, uniform, or solid fencing shall be installed where residential property adjoins one of the locations listed in Section 8.2.9.5 above. The Town may approve the use of chain link fencing where facilities such as playgrounds, parks, or school sites are adjacent to arterial roadways.

.7 Gates shall be installed on all residential lot fencing where the properties back onto public parks. Gates shall be located at the mid-point of the property line and shall open inwards into the residential lot.

.8 Wooden rail fencing may be required for selected park or walkway areas as determined by the Town Engineer.

.9 Basic designs for uniform wooden fencing and chain link fencing with gates are provided in Standard Drawings No. 8-6, No. 8-7 and No. 8-9 respectively. Basic designs for wooden rail fencing are provided in Standard Drawing No. 8-8. Proposed designs for these fences may be adapted from these standard drawings subject to approval from the Town Engineer.

8.2.9.1 Fencing Warrantee Period

.1 The warrantee period for all fencing shall be two (2) years from the date of issuance of the Construction Completion Certificate.

Table 8.1: Boulevard Tree Species and Spacing Guidelines

Tree Species (Common Name)	Minimum Spacing (m)
Poplar Brooks	10
Poplar N/W	10
Summit Ash	8
Patmore Ash	8
Black Ash	8
Manchurian Ash	8
Oak	8
Linden	6
Birch	6
Mountain Ash	6
Pear	6
Flowering Crab Apple (dependant on species)	4 to 6
Cherry Trees (dependant on species)	4 to 8
Pine (dependant on species)	4 to 8
Spruce (dependant on species)	4 to 8
Swedish Columnar Poplar	3 to 6
Tower Poplar	3 to 6

Note:

Developer may suggest other trees for boulevards depending on specific site contrstraints.

Table 8.2: Planting Materials for 6 m Walkway Rights-of-Way

Tree Species (Common Name)	Minimum Spacing (m)
Lodgepole Pine	4
Black Ash	8
Linden	6
Pin Cherry	4
Schubert Chokecherry	4
Pyramidal Flowering Crab	4
Japanese Tree Lilac	4
Columnar Aspen	4
Tower Poplar	4
Ground Cover Species (Common Name)	**Minimum Spacing (m)**
Juniper	n/a
Periwinkle	n/a
Phlox	n/a
Thyme	n/a
Gout Weed (Not permitted with other shrubs)	n/a

Note:

Developer may suggest other trees, tree form shrubs, and ground cover depending on specific site constraints.

Table 8.3: Major Utility Corridor Planting Materials (Part A)

Hedge Materials - Suitable for planting near power lines		
Species (Common Name)		**Height at Maturity (m)**
Caragana	Common	3
	Globe	1
	Pygmy	1
Cranberry	Nannyberry	5
	Wayfaring Tree	3
Honeysuckle	Clavey's Dwarf	1
	Tartarian	3
	Zabels	2
Lilac	Common	3
	Late	3
Red Osier Dogwood		2
Nanking Cherry		2
Cotoneaster Hedge		2
Prinsepia		3
Potentilla		1

Table 8.4: Major Utility Corridor Planting Materials (Part B)

Trees - May plant near power lines (Caution)	
Species (Common Name)	**Minimum Spacing (m)**
Pincherry	5
Western Chokecherry	5
Black Cherry	6
Tartarian Maple	6
Amur Maple	4
Flowering Crabapples	5
Hawthorns	5
Showy Mountain Ash	5
Green's Mountain Ash	5
French Pussy-Willow	5
Mugo Pine	6
Pyramidal White Cedar	5
Montgomery Blue Spruce	3
Caragana	3
Cotoneaster Hedge	2
Highbush Cranberry	3
Nannyberry	5
Dogwood	3
Elder	4
Honeysuckle	3
Lilac	5
Saskatoon	4

Table 8.5: Major Utility Corridor Planting Materials (Part C)

Trees - Do not plant within 8 m of power lines	
Species (Common Name)	**Minimum Spacing (m)**
Trembling Aspen	8
Balsam Poplar	20
Northwest Poplar	20
Plains Cottonwood	30
White Spruce	15
Colorado Blue Spruce	15
Manitoba Maple	14
Laurel Leaved Willow	15
Golden Leaved Willow	15
Sharp Leaf Willow	10
Green Ash	15
Patmore Green Ash	15
American Elm	20
Brandon Elm	15
Siberian Elm	12
Paper Birch	12
European White Birch	12
Cut-Leaved Weeping Birch	20
Slender Weeping Birch	12

Table 8.6: Major Utility Corridor Minimum Planting Requirements

Coniferous Trees - Suitable for planting	
Species (Common Name)	**Minimum Height Size (m)**
Pines	2
Spruce	2
Fir	2
Large Deciduous Trees - Suitable for planting	
Species (Common Name)	**Minimum Calliper (mm)**
Silver Maple	50
Black Ash	50
Patmore Green Ash	50
Summit Green Ash	50
Larch	50
American Elm	50
Harbin Chinese Elm	50
Linden Laurel Leaf Willow	50
Small Deciduous Trees - Suitable for planting	
Species (Common Name)	**Minimum Calliper (mm)**
Amur Maple	50
Crabapple	50
Amur Cherry	50
Pincherry	50
Schubert Chokecherry	50
Bur Oak	50
Mountain Ash	50
Lilac	50

Table 8.7: Deciduous Tree Sizing Requirements

Root System Size (mm)	Root Bulb Diameter (mm)	Machine Bulb Diameter (mm)
24 to 45	610	n/a
50	760	1,110
75	915	1,420
100	1,065	1,675
125	1,370	1,675
150	1,470	2,336
200	1,825	2,336
250	2,285	2,336

Notes:

Trees with a calliper larger than 75 mm shall be moved by a mechanical tree spade.

Table 8.8: Coniferous Tree Sizing Requirements

Height (m)	Root Bulb Diameter (mm)	Machine Bulb Diameter (mm)
1.5 to 1.75	760	1,110
1.75 to 2	915	1,110
2 to 2.25	1,065	1,420
2.25 to 2.5	1,220	1,420
2.5 to 2.75	1,370	1,675

Notes:

Trees that are larger than 2.75 m in height shall be moved by a mechanical tree spade.

END OF SECTION 8

9.0 General

.1 A composite franchise utility drawing must be submitted as part of the Detailed Engineering Design Set before approvals will be allowed.

9.1 Gas Service

.1 Natural gas services are provided under franchise agreements with natural gas retailers. Contact the Town for further information.

9.1.1 Gas Service Rights-of-Way

.1 The Developer shall provide rights-of-way and easements for natural gas services where required in accordance with Standard Drawing No. 7-1 through Standard Drawing No. 7-10.

.2 All rights-of-way and easements shall be registered with the Town of Westlock.

9.1.2 Gas Service Installation

.1 The Developer and the natural gas retailer shall obtain Town approval for the gas service installation methodology and specifications.

.2 The Developer shall coordinate the location of gas services to ensure that they do not interfere with other utility alignments.

.3 Residential gas services and meters shall be installed such that the gas meter is located at the side or rear of the dwelling.

.4 For residences with driveways, the gas meter shall be placed on the side of the dwelling opposite to the side that the driveway is located on. Gas meters shall not be located in the front of residences.

.5 Excavation permits shall be obtained from the Town for any excavations on Town property.

9.1.3 Costs

.1 All capital costs that the natural gas retailer charges for the installation of gas services shall be paid by the Developer.

9.2 Telephone Service

9.2.1 General

.1 Telephone services shall be installed underground.

.2 Telephone service cables shall be installed in the same trench as the electric power cables wherever possible.

9.2.2 Telephone Service Rights-of-Way

.1 The Developer shall provide rights-of-way and easements for telephone services where required in accordance with Standard Drawing No. 7-1 through Standard Drawing No. 7-10.

.2 All rights-of-way and easements shall be registered with the Town of Westlock.

9.2.3 Telephone Service Installation

.1 The Developer shall coordinate the location of telephone services to ensure that they do not interfere with other utility alignments. Alignments shall be approved by the Town Engineer.

.2 Excavation permits shall be obtained from the Town for any excavations on Town property.

.3 Service pedestals shall be located at property line intersections.

9.2.4 Telephone Service Costs

.1 All capital costs that the telephone service retailer charges for the installation of telephone services shall be paid by the Developer.

9.3 Electric Power Service

9.3.1 General

.1 Electrical power services are provided under franchise agreements with electricity retailers. Contact the Town for further information.

.2 Electric power service cables shall be installed underground and in the same trench as the telephone and cablevision cables.

9.3.2 Electric Power Service Rights-of-Way

.1 The Developer shall provide rights-of-way and easements for telephone services where required in accordance with Standard Drawing No. 7-1 through Standard Drawing No. 7-10.

.2 All rights-of-way and easements shall be registered with the Town of Westlock.

9.3.3 Electric Power Service Installation

.1 The Developer and the electricity retailer shall obtain Town approval for the gas service installation methodology and specifications.

.2 The Developer shall coordinate the location of telephone services, power service boxes, and transformers to ensure that they do not interfere with other utility alignments. Alignments shall be approved by the Town Engineer.

.3 Excavation permits shall be obtained from the Town for any excavations on Town property.

9.3.4 Electric Power Service Costs

.1 All capital costs that the electricity retailer charges for the installation of electric power services shall be paid by the Developer.

9.4 Cable Service

9.4.1 General

.1 Cablevision services are provided under franchise agreements with cablevision retailers. Contact the Town for further information.

.2 Cablevision service cables shall be installed underground and in the same trench as the telephone and electric power cables.

9.4.2 Cable Service Rights-of-Way

.1 The Developer shall provide rights-of-way and easements for telephone services where required in accordance with Standard Drawing No. 7-1 through Standard Drawing No. 7-10.

.2 All rights-of-way and easements shall be registered with the Town of Westlock.

9.4.3 Cable Service Installation

.1 The Developer and the electricity retailer shall obtain Town approval for the gas service installation methodology and specifications.

.2 The Developer shall coordinate the location of cablevision services to ensure that they do not interfere with other utility alignments. Alignments shall be approved by the Town Engineer.

.3 Excavation permits shall be obtained from the Town for any excavations on Town property.

9.4.4 Cable Service Costs

.1 All capital costs that the cablevision retailer charges for the installation of cablevision services shall be paid by the Developer.

END OF SECTION 9

10.1 General Requirements

.1 The intent of this section is to outline the design requirements for a Manufactured Homes Subdivision.

.2 Design drawings for manufactured home subdivisions are expected to meet the submission requirements outlined in Sections 1 and 2.

.3 Roadway design, lot grading, and utility designs shall be in accordance with the specifications established in this document unless detailed otherwise in this Section.

10.2 Development Size

.1 The preferred development size for a manufactured homes subdivision shall be in accordance with the current Land Use Bylaw.

10.3 Development Density

.1 Maximum development density shall not exceed 20 manufactured homes per gross hectare (8 per acre).

10.4 Open Space

.1 10% of the gross development area shall be open space. The total open space area may be obtained through the one of the following alternatives:

a) Small sites (less than 500 m^2) located at strategic points within the development.
b) Single large area located within the development that allows for access from all manufactured homes.
c) Combination of (a) and (b) above.

10.5 Landscaping

.1 Detailed landscaping plans shall be submitted with the final layout plans.

.2 Landscaping plans shall include a tree or shrub buffer strip around the perimeter of the development. Minimum size of the buffer strip shall be in accordance with the current Land Use Bylaw. Buffer strip shall not be considered as part of the open space required under Section 10.4. Manufactured home lots may extend into the buffer strip area.

10.6 Roadways

.1 All roadways and walkways within the development shall be paved to the residential subdivision standards. Permission for the use of gravel roads may be granted by the Town on a case by base basis. Minimum width of walkways shall be 1.2 m.

.2 Minimum right-of-way width within the development shall be 12 m, with a carriageway of no less than 8 meters. The remaining portion of the right-of-way shall be landscaped. Roadway parking will be permitted where the carriageway is of sufficient width to be able to do so safely and approval has been granted by the Town.

.3 Curb and gutters are strongly recommended for appearance, drainage, and maintenance purposes. Minimum longitudinal grade shall be 0.5%. Minimum cross fall shall be 2.5%.

.4 Inverted swale roadway sections may be approved by the Town Engineer. Minimum longitudinal grade for inverted swale roadways shall be 1%. Minimum cross fall shall be 2.5%.

.5 Ditches or drainage swales that are adjacent to the roadways section will not be approved.

.6 Roadways and drainage swales shall be in accordance with Standard Drawing No. 10-1.

10.7 Utilities and Services

.1 Utilities and services shall be located underground and provisions shall be made for the installation of natural gas services.

.2 Sanitary sewers shall be installed within the road right-of-way or in a registered public utility lot.

.3 Sanitary sewers may be installed under manufactured homes if the development is a fully private development. Utility operation and maintenance shall be the responsibility of the Developer.

.4 Minimum sanitary sewer pipe size shall be 200 mm at a minimum slope of 0.4%. Maximum manhole spacing shall be 120 m. Manholes shall also be located at all changes in alignment.

.5 Minimum water distribution pipe size shall be 200 mm. Larger diameter water distribution pipes may be required by the Town Engineer for future servicing or distribution system looping.

.6 Water and sanitary service connections shall be in accordance with Standard Drawing No. 10-2 and Standard Drawing No. 10-3.

10.8 Parking

.1 Parking for residents and visitors shall be in accordance with the current Land Use Bylaw.

10.9 Storage Facilities

.1 Secure storage facilities shall be provided for residents in accordance with the current Land Use Bylaw.

10.10 Service Buildings

.1 Service buildings shall be located a minimum of 6 m away from any manufactured home.

10.11 Show Homes

.1 A maximum of two manufactured show homes will be permitted for the development. Retail manufactured home sales shall not be permitted from the development without prior approval from the Town.

10.12 Fire Hydrants

.1 Fire hydrants shall be provided so that no manufactured home is more than 75 m from the closest hydrant. Maximum hydrant spacing shall be 150 m. Fire hydrant locations shall be approved by Town Engineer.

10.13 Roadway Lighting

.1 Roadway lighting shall be provided for the development.

10.14 Development Identification Signs

.1 A maximum of one (1) free standing development identification sign shall be permitted. The design shall be approved by the Town prior to installation.

10.15 Lot Sizing

.1 Minimum lot frontage and depth shall be in accordance with the current Land Use Bylaw.

10.16 Manufactured Home Spacing

.1 Manufactured home spacing and setbacks shall be in accordance with the current Land Use Bylaw.

10.17 Manufactured Home Installation

.1 Manufactured homes shall be permanently levelled and blocked. Skirting shall be erected within 30 days of home installation on the lot.

10.18 Manufactured Home Addition Area

.1 Total floor area of manufactured home additions shall not exceed that stipulated by the current Land Use Bylaw.

10.19 Garbage Storage

.1 Proper garbage storage facilities shall be provided in an amount appropriate for the number of lots. Storage facilities shall be enclosed and properly screened to limit unwanted access.

10.20 Fencing

.1 Fencing shall be provided in accordance with the current Land Use Bylaw.

10.21 Lot Definition

.1 Lots shall be defined (posted) by curb or survey pins at each of the lot corners.

10.22 Natural Gas Service

.1 Natural gas heating for manufactured homes shall be provided.

END OF SECTION 10

11.1 General Requirements

.1 The intent of this section is to outline the design requirements for recreational vehicle park developments.

.2 Existing vegetation and surface features shall be preserved as much as possible.

11.2 Submittals

.1 The Developer shall submit design plans to the Town for review. Minimum scale for plans shall be 1:1000.

.2 Existing site plans shall contain the following information:

a) Legal land description.
b) North arrow, plan scale, and project name.
c) Registered property lines, rights-of-way, and easements.
d) Existing roadways and land uses both within, and adjacent to, the proposed development.
e) Existing buildings, utilities, and other improvements.
f) Existing topography (maximum contour interval shall be 1 m) and natural features.
g) Existing environmentally sensitive areas.

.3 Development concept plans shall contain the following information and shall be approved by the Town prior to the submission of detailed design plans:

a) Locations of proposed user sites.
b) Proposed roadways, pedestrian trails, and parking areas.
c) Individual site locations.
d) Proposed sanitary facilities, administrative/maintenance buildings, sanitation dumps, garbage collection areas, and other service locations.

.4 Detailed design plans shall be reviewed by the Town Engineer prior to construction. The detailed design plans shall contain the following information:

a) All roadways.
b) Major and minor stormwater management systems (if required).
c) All parking areas.
d) Major activity areas.
e) All structures and buildings.
f) All sanitary facilities, administrative/maintenance buildings, sanitation dumps, garbage collection areas, and other service locations.
g) All potable water infrastructure.
h) All electrical power utility infrastructure.
i) All vegetated areas to be cleared.

11.3 Recommended Design Guidelines

11.3.1 Roadways

.1 One-way roads shall be utilized as much as possible to minimize traffic conflicts. Minimum roadway widths shall be 4 m for one-way roadways and 8 m for two way roadways.

.2 Curved roadways shall be used for the development. Long straight roadway sections will not be approved.

.3 Roadway intersections shall meet at 90°. Intersections shall properly accommodate the turning movement of recreational vehicles.

.4 Roadway designs shall maintain existing drainage patterns wherever possible. Ditches and culverts shall be used to accommodate surface drainage patterns. Minimum cross fall for roadways shall be 3%.

.5 Minimum roadway structure shall be 150 mm of compacted subgrade, 150 mm of pitrun gravel topped with 50 mm of 20 mm crushed gravel.

.6 Dead-end roadways shall have turnarounds at the end. Individual sites shall not be utilized as turnaround locations.

11.3.2 Campsites - General

.1 In general, a variety of campsite styles shall be provided. At least one campsite per loop shall be handicapped accessible and 15% of the campsites shall be double sites.

.2 Campsite layouts shall be in accordance with Standard Drawing No. 11-1.

.3 Minimum spacing between campsites shall be 15 m.

.4 Minimum distance between the camping space and any access road shall be 5 m.

.5 Barriers shall be installed to limit vehicle access to the roads and parking areas only.

.6 Campsites shall have the same structure as that specified for the roadways.

.7 Campsites shall be properly cleared and grubbed of vegetation.

11.3.3 Single Campsites

.1 Back-in spurs shall be placed at a 45° to 60° angle from the centreline of the roadway.

.2 Campsite spurs shall be 4 m wide and 18 m long.

.3 Level areas, measuring 6 m by 6 m shall be provided for camp stoves and picnic tables. Larger activity pads shall be required to accommodate tents.

.4 Activity pads shall be constructed to the right and rear of the parked vehicle when it is properly backed-in. Spur angles on the left side of a one-way roadway shall be 60°.

11.3.4 Double Campsites

.1 15% of the campsites in a proposed development shall be double campsites.

.2 Double campsites shall provide two camp stoves and two picnic tables.

.3 Double campsites shall be counted as two single campsites when calculating the number of sanitary and visitor services required.

11.3.5 Drive-through Campsites

.1 Larger recreational vehicles and trailers shall be accommodated by including some drive-through campsites.

.2 Pull-over campsites may be utilized where space is limited. Pull-over campsites shall be located to the right side of traffic flows.

.3 Pull-over campsites shall be 12 m to 15 m long and 4 m to 5 m wide. Minimum size of activity pad provided shall be 6 m by 6 m.

.4 Drive-through campsites shall be located on tangent sections of the roadway.

.5 Drive-through campsites shall be a minimum of 18 m long and 4 m wide. A 6 m by 6 m activity pad shall be located on the right side of the spur. Spurs shall be placed at a 45° to 60° angle to the centreline of the roadway.

11.3.6 Serviced Campsites

.1 All serviced campsites shall be located on a common loop.

.2 Service connections shall be located on the left hand side of the campsite and shall be in accordance with Standard Drawing No. 11-2 and Standard Drawing No. 11-3.

.3 Electrical service connections shall be provided in accordance with Standard Drawing No. 11-4.

.4 Central sewage dumping stations shall be used.

.5 Sewer hook-ups, if provided, shall utilize a 75 mm treated sewer ferrule and plug and shall be separated from the water riser by a minimum of 2 m.

.6 Water hook-ups shall be 20 mm swivel hose connections with a water pressure between 20 psi and 70 psi. All water supply bibs shall have backflow prevention provisions and shall incorporate self draining curb stops.

11.3.7 Visitor Services

.1 All recreational vehicle parks shall have sanitary facilities. A minimum of 2 sanitary facilities (toilets) shall be provided per 15 campsites. Shower facilities shall be provided if required by the Town.

.2 As minimum, sanitary facilities shall be in accordance with Standard Drawing No. 11-5.

.3 Potable water shall be supplied and clearly identified as "Potable Drinking Water". Potable water sources and sanitary facilities shall be separated by a minimum of 30 m.

.4 Sanitary facilities shall be located downwind of adjacent activity areas.

.5 Adequate garbage containers and storage shall be provided. Storage containers shall prevent odour and pest problems.

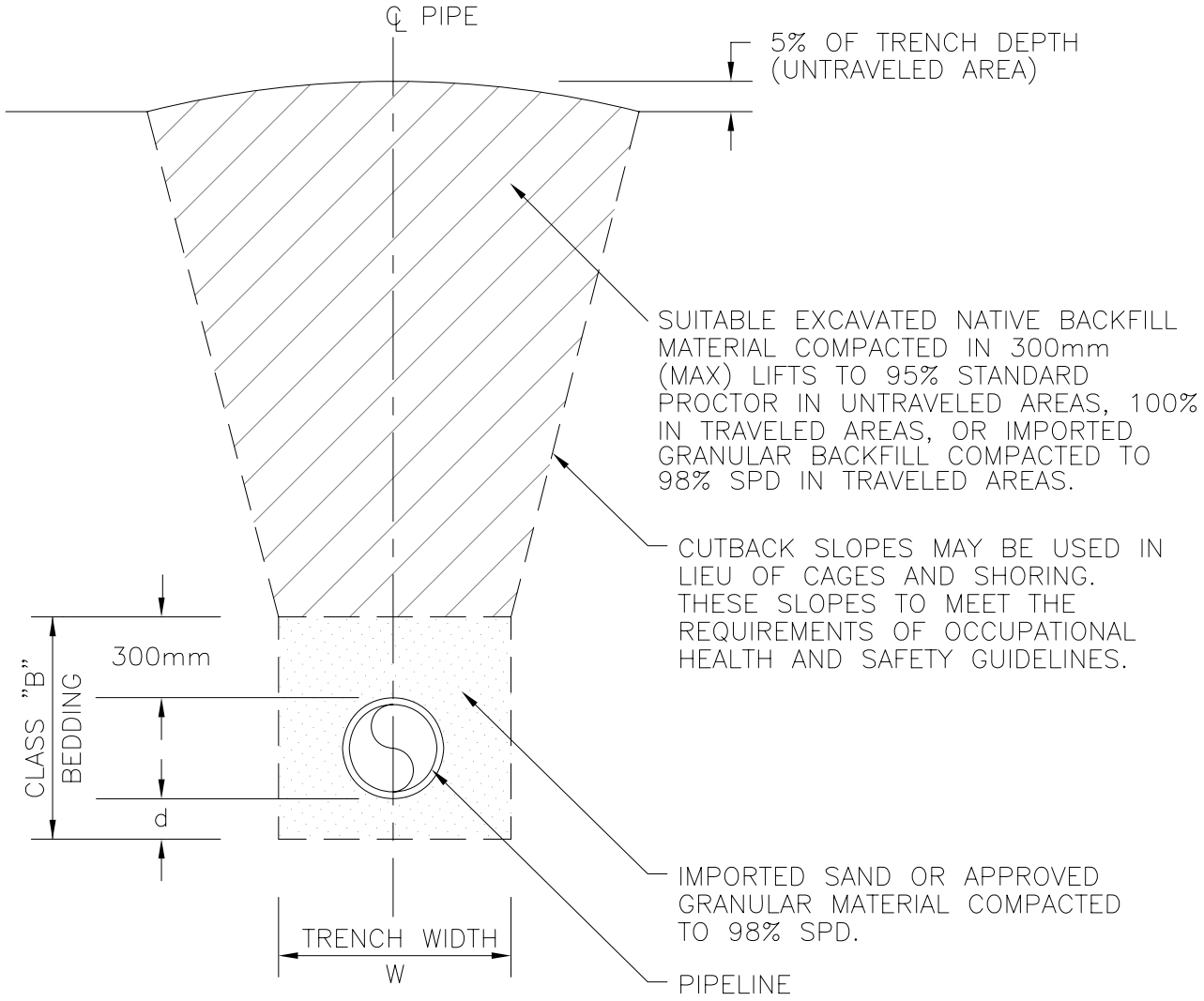
.6 Registration stations shall be located at the entrance of each camping development. Registration procedures shall be clearly identified.

.7 Visitor service and sanitary facilities shall be located in convenient locations.

.8 Adequate pull-over areas shall be provided adjacent to visitor service and sanitary facilities to accommodate service vehicles.

.9 General service areas such as firewood, picnic shelters, and open play areas shall be provided at the discretion of the Developer.

END OF SECTION 11

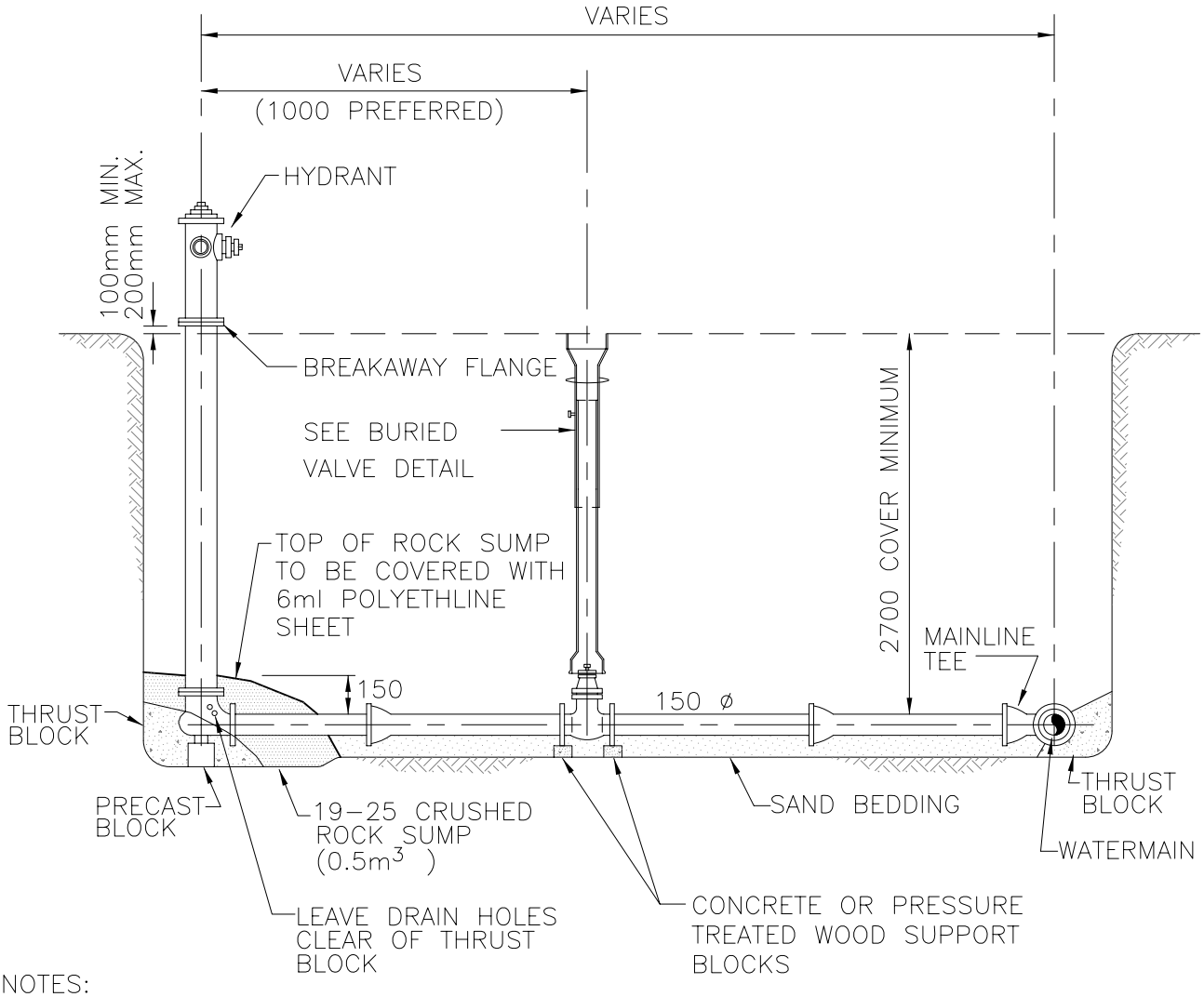


W = MINIMUM TRENCH WIDTH
= O.D. + 450mm
O.D. = OUTSIDE PIPE DIAMETER
I.D. = INSIDE PIPE DIAMETER

d = DEPTH OF BEDDING BELOW PIPE

I.D. = 675mm OR SMALLER : d MINIMUM = 75mm
I.D. = 750mm TO 1500mm : d MINIMUM = 100mm
I.D. = 1650mm AND LARGER : d MINIMUM = 150mm

REVISIONS			Town of Westlock	
Date	Details	Approved		
			TYPICAL TRENCHING DETAIL	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	3–1
			DATE: OCTOBER, 2009	



NOTES:

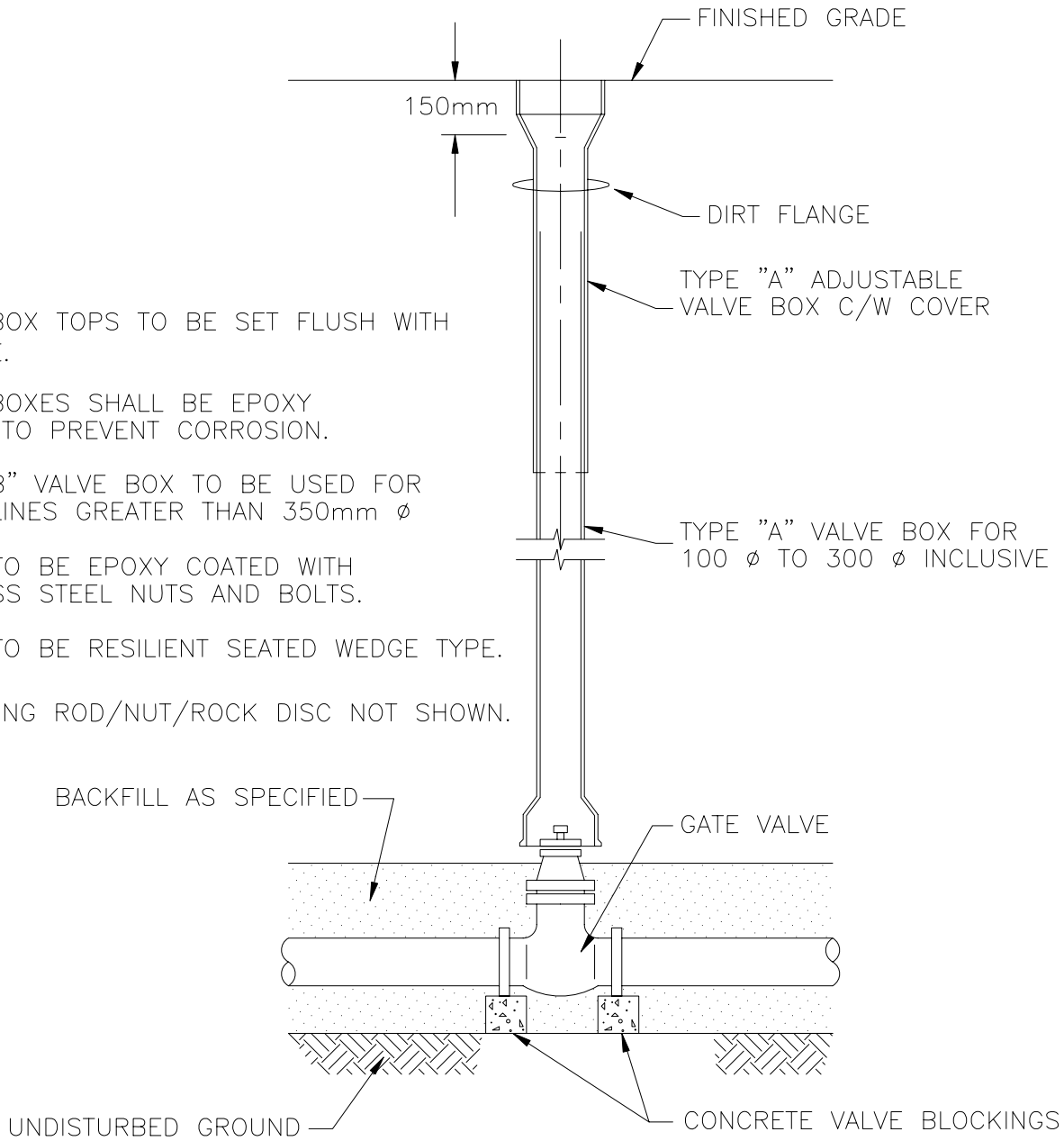
1. HYDRANT AND VALVE TO BE CATHODICALLY PROTECTED WITH A 5.5Kg ZINC ANODE.
2. VALVE TO BE LOCATED IN BOULEVARD WHERE POSSIBLE.
3. HYDRANT TO BE CHROME YELLOW WITH TOPS AND CAPS COLORED IN ACCORDANCE WITH NFPA GUIDELINES.
4. ALL NUTS AND BOLTS TO BE STAINLESS STEEL.
5. HYDRANT MUST NOT RESTRICT SIDEWALK. MINIMUM AND MAXIMUM DISTANCES AS SPECIFIED IN SECTION 3.4.2.4.
6. OPERATOR AND CAPS TO HAVE PENTAGONAL NUTS.
7. HYDRANT SHOULD BE LOCATED SO STEAMER PORT FACES THE ROAD OR MOST ACCESSIBLE SPOT FOR A FIRE TRUCK TO CONNECT.
8. ALL HOSE CONNECTIONS TO HAVE STANDARD THREAD.

REVISIONS		
Date	Details	Approved

Town of Westlock

STANDARD HYDRANT CONNECTION DETAIL

APPROVED:	STD. DWG. No.
SCALE: N.T.S.	3–2
DATE: OCTOBER, 2009	



NOTES:

(1) VALVE BOX TOPS TO BE SET FLUSH WITH SURFACE.

(2) VALVE BOXES SHALL BE EPOXY COATED TO PREVENT CORROSION.

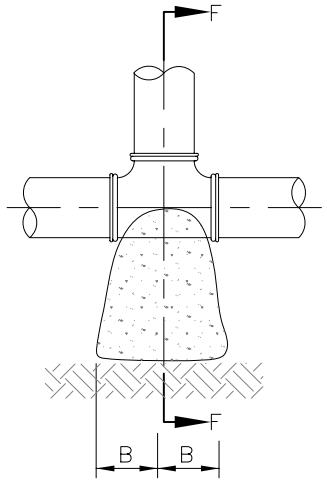
(3) TYPE "B" VALVE BOX TO BE USED FOR WATER LINES GREATER THAN 350mm ø

(4) VALVE TO BE EPOXY COATED WITH STAINLESS STEEL NUTS AND BOLTS.

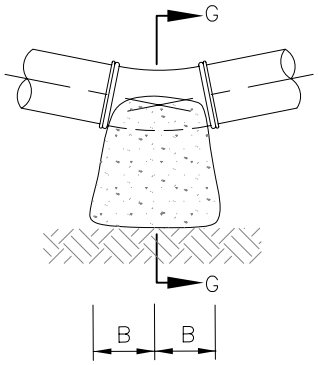
(5) VALVE TO BE RESILIENT SEATED WEDGE TYPE.

(6) OPERATING ROD/NUT/ROCK DISC NOT SHOWN.

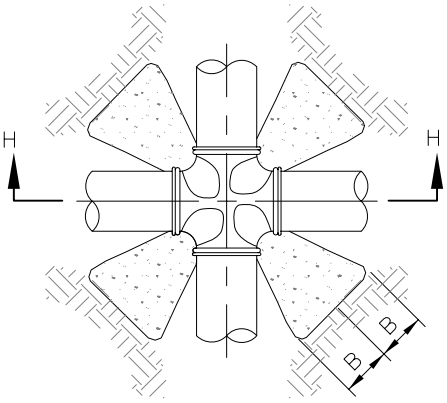
REVISIONS			Town of Westlock	
Date	Details	Approved		
			BURIED VALVE DETAIL	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	3–3
			DATE: OCTOBER, 2009	



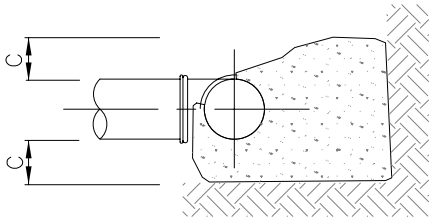
TEE & DEAD END CONNECTION



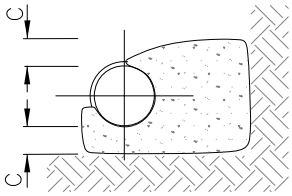
22 1/2° & 11 1/4° BENDS



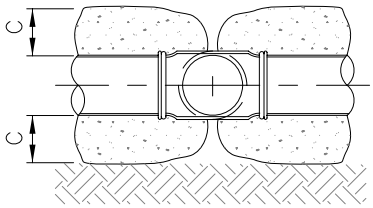
CROSS CONNECTION



SECTION F – F



SECTION G – G



SECTION H – H

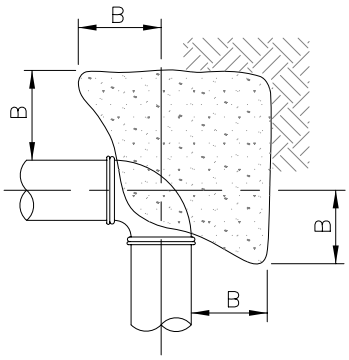
MINIMUM CONCRETE THRUST BLOCK DIMENSIONS

1035 Kpa WATER PRESSURE & 95.76 Kpa ALLOWABLE SOIL PRESURE								
FITTINGS	11 1/4° BEND	22 1/2° BEND	45° BEND	60° BEND	67 1/2° BEND	75° BEND	90° BEND	CROSS–TEE & PLUG
RAR	0.198 A	0.390 A	0.765 A	A	1.112 A	1.218 A	1.414 A	A

RAR = 2B x (2C + DIA.) & 2B ≥ (2C + DIA.)

RAR = REACTION AREA REQUIRED
A = AREA CONSTANT

DIA. =150 A=0.197	RAR	0.039	0.77	0.151	0.197	0.219	0.240	0.279	0.197
	B	100	150	220	250	250	275	310	250
	C	50 (MIN.)	50 (MIN.)	100	125	150	150	150	125
DIA. =200 A=.350	RAR	0.069	0.137	0.268	0.350	0.389	0.426	0.495	0.350
	B	125	175	275	300	325	360	360	300
	C	75	100	150	200	200	200	250	200
DIA. =250 A=0.547	RAR	0.108	0.213	0.418	0.547	0.608	0.666	0.773	0.547
	B	150	250	380	420	420	450	460	420
	C	75	100	150	200	250	250	300	200
DIA. =300 A=0.788	RAR	0.156	0.307	0.603	0.788	0.876	0.960	1.114	0.788
	B	200	310	430	440	440	440	500	440
	C	75	100	200	300	350	400	400	300

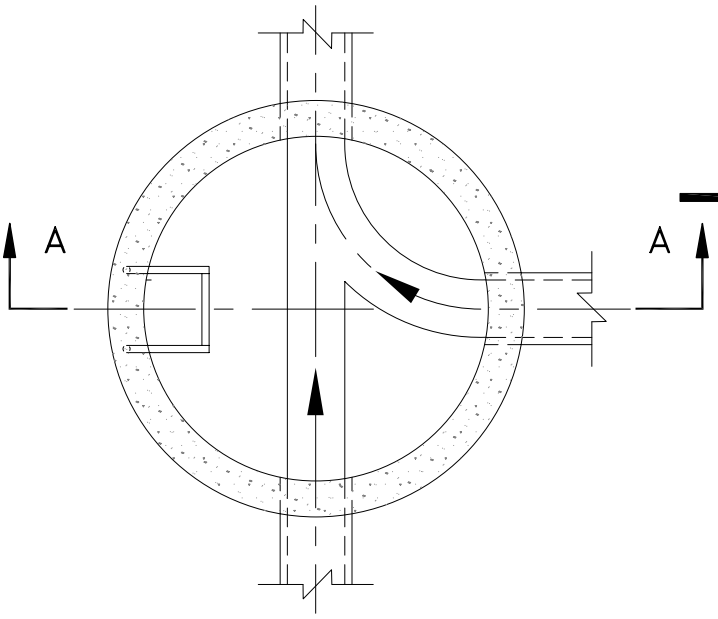


90° BEND

NOTE:
- CONCRETE TO BE 25 Mpa @ 28 DAYS
- CONRETE TO BE TYPE 50 SULFATE RESISTANT
- CONCRETE TO BE CLEAR OF BELLS & PIPE
- MINIMUM 75mm CONCRETE UNDER ALL FITTINGS.

THRUST BLOCK DESIGNED ON
- 100 Kpa ALLOWABLE SOIL BEARING PRESSURE.
- 1.5 FACTOR OF SAFETY
- 1035 Kpa PIPE WATER PRESSURE.
- LARGER REACTION AREAS ARE REQUIRED IN POOR SOIL CONDITIONS.

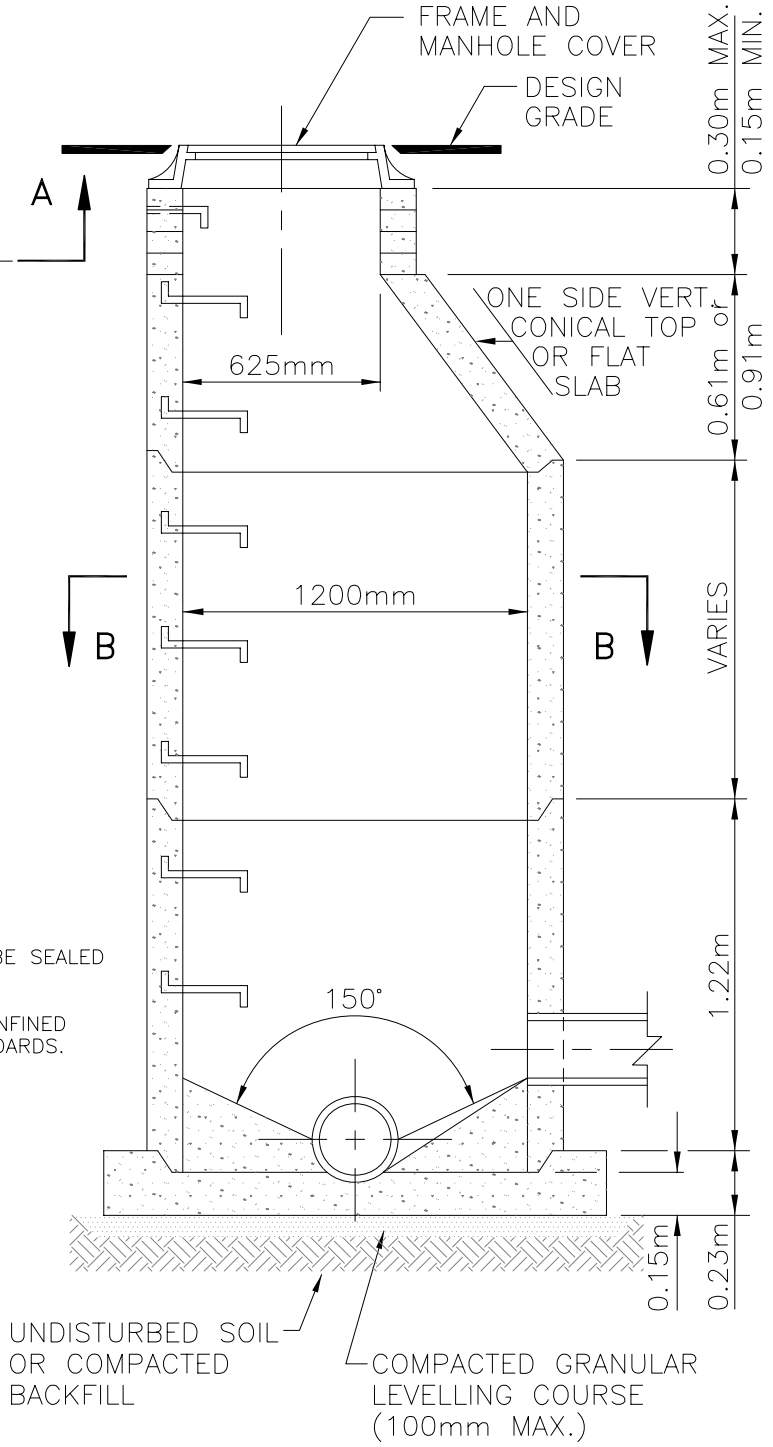
REVISIONS			Town of Westlock	
Date	Details	Approved		
			THRUST BLOCK DETAIL	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	3–4
			DATE: OCTOBER, 2009	



SECTION B – B

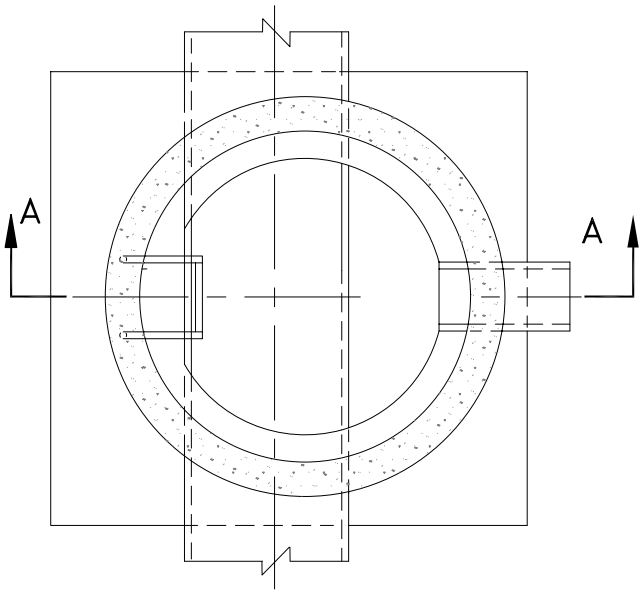
NOTES:

1. CAST–IN–PLACE CONCRETE BASE MAY BE USED. CAST–IN–PLACE CONCRETE TO BE TYPE 50 25MPa IN 28 DAYS. CAST–IN–PLACE CONC. BASE TO BE MIN. 150mm THICK AND CONSTRUCTED ON UNDISTURBED SOIL. FOR MH OVER 5.0m IN DEPTH, BASE TO BE REINFORCED WITH 10M BARS AT 250mm EACH WAY. SAFETY PLATFORMS REQUIRED IN MANHOLES OVER 5.0m IN DEPTH.
2. PRECAST RINGS, CONES AND BARRELS TO MEET CURRENT ASTM & CSA STANDARDS.
3. ALL EXTERIOR AND INTERIOR JOINTS & RINGS TO BE SEALED WITH NON–SHRINK GROUT.
4. ALL BARREL MH JOINTS TO BE SEALED WITH A CONFINED O–RING GASKET THAT MEETS CURRENT ASTM STANDARDS.
5. CONNECTION OF PIPES TO MH TO BE SEALED WITH CEMENT MORTAR.
6. INLET AND OUTLET PIPES TO BE GROUTED FLUSH WITH WALL.
7. CHANNELING AND BENCHING TO BE FINISHED TO TROWEL SMOOTHNESS.
8. SAFETY STEP SPACING TO BE EQUALLY SPACED AT A MAX. OF 410mm APART TO WITHIN 300mm BELOW COVER AND TO WITHIN 600mm OF THE BASE OR BENCHING. STEPS TO BE EPOXY COATED EXTRUDED ALUMINUM OR GALVANIZED METAL.
9. COMPACT BACKFILL AROUND MH TO A MIN. OF 95% STANDARD PROCTOR DENSITY.
10. PRECAST INLINE TEE MH's ARE ACCEPTABLE FOR SEWERS 900mmø AND LARGER. CONCRETE BEDDING REQUIRED TO SPRINGLINE OF MANHOLE TEE.
11. NF–39 FRAME AND COVER IN LANDSCAPED AREAS. NF–80 FRAME AND COVER IN HARD SURFACE AREAS. NF–90 GASKETED FRAME AND COVER AT SAGS.

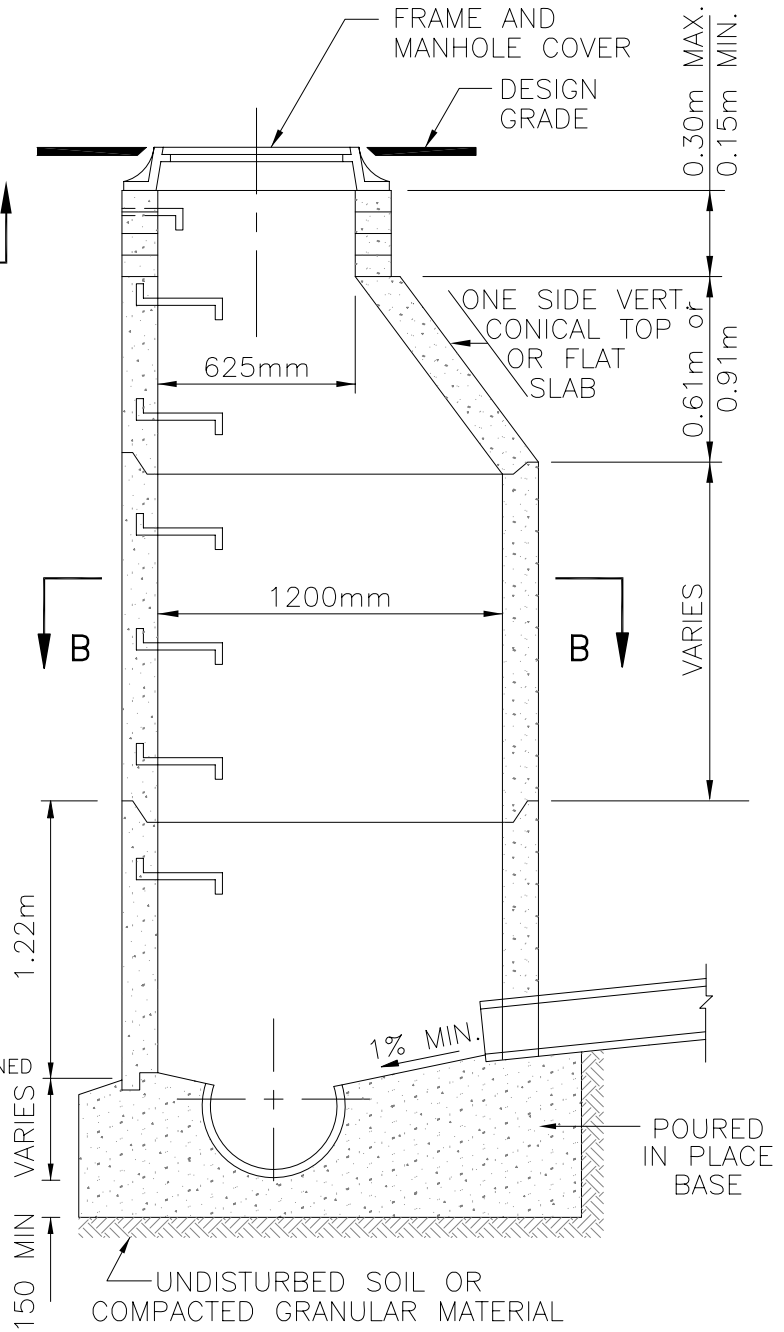


SECTION A – A

REVISIONS			Town of Westlock	
Date	Details	Approved		
			STANDARD 1200mm MANHOLE	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	4–1
			DATE: OCTOBER, 2009	



SECTION B – B



SECTION A – A

NOTES:

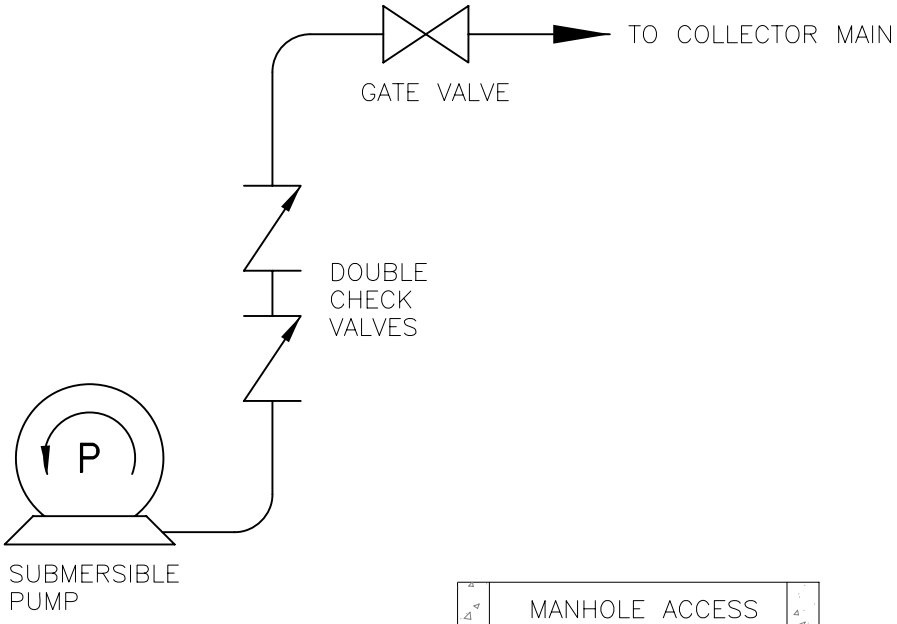
1. CAST–IN–PLACE CONCRETE BASE TO BE TYPE 50 25Mpa IN 28 DAYS. CAST–IN–PLACE BASE TO BE MIN. 150mm THICK AND CONSTRUCTED ON UNDISTRUBED SOIL. FOR MANHOLES OVER 5.0m IN DEPTH, BASE TO BE REINFORCED WITH 10M BARS AT 250mm EACH WAY. SAFTY PLATFORMS REQUIRED IN MANHOLES OVER 5.0m IN DEPTH.
2. PRECAST RINGS, CONES AND BARRELS TO MEET CURRENT ASTM & CSA STANDARDS.
3. ALL EXTERIOR AND INTERIOR JOINTS AND RINGS TO BE SEALED WITH NON–SHRINK GROUT.
4. ALL BARREL MH JOINTS TO BE SEALED WITH A CONFINED O–RING GASKET THAT MEETS ASTM STANDARDS.
5. CONNECTION OF PIPES TO MH TO BE SEALED WITH CEMENT MORTAR.
6. INLET AND OUTLET PIPES TO BE GROUTED FLUSH WITH WALL.
7. CHANNELING AND BENCHING TO BE FINISHED TO TROWEL SMOOTHNESS.
8. SAFETY STEP SPACING TO BE EQUALLY SPACED AT A MAX. OF 410mm APART TO WITHIN 300mm BELOW COVER AND TO WITHIN 600mm OF THE BASE OR BENCHING. STEPS TO EPOXY COATED EXTRUDED ALUMINUM OR GALVANIZED METAL.
9. COMPACT BACKFILL AROUND MH TO A MIN. OF 95% STANDARD PROCTOR DENSITY.
10. F–39 FRAME AND COVER IN LANDSCAPED AREAS.
    F–80 FRAME AND COVER IN HARD SURFACED AREAS.
    F–90 GASKETED FRAME AND COVER AT SAGS.

REVISIONS		
Date	Details	Approved

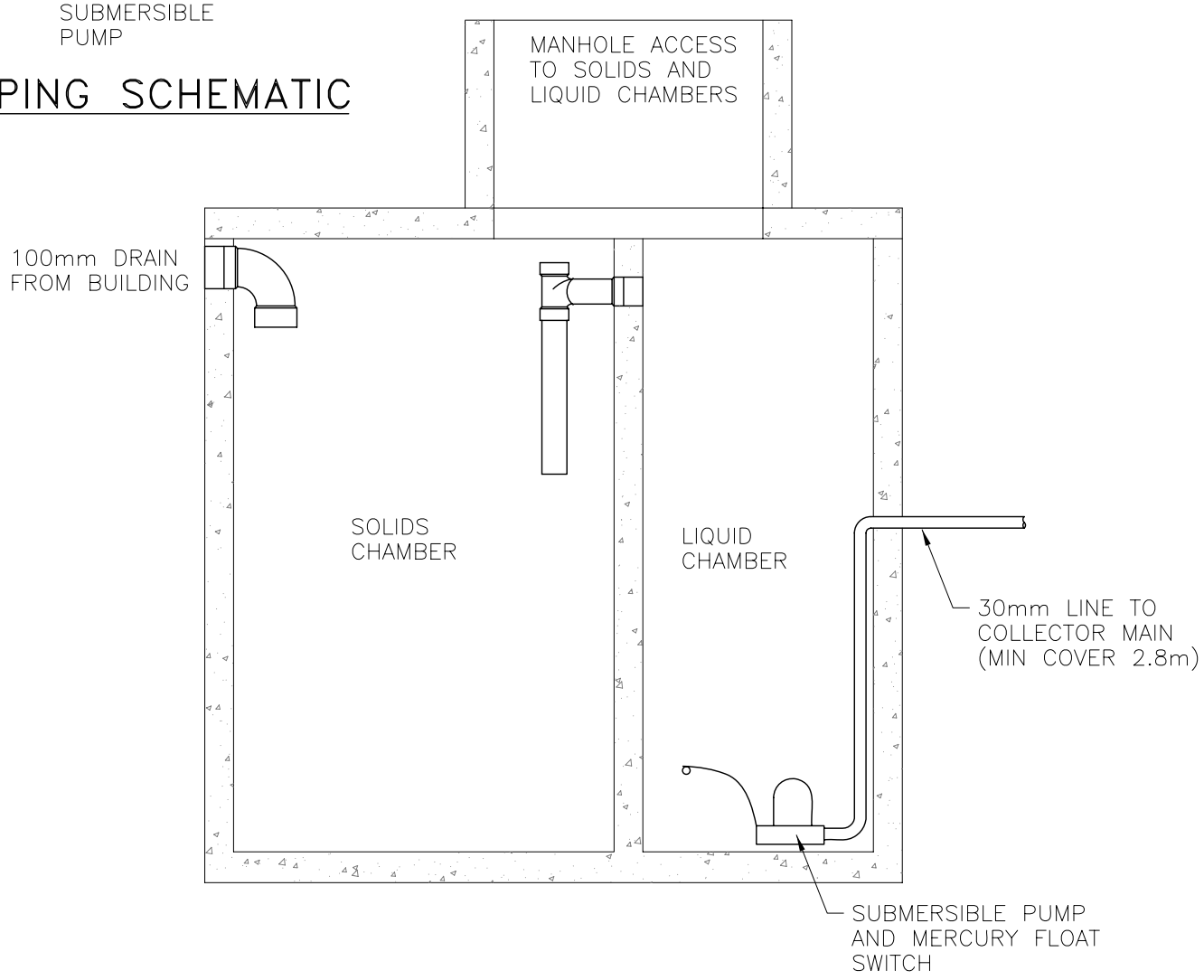
Town of Westlock

STANDARD 1200mm PERCHED MANHOLE

APPROVED:	STD. DWG. No.
SCALE: N.T.S.	4–2
DATE: OCTOBER, 2009	



PIPING SCHEMATIC

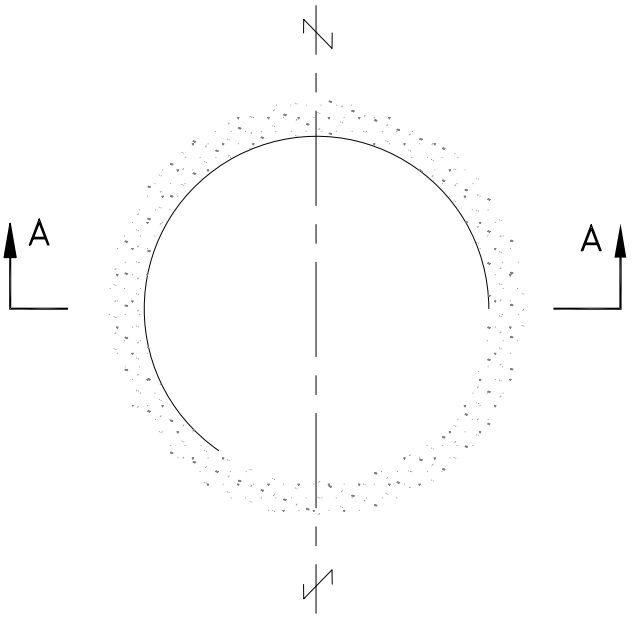


REVISIONS		
Date	Details	Approved

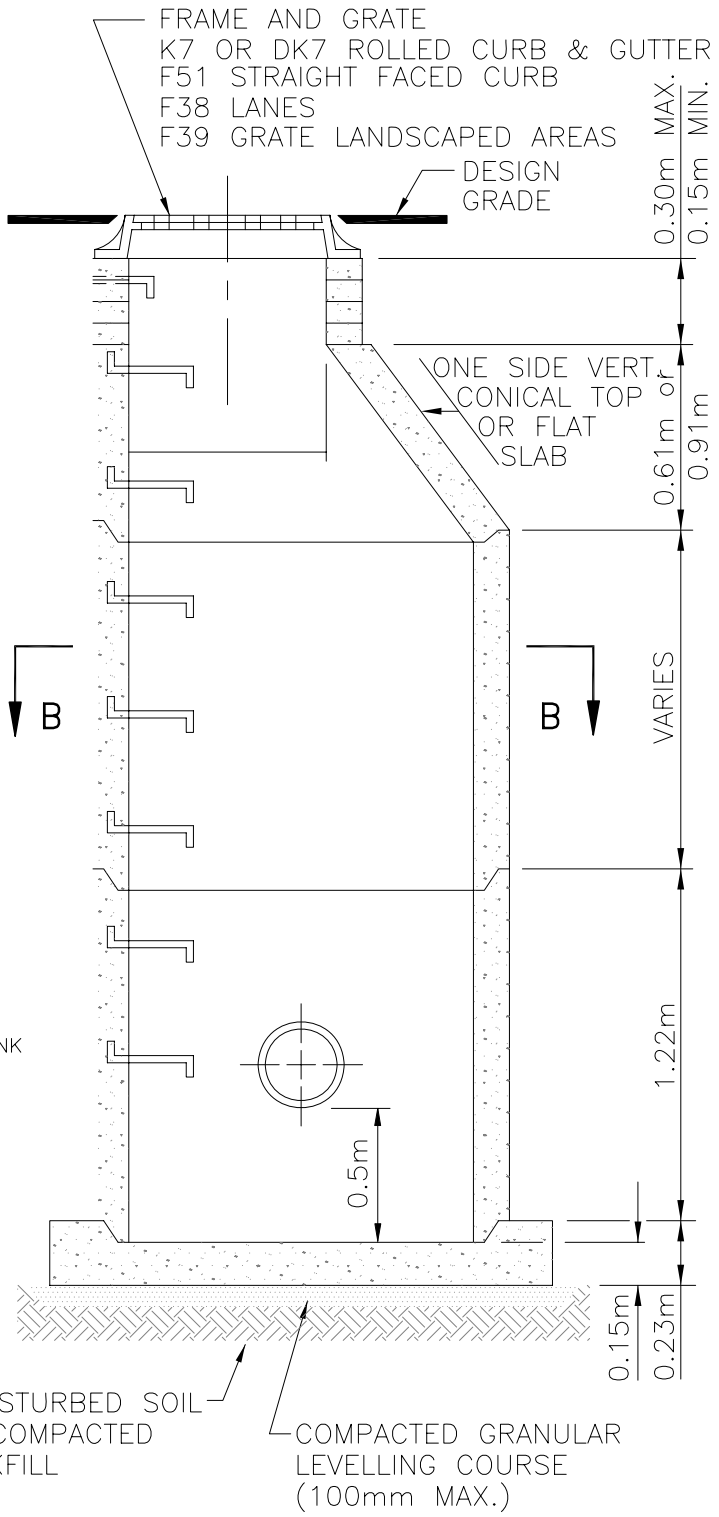
Town of Westlock

LOW PRESSURE SEPTIC TANK INSTALLATION

APPROVED:	STD. DWG. No.
SCALE: N.T.S.	4–3
DATE: OCTOBER, 2009	



SECTION B – B



SECTION A – A

REINFORCED WITH 10M BARS AT 250mm EACH WAY. SAFETY PLATFORMS REQUIRED IN MANHOLES OVER 5.0m IN DEPTH.

2. PRECAST RINGS, CONES AND BARRELS TO MEET CURRENT ASTM STANDARDS.

3. ALL MH JOINTS & RINGS TO BE SEALED WITH NON–SHRINK GROUT. BARRELL JOINTS SHALL BE C/W CONFINED O–RING GASKET THAT MEETS CURRENT ASTM STANDARDS.

4 CONNECTION OF PIPES TO MH TO BE SEALED WITH CEMENT MORTAR

5 INLET AND OUTLET PIPES TO BE GROUTED FLUSH WITH WALL.

6 BENCHING TO BE FINISHED TO TROWEL SMOOTHNESS.

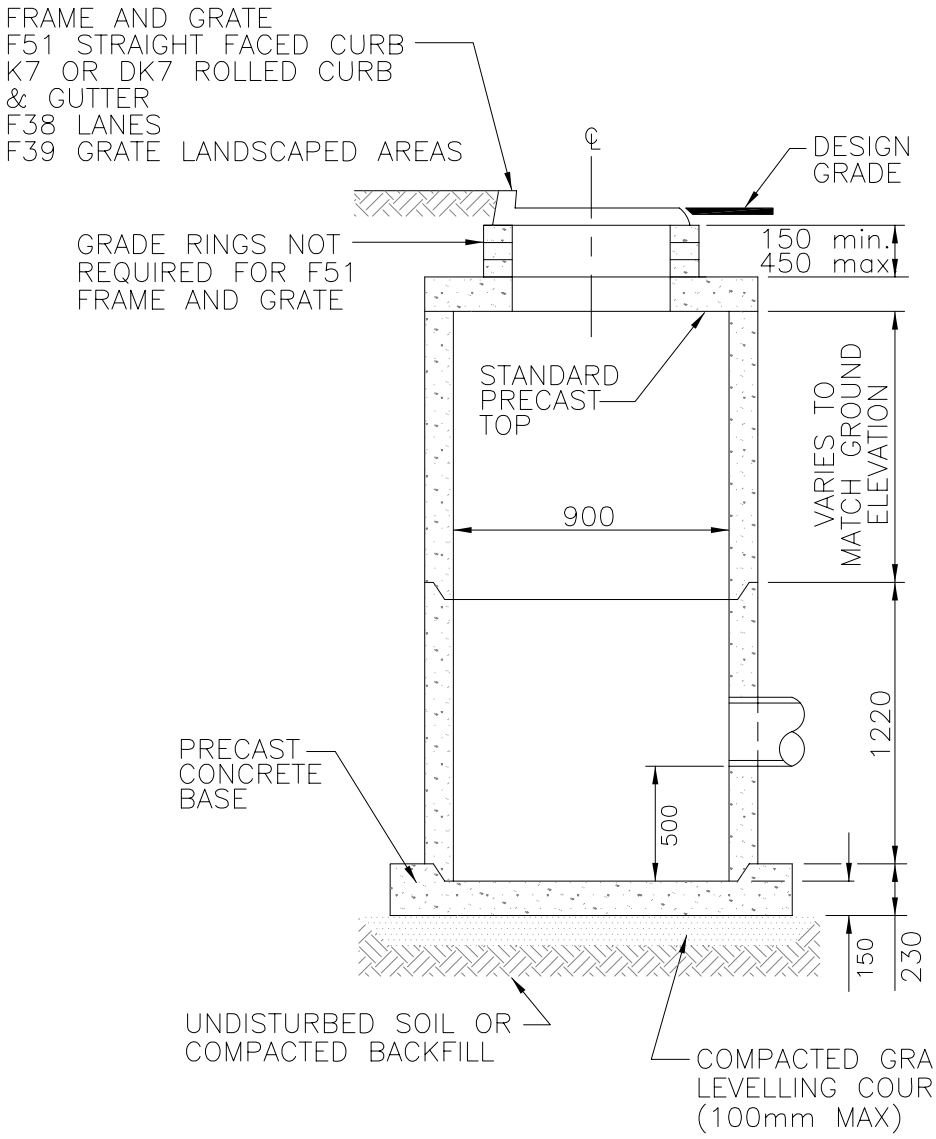
7 SAFETY STEP SPACING TO BE EQUALLY SPACED AT A MAX. OF 410mm APART TO WITHIN 300mm BELOW COVER AND TO WITHIN 600mm OF THE BASE OR BENCHING. STEPS TO BE EPOXY COATED EXTRUDED ALUMINUM OR GALVANIZED METAL.

8 COMPACT BACKFILL AROUND MH TO A MIN. OF 95% STANDARD PROCTOR DENSITY.

9 PRECAST INLINE TEE MH's ARE ACCEPTABLE FOR SEWERS 900mmø AND LARGER. CONCRETE BEDDING REQUIRED TO SPRINGLINE OF MANHOLE TEE.

10 0.5m SUMP REQUIRED IN CATCHBASIN MANHOLE.

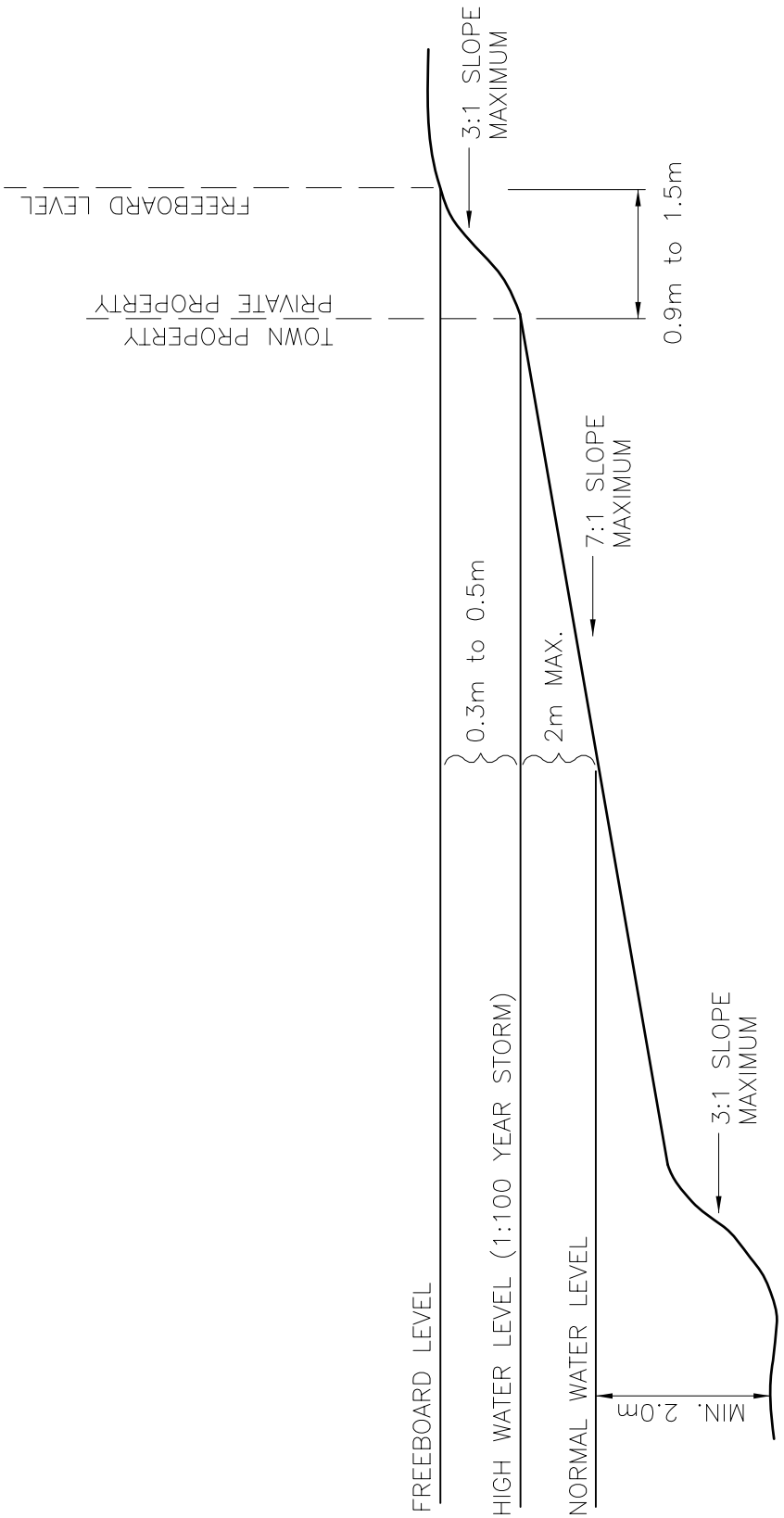
REVISIONS			Town of Westlock	
Date	Details	Approved		
			STANDARD 1200mm CATCHBASIN MANHOLE	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	5–1
			DATE: OCTOBER, 2009	



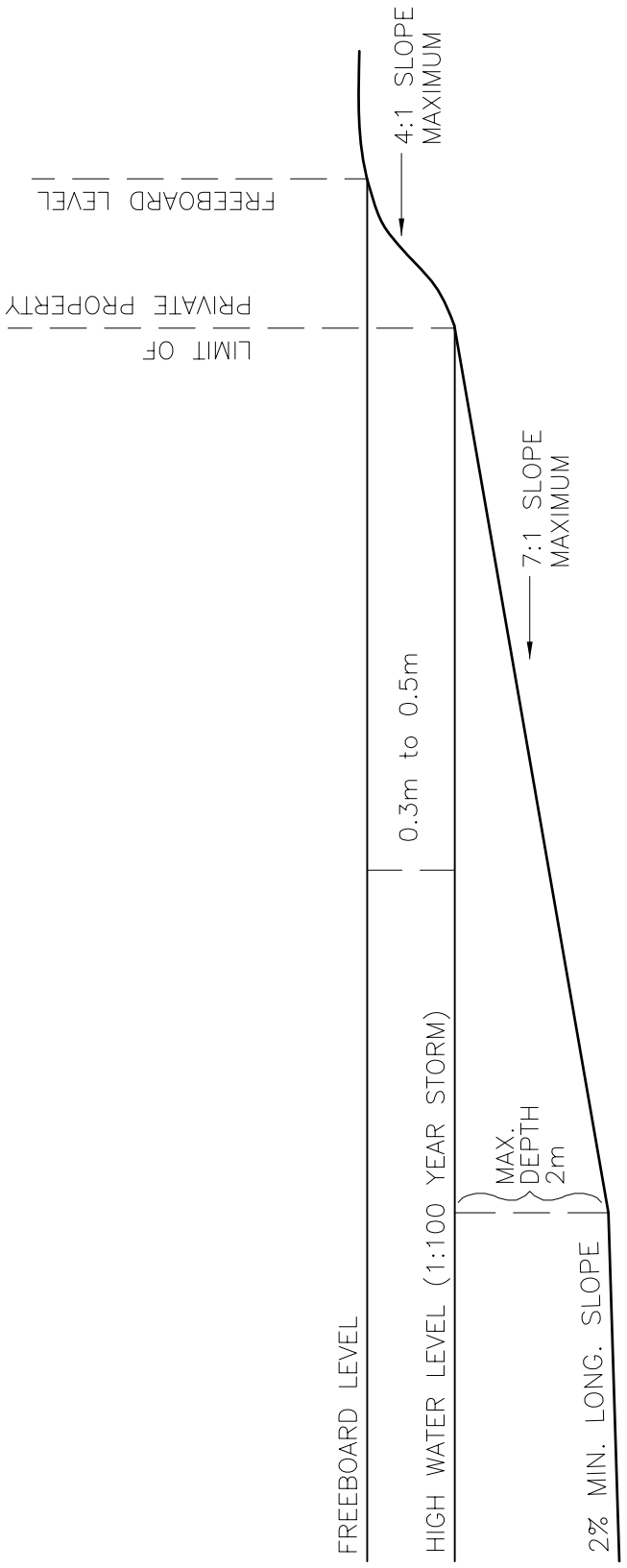
NOTES:

1. CAST–IN–PLACE CONC. BASE MAY BE USED. CAST–IN–PLACE CONC. TO BE TYPE 50 25MPa IN 28 DAYS. CAST–IN–PLACE CONC. BASE TO BE MIN. 150mm THICK AND CONSTRUCTED ON UNDISTURBED SOIL.
2. PRECAST RINGS, CONES AND BARRELS TO MEET CURRENT ASTM STANDARDS.
3. ALL MH JOINTS & RINGS TO BE SEALED WITH NON–SHRINK GROUT. BARRELL JOINTS SHALL BE C/W CONFINED O–RING GASKET THAT MEETS CURRENT ASTM STANDARDS.
4. CONNECTION OF PIPES TO MH TO BE SEALED WITH CEMENT MORTAR
5. INLET AND OUTLET PIPES TO BE GROUTED FLUSH WITH WALL.
6. BENCHING TO BE FINISHED TO TROWEL SMOOTHNESS.
7. COMPACT BACKFILL AROUND CB TO A MIN. OF 95% STANDARD PROCTOR DENSITY.
8. 0.5m SUMP REQUIRED IN CATCHBASIN.

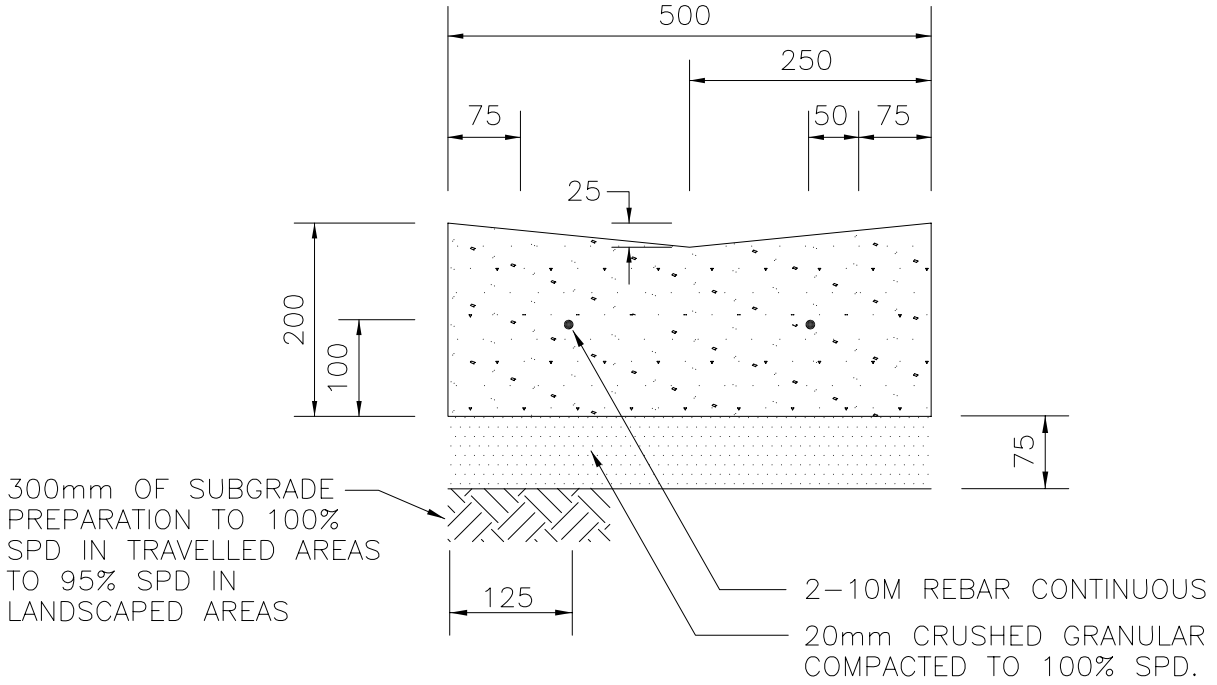
REVISIONS			Town of Westlock	
Date	Details	Approved		
			STANDARD 900mm CATCHBASIN	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	5–2
			DATE: OCTOBER, 2009	



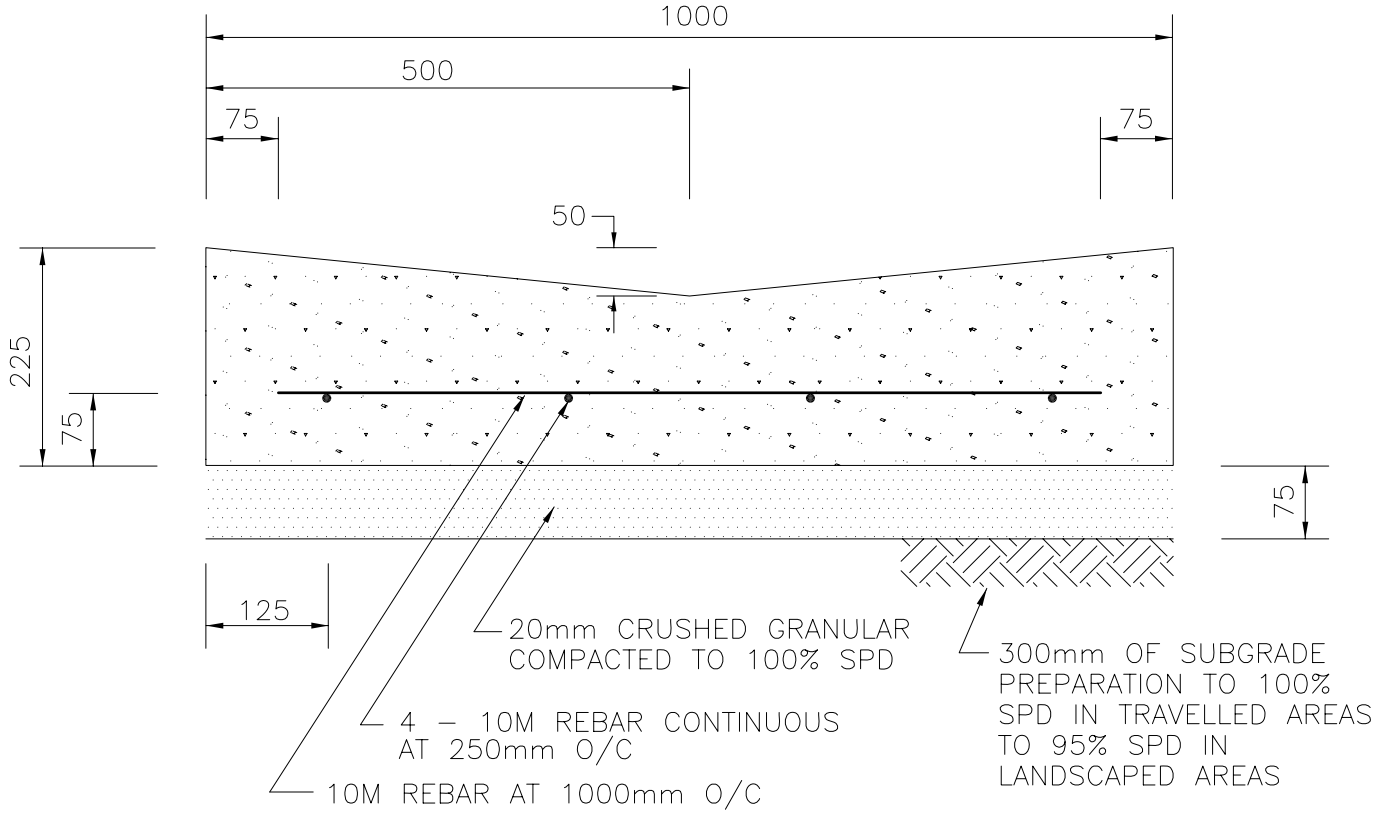
REVISIONS			Town of Westlock	
Date	Details	Approved		
			TYPICAL WET POND SECTION	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	5-3
			DATE: OCTOBER, 2009	



REVISIONS			Town of Westlock	
Date	Details	Approved		
			TYPICAL DRY POND SECTION	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	5-4
			DATE: OCTOBER, 2009	

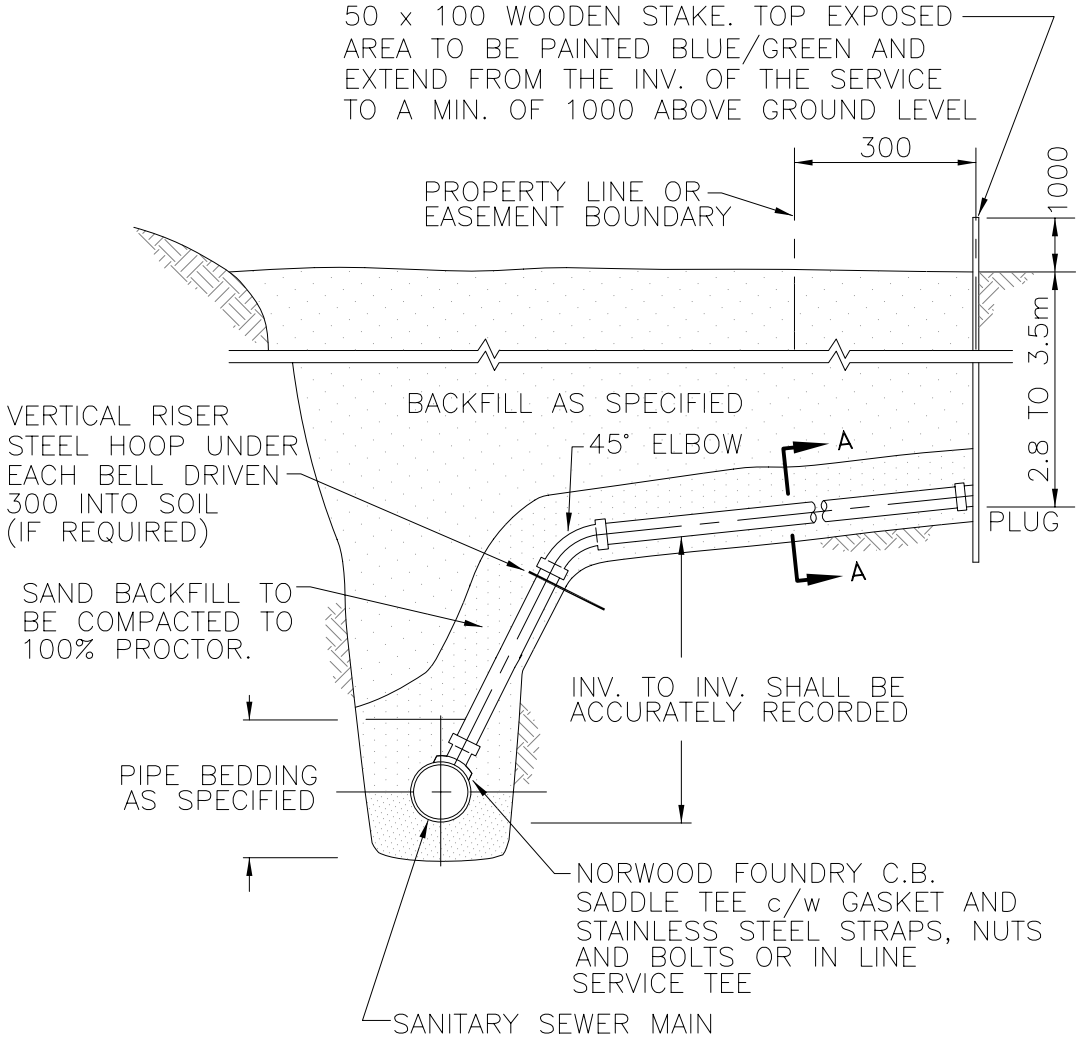


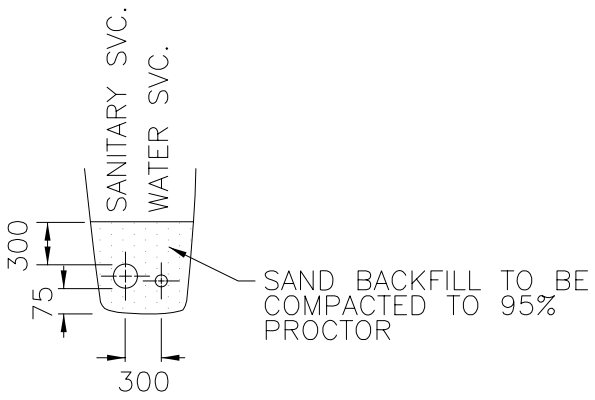
500mm CONCRETE SWALE



1000mm CONCRETE SWALE

REVISIONS			Town of Westlock	
Date	Details	Approved		
			CONCRETE DRAINAGE SWALES	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	5-5
			DATE: OCTOBER, 2009	



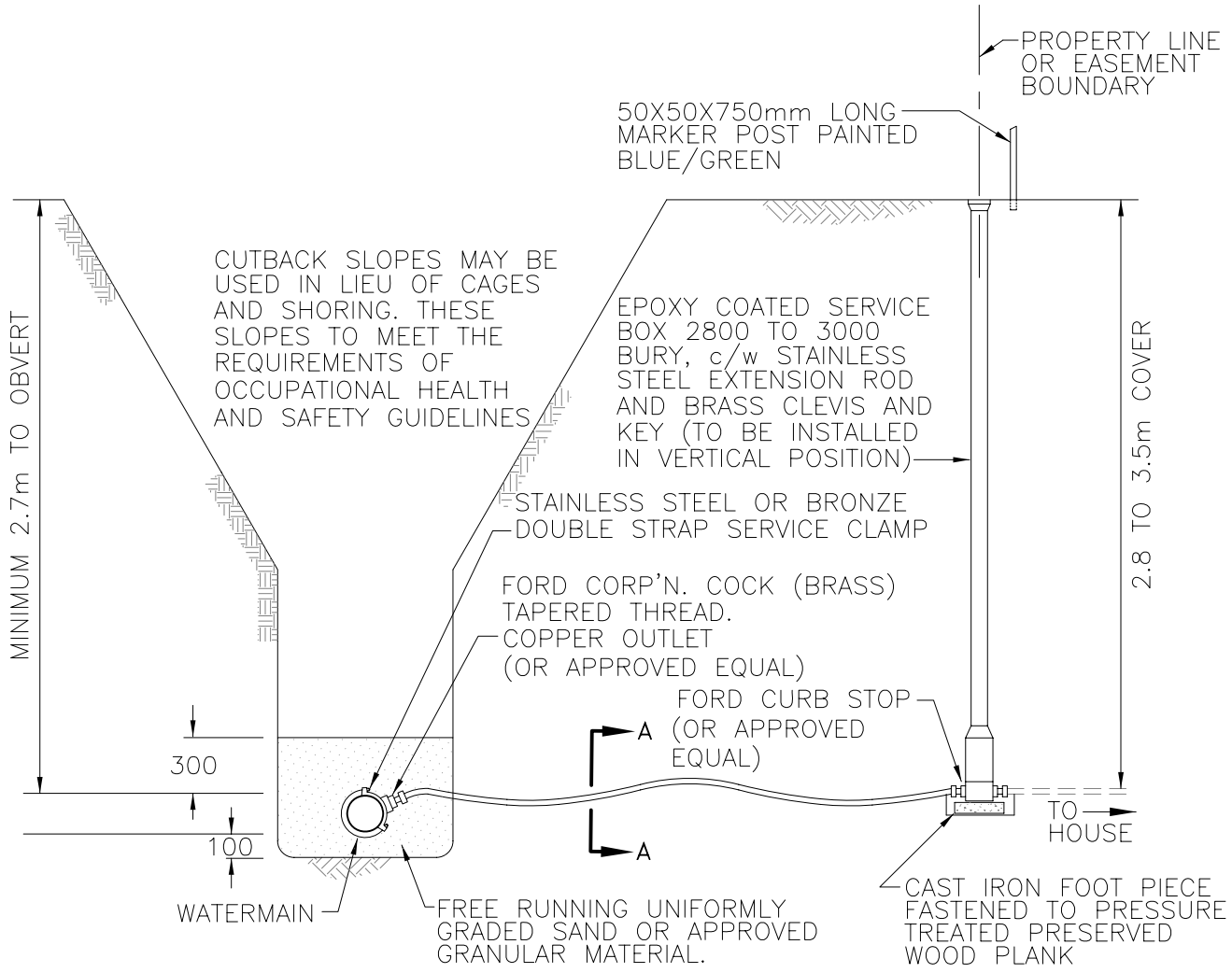


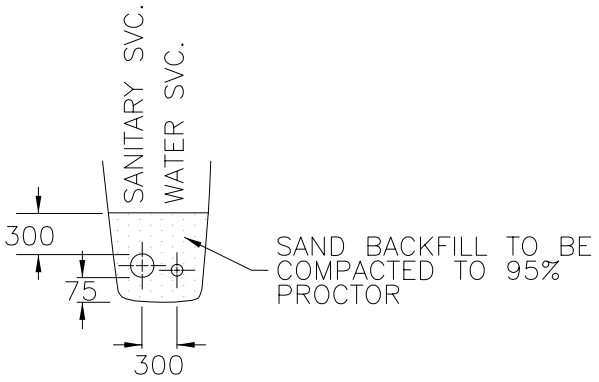
SECTION A (FACING PROPERTY)

NOTE :

1. MIN SLOPE FOR 100mm & 150mm DIA. PIPE IS 2%
2. SERVICE CONNECTIONS SHALL BE MINIMUM 100mm DIA. SDR 35 PVC
3. TOWN TO INSPECT ALL RISER INSTALLATIONS PRIOR TO BACKFILLING.
4. WHEN A GAS EASEMENT OCCURS ADJACENT TO THE P/L THE SANITARY SERVICE SHALL BE STUBBED 300mm BEYOND EASEMENT LIMITS.

REVISIONS			Town of Westlock	
Date	Details	Approved		
			STANDARD SANITARY SERVICE CONNECTION	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	6–1
			DATE: OCTOBER, 2009	



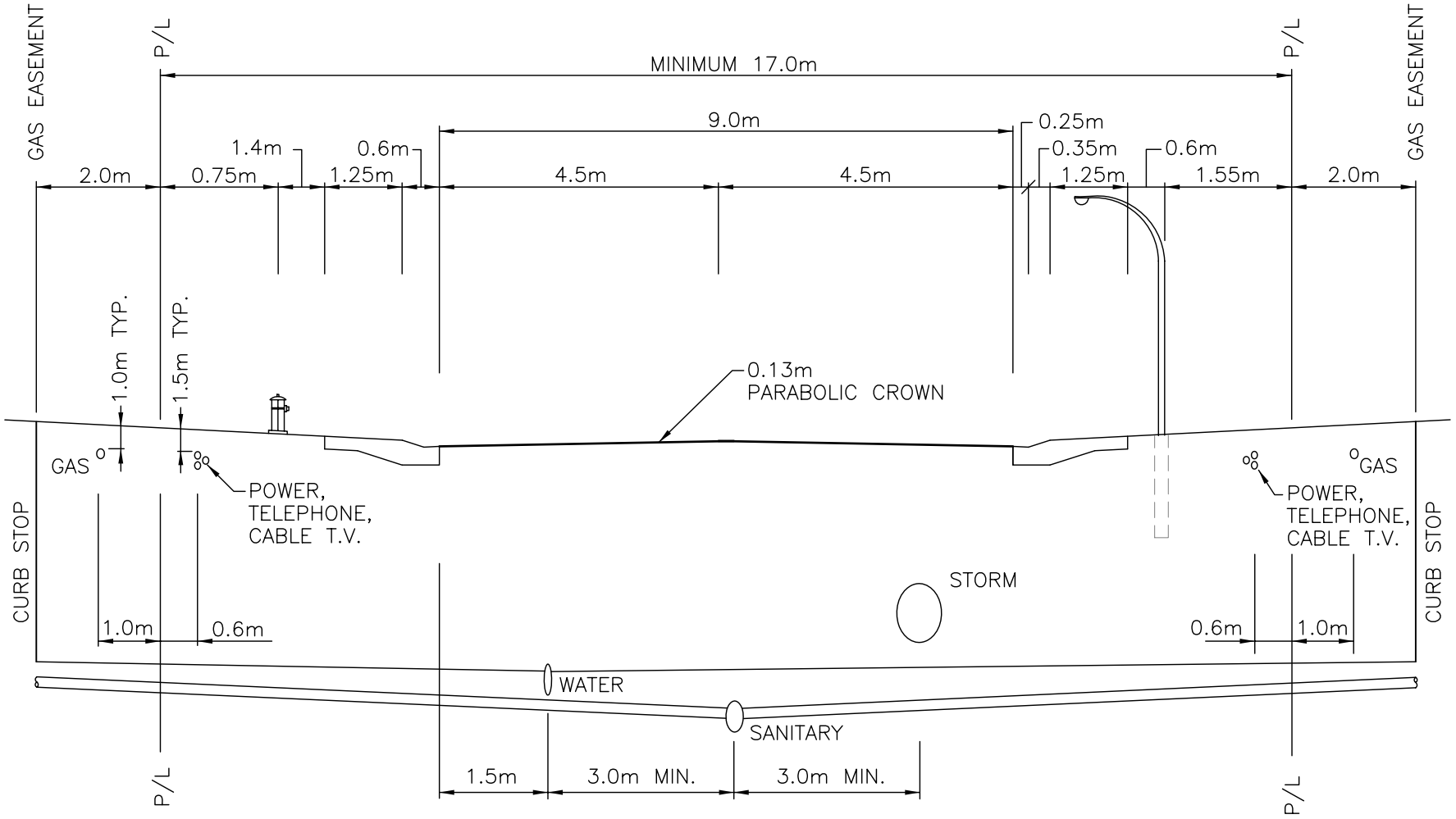


SECTION A (FACING PROPERTY)

NOTES:

1. WATER SERVICE TO BE TAPPED AT THE 2 TO 3 O'CLOCK POSITION.
2. WATER SERVICE TO BE TYPE K COPPER.
3. WATER SERVICE TO BE SNAKED IN THE TRENCH.
4. WATER SERVICE IS NOT TO BE GOOSENECKED AT THE CORPORATION STOP.
5. CORPORATION STOP AND CURB STOP TO BE CATHODICALLY PROTECTED WITH 5KG ZINC ANODES.
6. ALL FITTINGS TO BE PACKER NUT TYPE, NOT GRIPPER NUT.

REVISIONS			Town of Westlock	
Date	Details	Approved		
			STANDARD WATER SERVICE CONNECTION	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	6–2
			DATE: OCTOBER, 2009	



NOTES:
IF NO GAS EASEMENT, CURB STOP TO BE INSTALLED ON PROPERTY LINE

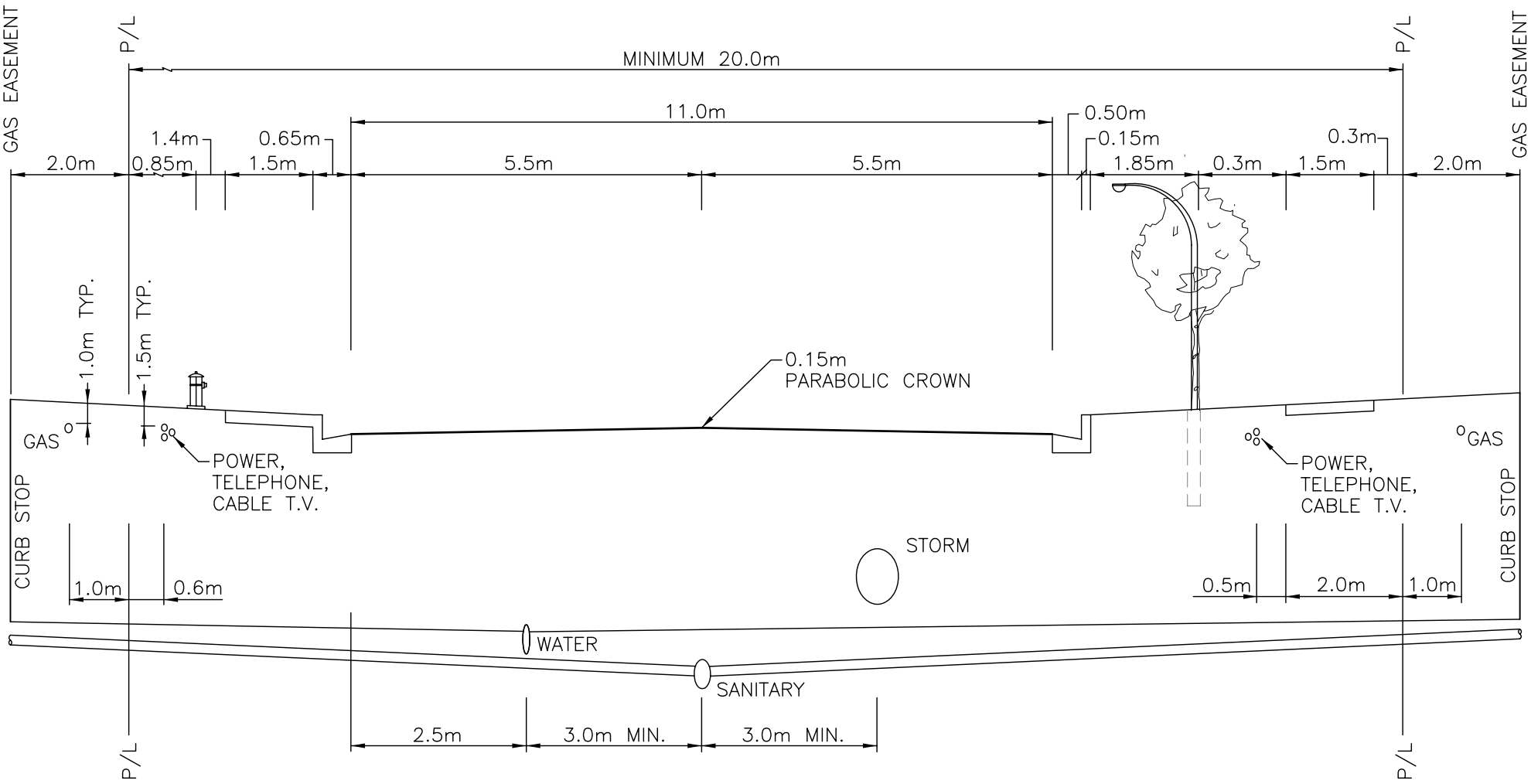
WICK DRAINS TO BE INSTALLED UNDER ALL SIDEWALKS, CURB & GUTTER AND CONNECTED TO CATCH BASINS

REVISIONS		
Date	Details	Approved

Town of Westlock

LOCAL RESIDENTIAL

APPROVED:	STD. DWG. No.
SCALE: N.T.S.	7-1
DATE: OCTOBER, 2009	



NOTES:
SIDEWALK MAY BE EITHER SEPARATE OR MONOLITHIC AS REQUIRED BY THE TOWN

IF NO GAS EASEMENT, CURB STOP TO BE INSTALLED ON PROPERTY LINE

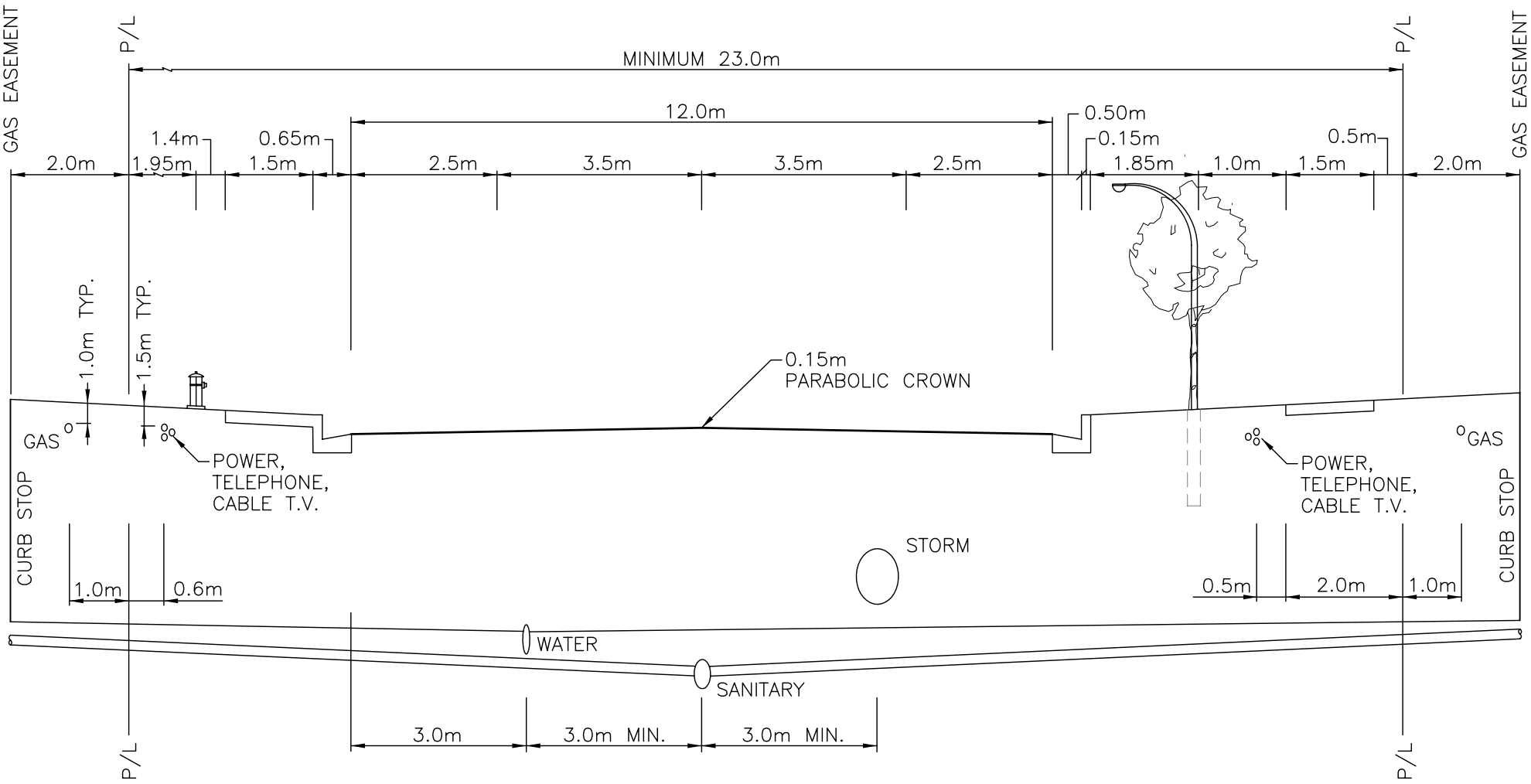
WICK DRAINS TO BE INSTALLED UNDER ALL SIDEWALKS, CURB & GUTTER AND CONNECTED TO CATCH BASINS

REVISIONS		
Date	Details	Approved

Town of Westlock

MINOR RESIDENTIAL COLLECTOR

APPROVED:	STD. DWG. No.
SCALE: N.T.S.	7–2
DATE: OCTOBER, 2009	



NOTES:
SIDEWALK MAY BE EITHER SEPARATE OR MONOLITHIC AS REQUIRED BY THE TOWN

IF NO GAS EASEMENT, CURB STOP TO BE INSTALLED ON PROPERTY LINE

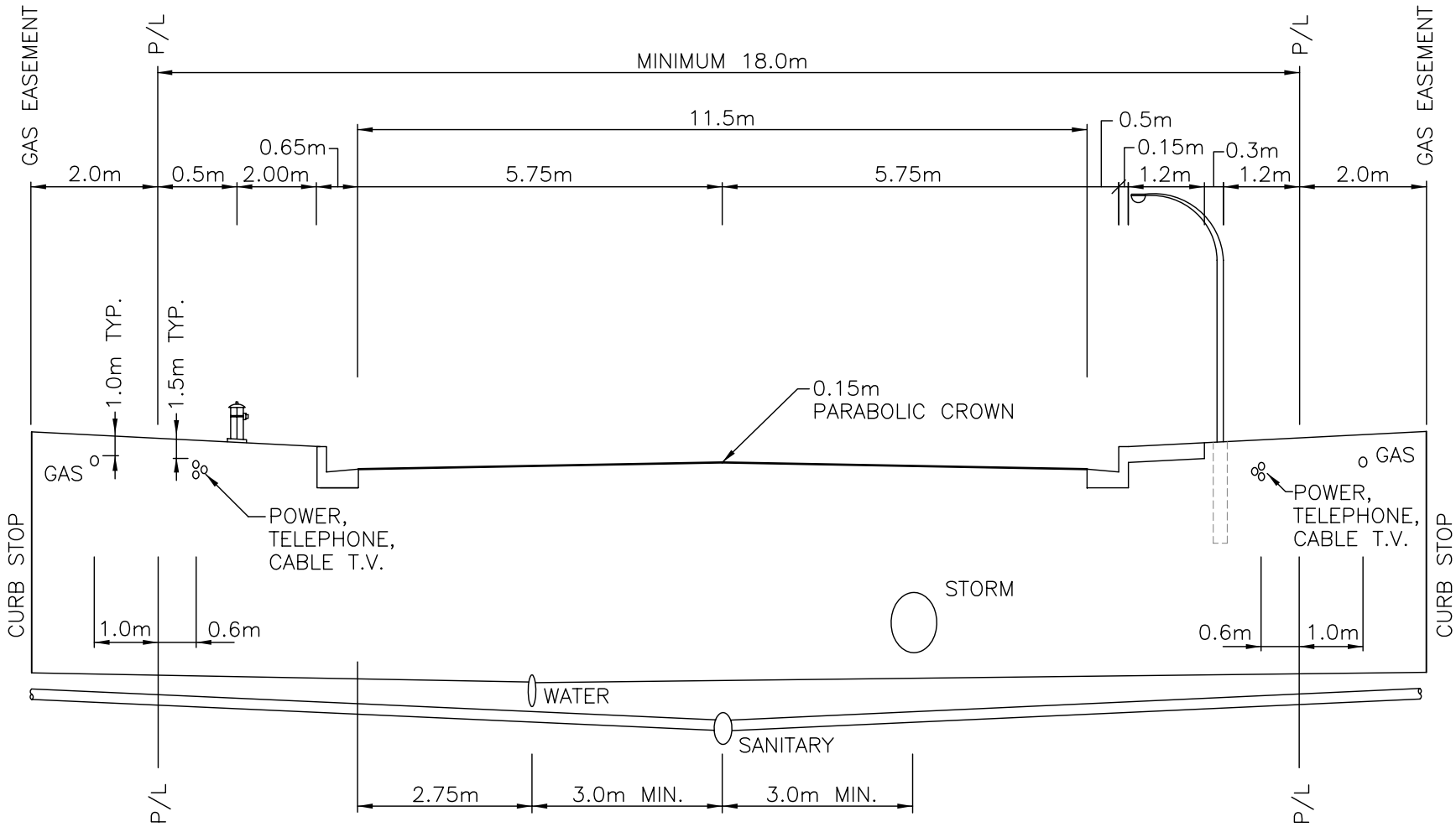
WICK DRAINS TO BE INSTALLED UNDER ALL SIDEWALKS, CURB & GUTTER AND CONNECTED TO CATCH BASINS

REVISIONS		
Date	Details	Approved

Town of Westlock

RESIDENTIAL COLLECTOR

APPROVED:	STD. DWG. No.
SCALE: N.T.S.	7–3
DATE: OCTOBER, 2009	



NOTES:
SIDEWALK MAY BE EITHER SEPARATE OR MONOLITHIC AS REQUIRED BY THE TOWN

IF NO GAS EASEMENT, CURB STOP TO BE INSTALLED ON PROPERTY LINE

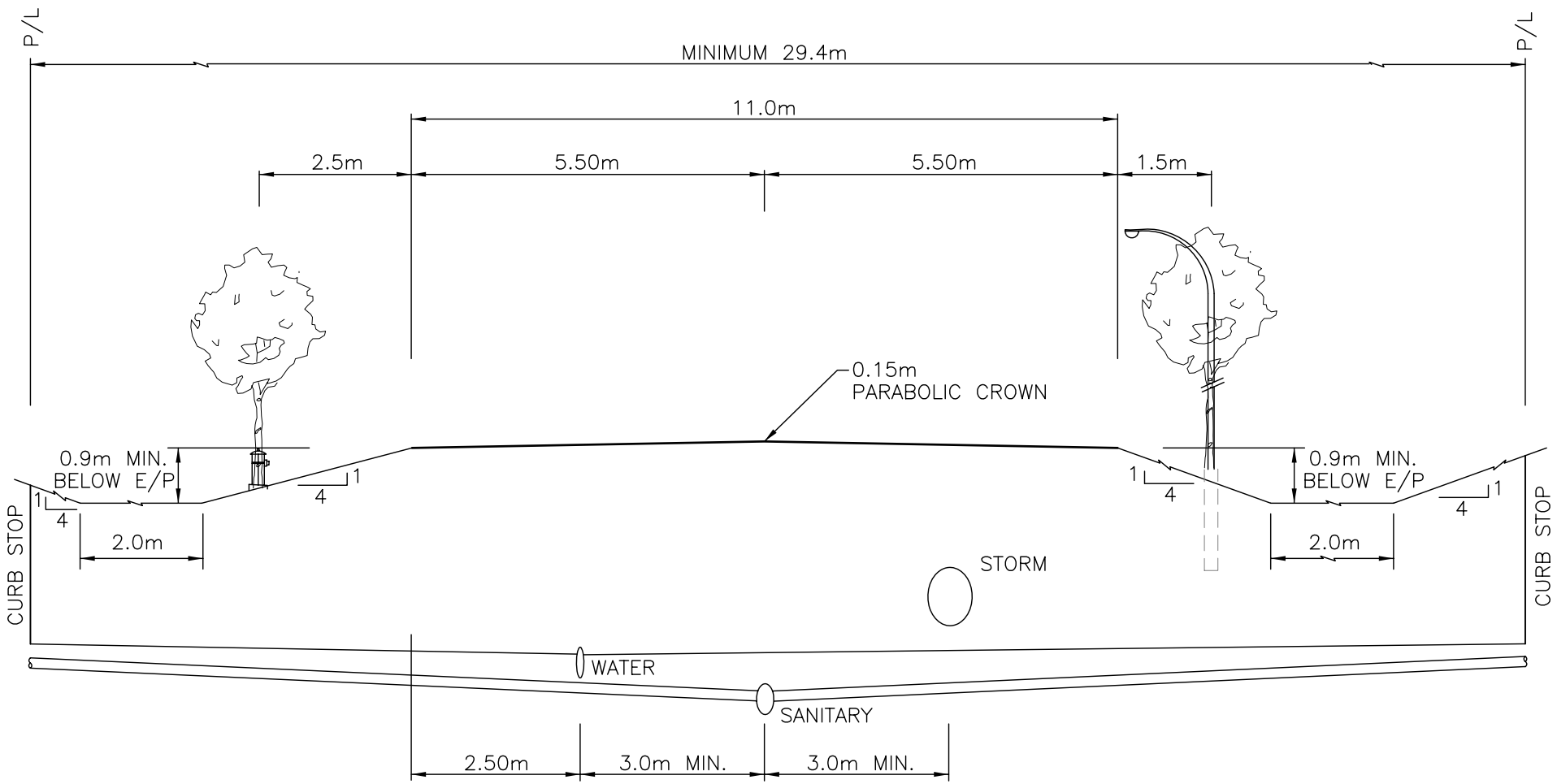
WICK DRAINS TO BE INSTALLED UNDER ALL SIDEWALKS, CURB & GUTTER AND CONNECTED TO CATCH BASINS

REVISIONS		
Date	Details	Approved

Town of Westlock

LOCAL INDUSTRIAL

APPROVED:	STD. DWG. No.
SCALE: N.T.S.	7–4
DATE: OCTOBER, 2009	



NOTE:

SIDEWALKS MAY BE REQUIRED AT THE REQUEST OF THE TOWN

CENTERLINE OF ROADWAY TO BE AT APPROXIMATELY SAME ELEVATION AS PROPERTY LINE

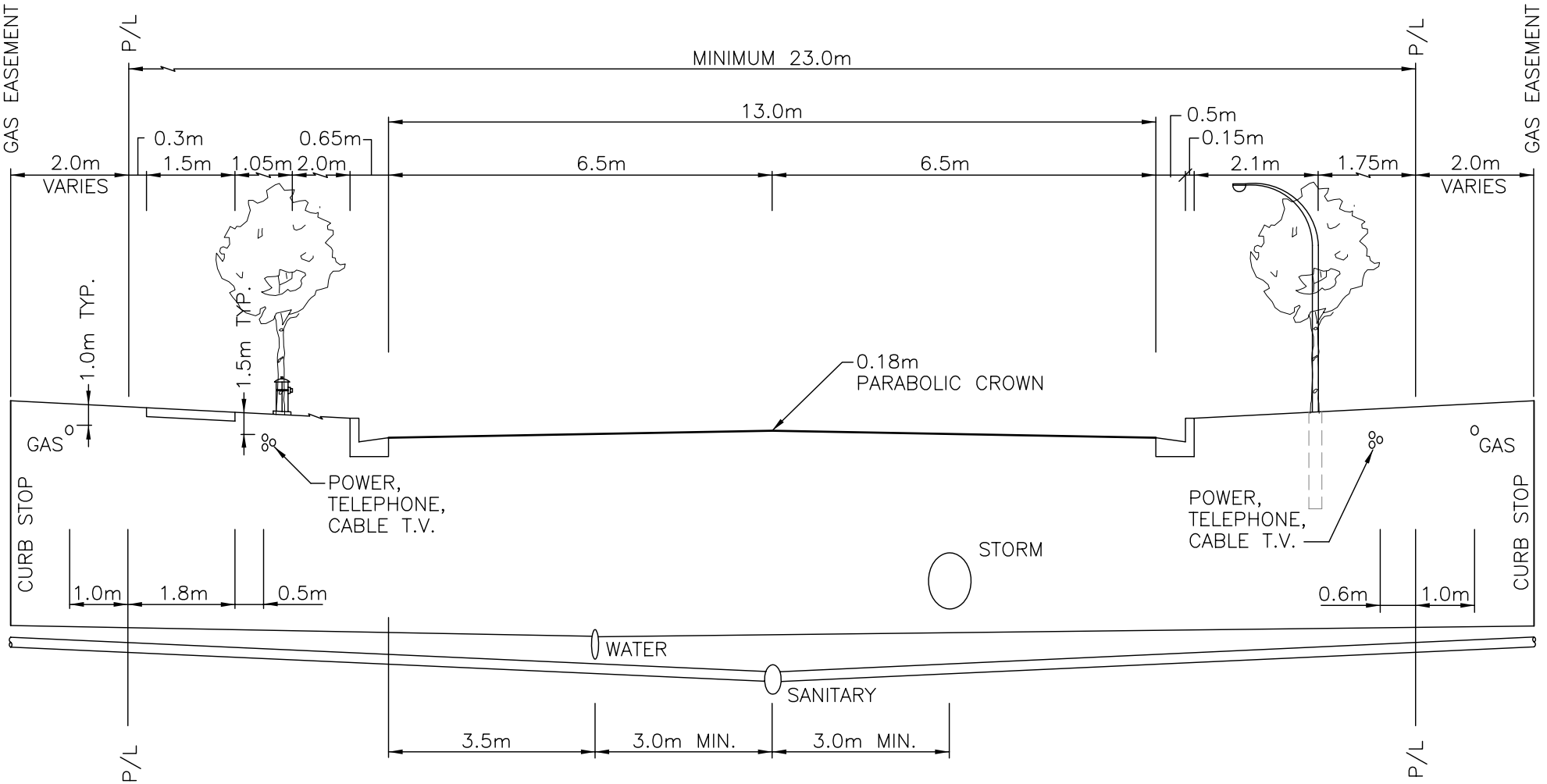
IF NO GAS EASEMENT, CURB STOP TO BE INSTALLED ON PROPERTY LINE

REVISIONS		
Date	Details	Approved

Town of Westlock

LOCAL INDUSTRIAL (RURAL)

APPROVED:	STD. DWG. No.
SCALE: N.T.S.	7-5
DATE: OCTOBER, 2009	



NOTES:
SIDEWALK MAY BE EITHER SEPARATE OR MONOLITHIC AS REQUIRED BY THE TOWN

IF NO GAS EASEMENT, CURB STOP TO BE INSTALLED ON PROPERTY LINE

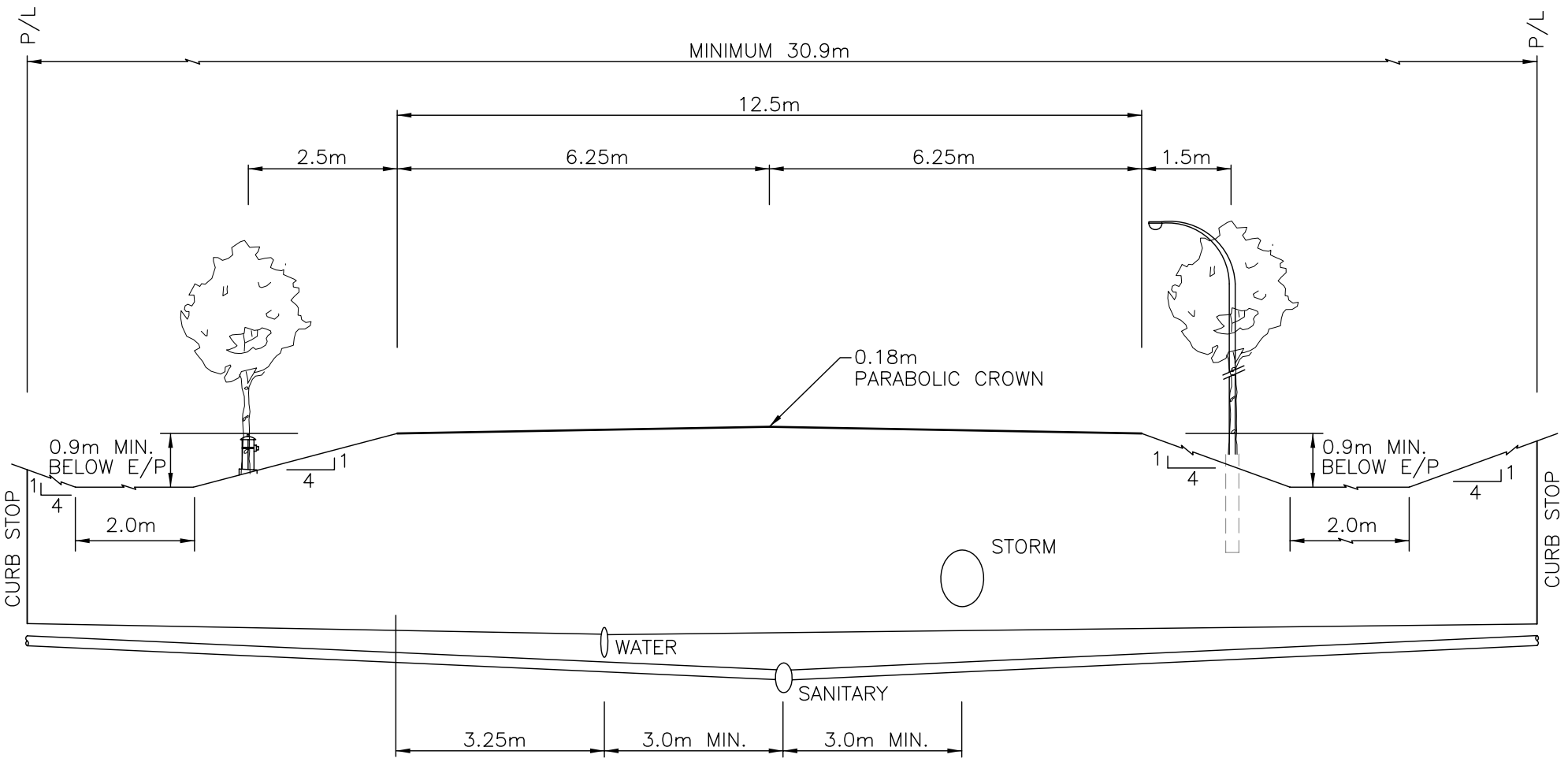
WICK DRAINS TO BE INSTALLED UNDER ALL SIDEWALKS, CURB & GUTTER AND CONNECTED TO CATCH BASINS

REVISIONS		
Date	Details	Approved

Town of Westlock

URBAN INDUSTRIAL COLLECTOR

APPROVED:	STD. DWG. No.
SCALE: N.T.S.	7–6
DATE: OCTOBER, 2009	



NOTE:

SIDEWALKS MAY BE REQUIRED AT THE REQUEST OF THE TOWN

CENTERLINE OF ROADWAY TO BE AT APPROXIMATELY SAME ELEVATION AS PROPERTY LINE

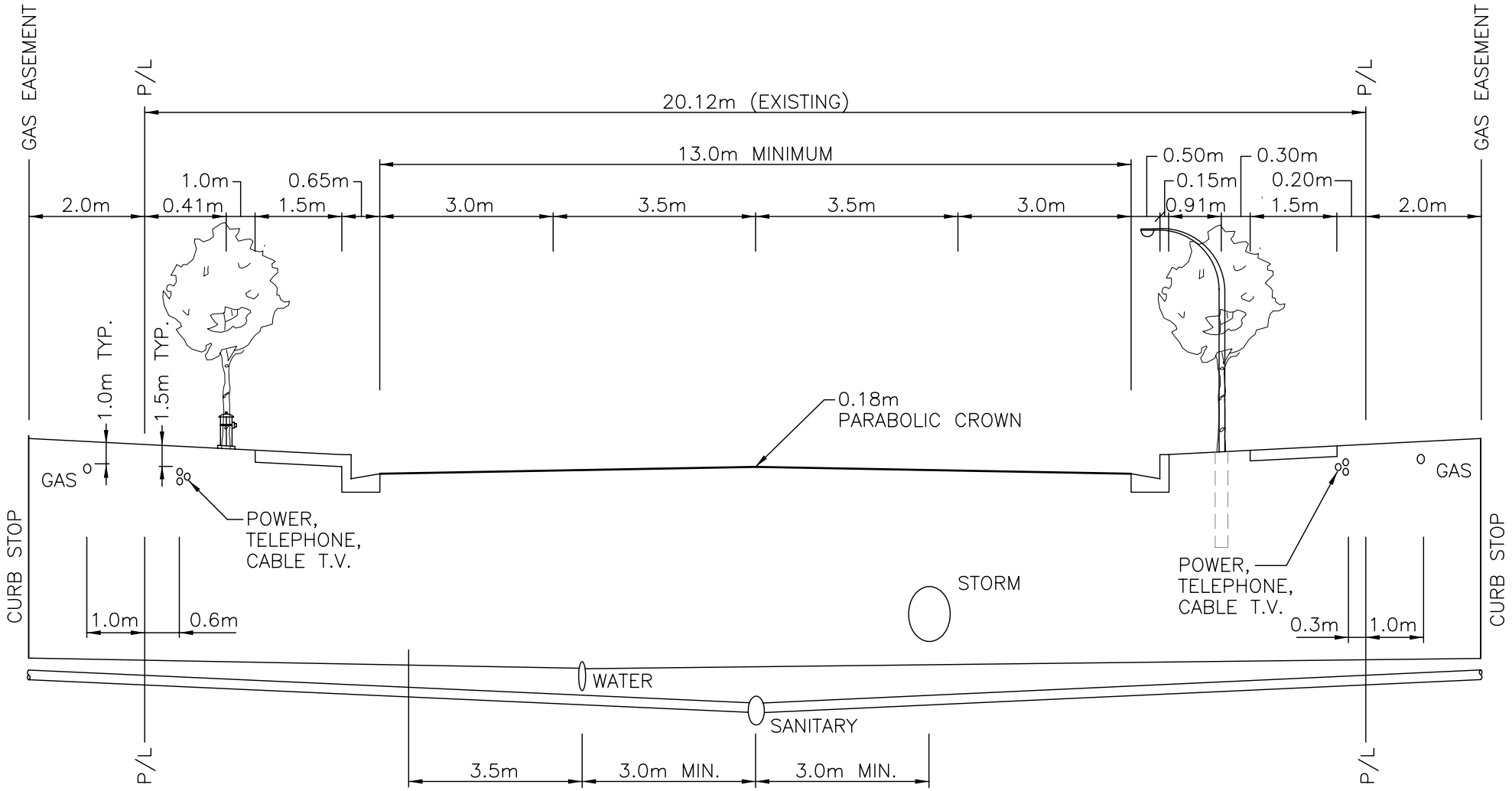
IF NO GAS EASEMENT, CURB STOP TO BE INSTALLED ON PROPERTY LINE

REVISIONS		
Date	Details	Approved

Town of Westlock

RURAL INDUSTRIAL COLLECTOR

APPROVED:	STD. DWG. No.
SCALE: N.T.S.	7–7
DATE: OCTOBER, 2009	



NOTES:
SIDEWALK MAY BE EITHER SEPARATE OR MONOLITHIC AS REQUIRED BY THE TOWN

IF NO GAS EASEMENT, CURB STOP TO BE INSTALLED ON PROPERTY LINE

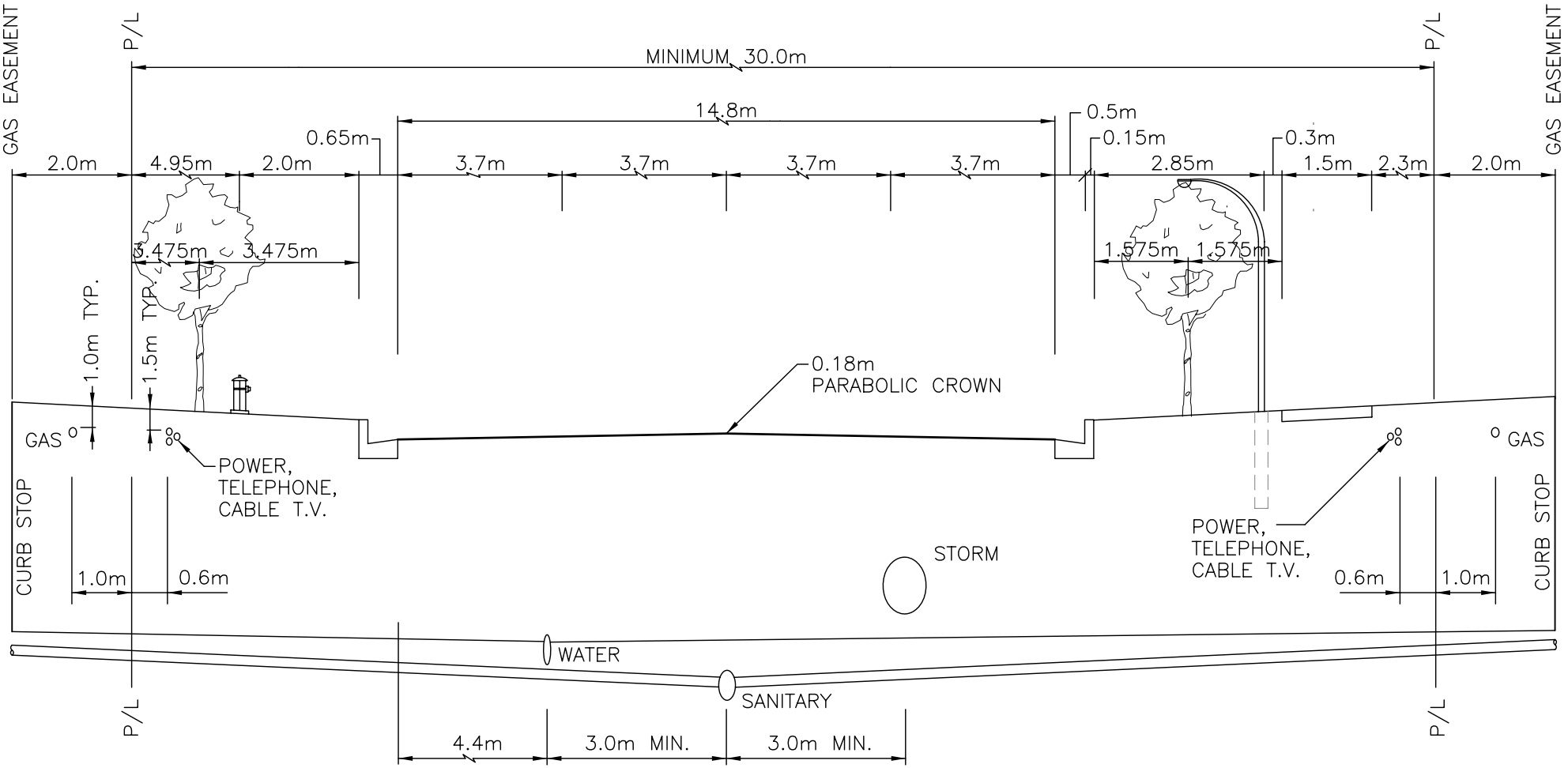
WICK DRAINS TO BE INSTALLED UNDER ALL SIDEWALKS, CURB & GUTTER AND CONNECTED TO CATCH BASINS

REVISIONS		
Date	Details	Approved

Town of Westlock

DOWNTOWN COMMERCIAL

APPROVED:	STD. DWG. No.
SCALE: N.T.S.	7–8
DATE: OCTOBER, 2009	



NOTES:
SIDEWALK MAY BE EITHER SEPARATE OR MONOLITHIC AS REQUIRED BY THE TOWN

IF NO GAS EASEMENT, CURB STOP TO BE INSTALLED ON PROPERTY LINE

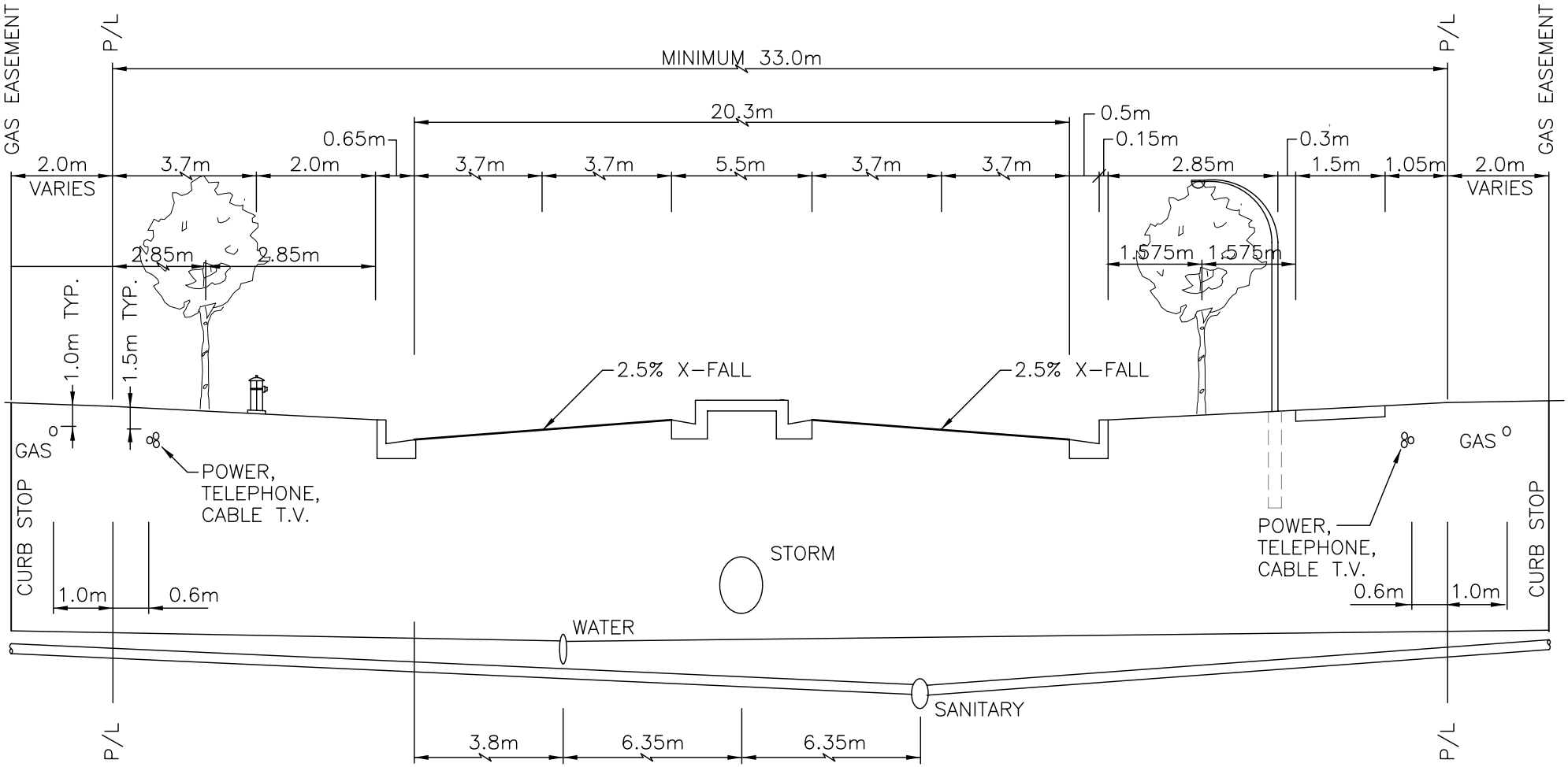
WICK DRAINS TO BE INSTALLED UNDER ALL SIDEWALKS, CURB & GUTTER AND CONNECTED TO CATCH BASINS

REVISIONS		
Date	Details	Approved

Town of Westlock

UNDIVIDED ARTERIAL

APPROVED:	STD. DWG. No.
SCALE: N.T.S.	7–9
DATE: OCTOBER, 2009	



NOTES:
SIDEWALK MAY BE EITHER SEPARATE OR MONOLITHIC AS REQUIRED BY THE TOWN

IF NO GAS EASEMENT, CURB STOP TO BE INSTALLED ON PROPERTY LINE

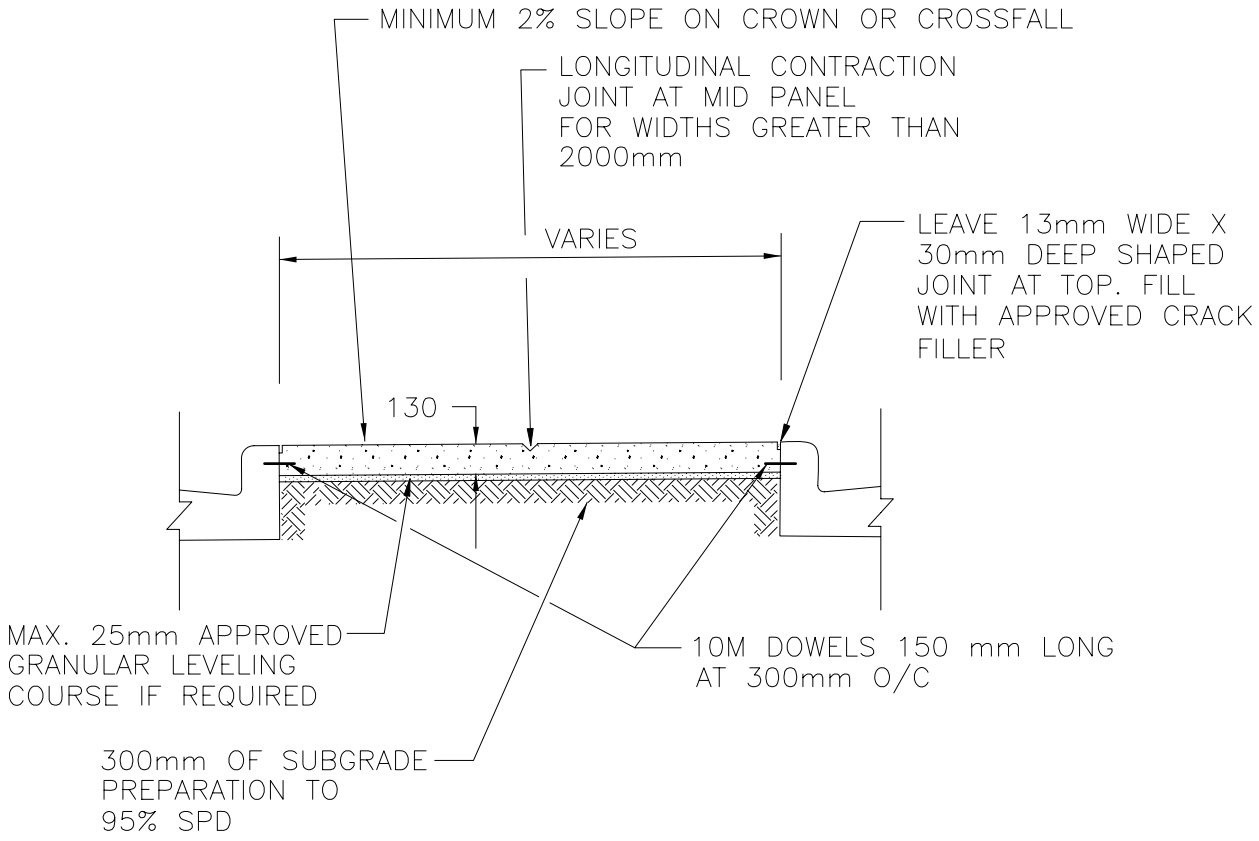
WICK DRAINS TO BE INSTALLED UNDER ALL SIDEWALKS, CURB & GUTTER AND CONNECTED TO CATCH BASINS

REVISIONS		
Date	Details	Approved

Town of Westlock

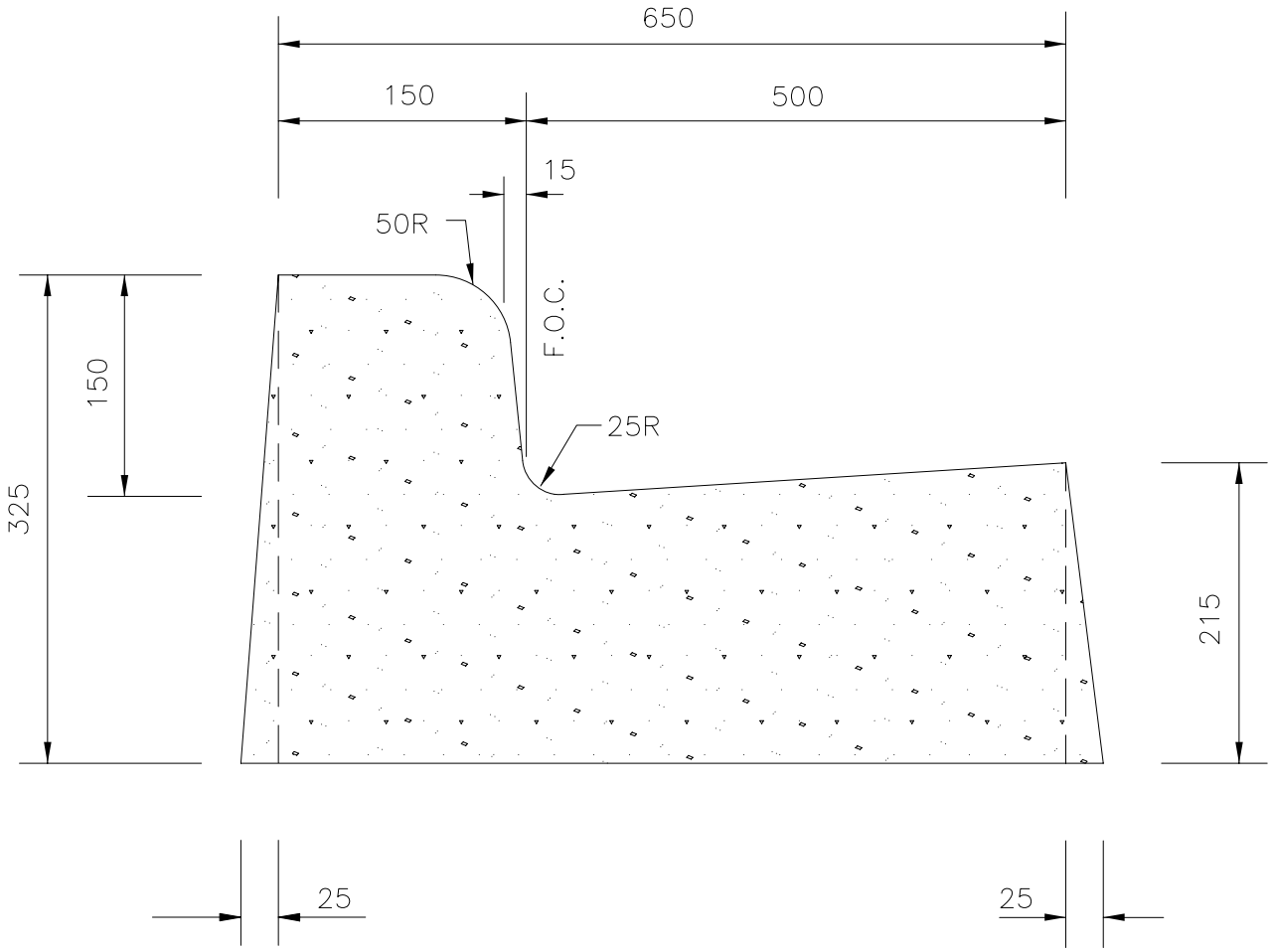
DIVIDED ARTERIAL

APPROVED:	STD. DWG. No.
SCALE: N.T.S.	7-10
DATE: OCTOBER, 2009	

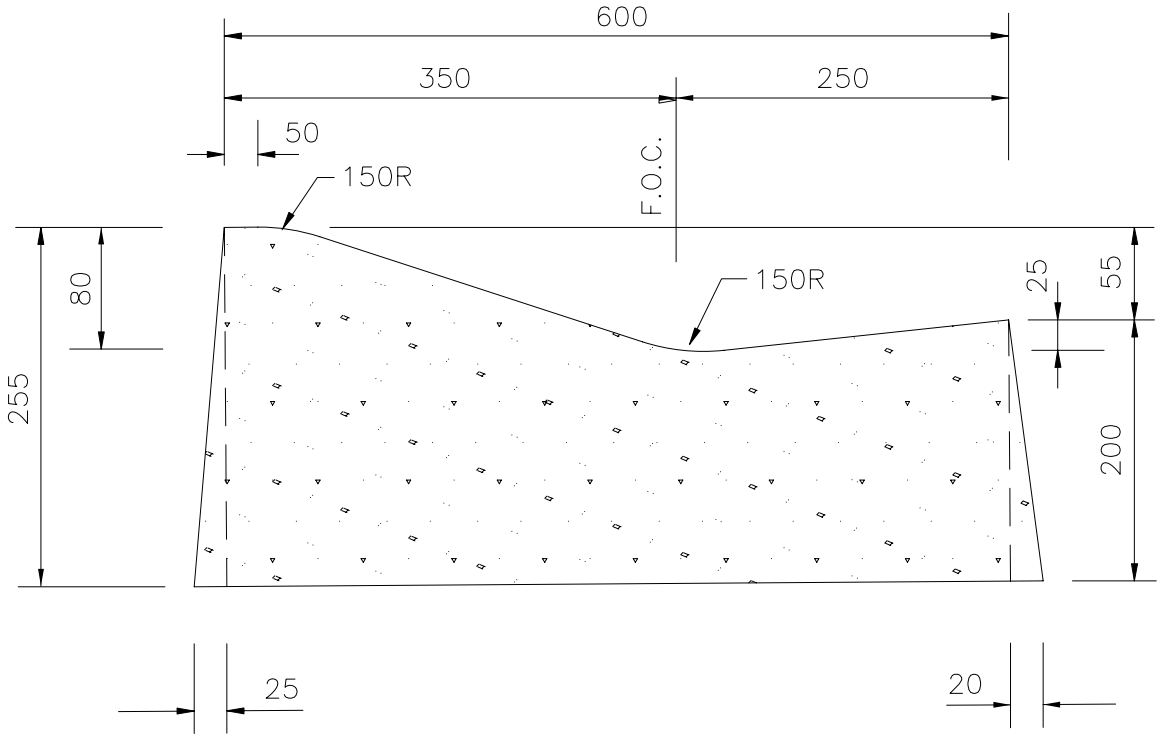


NOTE: TRANSVERSE CONTRACTION JOINTS TO COINCIDE WITH CURB AND GUTTER CONTRACTION JOINTS.

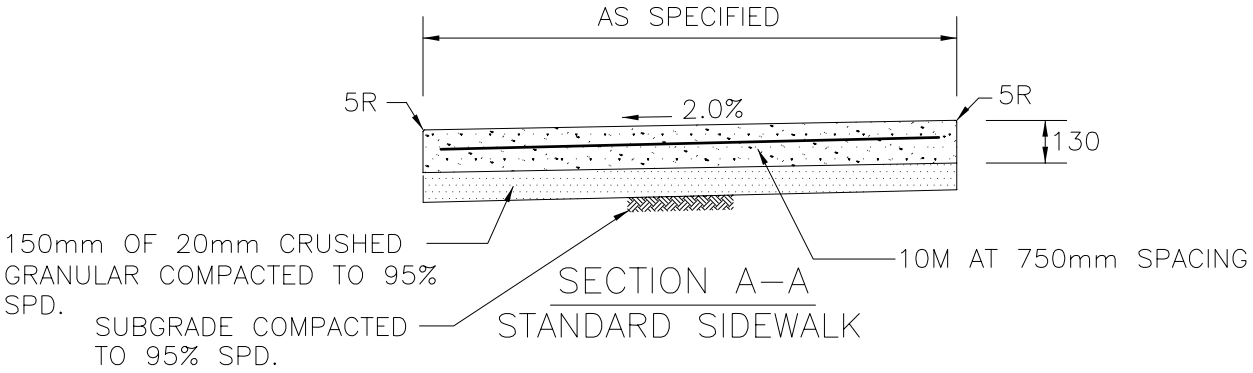
REVISIONS			Town of Westlock	
Date	Details	Approved		
			CONCRETE MEDIAN	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	7-11
			DATE: OCTOBER, 2009	



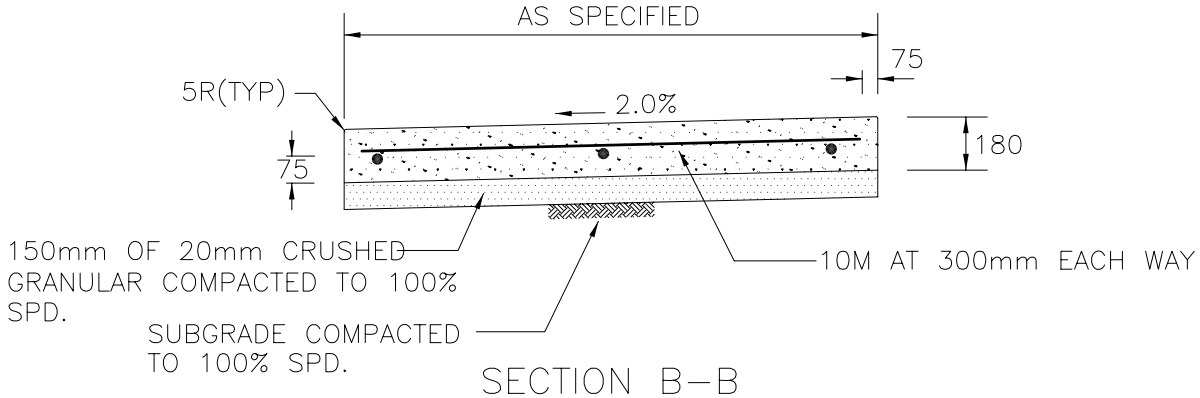
REVISIONS			Town of Westlock	
Date	Details	Approved		
			STRAIGHT FACED CURB AND GUTTER	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	7–12
			DATE: OCTOBER, 2009	



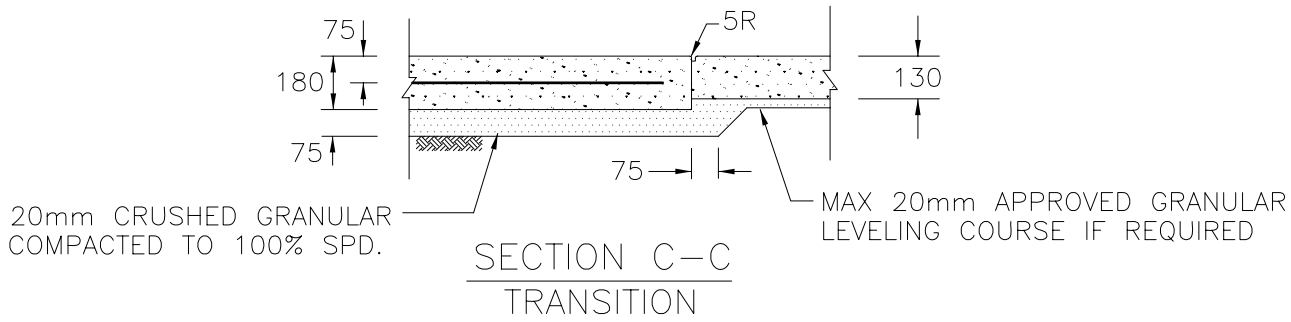
REVISIONS			Town of Westlock	
Date	Details	Approved		
			ROLLED CURB AND GUTTER	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	7–13
			DATE: OCTOBER, 2009	



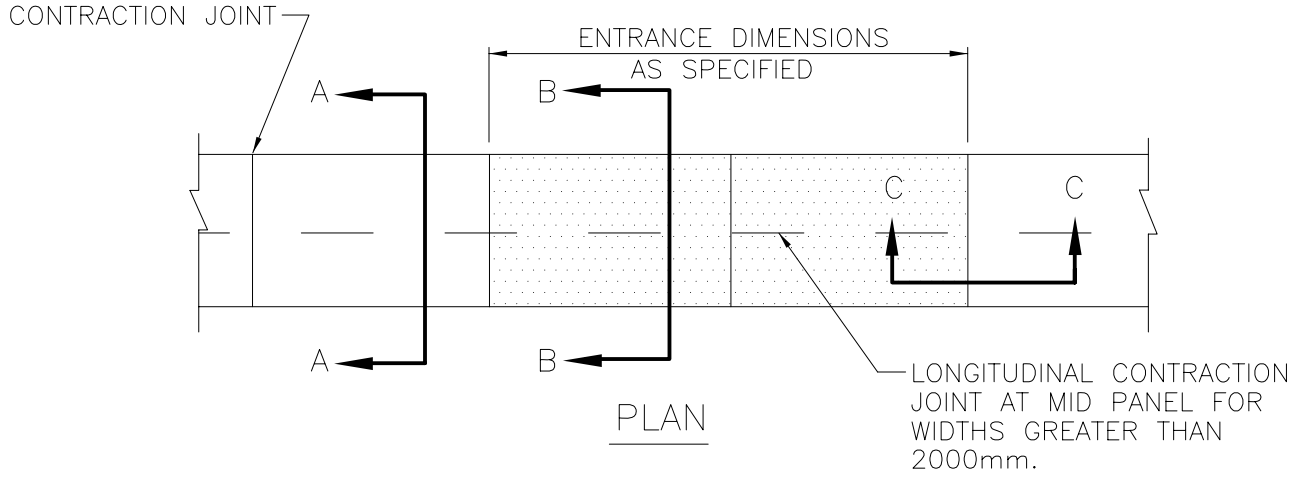
SECTION A–A
STANDARD SIDEWALK



SECTION B–B
DRIVEWAY SECTION

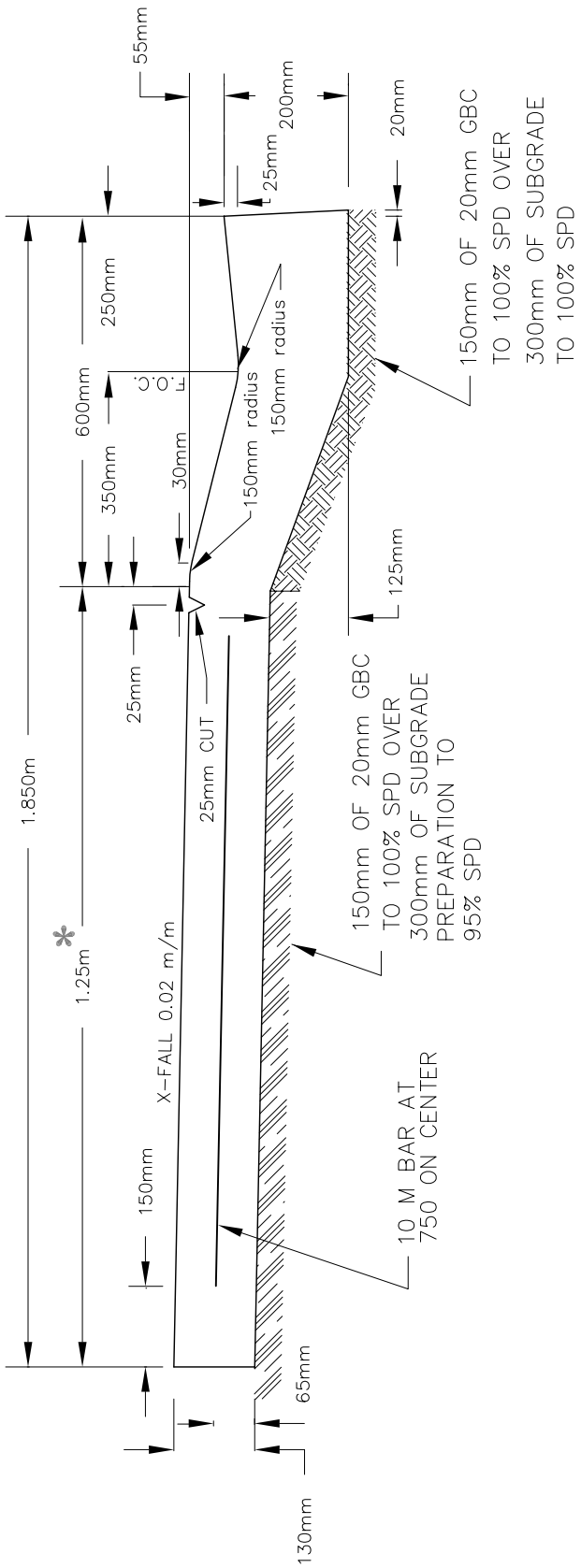


SECTION C–C
TRANSITION



PLAN

REVISIONS			Town of Westlock	
Date	Details	Approved		
			SEPARATE WALK AND DRIVEWAY ACCESS	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	7–14
			DATE: OCTOBER, 2009	



* 1.5m SIDEWALK MAY BE REQUIRED IN HIGH PEDESTRIAN TRAFFIC AREAS

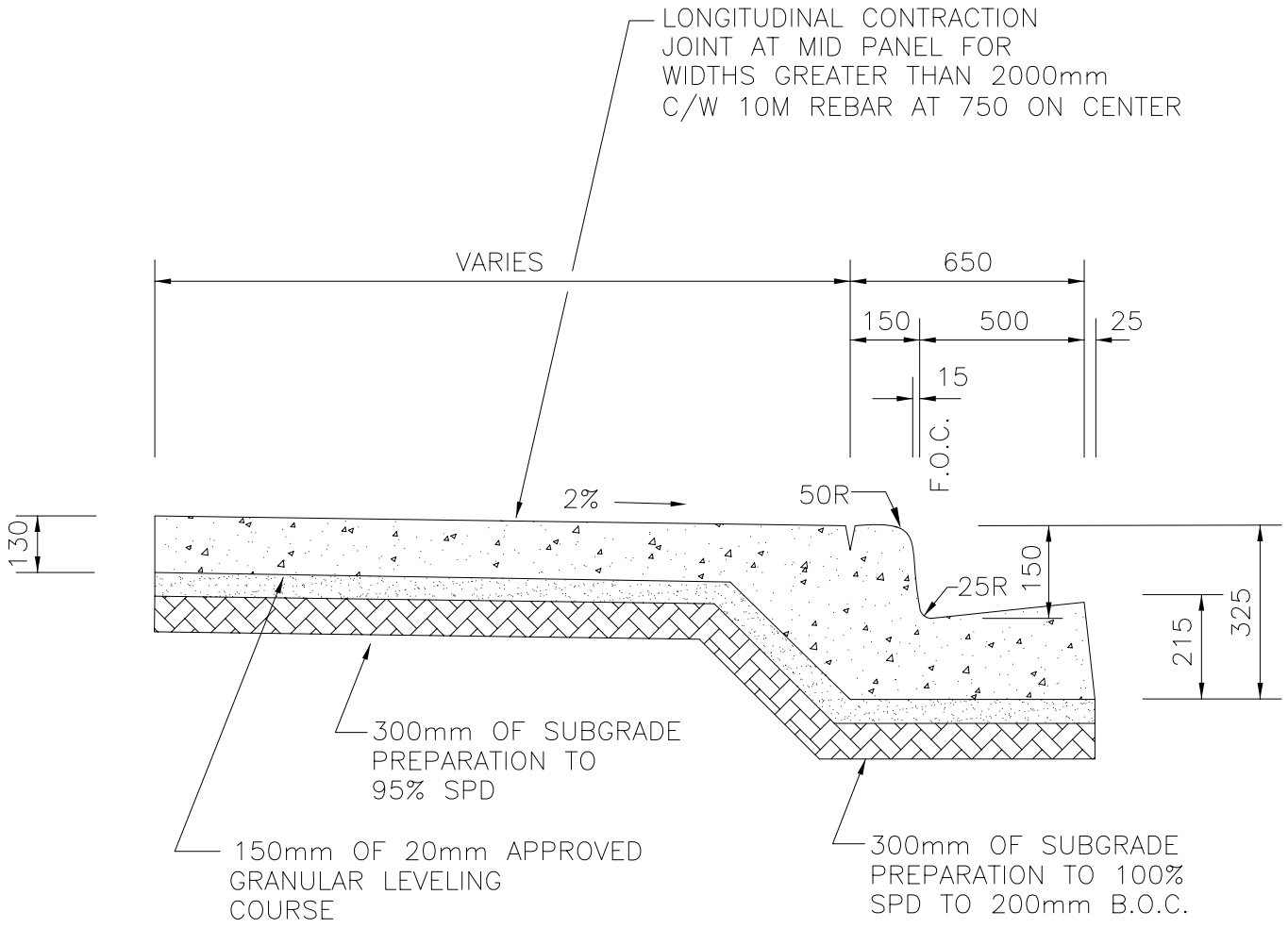
WICK DRAINS TO BE INSTALLED UNDER ALL SIDEWALKS, CURB & GUTTER AND CONNECTED TO CATCH BASINS

REVISIONS		
Date	Details	Approved

Town of Westlock

ROLLED MONOLITHIC CURB AND GUTTER

APPROVED:	STD. DWG. No.
SCALE: N.T.S.	7-15
DATE: OCTOBER, 2009	

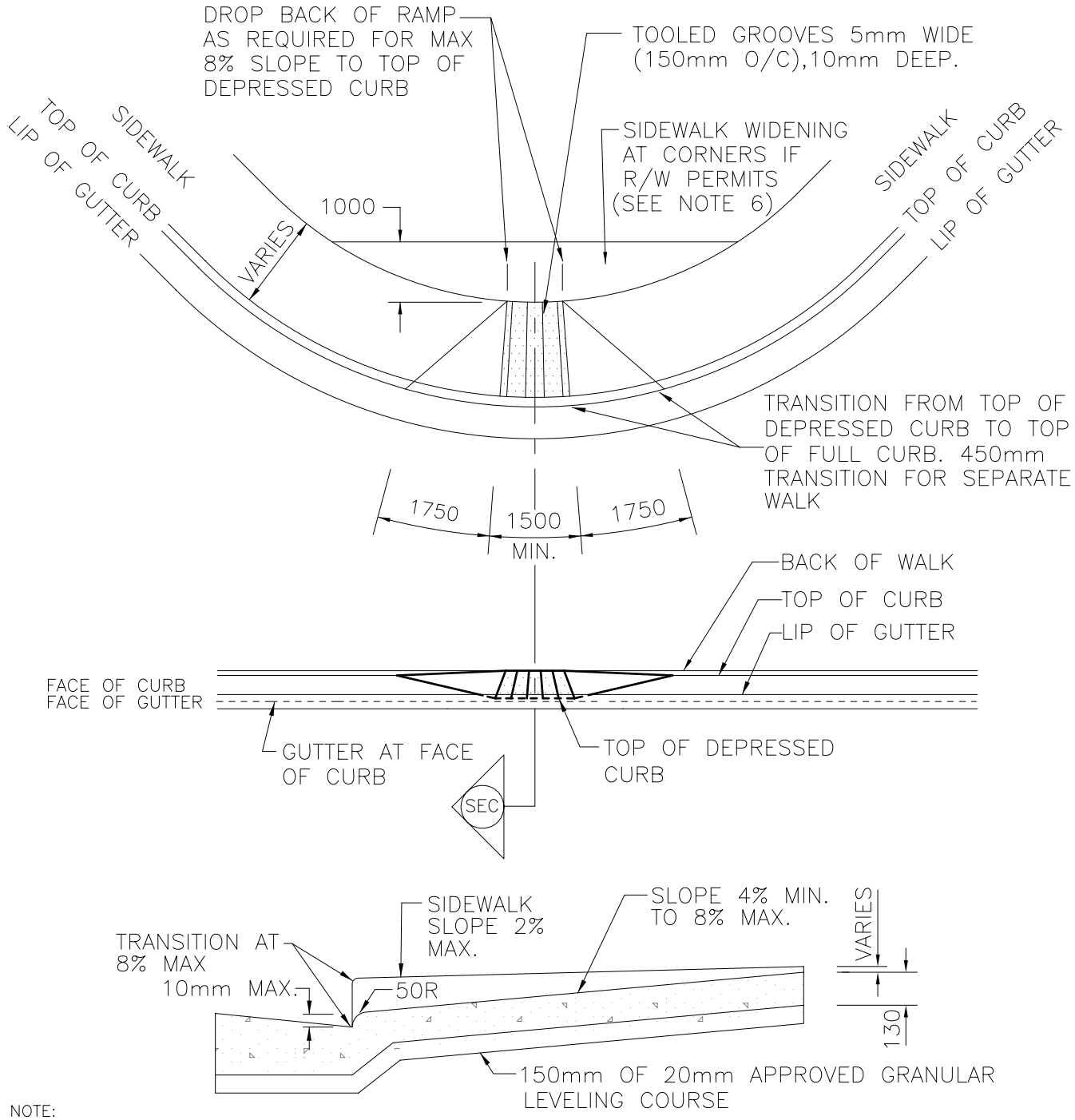


REVISIONS		
Date	Details	Approved

Town of Westlock

STRAIGHT FACED MONOLITHIC CURB AND GUTTER

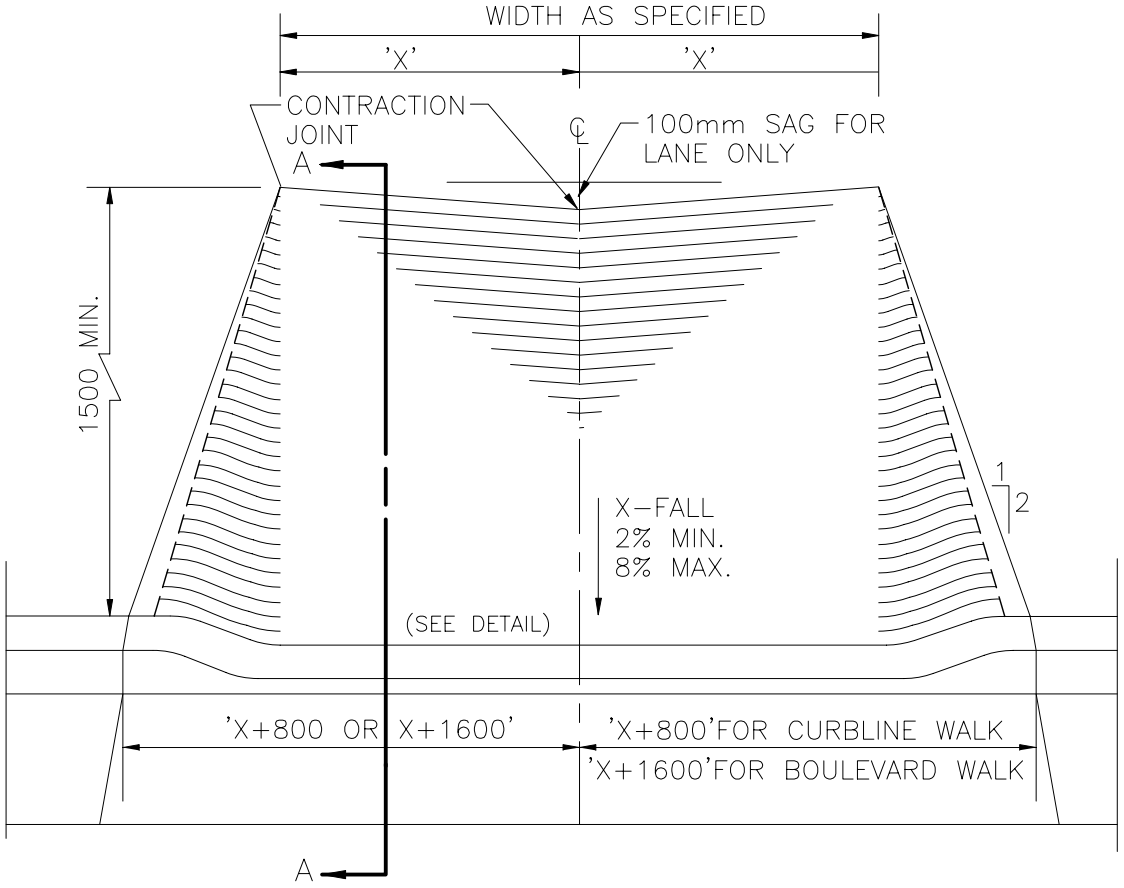
APPROVED:	STD. DWG. No.
SCALE: N.T.S.	7–16
DATE: OCTOBER, 2009	

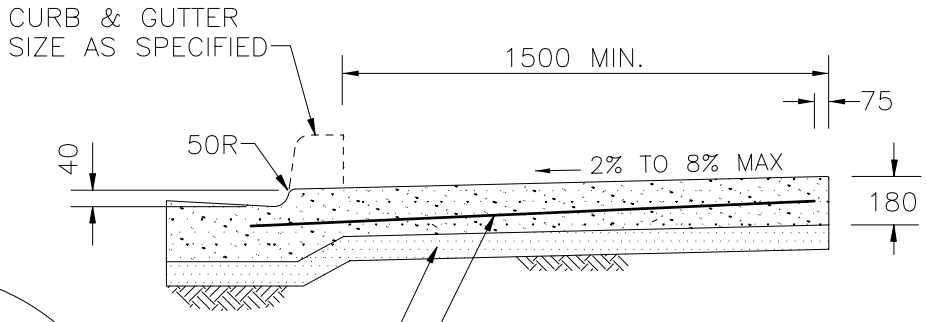


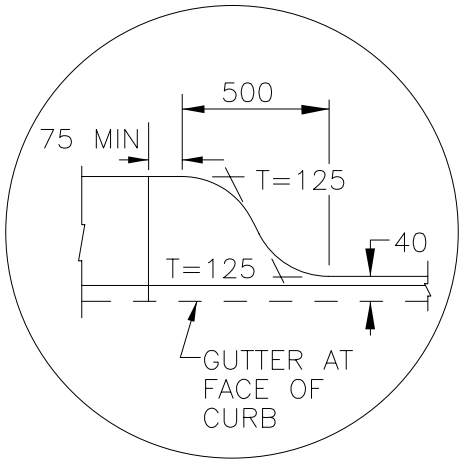
NOTE:

1. POUR CURB AND RAMP MONOLITHICALLY.
2. TRANSITION DISTANCE FROM TOP OF DEPRESSED CURB TO TOP OF FULL CURB VARIES WITH SIDEWALK DEPTH OR CURB HEIGHT.
3. RAMPS FOR USERS OF WHEELCHAIRS/BICYCLES SHOULD BE LOCATED AT ALL JUNCTIONS OF CROSSWALKS AND SIDEWALKS. RAMP MUST BE LOCATED WITHIN A CROSSWALK.
4. GROOVES ON SIDEWALK RAMPS ARE TO ALERT PERSONS WHO ARE VISUALLY IMPAIRED OF THE CURB–CUT AND A STREET CROSSING
5. WHERE CROSSWAKS ARE CONTROLLED BY SIGNALS WITH A PUSH–BUTTON SYSTEM, THE SIDEWALKS AND RAMPS MUST ALLOW ACCESS BY WHEELCHAIR TO THE PUSH–BUTTON.
6. WHERE RIGHT–OF–WAY IS AVAILABLE, THE SIDEWALK IS TO BE WIDENED AT CORNER LOCATIONS AS SHOWN SO THAT AT LEAST A 1.0m WIDTH OF FLAT SIDEWALK IS PROVIDED ADJACENT TO THE RAMP.

REVISIONS			Town of Westlock	
Date	Details	Approved		
			CURB RAMP	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	7–17
			DATE: OCTOBER, 2009	





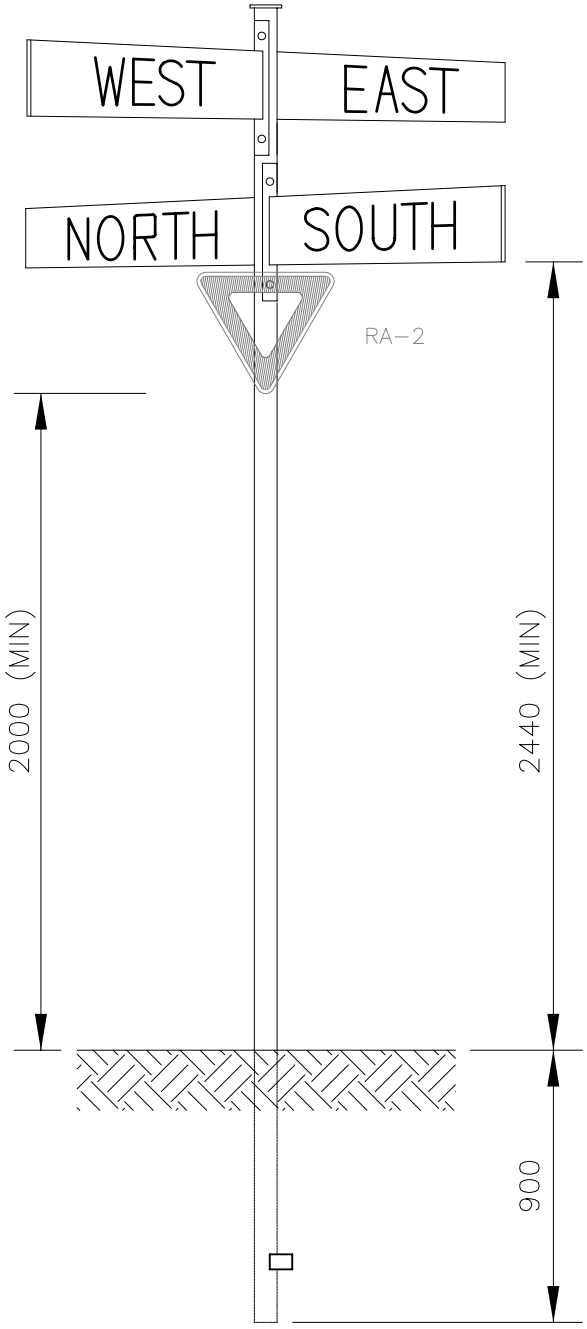


152 X 152 MW 18.7 X MW18.7 WELDED WIRE FABRIC AT 75mm DEPTH THROUGHOUT SLAB

150mm OF 20mm CRUSHED GRANULAR. COMPACTED TO 100% SPD

SECTION A–A

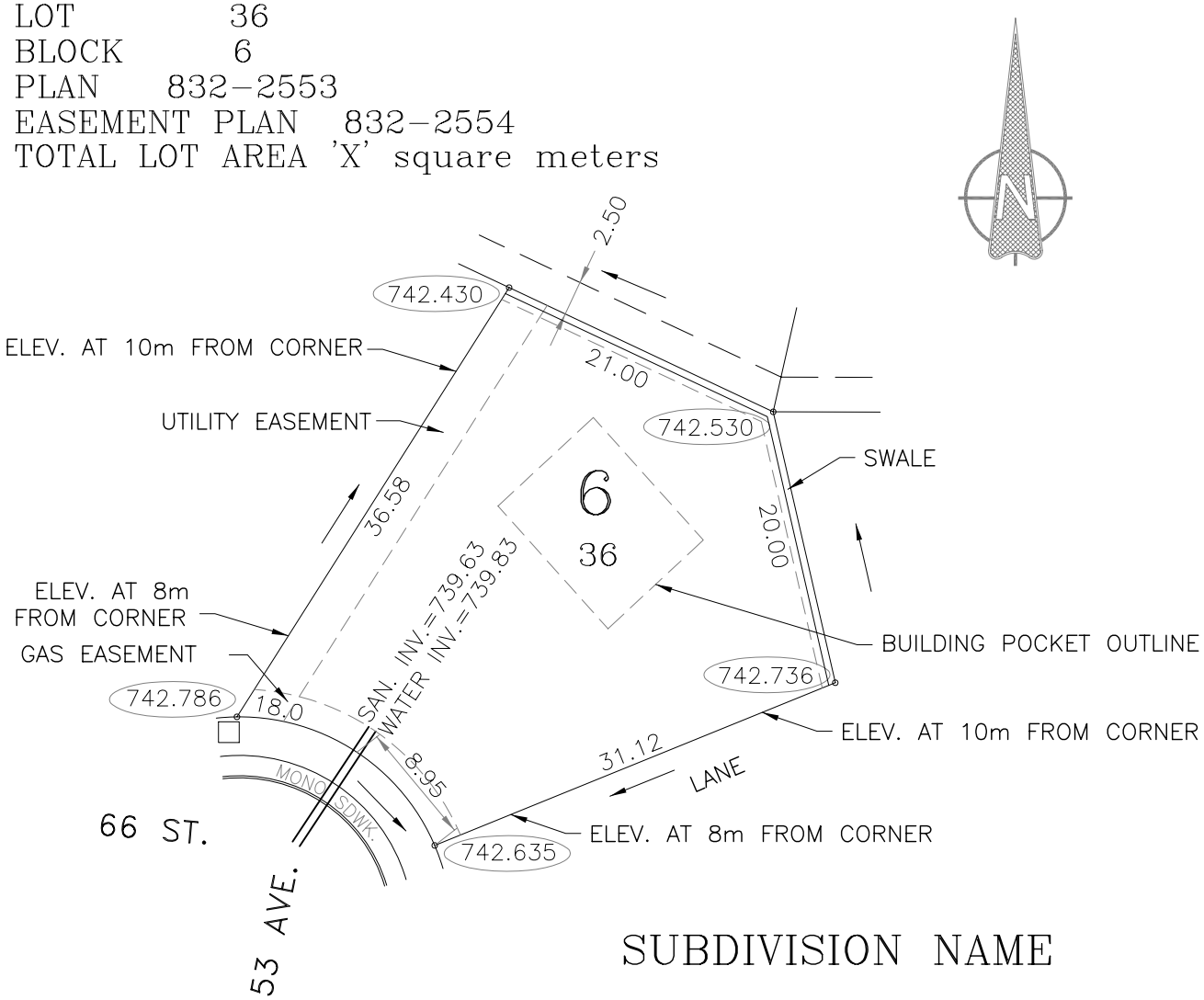
REVISIONS			Town of Westlock	
Date	Details	Approved		
			COMMERCIAL CROSSING	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	7–18
			DATE: OCTOBER, 2009	



- 50mm GALVANIZED SCHEDULE 40 STEEL PIPE OR APPROVED ALTERNATE.
- TOP OF SIGN TO BE 25mm BELOW TOP OF POST.
- HIGH INTENSITY BLADE WITH REINFORCED EDGES. 225mm WIDE FOR ARTERIAL ROADS AND COLLECTOR STREETS. 150mm WIDE FOR LOCAL STREETS.
- ALL HARDWARE TO BE GALVANIZED.
- 3.65m POST IS USED FOR STREET NAME SIGN, OR STOP OR YIELD SIGN.
- 4.25m POST IS USED FOR COMBINATION STREET NAME AND STOP OR YIELD SIGNS.
- POSTS TO BE LOCATED A MINIMUM OF 600mm BACK OF STREET CURB FACE IN URBAN AREAS OR 300mm BACK OF WALK WHERE NO BOULEVARD EXISTS.
- 75mm x 50mm FLAT BAR TO BE WELDED ON POST TO PREVENT SIGN FROM TURNING.

REVISIONS			Town of Westlock	
Date	Details	Approved		
			STREET SIGN	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	7-19
			DATE: OCTOBER, 2009	

LOT 36
BLOCK 6
PLAN 832–2553
EASEMENT PLAN 832–2554
TOTAL LOT AREA 'X' square meters



SUBDIVISION NAME

LEGEND

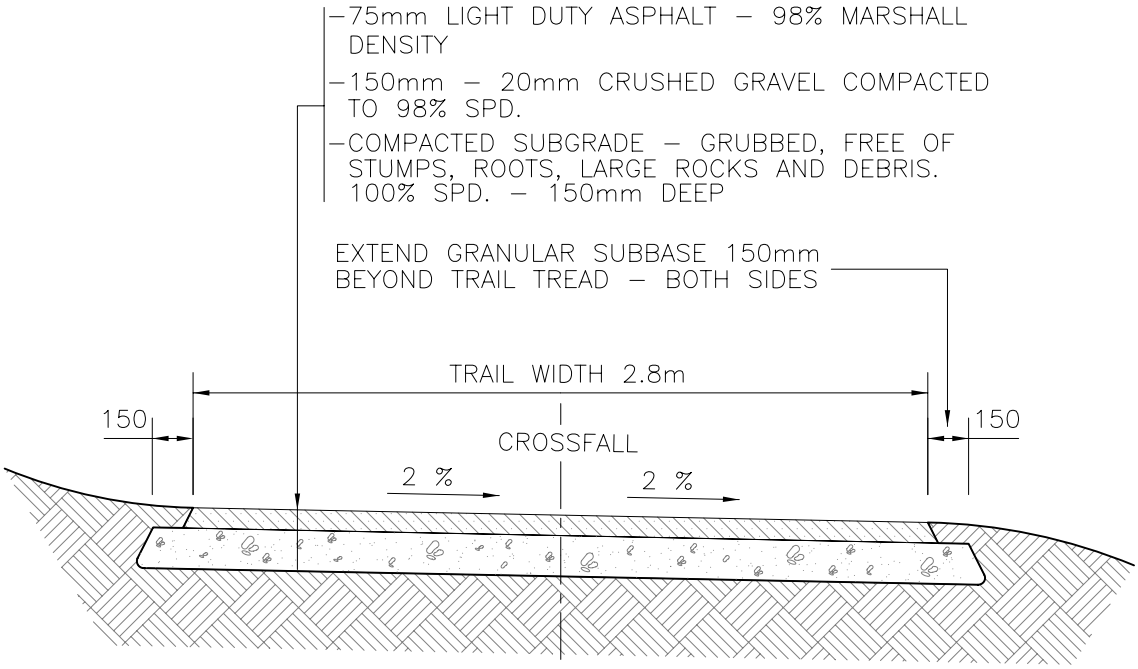
DESIGN LOT CORNER ELEVATIONS	742.500
IRON PINS	∘
DIRECTION OF DRAINAGE	→
FIRE HYDRANT	⊕
MAIL BOXES	▨
CATCHBASIN	▬
LIGHT STANDARD	☼
POWER	□

REVISIONS		
Date	Details	Approved

Town of Westlock

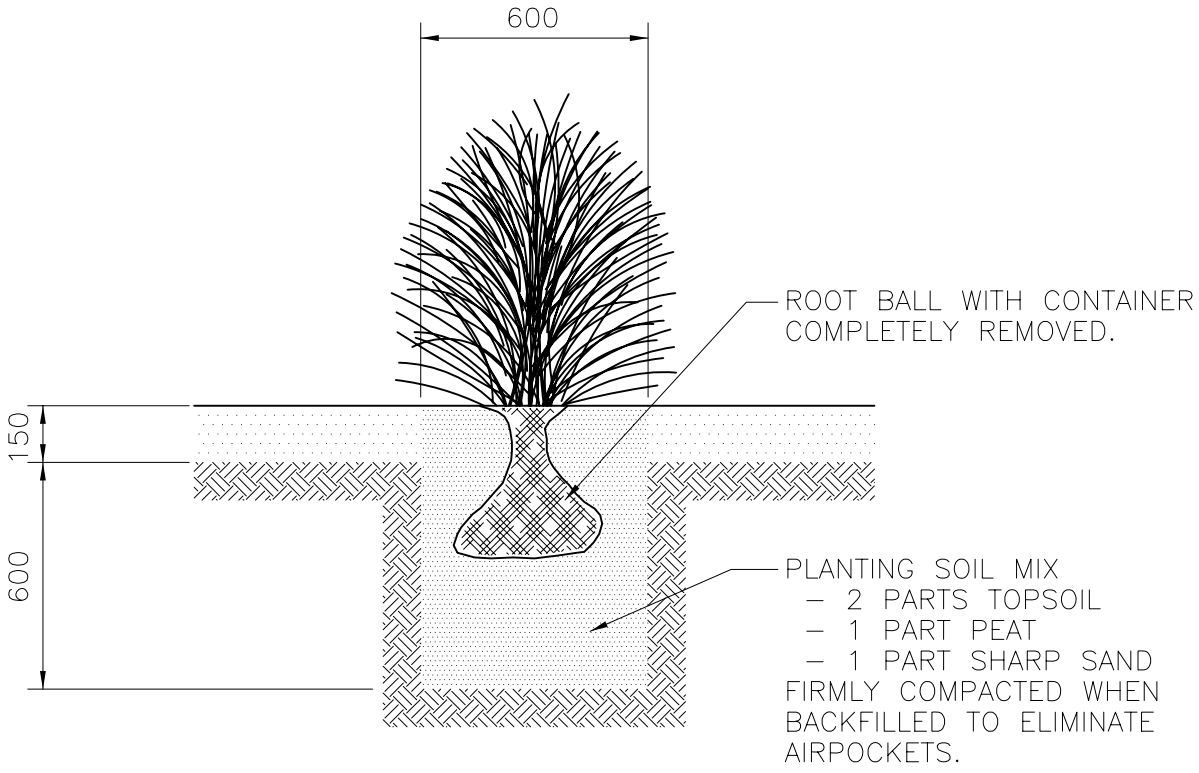
TYPICAL LOT GRADING PLAN

APPROVED:	STD. DWG. No.
SCALE: 1:500	8–1
DATE: OCTOBER, 2009	

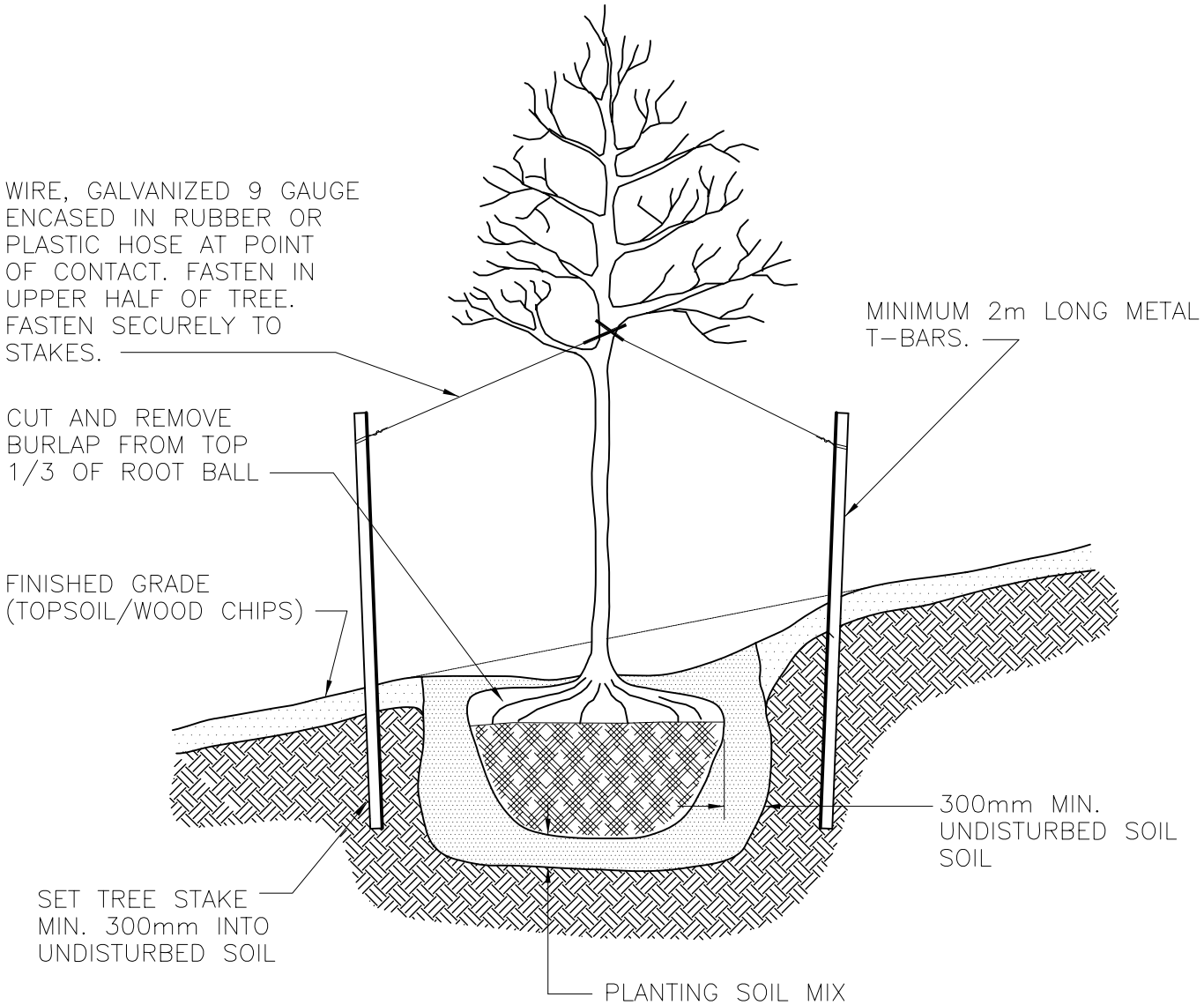


NOTE: WIDTH AND PAVEMENT STRUCTURE MAY VARY WITH LOCATION: CRITERIA ABOVE ARE MINIMUMS

REVISIONS			Town of Westlock	
Date	Details	Approved		
			ASPHALT TRAIL DETAIL	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	8–2
			DATE: OCTOBER, 2009	

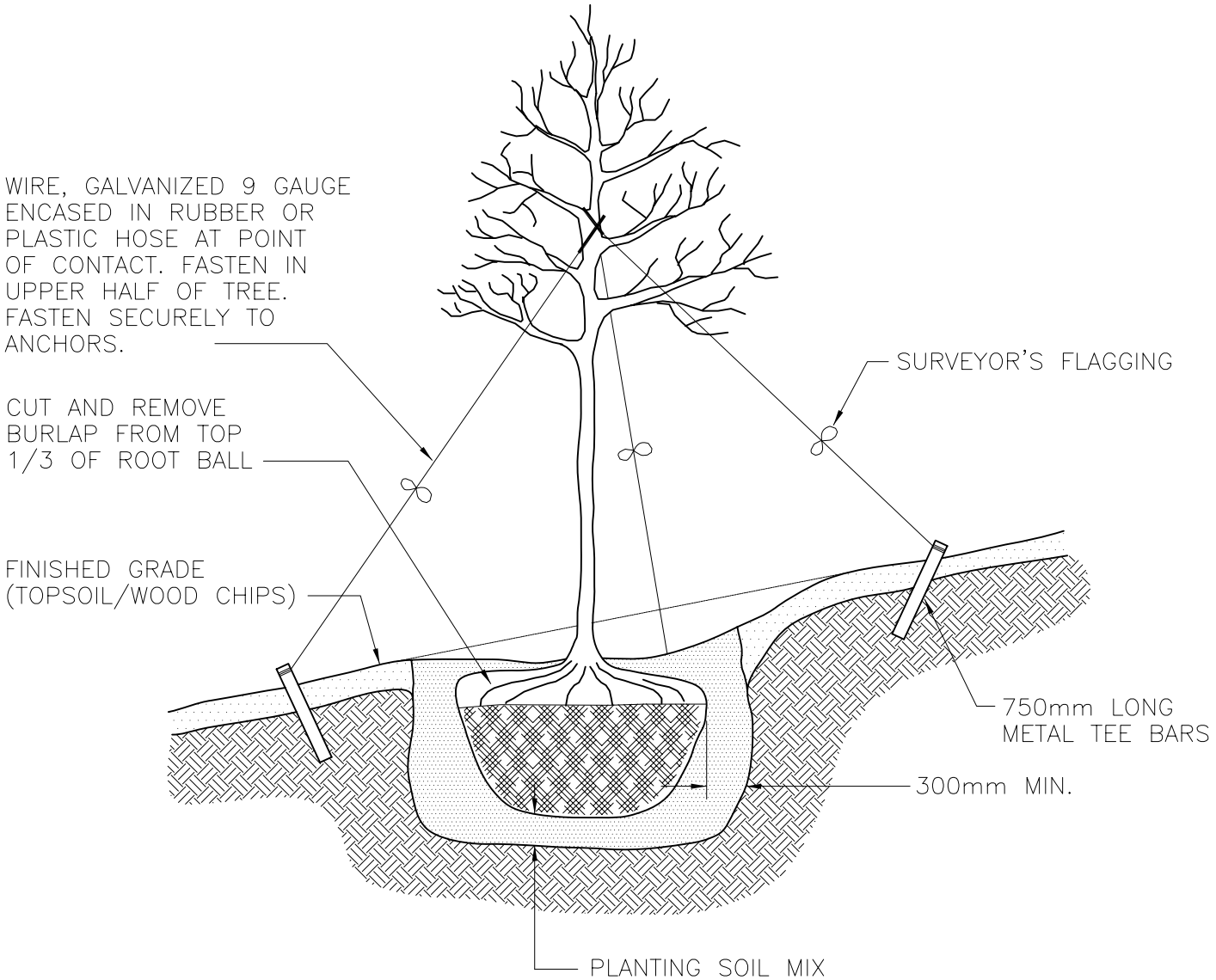


REVISIONS			Town of Westlock	
Date	Details	Approved		
			SHRUB INSTALLATION	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	8–3
			DATE: OCTOBER, 2009	



NOTE:
STAKING REQUIRED FOR ALL DECIDUOUS TREES LESS THAN 100mm CALIPER AND CONIFEROUS TREES LESS THAN 3.0m IN HEIGHT.

REVISIONS			Town of Westlcok	
Date	Details	Approved		
			SMALL TREE STAKING	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	8-4
			DATE: OCTOBER, 2009	



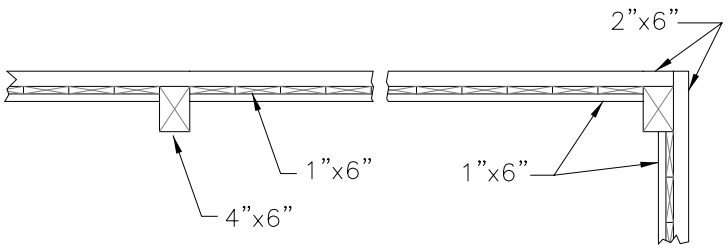
NOTE:
- GUYING REQUIRED FOR ALL DECIDUOUS TREES OVER 100mm CALIPER AND ALL CONIFEROUS TREES EXCEEDING 3.0m IN HEIGHT.
- HIGH USE PLAY AREAS TO HAVE TOP OF STAKE SET BELOW FINISHED GRADE FOR PUBLIC SAFETY.

REVISIONS		
Date	Details	Approved

Town of Westlock

LARGE TREE GUYING

APPROVED:	STD. DWG. No.
SCALE: N.T.S.	8–5
DATE: OCTOBER, 2009	



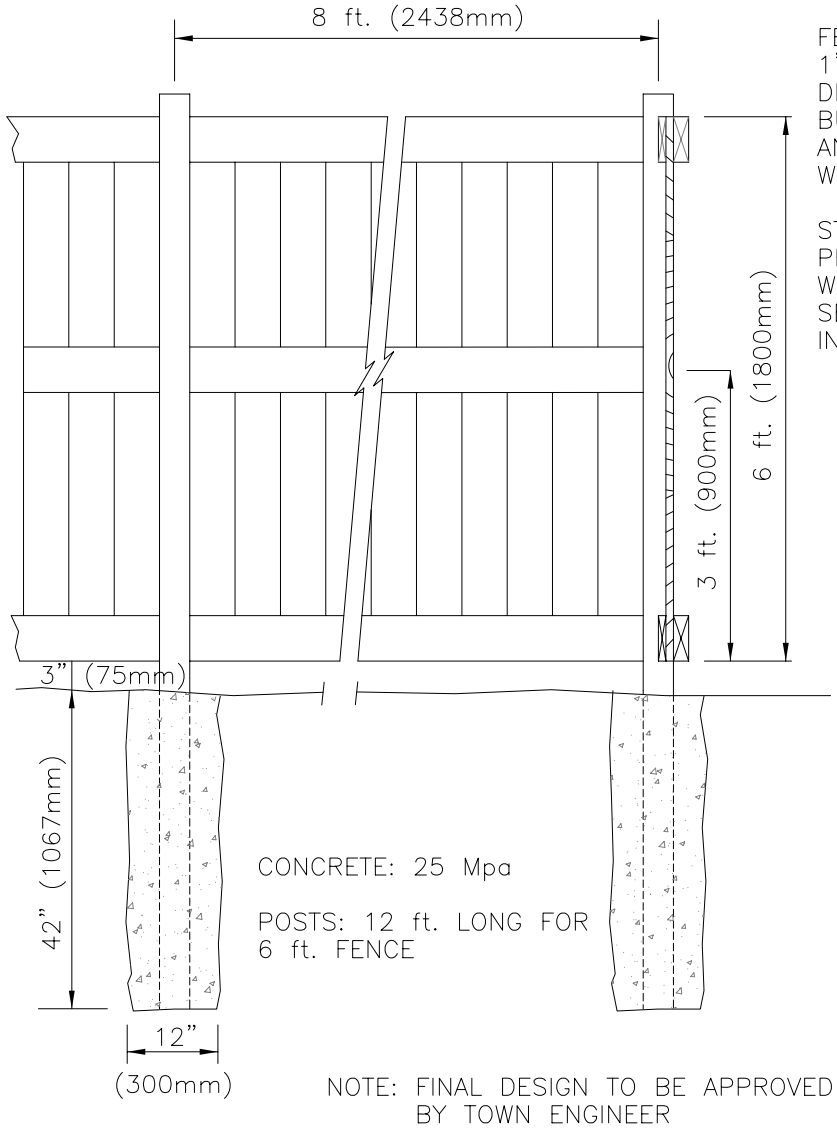
SPECIFICATIONS

POSTS:
4"X6" (100mm x 152mm) FULL DIMENSION PRESSURE TREATED PINE. TOP ANGLE CUT.

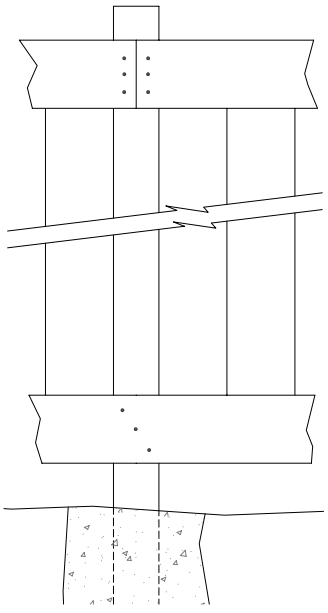
STRINGERS:
2"x6" (150mm x 152mm) S4S SMOOTH FINISH SPRUCE TOP, BOTTOM, & MIDDLE OUTSIDE STRINGERS. OUTSIDE STRINGERS ANCHORED WITH 3 – 4"(110mm) GALV. ARDOX NAILS AT POST CONNECTIONS. 1"x6" (25mm x 152mm) ROUGH SAWN SPRUCE INSIDE STRINGER FASTENED WITH 3" (75mm) GALV. ARDOX NAILS EVERY 24" (600mm) ON CENTER.

FENCE BOARDS:
1"x6" (25mm x 152mm) FULL DIMENSION ROUGH SAWN FINISH SPRUCE BUTTED TOGETHER. FASTENED TO TOP AND BOTTOM MAIN SUPPORT STRINGERS WITH 2" (50mm) GALV. ARDOX NAILS.

STAINING:
PRESTAINED PRIOR TO CONSTRUCTION WITH ONE COAT SOLID COLOR WOOD STAIN. SECOND COAT OF STAIN TO BE APPLIED IN FIELD AFTER CONSTRUCTION.

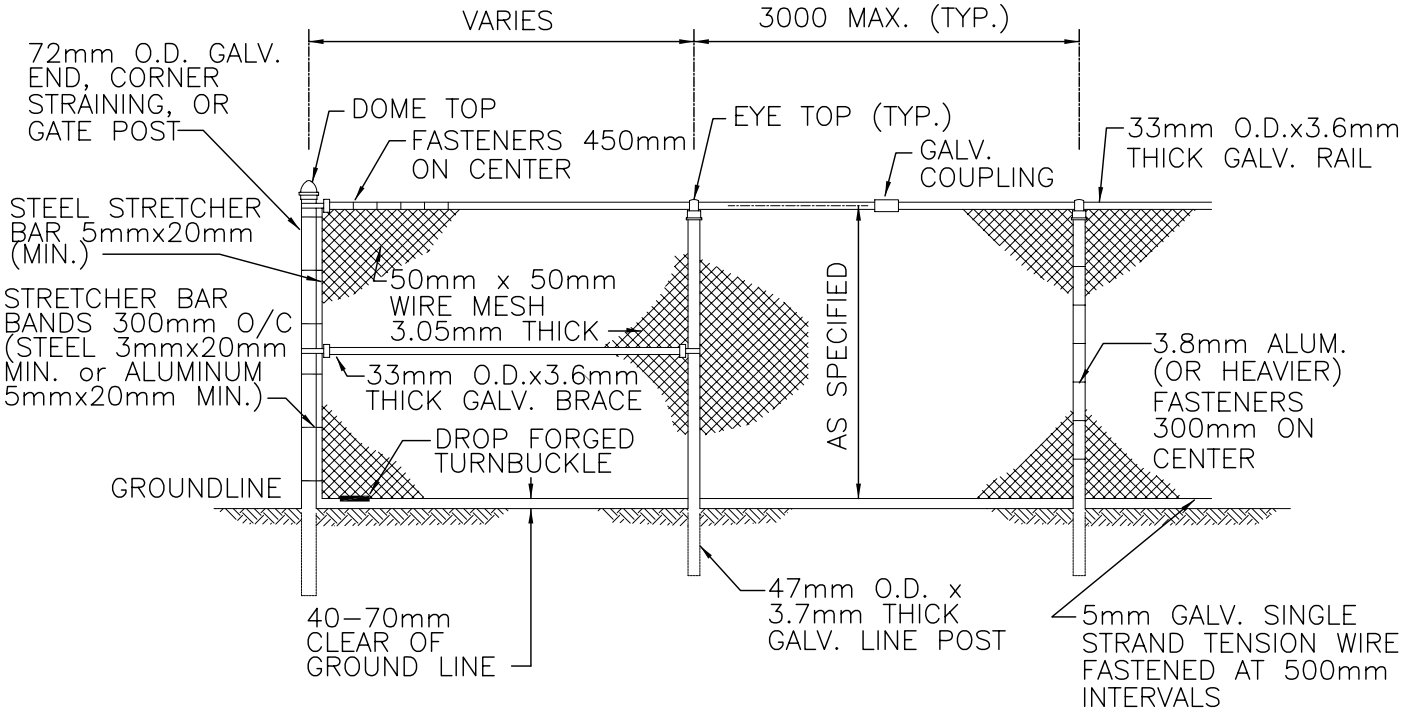


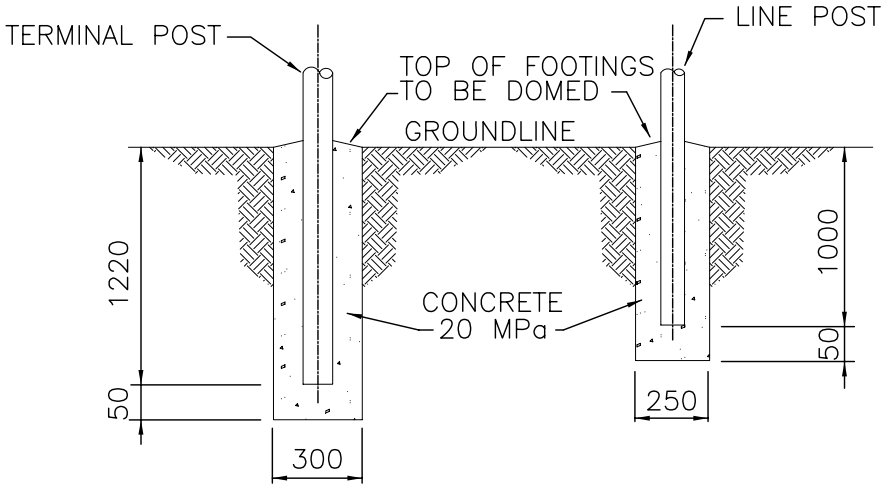
NOTE: FINAL DESIGN TO BE APPROVED BY TOWN ENGINEER



TYPICAL NAILING PATTERN

REVISIONS			Town of Westlock	
Date	Details	Approved		
			TYPICAL WOOD FENCING	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	8–6
			DATE: OCTOBER, 2009	

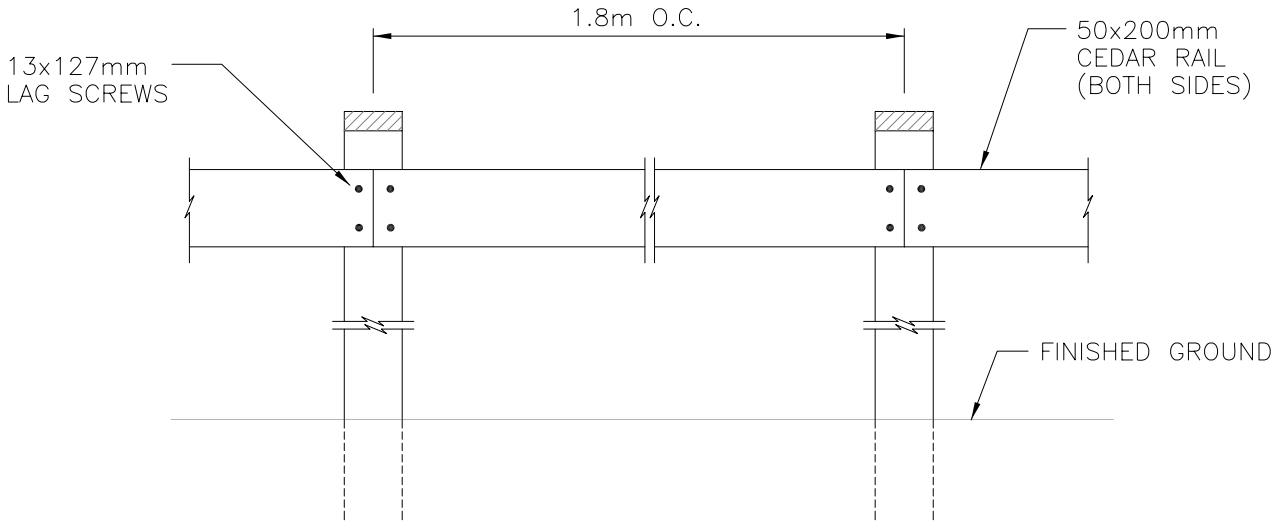




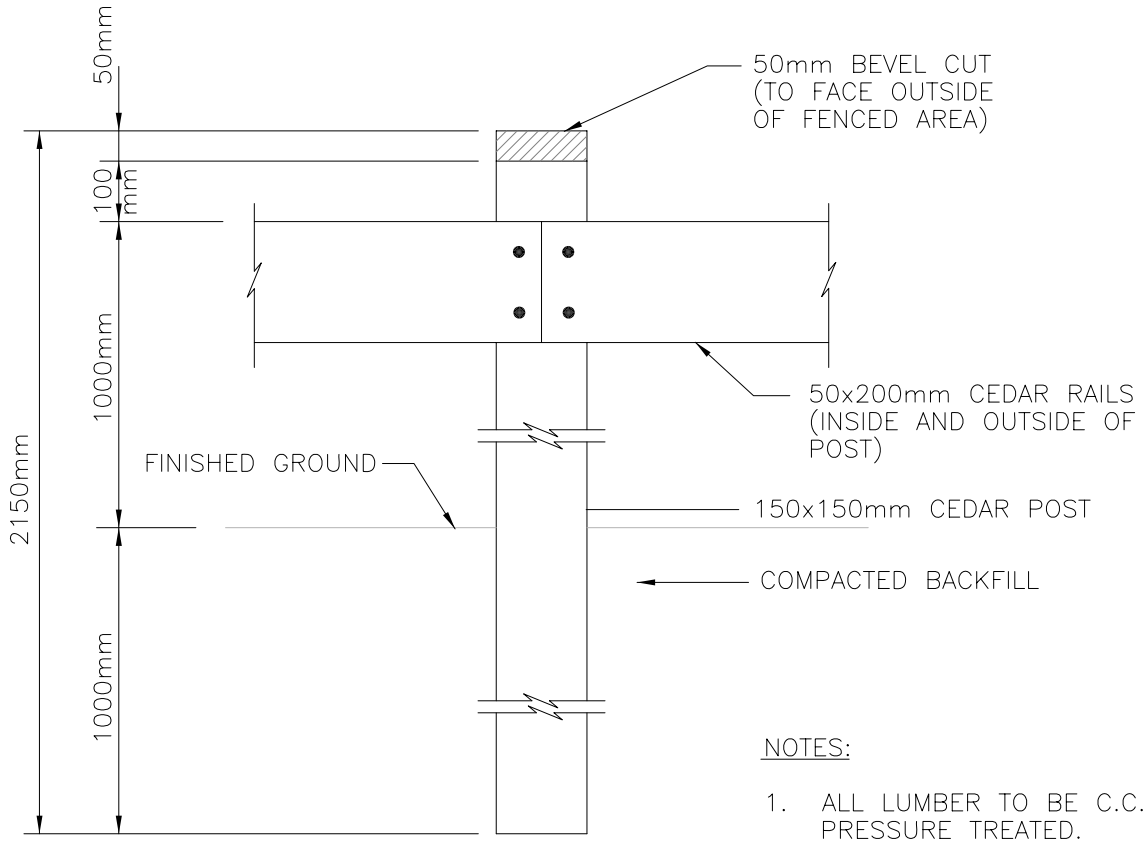
POST FOOTING DETAIL

- 2.7 GATE WIDTH
- 1520 FABRIC HEIGHT
- INSTALL KNUCKLED EDGE AT BOTTOM AND BARBED EDGE AT TOP.

REVISIONS			Town of Westlock	
Date	Details	Approved		
			CHAIN LINK FENCE	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	8–7
			DATE: OCTOBER, 2009	



FRONT ELEVATION

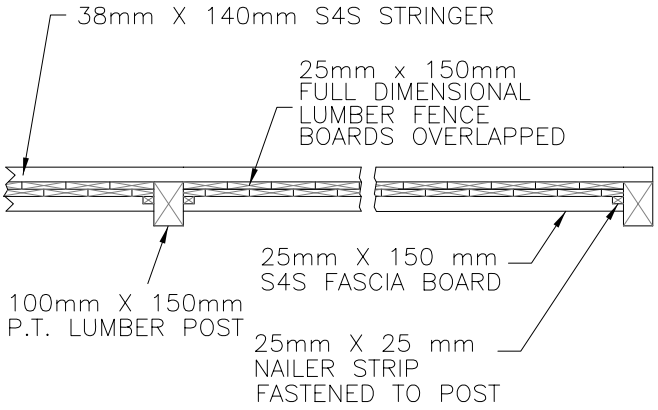


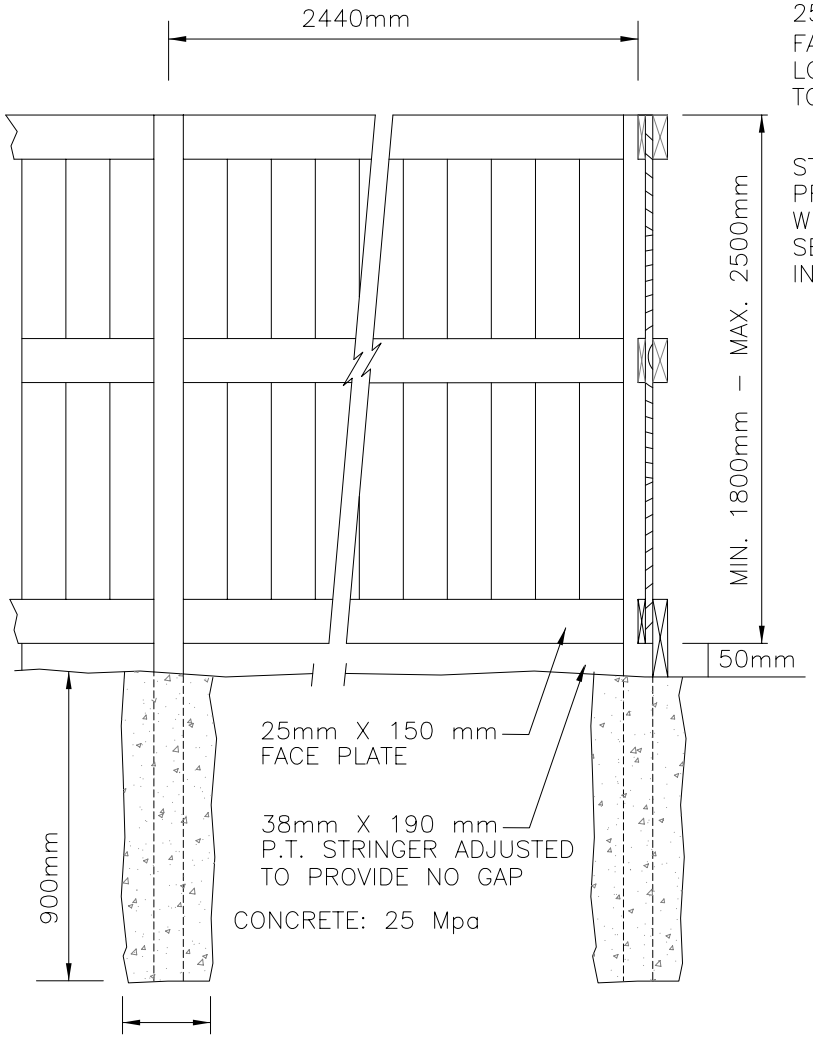
POST DETAIL

NOTES:

1. ALL LUMBER TO BE C.C.A. PRESSURE TREATED.
2. WHEN FENCE LINE CURVES, POSTS SHALL BE NOTCHED SUCH THAT 50x200mm RAILS LAY FLUSH TO POSTS.

REVISIONS			Town of Westlock	
Date	Details	Approved		
			TIMBER FENCE FOR OPEN SPACE AREAS	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	8-8
			DATE: OCTOBER, 2009	





NOTE: FINAL DESIGN TO BE APPROVED BY TOWN ENGINEER

SPECIFICATIONS

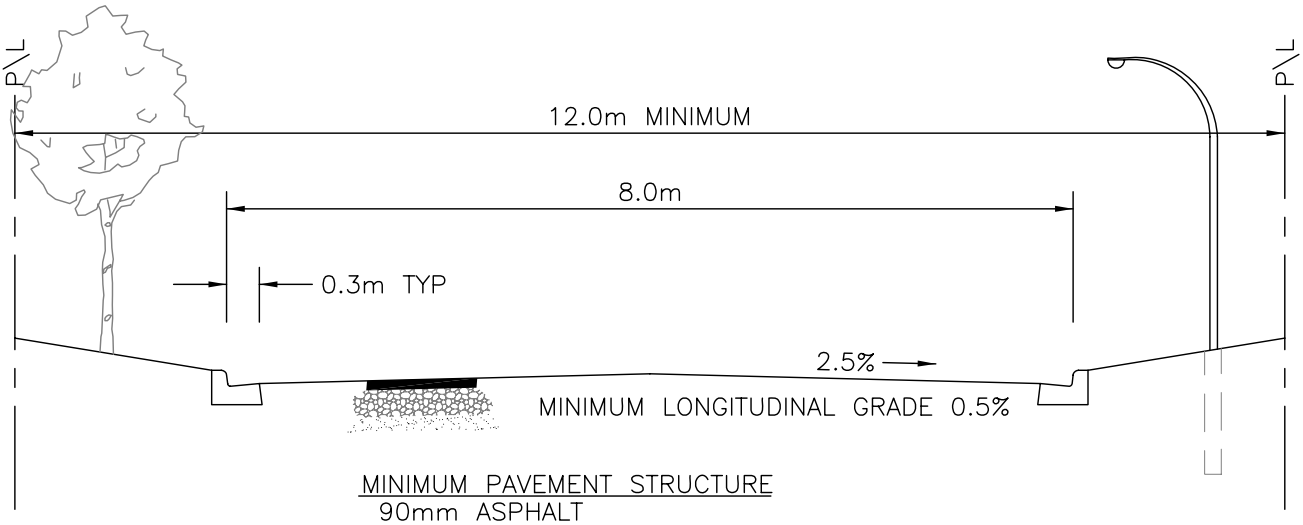
POSTS:
100mm x 150mm FULL DIMENSION PRESSURE TREATED PINE. TOP ANGLE CUT.

STRINGERS:
38mm x 140mm TOP STRINGER
38mm X 89mm MID STRINGER
38mm X 190mm P.T. BOTTOM STRINGER
BOTTOM STRINGER AND FACE PLATE SECURED TO POSTS WITH MIN. 75mm YELLOW COATED DECK SCREWS EVERY 400mm, ONE ON EACH SIDE.

FENCE BOARDS:
25mm x 152mm X 1830mm LONG FASTENED TO STRINGERS WITH MIN. 57mm LONG GALV. ARDOX NAILS, 3 PER BOARD TOP, BOTTOM, AND MID STRINGER.

STAINING:
PRESTAINED PRIOR TO CONSTRUCTION WITH ONE COAT SOLID COLOR WOOD STAIN. SECOND COAT OF STAIN TO BE APPLIED IN FIELD AFTER CONSTRUCTION.

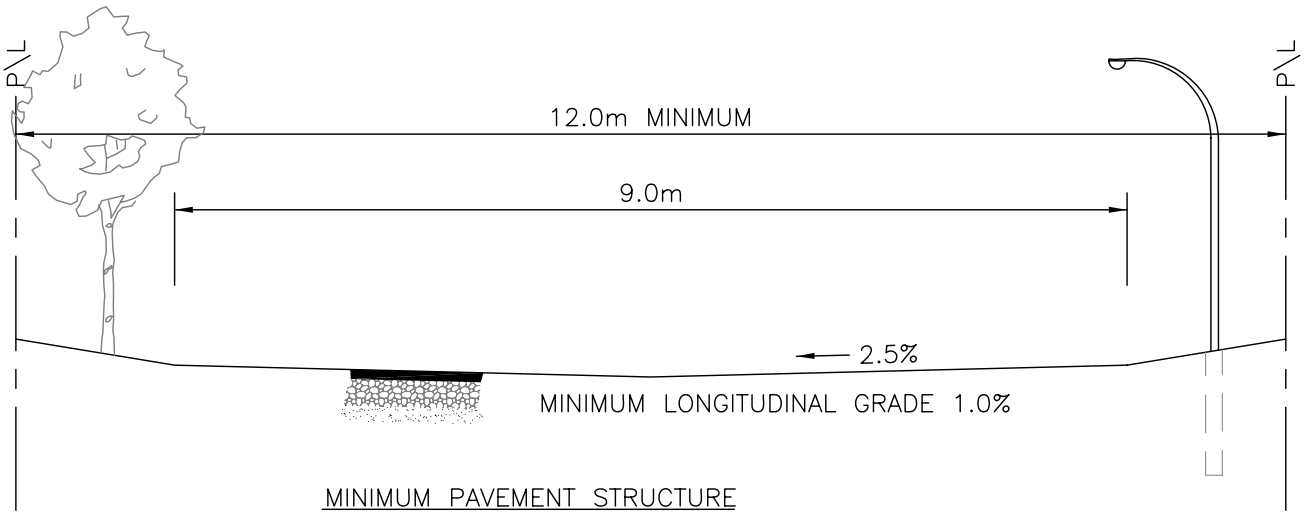
REVISIONS			Town of Westlock	
Date	Details	Approved		
			NOISE ATTENUATION FENCE	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	8–9
			DATE: OCTOBER, 2009	



MINIMUM PAVEMENT STRUCTURE
90mm ASPHALT
250mm CRUSHED AGGREGATE
150mm SUBGRADE PREP TO 100% SPD

NOTE: PAVEMENT STRUCTURE TO BE VERIFIED BY SITE SPECIFIC GEOTECHNICAL REPORT.

CURB and GUTTER SECTION

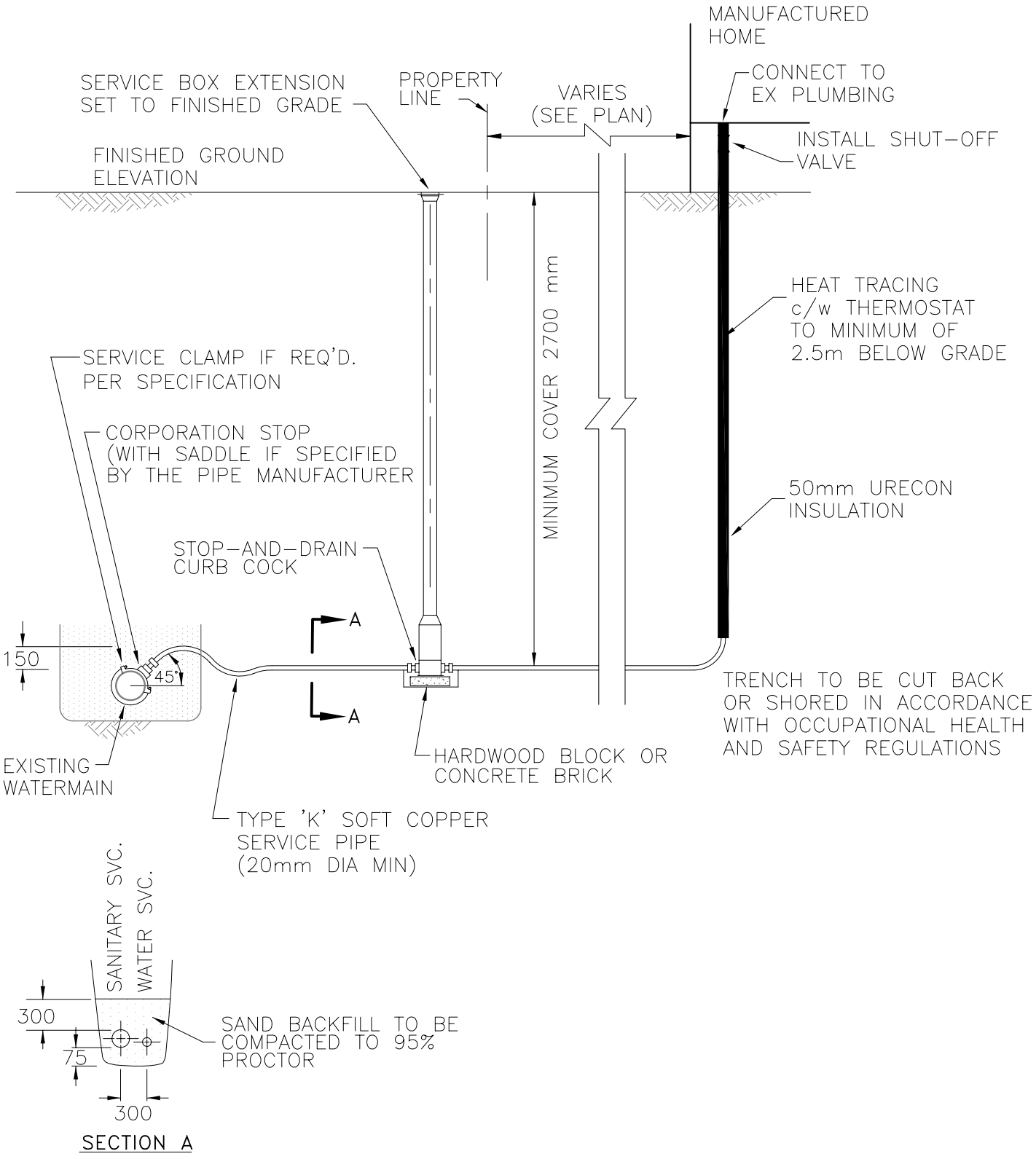


MINIMUM PAVEMENT STRUCTURE
90mm ASPHALT
250mm CRUSHED AGGREGATE
150mm SUBGRADE PREP TO 100% SPD

NOTE: PAVEMENT STRUCTURE TO BE VERIFIED BY SITE SPECIFIC GEOTECHNICAL REPORT.

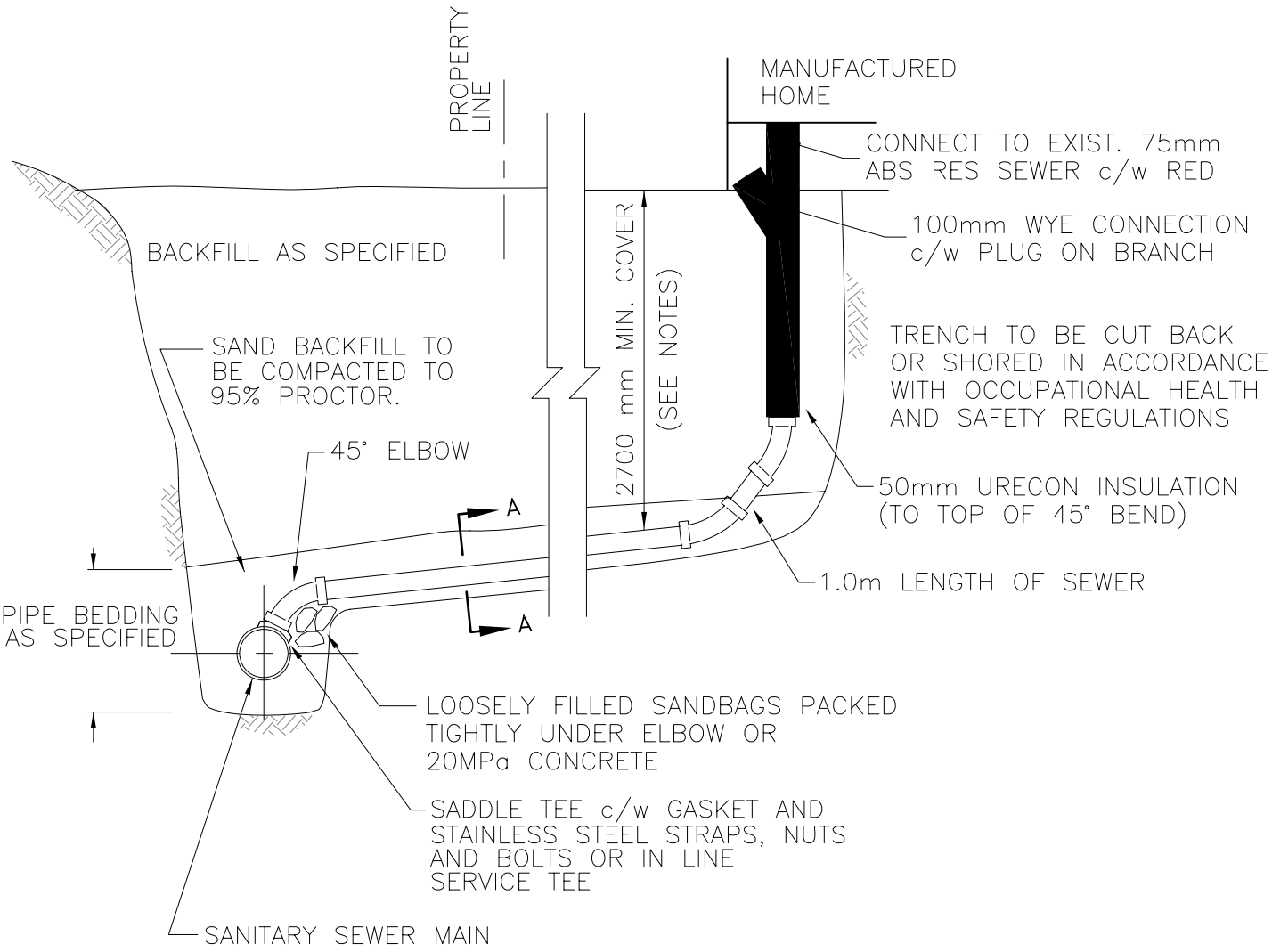
SWALE SECTION

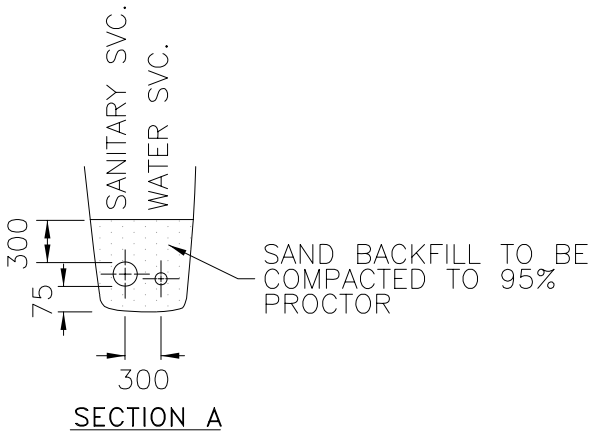
REVISIONS			Town of Westlock	
Date	Details	Approved	MANUFACTURED HOMES ROADWAY SECTION	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	10-1
			DATE: OCTOBER, 2009	



SECTION A

REVISIONS			Town of Westlock	
Date	Details	Approved		
			MANUFACTURED HOME WATER SERVICE CONNECTION	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	10-2
			DATE: OCTOBER, 2009	





SECTION A

NOTE :

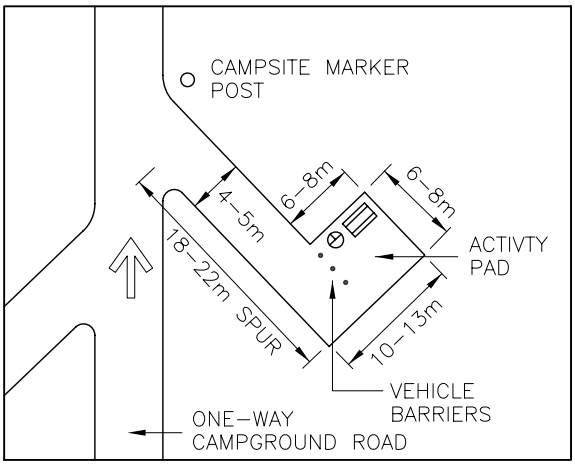
1. MIN SLOPE FOR 100mm DIA. PIPE IS 2%
2. SERVICE CONNECTIONS SHALL BE 100mm UNLESS SPECIFICALLY SHOWN OTHERWISE ON THE DRAWINGS
3. 50mm URECON INSULATION WILL BE REQUIRED

REVISIONS		
Date	Details	Approved

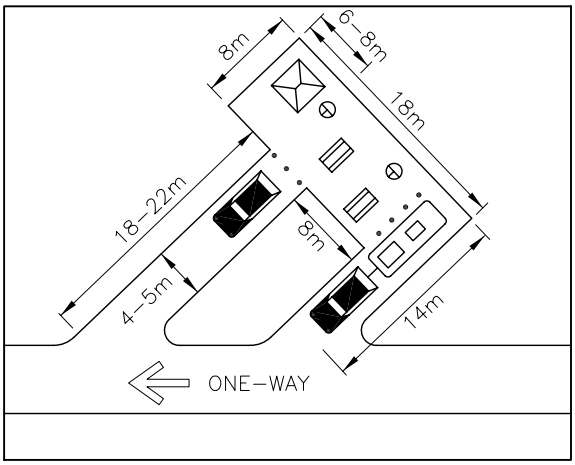
Town of Westlock

MANUFACTURED HOME
SANITARY SERVICE CONNECTION

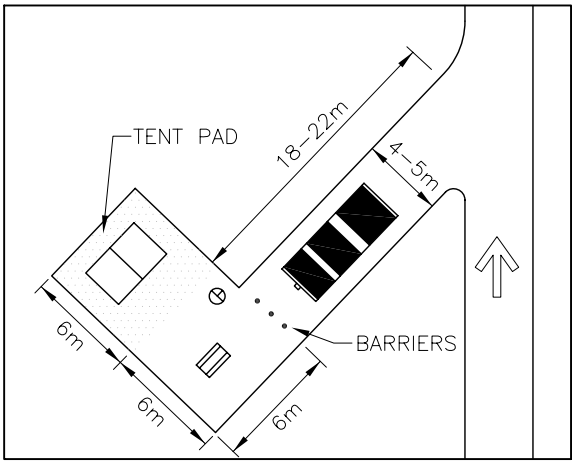
APPROVED:	STD. DWG. No.
SCALE: N.T.S.	10-3
DATE: OCTOBER, 2009	



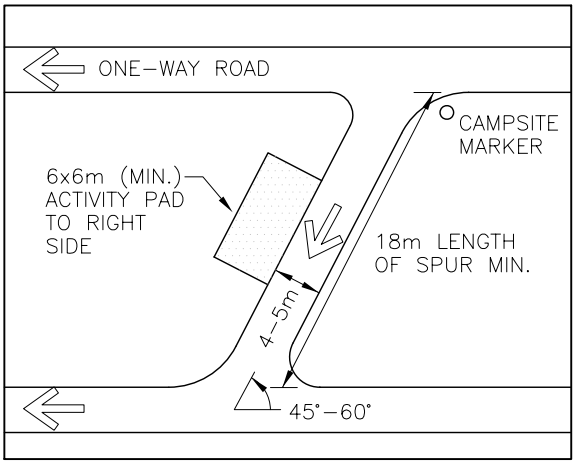
SINGLE BACK–IN CAMPSITE DESIGN



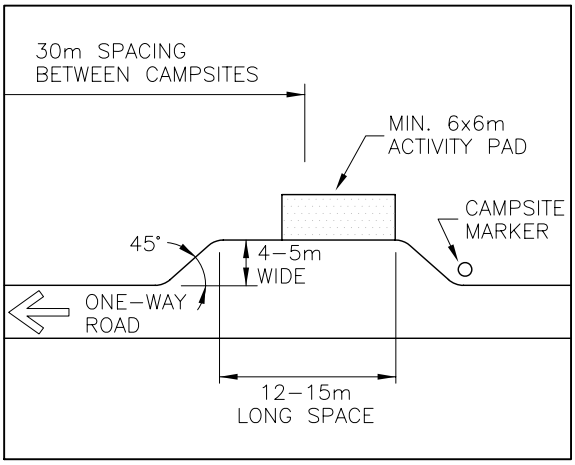
DIMENSIONS OF A DOUBLE BACK–IN CAMPSITE



CAMPGROUND LOCATED AT REAR WITH TENT PAD PROVIDED

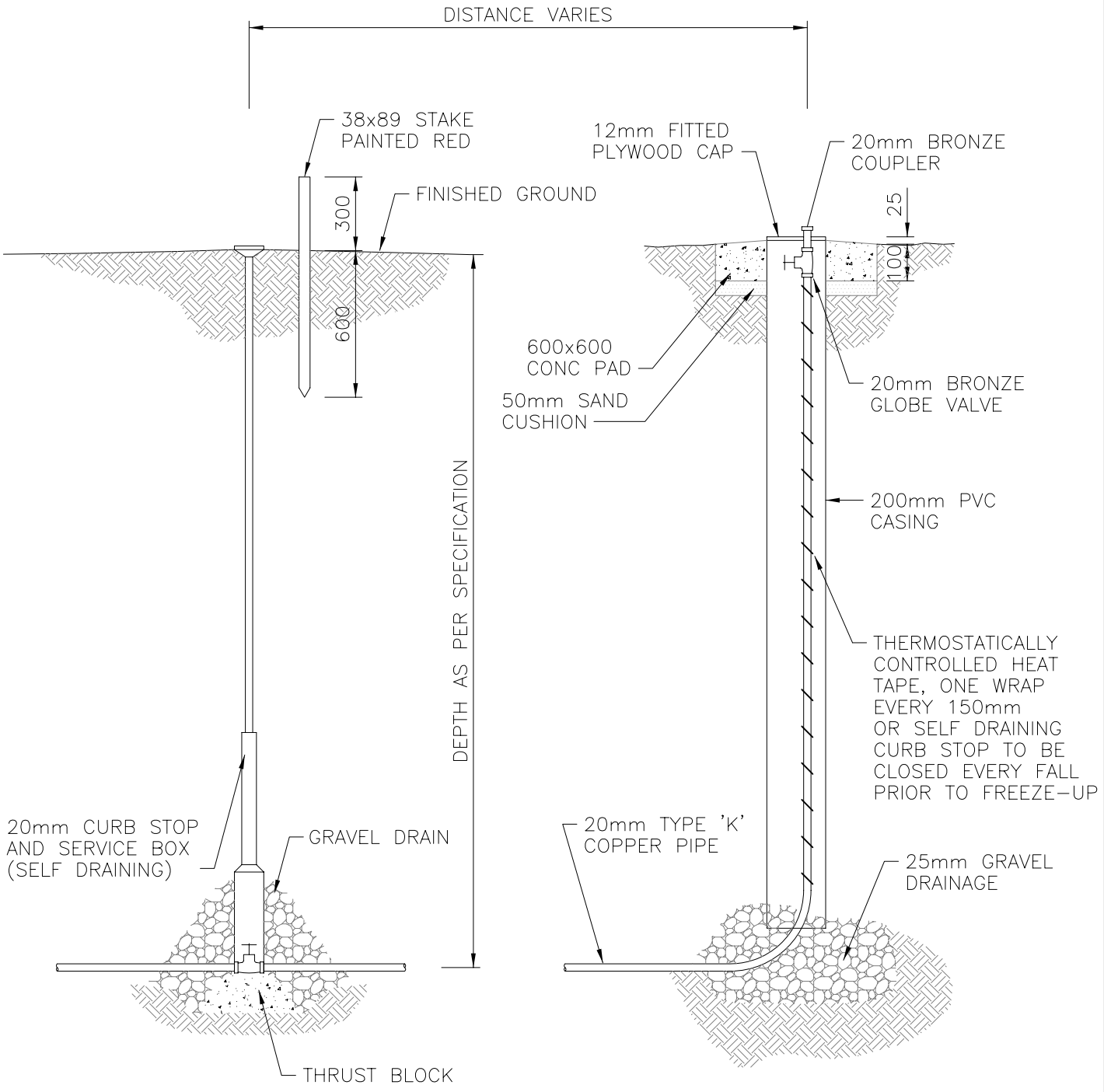


DIMENSIONS OF A PULL–THROUGH CAMPSITE

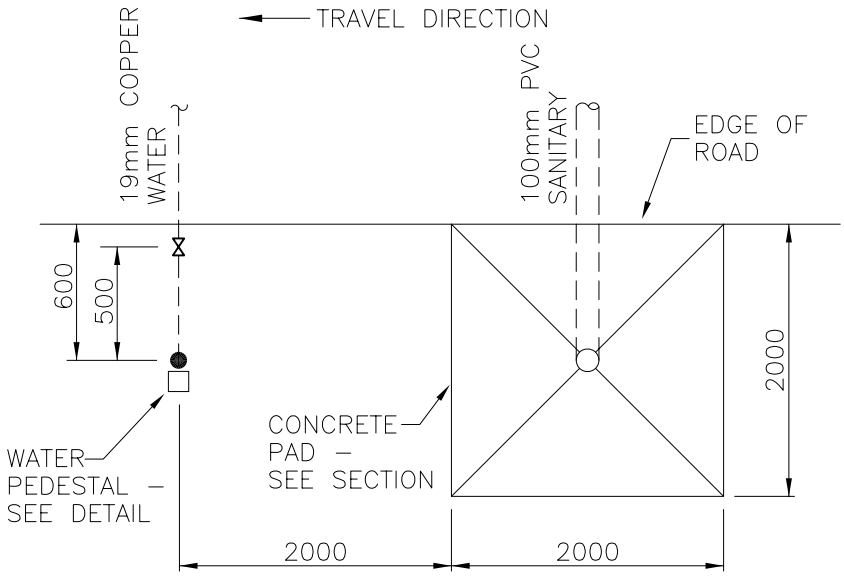


PULL–OVER CAMPSITE DESIGN

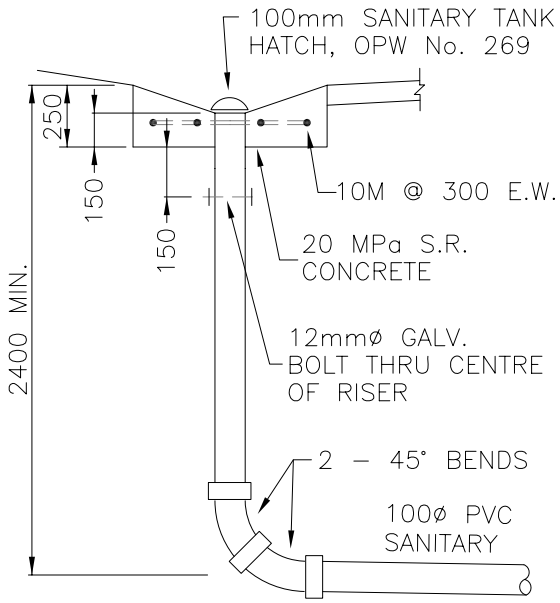
REVISIONS			Town of Westlock	
Date	Details	Approved		
			CAMPGROUND DETAILS	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	11–1
			DATE: OCTOBER, 2009	



REVISIONS			Town of Westlock	
Date	Details	Approved		
			WATER RISER FOR R.V. HOOKUP	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	11-2
			DATE: OCTOBER, 2009	

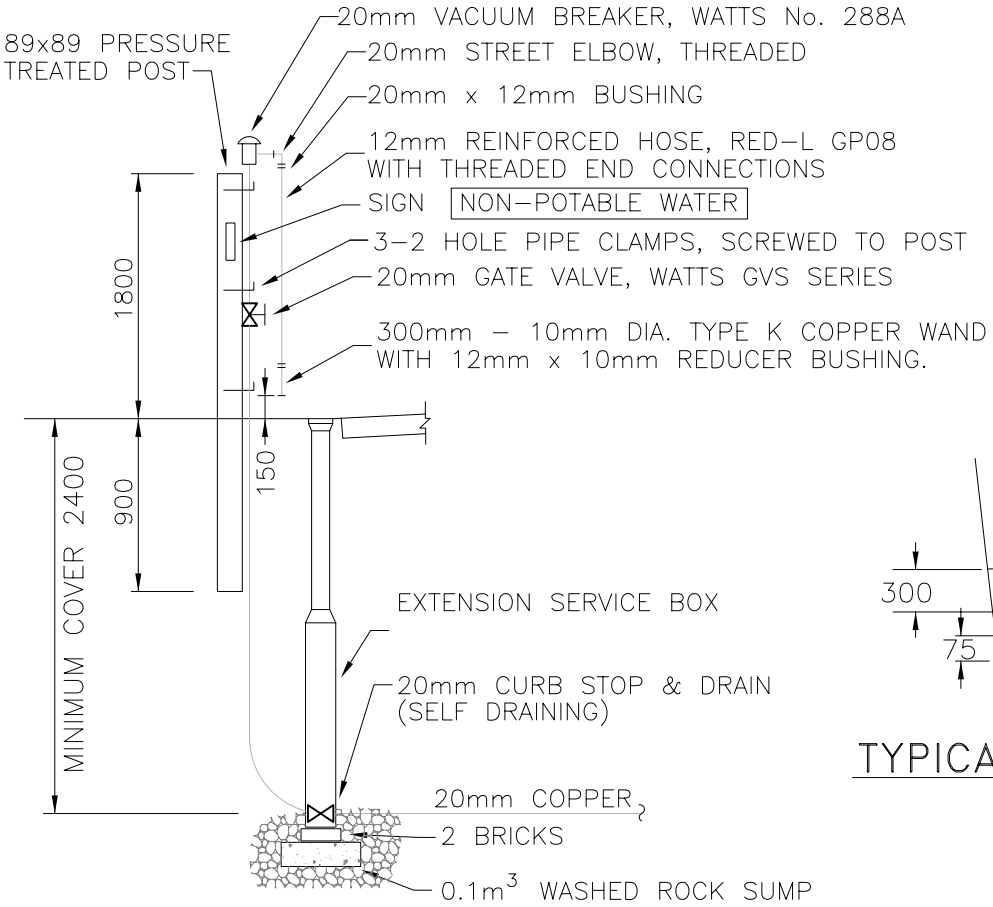


SANI–DUMP SITE

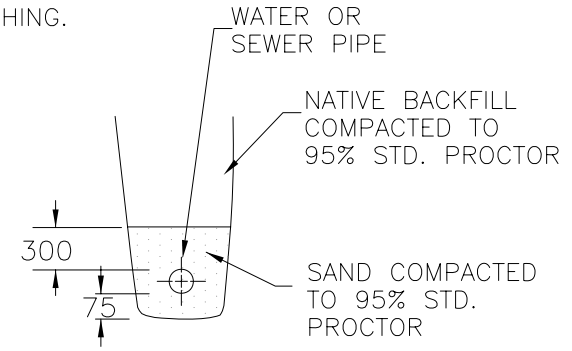


SANITARY PAD SECTION

NOTE: ALL BACKFILL 95% STD. PROCTOR

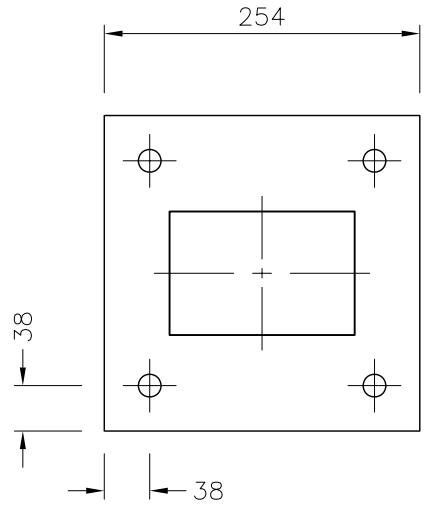


WATER PEDESTAL DETAIL

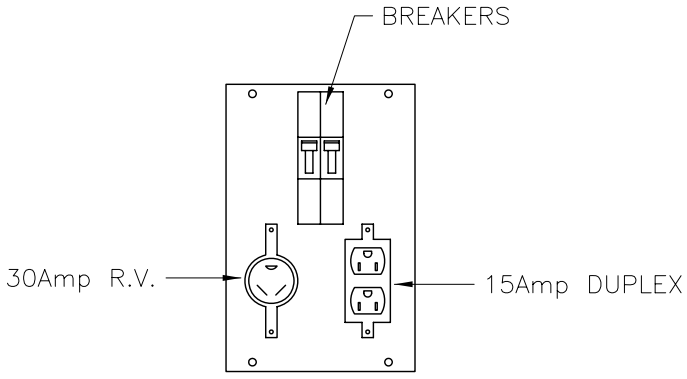


TYPICAL TRENCH SECTION

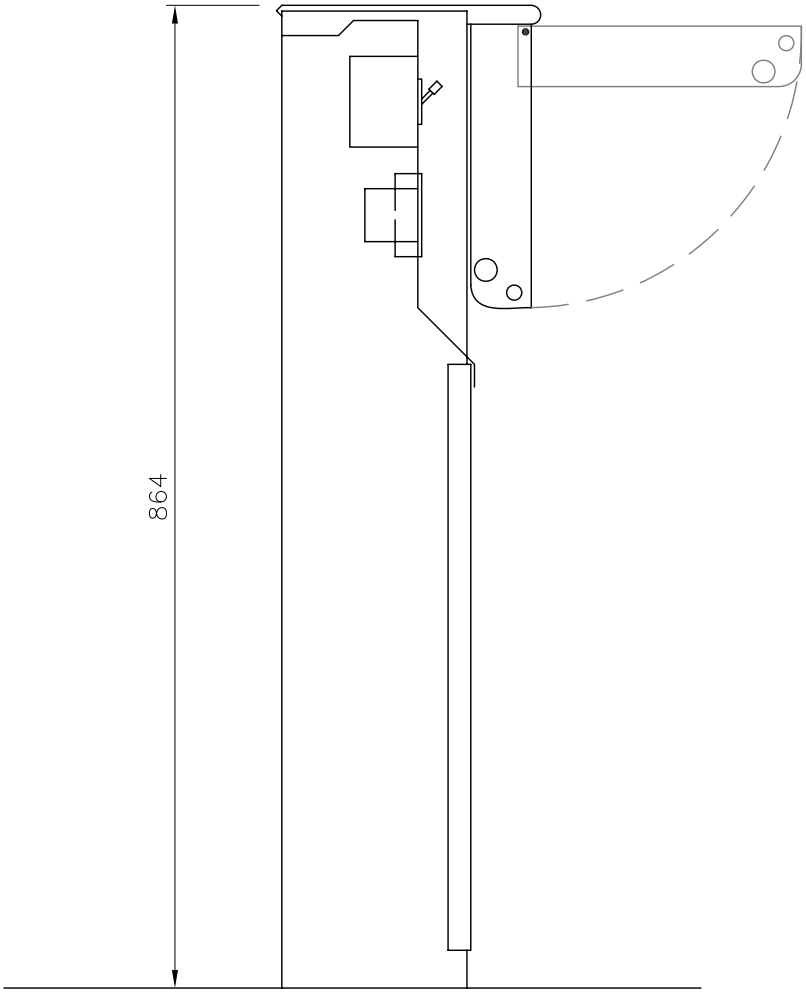
REVISIONS			Town of Westlock	
Date	Details	Approved		
			R.V. SANI–DUMP STATION	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	11–3
			DATE: OCTOBER, 2009	



TEMPLATE

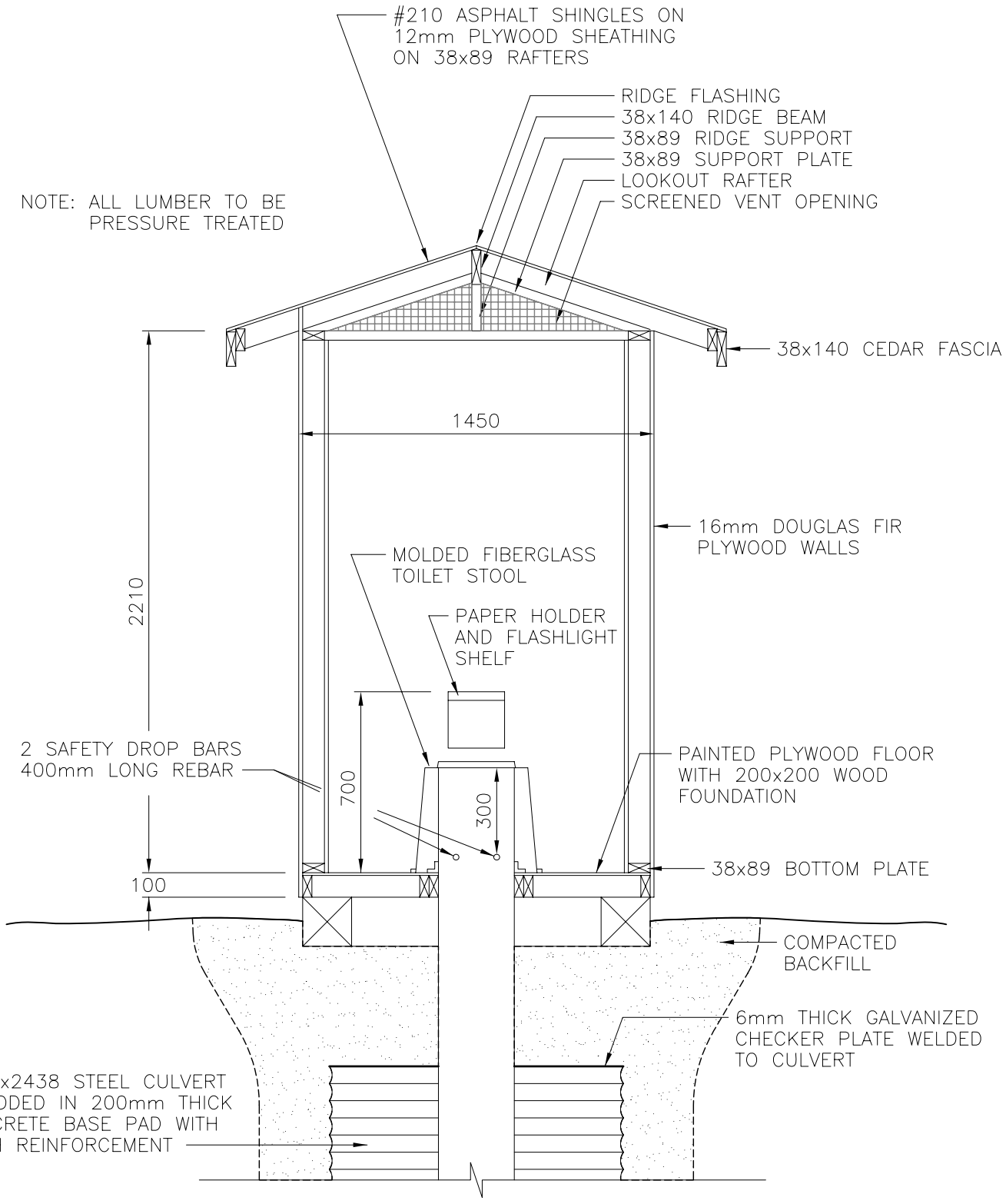


APR–3 INSERT



SIDE VIEW

REVISIONS			Town of Westlock	
Date	Details	Approved		
			ELECTRICAL RECEPTACLE	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	11–4
			DATE: OCTOBER, 2009	



REVISIONS			Town of Westlock	
Date	Details	Approved		
			SINGLE VAULT TOILET	
			APPROVED:	STD. DWG. No.
			SCALE: N.T.S.	11–5
			DATE: OCTOBER, 2009	