FOREWORD

This manual is intended to provide an information guide and to set standards governing design, preparation and submission of plans and specifications for construction of municipal improvements in the City Of Camrose. It is intended for use by Developers, Engineering Consultants, Utility Companies, and City Departments.

This manual may be purchased from the City of Camrose Engineering Department. The purchase price includes updates and revisions for a three year period after the date of purchase. Manual owners must notify the Engineering Department of any change in name or address.

All users of this manual should be aware that the City of Camrose has also produced a "Subdivision and Development Procedures Manual" which describes the administrative process to obtain Development Permits or agreements, land use redistricting, and subdivisions.

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GENERAL INDEX

GENERAL CONDITIONS AND PROCEDURES SECTION 1

1.0.0 PRELIMINARY PROCEDURES

1.1.0 DEFINITIONS

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

1. **"Applicant"** shall mean a person 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. **"City Engineer"** or his authorized representative shall mean a City employee who for the time being is acting for the City in their respective positions, or any person engaged by the City to act for the City.

3. **"Consulting Engineer"** shall mean the professional engineer retained by the Applicant to be responsible for the design, layout and supervision of installation, recording of as-built information and performing those duties in connection with the provision of Municipal Services as set out in these design standards. The Consulting Engineer must be licensed to practice in the Province of Alberta.

4. **"Contractor"** shall mean any person, persons or corporation which shall undertake the installation of Municipal Services on behalf of either the Applicant or the City.

5. **"Developer"** shall mean the person or entity that has executed a Development Agreement with the City, in which Agreement the Developer has undertaken to comply with the specified technical standards and requirements of the City.

6. **"Developer's Responsibilities"** any specification statement referring to acts to be performed or materials to be furnished by the Applicant, Consulting Engineer or Contractor 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 City for compliance with the Design Specifications by his Contractor.

7. **"Municipal Improvement"** is any addition or modification or proposed addition or modification to a service or facility the City of Camrose will ultimately be responsible for. These include, but are not necessarily limited to, watermains, sewers, roadways, walkways, park areas, signs, street lights and fencing.

8. **"Municipal, Municipality or City"** shall refer to the City of Camrose.

1.2.0 GENERAL

1.2.1 Development Brief

Development of new areas requires the subdivision of land in accordance with procedures and requirements set out in the Planning Act, the City of Camrose General Municipal Plan, Land Use Bylaw and the Subdivision and Development Procedures Manual. The City desires to be kept informed in regard to the proposed development. To this end, the Developer is requested to present his Development Brief to the City Engineer at an early stage so that the proposal can be reviewed and commented on prior to giving approval in principle of the subdivision development.

1.2.2 Developer's Engineer

The Developer shall engage a qualified professional engineer to undertake all phases of engineering, including conceptual design, detailed design, general engineering, construction inspection and as-built recording, for the proposed development. Such engineer shall design these services in accordance with accepted engineering practices and to exceed the minimum standards as set out herein or established by government bodies. All plans and documents shall utilize the Standard Metric System of Units (SI).

1.2.3 Development Proposal

Prior to any development taking place, the Developer shall submit a development proposal to the City. The proposal should include all pertinent information as to standards of construction, anticipated types of development, requirements for capacity of water mains, sewer mains, roadways, street patterns, utility easements and other significant aspects relating to the proposed development.

The development proposal shall include drawings at a scale of 1:1000 m or 1:2000 m of the proposed development outlining the concept of lots, blocks and street patterns. The following information shall be included on one or more copies of the above drawings:

1. Preliminary subdivision plan.
2. Lot plans.
3. Contours of existing land surface relative to geodetic elevation datum.
4. Location and size of watermains.
5. Location and size of sanitary sewer mains.
6. Location and size of storm sewer mains.
7. Curb face to curb face road widths.
8. Impact of servicing requirements on existing facilities.
9. Any other information that the Developer considers necessary to aid the City in assessing and considering the proposed development.

1.2.4 Overall Layout

1. **Overall Design**

The overall design shall conform to the Master Water, Sewer, Drainage Plans and Transportation concepts of the City, as well as the General Municipal Plan and the Land Use Bylaw.

1.2.4 Overall Layout - Continued

2. **Overall Development of the City**

The proposed development shall be laid out and designed having regard to the overall development of the City and possible future expansion of abutting areas. Tie-ins of proposed local improvements into existing development shall not create overloads on existing services.

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

3. **Layout Concepts**

The concepts of layout such as size of lots, widths of rights-of-way for traffic and other services, park reserves, densities and zoning, should be approved in principle by the City prior to submission of detailed plans, in order that any necessary or desirable revisions can be incorporated without requiring major changes.

4. **Curves on Roads**

Subdivisions requiring curves on roads should reflect right-of-ways boundaries with the same curves or sufficient size corner cut-offs to accommodate the curves as well as utilities and municipal services required to be installed in the boulevard.

5. **Rights-of-ways and/or Easements**

Rights-of-way and/or easements shall be provided for all utilities not located on streets, lanes, or utility lots, including rights-of-way for ditches or watercourses accommodating surface runoff.

1.2.5 Municipal Services

1. **Servicing Regulations**

The type and extent of servicing shall be in accordance with the development agreement and the "Approved" plans, specifications and regulations for each municipal improvement.

2. **Service Connections**

All service connections, including power, telephone and cable T.V. service connections, shall be installed underground from the mains to the buildings.

3. **Canada Post Mailboxes**

The location of Canada Post's "Superboxes" shall be co-ordinated with Canada Post by the Developer.

1.2.6 Existing Improvements

1. **Connections to Existing Facilities**

The Developer shall file a request for a connection to existing facilities with the City at least forty eight (48) hours prior to starting work on this connection. In the event existing services must be cut off, the Developer will notify all affected customers of this fact. The Developer must have all material, equipment and labour on hand as necessary to complete this connection in the shortest possible time before he will receive approval to make this connection. Depending upon the length of service interruption, the Developer may have to provide temporary services to the affected customers.

2. **Interference with Existing Services**

Any of the services to be installed by the Developer shall be installed in such a manner as to least interfere with existing services. Any additional cost incurred by the City on account of the installation of services by the Developer shall be charged to the Developer who will reimburse the City promptly for such additional expenditures incurred.

3. **Closing of Roads**

In the event that a road must be partially or fully closed for a crossing or connection, the Developer shall provide all detours, signs, flagmen, barricades, etc. necessary to provide for the orderly control of traffic around the construction area. The City must be notified at least forty eight (48) hours in advance of any road closures and appropriate permits obtained by the Developer.

4. **Road Crossings**

Any existing facilities disturbed during construction shall be returned to their original standard. Where it is necessary to excavate an existing road or lane for the purpose of providing an open trench crossing (for a water or sewer main, gas main, telephone cable, etc.) such excavation must be back filled with compacted sand and/or gravel material to the satisfaction of the City Engineer. Compaction shall be minimum 98% Standard Proctor Density. The Developer shall be responsible to repair any trench settlements which may occur within two years from installation of the service.

5. **Standards**

The standards outlined herein are intended to be the minimum standards. Where conditions dictate and good engineering practice requires higher standards then those indicated, they shall be incorporated into the design. It shall be the Developer's responsibility to develop the subdivision in accordance with standards which are acceptable to the City and which conform to good engineering and construction practices to meet and exceed a twenty (20) year life. If a relevant government body or approval agency has approved standards which exceed the City's minimum standards, the higher standards shall prevail.

1.2.6 Existing Improvements (Continued)

6. **Materials**

Materials installed within the subdivision shall be tested to confirm compliance with the most recent standard of either AWWA, ASTM, or CSA.

1.3.0 GENERAL CONDITIONS

1.3.1 Scope

1. These design standards shall apply to the design and installation of Municipal Services within the City of Camrose. They apply to the design and installation of storm and sanitary sewers, watermains and roads, together with their respective connections and appurtenances and any other services which are required to be designed and/or installed.

2. These design standards do not cover the design or installation (other than alignment) of street lighting, ornamental lighting, power, gas, telephone and television services, but does include coordination with the various utility companies.

3. The Standard Drawings as referred to in various sections shall form an integral part of these design standards.

1.3.2 Design Standards

1. The following design standards shall apply to all or any of the respective services:

Section 1: General Conditions and Procedures
Section 2: Preparation of Engineering Drawings
Section 3: Water Distribution System
Section 4: Sanitary Sewerage System
Section 5: Storm Drainage System
Section 6: Sewer and Water Service Connections
Section 7: Roads
Section 8: Landscaping
Standard Drawings

2. All services shall be designed and installed as detailed in the above mentioned design standards and according to the procedure as set out in this section.

3. No departure from these design standards shall be permitted except with the written approval of the City Engineer. The City Engineer may give verbal approval to revisions which he considers to be sufficiently minor. A Change Order shall be issued by the Developer and approved by the City to record such revisions.

3. The performance and responsibilities of all parties and persons carrying out the installation of services shall be as set out in Section 1: General Conditions.

1.4.0 PROCEDURE

1.4.1 Engineering Design

1. The Applicant shall retain a Consulting Engineer who shall be responsible for the design and preparation of drawings and specifications for all services (except lighting, telephone natural gas, cable T.V. and power) as required within the City of Camrose. These services shall be designed in accordance with the Minimum Design Standards for Development.

2. The Design Drawings shall show all existing and proposed services. It shall be the Consulting Engineer's responsibility to coordinate with the utility companies to establish the location of their existing and proposed services.

1.4.2 Submission of Engineering Design

1. Upon completion of the Design Drawings, the Consulting Engineer shall submit to the City Engineer, together with two complete sets of plans and specifications for the proposed project, the following:

   a) calculations of sanitary and storm sewer capacity and pipe loading, where these services are to be installed;

   b) water distribution analysis as specified in Section 3;

   c) a print of the registerable plan of the subdivision (if not already supplied by the Applicant).

2. All proposed streets shall be named on the drawings, names to have been approved by the City prior to the submission of drawings.

3. The Consulting Engineer shall bring to the attention of the Applicant the need for any rights-of-way outside the subdivision which the Applicant may have to obtain.

4. The Consulting Engineer shall bring to the attention of the Applicant the need for any oil and gas pipeline crossing agreements which the applicant may have to obtain.

1.4.3 Preliminary Design Review

1. All design drawings and specifications and relevant data shall be reviewed by the City Engineer. Any revisions requested by the City Engineer shall be incorporated in the final design drawings.

1.4.4 Final Design Review

1. Upon completion of all revisions, the Consulting Engineer shall submit four sets of Contract Drawings to the City Engineer for review. The City's review of the Contract Drawings is only for general compliance with the City's Development standards as detailed in this document. Review certification does not, in any manner, imply approval of the technical aspects of the reviewed design.

1.4.4 Final Design Review (Continued)

2. Upon completion of design review, the City Engineer shall certify the drawings and return one set to the Consulting Engineer.

3. No work shall be commenced within any parcel of land or any of the services to be provided by the Applicant until the City has certified the Design Drawings, the subdivision approved and the Development Agreement Executed.

1.4.5 Rights – of - Way Documents

1. Where easement or rights-of-way documents are deemed necessary, they shall be prepared and registered at Land Titles by a registered Land Surveyor at the Applicants expense.

1.4.6 Oil and Gas Pipeline Crossing Agreements

1. Where oil and gas pipeline crossing agreements are deemed necessary, they shall be obtained from the pipeline owner at the Applicants expense.

2. It is the responsibility of the Applicant to complete a title search with the ERCB (Energy Resources Conservation Board) to determine the existence of any pipelines in use or abandoned.

1.4.7 Construction Approval

1. Upon receipt of Certified Drawings and Specifications, the Applicant may proceed to install Municipal Services subject to:

   a) Satisfactory execution of Development Agreement or a Development Permit if applicable.
   b) Subdivision Approval.
   c) Obtaining appropriate Municipal, Provincial and Federal Permits (e.g. Alberta Environment Permit to Construct, Water Resources Permit to Discharge, etc.)

2. A copy of all approved drawings and specifications shall be maintained at the construction site during the installation of services

3. Underground subdivision services shall not be permitted to operate as part of existing Municipal Services until the respective subdivision services have been inspected, tested and approved in writing by the City Engineer.

1.4.8 Engineering Supervision

1. The Consulting Engineer shall be responsible for the layout, inspection and approval of materials and the supervision of installation of all services which are the responsibility of the Applicant. The Consulting Engineer or his authorized representative shall be available at all times to visit the site during the installation of services.

1.4.8 Engineering Supervision (Continued)

2. The Consulting Engineer shall be responsible for maintaining field surveys from which services not the responsibility of the Applicant may be installed if such installations are to be made before the acceptance of work being done by the Applicant.

3. In addition to supervision carried out by the Consulting Engineer, the City Engineer may periodically inspect the work and assist in coordinating the subdivision works with any related Municipal works. The City Engineer shall bring the use of any unacceptable materials or practices to the attention of the Contractor and/or the Consulting Engineer. If remedial action is not taken to the satisfaction of the City Engineer, he may order the work to cease.

4. If the Consulting Engineer wishes to make any changes in design either before or during the execution of the work, he shall first submit a marked print showing proposed revisions to the City Engineer. If approval is granted for revision, the original drawing shall be immediately revised and new prints issued. These two operations may be carried out simultaneously.

1.4.9 Survey Control System

1. The Developer shall provide a survey control system within and adjacent to the subdivision. The survey control system shall consist of survey monuments of a design mutually acceptable to both the City and the applicable provincial agency. The survey monuments shall be placed so as to be intervisible between adjacent pairs and spaced approximately 300 metres apart. Measurements shall be made between monuments and connection shall be made to existing geodetic monuments to not less than third order specifications as defined by the Geodetic Survey of Canada, to establish vertical and horizontal coordinates based on a three degree transverse mercator projection. The City and the applicable provincial agency shall be provided with the survey measurements, to the satisfaction of the Director of Surveys, the applicable provincial agency, for the survey control system.

   The Developer shall undertake to preserve all existing and new monuments and should it be necessary to destroy a monument, the Developer shall establish a new one in lieu thereof and provide the City and the applicable provincial agency with survey measurements for it to the satisfaction of the Director of Surveys.

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

1.4.10 Testing

1. It shall be the responsibility of the Consulting Engineer to ensure that the Contractor disinfects and tests all watermains and tests all sewers prior to the acceptance by the City. The City Engineer shall be advised at least 48 hours prior to any testing and may witness the test. The results of all tests shall be submitted to the City for their review.

1.4.11 Record Drawings

1. Within six months of completion of all services to be installed, the Consulting Engineer shall deliver "certified record" drawings to the City Engineer, in a reproducible format and in Autocad 2004 version format on compact disk.

1.4.12 Municipal Acceptance

1. Upon satisfactory completion of the project and after all the deficiencies have been corrected, the Developer shall submit, for the City Engineer's approval, a Completion Certificate certifying that construction has been completed in accordance with the City's' Development Standards and the project specifications and drawings. Only then shall the City Engineer issue a completion certificate to the applicant, notifying:

   a) Acceptance of the work by the City;
   b) Commencement date of maintenance period.

2. The applicant shall be responsible for, at his own expense to remedy any defect, fault of deficiency in the completed works during a twenty-four (24) month maintenance period. Normally the maintenance period shall commence from the date of issuance of the Completion Certificate.

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

1.4.13 Building Permits

1. No building permits shall be issued until the subdivision plan is registered, all essential services have been provided, completed and inspected as specified in the Development Agreement or Development Permit, and underground utility services records have been submitted and accepted by the City Engineer. An exception may be considered for the construction of a "display home".

END OF SECTION 1

PART 1 DESIGN DRAWINGS

2.1.0 SCOPE

1. The following specification shall govern the preparation of Engineering Drawings for all Municipal Services.

2.2.0 DRAWING SIZE, MATERIAL AND BASIC LAYOUT

1. The Standard Drawing size of 559 mm x 864 mm (22" x 34") will be used.
2. Originals shall be prepared in ink on mylar base.

3. Use plan profile sheets with profile at bottom of sheet. Leave enough clear space in the lower part of plan for title block and legend.

4. The plan shall not extend onto the profile section of the drawing. All profiles must be on the profile section of the drawing.

2.3.0 SCALES

Overall plans	1:1000			
Plan/Profile	Horizontal	1:500 m	Vertical	1:50 m
Cross Sections	Horizontal	1:100 m	Vertical	1:50 m

2.4.0 DRAWING TECHNIQUE

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

   a) Care in ensuring balanced distribution of detail throughout the drawing.

   b) Letters and figures shall be clearly legible, 2 mm size or larger (Leroy or equivalent), well spaced, properly formed and proportioned.

   c) Lines shall be uniform in weight and density.

   d) Dimensioning of a drawing is extremely important and should be such that it will not be misinterpreted. Dimensions should be given from an iron pin, lot line, chainage station, a centre line or any other reference that can be readily established. All dimensions shall be in SI System. (Standard Metric System at Units).

   e) Any computer drafting shall be submitted in Autocad Release 2004 or lower format compatible with the City's current version.

2.5.0 GENERAL REQUIREMENTS FOR ALL SERVICES

1. Elevations shall be relative to the Alberta Survey Control system. The reference Alberta Survey Control Monument (ASCM) and elevation shall be shown on the design drawing.

2.5.0 GENERAL REQUIREMENTS FOR ALL SERVICES (Continued)

2. Plan datum reference shall be as follows:

CS Code	CANA27-3TM114
Description	ALBERTA NAD 27, 3 DEGREE ZONE, CENTERED AT 114DEG WEST
Projection	TRANSVERSE MERCATOR ™
Datum	NAD 27
Autocad	Release 2004 or lower

3. Where there is more than one profile, clearly identify each.

4. A north arrow, adjacent lots and plan numbers, street names, and the legal description of the parcel being subdivided, shall be shown on the drawings. In general the north arrows should be orientated towards the top of the plan.

2.6.0 OVERALL PLANS

The following overall plans shall form a part of the whole design drawing set.

2.6.1 Cover Sheet

This will show the name of the subdivision, stage and year of development and names of the developer and consulting engineer.

2.6.2 Index Plan

This plan will be prepared on a scale of a minimum 1:1000 or a reduction thereof to fit the standard size sheet and will indicate that portion of the street which relates to a particular plan/profile sheet.

2.6.3 Road, Sidewalk and Walkway Plan

This plan will be drawn to a scale of a minimum 1:1000 and will indicate all locations and widths of roads, sidewalks and walkways, and locations of catch basins shall be shown.

2.6.4 Lot Grading Plan

An overall plan shall be drawn to a scale of 1:500 and will indicate the original contours, proposed finished lot corner elevations at back corners of the lot, proposed top of curb elevations at front corners of the lot, proposed lot grades, sewer connection inverts, directions of surface drainage flows, hydrants, street lighting standards, pedestals, transformers catchbasins, manholes and super mailbox locations.

2.6.5 Landscaping Plan

The landscape plan shall be drawn to a scale of 1:000 and shall utilize the Road, Sidewalk and Walkway Plan as a base. This plan shall identify areas to be seeded or sodded, location of and name of all trees and shrubs, location of planting beds and any park furniture or playground equipment being installed.

2.6.6 Sanitary Sewer, Storm Sewer and Watermain Overall Plan

This plan will be drawn to a scale of 1:1000 and will indicate the alignments and locations of mains, size of mains, direction of flows and locations of appurtenances. All manholes, fire hydrants and water valves shall be numbered to conform to the City's numbering system.

2.6.7 Power, Gas, Telephone and Cablevision

This plan shall be drawn to a scale of 1:1000 and will indicate the alignments of power, gas, telephone and cablevision.

2.7.0 DETAILED PLAN/PROFILE

1. Generally all underground services and surface improvement profiles shall be shown on the same drawing.

2. The following information shall be included on the detailed plan/profile drawings.

2.7.1 Water

1. Show the location of hydrants, valves, tees, crosses, and other fittings tied to the nearest iron pin.

2. Show the offset of the main from the property line and locate the end of the main to the nearest iron pin.

3. Indicate extent of work required in making connections to existing watermains.

4. Indicate the size, type, class of pipe and class of bedding on the plan.

5. A profile of the watermain shall be required showing invert elevations at all grade changes. Storm and sanitary mains shall also be shown on this profile.

6. Valves and fire hydrants to be numbered to conform to City standards.

2.7.2 Requirements for Sanitary and Storm Sewer

The following information shall be shown on the profile:

1. Size, type, class of pipe and class of bedding.

2. Sewer profiles shall be drawn showing length and percent grades between manholes.

3. Invert elevations at both inlet and outlet of manholes.

4. Pipe capacity and calculated five (5) year flow for storm sewer.

2.7.2 Requirements for Sanitary and Storm Sewer (Continued)

The following information shall be shown on the plan:

5. Tie location of manholes, cleanouts, and other appurtenances to property lines.

6. Pipe offsets from property line.

The following additional information shall also be shown on an appropriate part of the drawing:

7. Manholes shall be numbered in accordance with City standards.

8. Where the sanitary sewer or water and storm sewer are to be installed in a common trench, detail a typical cross section showing distance between pipes, class of pipe and bedding.

2.7.3 Requirements for Roads

1. Both plan and profile must be tied to an iron pin, preferably near or at 0 + 00 chainage. Alternatively, the plan may be referenced to the cadastral co-ordinate system with appropriate ties to Alberta Survey Control Monuments (ASCM) for layout purposes.

2. Show the road width and the curb offsets measured from the property line to the curb face.

3. Chainages of the BC and EC of horizontal curves shall be shown together with the delta angle, radius, tangent length and arc length for each curb. If the plan is referenced to the cadastral co-ordinate system, co-ordinates shall be provided for the BC, EL and CC of each curve.

4. The percent grade to two decimal places shall be shown on the profile together with the following information on vertical curves.

   a) The chainage co-ordinate and elevations of BVC, EVC and PVI.

   b) K valve of vertical curve.

   c) The length of vertical curve.

   d) The elevation and chainage of the low spot of sag curves, or the high spot of crest curves.

5. Road profiles shall show the centreline pavement elevations.

6. The profile shall be shown at true centreline length and projected above or below the plan in as close relationship as possible.

7. Locate catch basins (using road chainage) and show leads between the catch basin and the mainline manhole.

8. Cross section showing pavement structures.

PART 2 - RECORD DRAWINGS

2.8.0 SCOPE

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

2.8.1 General

1. The record drawings shall clearly show the location of all services as installed using offsets from survey pins.

2. On record drawings submitted to the City, the following information shall be included on each drawing:

   a) Date of completion.

   b) Name of Contractor.

   c) Date on which 'record' details were added.

3. The record drawings (mylars and two sets of prints) are to be submitted to the City Engineer within four (4) months of the installations.

2.8.2 Storm and Sanitary Sewer

1. Size, pipe material, pipe class and location of mains.

2. Location of manholes, cleanouts, and other appurtenances numbered in accordance with the City's number system.

3. Grades, lengths and inverts of mains.

4. Pipe capacity and calculated five (5) year flows for each section of storm pipe.

5. Design calculations for storm and sanitary sewer flows to be submitted to the City.

2.8.3 Water

1. Size, type and location of pipe;

2. Location of valves, tees, hydrants and other appurtenances number in accordance with the City's number system.

3. Profile of pipe.

4. Design flow calculations by an engineer, be submitted to the City.

2.8.4 Road, Curbs and Sidewalks

1. Location of curbs, sidewalks and elevations of curbs;

2. Lip of gutter profiles for each curb;

3. End of curb, sidewalks and pavement;

4. Type of road structure.

2.8.5 Water and Sanitary Service Connections

1. A table on each plan/profile drawing shall be prepared giving the following information with respect to service connection:

   a) Lot number.

   b) Distance of service saddle from the downstream manhole.

   c) Invert elevation of sanitary service at property line.

2. The service connection provided to each lot shall be shown on the plan and the location referenced to the property lot corner.

2.8.6 Individual Lot Plans

1. As an alternative to individual lot plans, the developer may provide an overall plan which will include the same information as the individual lot plan. The overall plan shall be the standard drawing size (see 2.2.0) and at the scale of 1:500 for clarity of details.

END OF SECTION 2

3.1.0 DESIGN REQUIREMENTS

1. The minimum size of distribution main shall be 150 mm diameter for single family residential, 200 mm for multi family development and 250 mm for industrial/commercial. 100 mm diameter watermains may be allowed in cul-de-sacs upon approval of the City Engineer. Over sizing may be required as per City's Master Waterworks Plan.

2. P.V.C. Pipe shall be used and the value of "C" in the Hazen-Williams formula shall be 140.

3. Per capita consumption shall be:

Average Daily Demand	-	454 L/person/d
Maximum Daily Demand	-	1.8 x Average Demand
Peak Hourly Demand	-	3.0 x Average Demand

4. The design population shall be the ultimate for the area under consideration. (See Section 4.1.1 for population densities).

5. 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.

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

7. Fire Flow requirements shall be in accordance with the Insurer's Advisory Organization Standards, latest revision thereof. Generally these are:

Single Family Residential	3.64 m^3/min. (800 igpm)
City Houses	5.45 m^3/min. (1200 igpm)
Apartments (walk-up)	9.10 m^3/min. (2000 igpm)
Schools	5.45 m^3/min. (1200 igpm)
Commercial	11.40 m^3/min. (2500 igpm)
Industrial	13.64 m^3/min. (3000 igpm)

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

3.2.0 WATERMAINS

3.2.1 Watermain - Material

1. Pipe for the watermain shall conform to the following:

   i) Polyvinyl Chloride (PVC)Class 1035 (150) DR 18 A.W.W.A. pressure pipe C900 Cast Iron Outside Diameter (CIOD)

2. Rubber rings for the couplings shall conform to A.S.T.M. D1869, latest revision thereof. Control lubrication of pipe joints to prevent taste and odour concerns.

3.2.1 Watermain – Material (Continued)

3. Cast iron fittings shall be in accordance with A.W.W.A. Specification C110, latest revision thereof and shall be cathodically protected. Cast iron tees, elbows and crosses will only be allowed if the fitting is not readily available in moulded P.V.C.

4. Polyvinyl Chloride (PVC) moulded fittings to CSA B137.2 (class 150).

3.2.2 Watermain - Location

1. Mains shall be installed to provide a minimum depth of 3.0 m to invert below final finished surface grade.

2. Mains shall be located within the road right-of-way in accordance with the Roadway Cross Section Standard. Drawings. No.'s T2 to T11.

3. A minimum of 3 m separation shall be maintained between a watermain and any sewermain.

4. The minimum requirement for pipe bedding shall be Class "B" bedding (Standard Drawing. No. U7).

3.3.0 HYDRANTS

3.3.1 Hydrant - Material

1. Hydrants shall be either AVK model model 2700, Canada Valve, Darling Century or Concord as presently used in the City of Camrose.

2. Hydrants shall conform to A.W.W.A. Specification C502, latest revision thereof, and shall include the following supplementary requirements:

   a) Breakaway traffic flange.

   b) Stainless steel trim (nuts and bolts).

   c) Compression type shut off.

   d) Designed for working pressure of 1035 kPa.

   e) Two 63 mm hose nozzles with Alberta Mutual Aid Thread.

   f) One steamer port with 146 mm (5.745") outside major diameter, 142 mm (5.58") pitch diameter of threads, 114 mm (4.5") inside diameter, 4 threads per inch.

   g) Size 12 pentagon operating nut and caps, 33 mm (1 5/16") from tip to midpoint of flat base.

   h) Self draining hydrants.

   i) A gravel drainage pit (min 0.5 m3) shall be provided at the bottom of the hydrant.

3.3.1 Hydrant – Material (Continued)

j) gate valve shall be provided on each hydrant lead

k) All hydrants shall be painted Chrome Yellow.

l) Tops and nozzle caps painted in accordance with the NFPA colour coding system as outlined in Table 3.2.

m) 150 mm diameter riser barrel with a 125 mm bottom valve

3.3.2 Hydrant - Location and Installation

1. The maximum allowable spacing between fire hydrants shall be 150 m in single family residential areas, 120 m in multiple-family residential and school areas and 90 m in industrial/commercial areas.

2. Hydrant locations shall be such that the distance to any building shall be not greater than 75 m.

3. Hydrants on the distribution mains shall be installed:

   a) At the projection of property lines except:

   b) Where the hydrants are installed at the intersections, they shall be installed at the beginning of curb returns

   c) Where the hydrants are installed on a cul-de-sac, they shall be installed at the intersection of the cul-de-sac and adjacent collector roadway.

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

   a) Areas with no sidewalk - hydrant is to be no more than 2 m from back of curb.

   b) Areas with monolithic sidewalk - hydrant is to be no more than 0.75 m from back of walk.

   c) Areas with separate sidewalk - hydrant is to be no less than 1.0 m and no more than 1.8 m from back of curb.

   d) Hydrants shall be no closer than 0.30 m and no more than 3.0 m from back of curb.

5. Additional hydrants shall be installed at high value properties if deemed necessary by the City.

6. All hydrants shall be on a minimum of 150 mm feeder line. Such feeder line shall be a maximum length of 7.5 metres from the main, otherwise a larger diameter line shall be considered.

7. Hydrants shall be installed in accordance with Standard Drawing Number U5 with the following requirements:

   a) Dirt flange to be no less than 100 mm and no more than 200 mm

   b) Minimum 0.5 m; washed gravel drainage sump adjacent to hydrant base. Top of sump to be 150 mm above hydrant drain holes and covered with 2 mm polyethylene sheet to prevent intrusion of clay or silt into the gravel.

   c) Cathodically protect with a 11 kg zinc anode.

   d) Paint top and nozzle caps in accordance with NFPA colour coding as outlined in Table 3.2.

   e) Paint hydrant number in 100 mm high block lettering.

   f) Place sign on hydrant to indicate if it is in service.

3.4.0 VALVES

3.4.1 Valve - Materials

1. Gate valves shall conform to A.W.W.A. Specification C509, latest revision thereof, and shall include the following supplementary requirements:

   a) Iron body.

   b) Bronze mounted with grade of bronze used completely resistant to de-zincification by water having a pH of 9.0.

   c) Operating pressure shall be 1,200 kPa.

   d) 51 mm square operating nut.

   e) Type 304 stainless steel stem for valves 250 mm and larger. 150 mm and 200 mm valves may be supplied with either bronze or type 304 stainless steel stems.

   f) "O" - ring stem seal.

   g) To open by turning counter clockwise direction.

   h) Non-rising stem.

   i) Resilient seated

   j) External epoxy coating

   k) Stainless steel trim (nuts and bolts)

3.4.2 Valve Boxes

1. Valve boxes shall be a two section, bituminous coated, Type "A", cast iron adjustable type complete with a cast iron lid. An acceptable alternate for the bottom section of a Type "A", valve box is the P.V.C. Schedule 40 lower box. An internal operating rod is not required.

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

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

4. Acceptable alternate for the bottom section of Type "A" valve box. P.V.C. Schedule 40 lower box.

3.4.3 Valve - Location

1. Valves on the distribution mains shall be installed:

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

   b) At the projection of property lines at intersections.

2. Distribution main 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 effect a shutdown.

   c) No more than one standard City block is taken out of service by a shutdown.

   d) Valves shall be installed in accordance with Standard Drawing No. U6.

3.5.0 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 450 mm.

3. Type B bedding as per Standard Drawing No. U7.

4. Backfilling shall be carried out with selected native material in 300 mm layers to a minimum of 98% Standard Proctor Density.

5. Backfilling in existing hard surfaced areas shall be carried out with granular material in 150 mm layers compacted to a minimum of 98% Standard Proctor.

3.6.0 THRUST BLOCKS

1. Thrust blocks shall be provided as per Standard. Drawing. No. U8.

3.7.0 DISINFECTION

1. All the watermains shall be disinfected in accordance with A.W.W.A. Specification C651, latest revision thereof.

2. The City shall be notified at least twenty four (24) hours prior to testing so they may witness the residual chlorine test and the sampling for the bacteriological test.

3. Minimum residual chlorine after twenty four (24) hours shall be 25 mg/L.

4. The line shall be flushed and the chlorine residual of the water being disposed neutralized prior to discharge.

5. The bacteria test results must be reviewed and approved by the City Engineer prior to the waterline being placed into service.

3.7.1 Testing

1. The Developer shall employ a CSA approved material testing firm to complete the tests as outlined in Table 7.2. One copy of the results shall be submitted to the City for their review.

2. All watermains shall be tested in accordance with A.W.W.A. C603, latest revision thereof. Hydrostatic test pressure shall be 1035 Kpa (150 psi) or 1.5 times the normal operating pressure based upon the elevation of the lowest point in the main and corrected to elevation of the test gauge, for a period of two (2) hours. For P.V.C. pipe, the overall leakage for the section of line tested shall not exceed the rate of leakage specified in Table 3.1.

TABLE 3.1 Maximum Allowable Leakage (L/100 Joints/Hour) For P.V.C. Pipe

	Test Pressure								
	345	515	690	860	1035	1380	1550	1724	Kpa
Pipe Dia.	50	75	100	125	150	200	225	250	psi
100 mm (4")	1.46	1.77	2.00	2.28	2.46	2.90	3.07	3.28	
150 mm (6")	2.17	2.65	3.07	3.43	3.76	4.34	4.60	4.82	
200 mm (8")	2.90	3.54	4.09	4.57	5.02	5.79	6.14	6.46	
250 mm (10")	3.62	4.42	5.12	5.71	6.27	7.34	7.67	8.10	
300 mm (12")	4.34	5.30	6.14	6.86	7.52	8.69	9.20	9.7	
350 mm (14")	5.07	6.19	7.16	8.00	8.77	10.13	10.74		
400 mm (16")	5.79	7.07	8.19	9.14	10.03	11.58	12.27		

450 mm (18")	6.51	7.96	9.21	10.28	11.28	13.03	13.80		

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TABLE 3.1 (Continued)

Maximum Allowable Leakage (L/100 Joints/Hour) For P.V.C. Pipe

Allowable leakage calculation is based upon the following formula:

a) PVC pipe $L = \frac{ND(p^{0.5})}{128,320}$

L - allowable leakage in litres per hour
N - number of joints
D - nominal diameter (mm)
P - test pressure (kPa) (1.0 PSI = 6.9 kPa)

TABLE 3.2

National Fire Protection Association
Recommended Practice for Colour Coding Hydrants

- 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

END OF SECTION 3

SANITARY SEWERAGE SYSTEM SECTION 4

4.1.0 DESIGN FACTORS

1. The sanitary sewerage system shall be of sufficient capacity to carry peak flows plus infiltration. The following factors shall be used in design of sanitary sewerage systems:

   a) Residential

For future annexed areas	- 40 people/hectre
Population Density (based upon zoning)	- R1 – 2.8 people/unit - R2 – 2.8 people/unit - R3 – 2.5 people/unit - R4 – 2.0 people/unit
Average Sewage Flow	- 320 L/persons/d
Peaking Factor (Harmon's Formula)	- 2
Infiltration	- 0.28 L/s/ha and - 0.15 L/s per manhole or 0.4L/s per sag Manhole if frame & cover is a gasketted NF-90

   b) Commercial, Industrial and Institutional

Average Sewage Flow	- Commercial: 0.25 L/sec/ha
Peak Flow	- 2.0 x Average Flow
Infiltration	- 0.28 L/s/ha

Average Sewage Flow	- Industrial: 0.24 L/sec/ha – Peak 3
Peak Flow	- 2.0 x Average Flow
Infiltration	- 0.28 L/s/ha

2. Minimum Velocity - 0.61 m/s

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

4. Minimum pipe slopes shall be as recommended by Alberta Environment.

5. Sanitary sewers may have to be oversized to conform to the City's Master Sanitary Sewer Plan.

4.2.0 SANITARY SEWERMAINS - MATERIALS

1. **Sewermains**

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

   b) All sanitary sewer pipe and fittings shall be PVC to A.S.T.M. D3034 - minimum Class DR35

4.2.0 SANITARY SEWERMAINS – MATERIALS - CONTINUED

2. **Manholes – Materials**

   a) Manhole section shall be precast reinforced concrete sections conforming to A.S.T.M. C478, latest revision thereof.

   b) All manholes shall be 1200 mm inside diameter for all pipe 900 mm diameter and less. For pipe exceeding 900 mm diameter, manhole diameter shall be pipe diameter plus 600 mm.

   c) Manhole frames and covers shall be cast iron conforming to Class 20 A.S.T.M. A48, latest revision thereof. Manhole frame and covers to be type NF-39 in landscaped areas, type NF-80 in paved areas and type NF-90 gasketted in sags.

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

   e) Manhole bases shall be precast slabs, concrete poured bases, vaults or precast tees.

   f) Refer to Standard Drawing No's. U1 and U3.

3. Concrete for Manholes and Appurtenances

   Cement - 25 MP sulphate resistant cement (Type 50)
   Maximum Slump - 75 mm

4.3.0 SEWERMAIN INSTALLATION AND LOCATION

1. Mains shall be installed to provide a minimum depth of 3.0 m to obvert below final finished grade at the surface or shall be insulated to the satisfaction of the City Engineer.

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

3. Mains shall be located within the road right-of-way in accordance with the Roadway Cross Section Standard Drawing No.'s T2 to T11.

4. Pipe bedding shall be provided for all mains in accordance with Standard Drawing No. U7.

4.4.0 MANHOLE INSTALLATION AND LOCATION

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

2. The maximum distance between manholes shall not exceed 120 m.

3. Inverts in manholes at changes in direction shall have at least 60 mm fall across manhole.

4.4.0 MANHOLE INSTALLATION AND LOCATION - CONTINUED

4. Manholes shall be installed as shown on Standard Drawing No's U1 and U3.

5. All joints shall be watertight.

6. Make sag manholes water-tight and avoid them wherever possible.

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

4.5.0 CURVED SEWERS

1. Curved sewers will be permitted with the following restrictions:

   a) The sewer shall be laid as a simple curve with a radius equal to or greater than 90 m or the manufacturers 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 curve.

   d) The main shall run parallel to the curb or street centreline.

   e) The minimum grade for sewers on curve shall be 50% greater than the minimum grade required for straight runs of sewers.

4.6.0 TRENCHING AND BACKFILLING

1. Trenching and backfilling to be carried out in accordance with Occupational Health and Safety Guidelines.

2. Minimum width - single pipe

Pipe Diameter	Minimum Trench Width
Less than 750 mm diameter =	O.D. + 450 mm
750 mm diameter or larger =	O.D. + 600 mm

3. Backfilling shall be carried out with selected native material in 300 mm layers to a minimum of 98% Standard Proctor Density.

4. In existing hard surfaced areas backfilling shall be carried out with granular material in 150 mm layers to a minimum of 98% Standard Proctor.

4.7.0 INSPECTION AND TESTING

1. The Developer shall employ a CSA approved material testing firm to complete the tests as outlined in Table 7.2. One copy of the results shall be submitted to the City for their review.

2. Prior to initial and final acceptance of the project, all sewermains shall be tested as follows:

   a) Leakage Test
   The City may require each section of sewer main and service connections to be tested for watertightness by an exfiltration test and/or infiltration test.

   Infiltration or exfiltration shall not exceed following limits in litres per hour per 100 m of pipe, including service connections.

Nominal Pipe Diameter in mm	Allowable Leakage Plastic Pipe
100	3.88
150	5.51
200	7.45
250	9.39
300	11.33
350	13.27
400	14.91
450	16.84
500	18.78
550	20.72
600	22.80

2. a) Values shown in column 2 are in litres per hour per 100 metres of pipe.

   b) Light Test

   Each section of sewer shall be subjected to a light test where a light is shone into the pipe at one manhole and the light itself is visible at the other end. If a light test is unsuccessful, then the section shall be subjected to a "pill test" where a ball or similar object, of a diameter 50 mm less than the diameter of the pipe shall be successfully pulled through encountering no obstructions.

   c) Closed Circuit Television Inspection

   All sections of sanitary sewers shall be inspected with closed circuit television camera equipment. A written report and a video tape in VHS format shall be submitted to the City for their approval and records.

END OF SECTION 4

5.1.0 DESIGN FACTORS

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

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

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

4. Effluent from sanitary sewers and any drainage from industrial, agricultural or commercial operations that may potentially be contaminated shall not be discharged to the storm sewers. Roof leaders of residential buildings shall be splashed on the surface and shall not be connected to the storm sewer system.

5. Roof drainage from one-family and two-family dwellings shall discharge to grassed or pervious areas. The point of discharge shall be a sufficient distance (i.e. at least 1.0 m) to ensure the water flows away from the building. Roof drainage from apartment buildings, commercial areas, and industrial areas may discharge to the storm sewer if approved by the City Engineer.

6. Ponding of runoff on roofs, parking lots or landscaped areas to reduce runoff rates must be approved by the City Engineer.

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

8. All developments shall provide sump pumps to discharge weeping tile water to the surface.

   A sump pump discharge collection system is required in all new developing residential areas. The system shall be dedicated to the collection of weeping tile flows. Other storm water (ie: roof drains) will not be allowed to connect to the system.

   The system will be installed within the road right of way and will be connected to the storm sewer system at the manhole. The system must be provided to property line for all single family and multi-family units. The minimum pipe size shall be 200mm with the service connection a minimum size of 75mm. Material to be PVC SDR35.

5.1.0 DESIGN FACTORS - CONTINUED

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

a) For areas less than 65 ha the Rational Method of storm sewer system i.e.

$Q = 2.78\ CIA$

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

b) The five year rainfall intensity table shall be used as shown on Table 5.1

c) Runoff coefficients shall be according to Table 5.2.

d) The weighted average of pervious and impervious area runoff coefficients shall be estimated from the following equation:

$$C = \frac{C_p A_p + C_i A_i}{A_p + A_i}$$

Where the subscripts p and i indicate the pervious and impervious surfaces, respectively. In these standards Cp = 0.15 and Ci = 0.90.

e) The duration of rainfall used to determine the intensity is equal to the time of concentration. The time of concentration is comprised of the overland time to the storm sewer inlet and the time of travel in the conduit. The overland flow time to curbside in residential and commercial areas shall not exceed 10 minutes in duration (specific overland flow times shall be computed separately for industrial and undeveloped areas). Gutter flow time shall not exceed 5 minutes and shall be estimated based on methods outlined in "Modern Sewer Design" (AISI, 1980). The time of travel in the conduit shall be based on the pipe flow velocity.

9. For areas greater than 65 ha:

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

b) The selection of an appropriate computer model shall be based on an understanding of the principles, assumptions, and limitations in relation to the system being designed. Acceptable computer models are ILLUDAS, USEPA, SWMM, OTTSWM, HVM, HYMO and OTTHYMO.

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

5.1.0 DESIGN FACTORS - CONTINUED

9. d) The design storm hyetograph shall be the 30% distribution for the Prairie Provinces developed by Hogg of Atmospheric Environment Services of Environment Canada (Table 5.3). Alternatively, the Chicago method may be used to generate a synthetic design storm (using a time to peak ratio of 0.30 and a ratio of maximum 5 minute intensity to maximum one hour intensity of 3.0).

   e) The duration of event that is critical for systems comprised of pipes only shall be one hour. The duration of the design rainfall event for the systems with storage shall be at least twelve (12) hours. Longer durations shall be used, if necessary, to properly assess the post-event drainage of the detention facility.

10. The minimum velocity shall be 1 m/s. Where velocities in excess of 3 m/s are attained, special provisions shall be made to protect against displacement by erosion or impact.

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

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

13. Surface water shall not be permitted to run a distance greater than 250 m along local roadways without provision for interception by the first catch basin. Within the piped drainage system, or on Collectors or Arterial roadways, surface runoff shall not run a distance greater than 120 m without interception.

14. Surface water shall be intercepted with a sufficient number of catch basins such that the inlet capacity is sufficient to receive the design stormwater flow. Catch basin capacity shall be considered as shown on Table 5.4 where values are given for sag conditions and on slope conditions based upon inlet grate type.

15. Minimum gutter grade shall be 0.50%.

5.2.0 STORM SEWERMAINS - MATERIALS

1. Sewermains

a) The minimum size of storm sewermains shall be 300 mm diameter.

b) Pipe for storm sewermain may be:
- reinforced sulphate resistant concrete pipe to ASTM C76
- PVC pipe conforming to ASTM F794 minimum Class DR35
- Ultra Rib PVC pipe to ASTM D3034 minimum Class DR35
- Boss 2000 HDPE to ASTM D3350

c) Pipe joints shall be rubber ring conforming to CSA A257.3 and/or ASTM C443 for concrete and ASTM 03212 for PVC Pipe.

d) Pipe classes shall be determined to withstand subsequent superimposed loadings.

1. Sewermains - Continued

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

2. Manholes

a) Refer to Section 4.2.0.2 (Sanitary Sewer) and Standard Drawing No.'s U1 to U3.

b) Safety platforms at intermediate levels are required for manholes greater than 5.0 m in depth.

3. Catchbasins

a) Catchbasin barrels with precast base and precast slab top shall be:

i) 900 I.D. pipe barrel conforming to A.S.T.M. C478 (Standard Drawing No. U4)

ii) Catchbasin manholes shall be in accordance with Standard Drawing No. U2.

iii) Catchbasin manholes shall be used in place of a catchbasin when the lead exceeds 30 m in length.

iv) Catchbasins are to have 500 mm deep sumps.

b) Catchbasin frames and covers shall be:

i) Standard inlet for rolled curb and gutter equal to Norwood K7 or DK7.

ii) Standard frame, grate and side inlet for use with 900 mm barrel equal to Norwood F51 for straight faced curb and gutter.

iii) Top inlet standard round top equal to Norwood F38 for swales or lanes.

iv) Top inlet standard round top equal to Norwood F39 Grate for landscaped areas.

c) Catchbasin leads

i) Shall be non-reinforced concrete pipe A.S.T.M. C14 - Class 3 or approved PVC pipe.

ii) The minimum size of catchbasin lead shall be 250 mm diameter with a minimum grade of 2.0%.

iii) The minimum grade on a 300 mm catchbasin lead shall be 2.0%.

iv) Two catchbasins may be connected in series. The catchbasin lead connecting to the storm sewer manhole shall be 300 mm at a minimum slope of 2.0%.

3. Catchbasins - Continued

v) The maximum length of a catchbasin lead shall be 30 m.

vi) If a lead of over 30 m in length is required, a catchbasin manhole shall be installed at the upper end.

vii) Catchbasin leads shall have minimum cover of 1.2 m to invert.

5.3.0 STORM SEWER INSTALLATION AND LOCATION

1. Mains shall be installed to provide a minimum depth to pipe obvert of 1.85 m below final finished grade.

2. Mains shall be located within the road right-of-way in accordance with the Roadway Cross Sections Standard Drawing No.'s T2 to T11.

3. Pipe bedding shall be provided for all mains in accordance with Standard Drawing No. U7.

5.4.0 MANHOLE INSTALLATION AND LOCATION

1. Refer to Section 4.4.0 (Sanitary Sewer).

2. Manhole spacing on storm sewers greater than 750 mm in diameter may exceed 120 m if approved by the City Engineer.

3. Benching in manholes shall be provided to minimize hydraulic losses. The downstream invert in a manhole shall be a minimum of 30 mm lower than the lowest upstream invert. At a change in direction, the drop shall be at least 60 mm. If an influent pipe diameter is greater than 525 mm and the bend is greater than 45^{o} or if the outflow pipe velocity exceeds 1.5 m/s, then minor losses shall be considered (see AISI, 1980).

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

5.5.0 CURVED SEWERS

Refer to Section 4.5.0 (Sanitary Sewer).

5.6.0 TRENCHING AND BACKFILLING

Refer to Section 4.6.0 (Sanitary Sewer).

5.7.0 INSPECTION AND TESTING

Refer to Section 4.7.0 (Sanitary Sewer).

5.8.0 DETENTION FACILITIES

1. Detention facilities shall be designed as part of both the minor and major drainage systems. They must control the peak runoff conditions for events up to the 100 year return period.

2. Detention facilities and the entire area that would be submerged by the 100 year event shall be contained on City property. The need for a specific detention facility shall require the approval of the City Engineer. In assessing the need for specific detention facilities, the applicant must consider the impacts of uncontrolled drainage as well as the capital and operating costs of providing control.

3. Soils investigation specific to the detention facility shall be undertaken to determine appropriate design factors. Where the facility is sited above a shallow aquifer the potential for groundwater contamination must be minimized.

4. Wet pond detention facilities shall be constructed in impervious soils to minimize water losses during dry weather periods. Intruding silt or sand seams shall be sealed off.

5. Where a detention facility is to have multiple functions, its design shall consider the aesthetic implications of shape, grading and landscape features.

6. An emergency overflow system shall drain to a receiving stream, if possible, for storms greater than the 100 year event.

7. The effects of the maximum pond water levels shall be considered in the design of the minor system and lot grading. The hydraulic gradeline elevations for the minor system piping shall be calculated starting from the maximum pond level during the 5 year storm event.

8. The maximum water level fluctuation for detention ponds in residential areas during the 100 year storm event shall be 1.2 m. The pond's outlet capacity shall be that the pond shall drain and reach normal water level within 72 hours of reaching maximum water level during the 100 year event. All inhabited building space, including basements, shall be constructed above the 100 year flood level.

9. An overflow channel and overland drainage route must be provided to the satisfaction of the City Engineer and the design of the pond and permitted water level fluctuations must ensure that:

    a) The lowest basement weeping tile of any building on a lot adjacent to the lake shall be a minimum of 300 mm above the 1:100 year high water level.

    b) The lowest manhole invert shall be at or above the normal water level elevation.

    c) The pipe obvert at the lowest manhole immediately upstream of the pond shall be above the high water level during a one in five year storm event.

    d) A minimum distance of six metres shall be maintained from any basement wall to the 1 in 100 year high water level.

5.8.0 DETENTION FACILITIES - CONTINUED

e) The inlet to the pond must be above the normal water level or below ice level.

f) The minimum surface area at normal water level shall be 2 hectares.

g) The minimum depth of the pond, at normal water level, will be 2 metres.

h) The lake bottom and side slopes will be composed of an impervious material.

i) No dead bay areas will be permitted.

j) Shoreline improvements and erosion protection will be subject to review and approval by Leisure Services, the Development Officer and the City Engineer.

k) Any property situated below the 1:100 year high water level shall become the property of the City.

l) The design will incorporate a semi-annual turnover at average annual precipitation.

m) Pond geometrics will be as shown on Standard Drawing Number U11.

n) Submerged inlets/outlets are preferred and will be constructed such that the tops are a minimum of 0.6 m below normal water level.

o) Inlets/outlets not submerged will require fencing along adjacent shoreline for 5.0 m in each direction from the centre line of pipe. All inlets/outlets will be provided with a grate permanently fixed to the structure.

p) Every pond will be sterilized during construction to prevent weed growth.

q) Minimum width of the water surface at the normal water level will be 25 metres.

r) A silt trap will be provided at the inlet of each pond.

10. In design, dry ponds shall:

a) not exceed 1.5 m depth of water for the 1 in 100 year event,

b) have flow bypass for flows from minor events,

c) have a bottom with a minimum longitudinal slope of 1%,

d) have a bottom with a minimum lateral slope of 1.0%,

e) have a French drain where longitudinal slopes are less than 2%,

f) have side slopes flatter than 7 (horizontal) to 1 (vertical),

g) have length, width and depth dimensions that are acceptable to the City Engineer,

h) have the bottom and sides sodded or grassed as per Section 8,

i) have trash bars on inlets and outlets to preclude access by children,

5.8.0 DETENTION FACILITIES - CONTINUED

j) address all safety issues (particularly during operation),

k) have pond geometrics in accordance with Standard Drawing Number U12.

11. Underground storage tanks shall be considered only if no other economical alternative means of storage is feasible.

12. Parking lot and rooftop storage shall be considered only for developments where the facilities are part of the project and must be approved by the City Engineer. Proposals which rely on third party implementation will not be accepted.

13. Infiltration and evaporation facilities require studies which involve site specific measurements of infiltration, knowledge of the groundwater regime, and an evaluation of the water balance for the system.

5.9.0 OUTFALLS

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

2. The outfall structure may be a chute, spillway, stilling basin or plunge pool with headwall. A cut off wall is required at the end of the outfall apron to prevent undermining of the structure.

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

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

5. Rip rap and a filter layer shall be placed downstream of the outfall structure where required to prevent erosion.

6. Weeping tile shall be placed under the structure to reduce any water pressure behind the headwall.

7. Grills shall be placed over all storm sewer outlets to prevent access.

8. Railings shall be placed along the headwall and wingwalls of the outfall structure.

9. Outfalls shall be landscaped to blend in with surrounding areas.

5.10.0 RECEIVING WATERS

1. Measures shall be incorporated in new developments to prevent any increase in the amount of downstream erosion.

2. If a development will cause downstream erosion despite the use of on-site peak run-off rate controls, appropriate measures shall be constructed in the downstream areas.

3. Preservation of watercourse aesthetics and wildlife habitat shall be considered in erosion and bank stability work.

5.11.0 CULVERTS AND BRIDGES

Culverts and bridge design should consider backwater effects over a range of flows. The design of a hydraulic structure requires assessment of both its nominal design "capacity" and its performance during the 100 year event.

5.12.0 SURFACE DRAINAGE SWALES

Drainage swales, whether on municipal or private property (through drainage easements), shall be constructed completely prior to any development of subdivision lots. Drainage swales running between adjacent private lots shall be constructed of concrete to ensure lots are graded to the correct elevation.

Design and construction shall be of an acceptable quality to City requirements. A detailed design shall be submitted to the City including a brief explaining:

a) materials to be used, and

b) design calculations, and

c) explanation of design features which eliminate or minimize the possibility of damage to the drainage swale by activities within the subdivision.

5.13.0 MAJOR DRAINAGE SYSTEM ANALYSIS

1. The major drainage system shall be assessed with respect to the 1 in 100 year return period event.

2. The grading of streets and the layout of the major drainage system shall be assessed, relative to the following guidelines, during the 100 year event:

    a) No building shall be inundated at its ground line.

    b) Continuity of the overland flow routes between adjacent developments shall be maintained.

    c) Arterials should have at least two lanes which are not inundated parallel with the direction of flow. Where the major system crosses an arterial, the depth of flow should be less than 0.05 m.

    c) Collectors should have at least one lane which is not inundated parallel with the direction of flow. Where the major system crosses a collector; this depth of flow should be less than 0.10 m.

5.13.0 MAJOR DRAINAGE SYSTEM ANALYSIS - CONTINUED

e) Local roads should have a depth of water no more than 0.05 m above the crown. Where the major system crosses a local road, the depth of flow should be less than 0.15 m.

f) The depth of water at curbside should be less than 0.50 m for all roadways.

g) The velocities and depths of flow in the major drainage system shall not exceed the values outlined in Table 5.5

3. The grading of lots shall meet the following requirements:

1. The minimum slope in the back and front yards shall be 5% for the first 2 m away from the house and 2% for remainder.

2. If the back yard area slopes toward the house, provision must be made to keep the runoff at least 3 m from the house and direct it to the street.

3. Reverse driveways shall not be permitted unless the runoff can be directed away from the structure and off the property in a controlled fashion.

4. Lot grading must not direct drainage onto adjacent lots.

-Continued on Next Page-

TABLE 5.1
RAINFALL INTENSITIES
CAMROSE, ALBERTA

Duration (minutes)	Rainfall Intensity (mm/hr.)		
	5 Year	10 Year	100 Year
10	78	95	147
11	75	92	142
12	72	88	137
13	70	85	131
14	67	81	126
15	64	78	121
16	62	76	118
17	61	75	116
18	60	73	113
19	58	71	111
20	57	70	108
21	55	68	106
22	54	66	103
23	52	65	101
24	51	63	98
25	50	61	96
26	48	60	93
27	47	58	91
28	45	56	88
29	44	55	86
30	47.4	53	83
60	25.1	30.8	45.8
120	15.0	18.1	27.7
360	7.37	8.8	13.6
720	4.36	5.26	8.08
1440	2.64	3.17	4.85

Notes:
1. Based on AES data at Edmonton Municipal Airport for period 1914 to 1980 (66 years).
2. Maximum Initial Time of Concentration is 10 minutes.

TABLE 5.2
RECOMMENDED MINIMUM RUNOFF COEFFICIENTS

Land Use or Surface Characteristics	Rainfall Event Return Period		
	5 Year	10 Year	100 Year
Residential	0.40	0.40	0.60
Apartments[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 (Farmland)	0.10	0.15	0.20
Paved Streets	0.90	0.90	0.95
Gravel Streets	0.30	0.35	0.65

Notes:

1. Values are recommended minimum for use in the Rational Method.

2. Where specific land surfaces are known for Apartment and Commercial areas, the runoff coefficient may be determined based on the surface characteristics for the ultimate development conditions.

3. Runoff coefficients for industrial land use must be estimated based on ultimate land use condition.

TABLE 5.3
DESIGN STORM HYETOGRAPHS

1 Hour Design Storm			12 Hour Design Storm		
Period Ending (minutes)	**Cumulative Rain (%)**	**Discrete Rainfall (%)**	**Period Ending (hours)**	**Cumulative Rain (%)**	**Discrete Rainfall (%)**
0	0	0	0	0	0
5	12	12	1	15	15
10	32	20	2	34	19
15	54	22	3	51	17
20	74	20	4	66	15
25	85	11	5	83	17
30	90	5	6	90	7
35	95	5	7	96	6
40	98	3	8	98	2
45	99	1	9	100	2
50	100	1	10	100	0
55	100	0	11	100	0
60	100	0	12	100	0

Notes:

1. Data from Atmospheric Environment Services of Environment Canada.
2. Design storms are the 30% distributions for the Prairie Provinces.

TABLE 5.4
CATCHBASIN CAPACITIES (L/s)

Catch Basin	Flow Condition	
	Continuous Slope	Sag Condition
F35A	10	23
F38, F39	20	38
F51 (base and curb inlet)	40	80

Note:

1. Capacities can be considered to be double those shown in the table when assessing the 100 year event.

TABLE 5.5
PERMISSIBLE DEPTHS FOR SUBMERGED OBJECTS

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

Note:

Based on a 20 kg child and concrete lined channel. Larger persons may be able to withstand deeper flows.

END OF SECTION 5

6.1.0 SERVICE CONNECTIONS - MINIMUM REQUIREMENTS

1. The minimum size of service connections to a single family dwelling shall be as follows:

Sanitary Sewer	100 mm diameter
Water Service	25 mm diameter

2. The minimum grade on a sewer service shall be 2.0%.

3. Connection to a main sewer line shall be by means of a saddle at the top quadrant of the main.

4. Where bends are utilized, the long radius type or a combination of 22½ bends and straight pipe shall be used.

5. For water services size 50 mm and smaller, the tapping shall be at the 2 to 3 o'clock position on the distribution main.

6. Watermains shall be tapped under pressure if already in service.

7. All water services must utilize service clamps.

6.2.0 SANITARY SEWER SERVICE - MATERIALS

1. Service pipe shall be:

   a) PVC SDR 35 building service pipe conforming to CSA Specification B 182.1, latest revision thereof.

2. Service fittings shall be either in line tees or saddle tees c/w gasket and stainless steel straps and nuts.

6.3.0 WATER SERVICE - MATERIALS

1. Water service pipe shall be:

   a) Copper pipe type K soft copper.

   b) Couplings - standard brass compression type.

2. Water service fittings:

   a) Corporation Cocks - compression type, Ford or approved equal, AWWA thread.

   b) Curb Stops - Ford or approved equal, copper to copper, ball valve without a drain. Curb stops 38 mm or larger shall be ball bearing type.

   c) Service Boxes - Epoxy coated extension type for maximum extension of 3.5 m c/w stainless steel operating rod, brass clevis and key. Service box to be supported on a cast iron foot piece nailed to a pressure treated preserved wood plank.

6.3.0 WATER SERVICE – MATERIALS - CONTINUED

d) Service Clamps - Bronze double strap conforming to Smith-Blair 323 or approved stainless steel AWWA Boss.

6.4.0 SERVICE CONNECTIONS - INSTALLATION REQUIREMENTS

1. Where the water service is 50 mm or smaller in size, the water and sanitary services shall be installed in a common trench to the middle of each lot.

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

3. The minimum depth of cover over the water and sanitary services at the property line shall be 2.80 m and shall be in accordance with Standard Drawing No's. U9 and U10.

4. Where the sewer services are required to connect to mains in excess of 4.50 m deep, risers shall be installed to within 3.60 m of finished surface in accordance with Standard Drawing No. U9.

5. Corporation stops and curb stops shall be installed in accordance with Standard Drawing No. U10.

6. Where a copper service is installed, there shall be a horizontal bend near the corporation stop. Water service is ***NOT*** to be goosenecked. Service shall be snaked in the trench to allow for thermal contraction.

7. Curb stops shall be installed at property or easement line as shown on Standard Drawing No's U10 and T2 to T11.

6.4.0 SERVICE CONNECTIONS - INSTALLATION REQUIREMENTS

8. Sewer services shall be extended to the property or easement line as shown on Standard Drawing No. U9 and shall be properly capped.

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

10. Blue/Green painted stakes of size 50 mm x 100 mm shall be extended from the end of the service connections to a minimum of 0.50 m above the ground level.

11. The Developer shall employ a CSA approved material testing firm to complete the tests as outlined in Table 7.2. One copy of the results shall be submitted to the City for their review.

END OF SECTION 6

7.1.0 GEOMETRIC DESIGN STANDARDS

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

2. The following are general minimum requirements used in the design of the streets.

3. Street cross-sections shall be as defined by Table 7.1 & Standard Drawings No. T2-T11.

4. Concrete curb and gutter shall be constructed on all streets in accordance with Standard Drawing No.'s T14 and T15.

5. Separate sidewalks shall be 1.2 m wide and shall be constructed in accordance with Standard. Drawing. No. T20. Monolithic curb, gutter and sidewalks shall have a 1.25m sidewalk width in accordance with Standard Drawing No's T16 and T17. Sidewalks shall be clear of all obstructions including surface utilities. Sidewalk locations shall be in accordance with Standard Roadway Drawing No's. T2 through T11. Wider sidewalks may be required in areas of high pedestrian activity, as determined by the City Engineer.

6. Rear lanes (alleys) shall have a surfaced width of 5.0 m within a 6.0 m right-of-way. Where rear lane traffic activity is expected to be high, such as for certain commercial developments, a wider surfaced width and right-of-way may be required as determined by the City Engineer.

7. All driveways shall be constructed to give a minimum of 1.8 m clearance from any structure, e.g., hydrants, light standards, service pedestals and shall be constructed in accordance with Standard Drawing No.'s T19 and T20.

8. Paraplegic Ramps shall be constructed in accordance with Standard Drawing No. T18.

9. Follow "Accessibility Guidelines" Alberta Transportation and Utilities Publication (March 1996.)

7.2.0 VERTICAL ALIGNMENT

1. Minimum gutter grades around all curves and along all tangents shall not be less than 0.5%. Minimum gutter grades on curb returns shall be 0.6%.

2. Maximum gutter grades shall not exceed those defined by Table 7.1.

3. All roadways shall be crowned or shall have a crossfall as shown on the applicable standard drawings. The standard crossfall rate is 2.5%.

4. All vertical curves shall be designed to meet or exceed the following minimum requirements:

7.2.0 VERTICAL ALIGNMENT - CONTINED

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

K = L/A
L = length of vertical curve in metres
A = Algebraic difference in grades percent
* = based on comfort control and assumes street lighting

5. The maximum superelevation is shown in Table 7.1.

6. Rear lane (alleys) shall have a minimum longitudinal grade of 0.6%. If gravel-surfaced, the lanes shall be cross sloped on one side at 3.0%. If paved, the lane shall have a centre swale and cross slopes of 2.5%.

7.3.0 HORIZONTAL ALIGNMENT

1. The minimum radius is relative to the Road Classification, the design speed and the maximum superelevation (See Table 7.1)

2. All horizontal curves shall be designed to meet the minimum design requirements shown in Table 7.1.

3. Minimum edge of pavement radius for cul-de-sacs is 11 m in residential areas and 14 m in industrial areas.

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

7.3.1 Curb Returns

1. Curb returns at residential local street intersections shall be constructed to a radius of 7.5 m.

2. Curb returns at residential collector street intersections shall be constructed to a radius of 12.5 m.

3. In industrial/commercial areas the radius should be 15 m to accommodate truck turning movements.

4. For arterial street intersections the curb returns shall be designed in consideration of the type and volume of the turning traffic. Two and three centered curves with or without islands may be required.

7.3.1 Curb Returns - Continued

5. Paraplegic Ramps are required at all intersections which have sidewalks.

7.4.0 PAVEMENT STRUCTURE

1. All roadways (including lanes) shall be paved with hot mix asphalt. A geotechnical report with recommended pavement designs shall be conducted by a Professional Engineer employed by a recognized engineering agency, and submitted to the City Engineer for review.

2. Paved roadways shall be designed in accordance with the Asphalt Institute method of pavement design using minimum design loadings of 8165 kg (18,000 pound) axle loads for local streets and 10,886 kg (24,000 pound) axle loads for collector streets. All industrial/commercial roads shall be designed using a minimum design loading of 10,886 kg (24,000 pound) axle loads. The design parameters such as traffic count, percentage of trucks, California Bearing Ratio (CBR), etc., are to be outlined to the City Engineer. The City reserves the right to request the Developer to engage a geotechnical engineering agency to carry out CBR tests on the subgrade prior to paving to confirm adequacy of design.

3. The following are the minimum pavement structure requirements. An independent pavement design, as outlined in 7.4.1 and 7.4.2, is required for all developments. Additional pavement structure strengths and/or materials may be required in areas with poor subgrade materials pending the results of the geotechnical investigation.

7.4.0 PAVEMENT STRUCTURE - CONTINUED

Street	Residential Land Use	Industrial/Commercial Land Use
Local	150 mm Subgrade Prep. to 100% SPD 250 mm Aggregate Base Course 90 mm Asphaltic Concrete Surface (Light Duty)-2 lifts 50mm/40mm final*	300 mm Subgrade Prep. to 100% SPD 300 mm Aggregate Base Course 100 mm Asphaltic Concrete Surface (Heavy Duty)
Collector	150 mm Subgrade Prep. to 100% SPD 300 mm Aggregate Base Course 100 mm Asphaltic Concrete Surface (Heavy Duty)	300 mm Subgrade Prep. to 100% SPD 350 mm Aggregate Base Course 100 mm Asphaltic Concrete Surface (Heavy Duty)
Arterial	300 mm Subgrade Prep. to 100% SPD 350 mm Aggregate Base Course 125 mm Asphaltic Concrete Surface (Heavy Duty)	300 mm Subgrade Prep. to 100% SPD 350 mm Aggregate Base Course 125 mm Asphaltic Concrete Surface (Heavy Duty)

*Note: The final lift of asphaltic concrete shall be placed in the second year of the maintenance period.

4. Alternative pavement designs, such as soil cement base, may be approved by the City Engineer. Approval of alternate pavement designs must be obtained in writing from the City Engineer prior to submission of design drawings.

7.5.0 GRANULAR BASE

1. Gradations to be within the limits specified below when tested to ASTM C136 and ASTM C117 and yield a smooth curve without sharp breaks when plotted on a semi-log grading chart.

<u>20 mm Minus Gravel</u>

Sieve Size	% Passing by Weight
20 mm	100
12.5 mm	60 - 95
5.0 mm	35 - 65
2.00 mm	25 - 55
0.400 mm	10 - 30
0.800	2 – 10

7.5.0 GRANULAR BASE - CONTINUED

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

3. All granular materials should be compacted to 100% Standard Proctor Density.

7.6.0 ASPHALTIC CONCRETE PAVEMENT

7.6.1 Description

1. Asphaltic concrete pavements shall consist of mineral aggregate, filler and asphaltic binder, and shall be laid and compacted to 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 meet the following gradation.

Sieve Size	Cumulative % Passing by Weight	
	Light Duty	Heavy Duty
12.5 mm	100	100
10 mm	78 - 94	83 - 90
5 mm	53 - 80	55 - 70
2.5 mm	42 – 67	40 - 60
0.630 mm	24 – 44	18 - 38
0.315 mm	16 – 32	12 - 30
0.160 mm	08 – 22	08 - 18
0.080 mm	04 – 10	02 – 06
Min. % retained on 5 mm sieve having at least two fractured surfaces	70	70
Manufactured fines content, as a percentage of fine aggregate mass	N/A	75 min

7.6.2 Minerals - Continued

2. Asphaltic Binder

The asphaltic binder shall be uniform in character, shall not foam when heated to 177^0C and shall meet the following requirements:

Designation	150 - 200 (A)
Penetration at 250C, 100 gm., 5 sec.	150 - 200
Flash Point (C.O.C.) - 0C	205 min.
Ductility at 250C, - cm.	100 min.
Solubility in carbon tetrachloride - %	99.9 min.
Penetration after thin film oven test, at 250C - % of original	40 min.
Kinematic Viscosity in Centistokes @ 1350C	150 min.

7.6.3 Mix Design

A mix design shall be based on the Marshall Method and shall conform to the following criteria:

	Light Duty Mix	Heavy Duty Mix
Compaction Blows on each face of specimen	50	75
Minimum Marshall Stability @ 60^0C	4,500 N	6,700 N
Flow Value - mm	2 to 4	1.5 to 3
% Air Voids, Total Mix	3 to 5	3.5 to 4.5
% Voids in Mineral Aggregates	15 min	15 min
Asphalt Content, % of Total Mix	5 to 7	5 to 8
Retained Stability (%)	75 min	75 min

The mix design shall be carried out by an accredited testing agency and shall be submitted to the City Engineer for approval at least one week prior to commencement of work.

7.6.4 Final Density Requirements

1. All asphaltic concrete to be compacted to 98% of density obtained with Field Marshall specimens prepared from the samples of mixture being used.

7.6.4 Final Density Requirements

2. The City may decide to accept areas deficient in density if the City receives compensation in accordance to the following:

Density	Unit Price Compensation
97.50 to 97.99%	0
97.00 to 97.49%	1%
96.50 to 96.99%	4%
96.00 to 96.49%	9%
95.50 to 95.99%	16%
95.00 to 95.49%	25%
94.00 to 94.99%	100% (No Payment)
Less than 94.0%	Asphaltic concrete to be removed

3. No adjustment to the unit price to be made for areas with excess density.

4. The application of an adjusted unit price does not relieve the Developer of the Contract Maintenance requirements.

7.6.5 Asphalt Thickness Tolerances

1. All asphaltic concrete pavement to be of thickness indicated on the approved design drawings.

2. The City may accept areas deficient in thickness if the City receives compensation in accordance with the following:

    1. No adjustment in unit price for areas thicker than required.

    2. For areas deficient in thickness by more than 5% of the total design thickness and less than 15 mm, the unit price is to be adjusted to the following formula:

$$\frac{\text{Adjusted Unit Price}}{\text{Contract Unit Price}} = \frac{(\text{Actual Thickness})^2}{(\text{Specified Thickness})^2}$$

    3. Areas deficient in thickness by more than 15 mm to be rejected.

7.6.6 Staged Asphalt Construction

1. All roadways shall be constructed with the final surface lift placed in the year the subdivision is eligible for Final Acceptance. The City may accept cash-in-lieu for the final lift of asphalt if significant development has not occurred at the time of Final Acceptance.

2. Asphalt placement shall bring the roadway to its original design crown as shown the approved engineering drawings.

3. The final surface lift shall be placed after the concrete deficiencies are rectified.

7.6.6 Staged Asphalt Construction - Continued

4. An additional one (1) year materials and workmanship warranty shall be required for the final lift after the Final Acceptance Certificate is issued for surface improvements.

7.7.0 PRIME COATS AND TACK COATS

7.7.1 Description

Prime coats shall be the application of bituminous material to subgrade on previously prepared gravel base course prior to placing bituminous surfacing materials.

Tack coats shall be the application of bituminous material to a previously constructed paving surface of any type in preparation of placing bituminous surfacing materials, and against curb gutter faces, manholes, valves and other appurtenances in the street to be paved.

7.7.2 Prime Coat (Over Granular Base)

The bituminous material for priming the base course shall be liquid asphalt. The asphalt types may vary from M.C. 30 to M.C. 250; from SS-1 to a special emulsified primer (S.E.P.1) to suit the conditions of the base. The rate of application may vary from 0.50 to 1.50 L/m^2 based on the nature of the base materials. The rate should permit a good penetration of the base without ponding on the surface. Excess asphalt materials remaining 6 hours after application shall be absorbed and removed with sand blotter material. Temperature of application shall fall within the following limits:

Medium Curing Asphalt:
M.C. 30 - (51^0C - 68^0C)
M.C. 70 - (74^0C - 88^0C)
M.C. 250 - (100^0C - 110^0C)

Emulsified Asphalt:
SS-1- (24^0C - 54^0C)
S.E.P.1 (15^0C - 50^0C)

7.7.3 Tack Coat (Over Asphalt Base)

The asphalt for the tack coat may vary from SS-1 to SS-1H; from R.C. 30 to R.C. 250 depending on conditions to suit the base. The SS emulsion shall be diluted by adding an equal amount of water prior to application. The rate of application shall be 0.25 to 0.90 L/m^2 , based on the condition of the asphalt base. The rate shall ensure that a uniform coverage providing a good bond, after curing, is achieved. Temperatures of application shall fall within the following limits:

Rapid Curing Asphalts:	Emulsified Asphalt:
R.C 30 - (51^0C - 68^0C)	SS-1 - (24^0C - 54^0C)
R.C. 70 - (74^0C - 88^0C)	SS1H - (24^0C - 54^0C)

7.8.0 CONCRETE FLATWORK

7.8.1 Description

Curb, gutter and sidewalk shall consist of concrete placed to conform to the approved lines, grades and typical cross sections.

7.8.2 Minerals

1. Portland Cement

Portland cement shall conform to A.S.T.M. C150 or CSA Standard A5, latest revision thereof.

2. Aggregates

Concrete aggregates shall conform to A.S.T.M. Specification C33, latest revision thereof.

3. Air Entraining Agent

An air entraining agent conforming to A.S.T.M. C260 shall be added to all concrete in sufficient amounts to produce air entrainment between limits of 5.5% to 8%.

4. Calcium Chloride

The use of calcium chloride will not be permitted except during cold weather conditions when a maximum of 2%, by weight of cement, will be allowed with Type 10 concrete.

5. Curing Compound

Curing compound shall be a resin base impervious membrane and shall conform to A.S.T.M. C309 Type 1D - Type B. It shall be sufficiently free from permanent colour to result in no profound change in colour from that of natural concrete. The compound shall however contain a dye of colour strength sufficient to render the film distinctly visible on the concrete for a period of at least four (4) hours after application.

6. Fly Ash

The maximum fly ash content is 10% by mass of cement. No fly ash permitted after September 1st.

7.8.3 Mix Design

1. The concrete for curb, gutter and sidewalk shall meet the following requirements:

Minimum Compressive Strength at 28 days	30 Mpa
Maximum Size of Coarse Aggregate	20 mm
Slump	25 mm -100 mm
Entrained Air Content	5.5% to 8%

7.8.3 Mix Design - Continued

2. After September 30th, all concrete shall attain the specified 28 day strength in seven (7) days.

7.8.4 Placing of Concrete

1. The subgrade shall be compacted to a minimum of 100% Standard Proctor Density under curbs, driveways, and swales in travelled areas and to 95% Standard Proctor Density under sidewalks.

2. Concrete shall be placed and vibrated to form curbs, gutters and sidewalks in accordance with the Standard Drawings.

3. The backfilling behind curb, gutter and sidewalk shall be carried out immediately after form removal and shall be compacted to a minimum of 95% Standard Proctor Density.

7.8.5 Concreting in Cold Weather

When the mean average temperature is below 5^0C, suitable means shall be provided for maintaining the concrete at a temperature of at least 10^0C for seven (7) days after placing of concrete.

7.9.0 TESTING AND INSPECTION

The Developer shall employ a CSA approved material testing firm to complete the tests as outline in Table 7.2. One copy of all test results shall be submitted to the City for their review.

7.10.0 TRAFFIC CONTROL DEVICES, STREET NAME SIGNS AND PAVEMENT MARKINGS

1. Plans shall be provided to the City Engineer which depict the locations and details of all traffic control devices (traffic signs and traffic signals), street name signs and pavement markings.

2. All traffic control devices and pavement markings shall be designed and installed in accordance with the manual "Uniform Traffic Control Devices for Canada" as issued and revised from time to time by the Transportation Association of Canada (formerly RTAC).

3. Guide and information signing shall be designed and installed in accordance with the "Urban Guide and Information Sign Manual" as issued by the Alberta Government.

4. Street signing shall be standard aluminum, white on green, with a minimum vertical dimension of 150 mm.

7.10.1 Materials

1. All signs shall utilize "diamond grade" reflectorized material.

2. All sign posts shall be 50 mm diameter galvanized schedule 40 steel post unless otherwise approved by the City Engineer.

3. Along arterial streets, and at arterial street intersections, pavement markings shall be of a "permanent" type, inlaid with the final asphaltic concrete surface course. Painted markings are acceptable elsewhere.

7.10.2 Installation

1. All traffic control signs shall be mounted to provide 2.0 m vertical clearance to the lowest portion of the sign, unless otherwise approved by the Engineer.

2. All signs shall be mounted to provide a minimum of 0.3 m of horizontal clearance from curb face.

7.11.0 STREET LIGHTING

7.11.1 General

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

2. All street lighting cables shall be installed underground.

7.11.2 Design

1. Street lighting posts with fixtures shall be steel posts comparable to the existing posts within the City for the several types of streets.

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7.11.2 Design - Continued

2. The location and density of street lights shall be such to provide the following minimum lighting levels. (Reductions in lighting levels in residential and industrial areas permitted upon City Engineer approval.)

Roadway Class	Area Class	Illuminance Average (lux)	Criteria Uniformity Maximum Avg/Min Ratio	Maximum Max/Min Ratio
Arterial	Downtown	22	3:1	6:1
	Commercial	17	3:1	6:1
	Residential	12	3:1	6:1
	Industrial	9	3:1	6:1
Collector	Downtown	17	3:1	6:1
	Commercial	13	3:1	6:1
	Residential	10	3:1	6:1
	Industrial	6	3:1	6:1
Local	Downtown	12	3:1	6:1
	Commercial	10	3:1	6:1
	Residential	6	6:1	12:1
	Industrial	6	6:1	12:1
Lane	Downtown	6	6:1	10:1
	Commercial	6	6:1	10:1
	Residential	4	6:1	10:1

3. Street lighting fixtures shall be high pressure sodium type.

4. Street lighting design shall be approved by Aquila Networks Canada.

7.11.3 Location

1. The Developer shall co-ordinate the location of street lights to ensure that they do not interfere with the other utilities and driveways.

2. Street lights shall be offset from roadway and sidewalks in accordance with current practice, as established by Aquila Networks Canada.

3. Street lights shall be provided for each internal park area that does not abut onto a lighted street. A street light shall be located at the point where each walkway opens out onto the park area where possible.

4. All street light standards shall be galvanised in a manner comparable to the existing standards within the City.

5. All street lighting will be installed under the "Investment" option (i.e., Aquila Networks Canada has investment in lighting system).

7.11.4Costs

1. Any capital contribution that the utility company may charge for

installation of underground street lighting shall be paid by the Developer.

2. The Developer shall pay all charges to the utility company for the operation and maintenance of street lights installed in the subdivision until occupancy of 50% of the subdivision area has been reached. At that time, the City will assume payment of operation and maintenance charges to the utility company.

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TABLE 7.1
SUMMARY OF RECOMMENDED DESIGN STANDARDS FOR STREETS

Classification	Traffic Volumes (vpd)	Design Speed[a] (km/h)	Right-of-Way Width (m)	Pavement Widths (m)	Travel Lanes[c]	Parking Lanes	Ma Gr
Undivided Arterials Divided Arterials	5,000-12,000 12,000-30,000	60 – 70 60 – 90	30.0 33.0[b]	14.8 20.3	4 - 3.7 m 4 - 3.7 m	outside lanes none	
Major Residential Collector	2,500-5,000	60	24.0	12.0	2 - 3.5 m	2 - 2.50 m	
Minor Residential Collector	1,000-2,500	60	20	10.0	N/A	N/A	
Local Residential	Up to 1,000	60	18.0[g]	9.0	N/A	N/A	
Local Industrial	N/A	60	18.5[d]	11.5	N/A	Optional	
Industrial Collector	N/A	60 – 70	24.0	13.0	N/A	Optional	

TABLE 7.1
SUMMARY OF RECOMMENDED DESIGN STANDARDS FOR STREETS (Continued)

Classification	Minimum Radius of Curvature (m)	Minimum Intersection Spacing (m)	Minimum Corner Cuts at Intersections	Sidewalks	Lighting Poles and Other Obstructions
Undivided Arterials	170	150	30 m Radius	Separate, 1 or 2 sides	2.5 m min. from face of curb or behind sidewalk
Divided Arterials	190	200		Separate, 1 or 2 sides	2.5 m min. from face of curb or behind sidewalk
Minor and Major Residential Collectors	150	60	10 m	Separate or Mono, both sides	2.0 m min. from face of curb
Local Residential	90	60	6 m	Mono, both sides	2.2 m min. from face of curb
Local Industrial	90	60	6 m	Optional	1.65 m min. from face of curb
Industrial Collector	150	60	10 m	Optional	2.25 m min. from face of curb

Notes:
a. Posted speed to be 10 km/h less than design speed.
b. Land for noise attenuation will be in addition to the road right-of-way requirement.
c. Additional travel lane width may be required to accommodate cyclists, e.g. on arterials the outside lanes are 4.2 m wide.
d. Additional right-of-way required where rural roadway cross section is used for initial stage.
e. Prohibited for residential land uses.
f. Rear lane (alley) access preferred.
g. Narrower R.O.W. may be allowed for short cul-de-sacs or restricted access areas.

TEST FREQUENCY

Specification	Type of Test	Recommended Test Frequency
Trenching, Backfilling Trenching, Backfilling & Compaction for Electrical Installation	Density Test: - Trench longer than 15 m - Trench shorter than 15 m	 2 tests per 600 mm of depth for every 100 m of trench length 3 tests per trench
Roadway Excavation, Backfill & Compaction	Grading/Fill Compaction: Subgrade Preparation Proof Rolling:	1 density test per 2000 sq.m of compacted lift 1 density test per 100 sq.m of compacted subgrade lift Entire project
Aggregate: General Granular Sub-base Granular Base	Source Sampling: Compaction: Proof Rolling:	1 sieve analysis per 500 tonnes of asphalt aggregate for crushing control 1 sieve analysis per 2500 tonnes of base and subbase aggregate 1 density test per 1500 sq.m of compacted granular lift of road Entire project
Stabilization: Lime	Source Sampling: Test Area: Proof Rolling:	 400 sq.m to establish and demonstrate work methods and timing At completion of curing period
Soil Cement	Source Sampling (aggregate): Mix Design: Thickness Test: Compaction Test: Strength Test:	1 sieve analysis per 2500 tonnes 1 core sample per 1000 sq.m of soil cement in place 1 density test per 1000 sq.m of soil cement in place 1 7-day compressive strength test per 1000 tonne of soil cement
Topsoil	Topsoil Analysis: - On-site Sources - Contractor Supplied	1 analysis report for each topsoil source Contractor to supply 1 litre sample of each topsoil type for testing
Asphaltic Concrete Paving	Mix design: Density/Thickness Test: Mix Proportions:	 3 cores per 600 tonnes of asphalt pavement 1 Marshall core per 600 tonnes of mix, with a minimum of 1 test from each fu day's production
Watermain	Hydrostatic/Leakage Test: * Bacteria/Chlorine Test *	 Test section not to exceed 365 m in length
Storm Sewer Sanitary Sewer	Television and Photographic Inspections:	 Upon completion of storm sewer installation, after backfilling
Forcemains	Hydrostatic/Leakage Test: *	 Test section not to exceed 365 m in length
Concrete Curbs & Gutters, Walks, Medians, Driveways & Swales General Concrete Slip Formed Concrete	Mix Design: Slump Test: Air Content Test: Strength Test:	 1 per 20 cu.m for each class of concrete poured, min. 1 per day 1 per 20 cu.m for each class of concrete poured, min. 1 per day 1 per 20 cu.m for each class of concrete poured, min. 1 per day

* Tests to be witnessed by City

END OF SECTION 7

7.1.0 GEOMETRIC DESIGN STANDARDS

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

2. The following are general minimum requirements used in the design of the streets.

3. Street cross-sections shall be as defined by Table 7.1 & Standard Drawings No. T2-T11.

4. Concrete curb and gutter shall be constructed on all streets in accordance with Standard Drawing No.'s T14 and T15.

5. Separate sidewalks shall be 1.2 m wide and shall be constructed in accordance with Standard. Drawing. No. T20. Monolithic curb, gutter and sidewalks shall have a 1.25m sidewalk width in accordance with Standard Drawing No's T16 and T17. Sidewalks shall be clear of all obstructions including surface utilities. Sidewalk locations shall be in accordance with Standard Roadway Drawing No's. T2 through T11. Wider sidewalks may be required in areas of high pedestrian activity, as determined by the City Engineer.

6. Rear lanes (alleys) shall have a surfaced width of 5.0 m within a 6.0 m right-of-way. Where rear lane traffic activity is expected to be high, such as for certain commercial developments, a wider surfaced width and right-of-way may be required as determined by the City Engineer.

7. All driveways shall be constructed to give a minimum of 1.8 m clearance from any structure, e.g., hydrants, light standards, service pedestals and shall be constructed in accordance with Standard Drawing No.'s T19 and T20.

8. Paraplegic Ramps shall be constructed in accordance with Standard Drawing No. T18.

9. Follow "Accessibility Guidelines" Alberta Transportation and Utilities Publication (March 1996.)

7.2.0 VERTICAL ALIGNMENT

1. Minimum gutter grades around all curves and along all tangents shall not be less than 0.5%. Minimum gutter grades on curb returns shall be 0.6%.

2. Maximum gutter grades shall not exceed those defined by Table 7.1.

3. All roadways shall be crowned or shall have a crossfall as shown on the applicable standard drawings. The standard crossfall rate is 2.5%.

4. All vertical curves shall be designed to meet or exceed the following minimum requirements:

7.2.0 VERTICAL ALIGNMENT - CONTINED

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

K = L/A
L = length of vertical curve in metres
A = Algebraic difference in grades percent
* = based on comfort control and assumes street lighting

5. The maximum superelevation is shown in Table 7.1.

6. Rear lane (alleys) shall have a minimum longitudinal grade of 0.6%. If gravel-surfaced, the lanes shall be cross sloped on one side at 3.0%. If paved, the lane shall have a centre swale and cross slopes of 2.5%.

7.3.0 HORIZONTAL ALIGNMENT

1. The minimum radius is relative to the Road Classification, the design speed and the maximum superelevation (See Table 7.1)

2. All horizontal curves shall be designed to meet the minimum design requirements shown in Table 7.1.

3. Minimum edge of pavement radius for cul-de-sacs is 11 m in residential areas and 14 m in industrial areas.

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

7.3.1 Curb Returns

1. Curb returns at residential local street intersections shall be constructed to a radius of 7.5 m.

2. Curb returns at residential collector street intersections shall be constructed to a radius of 12.5 m.

3. In industrial/commercial areas the radius should be 15 m to accommodate truck turning movements.

4. For arterial street intersections the curb returns shall be designed in consideration of the type and volume of the turning traffic. Two and three centered curves with or without islands may be required.

7.3.1 Curb Returns - Continued

5. Paraplegic Ramps are required at all intersections which have sidewalks.

7.4.0 PAVEMENT STRUCTURE

1. All roadways (including lanes) shall be paved with hot mix asphalt. A geotechnical report with recommended pavement designs shall be conducted by a Professional Engineer employed by a recognized engineering agency, and submitted to the City Engineer for review.

2. Paved roadways shall be designed in accordance with the Asphalt Institute method of pavement design using minimum design loadings of 8165 kg (18,000 pound) axle loads for local streets and 10,886 kg (24,000 pound) axle loads for collector streets. All industrial/commercial roads shall be designed using a minimum design loading of 10,886 kg (24,000 pound) axle loads. The design parameters such as traffic count, percentage of trucks, California Bearing Ratio (CBR), etc., are to be outlined to the City Engineer. The City reserves the right to request the Developer to engage a geotechnical engineering agency to carry out CBR tests on the subgrade prior to paving to confirm adequacy of design.

3. The following are the minimum pavement structure requirements. An independent pavement design, as outlined in 7.4.1 and 7.4.2, is required for all developments. Additional pavement structure strengths and/or materials may be required in areas with poor subgrade materials pending the results of the geotechnical investigation.

7.4.0 PAVEMENT STRUCTURE - CONTINUED

Street	Residential Land Use	Industrial/Commercial Land Use
Local	150 mm Subgrade Prep. to 100% SPD 250 mm Aggregate Base Course 90 mm Asphaltic Concrete Surface (Light Duty)-2 lifts 50mm/40mm final*	300 mm Subgrade Prep. to 100% SPD 300 mm Aggregate Base Course 100 mm Asphaltic Concrete Surface (Heavy Duty)
Collector	150 mm Subgrade Prep. to 100% SPD 300 mm Aggregate Base Course 100 mm Asphaltic Concrete Surface (Heavy Duty)	300 mm Subgrade Prep. to 100% SPD 350 mm Aggregate Base Course 100 mm Asphaltic Concrete Surface (Heavy Duty)
Arterial	300 mm Subgrade Prep. to 100% SPD 350 mm Aggregate Base Course 125 mm Asphaltic Concrete Surface (Heavy Duty)	300 mm Subgrade Prep. to 100% SPD 350 mm Aggregate Base Course 125 mm Asphaltic Concrete Surface (Heavy Duty)

*Note: The final lift of asphaltic concrete shall be placed in the second year of the maintenance period.

4. Alternative pavement designs, such as soil cement base, may be approved by the City Engineer. Approval of alternate pavement designs must be obtained in writing from the City Engineer prior to submission of design drawings.

7.5.0 GRANULAR BASE

1. Gradations to be within the limits specified below when tested to ASTM C136 and ASTM C117 and 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 mm	100
12.5 mm	60 - 95
5.0 mm	35 - 65
2.00 mm	25 - 55
0.400 mm	10 - 30
0.800	2 – 10

7.5.0 GRANULAR BASE - CONTINUED

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

3. All granular materials should be compacted to 100% Standard Proctor Density.

7.6.0 ASPHALTIC CONCRETE PAVEMENT

7.6.1 Description

1. Asphaltic concrete pavements shall consist of mineral aggregate, filler and asphaltic binder, and shall be laid and compacted to 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 meet the following gradation.

Sieve Size	Cumulative % Passing by Weight	
	Light Duty	Heavy Duty
12.5 mm	100	100
10 mm	78 - 94	83 - 90
5 mm	53 - 80	55 - 70
2.5 mm	42 – 67	40 - 60
0.630 mm	24 – 44	18 - 38
0.315 mm	16 – 32	12 - 30
0.160 mm	08 – 22	08 - 18
0.080 mm	04 – 10	02 – 06
Min. % retained on 5 mm sieve having at least two fractured surfaces	70	70
Manufactured fines content, as a percentage of fine aggregate mass	N/A	75 min

7.6.2 Minerals - Continued

2. Asphaltic Binder

The asphaltic binder shall be uniform in character, shall not foam when heated to 177^0C and shall meet the following requirements:

Designation	150 - 200 (A)
Penetration at 250C, 100 gm., 5 sec.	150 - 200
Flash Point (C.O.C.) - 0C	205 min.
Ductility at 250C, - cm.	100 min.
Solubility in carbon tetrachloride - %	99.9 min.
Penetration after thin film oven test, at 250C - % of original	40 min.
Kinematic Viscosity in Centistokes @ 1350C	150 min.

7.6.3 Mix Design

A mix design shall be based on the Marshall Method and shall conform to the following criteria:

	Light Duty Mix	Heavy Duty Mix
Compaction Blows on each face of specimen	50	75
Minimum Marshall Stability @ 60^0C	4,500 N	6,700 N
Flow Value - mm	2 to 4	1.5 to 3
% Air Voids, Total Mix	3 to 5	3.5 to 4.5
% Voids in Mineral Aggregates	15 min	15 min
Asphalt Content, % of Total Mix	5 to 7	5 to 8
Retained Stability (%)	75 min	75 min

The mix design shall be carried out by an accredited testing agency and shall be submitted to the City Engineer for approval at least one week prior to commencement of work.

7.6.4 Final Density Requirements

1. All asphaltic concrete to be compacted to 98% of density obtained with Field Marshall specimens prepared from the samples of mixture being used.

7.6.4 Final Density Requirements

2. The City may decide to accept areas deficient in density if the City receives compensation in accordance to the following:

Density	Unit Price Compensation
97.50 to 97.99%	0
97.00 to 97.49%	1%
96.50 to 96.99%	4%
96.00 to 96.49%	9%
95.50 to 95.99%	16%
95.00 to 95.49%	25%
94.00 to 94.99%	100% (No Payment)
Less than 94.0%	Asphaltic concrete to be removed

3. No adjustment to the unit price to be made for areas with excess density.

4. The application of an adjusted unit price does not relieve the Developer of the Contract Maintenance requirements.

7.6.5 Asphalt Thickness Tolerances

1. All asphaltic concrete pavement to be of thickness indicated on the approved design drawings.

2. The City may accept areas deficient in thickness if the City receives compensation in accordance with the following:

    1. No adjustment in unit price for areas thicker than required.

    2. For areas deficient in thickness by more than 5% of the total design thickness and less than 15 mm, the unit price is to be adjusted to the following formula:

$$\frac{\text{Adjusted Unit Price}}{\text{Contract Unit Price}} = \frac{(\text{Actual Thickness})^2}{(\text{Specified Thickness})^2}$$

    3. Areas deficient in thickness by more than 15 mm to be rejected.

7.6.6 Staged Asphalt Construction

1. All roadways shall be constructed with the final surface lift placed in the year the subdivision is eligible for Final Acceptance. The City may accept cash-in-lieu for the final lift of asphalt if significant development has not occurred at the time of Final Acceptance.

2. Asphalt placement shall bring the roadway to its original design crown as shown the approved engineering drawings.

3. The final surface lift shall be placed after the concrete deficiencies are rectified.

7.6.6 Staged Asphalt Construction - Continued

4. An additional one (1) year materials and workmanship warranty shall be required for the final lift after the Final Acceptance Certificate is issued for surface improvements.

7.7.0 PRIME COATS AND TACK COATS

7.7.1 Description

Prime coats shall be the application of bituminous material to subgrade on previously prepared gravel base course prior to placing bituminous surfacing materials.

Tack coats shall be the application of bituminous material to a previously constructed paving surface of any type in preparation of placing bituminous surfacing materials, and against curb gutter faces, manholes, valves and other appurtenances in the street to be paved.

7.7.2 Prime Coat (Over Granular Base)

The bituminous material for priming the base course shall be liquid asphalt. The asphalt types may vary from M.C. 30 to M.C. 250; from SS-1 to a special emulsified primer (S.E.P.1) to suit the conditions of the base. The rate of application may vary from 0.50 to 1.50 L/m^2 based on the nature of the base materials. The rate should permit a good penetration of the base without ponding on the surface. Excess asphalt materials remaining 6 hours after application shall be absorbed and removed with sand blotter material. Temperature of application shall fall within the following limits:

Medium Curing Asphalt:
M.C. 30 - (51^0C - 68^0C)
M.C. 70 - (74^0C - 88^0C)
M.C. 250 - (100^0C - 110^0C)

Emulsified Asphalt:
SS-1- (24^0C - 54^0C)
S.E.P.1 (15^0C - 50^0C)

7.7.3 Tack Coat (Over Asphalt Base)

The asphalt for the tack coat may vary from SS-1 to SS-1H; from R.C. 30 to R.C. 250 depending on conditions to suit the base. The SS emulsion shall be diluted by adding an equal amount of water prior to application. The rate of application shall be 0.25 to 0.90 L/m^2 , based on the condition of the asphalt base. The rate shall ensure that a uniform coverage providing a good bond, after curing, is achieved. Temperatures of application shall fall within the following limits:

Rapid Curing Asphalts:	Emulsified Asphalt:
R.C 30 - (51^0C - 68^0C)	SS-1 - (24^0C - 54^0C)
R.C. 70 - (74^0C - 88^0C)	SS1H - (24^0C - 54^0C)

7.8.0 CONCRETE FLATWORK

7.8.1 Description

Curb, gutter and sidewalk shall consist of concrete placed to conform to the approved lines, grades and typical cross sections.

7.8.2 Minerals

1. Portland Cement

Portland cement shall conform to A.S.T.M. C150 or CSA Standard A5, latest revision thereof.

2. Aggregates

Concrete aggregates shall conform to A.S.T.M. Specification C33, latest revision thereof.

3. Air Entraining Agent

An air entraining agent conforming to A.S.T.M. C260 shall be added to all concrete in sufficient amounts to produce air entrainment between limits of 5.5% to 8%.

4. Calcium Chloride

The use of calcium chloride will not be permitted except during cold weather conditions when a maximum of 2%, by weight of cement, will be allowed with Type 10 concrete.

5. Curing Compound

Curing compound shall be a resin base impervious membrane and shall conform to A.S.T.M. C309 Type 1D - Type B. It shall be sufficiently free from permanent colour to result in no profound change in colour from that of natural concrete. The compound shall however contain a dye of colour strength sufficient to render the film distinctly visible on the concrete for a period of at least four (4) hours after application.

6. Fly Ash

The maximum fly ash content is 10% by mass of cement. No fly ash permitted after September 1st.

7.8.3 Mix Design

1. The concrete for curb, gutter and sidewalk shall meet the following requirements:

Minimum Compressive Strength at 28 days	30 Mpa
Maximum Size of Coarse Aggregate	20 mm
Slump	25 mm -100 mm
Entrained Air Content	5.5% to 8%

7.8.3 Mix Design - Continued

2. After September 30th, all concrete shall attain the specified 28 day strength in seven (7) days.

7.8.4 Placing of Concrete

1. The subgrade shall be compacted to a minimum of 100% Standard Proctor Density under curbs, driveways, and swales in travelled areas and to 95% Standard Proctor Density under sidewalks.

2. Concrete shall be placed and vibrated to form curbs, gutters and sidewalks in accordance with the Standard Drawings.

3. The backfilling behind curb, gutter and sidewalk shall be carried out immediately after form removal and shall be compacted to a minimum of 95% Standard Proctor Density.

7.8.5 Concreting in Cold Weather

When the mean average temperature is below 5^0C, suitable means shall be provided for maintaining the concrete at a temperature of at least 10^0C for seven (7) days after placing of concrete.

7.9.0 TESTING AND INSPECTION

The Developer shall employ a CSA approved material testing firm to complete the tests as outline in Table 7.2. One copy of all test results shall be submitted to the City for their review.

7.10.0 TRAFFIC CONTROL DEVICES, STREET NAME SIGNS AND PAVEMENT MARKINGS

1. Plans shall be provided to the City Engineer which depict the locations and details of all traffic control devices (traffic signs and traffic signals), street name signs and pavement markings.

2. All traffic control devices and pavement markings shall be designed and installed in accordance with the manual "Uniform Traffic Control Devices for Canada" as issued and revised from time to time by the Transportation Association of Canada (formerly RTAC).

3. Guide and information signing shall be designed and installed in accordance with the "Urban Guide and Information Sign Manual" as issued by the Alberta Government.

4. Street signing shall be standard aluminum, white on green, with a minimum vertical dimension of 150 mm.

7.10.1 Materials

1. All signs shall utilize "diamond grade" reflectorized material.

2. All sign posts shall be 50 mm diameter galvanized schedule 40 steel post unless otherwise approved by the City Engineer.

3. Along arterial streets, and at arterial street intersections, pavement markings shall be of a "permanent" type, inlaid with the final asphaltic concrete surface course. Painted markings are acceptable elsewhere.

7.10.2 Installation

1. All traffic control signs shall be mounted to provide 2.0 m vertical clearance to the lowest portion of the sign, unless otherwise approved by the Engineer.

2. All signs shall be mounted to provide a minimum of 0.3 m of horizontal clearance from curb face.

7.11.0 STREET LIGHTING

7.11.1 General

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

2. All street lighting cables shall be installed underground.

7.11.2 Design

1. Street lighting posts with fixtures shall be steel posts comparable to the existing posts within the City for the several types of streets.

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7.11.2 Design - Continued

2. The location and density of street lights shall be such to provide the following minimum lighting levels. (Reductions in lighting levels in residential and industrial areas permitted upon City Engineer approval.)

Roadway Class	Area Class	Illuminance Average (lux)	Criteria Uniformity Maximum Avg/Min Ratio	Maximum Max/Min Ratio
Arterial	Downtown	22	3:1	6:1
	Commercial	17	3:1	6:1
	Residential	12	3:1	6:1
	Industrial	9	3:1	6:1
Collector	Downtown	17	3:1	6:1
	Commercial	13	3:1	6:1
	Residential	10	3:1	6:1
	Industrial	6	3:1	6:1
Local	Downtown	12	3:1	6:1
	Commercial	10	3:1	6:1
	Residential	6	6:1	12:1
	Industrial	6	6:1	12:1
Lane	Downtown	6	6:1	10:1
	Commercial	6	6:1	10:1
	Residential	4	6:1	10:1

3. Street lighting fixtures shall be high pressure sodium type.

4. Street lighting design shall be approved by Aquila Networks Canada.

7.11.3 Location

1. The Developer shall co-ordinate the location of street lights to ensure that they do not interfere with the other utilities and driveways.

2. Street lights shall be offset from roadway and sidewalks in accordance with current practice, as established by Aquila Networks Canada.

3. Street lights shall be provided for each internal park area that does not abut onto a lighted street. A street light shall be located at the point where each walkway opens out onto the park area where possible.

4. All street light standards shall be galvanised in a manner comparable to the existing standards within the City.

5. All street lighting will be installed under the "Investment" option (i.e., Aquila Networks Canada has investment in lighting system).

7.11.4Costs

1. Any capital contribution that the utility company may charge for

installation of underground street lighting shall be paid by the Developer.

2. The Developer shall pay all charges to the utility company for the operation and maintenance of street lights installed in the subdivision until occupancy of 50% of the subdivision area has been reached. At that time, the City will assume payment of operation and maintenance charges to the utility company.

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TABLE 7.1
SUMMARY OF RECOMMENDED DESIGN STANDARDS FOR STREETS

Classification	Traffic Volumes (vpd)	Design Speed[a] (km/h)	Right-of-Way Width (m)	Pavement Widths (m)	Travel Lanes[c]	Parking Lanes	Maximum Gradients (%)	Maximum Superelevation (m/m)
Undivided Arterials Divided Arterials	5,000-12,000 12,000-30,000	60 – 70 60 – 90	30.0 33.0[b]	14.8 20.3	4 - 3.7 m 4 - 3.7 m	outside lanes none	5 4	.04 - .06 .04 - .06
Major Residential Collector	2,500-5,000	60	24.0	12.0	2 - 3.5 m	2 - 2.50 m	7	.025 - .04
Minor Residential Collector	1,000-2,500	60	20	10.0	N/A	N/A	7	.025-.04
Local Residential	Up to 1,000	60	18.0[g]	9.0	N/A	N/A	8	.025
Local Industrial	N/A	60	18.5[d]	11.5	N/A	Optional	6	.025
Industrial Collector	N/A	60 – 70	24.0	13.0	N/A	Optional	6	.025

April/04

TABLE 7.1
SUMMARY OF RECOMMENDED DESIGN STANDARDS FOR STREETS (Continued)

Classification	Minimum Radius of Curvature (m)	Minimum Intersection Spacing (m)	Minimum Corner Cuts at Intersections	Sidewalks	Lighting Poles and Other Obstructions	Parking	Access
Undivided Arterials Divided Arterials	170 190	150 200	30 m Radius	Separate, 1 or 2 sides Separate, 1 or 2 sides	2.5 m min. from face of curb or behind sidewalk 2.5 m min. from face of curb or behind sidewalk	Restricted Prohibited	Restricted[e] Restricted[e]
Minor and Major Residential Collectors	150	60	10 m	Separate or Mono, both sides	2.0 m min. from face of curb	Permitted	Permitted[f]
Local Residential	90	60	6 m	Mono, both sides	2.2 m min. from face of curb	Permitted	Permitted
Local Industrial	90	60	6 m	Optional	1.65 m min. from face of curb	Optional	Permitted
Industrial Collector	150	60	10 m	Optional	2.25 m min. from face of curb	Optional	Some Restrictions

Notes:
a. Posted speed to be 10 km/h less than design speed.
b. Land for noise attenuation will be in addition to the road right-of-way requirement.
c. Additional travel lane width may be required to accommodate cyclists, e.g. on arterials the outside lanes are 4.2 m wide.
d. Additional right-of-way required where rural roadway cross section is used for initial stage.
e. Prohibited for residential land uses.
f. Rear lane (alley) access preferred.
g. Narrower R.O.W. may be allowed for short cul-de-sacs or restricted access areas.

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TEST FREQUENCY

Specification	Type of Test	Recommended Test Frequency	Remark:
Trenching, Backfilling Trenching, Backfilling & Compaction for Electrical Installation	Density Test: - Trench longer than 15 m - Trench shorter than 15 m	 2 tests per 600 mm of depth for every 100 m of trench length 3 tests per trench	Testing will vary with location of project and consequences of trench settlement.
Roadway Excavation, Backfill & Compaction	Grading/Fill Compaction: Subgrade Preparation Proof Rolling:	1 density test per 2000 sq.m of compacted lift 1 density test per 100 sq.m of compacted subgrade lift Entire project	
Aggregate: General Granular Sub-base Granular Base	Source Sampling: Compaction: Proof Rolling:	1 sieve analysis per 500 tonnes of asphalt aggregate for crushing control 1 sieve analysis per 2500 tonnes of base and subbase aggregate 1 density test per 1500 sq.m of compacted granular lift of road Entire project	Required 2 weeks prior to commencing work
Stabilization: Lime	Source Sampling: Test Area: Proof Rolling:	 400 sq.m to establish and demonstrate work methods and timing At completion of curing period	Required 2 weeks prior to commencing work
Soil Cement	Source Sampling (aggregate): Mix Design: Thickness Test: Compaction Test: Strength Test:	1 sieve analysis per 2500 tonnes 1 core sample per 1000 sq.m of soil cement in place 1 density test per 1000 sq.m of soil cement in place 1 7-day compressive strength test per 1000 tonne of soil cement	Required 2 weeks prior to commencing work Required 2 weeks prior to commencing work Areas suspected to have inadequate thickness
Topsoil	Topsoil Analysis: - On-site Sources - Contractor Supplied	1 analysis report for each topsoil source Contractor to supply 1 litre sample of each topsoil type for testing	 Required 4 weeks prior to commencing work
Asphaltic Concrete Paving	Mix design: Density/Thickness Test: Mix Proportions:	 3 cores per 600 tonnes of asphalt pavement 1 Marshall core per 600 tonnes of mix, with a minimum of 1 test from each full day's production	Required 2 weeks prior to commencing work
Watermain	Hydrostatic/Leakage Test: * Bacteria/Chlorine Test *	 Test section not to exceed 365 m in length	 Provide Engineer at least 24 hours notice
Storm Sewer Sanitary Sewer	Television and Photographic Inspections:	 Upon completion of storm sewer installation, after backfilling	 Performed by Contractor
Forcemains	Hydrostatic/Leakage Test: *	 Test section not to exceed 365 m in length	 Provide Engineer at least 24 hours notice
Concrete Curbs & Gutters, Walks, Medians, Driveways & Swales General Concrete Slip Formed Concrete	Mix Design: Slump Test: Air Content Test: Strength Test:	 1 per 20 cu.m for each class of concrete poured, min. 1 per day 1 per 20 cu.m for each class of concrete poured, min. 1 per day 1 per 20 cu.m for each class of concrete poured, min. 1 per day	Required 2 weeks prior to commencing work Every truck until consistency is established Every truck until consistency is established

* Tests to be witnessed by City

END OF SECTION 7

April/04

PART I - LOT GRADING

8.1.0 SUBDIVISION GRADING

8.1.1 Plans

The Developer shall submit plans indicating the following information:

a) Existing contours.

b) Proposed gutter elevations and grades.

c) Location of all proposed surface drainage swales.

d) Proposed elevations at lot corners.

e) Proposed general grading of lots.

f) Direction of drainage.

g) The proposed elevations and grades for all Public Lands.

A common drawing (Grading Plan) shall be used to consolidate this information.

8.1.2 Design

The grading design shall compliment the overall design of both the minor and major storm sewer system. In general, the lots shall be graded and sloped in such a manner that a minimum of surface runoff water will be conducted to other properties. Where surface drainage swales direct runoff from one lot to the next, the necessary drainage easements shall be registered concurrently with the plan of subdivision.

Public lands shall be graded to drain towards developed streets and/or storm sewer catchbasins.

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

8.2.0 LOT GRADING

8.2.1 Plans

The Developer shall submit to the City an overall plan of the area to be developed on which shall be indicated the following information:

a) Proposed top of curb elevation at each corner of the lot.
b) Existing and proposed lot corner elevations.
c) Invert and location of sanitary sewer service and water service.
d) Direction of drainage including a proposed grading plan showing final contours of the subdivision. Such contour plan shall have a 0.5 meter contour interval.

8.2.1 Plans (Continued)

The Developer shall also submit an individual lot plan in accordance with Standard Number 1.

8.2.2 Retaining Walls

Where extremes in elevation of adjoining lots require the construction of a retaining wall, such shall be indicated on the proposed grading plan and no work or construction will be permitted on the building lots which are the subject of or adjacent to the said retaining wall without a commitment by either owner of the two lots involved to construct such retaining wall at the time of construction of the proposed building.

8.2.3 Design

In general, the lots shall be graded to achieve a minimum slope of 10% away for 2 m from the building and a minimum slope of 2% along the lot lines.

In cases where the backyard slopes towards the building, provisions are required to keep the runoff at least 3.0 m away from the building with the possibility of draining the surface water along the lot lines onto the streets.

Reserves and public lands shall be graded to drain towards developed streets, lanes, and/or storm sewer catchbasins.

8.2.4 Surface Drainage

Where surface drainage swales are required they are to be constructed as outlined in Section 5.12.0.

PART II - LANDSCAPING

8.3.0 DESCRIPTION

1. The work under landscaping includes the following:

   a) Site preparation

   b) Seeding and/or sodding

   c) Planting

8.3.1 Scope

1. This section covers the following areas:

   a) Boulevards - Areas between curb and sidewalk.
   - To be topsoiled and sodded by Developer.
   - Plant material as per Section 8.4.0.

8.3.1 Scope (Continued)

b) Buffer Strip
- Areas separating arterial roads from residential property.
- To be topsoiled and sodded by Developer.
- Plant material as per Section 8.4.0.

1. c) Utility lots and/or walkways.
- To be topsoiled and seeded by Developer.
- Plant material as per Section 8.4.0.

d) Median strips and traffic islands.
- To be topsoiled and seeded by Developer.

e) Public Service and Recreation lands.
- To be topsoiled and seeded by Developer.
- Plant material as per Section 8.4.0.
- City may accept cash in lieu of additional park development ($300 per lot)

2. For fencing requirements see Section 8.10.0.

8.3.2 Landscaping Plan

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

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

3. No landscaping shall commence until the landscaping plan has been approved by the City Engineering and Leisure Services.

8.4.0 LANDSCAPE DESIGN REQUIREMENTS

8.4.1 General Requirements

1. Landscape specifications for rough site work, topsoil, seed and sod, trees, shrubs and ground covers, mulches, see: Section 8.5 through 8.9.

2. Where possible, trees will be set back a minimum distance from above and below grade utilities and property lines as specified in this section.

3. Trees will be set back a minimum of 1.0 m from back of curb, walk or verge.

4. Shrub will be set back a minimum of 450 mm from back of curb, walk, verge or back of turf landscape edging.

8.4.1 General Requirements - Continued

5. All plant materials shall be as specified on the approved plant list on landscape drawings.

6. Planting bed layouts to be designed to facilitate easy manoeuvrability of large turf maintenance and cutting equipment.

7. Uniform or screen fences will be positioned wholly on adjacent privately-owned lands.

8. The screen and uniform fencing to meet Leisure Services standards. See Section 8.10.

9. Furniture may be provided by the Developer and placed at strategic locations. The following set backs to be respected:

   Benches - 1.0 m back of walkway
   Waste Receptacles - 250 mm back of walkway
   Picnic Tables - designed in clusters to the satisfaction of the City Engineer

10. Furniture to meet Leisure Services Standards. All furniture will be anchored to concrete bases.

11. No annual plantings will be approved in planting beds to be maintained by the City of Camrose.

8.4.2 Residential Boulevards

1. Boulevards separated by a walk must be graded, topsoiled, and sodded between the back of curb and the walk by the Developer to the satisfaction of Leisure Services. No shrubs are permitted in the boulevard.

2. Boulevards shall be designed with a minimum boulevard tree spacing as specified by the "Boulevard Trees and Spacing Guidelines". Section 8.4.5.

3. Minimum deciduous tree calliper 60 mm. Minimum coniferous tree height shall be 2.5 m. Tree mix 60% coniferous and 40% deciduous not required. No coniferous are permitted in the boulevard.

8.4.3 Collector Roadways

1. Collector boulevards must be graded, topsoiled, sodded, and landscaped by the Developer to the satisfaction of the City Engineer.

2. Boulevards shall be designed with a minimum of one tree every 8 - 10 linear meters depending on tree species as specified by the "Boulevard Trees and Spacing Guidelines". See Section 8.4.5.

2. Minimum deciduous tree calliper 60 mm. Minimum coniferous tree height 2.5 m. Tree mix 60% coniferous and 40% deciduous suggested.

8.4.3 Collector Roadways - Continued

4. Boulevards may be designed to include planting beds, shrubs and ground covers.

5. Minimum shrub size five gallon potted and planted 1.0 m o.c.. Minimum shrub height and spread will be 600 mm, subject to availability.

8.4.4 Major Entrance Routes to the City

1. Boulevards shall be designed with a minimum of one tree every 8 - 10 linear meters depending on tree species as specified by the "Boulevard Tree Spacing Guidelines". See Section 8.4.5.

2. Boulevards shall be designed to include continuous large planting beds with trees, shrubs and ground covers.

3. Minimum deciduous tree calliper 80 mm. Minimum coniferous tree height 3.0 m. Tree mix 60% coniferous and 40% deciduous required.

4. Minimum shrub size five gallon potted. Minimum shrub height and spread will be 600 mm - 1200 mm, subject to availability.

- Continued On Next Page -

8.4.5 Development Permit Landscaping on City Lands

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 Leisure Services prior to the issuance of a development permit.

BOULEVARD TREES AND SPACING GUIDELINES

Common Name	Minimum Spacing (Metres)
American Elm (NOT Recommended)	10.0
Poplar Brooks	10.0
Poplar N/W	10.0
Brandon Elm (NOT Recommended)	8.0
Summit Ash	8.0
Patmore Ash	8.0
Manchrian Ash	8.0
Oak	8.0
Linden	6.0
Birch	6.0
Mountain Ash	6.0
Pear	6.0
Flowering Crab Apple (dependant on species)	4.0 - 6.0
Cherry Trees (dependant on species)	4.0 - 8.0
Pine Species (tree form and dependent on species)	4.0 - 8.0
Spruce Species (dependant on species)	4.0 - 8.0
Swedish Columnar Poplar	3.0 - 6.0
Tower Poplar	3.0 - 6.0

Note: The Developer may suggest other trees for roadway boulevards depending on specific site constraints. Spacing of other trees will be reviewed by Leisure Services on an individual project basis.

8.4.6 Medians and Entry Features

1. Landscaped road islands, medians and entry features must be topsoiled, sodded and planted with trees and/or shrubs and ground covers by the Developer to the satisfaction of the City Engineer. All road island, median and entry feature designs must be low maintenance.

2. Minimum deciduous tree calliper 60 mm. Minimum coniferous tree height shall be 2.5 m. Tree mix 60% coniferous and 40% deciduous suggested.

3. Tree and shrub planting design will consider important vehicular sight lines.

4. Shrubs will be massed within planting beds. Minimum shrub size five gallon potted and planted 1.0 m o.c. or appropriate to species. Minimum shrub height and spread will be 600 mm, subject to availability. Suggest trees be positioned within planting beds.

5. Planting beds to be designed c/w weed liners and landscape edging. All planting beds to have minimum 100 mm wood chip mulch or, decorative crushed granular, or shale topping.

6. If turf areas are designed within road islands and medians, total consolidated turf area to be greater than 75 sq. m.

7. No free standing architectural features ie. signs, sculptures, light poles, entry gates will be located within turf areas.

8. Paving stone and paving stone header, concrete or other special hard surfaced verge or walks to the satisfaction of the City Engineer.

9. Planting Cross Section Detail of road islands and medians drawn at an appropriate scale showing all underground utilities within 3.0 m of planting root zones, limits to road base and sub bases and the limits of the compacted verge base materials in relation to organic soils, mulches and to the root zones of trees and shrubs.

10. Planting Plan Detail of road islands and medians drawn at an appropriate scale showing all underground utility alignments within 3.0 m of road island; curb face; back of curb, verge or walk, tree and shrub set backs; proposed planting and spacing; landscaped edging, mulches and free standing features i.e. signs, gates, pedestals, sculptures, light poles, etc.

11. Planting Cross Section Detail and Planting Plan Detail to be cross referenced to engineering and landscape plans and details which support proposed design solution.

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

13. Sewers and other underground utilities should not be aligned under landscaped road islands and medians to avoid conflicts with landscape improvements.

8.4.6 Medians and Entry Features (Continued)

8.4.7 Walkways

1. Walkway rights-of-way must be graded, topsoiled, seeded or sodded, and planted with trees and ground covers by the Developer to the satisfaction of the City Engineer.

2. There shall be a minimum of four trees per every 35 linear meters of walkway right-of-way. Trees and ground covers as specified by "Plant Materials Appropriate for 6 m Walkway Rights-of-Way".

3. Where possible, trees will be set back a minimum distance of 1.0 m from adjacent private property lines.

4. Trees shall be grouped in rows. Tree groupings shall be positioned on the either side of the walk and groupings will be staggered. Minimum deciduous tree calliper 60 mm. Minimum coniferous tree height 2.5 m. Tree mix of 60% coniferous and 40% deciduous required.

5. Ground covers will be massed within planting beds. Minimum ground cover size three gallon pot planted 750 mm o.c. Suggest trees be positioned within planting beds.

6. Planting beds may be designed c/w weed liners and landscape edging. All planting beds to have a minimum 100 mm wood chip mulch. Decorative crushed granular will not be approved as a substitute for wood mulch.

7. Furniture may be provided by the Developer and placed at strategic locations within the walkway.

8. Screen and uniform fences if provided by the Developer shall meet the specifications in Section 8.10.

9. Walks may be required within walkway or top-of-bank rights-of-way to the satisfaction of the City Engineer.

8.4.7 Walkways (Continued)

PLANT MATERIALS APPROPRIATE FOR 6 M WALKWAY RIGHTS-OF-WAY

The following lists a variety of plant materials approved for use by the City of Camrose in walkway rights-of-way 6 m and wider.

Common Name	Minimum Spacing (Meters)
TREES	
Lodgepole Pine	4.0
Linden	6.0
Pin Cherry	4.0
Schubert Chokecherry	4.0
Pyramidal Flowering Crab	4.0
Japanese Tree Lilac	4.0
Columnar Aspen	4.0
Tower Poplar	4.0

Common Name	Minimum Spacing (Meters)
GROUND COVER	
Juniper	-
Periwinkle	-
Phlox	-
Thyme	-
Gout Weed (Not with other shrubs)	-

Note: The Developer may suggest other trees, tree form shrubs and ground covers for walkway rights-of-way depending on specific site constraints. These will be reviewed by Leisure Services on an individual project basis.

The following design issues to be considered by the Developer recommending alternative plant materials:

i. Maintaining adequate year round sight lines through the walkway rights-of-way for pedestrian safety and security.

ii. Suggested minimum 2 m (6 ft.) branching height for all trees to allow adequate pedestrian clearance beneath tree branches.

iii. Low maintenance hardy plant species common to northern Alberta.

iv. Limited horizontal root growth and no sucker-type roots to avoid encroachment into adjoining privately-owned lands.

v. Pyramidal/columnar tree forms to avoid tree branches overhanging into adjoining privately-owned lands.

8.4.8 Pipelines and Major Utility Corridors

1. Utility corridors must be graded, topsoiled, seeded or sodded and landscaped by the developer to the satisfaction of the City Engineer.

2. Utility corridors must be planted with a minimum of 30 trees per acre designed and massed into major groupings. Minimum deciduous tree calliper 50 mm. Minimum coniferous tree height 2.0 m. Tree mix of 60% coniferous and 40% deciduous required.

3. Shrubs may be substituted for trees at the rate of 5 shrubs to 1 tree, to a maximum of 15 trees per acre.

4. Shrubs will be massed within large planting beds to create major focal areas within the rights-of-way. Minimum shrub size five gallon pot, planted 1.0 m o.c. Minimum shrub height and spread will be 600 mm, subject to availability. Suggest trees be positioned within planting beds.

5. Planting bed layouts will provide a minimum width of turf areas between planting beds of 2.0 m. There will be no requirement for landscape edging.

6. Planting beds may be designed c/w weed liners. All planting beds to have minimum 100 mm wood chip mulch. Decorative crushed granular will not be approved as a substitute.

7. Healthy or vigorous trees within or abutting the utility corridor shall be preserved wherever possible.

8. Furniture may be provided by the Developer and placed at strategic locations within the utility corridor.

9. Screen and uniform fences if provided by the Developer shall meet the specifications herein.

10. Walks, if provided within the rights-of-way, shall be to the satisfaction of the City Engineer.

11. Lighting, if provided, shall be to the satisfaction of the City Engineer.

8.4.8 Pipelines and Major Utility Corridors (Continued)

Utilicorp Networks Canada Corridors / R.O.W. - Plant List (Source: Utilicorp)

Hedge Material - Suitable for planting near a power line.

Common Name		Height at Maturity	
Caragana	Common	3 m	(10 ft)
	Globe	1 m	(03 ft)
	Pygmy	1 m	(03 ft)
Cherry - Nanking		2 m	(07 ft)
Cotoneaster - Hedge		2 m	(07 ft)
Cranberry	Nannyberry	5 m	(16 ft)
	Wayfaring Tree	3 m	(10 ft)
Dogwood - Red Osier		2 m	(07 ft)
Honeysuckle	Clavey's Dwarf	1 m	(03 ft)
	Tartarian	3 m	(07 ft)
	Zabels	2 m	(10 ft)
Lilac	Common	3 m	(10 ft)
	Late	3 m	(10 ft)
Prinsepia		3 m	(10 ft)
Potentilla		1 m	(3 ft)

Caution - May plant near a power line.

Common Name	Height at Maturity	
Pincherry	5 m	(16 ft)
Western Chokecherry	5 m	(16 ft)
Black Cherry	6 m	(20 ft)
Tartarian Maple	6 m	(20 ft)
Amur Maple	4 m	(13 ft)
Flowering Crabapples	5 m	(16 ft)
Hawthorns	5 m	(16 ft)
Showy Mountain Ash	5 m	(16 ft)
Green's Mountain Ash	5 m	(16 ft)
French Pussy-Willow	5 m	(16 ft)
Mugo Pine	6 m	(20 ft)
Pyramidal White Cedar	5 m	(16 ft)

Common Name	Height at Maturity	
Montgomery Blue Spruce	3 m	(10 ft)
Caragana	3 m	(10 ft)
Hedge Cotoneaster	2 m	(07 ft)
Highbrush cranberry	3 m	(10 ft)
Nannyberry	5 m	(16 ft)
Dogwood	3 m	(10 ft)
Elder	4 m	(13 ft)
Honeysuckle	3 m	(10 ft)
Lilac	5 m	(16 ft)
Saskatoon	4 m	(13 ft)

DO NOT plant within eight metres of a power line.

8.4.8 Pipelines and Major Utility Corridors (Continued)

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Common Name	Height at Maturity
Trembling Aspen	8 m (60 ft)
Balsam Poplar	20 m (65 ft)
Northwest Poplar	20 m (65 ft)
Plains Cottonwood	30 m (90 ft)
White Spruce	15 m (50 ft)
Colorado Blue Spruce	15 m (50 ft)
Manitoba Maple	14 m (45 ft)
Laurel Leaved Willow	15 m (50 ft)
Golden Leaved Willow	15 m (50 ft)
Sharp Leaf Willow	10 m (35 ft)
Green Ash	15 m (50 ft)
Patmore Green Ash	15 m (50 ft)
American Elm	20 m (65 ft)
Brandon Elm	15 m (50 ft)
Siberian Elm	12 m (40 ft)
Paper Birch	12 m (40 ft)
European White Birch	12 m (40 ft)
Cut-Leaved Weeping Birch	20 m (65 ft)
Slender Weeping Birch	12 m (40 ft)

Pipelines and Other Major Underground Utility Corridors / R.O.W. - Plant List

Trees - Suitable for Planting

Common Name	Planting Size - Height
Coniferous	
Pines	2.0 m (min.)
Spruce	2.0 m
Fir	2.0 m
Large Deciduous	**Caliper**
Silver Maple	50 mm (min.)
Patmore Green Ash	50 mm
Summit Green Ash	50 mm
Larch	50 mm
American Elm	50 mm
Harbin Chinese Elm	50 mm
Linden Laurel Leaf Willow	50 mm

Common Name	Planting Size – Height
Small Deciduous	
Amur Maple	50 mm
Crabapple	50 mm
Amur Cherry	50 mm
Pincherry	50 mm
Schubert Chokecherry	50 mm
Bur Oak	50 mm
Mountain Ash	50 mm
Lilac	50 mm

8.4.9 Storm Water Management Facilities

1. Dry pond and areas surrounding new storm water management lake facilities must be graded, topsoiled, seeded or sodded, and landscaped by the Developer to the satisfaction of the City Engineer.

2. Plant materials will be selected to respect hydrological and soil saturation characteristics of the facility.

3. Public lands within the facility must be planted with a minimum of 30 trees per landscaped acre above normal water line and designed and massed into major groupings. Minimum deciduous tree calliper 60 mm. Minimum coniferous tree height 2.5 m. Tree mix 60% coniferous and 40% deciduous suggested.

4. Shrubs may be substituted for trees at a rate of 5 shrubs for one tree to a maximum of 15 trees per landscaped acre.

5. Shrubs will be massed within large planting beds above the 1:5 year flood line to create major focal areas on the slopes of the dry pond. Minimum shrub size five gallon pot planted 1 m o.c. or appropriate to species. Minimum shrub height and spread 600 mm, subject to availability. Suggest trees be positioned within planting beds.

6. Planting bed layouts will provide a minimum width of turf areas between planting beds of 2.0 m. Landscape edging may be required in formal shrub beds.

7. Planing beds may be designed c/w weed liners. All planting beds to have minimum 100 mm wood chip mulch, or decorative crushed granular or shale in flood prone areas. Use of weed liners for planting beds located in flood prone areas is strongly recommended.

8. Major storm sewer outlets/inlets should be landscaped with plant materials and large rockery to provide visual screening and security buffering for pedestrians and dry pond users.

9. Where possible, relatively flat open areas should be designed to encourage active recreational uses.

10. Furniture may be provided by the Developer and placed at strategic locations within the dry pond.

11. Lighting, if provided, to be to the satisfaction of City Engineer.

12. Special or unique features i.e. artificially pumped dry streams, special play courts, bridges and architectural and structural features will be designed and sealed by recognized accredited professionals.

8.4.10 Natural Areas

1. Existing natural and naturalized areas impacted by the proposed improvements which cannot be protected during construction must be renaturalized with native plant materials having regard for the surrounding environment, new drainage patterns, soil conditions, and ecological rehabilitation. Generally, renaturalization would apply to River Valley and Ravine lands.

2. The Developer will determine the level of restoration to be completed in consultation with Leisure Services and City Engineer.

3. The Developer will design an appropriate mix of native trees, shrubs, ground covers and wild seed mixes to rehabilitate impacted naturalized areas.

4. The Developer will design any required subsurface drainage, surface drainage and erosion control measures in the rehabilitation area.

5. The Developer shall, if required, coordinate this rehabilitation with other consultants to implement geotechnical, structural and bioengineering principles and recommendations.

6. The landscape drawings will identify all plant communities to be established and all other information necessary to implement the proposed improvements.

7. The Developer will specify all tree, shrub and ground cover sizes. No minimum or maximum sizes are specified. Tree mix 60% coniferous and 40% deciduous is suggested.

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

9. All plant materials to be nursery stock or obtained from Provincial Government sources.

10. The Landscape Architect to identify appropriate planting installation specifications and detailing on landscape drawings.

11. "Round-Up" or other approved herbicides may be used to eradicate natural slopes prior to planting of trees and shrubs. Herbicide to be applied by a licensed applicator.

8.5.0 SITE PREPARATION

8.5.1. Materials

1. Fill Material - Fill materials, where required shall be free of stones, clods, sticks, roots, concrete, any toxic materials (eg. salt, oil, etc.) and other objectionable extraneous matter and debris. These materials shall be removed from the site and disposed of.

8.5.1. Materials (Continued)

2. Topsoil - Topsoil shall be natural fertile agricultural soil, capable of sustaining vigorous plant growth. It shall be best quality, weed free and shall be approved by the City Engineer.

8.5.2 Subgrade Preparation

1. The subgrade shall be completely free of live quackgrass roots.

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

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

4. The final surface shall be sloped so that there is no runoff onto adjacent property, or any ponding.

8.5.3 Existing Utility Appurtenances and Features

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

2. All existing features e.g. trees, shrubs, monuments, curbs, sidewalks etc., shall be protected against any damage.

8.6.0 PLACING OF TOPSOIL

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

2. Boulevards - The finished topsoil level shall conform to the adjacent curb and sidewalk elevations and must provide for adequate drainage of sidewalk areas after turf establishment.

3. Buffer Strips - The finished topsoil level shall slope uniformly from the property line towards the back of the sidewalk at not less than 2%.

4. Utility lots and Walkways - Where sidewalks are present, a swale shall be provided at a distance of at least one metre, from either side of the sidewalk. The grade must be sloped away from the sidewalk at a minimum grade of 1%.

5. Median strips and Traffic Islands - The finished topsoil level shall be even from top of curb to top of curb.

6. Parks and Environmental Reserves - Rough grade to required levels, profiles and contours and make ready to receive surface treatment. Blend slopes into level area. Produce a uniform contoured grade, with the use of rototiller, harrow, float or roller as required.

7. The prepared seed bed must be inspected and approved by the City Engineer before seeding commences.

8.7.0 SEEDING

8.7.1 Seeding - Materials

1. Fertilizer - Fertilizer shall be 27-14-0 and shall be applied at a rate of 3 kg/100 m^2.

2. Grass Seed - Grass seed shall be certified seed comprised of the following varieties mixed in the proportion by weight shown and testing Canada #1 or better for purity and germination:

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

   b) Crested Wheat Grass (only to be used if prior approval is obtained from the City Engineer)
   Grass seed to be applied at a rate of 3 kg/$100\ m^2$.

8.7.2 Seeding - Execution

1. Fine grade area to a smooth, uniform grade with a loose textured surface free of stones, branches, roots, etc., 20 mm in diameter and larger. All areas must drain and positive drainage away from buildings must be assured.

2. Apply fertilizer at a rate of 3 kg per 100 square metres of area.

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

4. Seeding shall be applied at 3 kg per 100 square metres.

5. The seed may be sown by:

   a) Hand application, by using a cyclone type seeder with the seed applied in two directions in equal amounts.

   b) Mechanical application, by use of a calibrated specialized grass seeder that has a seed compaction roller. (This is the preferred method on parks and other large level areas.)

   c) Hydro seeding by applying an approved turf-fibre at the rate of 1350 kilograms (dry matter) per hectare when applying the seed.

8.8.0 SODDING

8.8.1 Sodding - Materials

1. Fertilizer - Fertilizer shall be 27-14-0 and shall be applied at a rate of 3 kg/100 m^2.

8.8.1 Sodding – Materials (Continued)

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

Kentucky Blue Grass 35%
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 at 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 required to hold sod in place on slopes shall have dimensions of approximately 25 mm x 50 mm x 300 mm. Metal pegs will not be accepted.

8.8.2 Sodding - Execution

1. Fine grade area to a smooth, uniform grade with a loose textured surface free of stones, branches, roots, etc., 20 mm in diameter and larger. All areas must drain and positive drainage away from buildings must be assured.

2. The fertilizer shall be applied on the finished surface by mechanical distributor, thoroughly and evenly incorporated with the soil to a depth not exceeding 75 mm.

3. The fertilizer rate of application shall be 3 kg per 100 square metres of area.

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

5. Sod shall be laid such that their long dimension is parallel to the direction of the slope and in a manner that permits alternating of joints.

6. Sod shall be fitted tightly together with no visible joint. The finished surface of the turn shall be true to line and grade, firm and free of irregularities and voids.

7. Sod laid on slopes of two (2) horizontal to one (1) vertical or steeper shall be held in place by wooden pegs. Pegs shall be driven flush with sod.

8.8.3 Maintenance

1. General - Maintenance shall include all measures necessary to establish and maintain all seeded and sodded areas in a healthy, vigorous growing condition,

8.8.3 Maintenance (Continued)

2. Mowing - first cutting should occur when the grass is a minimum of 75 mm high and covers 100% of the seeded or sodded areas. Cut as required to maintain grass at a minimum height of 65 mm.

3. Watering - when required, and with sufficient amounts to ensure germination and prevent grass and underlying soil from drying out.

4. Fertilizing - including all required supplementary fertilizer applications as necessary to establish a vigorous growing stand of grass.

5. Weed Control - shall be carried out when required to keep seeded areas reasonably free of weeds. When herbicides are used, they shall be applied in accordance with manufacturer's recommendations. Any damage resulting from the Contractor's use of herbicides shall be remedied at his own expense.

   Re-seed, or re-sod in the case of sodding, all areas which are deteriorating or which are bare, burned out, or are thin, and repair all damages resulting from erosion and wash-outs at the Contractor's expense.

   At time of final inspection, all seeded or sodded areas shall have a healthy, even, vigorously growing stand of grass, free of diseases, weeds, bare, thin, or burned -out areas.

6. Maintenance shall include the erection and removal of all temporary protection fences, barriers and signs, where deemed necessary, and all other work incidental to proper maintenance.

7. All damaged grass as a result of negligence on the part of the Contractor shall be replaced at the Contractor's expense. Only upon issuance of Final Acceptance Certificate by the City Engineer shall the Contractor cease maintenance work of the seeded or sodded area.

8. The maintenance period of seeded or sodded areas shall be two (2) years from the date of issuance of a Completion Certificate.

9. The City Engineer reserves the right to reject the seeded or sodded areas if he is not satisfied with its appearance and the Contractor must re-establish the area, by removing any or all parts of the rejected work and by supplying any or all new topsoil, seed, sod (in the case of sodding), peat moss, fertilizer and labour necessary for such an operation and must do so at his own expense.

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

8.9.0 PLANTING (TREES AND SHRUBS)

8.9.1 Materials

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

   Minimum planting requirements are specified in Section 8.4.0.

2. The City may request higher levels of plantings depending upon the location and type of development proposed.

3. All plants shall be typical of their species or variety and shall have a normal growth habit. They shall be sound, healthy and vigorous, well branched, and densely foliated when in leaf. They shall be free from disease and insect pests, eggs or larvae. They shall have healthy, well-developed root systems.

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

4. Substitutions will not be permitted, unless written proof is submitted that specific plants or sizes are unobtainable and such substitutions are acceptable to the City Engineer.

5. Bare root (B/R) shrubs shall be dug with adequate fibrous roots retained. The roots of these plants shall be covered with a uniformly thick coating of mud being puddled immediately after they are dug, or packed in moist straw, shingletow or moss.

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

7. Container growth stock shall have been grown in a container long enough for the root system to have developed sufficient to hold its soil together firm and whole. No plants shall be loose in the container.

8. Undersized root systems will be rejected. All plant matter is subject to the approval of the City Engineer.

   Plant material shall be delivered to the job site and stored, handled and planted with the producer's label intact. All plant material must be handled in a professional manner. Damaged, sick or diseased plants must be removed from the site immediately and be replaced.

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

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

8.9.1 Materials (Continued)

11. Arrangements for suitable water shall be undertaken by the Contractor.

8.9.2 Site Preparation

1. At least 24 hours notice shall be given to the City Engineer prior to commencement of planting. The Contractor shall stake the location of all plantings for approval by the City Engineer or his representative.

2. Boulevards shall be excavated to its required depth, and made ready to receive topsoil and tree planting.

3. No filling of boulevards or medians with topsoil is to commence until tree locations have been approved by the City Engineer or his representative.

4. The Contractor shall be responsible for planting at correct grade and alignment.

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

8.9.3 Planting Operations

1. Tree pits shall be excavated with vertical sides 300 mm greater in diameter than the ball of earth or spread of roots of the tree and sufficiently deep to allow for a 150 mm layer of the planting mixture beneath the ball or roots.

2. Shrubs shall be planted in pits 300 mm greater than the spread of the roots and 450 mm deep below the finished grade, and as necessary to properly set the plant at finished grade.

3. The depth of planting beds and pits shall be adjusted to permit a minimum of 225 mm of the planting mixture under balls or roots of all plants.

4. If pits are prepared and backfilled with the planting mixture to grade, prior to planting, their location (except in boulevards) shall be marked by 25 mm x 50 mm stakes sticking above grade by 100 mm so that when planting proceeds they can easily be found.

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

5. When approximately two-thirds of the plant pit has been backfilled with soil mix, 8-24-24 fertilizer shall be applied at the following rates:

Shade Trees	0.5 kg per 25 mm of calliper
Small Trees	0.25 kg per 25 mm of calliper
Shrubs	0.06 kg per 300 mm of height

8.9.3 Planting Operations (Continued)

Evergreens	0.03 kg per 300 mm of height or spread
Vines, Groundcover, 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 roots.

6. When balled and burlapped trees are set, the soil mixture shall be compacted around the base of balls to fill all voids. All burlap, ropes and wires shall then be removed from the tops of the balls.

   Roots of bare roots shall be properly spread out and the topsoil mixture carefully worked in among them. Any broken or frayed roots shall be cut off cleanly.

7. After the water has been absorbed the plant pit shall be filled with soil mix.

   Immediately after the plant mix is backfilled, a shallow basin (approximately 100 mm deep), slightly larger than the pit, shall be formed with a ridge of soil to facilitate watering and water retention.

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

8.9.4 Staking and Guying

1. For Deciduous trees (less than 1.0 m in height) the following procedure will be observed:

   Each tree shall be supported with a tree stake. This tree stake will be driven into the ground 450 mm to 600 mm below grade in a vertical position with the open side facing the street and located so that it is between the tree and the curb. Where trees are not adjacent to a street, all stakes are to be placed 150 mm northwest of the tree.

   The tree shall be supported with one (1) tree tie. This tie shall be placed around the tree and the stake, as close as possible to the top of the stake, with the tie being below rather than just above a branch.

   The tree stake and tie are to be attached as per Standard Drawing No. L3.

2. For Evergreens less than 2.45 m in height and Deciduous trees greater than 1 m in height with a calliper less than 75 mm, the following procedure will be observed:

   (a) Each tree shall be supported by two (2) steel U or T-bars driven securely into the ground without injury to the root ball.

   (b) Each tree shall be fastened at the top of the stakes with two (2) ties.

8.9.4 Staking and Guying

2. (c) The tree stakes and ties are to be attached as per Standard Drawing No. L3.

3. For guying of deciduous and evergreen trees the following procedure will be observed:

   All deciduous trees over 75 mm calliper and all evergreens exceeding 2.45 m height shall be done with three (3) guys, spaced equally about each tree.

   Each guy shall be attached to the tree trunk at an angle of 60^{o} at about 3/5 of the height of the tree and anchored at the ground by means of a wooden stake, 50 mm x 50 mm x 450 mm, driven securely into the ground. Trees 4.3 metres in height or greater, or 100 mm calliper or larger, shall be staked with a wooden stake 50 mm x 100 mm x 750 mm in length or 15 mm diameter reinforcing steel bars 760 m long.

   Guys, stakes and ties to be placed as per Standard Drawing No. L4.

8.9.5 Pruning

1. All plants shall be pruned after planting. The amount of pruning shall be limited to the minimum necessary to remove dead or injured branches and to compensate for the loss of roots as a result of the transplanting operations. Pruning shall be done in such a manner as to preserve the natural character of the plants. Leaders shall not be removed. Only clean sharp tools shall be used. All cuts shall be clean and flush, leaving no stubs.

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

8.9.6 Digging of Plants

1. All plants shall be dug and delivered to the site as specified on the Plant list and approved landscape plan.
2. Plants specified "B/R" shall be moved with bare roots. They shall be dug and moved while dormant, with the major portion of the fibrous root system provided. Immediately after digging, the root system shall be wrapped or puddled and shall be kept moist to prevent drying out until planted on the site.

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

4. No plants shall be used when the ball of earth surrounding the roots has been cracked or broken preparatory to or during the process of planting, or when the burlap, staves and ropes, required in connection with their transplanting, have been removed.

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8.9.6 Digging of Plants (Continued)

5. The sizes of roots balls for trees shall be as specified below. Ball sizes are minimum and shall be adjusted according to growth habits or plants. At any rate ball sizes shall be sufficiently large to contain at least 75% of the fibrous root system.

Deciduous Trees		
Root mm	**Root Ball Diameter mm**	**Machine Ball Diameter mm**
24 – 45	610	
50	760	1110
75	915	1420
100	1065	1675
125	1370	1675
150	1470	2336
200	1825	2236
250	2285	2336

Note: Deciduous Trees larger than 75 mm calliper shall be moved by machine (spade).

Coniferous Trees		
Height mm	**Root Ball Diameter mm**	**Machine Ball Diameter mm**
1.50 - 1.75	760	1110
1.75 - 2.00	915	1110
2.00 - 2.25	1065	1420
2.25 - 2.50	1220	1420
2.50 - 2.75	1370	1675

8.9.6 Digging of Plants (Continued)

5. For deciduous trees with a calliper of more than 250 mm and for coniferous trees over 2.75 m in height, root ball diameter shall be increased 150 mm for every additional 25 mm in calliper, or every 300 mm in height.

   Note: Coniferous trees larger than 2.75 m in height shall be machine moved with a 2300 mm diameter or larger spade.

6. All plant materials shall conform to the measurement specified in the Plant List and landscape plan. Plants larger than specified may be used if approved by the City Engineer. If larger plants are used, the ball of earth shall be increased in proportion to the size of the plant.

7. All plants shall be measured when the branches are in their normal position. Height and spread dimensions specified refer to the main body of the plant and not from branch tip to root base or from branch tip to branch tip. Where trees are measured by calliper reference is made to the diameter of the trunk measured 300 mm above ground as the tree stands in the nursery.

8.9.7 Maintenance

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

2. Maintenance shall include resetting to proper grade position of settled plants, and planting saucer repair. Defective work shall be corrected as soon as possible after it becomes apparent and weather and season permits. Upon completion of planting, and prior to construction completion, excess soil and debris shall be removed from the site and any damage to structures, etc., resulting from planting operations shall be repaired.

8.9.8 Guarantee Period

1. The maintenance period for all planted material shall be two (2) years from the date of issuance of a Completion Certificate.

2. Any plant that is dead, not true to name or size as specified, or not in satisfactory growth, as determined by the City Engineer shall be removed from the site. In case of any question regarding the condition and satisfactory establishment of a rejected plant, the Contractor may elect to allow such a plant to remain through another complete growing season at which time the rejected plant, if found to be dead, or in an unhealthy or badly impaired condition, shall be replaced by the Contractor.

8.10.0 UNIFORM FENCING

1. Uniform wood fencing shall be constructed in accordance with Standard Drawing. No. L6. Uniform wood fencing gates shall be constructed and installed in accordance with Standard Drawing No. L5.

8.10.0 UNIFORM FENCING (Continued)

2. Chainlink fencing and gates shall be constructed in accordance with Standard Drawing L5.

3. Uniform 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) City owned lands - e.g. Firehall sites etc.

   f) Multiple Family Sites

   g) Neighbourhood Commercial Sites

   h) Institutional Sites and

   i) Other areas as required by the City.

   Wooden fencing shall be installed where residential property adjoins the above mentioned facilities. The City may approve chainlink fencing where facilities such as playgrounds, parks or school sites are adjacent to arterial roadways.

4. Gates shall be installed on all residential lots which back onto a public park. Gates shall be located approximately at the mid-point of each lot and shall be constructed to open inwards onto the private property.

8.10.1. Maintenance Period

1. The applicant shall be responsible for, and at his own expense to remedy, any defect, fault or deficiency in the completed works during a twenty- four (24) month maintenance period.

END OF SECTION 8

9.1.0 GAS SERVICE

9.1.1 General

1. Natural Gas service is provided under Franchise Agreement by Atco Gas.

9.1.2 Rights-of-Way

1. Where required, the Developer shall provide rights-of-way and easements of sufficient size and location to satisfy the gas company. Refer to Standard Drawing. No.'s T2 through T11 for preferred locations.

2. All easements shall be registered in the name of the City of Camrose.

9.1.3 Installation

1. The Developer and Atco Gas shall obtain City approval for the method of installation including excavation and backfilling requirements.

2. The Developer shall co-ordinate the location of gas services to ensure that they do not interfere with other utilities.

3. Where gas distribution is installed at the front of lots, gas service to individual lots shall be installed such that the gas meter can be placed at the side or the rear of the dwelling. Where gas meters are placed at the side of the dwelling unit, the gas meter shall be placed on the side of the dwelling adjacent to the driveway. Gas meters shall not be permitted at the front of the dwelling unit.

4. An Excavation Permit must be obtained from the City of Camrose for any excavation on City property.

9.1.4 Costs

1. Any capital contribution that the utility company may charge for installation of gas services shall be paid by the Developer.

9.2.0 TELEPHONE SERVICE

9.2.1 General

1. Telephone services to be installed by Telus and shall be underground.

2. Where possible, telephone cable to be located in the same trench as power.

9.2.2 Rights-of-Way

1. Where required, the Developer shall provide rights-of-way and easements of sufficient size and location to satisfy Telus.

2. All easements shall be registered in the name of the City of Camrose.

9.2.2 Rights-of-Way

3. See Standard. Drawing. No.'s T2 through T11 for preferred alignments in road right-of-ways.

9.2.3 Installation

1. The Developer and Telus shall obtain City approval for the method of installation including excavation and backfilling requirements.

2. The Developer shall co-ordinate the location of telephone service boxes to ensure that they do not conflict with driveways or interfere with other utilities. Alignments to be approved by the City Engineer.

3. An Excavation Permit must be obtained from the City of Camrose for any excavation on city property.

4. Service pedestals to be located on the intersection of lot lines where possible.

9.2.4 Costs

1. Any capital contribution that the utility company may charge for installation of telephone services, shall be paid by the Developer.

9.3.0 ELECTRIC POWER SERVICE

9.3.1 General

1. Electrical power service is provided under Franchise Agreement by Aquila Networks Canada.

2. Power services to be installed by an approved contractor meeting Aquila Networks Canada criteria and shall be underground. Where possible, Telus and Cable T.V. shall run in a common trench.

9.3.2 Rights-of-Way

1. Where required, the Developer shall provide rights-of-way and easements of sufficient size and location to satisfy Aquila Networks Canada.

2. All easements shall be registered in the name of the City of Camrose.

3. See Standard Drawing No.'s T2 through T11 for preferred alignments in road right-of-ways.

9.3.3 Installation

1. The Developer and Aquila Networks Canada shall obtain City approval for the method of installation including excavation and backfill requirements.

9.3.3 Installation (Continued)

2. The Developer shall co-ordinate the location of power service boxes and transformers to ensure that they do not conflict with driveways or interfere with other utilities. Where possible service boxes and transformers should be located at the intersection of lot lines. Alignments to be approved by the City Engineer.

3. An Excavation Permit must be obtained from the City of Camrose for any excavation on city property.

9.3.4 Costs

1. Any capital contribution that the utility company may charge for installation of electrical services, shall be paid by the Developer.

9.4.0 TELEVISION CABLE

9.4.1 General

1. Television cable services are supplied by Cable T.V of Camrose Inc.

2. Where possible power, telephone and Cable T.V. shall run in a common trench.

3. All easements shall be registered in the name of the City of Camrose.

9.4.2 Rights-of-Way

1. Where required, the Developer shall provide rights-of-way and easements of sufficient size and location to satisfy the television cable company.

2. See Standard. Drawing. No.'s T2 through T11 for preferred alignments in road right-of-ways.

9.4.3 Installation

1. The Developer and the television cable company shall obtain City approval for the method of installation including excavation and backfill requirements.

2. The Developer shall co-ordinate the location of television cable services to ensure that they do not interfere with the other utilities. Alignments to be approved by the City Engineer.

9.4.4 Costs

1. Any capital contribution that the utility company may charge for installation of television cable services shall be paid by the Developer.

END OF SECTION 9

CITY OF CAMROSE

MINIMUM DESIGN STANDARDS

FOR DEVELOPMENT

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