County of Wetaskiwin No. 10

DESIGN GUIDELINES AND CONSTRUCTION STANDARDS

FOR SUBDIVISION DEVELOPMENTS

Issued September 2010

ABBREVIATIONS

The following abbreviations may be used in this document:

BC	-	Beginning of curve
BOW	-	Back of walk
BVC	-	Beginning of vertical Curve
CCC	-	Construction Completion Certificate
EC	-	End of Curve
EVC	-	End of vertical Curve
FAC	-	Final Acceptance Certificate
FOW	-	Face of walk
ha	-	Hectare
ID	-	Inside diameter
Kg	-	Kilogram
lcd	-	Litres per capita per day
m^3	-	Meter cubed
OC	-	On centre
OD	-	Outside diameter
PVI	-	Point of vertical intersection

Other abbreviations may be used or defined elsewhere in this document. Where undefined, an abbreviation shall carry a meaning consistent with industry standards. Ascertaining the meaning of a word or abbreviation in context is the responsibility of the Developer.

DESIGN GUIDELINES

Issued September 2010

1 FORWARD

This manual is intended to provide an information guide to set standards governing design, preparation and submission of plans and specifications for construction of municipal improvements in the County of Wetaskiwin No. 10. It is intended for use by Developers, Engineering Consultants, Utility Companies and County Departments. These standards are provided to set out the "minimum" allowable levels to which the requisite improvements are to be built. In instances where the standards do not cover a particular situation or occurrence, good engineering judgement shall be used. All development shall comply with the requirements of the County of Wetaskiwin No. 10, all applicable Land Use Bylaws and Provincial and Federal legislation.

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

The purpose of the County's review of Construction Drawings is to ensure that the Development is designed and constructed in general conformance with County Standards, such that upon acceptance of the Development by the County, the future public responsibilities for maintenance call within normal and reasonable levels.

This Manual does not attempt to set rigid policies, but rather provides the user with a guide outlining the County's requirements. Where unusual or complicated design situations arise, good engineering judgement should prevail. The County reserves the right to require a deviation from these Guidelines where conditions warrant same.

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

a) Final Design Drawings and Specifications

b) Letters of Credit

c) Authority Approvals

The County of Wetaskiwin No. 10, Planning and Economic Development Department address is:

Box 6960
Wetaskiwin, AB
T9A 2G5

Phone: 780-352-3321
Fax: 780-352-3486
E-Mail: webmaster@county.wetaskiwin.ab.ca

END OF SECTION

2 GENERAL CONDITIONS AND ENGINEERING PROCEDURES FOR MUNICIPAL DEVELOPMENT

2.1 GENERAL CONDITIONS

2.1.1 Scope

These design standards shall apply to the design and installation of the municipal infrastructure for new subdivisions and developments in the County of Wetaskiwin No. 10. They apply to the design and installation of storm and sanitary sewers, water mains, roads and sidewalks, together with their respective connections and appurtenances, and any other services that are required to be designed and/or installed.

These design standards also apply to the installation of water, sanitary sewer, and storm sewer services to existing properties, including surface reconstruction; the installation or alterations to roads, sidewalks, curb and gutter adjacent to existing properties; and the surface drainage of commercial, industrial, institutional and multi family developments within the County of Wetaskiwin No. 10.

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

The Standard Drawings, as referred to in various sections, will form an integral part of these design standards. Standard drawings are provided in Section 35.

No departure from these design standards will be permitted except with written approval of the Director of Planning and Economic Development. The Director of Planning and Economic Development may give verbal approval to revisions that he considers being sufficiently minor. A Change Order shall be issued recording such revision.

2.1.2 Definitions

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

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

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

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

"Director of Planning and Economic Development" means the Director of Planning and Economic Development of the County of Wetaskiwin No. 10 or his assigned designate.

"County" shall mean or refer to the County of Wetaskiwin No. 10, in the Province of Alberta.

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

"Prime Contractor" as defined by Occupational Health and Safety.

2.2 PROCEDURE

2.2.1 Engineering Design

The Applicant shall retain the services of a Professional Engineer, registered and licensed to practice in the Province of Alberta, who shall be responsible for the design and preparation of drawings and specifications for all infrastructure (except lighting, telephone and power) to be constructed within and/or related to the proposed development area, as required, within the County of Wetaskiwin No. 10. All required municipal improvements shall be designed in accordance with accepted engineering practices and shall meet or exceed the County of Wetaskiwin No. 10 Design Guidelines and Construction Standards as set out herein. If landscaping plans are deemed required by the Director of Planning and Development the landscape plans will be prepared and stamped by a Landscape Architect or a Professional Engineer as required by Provincial Legislation.

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

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

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

The Developer's Engineer shall bring to the attention of the Applicant the need for any right-of-way, outside the subdivision, that the Applicant will have to obtain. The applicant shall provide

proof of right-of-way to the County prior to the installation of services on such properties. Rights-of-way shall be assigned in the name of the County or, as applicable, the utility company. The applicant is to pay all costs associated with registering the right-of-way and fulfil all terms and conditions associated with establishing rights-of-way.

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

2.2.2 Geotechnical Report

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

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

At the requirement of the County, additional geotechnical information may be requested outlining recommended design and construction requirements and techniques that may have to be followed to satisfactorily develop the subdivision, particularly related to water and sewer main construction and roadway structures.

2.2.3 Submission of Engineering Design

Upon completion of the design drawings, the Developer's Engineer will submit to the Director of Planning and Economic Development, two (2) complete sets of stamped and signed drawings and specifications of the proposed works, including the following:

a) Calculations of sanitary and storm sewer capacity, as shown on the overall sewer and water plan, and pipe loading, where these services are to be installed;

b) Water distribution analysis as specified in Water Distribution Systems;

c) A print of the registerable plan of the subdivision (if not already supplied by the Applicant);

d) A copy of the soils investigation report, judged by the County to be pertinent to the stage of subdivision;

e) A copy of the Contract Documents proposed for construction purposes; and

f) Any other supporting document or report.

All proposed streets should be named on the drawings. All street names are to be approved by the Director of Planning and Economic Development.

2.2.4 Design Review

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

2.2.5 Design Approval

Upon completion of all revisions, the Developer's Engineer shall submit four (4) complete sets of Contract Drawings and Specifications to the Director of Planning and Economic Development.

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

No work will be commenced within any new parcel of land or any of the services to be provided by the Applicant until the County has examined and stamped the revised Contract Drawings.

2.2.6 Rights-of-Way and Easements

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

2.2.7 Construction Approval

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

a) Satisfactory execution of a Development Agreement pertaining to the development or subdivision.

b) All necessary approvals from the Developer's Engineer, and a copy received by the Director of Planning and Economic Development.

c) A list of materials that are being installed and a construction schedule submitted to the County's Engineering office.

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

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

2.2.8 Engineering Supervision

The applicant shall retain the services of an Engineer who shall be responsible for the layout to ensure finished construction conforms to the lines and grades shown on the approved plans for inspection and approval of all materials to be used, and for supervision of installation of all services, that are the responsibility of the Applicant. The Developer's Engineer, or his

authorized representative, shall be available at all times to visit the site during the installation of services.

The Developer's Engineer will be responsible for maintaining field surveys and recording of all "as-built" drawings.

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

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

2.2.9 Testing

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

2.2.10 As-Built Drawings

Within three (3) weeks of the Construction Completion Certificate of the underground improvements, the Developer's Engineer shall deliver to the Director of Planning and Development "as-built" prints indicating the service connections, tie-ins, invert charts on plan/profiles, and service invert elevations on lot grading plans. All as-built plans must also be submitted in digital format compatible with the County's latest version of AutoCAD.

No development permits or building permits will be processed until the County receives a set of as-built prints, including completed design building grades for each lot. As an exception, one (1) show home may be constructed with the written approval by the Director of Planning and Development, provided the subdivision design grades have been submitted and approved.

Within two (2) months of completion of roadway base course asphalt, the Developer's Engineer will deliver good quality mylar sepias of the "as-built" drawings, one complete set of prints and a digital copy (in the County's latest AutoCAD software version) of the as-built records to the Director of Planning and Economic Development.

2.2.11 Municipal Acceptance and Maintenance Period

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

a) Sanitary and storm sewers, and water distribution system, including service connections for water and sewer.

b) Sidewalks, curbs and gutters, catch basins, concrete walkways, and paved and graveled lanes.

c) Paved Roads.

d) Landscaping, including boulevards, uniform fencing, and subdivision signage.

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

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

The Developer shall maintain all Municipal Improvements constructed pursuant to this Agreement to the standard to which they were constructed, reasonable wear and tear excepted, for the period commencing upon the issuance of a Construction Completion Certificate and continuing for the periods as stated in the table below:

Table for Maintenance Period

Underground Services and Utilities	24 months
Roads and Sidewalks	24 months
Uniform Fencing, Grass and Sod for Landscape Areas	12 months

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

2.2.12 Development Permits

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

2.2.13 Existing Utilities

Prior to connecting to existing utilities, the County's Utilities Department shall be given a minimum of two (2) working days notification of the work being done.

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

No sanitary sewers will be used to discharge storm water.

2.2.14 Road Closures and Construction within Road Rights-of-Way

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

2.2.15 Survey Control System

The Developer shall provide a survey control system within, and adjacent to the subdivision. The survey control system shall consist of survey monuments of a design mutually acceptable to both the County and Alberta Environment, Land Administration Division. The survey monuments shall be placed so as to be inter-visible between adjacent pairs and spaced approximately three hundred meters (300m) 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 County and Alberta Environment, Land Administration Division, shall be provided with the survey measurements, to the satisfaction of the Director of Surveys, Alberta Environment, Land Administration Division, for the survey control system.

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

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

County of Wetaskiwin No. 10

PERMIT TO CONSTRUCT On County Property/Public Lands

County of Wetaskiwin No. 10
P.O. Box 6960
Wetaskiwin, AB. T9A 2G5
Tel. (780) 352-3321
Fax. (780) 352-3486

Project Address: _____

Roll #: □□□□□□ Lot: _____ Block: _____ Plan: _____

Application Date: _____ (yy/mm/dd)

Applicants Name: _____ Contractor Name: _____ Billing Address: _____
Address: _____ Address: _____ Prov: _____
Prov: _____ Prov: _____ Postal Code:_____
Postal Code _____ Postal Code: _____ Telephone: _____
Telephone: _____ Telephone: _____ Fax: _____
Fax: _____ Fax: _____

Type of Work Proposed:

□ Concrete Work
- □ Sidewalk □ Curb and Gutter □ Driveway Approach
- □ Asphalt □ Pavement Cut

□ Utilities Open Ditch Inspection Date: _____ (yy/mm/dd)
- □ Water – size and type: _____
- □ Sewer – size and type: _____ Closed Ditch Inspection Date: _____ (yy/mm/dd)
- □ Storm – size and type: _____
- □ Gas - size and type: _____ Inspector: _____
- □ Telephone Approved: ____ Rejected: _____
- □ Cable

Reasons for Rejection:
___ _____
___ _____

□ Roads
- □ Road closure □ Paving and gravelling □ Dust control □ Pavement markings
- □ Signage □ Street Cleaning

Length of time for Road Closure: _____

□ Boulevards/Green spaces
- □ Trees □ Turf □ Rock

□ Other

Project Description:

_____
_____
_____

(Drawing attached _____Yes \ ____No)

Project Start Date: _____ (yy/mm/dd) Estimated Completion Date: _____ (yy/mm/dd)

Conditions

1. All work is to meet the County of Wetaskiwin No. 10 design standards. Failure to have work inspected will result in the removal of backfill material at the cost of the builder to allow inspector access to work in question.
2. A two-year warranty is to be given to any work and repair beginning on the date of completion.
3. The County standards for traffic control must be met.
4. Occupational Health and Safety standards must be met (vests, excavation side slopes, etc.).
5. Any excavation on roadways must be backfilled and cold mix placed in the hole within 48 hours. Hot mix must be placed in hole by October 31 of that year.
6. Inspection is mandatory for all utilities – bedded in sand, all joints and connections exposed. A minimum of two working days notice is required for all inspections.
   Note: inspections outside of normal working hours (8:30 AM to 4:30 PM, Mon – Fri) will be subject to a fee of $100.00 (minimum).
7. Street must be returned to clean condition prior to opening road to public. Street abutting construction site must be kept clean at all times.

I, _____, acknowledge that I have received, read and understand all of the above, and I further acknowledge my commitment to the conditions stated in this form.

_____
Date

_____ _____
Applicant's Signature Print Name

DECISION:

The application to construct is hereby:

1. Approved subject to the following conditions:
2. Refused for the following reasons:

CONDITIONS OF APPROVAL \ REASONS FOR REFUSAL:

_____

_____

_____

_____

_____

_____

_____
County representative

The personal information on this form is collected under the authority of Section 32 (c) of the Alberta Freedom of Information and Protection of Privacy Act, Section 642 of the Municipal Government Act and/or Section 39 of the Safety Codes Act. The information will be used to process your application(s) and your name and address may be included on the reports that are available to the public.

2.3 CONSTRUCTION COMPLETION CERTIFICATE

County of Wetaskiwin No. 10	CONSTRUCTION COMPLETION CERTIFICATE

Development Area: _____ Development Name: _____

Developer: _____ _____

Contractor: _____

Municipal Improvement: _____

Location of Municipal Improvement referred to herein is as shown, outlined in red, on the plan on the reverse hereof, (Or see attached).

Date of Application: _____

PURSUANT TO THE DEVELOPMENT AGREEMENT, I _____ OF THE FIRM _____"DEVELOPER'S ENGINEERS", HEREBY CERTIFY THAT AS OF THE ABOVE DATE, THE SAID MUNICIPAL IMPROVEMENT IS COMPLETE AND CONSTRUCTED IN ACCORDANCE WITH THE SERVICING STANDARDS AS SET OUT IN THE DEVELOPMENT AGREEMENT, AND I HEREBY RECOMMEND THIS MUNICIPAL IMPROVEMENT FOR APPROVAL.

Date: _____

Project Engineer (seal) (Developer's Engineering Firm)

Date: _____

Signing Officer (Developer's Engineering Firm)

Date: _____

Authorized County Inspector
Approved on (date): _____

County Engineer: _____

Conditional Approval (date): _____

County Engineer: _____

Conditions: (See attached report) _____

Rejected on (date): _____ County Engineer: _____

Reason for rejection: (See attached report) _____

I HEREBY CERTIFY THAT THE ITEMS LISTED AS REASONS FOR CONDITIONAL APPROVAL OR FOR REJECTION HAVE BEEN CORRECTED.

Project Engineer (Seal) (Developer's Engineering Firm) Date: _____

Approved: _____ Date: _____
County Engineer

Date Maintenance Period to Start: _____
Date Maintenance Period to Expire: _____

2.4 FINAL ACCEPTANCE CERTIFICATE

County of Wetaskiwin No. 10	FINAL ACCEPTANCE CERTIFICATE

Development or Subdivision : _____ Permit or Subdivision #_____

Developer: _____

Contractor: _____

Municipal Improvement: _____

Location of Municipal Improvement referred to herein is as shown, outlined in red, on the plan on the reverse hereof, (Or see attached).

Date of Application: _____

Maintenance Expiry Date: _____

PURSUANT TO THE DEVELOPMENT AGREEMENT, I _____ OF THE FIRM _____"DEVELOPER'S ENGINEERS", HEREBY CERTIFY THAT AS OF THE ABOVE DATE, THE SAID MUNICIPAL IMPROVEMENT MEETS ALL REQUIREMENTS FOR FINAL ACCEPTANCE AS SPECIFIED IN THE DEVELOPMENT AGREEMENT AND I HEREBY RECOMMEND THIS MUNICIPAL IMPROVEMENT FOR FINAL ACCEPTANCE.

Date: _____

Project Engineer (Developer's Engineering Firm)

Date: _____

Signing Officer (Developer's Engineering Firm)

Date: _____

Authorized Director of Planning and Development
Approved on (date): _____ County Engineer: _____

Rejected on (date): _____ County Engineer: _____

Reason for rejection: (See attached report) _____

_____

I HEREBY CERTIFY THAT THE ITEMS LISTED AS REASONS FOR REJECTION HAVE BEEN CORRECTED.

Date: _____

Project Engineer (Developer's Engineering Firm)

Approved: _____ Date: _____
Director of Planning and Development

Date Maintenance Period to Start: _____

END OF SECTION

3 PREPARATION OF ENGINEERING DRAWINGS

3.1 DESIGN DRAWINGS

3.1.1 Scope

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

3.1.2 Drawing Size, Material

The Standard Drawing A-1 drawing size (600mm x 850mm) will be used.

Originals will be prepared using bond or vellum media.

3.1.3 Scales

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

Overall Plans 1:500

Plan/Profile	Horizontal 1:500 Vertical 1:50
Cross-Sections	Horizontal 1:100 Vertical 1:50

Rural Residential drawings shall be prepared using the following scales:

Overall Plans 1:2000

Plan/Profile	Horizontal 1:2000 Vertical 1:50
Cross-Sections	Horizontal 1:2000 Vertical 1:50

3.1.4 Drawing Technique

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, two millimetre (2mm) size or larger (Leroy or equivalent), well spaced, properly formed and proportioned.

c) Lines shall be uniform in weight and density.

d) Dimensioning shall be in the metric system. 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, a centreline or any other reference that can be readily established. Wherever possible, all dimensions shall be provided to a minimum of two (2) property lines.

3.1.5 Title Block

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

a) Developer's/Owner's Name.

b) Developer's Engineer or consulting engineering name.

c) Subdivision name, including staging and/or phasing.

d) Drawing name, number and issue date.

e) Drawing scale, including horizontal and vertical axis.

f) Space for dates and signature of the designer, draftsperson, reviewer or checker, and approving professional or principal.

g) Space for professional stamps and permits.

h) Space for revisions, including number, date, description, and approved signature.

3.1.6 General Requirements for All Drawings

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

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

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

3.1.7 Required Engineering Drawings

The following plans will form a part of the design drawings set:

Cover Sheet:

This will show the name of the subdivision, stage of development, location plan, County logo, and names of the Developer and Developer's Engineer. Space permitting, the index plan may be included here. A key plan of County of Wetaskiwin No. 10, or a significant portion thereof, shall be included, illustrating the location of the development or project.

Index Plan:

This plan will be prepared on a scale of 1:500, or a reduction thereof to fit the standard size sheet, and will indicate that portion of the street that relates to a particular plan/profile sheet.

Contour Plan:

This plan will be drawn at a scale of 1:1000 and will indicate the existing contours at one meter (1m) intervals (rural developments) and point five meter (0.5m) intervals (urban developments), the proposed land use and all significant above ground features, such as buildings, structures, trees, utilities and water bodies.

Sanitary Sewer, Minor Storm Sewer and Water Main Overall Plan:

This plan will be drawn to a scale of 1:500 or 1:1000 and will indicate the alignments and locations of mains, size of mains, valves, hydrants, manholes, catch basins, catch basin leads, minor storm catchment areas, direction of sewer main flows and locations of appurtenances. Manholes, catch basins, valves and hydrants shall have unique identification numbers. Catch basin types are to be shown.

Major Storm Management Plan:

This plan will be drawn to a minimum scale of 1:1000 and may be similar to the plan provided in the Storm Water Management Report. The plan shall indicate the Phase/Project boundary, major overland drainage routes, major storm catchment areas with areas labeled in hectares, minor drainage main alignments, direction of minor drainage pipe flow and detention pond locations, if applicable.

Road, Sidewalk and Walkway Plan:

This plan will be drawn to a scale of 1:500 and will show all locations and widths of roads, lanes, sidewalks, walkways, and right-of-way widths and alignment, and the storm drainage system including the local drainage areas, catch basins, pipe and culvert locations, sizes, inverts, direction of flow, as well as all proposed approaches.

Lot Grading Plan:

This plan will be drawn to a scale of 1:500 and will indicate the proposed contours at point five meter (0.5m) intervals (shown in screened format), proposed areas of grading, finished lot corner elevations, grades and direction of finished surface drainage flows.

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

This plan will indicate the alignments of power, gas, telephone and cable, and shall be drawn to a scale of 1:500. Existing infrastructure and other relevant features shall also be shown in detail.

Detailed Plan/Profile drawings:

Plan/Profile drawings shall be drawn to a scale of 1:500. The profile portion shall have a ten (10) times vertical exaggeration.

3.1.8 Detailed Plan/Profile

Generally, all underground services and surface improvement profiles are shown on the same drawing. The plan portion of the sheet shall be at the top, and the title blocks, revisions, legends, company stamps, and similar features will be placed along the bottom of the sheet.

The following information will be included on the detailed plan/profile drawings:

Requirements for Sanitary and Storm Sewer:

The following information will be shown on the profile:

a) Size, type, class of pipe and class of bedding.

b) Length and percent grades between manholes.

c) Invert elevations at both inlet and outlet of manholes.

d) Rim elevations at finished grade.

The following information will be shown on the plan:

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

b) Pipe offsets from property line.

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

a) Manholes shall be numbered.

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

Requirements for Water:

a) Tie the location of hydrants and other appurtenances to the nearest property pin.

b) Show the offset of the main from the property line and locate the end of the main to the nearest property pin.

c) Indicate extent of work required in making the connection to the existing water main.

d) Indicate the size, type, class of pipe, bedding and CSA specification number on the plan.

Requirements for Roads:

a) Both plan and profile must be tied to a property pin, preferably near or at 0 + 00 chainage.

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

c) Chainages of the BC and EC of horizontal curves will be shown together with the delta angle, radius, tangent length and arc length for each curb.

d) The percent grade, to two decimal places, shall be shown on the profile, together with the following information on vertical curves:

1) The chainage and elevations of BVC, EVC and PVI.

2) The external value, “e”;

3) The length of vertical curve.

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

e) Road profiles will show the Top-of-Curb or Lip-of-Gutter elevations, identifying which has been used

f) The profile will be shown at true centreline length and projected above the plan in as close a relationship as possible.

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

h) Label limits of construction.

3.1.9 Lot Grading Plan Requirements

Refer to Section 12 – Lot Grading

This plan will include:

a) Invert and location of sewer and water services.

b) Proposed top-of-curb or back-of-walk elevations.

c) Proposed contours at point five meter (0.5m) intervals.

d) Proposed finished lot corner elevations.

e) Distances from a property pin to the proposed grade break points on property lines that divide properties.

f) Proposed finished lot elevations at grade break points.

g) Standard detailed drawings shall govern the lot grading design, and critical swales elevations will be calculated as per the types shown.

h) The lot grading plan will have the following note: "The surveyor shall design and stake out the house elevations and finished grades at house to meet the building code slope requirements for drainage to critical swales".

i) The grading plan will identify lots with weak subsoil conditions and have a notation indicating the requirement for a Geotechnical Engineer's footing design.

j) The grading plan will identify all lots with areas of one meter (1m) of fill or greater, with these lots shaded a different colour.

k) Direction of surface drainage and critical swale elevations on side property lines.

3.1.10 Power, Gas, Telephone and Cable Utility Plan Requirements

This plan will include:

a) Street Light Locations.

b) Dimension of all Easements.

c) Location of pedestals, transformers, cabinets, and other hardware.

d) Lot Numbers.

3.2 AS-BUILT DRAWINGS

3.2.1 Scope

This procedure pertains to the as-built drawings of the following services:

a) Storm and sanitary sewers, watermains, roads, curbs, sidewalks, culverts and other miscellaneous permanent structures.

3.2.2 General

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

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

Red line as-built drawings are to be submitted for review, indicating changes.

The as-built drawings are to be submitted to the Director of Planning and Development on high quality mylar sepia sheets, within three months of the installations, along with one complete set of prints.

The as-built drawings referred to in this section will also be submitted to the Director of Planning and Development in digital format, as per the following requirements:

a) Must be compatible with the County version of AutoCAD.

b) Accompanied by a layer list and description.

c) Will conform to layering and symbol standards as established by the County or their consultant.

d) Be submitted on CD ROM.

On as-built drawings submitted to the County, the following information will be included on each drawing:

a) Date of completion.

b) Name of the Contractor.

c) Date on which “as-built” details were added.

3.2.3 Storm and Sanitary Sewer

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

a) Size, pipe material, pipe class, bedding and location of mains.

b) Location of manholes, cleanouts, and other appurtenances.

c) Grades, lengths, inverts of mains and rim elevation.

d) Profile of pipe top and bottom.

e) Corrected flow calculations.

3.2.4 Water

The following information will be included for water systems:

a) Size, type and location of pipe.

b) Location of valves, tees, hydrants and other appurtenances.

c) Profile of pipe top and invert.

3.2.5 Road, Curb, Sidewalks

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

a) Location of curbs, sidewalks and elevations of tops-of-curb or lip-of-gutter.

b) Top-of-curb or lip-of-the gutter for each curb.

c) End of curb, sidewalks and pavement.

d) Type of road structure on overall road plan and each plan profile.

e) A typical cross-section referencing the above and representing all conditions.

3.2.6 Water, Sanitary, and Storm Service Connections

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

a) Lot number.

b) Distance of service saddle from the downstream manholes.

c) Invert elevation at the end of sanitary and storm service.

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

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

3.2.7 Mechanical Systems

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

3.2.8 Building Grade Certificates

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

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

Building Grade Information

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

a) Water, sanitary, and/or storm services location and inverts at property line or easement line.

b) Power, telephone, and cable television service location.

c) Sidewalk and boulevard width.

d) Easements.

e) Lot corner surface elevations.

f) Landscape elevations at front of house.

g) Lot drainage pattern.

h) Streetlights, hydrants, etc.

This information shall be provided in the form as shown on the sample Building Grade Certificate.

END OF SECTION

4 WATER DISTRIBUTION SYSTEM

4.1 GENERAL

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

4.1.1 Municipal Water System

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

a) Give the Municipality two (2) weeks notice of the proposed Work and schedule so proper planning and approvals can take place.

b) Supply all water necessary for the Work and obtain written permission from the Municipality prior to using any hydrants.

c) Obtain written permission prior to operating any of the Municipality's valves and/or hydrants. The Contractor shall be held responsible for any damage done to the hydrants or surrounding area. The Municipality will require their own personnel to operate boundary valves and valves or hydrants beyond the limits of the development.

d) Make an agreement with the Municipality for payment of water used.

e) Be responsible for the supply of all water necessary for the Work.

f) Provide twenty four (24) hours notice to any property owner affected by water service disruption.

g) Supply an alternative water service if the water disruption is longer than four (4) hours.

h) For establishments relying on an uninterrupted water source for their operations, an alternative water source shall be provided.

i) The above noted requirements shall be done at the Contractor's cost.

4.2 DESIGN REQUIREMENTS

The minimum size of distribution main shall be one hundred fifty millimetre (150mm) diameter for residential, two hundred millimetre (200mm) diameter for commercial and three hundred millimetre (300mm) diameter for industrial.

PVC pipe shall be used and the value of "C" in the Hazen-Williams formula shall be 120 for all types of pipes.

Per capita consumption shall be:

Average Daily Demand	340 lcd
Maximum Daily Demand	1.8 x Average Demands
Peak Hourly Demand	3.0 x Average Demands

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

For non-residential developments, the minimum water consumption rate shall be equal to point two litres (0.2l) per second per hectare. The applied peaking factor shall be $Pf= 10Q^{-0.45}$ to a maximum of 25 and a minimum of 2.5, Q being in litres per second. Where possible, water demand shall be based upon site specific requirements for identified uses. Fire flow requirements are to be included in all calculations.

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

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

Fire flow requirements shall be in accordance with the Fire Underwriters Survey publication entitled "Water Supply for Public Fire Protection – a Guide to Recommended Practice", latest revision thereof. Generally these are: for single family residential 60 l/second, for multi-family residential 90 l/sec, for Institutional 90 l/sec, commercial 190 l/sec, and light industrial 230 l/sec.

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

Water main looping will be required where the number of lots exceed ten (10) lots.

Looping with twenty five millimetre (25mm) or fifty millimetre (50mm) lines may be considered on a case by case basis by the Engineer.

4.2.1 Water Main - Location and Installation

Mains shall be installed to provide a minimum depth of cover of three meters (3m) below the final finished surface grade. Maximum depth of cover shall be three point five meters (3.5m) unless authorized in writing by the Director of Planning and Development. Additional depth may be required under roadways.

Mains shall be located inside of the road, in accordance with the Roadway Cross-Section Standard Drawings.

In all cases a distance of three meters (3m) from the centreline of a road shall be maintained.

A minimum of a three meter (3m) horizontal separation shall be maintained between a water main and any sewer main.

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

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

4.2.2 Hydrant - Location and Installation

The maximum allowable spacing between fire hydrants shall be one hundred fifty meters (150m) in single-family residential areas and one hundred twenty meters (120m) in multiple-family residential, school, and one hundred meters (100m) in industrial/commercial areas.

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

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

a) Where the hydrants are installed at the intersections, they shall be installed adjacent to the cut-off corners of the lot.

b) Where the hydrants are installed in a cul-de-sac, they will not be installed within the turning circle but shall be located at the tangent points.

c) Where a hydrant and sanitary manhole fall on the same property line projection, the manhole will be moved a minimum of five meters (5m) away from a hydrant.

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

a) The center of the barrel is to be two meters (2m) back of face-of-curb or point five meters (0.5m) back of walk. With rural cross-sections, install hydrants one meter (1m) from property line.

b) The maximum distance from the face of the curb to the hydrant shall be three point five meters (3.5m).

c) Shall be installed in accordance with the Standard Drawing and the Engineering Specifications outlined in these documents.

d) Hydrants shall be plugged or draining depending on the site conditions (high ground water or poor soil drainage);

e) A gate valve will be provided on each hydrant lead;

f) Cathodic protection to be installed as per Drawing 4-400.

g) All fittings to be stainless steel.

h) All barrels to be epoxy coated.

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

4.2.3 Valve - Location and Installation

All valve boxes located in streets shall be left flush with the base course asphalt. Immediately prior to the final lift of asphalt being placed, these valve boxes shall be raised to final grade.

Valves on the distribution mains will be installed:

a) At the projection of a property line at intersections or in mid-block, for urban sections. One meter from property line for rural sections.

b) With two (2) valves at a tee and three valves at a cross.

4.2.4 Valve Box

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

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

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

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

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

a) No more than one (1) hydrant is taken out of service;

b) No more than four (4) valves are required to affect a shutdown;

c) No more than twenty (20) residential units are taken out of service by a shutdown, including cul-de-sacs; and

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

4.3 THRUST BLOCK

At all hydrants, plugs, tees, crosses, bends, and all other points of concentrated thrust, provide reaction blocking (thrust blocks), as detailed, to prevent movement. Place reaction blocking against solid undisturbed ground. Details provided herein are intended to be general, and are based upon soil load values of seven thousand three hundred kilograms per square meter (7300 kg/m^2) or more. Where soil will not provide this load value, provide additional bands and clamps, or provide more substantial reaction blocking, as required to take the anticipated reaction. Place blocking to provide access to pipe and fittings for repairs or future extensions of the line.

Thrust blocks will be provided as per the Standard Drawing. Thrust blocking shall be Type 50 sulfate resistant concrete having a minimum compressive strength of 20 MPa at twenty eight (28) days.

Pipe restraint devices shall be used separately or in conjunction with thrust blocks, where identified as being required, and shall be in accordance with the manufacturer's recommendation. All restraint devices shall be stainless steel or suitable, resistant to corrosion, to the satisfaction of the County.

4.4 HYDROSTATIC PRESSURE TESTING

Tests shall be made only after completion of services, partial or complete backfill, and a minimum of twenty four (24) hours after the pipe has been filled with water. No test will be applied until at least thirty six (36) hours after the last concrete reaction or thrust block has been cast with high early strength cement, or at least seven (7) days after the last concrete reaction or thrust block has been cast with sulfate resistant cement. The duration of each test shall be two (2) hours. Test pressure will be two (2) times the normal system operating pressures or 1,035 kPa, whichever is greater. Test pipeline in sections not exceeding three hundred sixty five meters (365m) in length.

4.4.1 Disinfection

All water mains will be disinfected in accordance with AWWA specification C651, latest revision.

Before being placed in service, and before certification of completion by the Engineer, all installed mains will be disinfected according to the AWWA Standard C651-99 "Disinfecting Water Mains" and tested for bacterial content and chlorine residual.

On completing the chlorination of the mains, the Contractor shall set the system in operation as directed by the Engineer.

Dechlorination of the chlorinated water may be required in some circumstances before discharging the water to the environment, in order to meet the regulatory requirements of The County of Wetaskiwin No. 10 or Alberta Environmental Protection. Dechlorination, if required, is to be performed by adding neutralizing chemicals (AWWA C651-86, Appendix B) to the chlorinated water as it is flushed from the system and before it enters the receiving environment.

4.4.2 Cathodic Protection

All buried fittings and valves shall be cathodically protected with a 2.3 kg Zinc Anode, and all hydrants shall be cathodically protected with a 5.5 kg Zinc Anode., per Standard Detail 4-400.

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

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

Wire shall be connected to fittings with a cadweld.

A minimum of three litres (3l) of water shall be poured on each Anode to initiate the Anode's operation.

4.4.3 Flushing of Existing and New Water Mains

Prior to flushing of any watermains, the County of Wetaskiwin No. 10 Public Works Office and the County's Utilities Department will receive a minimum of two (2) working days notice. Only County personal will operate existing valves.

4.4.4 Usage of County Water

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

4.5 FIRE PONDS

Fire protection requirements are to be in accordance with the most current Fire Underwriters Survey publication entitled Water Supply for Public Fire Protection - A Guide to Recommended Practice.

For details regarding the design of fire ponds consult Alberta Environment's wet pond standards in the publication entitled "Storm Water Management Guidelines for the Province of Alberta". Some general design parameters to consider for fire ponds are:

a) Capacity of 4000 imp. gal/lot. Active storage winter standard is one meter (1m);

b) Maximum 5:1 side slopes above active storage zone;

c) Maximum 5:1 interior side slopes in active storage zone;

d) Maximum 5:1 exterior side slopes;

e) Permanent depth to be a maximum of three meters (3m) and a minimum of two meters (2m);

f) Maximum water level should be below adjacent house basement footings;

g) All-weather access required with minimum seven meter (7m) road width;

h) Pond to be located not farther than thirty meters (30m) from main roadway;

i) Pond to have impervious liner, one point eight meter (1.8m) high paige-wire fence all around and warning signs;

j) Armoured emergency overflow spillway;

k) Provide details showing how fire pond levels will be maintained or recharged.

4.6 STANDARDS DRAWINGS – WATER DISTRIBUTION SYSTEM

4-100 Valve Box Construction Detail
4-101 Valve Box Detail – Sliding Type A
4-102 Main Valve Casing Detail

4-200	Typical Hydrant & Valve Detail
4-201	Flushing Valve
4-300	Thrust Block Details
4-301	Vertical Bend Thrust Block Detail
4-400	Typical Anode Installation at Valves - Iron Fittings and Hydrants
4-401	Anode Installation Cadweld
4-500	Air Relief Valve
4-600	Hydrant Location and Approach Detail
4-700	Catch Basin Barrel – Dry Hydrant
4-701	Typical Dry Hydrant

END OF SECTION

5 WATER TREATMENT PLANTS

5.1 WATER TREATMENT PLANT STANDARDS

a) Water Treatment Accessibility Features:

- The reservoir design should incorporate two (2) storage cells and two (2) clear wells sumps.
- All cells must be inter-connected and have the capability to be isolated without shut-off of the water treatment plant.
- Access hatches are required for each cell with access ladders and protection cage made of stainless steel. They should be installed on a concrete curb of at least two hundred millimetres (200mm) above the pumphouse floor slab with a stainless steel cover and handle.
- A monorail beam with electrical chain hoist must be located in the center of the wide double doors to lift heavy equipment.

b) Wells Water Supply Operational Philosophy:

- The starting and stopping of the well pump(s) shall be controlled by the reservoir level. When the reservoir level drops to a predetermined point, the well pump shall be commanded to start by the PLC
- The well pump starting and stopping function shall be controlled by float switches (Flygt bulbs) and/or ultrasonic by an analog level transmitter which connect into PLC inputs.
- Raw water flow from the well shall be measured by a flow meter. The flow meter will produce analog (4-20 mA) as well as totalize flow. The pulse signals which will both connect into PLC inputs and display on the HMI.
- When the PLC commands the well pump to start, it will monitor the flow meter signal to detect that a flow has been established. If the flow is below the set point rate, then after a time delay the PLC will shut the well pump down and initiate an alarm.
- Each well pump will have a hand-off-auto switch located on the plant control panel (PCP).
- Each well shall include a submersible level transmitter (4-20 mA) that will connect into a PLC input. If the well water level falls to a low level, then the pump shall be locked out and a low level alarm shall be triggered.
- Well pumps are to alternate with a pumps time indicator set by the PLC or manually.

c) Inlet Line Features:

- Isolation Valve must be installed on the inlet line just after the pipe penetration through the pumphouse floor slab.

- Air Release Valve with a ball valve must be installed on the high point of the inlet line upstream of the flow meter that records instantaneous and cumulative flow. 4-20ma signals will be received by the PLC and displayed on the HMI screen.
- A Pressure Transmitter and Pressure Gauge with a block and bleed valve with a 4-20mA analog input to the PLC and displayed on the HMI screen.
- Must be able to isolate Magnetic Flow Meter and Flow Control Valve. The Flow Control Valve if required must have a set point of flow controlled by the PLC and input of changing the flow from the HMI.
- Each fill line for each cell has the ability to be isolated without shutting the system.
- Ensure enough Contact Time is enough when sizing the reservoir base on AE guidelines.

d) Recirculation Line Features:

- Able to maintain night flows.
- Maintain Residual Chlorine Level at the discharge of the system and maintain a minimum Chlorine Level in the distribution system based on AE guidelines
- Flow Meter and Flow Control Valve must be installed on the recirculation so that the flow can be adjusted from the HMI screen. All readings must be displayed on the Flow Meter and on the HMI.
- The water plant shall include an Online Analyzer to measure Chlorine Level on the header of the pumping system. There shall be a recirculation line on the pumping system where we can connect the metering pump in order to satisfy the chlorine level. All chlorine injection and reaction time should satisfy Alberta Environment CT guidelines. The water must be in recirculation until the CT is achieved. When the CT level is achieved, water distribution can start.

e) Chlorination System:

- A liquid chlorine injection system shall inject liquid chlorine into the raw water supply line by means of a metering pump.
- Chlorine injection points at raw water and recirculation to maintain chlorine levels in the reservoir.
- The metering pump shall operate whenever the well pump is running and a flow is detected by the raw water flow meter.
- The pump shall be powered via a 120 vac receptacle. The power to the receptacle shall be controlled by the PLC.
- A chlorine analyzer shall be installed on the pump header to monitor the chlorine content.
- The monitor shall provide: backlit LCD display; high & Low Alarm; 4-20 mA outputs for chlorine for recording; sample low flow indicator.

1) Online Analyzer:

i. Analyzer shall be wall panel mounted, complete with DIC & DMT microprocessor, chlorine sensor, pH sensor, temperature sensor and holder, and flow indicator, pre-plumbed/valved and pre-wired.

ii. Measurement ranges: Free or Total: 0.02-5.00 ppm.

iii. Analyzer shall not require chemical reagents.

iv. The monitor shall provide: backlit LCDS display, high and low alarm, 4-20mA outputs for chlorine recording, sample flow indicator.

v. The CLE 3.1 sensor shall work on amperomteric principle with membrane covered 2-electrode cell.

vi. The CLE sensor and flow indicator shall be installed in in-line DGMA sensor holder module. Sample flow shall be 40-60 l/h & <14.5 psi.

vii. Pressure regulator, factory pre-set at 12-15 psi, shall be installed upstream of sample inlet.

viii. 1/2 * 3/8 in tubing connections for sample inlet/outlet.

2) Metering Pump:

i. A microprocessor-based solenoid-driven diaphragm.

ii. Stroke length adjustment 0-100%, in 1% increment.

iii. Digital stroke frequency adjustment from 0-180 spm.

iv. Remote on/off and contact pulse 1:1.

v. Three LED lights indicating operational status.

vi. Fiberglass-reinforced, PPE plastic housing with a NEMA 4X enclosure rating.

vii. Display output in gallon per hour or litre per hour.

viii. Totalized display in gallons or litres.

ix. Direct calibration and built in warning.

x. Flow rate: 0.16 gal. per hour/pressure 253psi.

3) Hypochlorite Solution Tank:

i. 45 gallon tank w/ graduated w/lid as manufactured by FLEXIHOPPER (Part No GT-45) or equal.

f) Distribution Pumping System:

- The distribution pumping system shall use two (2) or more pumps, each controlled by a variable frequency drive (VFD).

- A pressure transmitter (4-20 mA) shall be installed on the distribution header to measure the discharge pressure.
- The speed of the pumps shall be modulated to maintain the discharge pressure at a predetermined setpoint.
- A PID controller, located in the PLC program will control the speed of the pumps.
- At low flows, one (1) pump (lead pump) will run continuously and its speed will modulate to maintain the discharge pressure at its setpoint.
- As the flow demand increases, the lead pump will increase its speed to maintain the pressure. When the lead pump reaches ninety five percent (95%) of its maximum speed, the PLC will unlock the second pump (lag pump) and the two (2) pumps will modulate together via the PID controller to maintain the pressure setpoint.
- As the flow decreases, both pumps will decrease speed and when the point is reached where one pump can handle the demand, the PLC will turn off the lag pump after a time delay.
- The lead and lag pumps shall be selected by means of a selector switch on the plant control panel (PCP).
- If the lead pump should fail, then the PLC will automatically start the lag pump, lock out the failed pump, and initiate an alarm.
- A low level float bulb (Flygt bulb) and ultrasonic level indicator for control will be installed in the reservoir and will be set at the minimum safe operating level for the pumps. If the level falls below this point, the pumps will shut down when they are operating in AUTO mode. In HAND mode this protective feature is bypassed.
- Each VFD will be wired with an external hand-off-auto switch and a manual speed potentiometer. These devices will be wired to the customer field terminals in the VFDs. In the AUTO position, the VFD will receive its start/stop commands and speed command from the PLC. In the HAND position, the VFD is disconnected from the PLC and the operator can control the speed with the potentiometer. The intent is that in an emergency condition, or if the PLC fails, then the operator can control the VFD, but without the need to use the membrane keypad built into the VFD. The design should be such that the operator will never need to use the membrane keypad.

g) Genset for back-up power with auto on/off, A gen set to prevent pressure loss in event of power failure adequate to service the entire Water Treatment Plant.

h) Mop sink complete with hot water, toilet in a separate enclosure, and eye wash station installed near chlorine tank according to ABC.

i) Desk and chair, telephone or alternate communication.

j) Fifty foot (50') rubber garden hose and one half inch (½") hose bib near door off the header or from the mop sink.

k) ABC dry chemical fire extinguisher depending on Alberta Building code.

l) Except for Isolation Valves and piping, all equipment must be blue, ie Air Release Valves, pumps, ETC.

m) General Design Criteria Instrumentation and Controls:

- A Control Philosophy must be in place and approved by the County.
- The design shall utilize one (1) or more programmable logic controllers (PLC) to handle the control functions and alarming.
- The design shall include hand-off-auto switches as required to ensure the facility can be operated in hand if the PLC should fail.
- An HMI (human machine interface) operator panel shall be installed in the front of the control panel. The screen will display all operational data including:
    1) Pump on/off status
    2) Elapsed running time of each pump
    3) Flow rate
    4) Totalized flow
    5) Pressures
    6) Reservoir level
    7) VFD speed
    8) Valve position
    9) Low/High Chlorine Level
    10) Transfer to external data device
    11) Alarm status
- The HMI screen will include an alarm logging screen.
- The HMI will allow the operator to adjust certain setpoints, including:
    1) Chlorine high and low alarm setpoints
    2) Reservoir high and low alarm setpoints
- A UPS (uninterruptible power supply) shall be installed and connected to power the control panel, alarm dialer (AWU) and critical valves in the event of a power failure. The UPS must provide at least 30 minutes of backup power. In the event of a power failure, then after a time delay, the PLC will position any valves to default positions and initiate an alarm. After power is restored, the PLC will wait for a short time period to ensure that the power is stable and then initiate a structured restart of the plant.
- Flow meters must be sized based on the flow rate envelope.

- Victaulic couplings or other suitable equipment must be provided for in the design to ensure that the flow meters can be easily removed without damage to the flange faces.
- Bypass lines must be provided around flow meters and control valves to ensure they can be removed for servicing without interruption to the operation of the plant.
- A pressure relief valve shall be installed on the discharge header to relieve back into the reservoir. The valve setpoint shall be approximately 50 kPa above the operating setpoint of the VFDs.
- HMI screen can store data collected either on external storage device.

n) Alarms:

- The control panel shall include an automatic warning unit (AWU) if required and sent to the County's emergency response system.
- The AWU shall receive alarm signals from the PLC, and when an alarm condition occurs, it shall dial through a series of preprogrammed telephone numbers. When a called number is answered, it will announce the specific alarm message in a digitally recorded voice and prompt the called person to enter an acknowledge code on the telephone keypad. If the code is entered correctly, the AWU will cease dialling further numbers. If the code is not entered, the unit will call the next number on the list and repeat the sequence above.
- The following alarm conditions will be monitored and dialed out through the AWU:
- Building Intrusion: An intrusion alarm system will be installed in the building c/w keypad, door sensors and motion sensors as required.
- Smoke Alarm: Two (2) or more ionization smoke detectors will be installed.
- High/Low Building Temperature: A wall mounted thermostat will be installed in the building and will trigger an alarm when the building temperature falls below fifteen degrees Celsius (15°C).
- Utility Power Failure: A three (3) phase power monitor (PQM) will be installed in the MCC to monitor the incoming utility power. If the voltage goes low on one or more phases, or if reverse rotation is detected, the PQM will trigger an alarm. In addition, a power monitor relay will be installed in the plant control panel to monitor the single phase power feed to the panel.
- UPS Failure: The UPS unit will be equipped with internal diagnostics and a monitor relay. If any abnormal condition occurs within the UPS, it will initiate an alarm
- Reservoir High Level: A reservoir level transmitter (4-20 mA) shall measure the reservoir level and initiate an alarm if the level rises above a preset level. In addition, a float bulb will be installed in the reservoir to provide a redundant backup. It will initiate an alarm and shut down the well pumps.

- Reservoir Low Level: The reservoir level transmitter will initiate an alarm if the level falls below a preset level, in addition, a float bulb will be installed in the reservoir to provide a redundant backup. It will initiate an alarm and shut down the well pumps.
- Low Discharge Pressure: A pressure transmitter will measure the discharge pressure in the distribution header. If the pressure falls below a predetermined setpoint, then an alarm will be triggered after a time delay.
- VFD Failure: The alarm relay in each VFD shall be programmed to remain normally energized. If the VFD drive should fail, or if it loses utility power, then the relay will drop out and initiate an alarm
- Pump Overload Trip: Each non-VFD pump shall include an overload trip contact in its motor starter. If the motor trips, then an alarm will be triggered.
- Pump Fail-To-Start: For each pump controlled by the PLC. If the PLC commands a pump to start, then it shall monitor the "running" contacts of that pump motor to confirm that it has in fact started. If not, then an alarm will be triggered.
- Chlorine Residual Low/High: The 4-20 mA output from the chlorine analyzer shall connect into a PLC input. If the residual goes above or below predetermined setpoints, then an alarm will be triggered. The setpoints shall be operator adjustable from the HMI operator screen on the plant control panel.
- PLC Watchdog Alarm: One discrete output from the PLC will be programmed to remain permanently ON. It will connect into an AWU input. If the PLC should fail, this output will drop out and trigger an alarm in the AWU.
- All alarms shall be displayed on the HMI operator panel and will also be logged in chronological order on the screen.

o) The plant shall include the following equipment as a minimum:

- Supply of a computer connection or external storage device to analyze data from PLC.
- Plant control panel c/w PLC.
- HMI operator screen on control panel.
- Alarm dialer (AWU).
- Uninterruptible power supply (UPS).
- VFD motor drives.
- Magnetic or turbine flow meter on raw water line from wells.
- Magnetic flow meter on discharge line.
- Pressure transmitter on discharge line.
- Chlorine analyzer on discharge line.
- Ultrasonic Level transmitter for each reservoir cell.

- Minimum two (2) float bulbs on clearwell (high level alarm and low water level pump shutdown).

p) Acceptable Equipment:

- All major instrumentation and control equipment shall be of a recognized, major brand, commonly used in water and wastewater applications. Acceptable brand names include (but are not limited to):

  1) PLCs: Modicon, Rockwell (Allen Bradley), Automation Direct, Square D, Omron, Telemecanique

  2) FLOW AND PRESSURE MEASUREMENT: Endress & Hauser, Rosemount, ABB, Sensus

  3) LEVEL MEASUREMENT: Siemens Milltronics, Grayline, Endress & Hauser

  4) ANALYTICAL: Hach, Endress & Hauser, Prominent, Capital Controls

  5) VFD MOTOR DRIVES: ABB, Toshiba, WEG

  6) AWU ALARM DIALER, Barnett Protalk, Sensaphone

  7) Chlorine Analyzer: Prominentt PCM-CLE-PH-Temp with spare probes and replacement kit

  8) Metering Pump: ProMinentt gammma/L GALA160NPB900UD12000 with spare parts kits BT4A, Gala 1601 NPB, Auto-Degassing Material (1) 1001666 and Universal Control Cable (2m), 5 wire, 5 pole Material – 1001300

q) Instrumentation and Controls Installation Specifications for Contractors:

- The installation must be in compliance with all applicable codes and regulations, including electrical and environmental.
- The installation must be in accordance with industry accepted standards and best practices, including applicable ISA (Instrumentation, Systems and Automation) standards.
- Fluids and materials used in instruments must be environmentally suitable for potable water use. This includes capillary tube fill, diaphragm seals, and pressure gauge fill fluids. Mercury switches may not be used.
- All instruments shall be installed in a neat, workmanlike manner. Instruments shall be mounted level.
- Where installed on concrete or masonry block walls, expansion anchors shall be used.
- Where the instruments are mounted on sheet metal walls, the instrument shall be mounted on painted plywood or Unistrut that is securely fastened to at least two (2) adjacent wall studs. Instruments may not be directly fastened to the metal cladding.

- Control panels and operator adjustable instruments shall be mounted at eye height.
- All instruments shall be calibrated in metric units of measurements. All labels, scales and indicators shall be in metric.
- Where pipe vibration may be expected, the instruments shall be mounted remotely, either on a pipe stand or nearby wall.
- All equipment must be protected during construction to prevent the entry of dirt or dust. Equipment must be protected during any drilling, filing or cutting to prevent the entry of metal filings.
- Equipment manufacturers' recommendations must be observed.
- Pressure transmitters shall be installed using block and bleed valves. Each pressure transmitter is to include a pressure gauge co-located on the block and bleed valve.
- Magnetic flow meters must include grounding rings where electrically non-conductive pipe is used such as PVC or epoxy lined. In any case, the manufacturer's recommendations must be followed regarding grounding.
- Recommended upstream and downstream straight pipe must be provided for all flow meters, see manufacturer instructions.
- Conduits:
    1) All instrumentation and control field wiring shall be in EMT conduit. Watertight (compression type) fittings must be used.
    2) DC control signal wires (including analog 4-20 mA signal wiring) shall not be run in the same conduits that carry AC power or signals.
    3) Where field instruments are mounted on the process piping, pipe stand or any other location other than a wall of the building, the final point six meters (.6m) of conduit (minimum) connecting to the instrument shall be run in liquid tight flexible conduit.
    4) All electrical connections external to the control panels must be made on the instrument terminals. Control wires, including shielded analog cables, must be run continuously between the control panel and instrument(s). Wires shall not be spliced.
    5) All applicable provisions in the electrical section of this specification shall apply equally to the instrumentation and controls conduits.
    6) Where instruments consist of two (2) components, ex. A flow tube and flow transmitter, the conduit connecting the two (2) components shall be used for no other purpose than to carry the signal cable for that equipment.
- Wiring:

1) All wiring carrying instrumentation analog signals (4-20 mA) must be foil-shielded cable, #18 or #20 AWG, Belden 8760 or Belden 8762 or equivalent.

2) All shielded cable runs to have the shield connected to earth ground at the control panel end only.

3) Analog wiring may be run in non-shielded, multiconductor cables within the control panels, where it is more practical to do so. i.e. wiring between the PLC I/O modules and the field terminal strip.

4) All non-analog control signal and power wiring within the control panels to be type TEW stranded wire, AWG 16 to AWG 18 as required and with due regard for safety fusing. AWG 14 may be used within control panels only where required for high current loads. Type RW90 or TEW may be used for field wiring. Solid wire is not permitted.

5) Manufacturers' recommendations must be observed for minimum and maximum wire conductor sizes for connection to instruments and other equipment.

6) Solid wire may not be used in any case.

7) Where spare conductors are pulled into control panels or instruments, the spare wires shall be taped at the ends and tied back.

8) Telephone wiring may be run in "Station Z" type wire.

- Wire Numbering:

1) Each wire conductor shall have a wire number applied to each end of the conductor, including control panel wiring and field wiring.

2) Wire numbers shall be machine-stamped, heat shrink wire markers or thermally printed vinyl labels. Hand written numbers are not acceptable.

3) Shielded cables and multiconductor cables shall be identified by means of a heat shrink wire marker applied over the entire cable end, or thermally printed vinyl label, identifying the cable number. It is not necessary to label individual conductors within a shielded or multi conductor cable if they are colour coded or numbered by the manufacturer.

- Instrument Tags:

1) Every instrument shall be identified with an engraved lamacoid tag applied on or adjacent to the instrument by means of double-sided tape, or alternately by means of a stainless steel beaded chain. The tag shall identify the instrument by its P&I tag name (ex. LIT-101).

2) Every switch, lamp, pushbutton, etc. located on a control panel shall be identified with a self-adhesive engraved lamacoid tag, in accordance with the panel drawings.

3) Every instrument located inside a control panel shall be identified with a self-adhesive engraved lamacoid tag.

4) Lamacoid tags shall be machine-engraved, with black letters on white lamacoid. Edges shall be beveled. The tags shall be a minimum of twenty five millimetres by seventy five millimetres (25mm x7 5mm (one inch by three inches (1"x3")), with six millimetre (6mm) (one quarter inch (1/4") minimum letters.

- Control Panels:

1) Each facility shall utilize a central Plant Control Panel (PCP)

2) The PCP shall consist of a NEMA4 sheet metal enclosure, painted gray

3) All control equipment, including PLCs, relays, switches, HMI screens, power supplies, etc. shall be housed in the PCP

4) Where conditions dictate, auxiliary control panels may be used, such as for fill valve control or chemical feed control.

5) Every control panel shall contain a backpan. All equipment must be installed on the backpan.

6) A minimum hand operated switches for PLC and bypass PLC and HMI in case of failure.

7) All equipment and wiring shall be mounted on the backpan and/or sidepans within the enclosure.

8) Where any instruments are mountable on DIN rail, the DIN rail shall be used.

9) A schedule of fuse locations, sizes and functions shall be affixed to the inside of each control panel.

10) Where the same plug-in base configuration is used for relays with different coil voltages or pin configurations, then the bases shall be marked to prevent the accidental insertion of incorrect relays in the bases.

11) Where the control panel utilizes indicator lamps with replaceable bulbs, a schedule of bulb sizes shall be affixed to the inside of the control panel.

12) Where wiring is run from the control panel to the door, the wiring shall be bundled and formed into a "U" at the hinge to prevent stress on the wiring. The wiring shall be enclosed in a flexible vinyl spiral wrap or other protective cover to prevent chaffing at the cut metal edges. Each end of the "U" wire bundle shall be mechanically fastened to the door and control panel with proper fasteners and metal screws and nuts drilled through the metal.

13) Where analog signals (4-20 mA) are run to the control panel door, they shall be run in separate bundles, away from any AC wiring.

14) All wiring within the control panels shall be run in plastic wire duct, Panduit Type F or equivalent.

15) All incoming field wiring shall connect to one side of the field terminal strip. Panel wiring shall connect to the other side. Field and plant wiring shall not mix within the panel.

16) All terminals on the field terminal strip shall be numbered with machine-stamped numbers, Decafix (Weidmuller) or equivalent.

17) AC, DC and analog terminals shall be grouped into sections on the field terminal strip and kept separated. Barrier plates shall be used between the sections.

18) All devices within a control panel that require grounding shall have their ground wires run to a common point within the panel, grounded to the backpan, and then connected to a suitable building ground via a dedicated grounding conductor. Metallic conduits shall not be sufficient for grounding the control panels.

19) As much as possible, low voltage signal wiring shall be kept separate from AC wiring within the control panels.

- Wire Color Coding:

  1) All individual conductors shall be colour coded as follows:

  2) 120 VAC Hot: Black

  3) 120 VAC Neutral: White

  4) DC Positive: Red

  5) DC Negative: Blue

  6) Ground: Green

  7) The Contractor may utilize other colour coding schemes with the prior permission of the engineer.

  8) Where multiconductor cables are used, the colour coding shall not apply.

  9) Within two (2) conductor shielded cables, black shall always be negative. White or red, as applicable, shall be the positive wire.

- The Contractor will provide ten (10) spare fuses, two (2) relays, and ten (10) lamps of each type and size used in the control panels.

- On completion of the work, remove debris from the site, repair any damage done to this portion of the work, or the work of others, and leave the installation in a clean and neat condition.

- The inside of all control panels shall be vacuumed clean and the panel fronts and instruments cleaned of any grease or dirt.

r) Shop Drawings:

- Submit shop drawings for all equipment including, but not limited to:

  1) Control panels.

2) Programmable Logic Controllers (PLCs).
3) HMI Operator Interface Panels.
4) Flow meters, level transmitters, pressure transmitters, temperature transmitters, analytical equipment, chemical feed equipment.
5) Data communication and SCADA equipment including modems, radios, computers and interfaces.
6) Automatic warning units (alarm dialers).
7) Miscellaneous field equipment including smoke detectors, temperature switches, intrusion alarm panels.
8) Pump Data, Curves, Design Flow, Motor, Material.
9) VFD's.
10) Valves.
11) All other equipment that must be approved by an Engineer.

- Shop drawings shall be marked up to indicate the specific model or part number of the equipment to be supplied.
- Shop drawings shall include all information as detailed in the section of this specification.
- Metric units of measurement shall be used.

s) Record Drawings (As-Built):

- Mark up the engineering drawings with the as-installed details and submit one (1) set of drawings to the engineer.
- Include on the drawings all changes to the design drawings as well as instrumentation tags, wire numbers, cable numbers, conduit numbers, terminal numbers and PLC input and output connections and addresses.
- Provide one (1) final drawing of each control panel showing the layout of all instruments, controls, switches, wireways and lamps, including dimensions of the layout.
- Metric units of measurement shall be used.
- With each paper copy of drawings submitted, provide a digital copy in AutoCAD or pdf format
- Supply all marked drawings of the contract.

t) Final Documentation:

- The Contractor shall deliver to the Engineer, complete documentation on the completed in accordance with the general specifications.
- The documentation shall include installation, operation and maintenance manuals for each instrument or equipment.

- Where an instrument requires programming or calibration, a programming/calibration sheet shall be included in the manuals which include the "as installed" values of all such parameters, settings, calibrations, DIP switch settings, jumpers, etc.
- The final installed version of the programmable logic controller (PLC) program shall be printed out and included in the O&M manuals. The printout shall include complete and comprehensive documentation, including tag identifiers for all program elements (ex. LT-101), plain English descriptions (Storage Tank Level Transmitter), and rung comments that describe the function of all rungs in the program.
- The PLC program, as described in the previous paragraph, shall be copied onto disk or CD-ROM and two such disks or CDs provided to the engineer on completion of the project.
- Provide completed "As Built" drawings for the control panel wiring and field wiring. (in both paper and digital format- AutoCAD or pdf format).
- At least a two (2) year warranty on the Water Treatment Plant equipment and instruments also three (3) sets of operation manuals record drawings complete with shop drawings paper and digital (PDF).

u) Performance Verification Testing (PVT):

- Upon completion of work and prior to the PVT by the Engineer, the Contractor shall verify the operation of all circuits, instruments, controls, PLC inputs and outputs, and programs and ensure that they are operational within the manufacturer's specifications and within the requirements of the project specifications and drawings. The Contractor shall prepare a report certifying the tests performed and the results observed, and forward this to the Engineer.
- Prior to PVT, submit to the Engineer calibration sheets for each instrument which is adjustable or configurable, indicating the final calibration values.
- The Engineer will prepare test procedures for the PVT and forward to the contractor prior to the PVT. The test procedures will describe all tests to be performed. The test procedures will include actions and the expected results, to verify compliance with all the requirements of the drawings and this specification. The Contractor shall perform the test procedures to the satisfaction of the Engineer and demonstrate that the completed control system complies with the contract requirements. All physical and functional requirements of the project including any communication requirements shall be demonstrated by the Contractor.
- During PVT, the Contractor shall assist the Engineer in testing, commissioning and debugging the system and correct any deficiencies or problems that may appear.

END OF SECTION

6 SANITARY SEWERAGE SYSTEM

6.1 DESIGN FACTORS

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

a) Residential

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

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

Average Sewage Flow	-	340 lcd
Peaking Factor	-	$1 + 14/ (4 + p^{0.5})$
(Harmon's Formula)		
Where p equals the equivalent population in 1,000's		
Infiltration	-	0.20 L/s/ha

b) Commercial, Industrial and Institutional:

Average Sewage Flow	-	Commercial: 40,000 l/ha/d
		Industrial: 20,000 l/ha/d
Peak Flow	-	3.0 x Average Flow
Infiltration	-	0.28 l/s/ha (24,000 l/ha/d)
Minimum Velocity	-	0.61 m/s

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

The minimum size for sanitary sewer mains shall be two hundred millimetre (200mm) diameter for residential and two hundred fifty millimetre (250mm) for industrial/commercial areas.

Minimum pipe slopes shall be as recommended by Alberta Environment.

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

6.2 SEWER MAIN INSTALLATION AND LOCATION

Mains shall be installed to provide a minimum depth of three meters (3m) from top of pipe to final finished grade at the surface.

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

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

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

6.3 MANHOLE INSTALLATION AND LOCATION

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

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

Manholes shall be installed as shown on Standard Drawings. Manhole bases shall be pre-cast slabs, concrete poured bases, vaults or pre-cast tees. Pre-benched manholes shall be used when possible. All manholes shall be one thousand two hundred millimetre (1,200mm) inside diameter for all pipe nine hundred millimetre (900mm) diameter and less. For pipe exceeding nine hundred millimetre (900mm) diameter, manhole diameter shall be pipe diameter plus six hundred millimetre (600mm), or a Tee-Riser shall be used.

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

An interior drop manhole shall be used where invert levels of inlet and outlet pipes differ by more than seven hundred fifty millimetre (750mm).

All joints shall be watertight.

Safety platforms at intermediate levels are required for manholes greater than five meter (5m) in depth when measured from the top of the frame to the lowest invert.

6.4 CURVED SEWERS

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 ninety meters (90m) or the manufacturer’s minimum recommended radius, whichever is larger.

b) Manholes shall be located at the beginning and end of the curve.

c) Manholes shall be located at intervals not greater than ninety metres (90m) 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 fifty percent (50%) greater than the minimum grade required for straight runs of sewers.

6.5 INSPECTION AND TESTING

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

a) Closed Circuit Television Inspection

All sections of sanitary sewers shall be inspected with closed circuit television camera equipment prior to F.A.C. A written report and a DVD shall be submitted to the County for their approval and records.

b) Leakage Test:

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

6.6 LOW PRESSURE SEWAGE SYSTEMS

6.6.1 Design Factors

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

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

c) All materials incorporated in the system shall meet County approval and be installed as per manufacturer’s instructions. Unapproved materials shall be replaced at the Contractor’s or Developer’s expense.

d) All systems shall be designed for a minimum twenty (20) year operating life span.

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

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

g) A minimum of one meter per second (1m/sec) scouring velocity shall be achieved in each sub-system at least once per day, based on design flows.

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

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

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

1) Centrifugal Pump System

Q=1.2611 + (0.0316 x R) where
R=The accumulative number of residences contributing sewage flows to each system segment.
Q=Equivalent design flows for each segment in litres/second (l/s).

2) Semi-positive Displacement

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

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

246-278	13
279-311	14
312-344	15

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

3) All minor losses at bends and valves according to the supplier specifications.

4) Elevation changes shall be taken into consideration in system design.

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

l) System operating pressures shall normally be in the range of 200 kPa to 415 kPa (30.0 psi to 60.0 psi). The network shall be designed to prevent any long-term high-pressure situations.

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

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

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

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

6.6.2 System Requirements

a) Where possible all sewer piping shall be installed at sufficient depths to prevent freezing. Where pipe sections and appurtenances have less than three meters (3m) cover, necessary rigid insulation shall be used to prevent freezing.

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

c) Standard water/sewer clearances shall be maintained at thirty metres (30m) horizontal and point five meters (.5m) vertical.

d) Clean outs shall be installed at the upstream of each line segment and major directional changes. Bends and wye connections shall not exceed a forty five degree (45°) deflection angle. Maximum spacing for cleanouts and

isolation valves shall be one hundred fifty meters (150m). Units shall include a quick coupler system for system flushing compatible with County maintenance requirements.

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

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

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

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

i) Use of repair clamps will not be permitted.

6.6.3 Property Shut-off and Main Line Isolation Valves

a) Isolation valves shall be located at key points, and major directional changes for maintenance and repair requirements, to a maximum of one hundred fifty meters (150m) between each other.

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

c) Isolation valves on lines seventy five millimetres (75mm) in diameter or greater shall be eccentric plug type, suited for operation in sewage systems.

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

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

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

6.6.4 Pump Requirements

a) Pump operating parameters shall be based on the present and future system requirements as determined by the Engineer. The required individual grinder pumping rates shall be determined according to daily inflow rates as indicated in “Section 5 Sanitary Sewage System”. Pump units shall be submersible types, either semi-positive displacement or centrifugal, with integrally built grinder assembly and isolation valves. Pump units shall pump directly into low-pressure mains. Pumping equipment shall meet all applicable safety, fire and health requirements for the intended application and location.

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

c) While outside below ground installations are preferred, inside installations meeting all code and collection system requirements may be allowed subject to County approval. Pump operating parameters shall be based on the present and future system requirements as determined by the Engineer. The required individual grinder pumping rates shall be determined according to daily inflow rates as indicated in “Section 5 Sanitary Sewage System”.

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

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

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

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

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

i) Grinder pump rated maximum pumping pressures shall not exceed eighty five percent (85%) of low-pressure collection pump systems, designed maximum working pressures.

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

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

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

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

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

o) Maintenance replacement and power consumption evaluations shall be preformed as part of the final system design. Literature shall include but not be limited to:

- parts listing
- parts supplier
- maintenance schedule

Where required provide a minimum of two (2) manuals to County maintenance personnel.

6.6.5 System Testing

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

b) Zero infiltration/exfiltration is permitted.

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

d) The test pressure shall be one point two (1.2) times the maximum operating pressure, but not less than 350 kPa (50 psi).

6.7 STANDARDS DRAWINGS – SANITARY SEWERAGE SYSTEM

6-100 Type 5A Pre-Cast Manhole Detail
6-201 External Drop Manhole
6-202 Interior Drop Manhole Detail
6-203 Exterior Drop Manhole Detail
6-300 Prebenched Manhole Base
6-400 Manhole Safety Platform
6-500 Pipe Bedding Details
6-600 Typical Trench Detail

END OF SECTION

7 STORM DRAINAGE SYSTEM

7.1 DESIGN FACTORS

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

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

The major system comprises the street system, detention facilities, parkland and any other land required to convey runoff from events up to and including a one (1) in one hundred (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 one hundred (100) year event.

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

Roof leaders of residential buildings shall be splashed on the surface and shall not be connected to the storm sewer system. Roof drainage from one (1) family and two (2) family dwellings shall discharge to grassed or pervious areas. The point of discharge shall be a sufficient distance (i.e. at least one meter (1m)) to ensure the water flows away from the building. Roof drainage from apartment buildings, commercial areas, and industrial areas may discharge to the storm sewer, without the drainage crossing a sidewalk, if approved in writing by the Director of Planning and Development.

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

Where pre-development runoff rates are considered excessive for the existing drainage system, the Developer shall consider alternatives to reduce the existing runoff to a level acceptable by the Director of Planning and Development.

The Developer shall provide these designs and calculations to the County of Wetaskiwin No. 10 for approval.

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

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

No sump pump connections to the storm system are allowed unless approved in writing by the Director of Planning and Development.

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

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

a) For areas less than sixty five (65) ha, the Rational Method shall be used to design the storm sewer system:

$Q = 2.78\ CIA$

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 (5) year rainfall intensity table shall be used as shown on Table 7.1.

c) The following runoff coefficients shall be used for the one (1) in five (5) year analysis:

Parks	=	0.15
Residential	=	0.35
Industrial	=	0.70
Commercial	=	0.70
Multiple Family	=	0.70

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

$C = (Cp*Ap + Ci*Ai) / (Ap+Ai)$

In these standards, where the subscripts “p” and “i” indicate the pervious and impervious surfaces, respectively, 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 ten (10) minutes in duration (specific overland flow times shall be computed separately for industrial and undeveloped areas). Gutter flow time shall not exceed five (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.

For areas greater than sixty five (65) ha:

a) Computer models shall be used to determine design flows and the sizing of systems that 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.

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.

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

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

The minimum velocity within a piped system shall be one meter per second (1m/s). Where greater velocities in excess of one meter per second (1m/s) are attained, special provisions shall be made to protect against displacement by erosion or impact.

Pipe sizing shall be determined by utilizing the Manning’s Formula, using an “N” value of point zero one three (0.013).

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

Surface water shall not be permitted to run a distance greater than one hundred fifty meters (150m) along curbs and gutters without provision of interception by the first catch basin. Within the piped drainage system, or on Collector or Arterial roadways, surface runoff shall not run a distance greater than one hundred twenty meters (120m) without interception.

Surface water shall be intercepted with a sufficient number of catch basins such that the inlet capacity is sufficient to receive the design storm water flow. Catch basin capacity shall be considered, as shown on Table 7.7, where values are given for sag conditions and on slope conditions based upon inlet grate type.

Minimum gutter grade shall be point five percent (0.5%). Cul-de-sacs and curb returns are minimum point eight percent to one percent (0.8% - 1%).

Roadway ditches and swales will efficiently convey run-off through the storm drainage system. Roadway ditches, culverts (sized appropriately) and swales will not be used for stormwater detention or retention.

7.2 STORM SEWER MAINS

7.2.1 Sewer Mains

The minimum size of storm sewer mains shall be three hundred millimetre (300mm) diameter.

Pipe classes shall be determined to withstand subsequent superimposed loadings.

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

7.2.2 Catch Basins

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

   1) Nine hundred millimetre (900mm) I.D. pipe barrel conforming to CSA-A257 2. Joints to be confined O-ring to CSA-A 257.3 using rubber gasket.

   2) Catch basin manholes shall be one thousand two hundred millimetre (1,200mm) in diameter in accordance with the Standard Drawing.

   3) Catch basin manholes shall be used in place of a catch basin when the lead exceeds thirty meters (30m) in length or one (1) catch basin discharges into another.

   4) Catch basins are to have three hundred millimetre (300mm) deep sumps.

b) Catch basin frames and covers shall be:

   1) Standard frame, grate and two (2) piece side inlet curb component for use with nine hundred millimetre (900mm) barrel equal to Norwood F-51 for straight faced curb and gutter.

   2) Top inlet standard round top equal to Norwood F-38 for swales or lanes.

   3) Top inlet standard round top equal to Norwood F-39 grate for landscaped areas.

c) Catch basin leads:

   1) The minimum size of catch basin leads shall be two hundred fifty millimetre (250mm) diameter with a minimum grade of one percent (1%).

2) The minimum grade on a three hundred millimetre (300mm) catch basin lead shall be one percent (1%).

3) Two (2) catch basins may be connected in series. The catch basin lead connecting to the storm sewer manhole shall be three hundred millimetre (300mm) at a minimum slope of one percent (1%).

4) The maximum length of a catch basin lead shall be thirty meters (30m).

5) If a lead of over thirty meters (30m) in length is required, a catch basin manhole shall be installed at the upper end.

6) Catch basin leads shall have a minimum cover of one point two meters (1.2m) to obvert.

7.3 STORM SEWER INSTALLATION AND LOCATION

Mains shall be installed to provide a minimum depth to pipe obvert of one point five meters (1.5m) below final finished grade.

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

7.4 MANHOLE INSTALLATION AND LOCATION

Manhole spacing on storm sewers greater than seven hundred fifty millimetres (750mm) in diameter may exceed one hundred twenty meters (120m) if approved by the Director of Planning and Development.

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

Tee riser manholes may be utilized on lines nine hundred millimetres (900mm) diameter and larger. Tee riser manholes must be bedded in concrete to the springline of the pipe.

7.5 CONNECTIONS TO STORM SEWERS

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

7.6 CURVED SEWERS

Refer to (Sanitary Sewerage System).

7.7 INSPECTION AND TESTING

Refer to (Sanitary Sewerage System)

7.8 STORMWATER MANAGEMENT FACILITIES

7.8.1 Design Requirements Common to Stormwater Management Storage Facilities

a) General

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

b) Geotechnical Considerations

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

c) Sediment Control

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

7.8.2 Master Drainage Plan

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

1) Detailed description of the development area, including proposed street layout, locations of parks, direction of overland flow, natural storage and drainage sub-catchment boundaries, etc.

2) Identify and quantify the amount of upstream drainage entering onto the proposed development lands, including all points of entry.

3) Identify the impact of the proposed development on the watershed.

4) Identify all existing flow channels, drainage patterns or routes, and containment areas.

5) Identify the point(s) of discharge from the lands, as well as the type and calculated capacity of the receiving drainage facility(s), whether natural, man-made, or a combination of both.

6) Provide details of water quality enhancement facilities.

7) Identify all licensing requirements as may be required by Alberta Environment.

8) Post-development hydrographs for the five (5) year and one hundred (100) year events to be determined at key points in the system.

9) Delineation of flood lines for the one hundred (100) year design storm for creeks or watercourses.

10) Description and discussion of storage alternatives. All alternative storage and runoff control methods shall be reviewed and shall include, but not be limited to:

-retention storage;
-detention storage;
-off-line stream storage;
-channel storage;
-on-line storage; and
-wet ponds (retention storage) or dry ponds (detention storage).

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

11) Detailed description of the selected alternatives.

7.8.3 Emergency Spillway Provisions

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

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

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

7.8.4 Dry Detention Ponds

Dry pond (detention) storage is the storm water management method where the storm run-off is collected and the excess run-off is temporarily detained for a short period of time, and

released after the storm run-off from the contributing area has ended. Generally, low flows do not enter the pond.

Dry ponds should have gentle side slopes and be aesthetically contoured and landscaped to provide an attractive feature for the subdivision. Where possible, and as agreed by the Director of Planning and Development, they should be associated with municipal reserve areas to take advantage of the joint use ability of the facilities (e.g. extension of sport fields or passive park uses into the detention pond). Active park uses should not be located adjacent to the inlet/outlet facilities nor in areas that flood frequently (more than twice per year on average). The County should be contacted to provide input to the design of detention facilities from the concept stage through to detailed design and construction.

7.8.5 Safety Provisions at Inlets and Outlets

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

Grated outlet structures are to be designed with a hydraulic capacity of at least twice the required capacity to allow for possible plugging. Further, the velocity of the flow passing through the grating should not exceed one meter per second (1m/sec). Appropriate fencing and guard rails are to be provided to restrict access and reduce the hazard presented by the structure head and wingwalls.

7.8.6 Design Parameters

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

a) Storage capacity for up to the one hundred (100) year storm event.

b) Detention time to be determined based on downstream capacity; recommended maximum detention time is twenty four (24) hours.

c) Maximum active retention storage depth of one point five meters (1.5m). The maximum water level should be below adjacent house basement footings (a greater freeboard may be required if an emergency overflow route cannot be provided).

d) Maximum interior sideslopes of 4:1.

e) Maximum exterior sideslopes of 4:1.

f) Minimum freeboard of point six meters (.6m) above 1:100 year high water level (a greater freeboard may be required if an emergency overflow route cannot be provided).

g) Maximum 4:1 ratio of effective length to effective width measured at one hundred (100) year high water level.

h) Dimensions must be acceptable to the County when the bottom of the pond is to be used for recreational facilities.

i) Minimum lateral slope in the bottom of the pond of one percent (1%) (two percent (2%) is preferred) and a minimum longitudinal slope of point five percent (.5%) (one percent (1%) is preferred),

j) Low flow bypass for flows from minor events to be provided.

k) French drains are to be provided within pond bottom where water table is near pond bottom.

l) Address all safety issues (particularly during operation).

7.8.7 Wet Retention Ponds (Residential Subdivision)

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

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

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

a) Maximum sideslopes of 7:1 between the high water level and one meter (1m) below normal water level.

b) Minimum permanent pool depth of two meters (2m)

c) Maximum 1:100 year storage depth of one point five meters (1.5m)

d) Sediment forebays required at each inlet.

e) Hard edge treatment required along lake perimeter.

f) Minimum freeboard depth of point six meters (.6m). House footings must be above freeboard elevation.

g) Water recirculation and make-up system required.

h) Provide access for maintenance and emergency equipment.

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

7.9 OUTFALLS

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

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

apron to prevent undermining of the structure. All concrete outfall structures to be approved by the Engineer.

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

If the downstream channel is relatively flat, the apron shall be one hundred fifty millimetres (150mm) to two hundred twenty five millimetres (225mm) above the channel invert to prevent collection of debris on the apron.

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

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

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

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

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

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

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

TABLE 7.1 RAINFALL INTENSITIES

Duration (minutes)	Rainfall Intensity (mm/hr.)		
	5 Year	10 Year	100 Year
10	74.9	91.2	141.9
11	70.4	85.7	133.2
12	66.5	80.9	125.8
13	63.1	76.8	119.3
14	60.1	73.1	113.6
15	57.4	69.9	108.5
16	55.1	67.0	104.0
17	52.9	64.3	99.9
18	51.0	62.0	96.2
19	49.2	59.8	92.8
20	47.6	57.8	89.7

21	46.1	56.0	86.9
22	44.7	54.3	84.2
23	43.4	52.8	81.8
24	42.2	51.3	79.5
25	41.1	49.9	77.4
26	40.1	48.7	75.4
27	39.1	47.5	73.6
28	38.2	46.4	71.8
29	37.3	45.3	70.2
30	36.5	44.3	68.6
60	23.2	28.1	43.4
120	14.7	17.8	27.4
360	7.19	8.66	13.28
720	4.57	5.49	8.40
1440	2.90	3.48	5.31

Notes:

1) Based on AES data at Edmonton Municipal Airport for period 1914 to 1993 (79 years).
2) Maximum Initial time of Concentration is 10 minutes.

TABLE 7.2 CATCH BASIN CAPACITIES (l/s)

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

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

*based on 100mm depth of ponding **based on 50mm depth on 1% slope

7.10 STANDARDS DRAWINGS – STORM DRAINAGE SYSTEM

7-100 Catch Basin Manhole
7-101 Catch Basin Typical 900mm
7-102 Typical Perched Manhole for 600 to 1050mm Diameter Pipes
7-103 T-Riser Manhole for Pipes 1200mm and Larger
7-200 Typical Catch Basin Installation 150 Curb & 250 Gutter

7-300 Trash Grate Inlet
7-301 Typical Culvert Installation
7-302 Typical Rip-Rap for Culvert Size 400-1200 Diameter
7-400 Concrete Drainage Swale

END OF SECTION

8 SEWER AND WATER SERVICE CONNECTIONS

8.1 SERVICE CONNECTIONS – MINIMUM REQUIREMENTS

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

Sanitary Sewer	one hundred fifty millimetre (150mm) diameter
Water Service	twenty five millimetre (25mm) diameter

The minimum grade on a one hundred millimetre (100mm) sewer service shall be two percent (2%) and on a one hundred fifty millimetre (150mm) service shall be one percent (1%).

Connection to a main sewer line shall be by means of a tapped service saddle (full wrap) at the top quadrant of the main on existing mains. In-line tees may be used with prior approval of the County.

Where bends are utilized, the long radius type or a combination of twenty two and a half degree (22½°) bends and straight pipe shall be used.

For water services sized fifty millimetre (50mm) and smaller, the tapping shall be at the two (2) to three (3) o'clock position on the distribution main.

Water mains shall be tapped under pressure.

All water services to be direct tapped or utilize service clamps.

8.2 SERVICE PIPE

8.2.1 Sanitary Services

Pipe shall be PVC SDR 28 (minimum) building service pipe to CSA B182.1.

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

8.2.2 Water Services

Pipe shall be type 'K' soft copper to ASTM B88M.

8.3 SERVICE CONNECTIONS – INSTALLATION REQUIREMENTS

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

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

Where two (2) services are installed in a common trench, they shall be installed per the Standard Drawing.

The minimum depth of cover over the water and sanitary services at the property line shall be three meter (3m) and the maximum shall be three point five meter (3.5m), per the Standard Drawing.

Where the sewer services are required to connect to mains in excess of four point five meter (4.5m) deep, risers shall be installed to within three point six meter (3.6m) of finished surface.

Corporation main stops and curb stops shall be installed in accordance with the Standard Drawing. Material to be Meuller or approved equal.

Where a copper service is installed, there shall be a vertical loop near the corporation main stop. Water service is to be goosenecked. Service shall be snaked in the trench to allow for thermal contraction.

Service box for residential service to have adjustable sliding top section, standard block iron pipe with threaded top. Top section to be six hundred millimetres (600mm) in length, with a minimum ID of thirty five millimetre (35mm). The service box shall be adjustable from two point five meter to three point five meter (2.5m - 3.5m) bury. The threaded steel cap shall have a slotted top with a nineteen millimetre (19mm) pentagon brass plug.

The casing shall be standard block iron pipe with an OD of thirty three point five millimetre (33.5mm). The rod should be T-304 stainless steel, twelve point five millimetre (12.5mm) diameter by two point two meter (2.2m) long, complete with standard pig tail for twenty five millimetre (25mm) ID pipe and welded bottom bracket with an eight millimetre (8mm) cored hole. Rod to be complete with a six millimetre (6mm) diameter cotter pin of sufficient length.

Box bottom boot to be cast or ductile iron, factory coated, with a clear opening to allow curb stop access. The boot is to attach to the casing by means of a threaded joint.

Curb stops shall be installed at property or easement lines as shown on the Standard Drawing and shall be stop and drain unless approved otherwise based on site conditions.

Sewer services shall be installed at property or easement lines as shown on the Standard Drawing, and shall be properly capped or plugged to prevent the entry of earth, water or deleterious material into the pipe.

All services shall be laid on seventy five millimetre (75mm) of granular bedding, and the bedding material shall be placed up to a level of three hundred millimetre (300mm) above the crown of the highest service in the trench.

Painted stakes of fifty millimetre by one hundred millimetre (50mm x 100mm) size shall be extended from the end of the service connections to a minimum of point seven meters (.7m) above the ground level, per the Standard Drawing.

The Developer shall employ an Engineering firm to complete the tests as outlined in Table 9.2. One (1) copy of the results shall be submitted to the County for their review.

8.4 SERVICE CONNECTION REPORT

The Developer's Engineer shall provide detailed as-built drawings for all installed service connections, with such drawings providing information related to pipe dimensions, invert elevations, depth of service lines, location of services relative to property line(s), manholes and/or watermain valves.

8.5 STANDARDS DRAWINGS – SEWER AND WATER SERVICE CONNECTIONS

8-100 Single and Double Service Layout
8-101 Typical Water Service Connection
8-102 Typical Sanitary Service Connection
8-103 Typical Standard Riser Detail
8-200 Water Service Connection – Manufactured Home
8-201 Sanitary Service Connection – Manufactured Home
8-300 Anode on 50mm and Smaller Copper Water Service
8-400 Typical 50mm and Smaller Residential Water and 150mm Sanitary Sewer
8-500 Inspection Manhole Detail

END OF SECTION

9 ROADWAYS

9.1 GEOMETRIC DESIGN STANDARDS

9.1.1 Urban Roadways

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

b) Street cross-sections shall be as defined by Table 9.1 and Standard Drawings. Curb and gutter will be required in some areas, at the discretion of the County.

c) Straight face curb and gutter shall be constructed on all streets, in accordance with the design Drawings. With written approval by the Director of Planning and Development, rolled curb and gutter may be constructed in accordance with the drawings.

d) Separate Sidewalks shall be preferred, although conditions requiring monolithic sidewalks may occur. Separate sidewalks shall be one point five meters (1.5m) wide and shall be constructed in accordance with the Standard Drawing, with written approval by the Director of Planning and Development. Monolithic curb, gutter and sidewalks may be constructed in accordance with the Standard Drawing. Sidewalks shall be clear of all obstructions including surface utilities. Sidewalk locations shall be in accordance with the Standard Roadway Drawings. Wider sidewalks may be required in areas of high pedestrian activity, as determined by the Director of Planning and Development.

e) All driveways shall be constructed to give a minimum of one point five meter (1.5m) clearance from any structure, (e.g. hydrants, light standards, service pedestals), and shall be constructed in accordance with the Standard Drawing.

f) Curb ramps shall be constructed in accordance with the Standard Drawing.

9.1.2 Rural Roadways

a) Rural roadways cross sections shall be as defined by Table 9.2 and Standard Drawings.

b) Ditches shall have one meter (1m) bottom width and 4:1 side slopes and back slopes. Minimum depth of ditches shall be nine hundred millimetres (900mm) below shoulder of roadway.

c) Roadways shall have a two percent (2%) crowned surface.

d) Driveways shall have minimum four hundred millimetre (400mm) diameter ditch culverts with no less than two hundred millimetre (200mm) cover over the culvert.

e) All driveways shall be constructed to give a minimum of one point five meter (1.5m) clearance from any structure, (e.g. hydrants, light standards, service pedestals), and shall be constructed in accordance with the Standard Drawing.

9.1.3 Urban Lanes

a) Rear lanes (alleys) shall have a surfaced width of six meters (6m) within a ten meter (10m) right-of-way. Where rear lane traffic activity is expected to be high, such as certain commercial developments, a wider surfaced width and right-of-way may be required as determined by the Director of Planning and Development.

b) Urban lanes shall have an ACP surface with three percent (3%) centre swale.

9.1.4 Rural Lanes

a) Rear lanes (alleys) shall have a surfaced width of ten meters (10m) within a fifteen meter (15m) right-of-way.

b) Rural lanes shall have a gravel surface with two percent (2%) crossfall.

9.2 VERTICAL ALIGNMENT

Minimum gutter grades around all curves and along all tangents shall not be less than point six percent (.6%). Minimum gutter grades on curb returns shall be point eight percent (.8%).

Maximum gutter grades shall not exceed those defined by Table 9.1.

All roadways shall be crowned or shall have a crossfall as shown on the applicable standard drawings. The standard crossfall rate is two percent (2%).

The grades at intersections for all roadway classifications shall not exceed two percent (2%) for a minimum distance of thirty meters (30m), measured from the shoulder edge of the receiving road.

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

K VALUE

Design Speed	Crest	Sag*	Minimum Length
(km/h)			(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

The maximum super elevation is shown in Table 9.1.

Rear lanes (alleys) shall have a minimum longitudinal grade of point six percent (.6%). If gravel-surfaced, the lane shall be cross sloped to one side at three percent (3%). If paved, the lane shall be cross sloped to one side at two percent (2%). Paved lanes that have a centre

swale must be approved in writing by the County and shall have cross slopes of two percent (2%).

9.3 HORIZONTAL ALIGNMENT

The minimum radius is relative to the Road Classification, the design speed and the maximum super elevation (see Table 9.1 and Table 9.2).

All horizontal curves shall be designed to meet the minimum design requirements shown in Table 9.1.

Minimum edge of pavement radius for cul-de-sacs is fifteen meters (15m).

Maximum cul-de-sac length shall be one hundred twenty meters (120m).

Flares at intersecting roadways shall have the following minimum radius from shoulder to shoulder:

Residential access and local	10 metres
Residential collector	15 metres
Industrial local and collector	15 metres

9.3.1 Curb Returns

Curb returns at residential local street intersections shall be constructed to a radius of eight meters (8m) at face of curb.

Curb returns at residential/collector street intersections shall be constructed to a radius of twelve point five meters (12.5m) at face of curb.

In industrial/commercial areas the face of curb radius should be fifteen meters (15m) to accommodate truck turning movements.

For arterial street intersections the curb returns shall be designed in consideration of the type and volume of the turning traffic. Two (2) and three (3) centred curves, with or without islands, may be required.

Curb ramps are required at all intersections which have sidewalks.

9.4 CUL-DE-SACS

The maximum length of a cul-de-sac is one hundred twenty metres (120m) from the entrance at property line of the intersecting road to the centre of the cul-de-sac. Watermain looping will be required where cul-de-sacs in excess of one hundred twenty metres (120m) are proposed. Cul-de-sacs greater than one hundred twenty metres (120m) may require an emergency access, which is at the discretion of the County of Wetaskiwin No. 10.

The minimum radius for cul-de-sacs is fifteen point two five meters (15.25m) to face of curb in residential areas and fifteen point two five meters (15.25m) for industrial/commercial developments.

9.5 CULVERTS AND DRAINAGE

a) The minimum allowable ditch grade shall be point five percent (.5%). Ditch grades in excess of two percent (2%) shall be protected against erosion through rock ditch checks, silt fences, Enviroberm fences and/or erosion control blankets. Typical ditch check installations are illustrated in the Standard Detail Drawings.

b) Ditch side slopes and back slopes shall not be steeper than 4:1.

c) The minimum ditch bottom width shall be one meter (1m) along arterial roads and one meter (1m) along the collector and local roadways, sloping away from the roadway at a minimum of five percent (5%).

d) Culvert size requirements shall be determined through the storm water drainage analysis; however, the minimum size culverts shall be as follows:

Roadway cross culvert	600 mm (24 inch)
Residential approach culvert	400 mm (16 inch)
Industrial approach culvert	400 mm (20 inch)

e) Culverts shall be new galvanized C.S.P. (corrugated steel pipe) with a minimum wall thickness of one point six millimetre (1.6mm), or as required by the loading criteria.

f) All culverts shall be installed in accordance with the manufacturer's recommendations.

In high density residential developments, all culverts shall be installed with bevelled end sections on both the inlet and outlet sides, with the invert extended to the toe of the side slope.

a) All culverts, except those in industrial developments, shall be installed to provide a minimum depth of cover of three hundred millimetres (300m) or one-half (1/2) the culverts diameter, whichever is greater. This should be measured from the finished shoulder grade of the roadway to the top of the culvert as shown on the Standard Detail Drawing. Installation. Culverts in industrial developments shall be installed to provide a minimum depth of cover of five hundred millimetres (500mm) or one-half (1/2) the culverts diameter, whichever is greater, as measured from the finished shoulder grade of the roadway to the top of the culvert.

b) Rip-rap shall be placed around the inlet and outlet of each culvert, with the rip-rap extending a minimum of point five meter (.5m) beyond the inlet end of the culvert and three (3) times the pipe diameter beyond the outlet end of the culvert. Rip-rap material shall consist of rock ranging in size from one hundred fifty millimetres (150mm) to three hundred fifty millimetres (350mm) with fifty percent (50%) of the rock material being larger than two hundred millimetres (200mm). A typical rip-rap installation is illustrated in the Standard Detail Drawing.

9.6 ROAD APPROACHES

This sub-section outlines the requirements respecting the design and construction of approaches within subdivision developments.

a) Residential approaches shall typically be located as follows:

- For low density residential, the approach shall typically be located to provide the best and most direct access to the building site on the lot.
- For internal high-density residential lots, the approach shall typically be centered on the lot frontage.

b) A residential approach shall be a minimum of seven metres (7m) in width and a maximum of ten metres (10m) in width; an industrial lot approach shall be a minimum of ten metres (10m) in width and a maximum of fifteen metres (15m) in width. Any deviation from these widths requires the written approval of the Director of Planning and Development.

c) All approaches shall be constructed to the same structure as the adjoining roadways, with asphalt surfacing extending to the following limits:

Low-density residential	to property line
High-density residential	to property line
Industrial/commercial	to 3.0m past property line

d) All residential subdivision development shall require the Developer to construct one (1) approach to each lot, consistent with the standard outlined herein.

e) Approaches to industrial/commercial lots are required to be constructed by the Developer where the access locations are known. Where access locations cannot reasonably be determined, the County may choose to have the Developer provide materials and/or securities to permit future construction of the approaches.

9.7 ROAD SURFACE FINISHES

The County presently approves two (2) types of roadway surface finishes:

- Gravelled surface
- Asphalt concrete (hot mix asphalt) pavement surface (A.C.P.)

a) Roadways in all subdivision developments which are to be surfaced with gravel shall be constructed in preparation for future asphalt concrete pavement (hot mix asphalt). In high-density residential subdivisions where asphalt concrete pavement (hot mix asphalt) is required, the County will require the Developer to supply a deposit to complete the road surfacing with ACP in the year following base construction as part of the development agreement.

b) Irrespective of the roadway surface finish approved by the County for a specific development, good roadway industry construction practices and techniques shall be employed at all times. Furthermore, roadway subgrade and base construction shall be undertaken with the view that an asphalt concrete pavement will ultimately be placed as the surface finish for the roadway.

c) Should a gravelled surface be approved, even for an interim period, the surface gravel shall be a minimum compacted layer of one hundred millimetre (100mm) depth of crushed gravel. The bottom fifty millimetres (50mm) shall consist of 4:30 (one and one quarter inch (1 ¼")) Gravel, in accordance with Alberta Transportation Specification for Aggregates, compacted into the subgrade. The top fifty millimetres (50mm) shall be 4:20 (three quarter inch ($^3/_4$")) Gravel, placed in the second year, to bring the full depth of gravel to one hundred millimetres (100mm) at the end of the warranty period. All approaches shall be similarly treated.

9.7.1 Urban Cross Section

Lots proposed at one quarter (¼) acre (one thousand square meters (1,000m^2)) in size or less will require a full urban cross section including curb and gutter.

9.7.2 Rural Paved Cross Section

Lots proposed between one quarter (¼) acre (one thousand square meters (1,000m^2)) to one (1) acre (four thousand square meters (4,000m^2)) in size will require pavement with the option of a rural ditch cross section.

9.7.3 Rural Gravel Cross Section

Lots proposed over one (1) acre (four thousand square meters (4,000m^2)) in size will not be required to have pavement, instead will be allowed to be developed to a rural gravel standard.

9.7.4 Linking and Abutting Roads

a) For multi-lot residential subdivisions with a proposed density up to and including twelve (12) lots, the Developer **shall not be** required to pave a linking road unless deemed necessary by Council;

b) For multi-lot residential subdivisions with a proposed density between thirteen (13) and twenty-four (24) lots, the Developer **shall be** required to pave a linking road from the subdivision to an existing paved arterial, collector or resource road identified in the County's Rural Road Study or other paved County road if the linking road is within one (1) mile or less to such paved road;

c) For multi-lot residential subdivisions with a proposed density of twenty-five (25) or more lots, the Developer **shall be** required to pave a linking road from the subdivision to an existing paved arterial, collector or resource road identified in the County's Rural Road Study or other paved County road.

The paving of a linking road in accordance with these provisions shall not be waived by the Developer paying the Road Contribution Fee unless Council approves the acceptance of paying the fee in lieu of paving. .

9.7.5 Commercial and Industrial Developments

Pavement shall be required for all internal roads within Commercial and Industrial subdivisions where the lots are 1 acre (4000 m^2) or less unless the development accesses a paved road in which case pavement shall be required in all cases regardless of lot size. All other paving, linking road and road contribution fee provisions outlined above also apply to Commercial and Industrial developments.

9.8 PAVEMENT STRUCTURE

For all roadways and lanes that shall be paved with hot mix asphalt, a geotechnical report with recommended pavement designs shall be conducted by a Professional Engineer and submitted to the County for review.

Paved roadways shall be designed in accordance with the Asphalt Institute Method of pavement design, using minimum design loadings of eight thousand one hundred sixty five kilograms (8,165 kg) (eighteen thousand pound (18,000 lb)) axle loads. The design parameters, such as traffic count, percentage of trucks, California Bearing Ratio (CBR), are to be outlined to the Director of Planning and Development. The County reserves the right to request the Developer to engage an Engineering firm to carry out tests, prior to paving, to confirm adequacy of design.

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

Street	Residential Land Use	Industrial/Commercial Land Use
Local	Country Residential: 150mm Subgrade Prep. To 100% SPD 50mm 4:30 Gravel (1 ¼") First Year 50mm 4:20 Gravel ($^3/_4$") Second Year	
Local	150 mm Subgrade Prep. to 100% SPD 250 mm Aggregate Base Course 90mm Asphaltic Concrete Surface(Light Duty)-2 lifts 50 mm/40 mm final*	300 mm Subgrade Prep. to 100% SPD 250 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 forty millimetre (40mm) lift of asphaltic concrete shall be placed in the second year of the maintenance period, sixty (60) days prior to FAC.

Alternative pavement designs, such as soil cement base, may be considered. Approval of alternate pavement designs must be obtained in writing from the Director of Planning and Development prior to submission of design drawings.

Gravel surfacing is permitted on rear lanes (alleys). Aggregate base material shall be used to a minimum depth of two hundred millimetres (200mm), with one hundred fifty millimetres (150mm) placed during initial construction and fifty millimetres (50mm) placed during the final year of the maintenance period.

For paved lanes, fifty millimetres (50mm) of ACP shall be placed over two hundred millimeters (200mm) of 4:20 GBC. If the geotechnical report for the development recommends a deeper structure for either gravel or paved lanes, the recommendations of the report shall be adopted.

9.9 RIGHT-OF-WAY PREPARATORY REQUIREMENTS

The entire road right-of-way (R.O.W.) shall be cleared of all vegetation (trees, shrubs, brush, etc.) including removal of all tree roots and stumps. All such material shall be removed from the site for disposal at approved locations. No burying of this material, or any portion thereof, shall be permitted within the R.O.W.

Organic soil and material are not acceptable as subgrade materials and shall be stripped within the roadway, ditch and back slope portion of the new construction. Organic soils (horizon A) shall be stockpiled in approved locations for the re-spreading on the ditches and backslopes after completion of the roadway construction.

TABLE 9.1
URBAN ROADWAYS
SUMMARY OF RECOMMENDED DESIGN STANDARDS FOR STREETS (TAC 1999)

Classification	Traffic Volumes (vpd)	Design Speed [a] (km/h)	Right-of-Way Width [b] (m)	Pavement Widths (m)	Travel Lanes [c]	Parking Lanes	Maximum Gradients (%) [g]	Maximum Superelevation (m/m)
Undivided Arterials (UAU 80)	8,000 - 20,000	80	30.0	14.8	4 x 3.7 m	outside lanes	5	.04 - .06
Major Residential Collector (UCU 70)	< 8,000	70	24.0	14.0	2 x 3.7 m	2 x 3.3 m	6	.025 - .04
Minor Residential Collector (UCU 70)	< 8,000	70	20.0	11.0	2 x 3.0 m	2 x 2.5 m	6	.025 - .04
Local Residential (ULU 60)	< 1,000	60	18.0	9.5	2 x 3.0 m	2 x 1.75 m	6	.025
Local Industrial (ULU 60)	< 3,000	60	20.0 [d]	12.0	2 x 3.5 m	2 x 2.5 m	8	.025
Industrial Collector (UCU 70)	< 12,000	70	24.0	13.0	2 x 3.5 m	2 x 3.0 m	8	.025
Cul-de-sac (ULU 60)	< 1,000	60	20.0	9.5	N/A	N/A	6	.025

Notes:

Classification	Minimum Radius of Curvature (m)	Minimum Intersection Spacing (m)	Minimum Corner Cuts at Intersections [h]	Sidewalks	Lighting Poles and Other Obstructions	Parking	Access
Undivided Arterials (UAU 80)	280	200	10 m	Separate, 1 or 2 sides	3.0 m min. from face of curb or behind sidewalk	Restricted	Restricted [e]
Minor and Major Residential Collectors (UCU 70)	200	60	5 m	Separate or mono, both sides	2.0 m min. from face of curb	Permitted	Permitted [f]
Local Residential (ULU 60)	150	60	5 m	Separate or mono, both sides	1.5 m min. from face of curb	Permitted	Permitted
Local Industrial (ULU 60)	150	60	10 m	Optional, 1 side mono	2.1 m min. from face of curb	Optional	Permitted
Industrial Collector (UCU 70)	200	60	10 m	Optional, 1 side mono	2.5 m min. from face of curb	Optional	Some Restrictions
Cul-de-sac (ULU 60)	150	60	5 m	Separate or mono, 1 or 2 sides	2.5 m from face of curb	Permitted	Permitted

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.
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. Short grades less than 150m in length, and one-way down grades may be 1% higher.
h. Highest classification of intersecting roads governs.

TABLE 9.2
RURAL ROADWAYS
SUMMARY OF RECOMMENDED DESIGN STANDARDS FOR STREETS (TAC 1999)

Classification	Traffic Volumes (vpd)	Design Speed [a] (km/h)	Right-of-Way Width [b] (m)	Pavement Widths (m)	Travel Lanes [c]	Parking Lanes	Maximum Gradients (%) [f]	Maximum Superelevation (m/m)
Undivided Arterials (RAU 80)	< 12,000	80	40.0	14.8	2 x 3.7 m	Outside lane	4	.04 - .06
Major Residential Collector (RCU 70)	2,500 – 5,000	70	30.0	14.0	2 x 3.7 m	2 x 3.3 m	6	0.2
Minor Residential Collector (RCU 70)	1,000 – 2,500	70	30.0	13.0	2 x 3.5 m	2 x 3.0 m	6	0.2
Local Residential (RLU 60)	< 1,000	60	24.0	8.0	N/A	N/A	7	0.2 Normal Crown
Local Industrial (RLU 60)	< 1,000	60	30.0	12.0	2 x 3.5 m	2 x 2.5 m	7	0.2 Normal Crown
Industrial Collector (RCU 70)	< 5,000	70	30.0	13.0	2 x 3.5 m	2 x 3.0 m	6	0.2 Normal Crown
Cul-de-sac (RLU 60)	< 1,000	60	24.0	8.0	N/A	N/A	6	0.2 Normal Crown

Classification	Minimum Radius of Curvature (m)	Minimum Intersection Spacing (m)	Minimum Corner Cuts at Intersections [g]	Parking	Access
Undivided Arterials (RAU 80)	280	200	10 m	Restricted	Restricted [d]
Minor and Major Residential Collectors (RCU 70)	200	60	5 m	Permitted	Permitted [e]
Local Residential (RLU 60)	150	60	5 m	Permitted	Permitted
Local Industrial (RLU 60)	150	60	10 m	Optional	Permitted
Industrial Collector (RCU 70)	200	60	10 m	Optional	Some Restrictions
Cul-de-sac (RLU 60)	150	60	5 m	Permitted	Permitted

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 cyclist
d. Prohibited for residential land uses.
e. Rear lane (alley) access preferred.
f. Short grades less than 150m in length, and one-way down grades may be 1% higher.
g. Highest classification of intersecting roads governs.
h. Does not include shoulders.

TABLE 9.3
TEST FREQUENCY

Specification	Type of Test	Recommended Test Frequency	Remark:
Trenching, Backfilling and Compaction for sewers, catch basins leads, watermains and hydrants sewer and water service connections, shallow utilities, and for Electrical Installation	Density Test: -Trench longer than 15 m -Trench shorter than 15 m	2 tests per 600 mm of depth for every 100 m of trench length 3 tests per trench	Testing will vary with location of project and consequences of trench settlement.
Roadway Excavation, Backfill and Compaction	Grading/Fill Compaction: Subgrade Preparation Proof Rolling:	1 density test per 2000 sq.m of compacted lift 1 density test per 1000 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 per 600 tonnes of mix, with a minimum of 1 test from each full day's production	Required 2 weeks prior to commencing work
Water Main	Hydrostatic/leakage test* Bacteria/Chlorine Test *	Test section not to exceed 365 m in length or as per manufacturer's recommendations.	Provide County at least 24 hours notice
Storm Water Sanitary Sewer	Television and Photographic Inspections:	Upon completion of sewer installation, after backfilling	Performed by Contractor
Force Mains	Hydrostatic/Leakage Tests *	Test section not to exceed 365 m in length or as per manufacturer's recommendations.	Provide COUNTY at least 24 hours notice.
Concrete Curbs and Gutters, Walks, Medians, Driveways and Swales General Concrete Slip Formed Concrete	Mix Design: Slump Test: Air Content Test: Strength Test:	1 per 20 cu.m for each class of concrete poured, min. 1 per day 1 per 20 cu.m for each class of concrete poured, min. 1 per day 1 per 20 cu.m for each class of concrete poured, min. 1 per day	Required 2 weeks prior to commencing work Every truck until consistency is established Every truck until consistency is established

*Tests to be witnessed by County

9.10 STANDARDS DRAWINGS - ROADWAYS

9-100	Local Residential (Urban)
9-102	Undivided Arterial (Urban)
9-103	Major Residential Collector (Urban)
9-104	Minor Residential Collector (Urban)
9-105	Local Industrial (Urban)
9-107	Rural Residential – 24.0m R/W
9-108	Rural Industrial – 30.0m R/W
9-110	RV Resort Cross Section
9-111	Typical Trail Cross-Sections
9-112	Urban Residential Cul – De – Sac
9-114	Rural Residential Cul – De – Sac
9-115	Local Industrial/Commercial Cul – De – Sac Curb and Gutter
9-200	500mm Curb & Gutter for Arterial Roadways
9-201	250mm Standard Curb & Gutter
9-202	250mm Rolled Curb and Gutter
9-203	1.50m Standard Monolithic Sidewalk
9-204	1.50m Rolled Monolithic Sidewalk
9-205	1.20m or 1.50m Separate Sidewalk
9-300	Paraplegic Ramp Details on Tangent
9-301	Paraplegic Ramp Details at Both Curb Returns
9-302	Paraplegic Ramp Details at Centre of Curb Return – Rolled Curb
9-303	Wheel Chair/Bike Ramp Locations
9-400	Industrial/Commercial Curb and Gutter Crossing
9-401	Typical Monolithic Lane and Driveway Crossing
9-501	Typical Residential Approaches
9-502	Typical Industrial Approaches
9-700	Barrier Posts

END OF SECTION

10 TRAFFIC CONTROL DEVICES, STREET NAME SIGNS AND PAVEMENT MARKINGS

Plans shall be provided to the Director of Planning and Development that depicts the locations and details of all traffic control devices (traffic signs and traffic signals), street name signs and pavement markings.

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

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

Street signing shall be standard aluminium, white on blue, with a minimum vertical dimension of one hundred fifty millimetres (150mm).

Materials:

All signs shall utilize High Intensity reflectorized material to ASTM-D4956, Type III.

All sign posts shall be U Channel, galvanized Schedule 40 steel unless otherwise approved in writing by the Director of Planning and Development.

Along arterial streets and at arterial street intersections, pavement markings shall be of a "permanent" type, thermoplastic. Painted markings are acceptable elsewhere.

10.1 SUBDIVISION ENTRANCE SIGNS

a) Developers shall be required to purchase and install four foot by eight foot (4' x 8') high intensity, high density plywood, crezon substrate reflective signs with the subdivision plan and name and the County of Wetaskiwin name and crest clearly displayed in reflective lettering, for every access route to the planned subdivision. The signs shall be erected according to Alberta Transportation Guidelines and shall be clearly visible to oncoming traffic in both directions.

b) Those subdivisions in existence at the time of the adoption of this policy may be entitled to receive four foot by eight foot (4' x 8') high intensity, high density plywood, crezon substrate reflective signs with the subdivision plan and name and the County of Wetaskiwin name and crest clearly displayed in reflective lettering, for every access route to the planned subdivision subject to funding availability.

c) The County of Wetaskiwin shall maintain all emergency subdivision signage, however shall not maintain decorative signage or signage that is not erected pursuant to the County's subdivision sign policy.

d) The location of subdivision signage is to be approved by the County.

10.2 INSTALLATION

All traffic control signs shall be mounted to provide two meter (2m) vertical clearance to the lowest portion of the sign, unless otherwise approved by the Director of Planning and Development.

All signs shall be mounted to provide a minimum of point three meter (.3m) of horizontal clearance from back of curb or back of walk. Where there is no curb or walk within the right-of-way, the sign location is to be approved by the County.

END OF SECTION

11 STREET LIGHTING

11.1 GENERAL

The following standards are applicable to all types of development in the County of Wetaskiwin No. 10, except for industrial developments. Standards for industrial developments shall be determined by the County during the initial planning stages of the proposed development. In general, no street lighting will be required in subdivisions, other than Hamlets. Privat lighting may be acceptable.

All street lighting cables in new subdivisions shall be installed underground. Additional street lights in neighbourhoods with overhead cabling may be installed if approved by the Director of Planning and Development.

11.2 DESIGN

Street lighting posts with fixtures shall be steel posts, comparable to the existing posts within the neighbourhood, for the several types of streets. Wooden Poles may be permitted in existing neighbourhoods were additional lighting is being added and wooden poles presently exist.

The location and density of street lights shall provide the following minimum lighting levels:

a) Street lighting fixtures shall be high pressure sodium type.

b) Street lighting design shall be approved by Aquila.

11.3 LOCATION

In general, no street lighting will be placed, with the possible exception for streets within a Hamlet. Private shed lights or yard lights may be acceptable. All street lighting is to be approved by the County.

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

Street lights shall be offset from roadways and sidewalks in accordance with Table 9.1.

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

All street light standards shall be galvanized in a manner comparable to the existing standards within the County.

11.4 COSTS

Any capital contribution that the utility company may charge for installation of underground street lighting shall be paid by the Developer.

END OF SECTION

12 LOT GRADING

12.1 DESIGN

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

Reserves and public lands shall be graded to drain towards developed streets and/or storm water catch basins or drainage channels.

Boulevard areas shall be graded to provide a minimum slope of tow percent (2%) from property line to top of curb.

Commercial and industrial lots shall be graded to drain to on-site storm water catch basins.

In cases where the backyard slopes towards the building, provisions are required to keep the runoff at least three meters (3m) away from the building, with the possibility of draining the surface water along the lot lines onto the streets.

Where drainage swales are provided on rear property lines in laneless subdivisions, the Developer shall provide an approved concrete drainage swale. The drainage swale shall be provided on one side of the property line and be placed in a drainage easement.

The maximum slope draining towards property lines shall not exceed ten percent (10%) within one point five meters (1.5m) of the property line. The slope away from buildings shall meet the minimum requirements of the Alberta Building Code. Downspouts from eavestroughs and discharges hoses from sump pumps shall not discharge within point six meters (.6) metres from the property line.

12.2 RETAINING WALLS

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

12.3 STANDARDS DRAWINGS - LOT GRADING

12-100 Typical Lot Grading

12-101 Building Grade Certificate

END OF SECTION

13 LANDSCAPING

13.1 STORM WATER MANAGEMENT FACILITIES

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 Director of Planning and Development.

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

Public lands within the facility must be planted with a minimum of thirty (30) trees per landscaped acre above normal water line, and designed and massed into major groupings. Minimum deciduous tree caliper sixty millimetres (60mm), minimum coniferous tree height two point five meters (2.5m). Tree mix sixty percent (60%) coniferous and forty percent (40%) deciduous suggested.

Shrubs may be substituted for trees at a rate of five (5) shrubs for one (1) tree, to a minimum of fifteen (15) trees per landscaped area, with approval from the Director of Planning and Development.

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

Planting bed layouts will provide a minimum width of turf areas between planting beds of two meters (2m). Landscape edging may be required in formal shrub beds.

Planting beds shall be designed complete with weed liners. Use of weed liners for planting beds located in flood prone areas is strongly recommended.

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

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

Approved furniture may be provided by the Developer and placed at strategic locations within the dry pond.

Lighting, if provided, to be to the satisfaction of the Director of Planning and Economic Development.

Special or unique features, such as recreational facilities, bridges and architectural and structural features will be designed and sealed by recognized accredited professionals.

13.1.1 MR's and PUL's

Existing natural and naturalized areas impacted by the proposed improvements that cannot be protected during construction must be re-naturalized with native plant materials having regard for the surrounding environment, new drainage patterns, soil conditions, and ecological rehabilitation.

The Developer will determine the level of restoration to be completed in consultation with the Director of Planning and Economic Development.

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

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

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

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

The Developer will specify all tree, shrub and ground cover sizes. No minimum or maximum sizes are specified. Tree mix to match natural setting.

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

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

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

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

13.1.2 Maintenance Period

The maintenance period for all planted material shall be two (2) years from the date of issuance of a Completion Certificate.

Any plant that is dead, not true to name or size as specified, or not in satisfactory growth, as determined by the Director of Planning and Development, shall be removed from the site. In case of any question regarding the condition and satisfactory establishment of a rejected plant, the Contractor may elect to allow such a plant to remain through another complete growing season, at which time the rejected plant, if found to be dead or in an unhealthy or badly impaired condition, shall be replaced by the Contractor.

The applicant shall be responsible for, and at his own expense to remedy, any defect, fault or deficiency in the completed works during the maintenance period.

The Developer is responsible for maintenance until the Final Acceptance Certificate has been approved (see Section 2.2.11 for maintenance periods).

END OF SECTION

14 UTILITY COMPANIES

The following guidelines apply to all Developers for the construction of municipal improvements, as well as Utility companies wishing to repair, replace or otherwise modify their existing services, within the County of Wetaskiwin No. 10.

14.1 ELECTRICAL POWER, TELEPHONE, GAS, AND CABLE TV SERVICES

14.1.1 General

Private Utility Companies provide Electrical Power service, Gas Service, Telephone service, and Cable TV service.

14.1.2 Rights-of-Way

Where required, the Developer shall provide right-of-way and easements of sufficient size and location to satisfy the above mentioned Utility Companies.

Utilities shall be located according to the Standard Drawings, or as directed in writing by Director of Planning and Economic Development.

All easements on County property shall be registered in the name of the County of Wetaskiwin No. 10.

14.1.3 Installation

An approval must be obtained from the County of Wetaskiwin No. 10 for any excavation on County property.

All distribution cables shall be installed in one common trench, a minimum of three hundred millimetres (300mm) wide, at the required alignment. All power and communication cable trenches on the road allowance shall be at a minimum of one point five meters (1.5m) below finished grade level. The trench bottom shall be free of stones, loose earth and sharp objects.

All gas trenches on the road allowance shall be at a minimum of one meter (1m) below finished grade level. Trenches shall be a minimum of 300 mm wide. The trench bottom shall be free of stones, loose earth and sharp objects.

Gas lines shall be installed in a separate trench from cable installations, and shall maintain a minimum distance of three meters (3m) from any valve, hydrant, catch basin, manhole, vault and sanitary and storm water lines. A minimum three meter (3m) clearance is required to any water lines.

Power, telephone, or cable TV cables shall maintain a minimum distance of three meters (3m) from any valve, hydrant, catch basin, manhole, vault, watermains, sanitary mains, and storm water line. A minimum clearance of point three meters (.3m) in all directions is to be maintained when crossing gas service lines.

Extreme care must be taken when backfilling so as not to disturb any Legal survey pins. Any survey pins disturbed during installation shall be replaced at the Utility Company's expense.

Trenches shall not be left open, with cables or gas line exposed, longer than forty-eight (48) hours without permission of the Director of Planning and Development. In such cases, the open trenches shall be properly marked and barricades with flashers provided by the Developer. In locations where flooding of the trenches may occur, or the open trench creates a public hazard, the Director of Planning and Development may, at his discretion, require the excavation to be appropriately covered.

The use of trench digging machinery will be permitted, except where its operations will cause damage to trees, buildings, fences, or other existing structures or municipal infrastructure above or below the ground. At such locations, hand digging shall be employed to avoid damage.

To protect persons from injury and to avoid property damage, adequate barricades, construction signs, warning lights and guards, as required, shall be placed. Whenever required, watchmen shall be provided to prevent accidents.

Backfill material shall be native soil material excavated from the ditch/trench or Fillcrete, at the discretion of the Director of Planning and Development. Sand must be substituted for poor existing soils. Poor existing soils are defined as organic soils, peat, black loam, sod, clay that has hardened and stones. Backfill material shall be compacted to ninety five percent (95%) density of the maximum density of a standard proctor compaction test within boulevards and ninety eight percent (98%) within streets under concrete, asphalt structures or lanes. All backfill material may be subject to the approval of the Director of Planning and Development.

Augering, in some instances, may be required. In cases were augering is necessary, the diameter of the augered hole shall not be over 50 mm greater than the diameter of the duct to be installed.

14.1.4 Costs

Any capital contribution that the utility company may charge for installation of the above services shall be paid by the Developer.

END OF SECTION

CONSTRUCTION STANDARDS

Issued September 2010

15 AGGREGATES GENERAL

15.1 GENERAL

This section specifies general requirements for supplying and processing of aggregates to be stockpiled or incorporated into work. Specific requirements for physical properties of aggregates not provided in this section are given in related work sections.

15.1.1 Source Approval

Source of materials to be incorporated into work or stockpiled requires approval.

Inform the County of proposed source of aggregates and provide access for sampling at least two (2) weeks prior to commencing production.

If, in opinion of the County, materials from proposed source do not meet, or cannot reasonably be processed to meet specified requirements, produce an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.

Should a change of material source be proposed during work, advise the County two (2) weeks in advance of proposed change to allow sampling and testing.

Acceptance of a material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.

15.1.2 Production Sampling

Aggregate will be subject to continual sampling during production.

Provide the County with ready access to source and processed material for purpose of sampling and testing.

Bear the cost of sampling and testing of aggregates in order to meet design gradations and specifications.

15.2 PRODUCTS

15.2.1 General

All imported backfill, granular material, gravel and screened rock shall be suitable for the uses intended.

Aggregate shall be sound, hard, durable material free from soft, thin, elongated, or laminated particles, organic material, or other deleterious substances.

Flat elongated particles are those whose greatest dimension exceeds five times their least dimension.

Fine aggregates satisfying requirements of applicable section shall be one, or a blend of following:

a) Natural sand

b) Manufactured sand and/or fines

c) Screenings produced in crushing of quarried rock, boulders, gravel or slag.

Course aggregates satisfying requirements of applicable section shall be one of following:

a) Crushed rock or slag.

b) Gravel composed of naturally formed particles of stone.

15.2.2 Materials

Gradation: To be within the limit and for the types of materials specified below, when tested to ASTM C117 and ASTM C136, and having a smooth curve without sharp breaks when plotted on a semi-log grading chart to ASTM E11

Production of Manufactured Fines: Manufactured fines are defined as that portion of the material passing the five thousand (5,000) sieve size which is produced by the crushing process.

In the event the manufactured fines in the total combined aggregate do not meet the requirement for the specified Asphaltic Concrete Mix, extra manufactured fines shall be produced by screening the pitrun material so that the screened material contains no more than five percent (5%) material passing a five thousand (5,000) sieve. This screened material shall then be crushed so that one hundred percent (100%) passes the ten thousand (10,000) sieve and a minimum of ninety five percent (95%) passes the five thousand (5,000) sieve. All material produced by this crushing process shall be placed in a separate stockpile and designated as manufactured fines.

Moisture Content: As specified in specific sections.

Bedding Sand: Bedding sand shall be free from organic material and meet the following gradation:

Sieve Size (mm)	% Passing by Mass
12.500	100
5.000	90-100
1.250	55-85
0.315	10-35
0.080	0-5

The liquid limit shall not exceed twenty five (25) and the PlastiMD Index shall not exceed 6.

Granular Material (imported Sand): Imported sand shall be free from rubbish, rubble, organic material, vegetation, clay lumps and meet the gradation of bedding sand.

Granular Material (Imported Gravel): Imported gravel shall be a well graded mixture of sand and gravel meeting the following gradation:

Sieve Size (mm)	% Passing by Mass
80.000	100
50.000	80-100
25.000	50-75
5.000	25-55
0.080	2-10

Screened Rock: Screened rock shall be composed of sound, hard uncoated particles free from clay lumps, flaky particles, soft shale, friable materials, roots, vegetable matter and frozen lumps meeting the following gradation:

Sieve Size (mm)	% Passing by Mass
50.000	100
40.000	95-100
20.000	5-10
10.000	0-5
5.000	0-5

15.3 EXECUTION

15.3.1 Processing

Process aggregate uniformly using methods that prevent contamination, segregation, and degradation.

Split and combine aggregates if required to obtain gradation requirements specified. Use approved methods and equipment. Do not blend in stockpiles.

Blending to increase percentage of crushed particles or decrease percentage of flat and elongated particles is permitted.

Wash aggregates, if required to meet specifications. Use only equipment approved by the County.

15.3.2 Handling

Handle and transport aggregates to avoid segregation, contamination and degradation.

15.3.3 Stockpiling

Stockpile aggregates on site in location indicated or designated. Do not stockpile on completed pavement surfaces where damage to pavement may result.

Stockpile aggregates in sufficient quantities to meet project schedules.

Stockpiling sites shall be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials.

Except where stockpiled on acceptably stabilized areas, provide a compacted sand base not less than three hundred millimetres (300mm) in depth to prevent contamination of the aggregate or, if permitted, stockpile aggregates on ground but do not incorporate bottom three hundred millimetres (300mm) of pile into work.

Separate aggregates by substantial dividers or stockpile far enough apart to prevent intermixing.

Reject intermixed or contaminated materials. Remove and dispose of rejected materials as directed within 48 hours of rejection.

Stockpile materials in uniform layers of thickness as follows:

a) Max one meter (1m) for course aggregate and base course materials

b) Max two meters (2m) for fine aggregate and subbase materials.

c) Max one point five meters (1.5m) for other materials

Complete each layer over entire stockpile area before beginning next layer.

Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

Coning of piles or spilling of material over edges of pile will not be permitted. Stacking conveyors will not be permitted for stockpiling road base and graded seal coat aggregates.

During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

15.3.4 Stockpile Cleanup

Leave stockpile site in a tidy, well drained condition, free of standing surface water.

Remove any unused aggregates as directed.

END OF SECTION

16 TRENCHING AND BACKFILLING FOR UTILITIES

16.1 GENERAL

Trenching and backfilling to be carried out in accordance with Alberta Occupational Health and Safety Regulations, Part 10.

16.1.1 Work Included

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

a) watermains
b) sanitary sewers
c) storm sewers
d) manholes, valve boxes
e) lot service connections
f) shoring, sheet piling
g) dewatering

16.2 EXECUTION

16.2.1 Excavation

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

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

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

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

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

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

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

Maximum lengths for open trenches are thirty meters (30m) ahead of pipe laying crew and two hundred meters (200m) behind, unless otherwise permitted by the County.

Where pipelines are constructed through fills and embankments, surface elevations will generally at least be two hundred fifty millimetres (250mm) above top of pipeline prior to excavation.

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

16.2.2 Rocks and Boulders

Remove boulders to provide one hundred fifty millimetre (150mm) minimum clearance under pipes. Backfill with granular and compact at required level to provide suitable bearing, if boulders are less than point four cubic meters (.4m³).

Boulders larger than point four cubic meters (.4m³) and material which cannot be removed with pick and bar will be classified as rock by the County. Notify the County when rock is encountered for classification and measurement.

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

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

16.2.3 Shoring, Bracing and Sheet Piling

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

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

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

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

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

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

16.2.4 Backfilling - General Requirements

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

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

Place and compact all backfill in maximum three hundred millimetres (300mm) deep loose layers, prior to compaction.

Compact site material used as trench backfill in all areas from three hundred millimetres (300mm) above top of pipe to three hundred millimetres (300mm) below bottom of granular base for roads to a density not less than ninety five percent (95%) of Standard Proctor Density, as defined herein, and carried out at a moisture content of within three percent (3%) of optimum moisture content. Remove any free water in the trench prior to placing additional lifts. Note that if moisture content is too high and densities not initially attainable the Contractor will make every reasonable attempt to dry the material by whatever means available (i.e. discing, spreading, etc.) should the County deem the material to be "unworkable" the use of imported granular backfill may be required. Compact the final three hundred millimetres (300mm) below road or lane granular base to not less than one hundred percent (100%) of Standard Proctor Density.

Compaction results will be based on a minimum of one density test per one hundred fifty (150) lineal meters of trench for each one point five meters (1.5m) of depth. If a density test indicates insufficient compaction at any depth, then two (2) more densities, which are proportionally representative of trench length, will be taken at that depth. Then, if the average of the three (3) tests is below the required density, the Contractor will re-excavate and re-compact to meet the specified density.

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

Stockpile spread or remove excess excavated earth material where directed by the County.

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

Where additional pipes are to be, or have been laid, crossing the trench being backfilled and at a higher elevation, take special care to ensure the backfill is compacted to a minimum of ninety seven percent (97%) of Standard Proctor Density from the lower pipeline up to the obvert elevation of the higher pipeline.

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

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

16.2.5 Settlement

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

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

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

END OF SECTION

17 SUBGRADE PREPARATION

17.1 GENERAL

17.1.1 Work Included

The work described in this section pertains to the preparation and construction of the subgrade.

17.2 DEFINITIONS

17.2.1 Subgrade

Subgrade is that material immediately beneath the compacted granular course as detailed on the drawings.

17.2.2 Common Excavation

Common excavation shall consist of all materials such as earth, topsoil, organic material, muskeg, clay, hardpan, shale, silt, sand, gravel, fractured bedrock, cobbles and frozen material, removed from the roadway and placed in fill or embankment areas, or otherwise disposed as approved by the County. Excavation shall be to the lines and grades indicated on the plans, or as directed by the County. Schedule work to utilize all excavation materials completely. Borrowing materials will be authorized only after excavated materials have been utilized.

17.3 EXECUTION

17.3.1 Scarify and Compact

In excavation areas, the top one hundred fifty millimetres (150mm) of the subgrade shall be scarified and compacted to ninety five percent (95%) Standard Proctor Density at optimum moisture content. In lieu of sub-grade preparation a geotextile filter fabric will be accepted.

No stones or boulders larger than one hundred millimetres (100mm) in diameter shall be left within the top two hundred millimetres (200mm) of the subgrade unless otherwise directed by the County.

17.3.2 Overexcavation

Notify the County whenever unsuitable materials are encountered.

Materials which cannot be compacted to the specified density due to a high or low moisture content shall be dried or watered by the Contractor to their optimum moisture content in order to achieve the specified compaction.

All common excavation materials below subgrade elevation which, in the opinion of the County, are considered unsuitable shall be removed and disposed in a site located by the Contractor, and approved by the County.

17.3.3 Stockpiling of Material

To facilitate the Work, the Contractor may stockpile embankment material. Such material shall be piled at a location determined by the Contractor, approved by the County, and in such a manner that it will not endanger persons, the Work, or adjacent properties, and ensure proper drainage is maintained. If the construction site does not facilitate stockpiling, the Contractor shall haul material to an approved location.

17.3.4 Excavation Waste

All common and rock excavation deemed unsuitable for use in embankments, or in excess of that required for embankment, shall be disposed at locations determined by the Contractor and approved by the County.

All disposal areas shall be left in a neat and tidy condition satisfactory to the County. Excavation materials shall be graded smooth to promote surface drainage and not to impede existing surface drainage by the Contractor to the approval of the County.

17.3.5 Common Embankment (for site grading)

Embankment placed on lots and within the road right of way, but not under the road structure, shall be uniformally constructed to the typical cross-section and grades shown on the plans or as set out by the County, and shall include the formation, compaction and shaping of the embankment.

The full depth of fills shall be constructed of suitable material in layers not exceeding two hundred millimetres (200mm) compactive depth. Each layer shall be compacted to ninety five percent (95%) Standard Proctor Density (SPD) at optimum moisture content. All fills greater than one meter (1m) are to be compacted to ninety five percent (95%) SPD.

Do not place material in free standing water. Drain all areas before placing materials.

Materials which cannot be compacted to the specified density due to high or low moisture content shall be dried or watered by the Contractor to their optimum moisture content as necessary to achieve the specified compaction.

17.3.6 Shaping and Finishing

The finished compacted subgrade shall be constructed to within thirty millimetres (30mm) of the design section. Localized soft spots that develop in the finished subgrade due to poor work shall be corrected by excavating the material to a depth approved by the County, and replacing it with suitable subgrade material compacted in place.

Subgrade shall be true to the design cross-section.

Maintain and keep ditches open and free from debris to permit ready flow of surface water, and until final acceptance of the Work.

17.4 TESTS

Field density and moisture content tests shall be carried out by a representative approved by the County in accordance with the following ASTM standards:

Standard Proctor Compaction Test	ASTM D698, Methods (A) and (B)
ASTM D1556 or In-Place Density Test	ASTM D2167 or ASTM D2922 and D3017.

The frequency of field density and moisture content tests shall be at minimum one (1) test per one hundred meters (100m) of constructed roadway and at various locations left and right of centre line, or as directed by the County.

Before approval by the County, the subgrade shall conform to the compaction requirements specified and shall show no visible subsidence or deflection under the wheels of a loaded water or tandem gravel or water truck. Such trucks shall be provided by the Contractor, as the County requires, for proof rolling of the subgrade.

The following outlines the structural requirements for roadways and approaches which must be followed:

Surface Aggregate	Designation 4 Class 20 material, ¾ inch crush, Ab. Infrastructure Spec., minimum 100 mm depth
Grade	0.90 meter minimum non-organic material with 0.20 meters of clay cap
Compaction	Upper 0.30 meters – 100% of Standard Proctor Density Below 0.30 meters – 98% of Standard Proctor Density
Moisture Content	Optimum Moisture Content

END OF SECTION

18 GEOTEXTILE

18.1 GENERAL

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

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

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

18.1.1 Mill Certificates

At least one (1) week prior to the commencement of Work the Contractor shall submit a sample of the geotextile filter fabric to be used in the Work with copies of mill test data and Manufacturers Certificate of Compliance that the geotextile filter material delivered to the job site meets the requirements of this section.

18.1.2 Approval

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

18.1.3 Delivery and Storage

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

18.2 PRODUCTS

18.2.1 Material

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

The geotextile filter fabric shall be supplied in rolls of minimum width of three meters (3m) and minimum fifty meter (50m) lengths.

18.2.2 Physical Properties

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

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

18.3 EXECUTION

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

The fabric shall be laid parallel to the slope direction in one continuous length from toe of slope to upper extent of fabric. It shall be placed in a loose fashion; however creases, folds, wrinkles and tensile stresses shall be avoided. Adjacent strips of fabric shall be overlapped as specified, except where placed underwater, the minimum lap width shall be one meter (1m). Overlaps shall be pinned using six millimetre (6mm) diameter steel pins fitted with washers and spaced at one meter (1m) intervals along the overlaps.

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

Rip-rap placement shall commence at the base of the filter fabric area and proceed up the slope. The height of drop of rip-rap shall be limited to one meter (1m) or less, and the rip-rap shall not be allowed to roll down the slope. Heavy equipment will not be permitted to operate directly on the geotextile.

18.4 PROTECTION

After installation the filter fabric shall be covered with overlaying layer within three (3) days of placement.

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

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

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

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

END OF SECTION

19 RIP – RAP

19.1 GENERAL

19.1.1 Definition

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

19.1.2 Work Included

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

19.1.3 Approval

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

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

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

19.1.4 Quality Assurance

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

19.1.5 Job Conditions

Suspend placement operations whenever climatic conditions, as determined by the County, are unsatisfactory for placing rip-rap fill to requirements of this Specification.

Do not permit or cause material to slide or roll down slopes.

When placing rip-rap do not disturb satisfactorily placed material or structures already in place.

Sequence delivery of material to site in a manner to minimize stockpiling and in any event obtain approval from County to stockpile.

19.2 PRODUCTS

19.2.1 General

The rock supplied shall be hard, durable and angular in shape, resistant to weathering and water action, free of overburden, spoil, shale seams and organic material. No sandstone will be permitted. The minimum dimension of any single rock shall be not less than one third (1/3) of its maximum dimension. The minimum acceptable unit weight of the rock is two point five tonnes per cubic meter (2.5t/m^3) or as specified for the intended use.

The rock rip-rap shall be free from seams, cracks or other structural defects to meet the following specified size distribution.

		Class 1
Nominal Mass **Nominal Diameter**	**Kg** **or mm**	**40** **300**
None heavier than:	Kg	130
	or mm	450
No less than 20% or more	Kg	70
than 50% heavier than:	or mm	350
No less than 50% or more	Kg	40
than 80% heavier than:	or mm	300
100% heavier than:	Kg	10
	or mm	200

Percentages are by mass. Sizes are equivalent spherical diameters, and are for guidance only.

19.3 EXECUTION

19.3.1 Preparation

Prepare surfaces to receive rip-rap to lines and grades as shown on the Drawings.

19.3.2 Inspection

Do not place rip-rap until foundation to receive it has been approved by the County.

19.3.3 Installation

The rock rip-rap shall be placed on a non woven geotextile filter fabric unless otherwise noted on the drawings or in the specifications.

The hand laid rock rip-rap erosion protection shall be placed in the areas indicated on the drawings or as designated by the County.

Place rip-rap by suitable mechanical equipment so that no intermixing of foundation material and rip-rap is allowed to occur during placing and that minimum breakage of rock fragments will occur and that the mass is stable.

Rip-rap need not be compacted but shall be dumped and graded off to same regular surface and in such manner that larger rock fragments are uniformly disturbed and smaller rock fragments fill voids between larger pieces.

Hand placing will be required only to extent to secure results specified above in the areas where mechanical equipment cannot operate adequately.

Do not place rip-rap against structures until permission is obtained from the County.

The rip-rap stones shall be placed on the surface to be covered as shown by the plans or as directed by the County, on slopes not exceeding 1½ H: 1V starting with the larger stones on the bottom row. Rip-rap shall be placed on the prepared surface such that the weight of the stone is carried by the subgrade and not by the underlying stones. Rip-rap shall be placed proceeding upward from the bottom. Voids between rip-rap shall be filled with broken rock fragments.

Care shall be taken not to puncture the geotextile filter fabric when placing the rip-rap. Any damaged filter fabric shall be repaired or replaced as requested by the County.

END OF SECTION

20 WATERMAINS

20.1 GENERAL

20.1.1 Work Included

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

a) bedding under and over pipe
b) watermains and appurtenances
c) testing watermains
d) flushing and disinfecting watermains
e) connection to existing systems
f) thrust blocks

20.1.2 Quality Standards and Assurances

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

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

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

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

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

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

20.2 PRODUCTS

20.2.1 Polyvinyl Chloride (PVC) Water Pipe

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

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

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

Gaskets shall conform to AWWA C111.

An affidavit of compliance shall be provided if requested.

20.2.2 Water Pipe Fitting

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

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

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

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

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

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

20.2.3 Gate Valves (NRS)

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

Valves to be bronze mounted with a grade of bronze completely resistant to de-zincification by water having a ph of 9.0

Valve ends shall be consistent with the type of joint used for pipe and fittings except where otherwise detailed.

Valves to be supplied with either bronze or type 304 stainless steel stems.

Working pressure 1035 kPa.

Valve interior to be epoxy coated for corrosion protection.

Valves shall close by turning clockwise and be a non-rising stem type and be equipped with a fifty millimetre square (50mm²) operating nut. Valve stem shall be equipped with "O-Ring" type seals.

Exterior to be factory coated.

All exterior bolts and nuts must be T304 or type 3145.5 stainless steel.

20.2.4 Valve Boxes

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

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

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

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

20.2.5 Hydrants

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

Working pressure of 1035 kPa.

Two (2) hose connections at one hundred eighty degrees (180°)., sixty three millimetre (63mm) ID with threads to Alberta Mutual Standard.

One (1) pumper connection, one hundred millimetres (100mm) OD, outlet nozzles to be fastened by a thread connection.

One hundred fifty millimetre (150mm) riser barrel, one hundred twenty five millimetre (125mm) bottom valve.

Minimum distance from flange to bonnet will be six hundred millimetre (600mm).

Main connection to be one hundred fifty millimetre (150mm) ductile iron size rubber gasketed bell end joint.

Self Draining hydrants (or as determined by site condition)

Number 6 operating nut with five (5) sides.

Hydrant to open counter-clockwise.

All hydrants will be painted Tremclad Yellow (No. 270-97X).

Ground line breakway system: two point seven five meters (2.75m) from invert to flange, including a four hundred fifty millimetre (450mm) top extension spool section with hydrant rod coupled at extension.

Minimum seven hundred ten millimetres (710mm) from top of operating nut to bottom of base flange.

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

Interface between removable parts of main valve and hydrant body shall be bronze to bronze. Hydrants shall be of the same type and make as presently used in the County of Wetaskiwin No. 10 (Canada Valve only).

20.2.6 Watermain Plugs

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

20.2.7 Air Relief Valve & Flushing Chamber

Valve and chamber shall conform to the detail drawing referenced or attached.

20.2.8 Bedding Pipes

Excavate trenches to widths not less than three hundred millimetres (300mm) greater than pipe diameter. Maximum width at top of pipe zone shall not exceed outside pipe diameter plus six hundred millimetres (600mm), plus allowance for timbering, if required.

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

Place sand bedding for PVC pipe as per trench bedding and installation and backfill Class B granular surround as detailed in the structural drawing attached. If site material meets bedding sand specification requirements, it may be used to replace the top three hundred millimetres (300mm) of bedding sand.

For trench in rock, bed pipe on minimum of one hundred fifty millimetres (150mm) of compacted sand.

20.2.9 Laying and Jointing Pipe

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

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

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

At all hydrants, plugs, tees, crosses, bends of twenty two degrees (22°) or more and all other points of concentrated thrust, provide reaction blocking as detailed to prevent movement. Place reaction blocking against solid undisturbed ground. Details are based on soil load values of seven thousand three hundred twenty three kilograms per square meter (7,323 kg/m^2), or more. Where soil will not provide this load value, provide bands and clamps to take reaction. Refer also to special thrust block details. Place blocking to provide access to pipe and fittings for repairs or extensions of line.

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

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

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

20.2.10 Setting and Jointing Valves

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

Set valves accurately in position, set valve box carefully over hood with shaft vertical and cap at proper level plus or minus fifty millimetres (+/-50mm) from elevations provided by the County.

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

Check operation of valves in presence of the County before testing and after testing.
Setting and Jointing Hydrants
Set hydrants and hydrant valves on pressure treated timber blocking as per the details.

Ensure hydrant stock and valve box are truly vertical.

Locate hydrants and valves as per the drawings within the following tolerances: fifty millimetre (50mm) horizontal, fifteen millimetre (15mm) vertical.

Face pumper nozzles to roadway with hose nozzles parallel to roadway. No portion of the hydrant or nozzle cap shall be within one hundred fifty millimetres (150mm) of the sidewalk.

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

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

20.2.11 Thrust Blocks

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

Cement to be sulfate resistant Portland cement.

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

Keep joints and couplings free of concrete.

Do not backfill over concrete within 24 hours after placing.

20.2.12 Testing Watermains

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

a) a section of watermain not exceeding three hundred sixty five meters (365m) in length has been completed.

b) the section has been carefully filled with water and allowed to sit for at least twenty four (24) hours.

c) reaction or thrust blocking within the section has reached 15.0 MPa design strength.

If all the conditions have been met, apply a constant pressure of 1035 KPa for a minimum of two (2) hours to mains, hydrants, valves and services. Make good all defects at no additional cost to Owner. Ensure all water service connections are turned off at curb stops to avoid damage to private plumbing.

Conduct leakage tests after completion of pressure testing. Conduct leakage tests at 1035 KPa in accordance with AWWA C600-82 procedures. Allowable leakage will be calculated using the following formula:

Allowable leakage = $N \times D \times P^{0.5} \div 128320$ = Litres per hour

Where N = Number of joints; D = nominal diameter of pipes (mm); and P = average test pressure (kPa).

If test leakage in any section is greater than permitted by AWWA Standards, locate and repair defective pipe joints until leakage is within permitted allowance. Test pipelines in sections not exceeding three hundred sixty five meters (365m) in length.

Provide all equipment and labour for tests.

20.2.13 Flushing and Disinfecting Watermains

After completing satisfactory hydrostatic tests and before placing into service, flush all mains to remove as much foreign matter as possible from system. Flush at minimum velocity of point eight meters per second (.8m/s) as required by AWWA C651-99 procedures (two hundred fifty millimetre (250mm) line requires two (2) fifty millimetre (50mm) openings to provide the required flushing velocity).

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

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

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

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

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

Dechlorination of the chlorinated water may be required in some circumstances before discharging the water to the environment in order to meet the regulatory requirements of the County of Wetaskiwin No. 10 or Alberta Environment. Dechlorination, if required, is to be performed by adding neutralizing chemicals (AWWA C651-86, Appendix B) to the chlorinated water as it is flushed from the system and before it enters the receiving environment.

20.2.14 Markers

A fifty millimetre by one hundred millimetre (50mm x 100mm) stake, from six hundred millimetres (600mm) below ground to six hundred millimetres (600mm) above ground level shall be placed at each water valve, the top six hundred millimetres (600mm) to be painted blue.

END OF SECTION

21 SANITARY SEWER MAINS

21.1 GENERAL

21.1.1 Work Included

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

a) bedding under and over piping
b) sanitary sewers and appurtenances
c) manholes and appurtenances
d) cleaning sewers
e) testing sewers
f) connection to existing systems

21.1.2 Quality Standards and Assurances

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

All products and workmanship are subject to inspection by the County.

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

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

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

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

21.2 PRODUCTS

21.2.1 Sewer Pipe

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

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

Reinforced concrete pipe meeting ASTM Specification C76- CSA-A257.2-M92.

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

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

21.2.2 Pipe Joints

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

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

PVC - rubber gasket to ASTM 03212 or ASTM F477.

21.2.3 Pre-cast Concrete Manhole Units

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

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

Manhole steps shall be nineteen millimetre (19mm) diameter, galvanized iron safety rungs spaced at a maximum distance of four hundred millimetre (400mm) center to center for full height.

Pre-cast bases to be minimum 20.7 MPa concrete.

21.2.4 Concrete Blocks and Bricks

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

Cement - sulfate resisting Portland CSA A5, Type 50.

21.2.5 Mortar

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

21.2.6 Cast Iron Frame, Covers and Grates

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

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

Hot dip in asphaltic varnish.

Manhole covers and frames:

Sanitary - Norwood Foundry Model F-39, or NF-80, or approved equal

21.2.7 Manhole Steps

Safety type, nineteen millimetre (19mm) diameter solid steel bar, hot dip aluminium after fabrication.

21.2.8 Safety Platforms

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

To be installed according to manufacturer's recommendations.

To be installed on manholes greater than five meters (5m) in depth when measured from the top of the frame to the lowest invert.

21.2.9 Concrete

Ready-mixed concrete, sulfate resisting, Portland cement CSA A5, Type 50, 20 MPa compressive strength at twenty eight (28) days of age, to CSA A23.1

21.2.10 Reinforcing Steel

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

21.2.11 Sewer Pipe Tests and Rejection

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

The County reserves the right to select, either on site or at the manufacturer's stockpile, point five percent (.5%) of total length of each category of pipe for testing, minimum number of lengths as follows:

a) for each category of over one hundred (100) lineal meters – four (4) lengths

b) for each category of over fifty (50) lineal meters and less than one hundred (100) lineal meters – two (2) lengths

c) for each category of less than fifty (50) lineal meters – one (1) length.

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

Should any specimens fail to meet test requirements, test two (2) additional selected specimens for each failure. Pipe will be acceptable only if all re-test specimens meet requirements. Should test results be unsatisfactory, all or part of pipe supplied may be rejected and acceptance withheld until satisfactory tests of pipe in place are conducted.

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

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

21.3 EXECUTION

21.3.1 Bedding Sewers

Excavate trenches to widths not less than three hundred millimetre (300mm) greater than pipe diameter. Maximum width at top shall not exceed outside pipe diameter plus six hundred millimetres (600mm).

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

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

21.3.2 Laying and Jointing Pipe

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

21.3.3 Infiltration/Exfiltration Testing

Total infiltration of groundwater into whole of system or exfiltration, shall not exceed five litres per millimetre (5l/mm) of internal pipe diameter per kilometer per day including manholes, for PVC pipe, and twenty liters per millimetres (20l/mm) of internal pipe diameter per kilometer per day including manholes for concrete and clay tile pipe. Where such leakage is exceeded, repair sewer mains so total infiltration is within specified limits.

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

21.3.4 Cleaning Sewer Mains

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

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

Whenever practicable, flush out in runs not over two hundred fifty meters (250m). Remove all foreign material from each run before proceeding with next.

21.3.5 Testing

If required by the County, perform pill test after cleaning sewer mains. Through each section of main, pull wood or metal ball with diameter fifty millimetre (50mm) less than inside pipe diameter. If pill does not readily pull through, uncover pipe and make good defects.

Pill test is not required on lines two hundred sixteen millimetre (216mm) diameter and larger if they are visually inspected in a satisfactory manner.

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

21.3.6 Manholes

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

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

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

Construct manholes watertight and complete, including finishing flow bottoms, as work proceeds. Do not lay pipe in advance more than two (2) manholes ahead of last completed manholes.

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

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

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

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

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

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

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

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

END OF SECTION

22 STORM WATER MAINS

22.1 GENERAL

22.1.1 Work Included

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

a) bedding under and over piping
b) storm water mains and appurtenances
c) manholes, catchbasins and appurtenances
d) cleaning sewers
e) testing sewers
f) connection to existing systems

22.1.2 Quality Standards and Assurances

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

All products and workmanship are subject to inspection by the County.

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

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

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

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

22.2 PRODUCTS

22.2.1 Sewer Pipe

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

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

Reinforced concrete pipe meeting ASTM Specification C76-70 CSA-A257.2-M92.

PVC pipe and fittings - DR 35 meeting ASTM Specification D3034 and CSA-B182.2 and CSA-B182.1 may be utilized for mains up to and including three hundred seventy five millimetre (375mm) diameter with prior approval of the County.

Ribbed PVC pipe and fittings to meet CSA B182.4, ASTM F794 with pipe stiffness of 320 kPa as measured in accordance with ASTM D2412. Maximum long term deflection is less than seven point five percent (7.5%).

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

22.2.2 Pipe Joints

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

Concrete pipe - rubber gasket to ASTM C443 and CSA A257.3.

PVC - rubber gasket to ASTM 03212 or ASTM F477.

22.2.3 Pre-cast Concrete Manhole Units

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

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

Manhole steps shall be nineteen millimetre (19mm) diameter, galvanized iron safety rungs spaced at a maximum distance of four hundred millimetre (400mm) center to center for full height.

Pre-cast bases to be minimum 20.7 MPa concrete.

22.2.4 Concrete Blocks and Bricks

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

Cement - sulfate resisting Portland CSA A5, Type 50.

22.2.5 Catch Basins

To meet requirements of ASTM C478 and CSA A257.2, nine hundred ten millimetre (910mm) diameter reinforced concrete riser, reinforced pre-cast concrete base slab, to details shown on drawings.

Cement - sulfate resisting Portland CSA A5, Type 50.

22.2.6 Catch Basin Lead Pipes

Catch basin lead pipes shall be:

a) Non-reinforced concrete pipe to meet CSA A257.1

b) PVC pipe DR 35 to meet ASTM D3034 or approved equivalent.

Pipe diameter shall be two hundred fifty millimetre (250mm) diameter for single catch basins and three hundred millimetre (300mm) diameter for twinned catch basins with a minimum grade of two percent (2%).

22.2.7 Mortar

For pipe joints and all other parts of the work, one (1) part sulfate resisting Portland cement to two (2) parts clean sand, by volume.

22.2.8 Cast Iron Frame, Covers and Grates

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

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

Hot dip in asphaltic varnish.

Manhole covers and frames:

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

Catch basin covers and frames:

a) Rolled monolithic curb and gutter - Norwood Foundry Model F-33
b) Round Top Catch Basin - Norwood Foundry Model F-49
c) Side inlet - Norwood Foundry Model F-51.

22.2.9 Manhole Steps

Safety type, nineteen millimetre (19mm) diameter solid steel bar, hot dip galvanized after fabrication.

22.2.10 Safety Platforms

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

To be installed according to manufacturer's recommendations.

To be installed on manholes greater than five meters (5m) in depth when measured from the top of the frame to the lowest invert.

22.2.11 Concrete

Ready-mixed concrete, sulfate resisting, Portland cement CSA A5, Type 50, 20 MPa compressive strength at twenty eight (28) days of age, to CSA A23.1

22.2.12 Reinforcing Steel

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

22.2.13 Sewer Pipe Tests and Rejection

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

The County reserves the right to select, either on site or at the manufacturer's stockpile, point five percent (.5%) of total length of each category of pipe for testing, minimum number of lengths as follows:

a) for each category of over one hundred (100) lineal meters – four (4) lengths

b) for each category of over fifty (50) lineal meters and less than one hundred (100) lineal meters – two (2) lengths

c) for each category of less than fifty (50) lineal meters – one (1) length.

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

Should any specimens fail to meet test requirements, test two (2) additional selected specimens for each failure. Pipe will be acceptable only if all re-test specimens meet requirements. Should test results be unsatisfactory, all or part of pipe supplied may be rejected and acceptance withheld until satisfactory tests of pipe in place are conducted.

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

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

22.3 EXECUTION

22.3.1 Bedding Sewers

Excavate trenches to widths not less than three hundred millimetre (300mm) greater than pipe diameter. Maximum width at top shall not exceed outside pipe diameter plus six hundred millimetre (600mm).

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

a) Obtain the County's approval for all materials to be used in the pipe bedding zone.

22.3.2 Laying and Jointing Pipe

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

22.3.3 Infiltration/Exfiltration Testing

Total infiltration of groundwater into whole of system or exfiltration, shall not exceed five litres per millimetre (5l/mm) of internal pipe diameter per kilometer per day including manholes, for PVC pipe, and twenty liters per millimetre (20l/mm) of internal pipe diameter per kilometer per day including manholes for concrete and clay tile pipe. Where such leakage is exceeded, repair sewer mains so total infiltration is within specified limits.

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

22.3.4 Cleaning Sewer Mains

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

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

Whenever practicable, flush out in runs not over two hundred fifty meters (250m). Remove all foreign material from each run before proceeding with next.

22.3.5 Testing

If required by the County, perform pill test after cleaning sewer mains. Through each section of main, pull wood or metal ball with diameter fifty millimetres (50mm) less than inside pipe diameter. If pill does not readily pull through, uncover pipe and make good defects at no cost to Owner.

Pill test is not required on lines two hundred sixteen millimetres (216mm) diameter and larger if they are visually inspected in a satisfactory manner.

TV Testing - the Contractor, at his cost will carry out a TV inspection of all sanitary and storm water mains. All defects identified by the TV inspection shall be corrected by the Contractor at the Contractor's expense. The Contractor shall be responsible for the cost of flushing and stringing the mains prior to TV inspection. If additional TV inspection is required to verify

correction of defective work, it will be at the Contractor's cost. The Contractor shall provide a copy of the video tape recordings and a written report to the County for record purposes.

22.3.6 Manholes

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

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

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

Construct manholes watertight and complete, including finishing flow bottoms, as work proceeds. Do not lay pipe in advance more than two (2) manholes ahead of last completed manholes.

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

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

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

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

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

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

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

All sanitary manhole barrels are to be sealed with rubber neck to prevent infiltration. Gaskets for storm manholes only, may be omitted at the discretion of the County.

END OF SECTION

23 LOT SERVICE CONNECTIONS

23.1 GENERAL

23.1.1 Work Included

Provide all labour, products and equipment required for the lot service connections, including but not limited to:

a) water service piping

b) sewer service piping

c) corporation cocks, connection to main

d) curb stops, service boxes, service markers

23.1.2 Quality Standards and Assurances

Products and workmanship shall conform to applicable municipal and provincial standards and to specifications.

All products and workmanship will be subject to inspection by the County.

Perform all tests required by authorities having jurisdiction. Test water and disinfect services with mains.

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

Do not cover work before inspection and testing unless authorized by the County in writing.

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

23.2 PRODUCTS

23.2.1 Service Pipe, Fittings

Underground copper service pipe - type K soft copper for a diameter of twenty five millimetres (25mm) and less, and Type K copper and approved PVC materials for diameters greater than twenty five millimetres (25mm).

Main or corporation cocks – Compression type AWWA thread.

Curb stops – Copper to copper ball valve with a drain. Curb stops thirty eight millimetres (38mm) or larger shall be ball bearing type.

Couplings – Standard Brass Compression type.

Service Boxes – Epoxy coated extension type for a maximum extension of three point five meters (3.5m), complete with stainless steel operating rod, brass clevis and key. Service box to be supported on a cast iron piece nailed to a pressure treated preserved wood plank.

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

2.3 kg Zinc Anode Protection to be installed as indicated on Drawing No. 8-300.

Service boxes to be adjustable from 2.4 m to 3.0 m bury, unless otherwise noted on drawings.

23.2.2 Sewer Service Pipe

PVC, SDR 35 minimum.

23.2.3 Sewer Saddles

Manufactured tee saddles, gasketed joints secured with double steel clamps.

23.2.4 Sand Bags

Bags to be new material and in a condition acceptable to the County. Sand to be clean and free from debris, conforming to imported sand requirements as specified in section 02161 Trenching and Backfilling for Utilities.

23.2.5 Rigid Foamed Urethane Insulation

Density (ASTM D1622) not less than twenty eight point eight kilograms per cubic meter (28.8 kg/m^3). (Nominal thirty two kilograms (32 kg)).

Closed cell content (ASTM D2856) not less than ninety percent (90%).

Water absorption (ASTM D2842) not greater than 0.34 kg/square meter.

Initial thermal conductivity (ASTM D2326) (K Factor) not greater than watts/meter degree Celsius.

Dimensional stability (ASTM D2126)

Compressive strength (ASTM D1621) not less than 206.8 kPa at ten percent (10%) deflection.

23.3 EXECUTION

23.3.1 Water Services

Use tapping machine to drill, tap and thread corporation main stop into main. Use special care to prevent cuttings falling into main. Wherever possible, tap main under pressure and obtain written approval from the County to do otherwise.

Lay copper service pipe to designated location and connect to existing service lines. Service connections shall be tapped into the upper portion of the watermain at an angle of at least forty five degrees (45°) from the horizontal. Tappings shall have a minimum spacing of at least six hundred millimetre (600mm). Attach curb stop and set service box to grade where required.

Brace boxes securely to keep plumb during backfilling. Test for operation both before and after pressure test.

Where curb stop is located under sidewalk, concrete slab or other structure, set top of extension service box flush with surface and fill hole around pipe neatly with concrete.

Use service clamps on all services tapped into one hundred fifty millimetre (150mm) mains and on twenty five millimetre (25mm) and larger services tapped into two hundred millimetre (200mm) to three hundred millimetre (300mm) lines. In all other cases, use service clamps where size of main stop is larger than recommended for size of main.

Place water service lines at least two point seven meters (2.7m) below final finished grade elevations, unless otherwise directed.

Lay water service lines in same trench with sewer service line. Install sanitary services on left side of water service as viewed from main towards property line. Install storm sewer service on right side of water service as viewed from main towards property line. Paint last one meter (1m) of sanitary service pipe red. Paint last storm service pipe green. Make all connections to existing services using appropriate couplings.

Lot service connections to residential lots (R.1 and R.2) shall be installed inside property line to easement line for lane servicing; and to property line, or easement line if an easement exists, for street servicing. (as shown on the drawings) Water services connections to residential lots (R.1 and R.2) shall be point one five meter (.15m) short of the easement line for lane servicing and point one five meter (.15m) outside property line or easement line if an easement exists, for street servicing.

The County may require the delivery of curb stop risers to the public works yard. The Contractor shall confirm this requirement with the County and shall provide evidence of a receipt signed by the Public Works employee accordingly.

23.3.2 Sewer Services

Connect services to mains with manufactured tee or wye fittings placed in mains, or by cutting into mains and installing manufactured tee saddles or wye saddles and forty five degree (45°) bends. A one hundred fifty millimetre by one hundred millimetre (150mm x 100mm) reducer shall be installed at property line to transition from the one hundred fifty millimetre (150mm) connection at the main to the one hundred millimetre (100mm) Lot Service Pipe. Take care to avoid cracking pipe and remove all cuttings from pipe. Secure joint between saddle and main with mortar or other means acceptable to the County.

Do not allow spigots or other obstructions to project into main. Lay service pipe to an even gradient as directed.

Install service lines as detailed, at locations and to grade designated by grade sheet provided in field. Install services at right angle to main, unless otherwise specified.

Bends permitted only at three locations – forty five degree (45°) bend with wye or twenty two point five degree (22.5°) bend with tee connection at main, forty five degree (45°) bend at top of riser and twenty two point five degree (22.5°) bend maximum at property line for house service connection between these points.

Support service lines adequately to prevent dislocation, buckling or settlement. When water lines must be laid below sewer lines, ensure that backfill over water lines is adequately compacted to prevent settlement or dislocation of sewers.

When a connection cannot be made directly to a house service line, plug end of sewer service to prevent entry of water and dirt.

Install service risers only where noted on the lot grading plan. Ensure adequate support for the riser section utilizing sandbags or screened rock.

23.3.3 Markers

A fifty millimetre by one hundred millimetre (50mm x 100mm) marker stake, from invert elevation to six hundred millimetre (600mm) above ground level shall be placed at the end of each water service line, the top six hundred millimetre (600mm) to be painted blue. Place a one hundred millimetre (100mm) diameter white PVC pipe over the water service box from six hundred millimetre (600mm) below ground to six hundred millimetre (600mm) above ground.

END OF SECTION

24 ADJUSTMENT OF APPURTENANCES

24.1 GENERAL

24.1.1 Work Included

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

24.2 EXECUTION

24.2.1 Valve and Curb Boxes Adjustments

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

24.2.2 Manhole and Catch Basin Adjustments

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

24.2.3 Damaged Appurtenances

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

24.2.4 Final Adjustment Elevations

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

a) in asphaltic pavement, five millimetre (5mm) below the finished surface elevation for manhole frames.

b) in concrete curb and gutter, ten millimetre (10mm) below gutter elevation for catch basin frames.

c) in gravel roadways/lanes, fifty millimetre (50mm) below the surface.

d) in landscape areas, fifty millimetre (50mm) above the final surface, providing a smooth transition to match the surrounding areas.

END OF SECTION

25 CULVERTS

25.1 GENERAL

25.1.1 Definition

Culverts shall mean galvanized corrugated steel pipes acting as drainage conduits to conduct the flow of surface drainage water.

25.1.2 Terminology

CSP shall mean Corrugated Steel Pipe.

CSP Arch means Corrugated Steel Pipe Arch.

SPCSP means Structural Plate Corrugated Steel Pipe

25.1.3 References

The latest version of the publications listed below form part of this Specification to the extent specified in this Section:

CSA Standard G401

Corrugated Steel Pipe Institute (CSPI):

501-78 Metric Specification for Corrugated Steel Pipe Products.

25.1.4 Quality Assurance

Supply, fabricate and install CSP culverts strictly in accordance with manufacturer's instructions and recommendations and as specified.

25.1.5 Product Delivery and Handling

Deliver to site, handle and store pipes, sections, fittings and hardware in a manner to prevent distortion or bending and damage to metal or galvanized coating.

25.1.6 Job Conditions

Protect CSP pipes before, during and after installation and protect installed work and materials.

In the event of damage, make repairs or replacements necessary to the County's approval.

25.2 PRODUCTS

25.2.1 Materials

Culvert pipe shall be galvanized corrugated steel pipe complying with CSA Standard G401.

Culvert pipes up to six hundred millimetre (600mm) diameter shall have a wall thickness of one point six millimetre (1.6mm) and larger pipe up to and including nine hundred millimetre (900mm) diameter, shall have minimum two millimetre (2mm) wall thickness.

Specified wall thicknesses shall not include the thickness of galvanized coating.

The zinc coating mass shall be not less than one thousand one hundred grams per square meter (1,100g/m^2) when tested by the single spot test.

Corrugation profile for the pipes shall be sixty eight millimetre by thirteen millimetre (68mm x 13mm).

End sections (square or bevelled as indicated), couplers, fittings and hardware shall match the culvert pipe.

25.3 EXECUTION

Trench shall be properly drained and free of unsuitable material prior to placing and compaction of bedding material.

25.4 TRENCHING AND EXCAVATION

The excavation for the culvert base shall be carried to a depth of not less than one hundred fifty millimetre (150mm) below the invert grade, as established by the County and shall be of sufficient width to permit pipe assembly and to accommodate operation of compaction equipment on either side of the culvert.

25.4.1 Culvert Bedding

Place minimum one hundred fifty millimetre (150mm) thick layer of compacted granular material on bottom of excavation. Place material in uniform layers not exceeding one hundred fifty millimetre (150mm) thickness, and compact each layer to at least ninety eight percent (98%) Standard Proctor Density before placing succeeding layer. Any soft and yielding or other unsuitable material below this level shall be removed to the depth required by the County and backfilled with approved granular material compacted to a uniform density of ninety eight percent (98%) of Standard Proctor Density throughout the entire length of the culvert.

The base for culverts installed along main water courses or through yielding areas shall consist of gravel bedding compacted to the excavated depth and extending over a width of three (3) times the diameter of the pipe. The depth of this base shall be not less than three hundred millimetre (300mm). An impervious compacted bedding material shall be provided for a minimum length of three meter (3m) or three (3) times the diameter of the pipe, whichever is greater, at the inlet end of the culvert to achieve a seal against seepage.

Trench line and grade requires the County's approval prior to placing bedding material or pipe.

Do not backfill until pipe grade and alignment are checked and accepted by the County.

25.4.2 Laying Corrugated Steel Pipe Culverts

Commence pipe placing at downstream end on the prepared granular bedding with separated sections securely joined together by means of a coupling band.

The couplers are to match thickness and corrugations of the pipe.

Corrugations of pipes and couplers must mate before tightening and joints shall be tapped with a mallet during tightening to ensure proper seating of couplers.

Do not allow water to flow through pipes during construction except as permitted by the County.

All culverts shall be laid so that the horizontal seams fall at the sides of the culverts.

The pipe shall be laid true to line and grade as established by the County and the pipe shall be carefully handled to prevent damage to the galvanized coating. Damaged pipe sections shall be immediately reported to the County and repaired and replaced according to his direction. Damaged protective coating shall receive two coats of zinc rich paint.

Centreline of culvert shall not vary from the designated horizontal alignment by more than seventy five millimetre (75mm). Invert grade shall not vary from the designated invert grade elevation by more than twelve millimetre (12mm) provided positive flow is maintained.

25.4.3 Culvert Backfill

After assembly of the culvert on the bedding, the culvert shall be backfilled with approved granular and random backfill. Backfill shall be brought up on both sides of the culvert simultaneously in one hundred fifty millimetre (150mm) lifts and shall be compacted with a method approved by the County to a minimum density of ninety five percent (95%) Standard Proctor.

The backfill shall be spread and compacted in one hundred fifty millimetre (150mm) layers and special care shall be taken to ensure proper filling and compacting under the haunches and within the culvert corrugations. Heavy equipment shall not be allowed over the culvert until a minimum of point five meter (.5m) of fill is obtained above the crown of the pipe.

25.4.4 Rock Rip Rap

The ends of the culvert shall be finished with the placement of rock rip-rap as shown in the detailed sketches.

Rip-rap shall not be placed in the water line at an elevation above the invert of the pipe at the outlet end. See standard drawing. .

25.4.5 Adjustment and Cleaning

Inlet and outlet ends and waterway through the pipe shall be kept free from debris or foreign matter, to prevent restriction to flow of water through the culvert.

END OF SECTION

26 GRANULAR SUB-BASE

26.1 GENERAL

26.1.1 Work Included

The work described in this section pertains to granular sub-base material as detailed on the drawings.

26.2 PRODUCTS

26.2.1 Granular Sub-base

Granular sub-base is the material lying above the subgrade and below the base course. The gradation to be utilized shall be as designated by the County.

26.2.2 Gradation

The granular sub-base material shall consist of rock, gravel, and sand consisting of hard, clean, durable material, free from coatings of silt, clay or other deleterious materials and contain no organic matter.

The following gradation shall apply to pit run granular sub-base courses:

Sieve Size (mm)	% Passing by Mass
150.000	100
80.000	80-100
25.000	50-80
5.000	25-55
0.080	2-10

26.2.3 Approval

Preliminary approval of the material as represented in the test results shall not constitute general acceptance of all material in the deposit or source of supply, and acceptance shall be subject to confirming field tests taken at the discretion of the County. Materials may be considered unsuitable, even though particle sizes are within the limits of the gradation sizes required, if any characteristic precludes satisfactory compaction or if the material fails to provide a roadway suitable for traffic. The acceptability of the final material will be determined by the County.

26.2.4 Quality

The material shall consist of durable rock or gravel. The granular sub-base shall not contain any organic or other deleterious materials.

Liquid Limit: ASTM D423, max. 25
Plasticity Index: ASTM D424, max. 6

26.3 EXECUTION

26.3.1 Placement

The granular sub-base material shall not be placed until the underlying subgrade has been inspected and approved by the County.

Unless otherwise specified, the granular material shall be placed in uniform layers not exceeding two hundred millimetre (200mm) in thickness before compaction. The material shall be placed by mechanical spreaders or deposited in windrows and levelled with a suitable motor grader.

26.3.2 Compaction

The material shall be compacted by rolling with a pneumatic-tired or vibrating roller of a type approved by the County. The material shall be compacted near optimum moisture content to ninety eight percent (98%) Standard Proctor Density.

If the moisture content exceeds the optimum during compaction, the material shall be aerated by mechanical means until the material has been dried sufficiently to obtain the specified density.

If the moisture content is below optimum, water shall be added by an acceptable applicator and in such quantities to achieve specified compaction.

26.3.3 Shaping and Finishing

A motor grader shall be used in conjunction with the compaction equipment to keep the finished surface of each layer even and uniform. The finished surface of the granular sub-base shall conform to the required cross-section and grades as shown on the drawings or as directed by the County, within a tolerance of thirty millimetre (30mm). The sub-base material shall be uniform and show no signs of segregation.

26.3.4 Tests

Field density, moisture content and sieve analysis tests will be carried out by the representative of the County to ensure that the material is satisfactory.

The frequency of field density and moisture content tests shall be one (1) test per approximately one hundred meters (100m) of constructed roadway and at various locations offset left and right of centre line, or as directed by the County.

All sieve tests should comply with the gradation limits as stated in above.

The Contractor will, as the County requires, provide a loaded gravel truck with operator for visual checks of soft spots.

END OF SECTION

27 GRANULAR BASE COURSE

27.1 GENERAL

27.1.1 Work Included

The work described in this section pertains to base course gravel as detailed on the drawings.

27.2 PRODUCTS

27.2.1 Gradation

Granular base material shall consist of crushed rock and/or crushed gravel and sand consisting of hard, clean, durable material, free from coatings of silt, clay or other deleterious materials, and containing no organic matter. The base course aggregate shall meet the following gradation requirements when tested to ASTM C136 and C117, (AASHTO T11 and T27):

Sieve Size (mm)	% Passing by Mass
20.000	100
16.000	84-94
10.000	63-86
5.000	40-67
1.250	20-43
0.630	14-34
0.315	9-26
0.160	5-18
0.080	2-10

A minimum of sixty percent (60%) by weight of the material retained on the five thousand (5,000) sieve shall have at least two (2) fractured faces. Other properties shall be as follows:

Liquid Limit:	maximum 25, ASTM D423-66
PlastiMD Index:	maximum 6, ASTM D424-59
Los Angeles Abrasion Gradation "B": 35%	maximum loss by mass, ASTM C131-76
Sand Equivalent:	minimum of 35%, ASTM D2419-74

27.2.2 Approval

Preliminary approval of the material as represented in the test results shall not constitute general acceptance of all material in the deposit or source of supply, and acceptance shall be subject to confirming field tests taken at the discretion of the County.

Materials may be considered unsuitable even though particle sizes are within the limits of the gradation sizes required, if particle shapes are thin or elongated, if any other characteristic precludes satisfactory compaction or if the material fails to provide a roadway suitable for traffic.

The acceptability of the final material will be determined by the County.

27.2.3 Quality

The material shall consist of durable rock or gravel. The base course shall not contain any organic or other deleterious materials.

27.3 EXECUTION

27.3.1 Placement

The granular base course material shall not be placed until the underlying subgrade or granular sub-base course has been inspected and approved by the County. The subgrade or sub-base shall be shaped to cross section shown on the drawings, or as directed by the County, and shall be maintained free of ruts, waves, and undulations by what ever means are necessary.

Unless otherwise specified, the granular material shall be placed in uniform layers not exceeding a two hundred millimetre (200mm) compactive depth. The material shall be placed by mechanical spreaders or deposited in windrows and levelled with a suitable motor grader.

When called in the contract temporary material shall be placed from the granular base course level to the lip of gutter, with a one percent (1%) crown. The following year this material shall be excavated, reshaped and recompacted prior to paving. Any additional material shall be used as sub-base material in lanes or as directed by the County.

27.3.2 Compaction

The material shall be compacted by rolling with a pneumatic-tired or vibrating roller of a type approved by the County. The material shall be compacted near the optimum moisture content to one hundred percent (100%) Standard Proctor Density.

For temporary material, compaction shall be ninety five percent (95%) Standard Proctor Density.

If the moisture content exceeds the optimum during compaction, the material shall be aerated by mechanical means until it has dried sufficiently to obtain the specified compaction.

If the moisture content is below the optimum, water shall be added by an acceptable applicator and in such quantities to achieve the specified moisture content.

27.3.3 Shaping and Finishing

A motor grader shall be used in conjunction with compaction equipment to keep the finished surface of each layer even and uniform.

The finished surface of the granular base course shall conform to the required cross-section and grade as shown on the drawings or as directed by the County, within a tolerance of plus or minus twenty millimetre (+/-20mm).

The granular base course shall be uniform and show no signs of segregation of the material placed.

27.3.4 Tests

Field density, moisture content and sieve analysis tests will be carried out by the representative of the County to ensure that the material is satisfactory.

The frequency of field density and moisture content tests shall be one (1) test per approximately one hundred meters (100m) of constructed roadway and at various locations offset left and right of centre line, or as directed by the County.

The Contractor will, as the County requires, provide a loaded gravel truck with operator for visual proof rolling of soft spots. The granular surface course shall show no visible subsidence of deflection under the wheels of the truck.

END OF SECTION

28 HOT MIX ASHPALTIC CONCRETE

28.1 GENERAL

The work of this section pertains to urban roadways. The County, in their sole discretion, may apply Alberta Transportation guidelines for asphalt or road construction for any roadway in their jurisdiction.

28.1.1 Work Included

The work described in this section is that required for construction of a hot-mix asphaltic concrete surface course.

28.2 PRODUCTS

28.2.1 Aggregates

The Contractor shall submit to the County at least ten (10) work days before start of paving, a mix design using the Marshall Method and performed by an independent testing laboratory acceptable to the County. The Contractor shall submit a separate mix design for each change in the supplier or source of materials. No mixing of asphaltic concrete shall proceed until the job mix formula or any subsequent change is approved by the County.

Preliminary approval of the aggregate as represented by the samples shall not constitute general acceptance of all material in the deposits or source of supply; acceptance shall be subject to field tests taken at the discretion of the County.

Materials may be considered unsuitable even though particle sizes are within the limits of the gradation sizes required if particle shapes are thin or elongated or any other characteristic precludes satisfactory compaction, or if the material fails to provide a pavement suitable for traffic. The acceptability of the final material will be determined by the County.

28.2.2 Gradation

Aggregate shall consist of hard, durable, uniformly graded, crushed gravel, free of coatings of silt or clay, and shall not contain organic or soft materials that break up when alternately frozen and thawed, or wetted and dried, nor other deleterious materials.

Coarse aggregate is aggregate retained on the five thousand (5000) μm sieve. Fine aggregate is aggregate passing the five thousand (5,000) μm sieve.

The combined aggregates shall meet the following gradation requirements when tested to ASTM C136 and C117.

Sieve Size (mm)	% Passing by Mass
12.500	100
10.000	83-92
5.000	55-70
1.250	26-45

0.630	18-38
0.315	12-30
0.160	8-20
0.080	4-10

Additional properties that shall be met are as follows:

PlastiMD Index:	Non Plastic, ASTM D424-59
Los Angeles Abrasion Gradation "B":	35% maximum loss by mass, ASTM C131-76

28.2.3 Asphalt Cement

The asphalt cement shall be uniform in character, free of water and shall not foam when heated to one hundred seventy five degrees Celsius (175°C) and it shall have a penetration value of one hundred fifty to two hundred (150-200) dmm at twenty five degrees Celsius (25°C) and shall meet all specifications as to viscosity, flash point, thin film oven test and solubility established by Alberta Transportation for the Premium Grade 150 – 200 (A) Asphalt Cement.

28.2.4 Mix

A qualified testing laboratory engaged by the Contractor shall be employed to prepare a mix design and job mix formula for the aggregate on which the tender is based. The mix design and job mix formula shall be submitted to the County for approval a minimum of ten (10) days prior to paving. No paving shall commence before the County's approval is given for the mix design or job mix formula.

The laboratory mix design shall be based on the Marshall Method. Absorption of asphalt into the aggregate shall be taken into account using the ASTM bulk specific gravity of the aggregate in calculating optimum asphalt content.

The mix design shall meet the following specifications:

		Local Residential Only
Number of compaction blows each face of specimen:	75	50
Min. Stability (kN) at 60 degrees Celsius:	10	5.3
Flow (mm):	2 to 3.5	2 to 4
% Air Voids total mix:	3.5 to 4	3.5 to 4
% Voids in Mineral Aggregate (min):		
at 3.5% air voids	13.5	13.5
at 4% air voids	14	14
% aggregate Voids Filled with Asphalt:	65 to 75	65 to 78
Retained Stability (%)(min):	70	70
Minimum Theoretical Film Thickness (μm)		
Design Air Voids (%)		
4.0 and 3.9	6.0	6.5
3.7 and 3.8	6.1	6.6
3.5 and 3.6	6.2	6.7
Crushed Fragments: minimum material retained on the 5 000 μm with two crushed faces:	70	60
Manufactured fines content as a percentage of fine aggregate mass (minimum)	70	50

The mix produced shall conform to the job mix formula approved by the County and to the following tolerances:

a) The percent of asphalt in the mix shall not vary by more than point three percent (.3%) from the percentage indicated in the approved mix design.

b) The mixing temperature for asphaltic materials shall not vary from those specified in the job mix formula by more than nine degrees Celsius (9°C). In no case shall the mixing temperature exceed the maximum mix temperature indicated from the asphalt temperature-viscosity curve data.

28.2.5 Data

The Contract shall make available to the County any of the following upon request:

Temperature-viscosity data or curves, as obtained from the refineries, for the various grades and types of asphaltic material.

All test data performed by the testing company licensed to practice in the Province of Alberta.

28.2.6 Changes

The Contractor shall notify the County of all proposed changes in the mix proportions. No changes shall be made until a representative of the County is there to witness the change.

28.3 EXECUTION

28.3.1 Transportation

The mixture shall be transported from the mixing plant to the work in vehicles with tight metal bottoms previously cleaned of all foreign materials. The vehicle shall be suitably insulated, and each load shall be covered with canvas or other suitable material of sufficient size to protect it from weather conditions.

The inside surface of the box may be lubricated with a light coating of soap or detergent solution; petroleum derivatives shall not be permitted. Any accumulation of asphaltic material which has collected in the box shall be thoroughly cleaned before loading with hot mix. Trucks shall be clean of mud or any substance which could contaminate the working area.

28.3.2 Preparation of Existing Surface

General

Before the asphalt mix is placed, dirt and other objectionable material shall be removed from the surface to be paved, by brooming or other methods, and a tack coat shall be applied.

Contact edges of existing mats and contact faces of curb, gutters, manholes, sidewalks and other structures shall be coated with a film of liquid asphalt material before placing the asphalt mix.

Preliminary Levelling

Areas that require preliminary levelling will be identified. Generally areas that show depressions, rutting or other deformations to a depth of fifteen millimetre (15mm) or greater will be designated for preliminary levelling and all the following shall apply for acceptance.

a) asphalt mix for preliminary levelling shall be spread by means of a motor grader or other approved method.

b) only pneumatic tired rollers will be allowed for compaction, and a minimum density of ninety one percent (91%) of the Marshall density, is required.

c) preliminary levelling is intended to be a separate operation and shall not be done as part of the construction of the subsequent lift of asphaltic concrete pavement.

28.3.3 Placing

Unless otherwise permitted by the County, the mixture shall be spread by a mechanical self-powered paver, with an automatic levelling device and automatic grade control capable of spreading the mix without segregation or tearing, in thicknesses varying from twelve millimetre to one hundred fifty millimetre (12mm - 150mm) and in widths greater than three meter (3m) and to true line, grade and cross-section as shown on the plans.

The mixture shall be laid at a temperature not lower than one hundred twenty degrees Celsius (120°C) or higher than one hundred forty degrees Celsius (140°C). The air temperature shall not be less than two degrees Celsius (2°C) and rising, no frost shall be present and the roads dry.

Where the asphaltic surface course is to be placed in two (2) lifts, the first lift shall be placed, finished and compacted for the full width as shown on the drawings, prior to commencing on the second lift. The maximum lift thickness is seventy five millimetre (75mm).

In placing the second lift, the individual mixture spreads shall be aligned in a manner such that the longitudinal joints in each layer will not coincide.

In narrow areas, deep or irregular sections, intersections, turnouts or driveways, where it is impractical to spread with a paver, the Contractor may use hand methods as directed by the County.

28.3.4 Weather Limitations

The mixture shall not be placed:

a) during periods of rain or when there is an imminent danger of rain;

b) during excessive winds; or

c) when air temperature is two degrees Celsius (2°C) or cooler or frost is present on the surface.

28.3.5 Joints

The mixture shall be laid so that all longitudinal joints are made while the first mat of the two (2) being laid is still hot. A narrow strip along the edge of a mat which is joined with another asphalt mat shall be left without rolling until the adjoining mat has been placed against it. The joint which is formed shall be rolled immediately after the adjacent mat has been placed to ensure a bonding of the material while the asphalt is still hot.

Transverse joints shall be carefully constructed and thoroughly compacted to provide a smooth-riding surface. Joints shall be straight-edged to assure smoothness and true alignment and shall be offset at least one metre (1m) from joints of adjacent mats.

All concrete or metal structures such as gutters, manholes, etc. shall be painted with an approved bituminous material prior to placing the asphalt.

28.3.6 Tolerance and Penalties

The pavement shall have the thickness specified on the County's drawings. Areas suspected to be deficient shall be cored, as directed by the County, on the basis of one (1) core for every one thousand square metres (1,000m²) of pavement. At least one (1) core shall be taken at the designated Marshall location.

Should the asphalt be found to be deficient in thickness, the Contractor will be permitted to take two (2) additional cores in an effort to isolate and confirm the deficient areas. The location

of the two (2) additional cores shall be located no further than half way between the deficient core, and the next adjacent core, or contract boundary.

The exact location of the core locations are to be determined by the Contractor, and approved by the County. The Contractor shall be responsible for all costs associated with the recoring of the asphalt.

A deficiency penalty shall be assessed according to the following:

Thickness Deficiency (mm)	Payment Reduction Factor %
0 to 5	0
6 to 9	10
10 to 12	25
13 to 15	50
Over 15	Remove and Replace

No additional payment will be made to the Contractor for greater thicknesses.

The Contractor shall fill all core holes within a maximum period of twenty four (24) hours.

28.3.7 Densities

Densities shall be based on core samples, each of which shall represent approximately one thousand square metres (1,000m²) per constructed lift. Asphalt densities are specified as ninety seven percent (97%) of the standard laboratory Marshall. A minimum of one (1) Marshall per day shall be performed with one (1) core sample taken at a designated Marshall location.

If any core fails to meet the density specified, no more than two (2) additional cores may be taken by the Contractor within one metre (1m) of the first core sample, and the average density of the three cores shall represent the area. No additional rolling to achieve a more favourable density shall be allowed WITHOUT THE WRITTEN CONSENT of the County. The Contractor shall be responsible for all costs associated with the recoring of the asphalt.

If the densities are less than specified, a deficiency penalty shall be assessed according to the following:

Field Density	Payment Reduction Factor (%)
97.0 to 96.6	0
96.59 to 96.1	3
96.09 to 95.6	12
95.59 to 95.0	25
<95.0	Remove and Replace

All asphalt below ninety five percent (95%) standard Marshall density shall be removed and replaced at the Contractor's expense.

No adjustment to the unit price is to be made for areas with a density higher than that specified.

28.3.8 Smoothness

The surface of the compacted pavement shall be true to the required grade and cross-section with a smooth riding quality acceptable to the County.

In addition to the above, when checked with a three meter (3m) straight-edge, held in successive positions parallel or perpendicular to the center line and in contact with the surface, the pavement surface shall not deviate from the straight-edge by more than three millimetre (3mm).

If, in the opinion of the County, an objectionable riding surface exists, the Contractor shall either grind and resurface with an asphalt overlay or remove and replace the asphalt surface.

28.3.9 Texture

The completed pavement shall have a tightly knit texture and shall be free from segregation and surface cracking. Mixes that are excessively tender or difficult to roll shall be redesigned in order to remedy the situation. The new design shall meet all of the requirements of this section, and shall be submitted to the County for approval at least three (3) working days prior to its use.

28.3.10 Traffic

No traffic shall be allowed on the finished surface until it has cooled to atmospheric temperature.

END OF SECTION

29 PRIME, TACK AND FOG COATS

29.1 GENERAL

29.1.1 Definitions

Prime Coat

Prime coat shall be the application of bituminous material to previously prepared granular base course, prior to placing bituminous surfacing materials.

Tack Coat

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

Fog Coat

Fog coat shall be the application of bituminous material to seal small cracks and surface voids on surface materials.

Fog coat shall only be required if, in the opinion of the County, the asphalt is open in texture.

29.2 PRODUCTS

29.2.1 Prime Coat

The bituminous material for priming the base course shall be liquid asphalt. The asphalt types may vary from medium curing (MC) type MC-30 to MC-250; from slow setting (SS) type SS-1 to SS-1H or a special emulsified asphalt primer S.E.P. to suit the condition of the base.

29.2.2 Tack Coat

The bituminous material for tacking the existing asphalt surface shall be liquid asphalt. The asphalt types may vary from rapid curing (RC) type RC-30 to RC-250; from slow setting (SS) type SS-1 to SS-1H depending on conditions to suit the base. The SS emulsion shall be diluted by adding an equal amount of water prior to application.

29.2.3 Fog Coat

The bituminous material for sealing the surface course if specified shall be liquid asphalt. The asphalt types may be slow setting (SS) type SS-1 or medium curing (MC) type MC-30 depending on the surface material to be sealed.

29.2.4 Sand Blotter

The materials for sand cover shall consist of clean granular mineral material approved by the County, all of which shall pass a five thousand (5,000) sieve.

29.3 EXECUTION

29.3.1 Equipment

Cleaning equipment shall consist of power brooms, flushers, and whatever hand scrapers may be necessary to remove all foreign material.

The pressure distributor used for applying asphaltic material shall distribute the asphaltic material at an even temperature, uniformly on variable widths of surface up to five meters (5m). Uniform spray without atomization shall be determined and controlled from point two litres per minute to five point four litres per minute (.2 L/m - 5.4 L/m) with uniform pressure, and with an allowable variation from any specified rate not exceeding point one litre per minute (.1 L/m).

Suitable means for accurately indicating the temperature of the asphaltic material shall be provided at all times. The thermometer well shall be so placed as not to be in contact with a heating tube.

If provided with heating attachments the distributor shall be so equipped and operated that the asphaltic material shall be circulated or agitated throughout the entire heating process.

29.3.2 Preparation

Immediately prior to applying the asphalt primer, tack or fog coat, the surface shall be brought to uniform cross-section by patching all depressions and defective areas using an approved patching material and by removing all bumps and irregularities.

All loose and foreign material shall be removed by light sweeping.

29.3.3 Application

Obtain County's approval of existing surface before applying asphalt prime, tack or fog coats. Clean surface as required.

Upon the prepared surface the asphalt shall be applied uniformly at a rate of from point five litres per square meter to one point five litres per square meter (.50 L/m² - 1.50 L/m²) for asphalt primer, and at a rate of from point two five litres per square meter to point nine litres per square meter (.25 L/m² - .9 L/m^2) for tack coat. The asphalt primer, tack or fog coat shall be applied only when the surface is dry or slightly damp, unless otherwise allowed by the County in writing, or only when the air temperature in the shade is above ten degrees Celsius (10°C).

The application temperature of the asphalt primer, tack or fog coat shall be as follows:

Rapid Curing Asphalt:	
RC-30	51 – 68°C
RC-70	74 – 88°C
RC-250	100 – 110°C
Medium Curing Asphalt:	
MC-30	51 – 68°C

MC-70	74 – 88°C
MC-250	100 – 110°C

Emulsified Asphalt:

SS-1	20 – 50°C
SS-1H	20 – 50°C

Special Emulsified Primer Asphalt

S.E.P.	15 – 50°C

Coat contact surfaces of curbs, gutters, headers, manholes and like structures with a thin uniform coat of asphalt material. Do not prime or tack surfaces that will be visible when paving is complete. Work adjacent to the roadway shall be completely protected from the application operation by a suitable covering. Any unnecessary splashing of the concrete shall be cleaned.

Do not apply asphalt coat when air temperature is less than five degrees Celsius (5°C) or when rain is forecast within two (2) hours.

The Contractor shall maintain the primed surface until the surface course has been placed. Maintenance shall include spreading any additional sand and patching any breaks in the primed surface with additional asphaltic material.

The asphalt primer should preferably be entirely absorbed by the base course and therefore require no sand cover. If, however, the asphalt has not been completely absorbed twenty four (24) hours after application, just sufficient sand shall be spread over the surface to blot up excess asphalt and prevent it from being picked up by any traffic.

Traffic shall not be permitted to travel on tack or fog coat until cured. The Contractor shall use flagmen, if required, and signage to control traffic until the tack or fog coat has cured.

Traffic shall not be permitted to travel on prime coat until six (6) hours after application or until it has cured. After this period of time, excess asphalt material remaining on the surface shall be blotted by sand before traffic is permitted to travel on the surface.

END OF SECTION

30 PAVEMENT MARKINGS

30.1 GENERAL

30.1.1 Samples

If requested by the County, submit the following material sample quantities at least four (4) weeks prior to commencing work.

a) Two (2) one litre (1 L) samples of each type of paint.

b) One (1) one kilogram (1 kg) sample of glass beads.

c) Sampling to CGSB 1-GP-71.

Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, CGSB specification number and formulation number and batch number.

30.2 PRODUCTS

30.2.1 Painted Markings

To CGSB 1_GP_74M, alkyd traffic paint.

Colour: to CGSB 1_GP_12C, yellow 505_308, white 513_301.

Thinner: to CAN/CGSB_1.5.

30.2.2 Permanent Markings

The use of other permanent marking materials that do not meet the following requirements will be subject to approval by the County. Acceptance during the warranty period will be based on the following:

a) not lift from the pavement,

b) exhibit no material loss within four (4) weeks of installation,

c) not deteriorated by contact with sodium, calcium chloride or traffic residue,

d) show no appreciable deformation or discoloration under exposure to traffic and road temperatures between minus forty degrees Celsius and forty degrees Celsius (–40ºC and 40ºC) and,

e) maintain their original dimension and placement without chipping or cracking.

Cold Plastic Marking: two-component, cold-extruded and cold-curing, having a specific gravity of one point nine (1.9) minimum at twenty five degrees Celsius (25°C).

Hot Thermoplastic Marking: hot-extruded, having a specific gravity of two (2.0) minimum at twenty five degrees Celsius (25°C), having a softening point of ninety degrees Celsius (90°C) minimum according to ASTM E28.

Both cold and hot plastic markings shall conform to the following:

a) Water Absorption: point five percent (.5%) maximum by mass retained water after twenty four (24) hour immersion, according to ASTM D570 Procedure A.

b) Impact Resistance: minimum 1.13 J at twenty five degrees Celsius (25°C) when material is cast into bar of twenty five square millimetres (25mm²) cross-section by seventy five millimetre (75mm) long, with twenty five millimetres (25mm) extending above vice jaws in a cantilever beam (Izod type) tester using the 2.82 J scale, according to ASTM D256 Method C.

c) Abrasion Resistance: maximum weight loss of point five grams (.50 g) when subjected to two hundred (200) revolutions on Taber abrader at twenty five degrees Celsius (25°C) using H-22 Calibrade wheels weighted to five hundred grams (500 g) with sample kept continuously wet with distilled water. Prepare test sample with representative material placed on one hundred millimetre (100mm) square plate, 3 ±0.1 mm thick.

d) Chemical Resistance: Test samples of fifty square millimetres (50mm²), no degradation after exposure to:

    1) Twenty four (24) hours immersion in five percent (5%) NaCl.

    2) Twenty four (24) hours immersion in five percent (5%) CaCl.

    3) One (1) hour spot test with mineral oil.

e) No deterioration when in direct contact with asphalt cement in asphalt materials, or with sodium chloride, calcium chloride or other de-icing chemicals.

f) Non-toxic and not harmful to persons or property when in hardened state.

g) No discoloration from sunlight ultraviolet exposure and no bond failure for warranted life of material.

Glass Beads: minimum eighty percent (80%) true spherical shape; clear of cloudiness, dark inclusions, trapped air, or other defects; and conforming to the following:

a) Index of Refraction: one point five (1.5) minimum when tested in liquid immersion at twenty five degrees Celsius (25°C) according to CGSB 1-GP-71 Method 49.1.

b) Gradation of glass beads for mixing with and for surface application on thermoplastic material, tested according to ASTM D1214:

Sieve Size (mm)	% Passing by Mass
850	90 – 100
300	15 – 50
180	0 – 10

Premarking Paint: as reviewed by the County.

Groove Filler: LRS 424 or approved equal.

30.3 MIX FORMULATION

Glass Sphere Content: minimum twenty percent (20%), maximum thirty percent (30%) by mass of thermoplastic material.

White Colour: brilliant white, seventy percent (70%) minimum when measured with the Gardner Multi-Purpose Reflectometer 0, forty five degree (45°) daylight luminous directional reflectance, with a green filter.

Yellow Colour: conforming to CGSB Colour #505-308 or U.S. Federal Standard 595a, Colour Chip 33538, forty five percent (45%) minimum when measured with the Gardner Multi-Purpose Reflectometer 0, forty five degree (45°) daylight luminous directional reflectance, with a green filter. Colour tolerance to be within limits of U.S. Department of Transport Yellow Tolerance Chart PR#1 December 1972.

No formulation change unless approved by the County. Any significant change will be subject to field trials.

30.4 EXECUTION

30.4.1 Equipment Requirements

Paint applicator to be an approved pressure type distributor capable of applying paint in single, double and dashed lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.

Grooving machine subject to the County's approval.

30.4.2 Condition of Surfaces

Pavement surface to be dry, free from ponded water, frost, ice, dust, oil, grease and other foreign materials.

Remove conflicting markings.

30.4.3 Traffic Control

Conduct all traffic control to the requirements as specified.

30.4.4 Paint Application

Lay out pavement markings and review with the County.

Apply paint only when air temperature is above ten degrees Celsius (10°C), wind speed is less than sixty kilometres per hour (60 km/h) and no rain is forecast within next four (4) hours.

Apply traffic paint evenly at rate of three square meters per litre ($3m^2/L$).

Paint lines to be of uniform colour and density with sharp edges.

Thoroughly clean distributor tank before refilling with paint of different colour.

30.4.5 Cold Plastic Application

Mix components and apply cold plastic marking according to manufacturer's surface application procedure, to a thickness of two millimetres (2mm) minimum and three millimetres (3mm) maximum.

Apply when ambient temperature is between minus ten degrees Celsius and thirty degrees Celsius (–10°C and 30°C).

Apply glass beads to surface of extruded material before it has set, at a rate of one hundred forty grams per square meter to two hundred fifty grams per square meter (140g/m² - 250 g/m^2).

Let marking cure into a hardened state.

30.4.6 Hot Thermoplastic Application

Cut groove into pavement surface to designated width and depth. Remove grindings and haul to designated location. Sweep or airblast groove clean and dry.

Heat material and apply according to manufacturer's hot extrusion process.

Fill groove with hot molten material. Do not overfill more than three millimetres (3mm) above pavement surface.

Apply glass beads to surface of extruded material while it is still molten at a rate of one hundred forty grams per square meter to two hundred fifty grams per square meter (140 g/m² to 250 g/m^2).

Trim surplus material to give clean straight edges.

Let marking cool to a hardened state.

30.4.7 Protection and Cleanup

Do not permit traffic over applied markings until they have adequately hardened.

Protect surrounding areas and structures from disfiguration and damage. Repair any damage as directed by the County.

On completion of work, clean up and leave site free of debris and waste matter.

30.4.8 Tolerance

Painted Marking

Paint markings to be within plus or minus twelve millimetres (+/-12mm) of dimensions indicated.

Remove incorrect markings.

Cold Plastic Marking

Measurement: The quality assurance laboratory will measure suspect markings with a surface micrometer. The average of five (5) measurements will represent three hundred meters (300m) of marking, or one (1) job site, whichever is less.

Thickness Deficiencies: Where a significant number of deficiencies occur in the work, involving average thicknesses greater than three millimetres (3mm) or less than one point eight millimetres (1.8mm), the County may order removal and replacement, or application of additional material.

If surface dishing deeper than point five millimetres (.5mm) occurs, the County may order removal and replacement.

The quality assurance laboratory will determine the width of suspect markings by the average of five (5) measurements representing three hundred metres (300m) of marking, or one (1) job site, whichever is less.

Hot Thermoplastic Marking

Measurement: The quality assurance laboratory will core suspect markings. The average thickness of three (3) cores will represent three hundred meters (300m) of marking, or one (1) job site, whichever is less.

Overfill Thickness: That portion of marking above pavement surface will receive no additional payment. If overfill exceeds three millimetres (3mm), the County may order removal and replacement of marking.

Groove Thickness Deficiencies: Where a significant number of deficiencies occur, involving average thicknesses less than seventy percent (70%) of that specified, the County may order removal and replacement.

If surface dishing deeper than point five millimetre (.5mm) occurs, the County may order removal and replacement. Variations in asphalt surface profile may be taken into consideration.

The quality assurance laboratory will determine the groove width of suspect markings by average measurement of three (3) cores representing three hundred meters (300m) of marking, or one (1) job site, whichever is less.

Width Deficiencies:

Where a significant number of deficiencies occur greater than ten millimetre (10mm) in average widths of cold plastic, or in average groove widths of hot thermoplastic, the County may order removal and replacement.

30.5 PROTECTION OF COMPLETED WORK

Protect pavement markings until dry.

END OF SECTION

31 CURB, GUTTER AND SIDEWALKS

31.1 GENERAL

Products, Concrete Materials, Execution and Methods of Concrete Construction shall be in accordance with CSA CAN3-A23.1or as modified in this section.

31.1.1 Work Included

The work described in this section pertains to the construction of concrete curbs, gutters, sidewalks, crossings and paving stones.

31.2 PRODUCTS

31.2.1 Portland Cement

Portland cement shall meet the requirements of CSA Standard Portland A5-M cement and shall be Type 10 normal, or type 50 sulfate resistant, as required by the County.

31.2.2 Aggregates

The fine and coarse aggregate used in the concrete mix shall conform to the following specifications:

a) Fine Aggregate: CSA CAN3-A23.1, Clause 5.3.

b) Coarse Aggregate: CSA CAN3-A23.1, Clause 5.4. Table 2 Group 1 (28-5)

Sieve Size (mm)	% Passing by Mass
40.000	100
28.000	95-100
14.000	30-65
5.000	1-10
2.500	0-5

31.2.3 Admixtures

All admixtures used to enhance the concrete shall conform to the following specifications:

a) Air Entrainment: ASTM C260

b) Chemical: ASTM C494

c) Calcium Chloride: ASTM C494

The use of calcium chloride shall only be used when approved by the County, but in no case will the amount added be greater than two percent (2%) of the cement weight. It shall not be used when the air temperature is above four degrees Celsius (4^{o}C).

a) Fly ash shall not exceed ten percent (10%) by weight of cement, and it shall conform to the requirements of CAN/CSA-A23.5. Only approved compatible superplasticizing admixtures and air entertaining agents shall be used with

the fly ash. The County may require characteristic data for fly ash to prove conformance to the standards. After September 1st no portion of the specified cement content may be replaced with fly ash unless approved in writing.

31.2.4 Reinforcing Steel

Reinforcing bars shall be deformed bars in accordance with CSA Standard Specification G30.12-M1977.

Cold drawn wire or welded wire fabric for concrete reinforcement shall be one hundred and fifty by one hundred and fifty (150x150) and conform to the requirements of CSA Standard Specification G30.3-1972.

31.2.5 Expansion Joint Filler

Joint filler shall conform to CGSB Standard Specification for polyurethane sealing compound #19-GP-15 or ASTM Standard Specification for SIKA FLEX 1A.

31.2.6 Membrane Curing Compound

Resin-base impervious curing compound shall conform to ASTM Standard Specification C309 Type 1D-Type B. The curing compound shall contain white fugitive dye.

31.2.7 Preformed Expansion Joint Filler

Preformed expansion joint filler shall conform to ASTM Standard Specification D-1752.

31.2.8 Concrete

Concrete mixes shall be designed by a qualified testing laboratory engaged by the Contractor. The mix design shall be submitted to the County for approval a minimum of ten (10) days prior to delivery of any concrete to the site. The specified compressive strength at twenty eight (28) days shall be 30Mpa. The strength level of 30Mpa shall be considered to be achieved if averages of all sets of three (3) consecutive strength tests equal or exceed the specified strength, and no individual strength test is less than 20Mpa.

The concrete shall contain not less than 315kg of Portland Cement per cubic metre (m^3) of concrete produced.

The air content of the concrete shall be maintained between the limits of six percent to eight percent (6% - 8%).

The minimum slump permissible will be that which will allow the concrete to be placed efficiently and provide a homogeneous mass. The maximum allowable slump shall be seventy millimetres plus or minus ten millimetres (70mm +/- 10mm) for all hand-poured concrete and forty millimetres plus or minus ten millimetres (40mm +/-10mm) for all machine-poured concrete.

31.2.9 Retempering With Air

If, due to a low air entrainment percentage, as specified, the County feels it is necessary to add an approved air-entraining agent on site, placement of concrete shall stop to allow the concrete truck's drum to turn at mixing speed for a minimum of three (3) minutes. Should the

air content of the concrete not conform to specifications after retempering, then the concrete shall be rejected.

The County has the right to withdraw permission to add an air-entraining agent to the mix and reject the concrete if this practice is being abused.

31.2.10 Retempering With Water

If, due to a low slump as specified, the County feels it is necessary to add water to the mix, it shall be injected into the drum under such pressure and direction of flow that it conforms to the specifications in ASTM C-94, Appendix XI. Placement of concrete shall stop at that point to allow the concrete truck's drum to turn at mixing speed for a minimum of three (3) minutes. Should the slump of the concrete not conform to specifications, after retempering, then the concrete shall be rejected.

The County has the right to withdraw permission to add water to the mix and reject the concrete if this practice is being abused.

31.3 EXECUTION

31.3.1 Placing Concrete

Concrete shall not be placed until the subgrade, sub-base and base course materials have been completed, and approved by the County. The base shall be sufficiently moist to prevent absorption of water from the concrete, and free from mud or water pondage.

The concrete shall be placed within ninety (90) minutes of initial mixing at the plant, or before the drum on the concrete truck has turned three hundred (300) revolutions. Complete discharge of concrete shall not exceed two (2) hours. The concrete shall be transported by methods which will prevent segregation and deposited on the subgrade so that as little handling as possible is required.

Concrete shall be placed continuously until a complete section between expansion joints has been poured.

The concrete shall be thoroughly consolidated against and along the faces of the forms. Hand spreading shall be done with shovels, not with rakes, in order that the concrete will not be segregated. Precautions should be taken to prevent overworking of the concrete.

Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which shall prevent the separation or loss of the ingredients. It shall be deposited in the forms as near as practicable to its final position to avoid rehandling.

The sequence of concrete placement shall be arranged so that concrete which has partially hardened shall not be subjected to injurious vibration.

The vertical free fall height of concrete shall not exceed one meter (1m). For falls greater than one meter (1m) chutes or tremies shall be used.

During placement, concrete shall be sufficiently tamped or vibrated with suitable equipment to secure a close bond with the reinforcement, eliminate entrapped air voids and ensure a homogeneous structure with adequate consolidation.

The rate of delivery of mixed concrete shall be such that the interval between the placing of successive truck loads shall not exceed thirty (30) minutes. If the time exceeds thirty (30) minutes, then a construction joint shall be formed.

After the initial set of the concrete, neither the forms or the concrete structure shall be jarred and no strain shall be placed on the ends of projecting reinforcement.

Construct all pararamps and crossings monolithically to the dimensions and at locations specified.

31.3.2 Joints

Curb, gutter and sidewalk contraction joints shall be constructed at three meter (3m) intervals and as detailed on the standard drawings, and shall not be less than fifty millimetre (50mm) deep. Contraction joint widths shall not be greater than five millimetre (5mm).

Midway between each contraction joint on the sidewalk, a surface joint, thirteen millimetre (13mm) deep, shall be constructed. These joints shall not extend into curb and gutter.

A surface joint shall be constructed longitudinally at the location shown on the standard drawings and shall continue through all driveways and lane crossings.

A construction joint shall be formed at the end of every pour. This joint shall be constructed in a “V” shape, as directed by the County, and using ten (10) M rebar six hundred millimetres (600mm) long, spaced every five hundred millimetre (500mm).

Ten (10) M bars at five hundred millimetre (500mm) on centre shall be dowelled and epoxied into the back of the existing curb prior to placing concrete.

31.3.3 Finishing

Sidewalk surfaces, either separate or monolithic with curb and gutter, shall be struck off and screeded to the slope, cross-section and elevation shown on the drawings or as directed by the County. The surface shall be consolidated and smoothed using a wood float. Light-steel trowelling shall be used followed by a uniform brush finish. Sidewalk shall be edged at all joints to prevent chipping of the concrete.

The exposed surfaces of concrete curbs and gutters, either separate or monolithic with sidewalks, shall be finished by means of a wood floating, light-steel trowelling and uniform brushing, and all edges shall be rounded to the required radius. No patching will be allowed.

Pararamps and crossings to lanes and private property shall be struck off and screeded to the required slope and cross-section. The finished surface shall be brushed as specified above.

All edges, including contraction or surface joints, shall be tooled for a width of fifty millimetre (50mm) and rounded to a radius of six millimetre (6mm). The brush grooves shall be

transverse on the sidewalk and longitudinal on the curb and gutter. The finished surface shall have no exposed aggregate or honeycomb.

If there is evidence of excess water on the concrete surface, finishing shall be delayed until the excess water has evaporated.

Surface grooves made by the broom shall not be more than three millimetre (3mm) deep. Before brushing, all surplus water shall be removed from the brush.

31.3.4 Curing

Immediately after finishing, the concrete surface shall be protected by applying a membrane curing compound. After finishing and removal of forms if necessary, all exposed surfaces shall be wetted with water and then thoroughly sprayed with membrane curing compound. The membrane curing compound shall be applied in accordance with the manufacturer's instructions with an approved pressurized spray.

The curing compound shall be applied in such a manner as to cover the entire surface thoroughly and completely with a uniform film at a rate which shall depend on the roughness of the surface of the concrete, but in no case at less than point two five litres per square meter (.25 L/m^2) of concrete surface.

31.3.5 Backfilling

Unless otherwise directed by the County, the Contractor shall backfill along the back of the curb edges, to the top of the concrete, within three to seven (3 – 7) days of the placing of the concrete. The backfill shall be mechanically tamped in maximum lifts of one hundred fifty millimetres (150mm), to a minimum of ninety five percent (95%) Standard Proctor Density and to a distance of three hundred millimetres (300mm) from the back of the walk or curb.

Where landscaping is to be carried out immediately after completion of the walks or curbs and gutters, the backfilling shall be left one hundred millimetres (100mm) low to allow for the topsoil.

31.3.6 Forming

Forms shall be steel or wood of sufficient strength to resist the pressure of wet concrete, and the supply shall be sufficient to permit their remaining in place until hydration has occurred, or longer if the County considers it necessary. The Contractor shall remove all face forms to allow for a smooth brush finish. The use of bent, twisted, battered or worn-out forms will not be permitted. Forms will be checked for alignment and elevation by the County before concrete is poured, and shall be cleaned and oiled before each use.

Where required, reinforcement shall be secured in the location shown on the standard drawings and shall be free from mill scale, grease and rust prior to placing concrete. Forms shall be held securely by approved methods to prevent movement and bulging when the concrete is placed. Forms must be approved by the County before concrete is poured.

Curbs having a radius of less than forty meter (40m) shall be constructed with flexible forms. A sufficient length of form (not less than fifty meters (50m)) shall be placed and checked before concrete is poured to ensure true line and grade. The forms shall be well staked, braced or

otherwise held rigidly true to the established line and grade. The County may, at any time, reject the use of any forms considered unsatisfactory.

31.3.7 Mechanical Extruding Machines

Slip-form paving machines or concrete, extruding machines may be used for placing concrete provided they have received the approval of the County prior to commencement of the work and meet the following requirements:

a) The vibrators on the equipment shall be capable of producing a dense mass with a smooth surface, free of honeycombing.

b) The equipment shall include automatic grade and line controls which shall be used at all times.

Commence placement of concrete only after the subgrade has been prepared and approved by the County.

Any special grading or preparation of the base required by the Contractor to accommodate equipment shall be the responsibility of the Contractor, and shall restore the roadway and boulevards to their original condition within three to seven (3 – 7) days of the initial disturbance.

The extruded concrete shall be checked for alignment and elevation by the County while the concrete is being placed. All incorrectly placed or misaligned work shall be immediately removed while the concrete is still wet, and the work redone to the proper specifications using whatever means are required.
Whenever possible, the forming and placing of concrete by conventional hand pouring methods (as may be required at corners, crossings and catch basins) shall be carried out in conjunction with the extruding machine operation. Where this procedure is not practical, the “tie-ins” shall be completed within three (3) days of construction of the adjacent extruded section, using ten (10) M rebar at all joints. All “tie-ins” shall be completed in one (1) continuous pour.

31.3.8 Consolidation

The concrete shall be consolidated by means of an approved vibrating screed or, in the case of curb and gutter only, by means of a poker or pencil vibrator not exceeding fifty millimetre (50mm) in diameter.

Particular care shall be given to placing and tamping along the faces of the forms to ensure a dense, smooth surface.

Vibrations shall be of sufficient duration to thoroughly compact the concrete but not long enough to cause segregation. Vibrators shall not be used for moving concrete.

31.3.9 Inspection

All exposed concrete surfaces shall be checked by the Contractor with a three meter (3m) straight-edge, and any water pockets or deviations in line or grade exceeding a total of six millimetres (6mm) shall be corrected immediately.

Differences in elevation at any given point from that given by the design shall not exceed thirteen millimetre (13mm), and the maximum variation shall not be greater than thirteen millimetre (13mm).

Deviations in horizontal alignment at any given point from that given by the design shall not exceed twenty five millimetre (25mm), and the fluctuations in the horizontal alignment shall not be greater than twenty five millimetre (25mm).

Concrete not meeting the above criteria shall be replaced.

31.3.10 Field Tests

Testing shall be performed by a qualified CSA testing laboratory in accordance with the following:

a) Samples of concrete shall be obtained in accordance with CSA Test Method A23.2-1C for sampling plastic concrete.

b) Test cylinders shall be made and stored in accordance with CSA Test Method A23.2-3C. No less than one (1) strength test shall be made from samples from each one hundred fifty cubic meters (150m³) of concrete placed, and in no case shall there be less than one (1) test from each day's pour. Each strength test shall consist of three (3) test cylinders, one (1) tested at seven (7) days and two (2) at twenty eight (28) days.

c) Air content determinations shall be made in accordance with CSA Test Method A23.2-7C, air content of plastic concrete by the volumetric method.

During construction start-up, every load or batch of concrete shall be tested until such time as satisfactory control of the air content has been established. Air content tests taken with the test cylinders will be sufficient once satisfactory control has been established. Whenever a test falls outside the specified limits, the testing frequency shall revert to one (1) test per load or batch until satisfactory control is re-established. Any concrete that falls outside specified air control levels shall be rejected from use.

Slump tests made in accordance with CSA Test Method A23.2-5C, Slump of Concrete, shall be made in conjunction with each strength test.

31.3.11 Clean up

As the work progresses, the Contractor shall clean up the site and all areas in which work has been done shall be left in a neat and presentable condition. All gutters and street drainage ditches that have been blocked as a result of the Contractor's operation shall be restored or repaired.

The Contractor shall dispose of all surplus excavated material, organic soil, rock, boulders and pieces of concrete and masonry at an approved location.

31.3.12 Protection

The Contractor shall be responsible for keeping all animals and pedestrians off the newly constructed sidewalks or curb until completely set. The Contractor shall also be responsible for keeping all vehicles off the work for a period of three (3) days after the concrete has been finished.

31.3.13 Deficiency Penalty

Where there are variations from specified design strength, the following Deficiency penalty shall be assessed based on the twenty eight (28) day, laboratory-cured cylinders.

a) When the concrete strength of any set exceeds ninety five percent (95%) of design strength, no deficiency penalty will be administered.

b) When the concrete strength of any set is greater than eighty percent (80%) but less than ninety five percent (95%) of design strength, the deficiency penalty will be administered as follows:

$$Q\left[P \times \frac{2\,(A - B)}{A}\right]$$

Where: P = unit price

A = specified strength

B = average 28 day cylinder strength

Q = quantity of deficient concrete

c) If the concrete strength of any set is less than eighty percent (80%) of design strength, the work represented by that set of cylinders will be rejected and replaced by the Contractor.

END OF SECTION

32 REGULATORY ROADWAY SIGNS

32.1 GENERAL

32.1.1 Design Requirements

Sign supports and appurtenances to be capable of withstanding summation of following loads:

a) Wind and ice loading specified to be consistent with anticipated loads in locality of installation. Refer to National Building Code of Canada and/or applicable provincial building code.

b) Dead load of signboards, sign supports and appurtenances.

c) Ice load on one face of signboards and around surface of all structural members and appurtenances.

Structural deflections and vibration in accordance with American Association of State Highway and Transportation Officials (AASHTO), “Specifications for the Design and Construction of Structural Supports for Highway Signs”.

32.1.2 Shop Drawings

Submit shop drawings for signage structures indicating product data and design.

32.2 PRODUCTS

32.2.1 Sign Supports

Steel posts: to CAN_G40.21, three point one meter (3.1m) long, flanged “U” shaped in cross section, measuring sixty five millimetre (65mm) wide by thirty millimetre (30mm) deep. Metal thickness: four point five millimetre (4.5mm). Hot dipped galvanized: to CAN/CSA_G164

Base plates for mounted signs: to ASTM B209M.

Fasteners: bolts, nuts, washers and other hardware for roadside signs to be cast aluminium alloy, or galvanized steel.

32.2.2 Signboards

Aluminium sheet shall be tension levelled, sign grade aluminium and conform to ASTM B209M, Alloys 6061-T6 or 5052-H38 pre-cut to required dimensions. Minimum thickness to be one point six millimetre (1.6mm) for signboards up to seven hundred fifty millimetre (750mm) wide. Minimum thickness to be two millimetre (2mm) for signboards seven hundred fifty millimetre to one thousand two hundred millimetre (750mm - 1200mm) wide.

Connecting straps and brackets to ASTM B209M.

Reflective sheeting shall meet or exceed the minimum requirements specified in ASTM-D4956 Performance Requirements Type III, High Intensity Retro Reflective Sheeting.

32.2.3 Fabrication

Signboards:

Aluminium blanks: Degrease, etch and bonderize with chemical conversion coating. Clean surfaces with xylene thinner. Dry. Aluminium signboards are to be painted before installation. Spray and bake face of signboards with two coats of enamel in accordance with CAN/CGSB_1.104.

Sign identification:

Apply sign number and date of installation with twenty five millimetre (25mm) high stencil painted black letters on lower left back face of each signboard.

32.3 EXECUTION

32.3.1 Installation

Sign Support:

a) Erect supports as indicated. Where separate concrete footings have been placed, erect posts with base plates resting on aluminium nuts and restrained with nuts and washers.

b) Coat underside of base plate with corrosion protective paint before installation.

c) Close open aluminium tubes and posts with aluminium cap.

d) Erect posts plumb and square to details as indicated.

e) Single channel steel posts are to be driven to required depth without damage to posts. If rock or concrete is encountered, auger hole to required depth and set post in sand.

f) In finished concrete or asphalt surfaces, backfill with concrete or grout. Protect from adverse conditions until cured.

g) Wooden post installations are to be excavated with an auger. Compact bottom of hole to provide firm foundation. Set post and backfill in one hundred fifty millimetre (150mm) layers with excavated material. Compact each layer before placing each subsequent layer.

h) Permissible tolerance is plus or minus twelve millimetre (±12mm) departure from vertical.

Signboard:

a) Fasten signboards to supporting posts and brackets as indicated.

b) Use strapping with crimped or bolted connections where signs fastened to utility poles.

32.3.2 Protection

Place temporary covering on signboards where required. Covering to be capable of withstanding rain, snow and wind and be non-injurious to signboard. Replace deteriorated covering and remove covers as reviewed by the County.

32.3.3 Correcting Defects

Correct defects, identified by the County, in consistency of reflectivity, colour or illumination.

END OF SECTION

33 ASPHALTIC CONCRETE PAVEMENT MILLING

33.1 GENERAL

This section specifies requirements for milling or grinding existing asphalt pavement to lines, grades, and typical cross sections indicated on plans or as established by the County.

33.1.1 Protection

Protect existing pavement, utility appurtenances, traffic detector loops, home runs, light units, and structures from damages. In event of damage immediately replace or make repairs to approval of the County and at no additional cost to the Owner.

33.2 EXECUTION

33.2.1 Preparation

Inspect site and verify with the County areas designated for milling.

Arrange for temporary traffic control in areas where signal light traffic detector loops and home runs are to be removed.

33.2.2 Equipment

Use cold milling or grinding equipment capable of removing part of asphalt pavement surface to depths or grades indicated with a tolerance of plus or minus ten millimetre (+/- 10mm) within areas designated.

Sweeping and collecting equipment capable of removing all residue from milling operations.

Apply water as necessary during milling operation to suppress dust.

33.2.3 Asphalt Removal

Mill asphalt pavement to grade and cross section dimensions indicated or as directed by the County.

Exercise care to avoid disturbance to pavement or other work designated to remain.

Keep drainage system clear of loose and waste materials.

Asphalt is to be removed to a uniform level including areas surrounding valves, manholes or other appurtenances.

Remove all residue materials resulting from milling operation.

Milling may be restricted on designated roads and streets with particular time frames throughout the week. The Contractor shall abide by these restrictions.

Surface to be left in a condition that can be reopened to traffic following removal of grindings.

33.2.4 Disposal of Materials

Removed pavement material is the property of the Owner and is to be stockpiled at a location designated by the County.

33.2.5 Finish Tolerances

Milled surfaces to be within plus or minus ten millimetres (+/- 10mm) of specified grade but not uniformly high or low.

END OF SECTION

34 ASPHALT PAVEMENT CRACK ROUTING AND SEALING

34.1 GENERAL

The Work Consists of routing, cleaning and drying cracks in pavement surfaces, supplying crack sealant material and sealing the routed cracks with the sealant.

34.2 MATERIAL

Hot poured rubberised asphalt products generally accepted for this work are Husky 1G11, CRAFCO 522, KOCH 9030 or Beram 195LM.

The use of other materials will be subject to the approval of the County. In situations where the Contractor obtains approval to use a material not included in the above list, he shall provide the County with the following information five (5) days prior to commencing the Work:

a) Name and mailing address of the crack sealant supplier and manufacturer

b) Name of crack sealant product to be supplied

c) Written confirmation from the manufacturer that the crack sealant to be supplied meets all specified requirements along with test results that demonstrate that the product meet all specified requirements.

The Contractor shall verify that the crack sealant delivered and used in the Work is the type and grade ordered.

34.3 PROCEDURE

No Work shall be performed during rain or snow or when the pavement surface is wet.

The crack sealant shall not be applied when the pavement temperature is below ten degrees Celsius (10°C).

Unless otherwise directed by the County, all cracks between two millimetres and twelve millimetres (2mm and 12mm) in width shall be routed and sealed. All cracks shall be routed to a minimum width of twenty millimetres (20mm) and a depth of ten millimetres (10mm).

Prior to the application of crack sealant, the entire road surface shall be cleaned ensuring all loose material and moisture is removed from the routed cracks and surrounding areas.

Crack sealant shall be heated and applied in accordance with the manufacturer's recommendations. Routed cracks shall be filled with crack sealant such that upon cooling the sealant shall not be more than three millimetres (3mm) below the pavement surface.

Excessive crack sealant shall be removed from the pavement surface immediately following application. Traffic shall be kept off sealed cracks until the crack sealant has cured. At locations such as intersections where this is not practical, the Contractor shall prevent tracking by applying a blotting agent to the crack sealant. When a blotting agent is used, it shall not be applied until the sealant has cooled sufficiently to prevent inclusion of the blotting agent into the sealant.

When necessary, the Contractor shall supply one (1) of the following blotting agents:

a) Screened sand with a maximum topsize of two millimetre (2mm)
b) Cement
c) Flyash

The use of other blotting agents shall be subject to the approval of the County.

Fuel, asphalt and any other spills shall be cleaned up to the satisfaction of the County at the Contractor's expense.

34.4 SAMPLING AND TESTING

The Contractor shall supply material samples to the County for QA (Audit) testing purposes when requested.

34.5 ACCEPTANCE CRITERIA

Evaluation of the Work will be based on a visual inspection by the County. To be acceptable, the Work must conform to the following:

a) All routed cracks conform with the specified rout profile
b) The rout conforms to the path of the crack with no part of the crack outside or touching the edge of the rout cross section
c) All routed cracks have been sealed
d) At least ninety five percent (95%) of the cracks treated have been filled with an adequate amount of crack sealant material.

Failure to comply with the acceptable criteria will result in the Contractor re-treating all failed cracks at his own expense.

END OF SECTION

35 ASPHALTIC PAVEMENT CRACK SEALING

35.1 GENERAL

The work consists of supplying crack sealant and sealing cracks in asphalt concrete pavement.

35.2 MATERIALS

The type and grade of asphalt/emulsified asphalt material generally accepted for this work are Alberta Transportation designated EC101 or HC200.

The use of other materials will be subject to the approval of the County. In situations where the Contractor obtains approval to use a material not included in the "Recognized Products List", he shall provide the County with the following information five (5) days prior to commencing the Work:

a) Name and mailing address of crack sealant supplier and manufacturer

b) Name of crack sealant product to be supplied

c) Written confirmation from the manufacturer that the crack sealant to be supplied meets all specified requirements along with test results that demonstrate that the product meets all specified requirements.

The Contractor shall verify that all crack sealant delivered and used in the Work is the type and grade ordered.

35.3 PROCEDURE

No Work shall be performed during rain or snow or when the pavement surface or cracks are wet.

Crack sealant shall not be applied when the atmospheric temperature at the work site is below ten degrees Celsius (10°C).

All cracks within the entire width of the pavement surface, which are between five millimetres and twenty five millimetres (5mm and 25mm) in width, shall be sealed.

Prior to the application of crack sealant, the Contractor shall ensure that the road surface adjacent to the cracks is clean.

Hot Pour crack sealant shall be heated to the temperature specified by the manufacturer. Overheating will not be permitted.

Crack sealant shall be applied within the manufacturer's specified temperature range. Crack sealant shall be applied so that the crack is flush filled immediately following application and a thin overband of sealant extends approximately twenty five millimetres (25mm) beyond the edges of the crack. Excess crack sealant shall be removed from the pavement surface immediately following application. Removal shall involve the use of a squeegee, starting from the centreline and proceeding to the shoulder.

Traffic shall be kept off sealed cracks until the crack sealant will not track under action of traffic. At locations such as intersections where this is not practical, the Contractor shall prevent tracking by applying a blotting agent to the crack sealant.

When necessary, the Contractor shall supply one (1) of the following blotting agents:

a) Screened sand with a maximum topsize of two millimetres (2mm)

b) Cement

c) Flyash

The use of other products shall be subject to the approval of the County.

Fuel, asphalt and other spills shall be cleaned up to the satisfactory of the County at the Contractor's expense.

35.4 SAMPLING AND TESTING

The Contractor shall supply material samples to the County for QA (Audit) testing purposes when requested.

35.5 ACCEPTANCE CRITERIA

Evaluation of the Work will be based on a visual inspection by the County. To be acceptable, all applicable cracks must be treated as specified herein and at least ninety five percent (95%) of the treated cracks must contain an adequate quantity of crack sealant material.

Failure to comply with the acceptable criteria will result in the Contractor re-treating all failed cracks at his own expense.

EC101
Specification for Cold Pour Rubber Filled Bituminous Emulsified Pavement Crack Sealant

Cold pour rubber filled bituminous emulsified pavement crack sealant shall conform to the requirements specified in the following table, for the grade designated by the County:

Asphalt Grade	EC-101		Test Method	
Requirements	**Minimum**	**Maximum**	**Alberta Transportation**	**A.S.T.M**
Uniformity	Pass		9.1	-
Viscosity @ 25^{0}C, Krebs units	70	90	9.2	D562
Solids Content by Evaporation, % by mass	59	-	9.3	D244
Ash Content, % by mass	-	2.0	9.4	-
Rate of Curing, %	-	-	9.5	-
24 hour	50	-	-	-
6 days	80	-	-	-
Low Temperature Flexibility	Pass		9.6	-
Elastic Recovery, %	40	-	9.7	-

HC200
Specifications for Hot Pour Bituminous Crack Sealant

Hot pour bituminous crack sealant shall conform to the requirements specified in the following table, for the grade designated by the County:

Asphalt Grade	HC200		A.S.T.M Test Method
Requirements	**Minimum**	**Maximum**	
Softening Point, ^{0}C	80	95	D36
Flash Point, C.O.C. , ^{0}C	230	-	D92
Penetration	-	-	D5
@ 0 ^{0}C, 200g, 60 sec.	30	-	-
@25 ^{0}C, 100g, 5 sec.	55	60	-
@46 ^{0}C, 50g, 5 sec.	-	150	-
Ductility @ 25 ^{0}C	45	-	D113
Solubility in Trichloroethylene, % by mass	98	-	D2042
Viscosity @ 177 ^{0}C, mm^2/s	-	1200	D2170

END OF SECTION