
**CITY OF WETASKIWIN
MUNICIPAL ENGINEERING STANDARDS
December 2018 (updated to December 5, 2018)**

Disclaimer:

These municipal engineering standards are subject to periodic update. The most current version of these standards will be posted to the City of Wetaskiwin's website at www.wetaskiwin.ca. Users of these standards for work in Wetaskiwin are required to download the latest version prior to proceeding with project design.

Contact:

For general inquiries or to suggest revisions to this document, please forward a completed copy of Appendix B – Standards Revision Request Form to:

In Person:

Wetaskiwin City Hall (Second Floor)
4705 – 50 Ave
Wetaskiwin, Alberta
8:30AM – 4:30PM

Mailing Address:

Box 6210
Wetaskiwin, AB
T9A 2E9

Phone: (780) 361-4400 (Main Switchboard)

Phone: (780) 361-4432 (Engineering Direct)

Fax: (780) 352-0101

E-Mail: engineering@wetaskiwin.ca

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SECTION 1.0

1.0 GENERAL

All development within the City of Wetaskiwin is to be designed and constructed in accordance with the Municipal Engineering Standards. It is intended for use by Developers, Engineering Consultants, Utility Companies and City Departments. These standards are provided to set out the “minimum” acceptable requirements to be satisfied in the planning, design, and construction of municipal infrastructure within the City of Wetaskiwin. 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 City of Wetaskiwin Land Use Bylaw. The distinction between private property and public property is irrelevant to the adherence to the Municipal Engineering Standards.

No variance from the Municipal Engineering Standards shall be permitted unless written approval of the City Engineer is obtained. A written request for variance to the Municipal Engineering Standards must be submitted to the City Engineer for review. A written request for variance will be reviewed during the winter months between active construction seasons. As such, a request received in the current calendar year will be considered for implementation into the following calendar year. Special considerations will be evaluated on a case by case basis. City of Wetaskiwin Inspectors will reject installations that do not adhere to the Municipal Engineering Standards.

The City of Wetaskiwin supports sustainable design as it seeks to reduce negative impacts on the environment, and the health and comfort of the community, thereby improving performance. The basic objectives of sustainability are to reduce consumption of non-renewable resources, minimize waste, and create healthy, productive environments.

Sustainable design principles include the ability to:

- Optimize site potential;
- Minimize non-renewable energy consumption;
- Use environmentally preferable products;
- Protect and conserve water;
- Enhance environmental quality; and
- Optimize operational and maintenance practices.

Utilizing a sustainable design philosophy encourages decisions at each phase of the design process that will reduce negative impacts on the environment and the health of the occupants, without compromising the bottom line. It is an integrated, holistic approach that encourages compromise and trade-offs. Such an integrated approach positively impacts all phases of a project’s life-cycle, including design, construction, operation and decommissioning. For guidelines on Low Impact Development please refer to City of Edmonton document Low Impact Development Best Management Practices Design Guide (Current Edition).

1.1 Definitions

- .1 “As-Built” means a document that reflects the installed, fabricated, constructed or commissioned condition of an item or project based on information provided by another party and not verified by the

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- professional member. As-Built drawings document how a project was actually constructed in the field and identify variances from the initial design. Upon completion of a project, a set of red line markup drawings shall be submitted to the City for review. This is step 1 of a two-step process. Upon completion of construction, a set of red line markup drawings shall be submitted reflecting how the development was actually constructed relative to the design.
- .2 “Change Authorization” means a written communication issued by a City Engineer authorizing a departure from these Standards in accordance with Article 1.7 of these Standards.
- .3 “City, Municipal, Municipality” shall refer to the City of Wetaskiwin.
- .4 “City Engineer” shall refer to the professional engineer, or designated representative, authorized by the City to authorize changes to these Standards.
- .5 “Consultant” shall mean the professional engineer responsible for the Design. Where applicable throughout these Standards, this term may refer to or include the Landscape Architect or the Developers designated representative.
- .6 “Contractor” shall mean the person, firm, or corporation that undertakes the installation of municipal infrastructure on behalf of the Developer or the City.
- .7 “Design” shall mean the designs, reports, studies, engineering drawings, technical specifications, and associated documents, including the execution and implementation of such, pertaining to a Development, Subdivision, or other municipal improvement within the City of Wetaskiwin.
- .8 “Developer” shall mean the person, firm, or corporation named within an Area Structure Plan or Development Agreement, whether as the owner or an agent for the owner of the land included therein.
- .9 “Development” shall mean the land area to be developed as defined by the Area Structure Plan of the Development Agreement.
- .10 “Engineering Drawings” shall mean the detailed engineering drawings and specifications prepared by the Consultant for a Subdivision that form part of a development agreement.
- .11 “Municipal Infrastructure” includes roads, utility works, landscaping, and other surface or underground improvements to be owned and/or operated by the City.
- .12 “On Street Construction Permit”(OSCP) is required for construction activity on City of Wetaskiwin property or within the road right-of-way. In addition, an OSCP is required for any construction activity adjacent to public property or service connection to public infrastructure. Fines will be enforced for construction occurring prior to permit approval.
- .13 “Prime Contractor” is as defined by the Occupational Health and Safety Act – Alberta.
- .14 “Record Drawing” means a professional document prepared by the professional member to record design changes to an initial design for which he or she has accepted responsibility and which represents the final design of the project. Typically issued or retained as verification that on-site conditions are in accordance with the final design. Once the City has reviewed and accepted the As-Built drawings, the Consultant must submit the Record Drawing package for project closure. Red line mark ups are to be converted to black text and the Record Drawings submission is to be reviewed and authenticated by the professional member. This is step 2 of a two-step process. Upon acceptance of the As-Built drawing, the City will require the submission of the finalized Record Drawing. A professional document prepared by the professional member to record design changes to an initial design for which he or she has accepted responsibility and which represents the final design of the project, retained as verification that on-site conditions are in accordance with the final design.
- .15 “Standards” refers to the latest version of these municipal engineering standards in their entire scope, as further defined in Article 1.3.

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- .16 “Subdivision” shall mean the particular subdivision stage of the development that is proposed for consideration as per the development agreement.

1.2 Objective

- .1 The objective of these Standards is to provide a clear guiding framework for designers and developers in the design of municipal infrastructure in the City of Wetaskiwin. These standards are intended to ensure that new municipal infrastructure is acceptable to the City with regard to overall quality, safety, environmental considerations, functionality, operation, maintenance requirements, and life cycle costs. The developer and consultant are responsible for ensuring that municipal infrastructure is designed and constructed to achieve the City’s objectives in this regard.

1.3 Scope

- .1 These Standards apply to the design and installation of all municipal infrastructure within the City of Wetaskiwin.
- .2 These Standards do not cover the design or installation of street lighting, ornamental lighting, power, gas, telephone and cable services, but does include coordination with the various utility companies. The general location of such services must be approved by the City. New development areas shall be designed with Light-Emitting Diode (LED) street lighting.
- .3 The Engineering Standard Drawings, as referred to in various sections, shall form an integral part of these Standards. Engineering Standard Drawings can be found in Appendix A of these Standards.
- .4 No variance from the Municipal Engineering Standards shall be permitted unless written approval of the City Engineer is obtained.

1.4 Interpretation

- .1 The City reserves the right to make the final decision regarding the interpretation of the intent of these Standards.
- .2 These Standards are not specifications and should not be treated as such.

1.5 Use of the Municipal Engineering Standards

- .1 These Standards define the *minimum* acceptable requirements to be satisfied in the planning, design, and construction of municipal infrastructure within the City of Wetaskiwin. More stringent planning, design, and/or construction criteria should be applied by the consultant as appropriate.
- .2 The City’s acceptance of the design covers only compliance of the design with respect to these Standards and is not a warranty of the design.
- .3 Notwithstanding the requirements of these Standards, the Developer and Consultant shall remain fully responsible for the Design.
- .4 Where a departure from these Standards might achieve a better design with regard to infrastructure quality, safety and environmental considerations, functionality, operation and maintenance requirements, or life cycle costs, the Consultant is encouraged to present a change proposal to the City in accordance with Article 1.7 of this section.

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- .5 If in the opinion of the City Engineer the weather is unsuitable the City reserves the right to suspend construction activity.

1.6 Revisions to the Municipal Engineering Standards

- .1 The City reserves the right to alter, revise, or update the Standards from time to time based on new or improved knowledge or innovations. Any such changes will be established following reasonable notice to designers and developers.

1.7 Proposed Changes and Items Not Covered

- .1 Where the Designer is inclined to use a Design which differs from these Standards or which is not covered by these Standards, the Designer may apply to the City to review the Design.
- .2 The City will review requests to revise these Standards, provided such requests are submitted using the Standards Revision Request Form attached in Appendix B-2. The revision request process is described in more detail on the second page of the form.
- .3 The City will review such change proposals on a case-by-case basis.
- .4 The Designer must provide a detailed proposal describing the Design to the City for review. The proposal must be prepared, signed, and sealed by a professional engineer, landscape architect, architect, or other industry professional, as applicable to the Design.
- .5 The proposal shall include sufficient detail regarding the proposed method or material to be used in the Design, including justification with respect to the impact on infrastructure quality, safety and environmental considerations, functionality, operation and maintenance requirements, and life cycle costs. The City may request additional information as required to make an informed decision regarding the proposed design.
- .6 No departure from these Standards shall be permitted except with written authorization of the City Engineer. A change authorization shall be issued recording any such revision.
- .7 A Change Authorization is only valid for the Development or Subdivision under consideration.
- .8 Notwithstanding review and acceptance of any such proposal by the City Engineer, the Developer and Consultant shall remain fully responsible for the Design.

1.8 Requirements by Other Authorities

- .1 It is the responsibility of the designer to ensure the design conforms to all applicable statutes, laws, bylaws, regulations, ordinances, orders, directives, permits, licenses and requirements of governmental or other public authorities having jurisdiction, and all amendments thereto.
- .2 Wherever the standards of other authorities are referred to in these Standards, the current edition of such standards shall apply.
- .3 Where two or more applicable standards govern the design, the more restrictive shall apply.

1.9 Area Structure Plan – Detailed Requirements

Section Under Review

1.10 Development Agreement Application Requirements

Section Under Review

1.11 Development Agreement Application Review Process

Section Under Review

1.12 Design Revisions After a Development Agreement is Issued

Section Under Review

1.13 Easements

- .1 The Developer shall be responsible for securing all the necessary easements to protect municipal infrastructure not located within a road right-of-way or utility lot.
- .2 All permanent easements shall be registered prior to application to the City for a construction completion certificate for municipal infrastructure. The Construction Completion Certificate shall not be issued until this is completed.

1.14 Crossing Agreements

- .1 Where a crossing of gas or oil pipelines, power transmission lines, or a railway is required by a Design, the Developer shall be responsible for securing and coordinating the crossing agreement with the necessary authorities.
- .2 The Developer shall be responsible to comply with all terms and conditions of the crossing agreement.
- .3 Prior to application to the City for a construction completion certificate for municipal infrastructure subject to a crossing agreement, the Developer shall apply to the City and the crossing agreement authority to have the crossing agreement transferred to the City's name. The construction completion certificate shall not be issued until all applicable crossing agreements are transferred to the City.

1.15 Control Markers and Legal Pins

- .1 Existing Control Markers
 - a) Every effort shall be made to protect existing markers.
 - b) The Developer shall be responsible for replacing any markers which are disturbed, destroyed, or missing, at the Developer's sole expense. Markers are to be replaced only by a licensed legal surveyor.
- .2 Alberta Survey Control Markers (ASCM)

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- a) The Developer shall provide additional markers as required for the Development.
 - b) All elevations related to the development must be geodetic and referenced in ASCM near the development area. Elevations for site survey calibrations and site survey control must be derived from or confirmed with an ASCM elevation.

.3 Legal Pins

- a) The Developer shall hire a licensed legal surveyor to install legal pins through the Development.
- b) Legal pins shall be installed prior to Construction Completion Certificate (CCC) inspection.
- c) The Developer shall be responsible for replacing any markers or legal pins which are disturbed, destroyed, or missing. Legal pins are to be replaced only by a licensed legal surveyor, at the Developer's sole expense. The City will not issue the Final Acceptance Certificate (FAC) until this is completed.

1.16 Construction

- .1 At discretion of the City Engineer, construction projects that include major ground disturbance including, but not limited to, demolition and piling require noise and vibration monitoring for the duration or as specified by the City Engineer. It is the responsibility of the Consulting Engineer to contract the services of a noise and vibration specialist on behalf of the Owner. To protect the public interest, noise and vibration monitoring is to be conducted at key locations based upon the proximity to adjacent properties, the findings of the geotechnical report and the sub-surface topography. Residential construction can be taken on a case by case basis, whereas properties with zero lot lines must have noise and vibration monitoring.

A copy of the noise and vibration monitoring results shall be made available to the City Engineer and to any adjacent property owner who requests the monitoring results.
- .2 A copy of all construction drawings, construction specifications, and applicable supporting documentation shall be maintained at the construction site during construction.
- .3 Underground utilities shall not be permitted to operate as part of their respective existing utility systems until such utilities have been inspected and tested by the Contractor under witness of the Consultant, and accepted by the City in writing. Only the City may operate existing utility systems.
- .4 Where required, the Consultant, or designated representative, shall be available at all times to visit the site during the installation of municipal infrastructure.
- .5 In addition to construction observation carried out by the Consultant, the City will periodically review the work. Should the City note any method or material being employed that is contrary to the accepted Design, the City shall bring such to the attention of the Consultant. If remedial action is not taken to the satisfaction of the City, the City will issue a stop work order in accordance with the Development Agreement.
- .6 It shall be the responsibility of the Developer and Consultant to ensure that the Contractor successfully completes all necessary testing, to the satisfaction of the City. The Consultant shall

provide the City with a written report acknowledging that all required testing has been successfully completed.

- .7 Where the work of the Contractor fails to meet the specifications of the accepted Design, the Developer and Consultant shall be responsible to ensure such work is rectified and retested accordingly.
- .8 Following construction completion, record drawings must be prepared and submitted to the City in accordance with Article 1.21 of these Standards.

1.17 Materials

- .1 Only new materials shall be used in the construction of municipal infrastructure.
- .2 Any materials which are defective in manufacture or which are damaged prior to installation and acceptance by the City shall be replaced by the Developer, at the Developer's sole expense.
- .3 Where specific materials are specified in these Municipal Engineering Standards, the City shall consider applications for substitute products which can be considered comparable in terms of these Municipal Engineering Standards. Written acceptance of such must be obtained from the City before any substitution can be made.

1.18 Operation and Maintenance Manuals

- .1 Six (6) copies of all applicable operation and maintenance manuals shall be provided to the City prior to application to the City for a construction completion certificate. The construction completion certificate shall not be issued until such documents are provided to the City.
- .2 Commissioning reports and/or video for various infrastructures shall be incorporated into the applicable operation and maintenance manuals.

1.19 Construction Completion Certificate

- .1 Prior to applying to the City for a Construction Completion Certificate (CCC) inspection, the Consultant shall fully inspect the work and ensure that the constructed infrastructure is complete, functional and fully commissioned in accordance with the accepted engineering drawings and these Municipal Engineering Standards.
- .2 A CCC Request must be submitted to the City, complete with all necessary supporting documentation.
- .3 CCC inspections may be requested at any time. At the discretion of the City of Wetaskiwin and weather permitting and site amenities can be inspected year round, provided snow cover, temperature, and other considerations do not prevent the ability to perform a thorough inspection. If an inspection occurs after October 15 of any year an additional 6 months of warranty is required.

1.20 Warranty

- .1 The warranty period shall be effective the date of the inspection which showed all deficiencies have been rectified and shall not expire until the City has issued the Final Acceptance Certificate.
- .2 The Developer shall be responsible to correct any defects or deficiencies in design, material, and/or installation that are noted during the warranty period.

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- .3 The following warranty periods shall apply to the specified infrastructure:
- a) Roads, sidewalks, trails, walkways, curbs, and gutters – 2 years.
 - b) Fill greater than 1 m depth – 5 years (in accordance with Development Agreement).
 - c) Underground services and utilities – 2 years.
 - d) Uniform fencing – 2 years.
 - e) Trees and shrubs – 2 years for private commercial, multi-family and institutional property. 2 years for all public property.
 - f) Seeding (95% Germination), Sod and Perennials – 2 years.
 - g) Entry Features – 2 years.
 - h) Minimum 2 years for all other municipal infrastructure not specified in the preceding.

If a CCC inspection occurs after October 15 of any year an additional 6 months of warranty is required, with the exception of e) and f) which is an additional year.

- .4 Trench Settlement During the Warranty Period
- a) During the Warranty Period, the Developer shall be responsible to replace materials and rectify all failures that occur as a result of settlement of trench backfill or collapse of trench walls.
 - b) Trenches in which backfill settles shall be refilled with the specified backfill material. Paved surfaces that are adjacent to trenches or on trench backfill, which fail during this period, shall be replaced or repaired in an acceptable manner.
 - c) Replacement of materials and rectification of failures that occur as a result of settlement of trench backfill or collapse of trench walls, are entirely the responsibility of the Contractor and such repair work shall be done at the Contractor's expense.
 - d) The Developer shall be responsible for extra road maintenance required as a result of trench settlement or disruption of surface drainage during the warranty period.

1.21 As-Built Drawings and Record Drawings

- .1 As-Built drawings shall include all the information specified in Section 2.0, updated to reflect how the project was actually constructed. All design information will be struck through and replaced with field verified construction data. This information will be shown in red text.
- .2 No later than six months before the Final Acceptance Certificate (FAC) deadline, submit one (1) full size printed set of the As-Built drawings to the City for review.
- .3 The cover sheet shall include the following information:
 - a) Date of construction completion;
 - b) Date on which the As-Built information was updated;
 - c) A table summarizing all underground utilities installed with information regarding pipe material, size, type, class, pressure rating, manufacturer, supplier, and applicable reference standard; and
 - d) A table summarizing the following information:

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- i) Name of the contractor for wastewater collection system infrastructure construction with construction start and completion dates;
 - ii) Name of the contractor for stormwater management system infrastructure construction with construction start and completion dates;
 - iii) Name of the contractor for water system infrastructure construction with construction start and completion dates;
 - iv) Name of the contractor for road infrastructure construction with construction start and completion dates;
 - v) Name of the contractor for sidewalk, curb, and gutter infrastructure construction with construction start and completion dates; and
 - vi) Name of the contractor for landscaping infrastructure construction with construction start and completion dates.
- .4 If not yet completed, plans shall identify property lots by their address number, as provided by the City.
- .5 Should the City, upon its review, note any errors, omissions, or discrepancies in the As-Built drawings, the drawings shall be returned to the Consultant with the City's comments. The Consultant shall correct the drawings and return to the City for review. This process shall be repeated until the City deems the As-Built drawings are acceptable. The time period for review by the City may be increased if excessive review cycles are required, and may impact the date of the Final Acceptance Certificate. The City may also assign drawing numbers and asset numbers upon the reviewed As-Built drawings for inclusion into the Record Drawing submission.
- .6 Upon written acceptance of the As-Built drawings by the City, the Consultant shall convert red line markups to black text and prepare project Record Drawings. After verification by the professional member, the Consultant shall provide one (1) copy of the Record Drawings in AutoCAD-format electronic files, compatible with the City's mapping system, and one (1) set of signed PDF files.
- .7 The FAC will not be issued by the City until all applicable Record Drawings have been reviewed and accepted by the City.
- .8 For development permit projects upon private property, As-Built drawings can be provided in lieu of a Record Drawing submission.
- A professional land surveyor must be retained to conduct a topographic survey of the completed project in order to document:
- a) Full site surface elevations.
 - b) Building outline.
 - c) Finished Floor Elevation of the Building.
 - d) Elevations at each corner of the building.
 - e) Rim & invert elevations for the sanitary system.
 - f) Rim & invert elevations for the storm system.
 - g) Valves and hydrants for the water system.

The professional land survey shall deliver to the City a PDF file of a representative site drawing with the topographic survey information superimposed. AutoCAD files are not required for Development Permit projects upon private property.

1.22 Final Acceptance Certificate

- .1 Prior to applying to the City for a Final Acceptance Certificate (FAC), the Consultant shall fully inspect the work and ensure that the constructed infrastructure is free of defects or deficiencies in design, material, and/or installation.
- .2 Submit a FAC Request, complete with all necessary supporting documentation.

1.23 Infill and Redevelopment Projects

- .1 Applications for a development agreement and/or development permits for infill and redevelopment projects must be accompanied by a design report, lot grading plan, and overall utility plan.
 - a) Design Report
 - i) Four (4) copies of the report must be provided for the City's review.
 - ii) The report should define the methodology utilized by the Designer, clearly demonstrate conformance of the Design with these Standards, and contain all pertinent information regarding the Design.
 - iii) The report shall be signed and sealed by a professional engineer, licensed to practice in the Province of Alberta.
 - iv) The information provided in the report shall follow that prescribed in Article 1.10.1, as applicable to the nature of the proposed development.
 - b) Lot Grading Plan
 - i) The lot grading plan shall follow the requirements of Article 2.2.8.
 - c) Overall Utility Plan
 - i) The overall utility plan shall follow the requirements of Article 2.2.9.
 - ii) The plan shall include a note stating "No groundwater or storm water shall be discharged to the wastewater collection system."
 - d) Landscaping Plan
 - i) The landscaping plan shall follow the requirements of Article 2.2.11.
 - e) Erosion and Sediment Control Plan
 - i) Provide and adhere to an Erosion and Sediment Control Plan in accordance with Article 1.10.2.
- .2 Each infill and redevelopment site will be unique in its utility servicing requirements. As such, the City may request additional details regarding the design in order to ascertain its acceptability.
- .3 The development permit and/or building permit will not be issued until the Construction Completion Certificate, (CCC), is issued by the City.

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- .4 Construction activities shall follow the applicable requirements provided in Articles 1.16 and 1.17.
 - .5 Record drawings must be provided to the City once the project is complete.

1.24 Abandoning Services

- .1 Where an existing water or sewer service connection must be abandoned, the service connection shall be abandoned at the main, to the satisfaction of the City.

1.25 Tie-Ins to Existing Service Connection Stubs

- .1 Prior to connection to an existing service connection stub, the stub shall be exposed and the City contacted to inspect the stub.
- .2 In the event that the City determines the existing stub to be insufficient or unsuitable to accommodate the new connection, the Developer shall replace the stub with a new service from the main to the property line, at the Developer's sole expense.
- .3 An On Street Construction Permit (OSCP) must be obtained and approved prior to any construction activity occurring on the site, private property or public property.



Municipal Engineering Standards

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SECTION 2.0**2.0 DRAWING STANDARDS**

The following standards apply to detailed design drawings submitted to the City for review as part of the Development Agreement application process (refer to Article 1.10), and to the as-built and record drawings for the completed Subdivision (refer to Article 1.21).

2.1 General

- .1 Detailed design drawings shall provide a complete description of the existing and proposed infrastructure, provide sufficient information to construct the proposed infrastructure, and indicate any provisions for future extension of utilities and systems.
- .2 All drawings shall include the following:
 - a) A suitable title which identifies the project;
 - b) Drawing scale;
 - c) North direction indicator;
 - d) Date of issue; and
- .3 Where appropriate:
 - a) Adjacent lots and plan numbers
 - b) Street names
 - c) Legal description of the parcel; and
- .4 The title block must indicate the following information:
 - a) Developer's name;
 - b) Consultant's name;
 - c) Subdivision name and stage number;
 - d) Drawing name;
 - e) Drawing number;
 - f) Revision number;
 - g) Drawing scales (horizontal and vertical);
 - h) Table listing the name, signature, and signature date for the designer, drafter, checker, and approver;
 - i) Table listing the revision number, date, description, designer, and approver for all drawing revisions;
 - j) Table listing the dates for each of the various issues (i.e. preliminary, tender, construction, record drawing) of the drawing with the initials and date of the approver corresponding to each issue;

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- k) Professional stamps and permits, as applicable; and
 - l) A 10 cm wide by 1.5 cm tall space in the lower right hand corner of the drawing for the City's drawing number.
- .5 Dimensions and measurements shall be in metric units.
 - .6 All elevations shall be referenced to geodetic datum.
 - .7 Lettering must clearly legible, 2 mm size or larger.
 - .8 Drawings shall be standard A-1 size (594 mm by 841 mm).
 - .9 Where drawing submissions to the City are required, in addition to the specified number of hardcopies, also provide the City with one (1) copy of the applicable drawings in AutoCAD-format *and* Portable Document Format (.pdf) electronic files.

2.2 Required Drawings

The following drawings are required and shall include the information specified:

- .1 Cover Sheet
 - a) The cover sheet shall identify the subdivision name and stage number and/or development name, Developer's name, Consultant's name, and the City of Wetaskiwin.
 - b) A key plan of the City of Wetaskiwin will be included and will clearly indicate the location of the overall development and identify the location of the subdivision stage.
- .2 Legend and Abbreviations Sheet
 - a) This drawing shall indicate and define all symbols and abbreviations used in the drawings. Alternatively, the City may authorize use of legends on individual drawings, as required.
- .3 Index Plan
 - a) This plan drawing shall delineate the coverage of each plan/profile drawing covering the Subdivision for the drawing set.
- .4 Legal Plan
 - a) This plan drawing shall illustrate all legal and easement information for the site.
 - b) The plan shall indicate the proposed land uses for the site.
- .5 Road and Walkway Overall Plan
 - a) This plan drawing shall illustrate the location of all road right-of-ways, lanes, boulevards, sidewalks, trails, walkways, and emergency access.
 - b) Identify light duty and heavy duty pavement including but not limited to asphalt or concrete areas.
 - c) Provide cross-sections.
 - d) Identification of road right-of-way names or temporary designations.
 - e) Alignments of adjacent roads, lanes, boulevards, and walkways including identification by names or designations.

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- f) Horizontal and vertical alignments and locations of existing and proposed surface infrastructure including roads, curb, gutter, sidewalk, sidewalk connectors, paraplegic ramps, and bus stop pads.
 - g) Signage plan identifying street names, regulatory signs, transit pad location signs, details, sign placement, and any required temporary or permanent thermoplastic lane markings.
 - h) The location of potential future extensions shall be identified.
- .6 Stormwater Drainage Basin Overall Plan
- a) This plan shall illustrate the stormwater drainage basin within which the overall development, defined by the Area Structure Plan, is located.
 - b) The limits of the drainage basin shall be clearly delineated.
 - c) The location and identification of the Subdivision shall be indicated.
 - d) The alignment of any existing or proposed trunk storm mains within the drainage basin shall be shown, along with their respective pipe diameters, catch basins and manholes.
 - e) Storm water catchment areas shall be delineated within the Subdivision and labeled in hectares.
 - f) Storm water design calculation charts must also be included.
 - g) Existing and proposed storm water management facilities, ponding areas, and overflow areas within the drainage basin shall be located and identified.
 - h) Major drainage routes through the drainage basin, along with any receiving drainage courses, shall be illustrated and identified. The plan shall indicate the anticipated flow depths and velocities for all major drainage routes resulting from a 1:100 year rainfall event plus 20%, and identify any ponding areas and overflow areas.
 - i) Where major system flows shall discharge or overflow into watercourse, ravine, or environmental reserve, the rate and projected frequency of the flows shall be noted on the plan.
- .7 Wastewater Drainage Basin Overall Plan
- a) This plan shall illustrate the wastewater drainage basin within which the overall development, defined by the Area Structure Plan, is located.
 - b) The limits of the drainage basin shall be clearly delineated.
 - c) The location and identification of the Subdivision shall be indicated.
 - d) The alignment of any existing or proposed trunk sewer mains within the drainage basin shall be shown, along with their respective pipe diameters, direction of sewer main flows and locations of appurtenances.
 - e) Wastewater catchment areas shall be delineated within the Subdivision and labeled in hectares.
 - f) Sanitary design calculation charts must also be included.
- .8 Lot Grading Overall Plan
- a) The plan shall include, at a minimum;

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- i) The existing surface contours starting at 10metres outside the development boundary and throughout the site;
 - ii) The proposed lot perimeter elevations in relation to current existing ground elevations.
 - iii) Clear demonstration that the lot grading design contains surface drainage within the bounds of the property.
 - Single family residential lots shall convey site drainage to public property without adversely affecting adjacent property.
 - Multi-family and commercial lots shall collect all site drainage into an on-site stormwater management system. The major overland flow from this on-site system shall be directed to public property, not adjacent property.
 - iv) The proposed finished grades;
 - v) The anticipated/proposed building main floor elevation;
 - vi) Drainage basin boundaries, storage areas, ponding depths, overflow locations; and
 - vii) The proposed curb line grades.
 - b) Provide existing spot elevations along development boundaries at 10m intervals. These boundary elevations are to be maintained as part of the overall grading design plan.
 - c) This plan shall indicate the proposed finished surface elevations at lot corners, the proposed direction of flow of surface drainage on each lot.
 - d) The plan shall indicate the proposed finished grades of roadways and other surfaces within the Subdivision with arrows indicating direction of overland flow.
 - e) The location of any geodetic benchmarks to be used in the construction of the project shall be identified.
 - f) Existing and proposed surface contours shown at 0.5 m intervals.
 - g) The geotechnical report should be referenced for builders to consult in the design/construction of building foundations, weeping tiles, and foundation drain discharge systems.
 - h) Notes should be included which indicate to builders the requirements with respect to roof leader discharges and foundation drainage, cross-referenced to the applicable detail for stormwater discharge piping. The plan shall indicate the intentions for the roof top drainage conveyance and downspout location design.
 - i) The plan shall include typical three-dimensional details of the various lot grading types with a depiction of the house, required slopes around the house, and lot grades. Each lot on the plan shall be labeled to identify the applicable detail corresponding to the proposed lot grading type for that lot.
 - j) Lots requiring greater than 1.0 m of fill to meet the proposed grades should be clearly indicated on the plan.
 - k) Where the use of swales has been accepted by the City, the plan shall indicate the locations, easement requirements, slopes, cross-sections, and construction details for the

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swales. Additional spot grades shall be provided at the boundary of the easement, at the midpoint of the swale, and at the property line.

- l) The plan must clearly convey any potential problems or restrictions with respect to building design and lot grading. Building foundation elevation restrictions for lots adjacent to a stormwater management facility is one example of this.
- m) Any easements or restrictive covenants related to the stormwater management system must be shown and identified on the plan.
- n) Where more than one sheet is required for the lot grading plan, each sheet shall include the typical details and notes which apply.
- o) For rear lot and concrete swales the channel capacity analysis is required to verify the conveyance of a 1:100, plus 20%, year storm event from the contributing area.

.9 Water System, Wastewater Collection System, and Stormwater Management System Infrastructure Overall Plan

- a) Site servicing designs that propose utility servicing underneath buildings will not be accepted. The onus is on the design engineer to prove that all other design alternatives are not possible.
- b) With respect to the water system, this plan shall include the following:
 - i) Alignment, diameter, and material of all water mains;
 - ii) Location of all valves, hydrants, and other appurtenances;
 - iii) Location of potential future extensions; and
 - iv) Identification of all bacteria sampling locations.
- c) With respect to the wastewater collection system, this plan shall include the following:
 - i) Alignment, diameter, grade, pipe material, and direction of flow of all sewer mains;
 - ii) Location of all manholes and other appurtenances;
 - iii) Delineation, identification, and area of all local drainage areas contributing drainage to the proposed wastewater collection system; and
 - iv) Location of potential future extensions.
- d) Tables summarizing design calculations for the wastewater collection system in residential areas shall list the following information for each sewer main:
 - i) Sewer main identification number;
 - ii) Upstream and downstream manhole identification numbers;
 - iii) Upstream and downstream manhole rim and invert elevations;
 - iv) Incremental number of lots directly served by sewer main;
 - v) Cumulative number of lots served by sewer main (i.e. upstream number of lots served plus incremental number of lots);

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- vi) Population density per lot (capita/lot);
- vii) Incremental population directly served by sewer main;
- viii) Cumulative population served by sewer main (i.e. upstream population served plus incremental population);
- ix) Peaking factor;
- x) Design domestic flow rate (m³/s);
- xi) Incremental area directly served by sewer main (ha);
- xii) Cumulative area served by sewer main (i.e. upstream sewer main area plus incremental drainage area, in ha);
- xiii) Inflow rate (m³/s);
- xiv) Infiltration rate (m³/s);
- xv) Design flow rate (m³/s);
- xvi) Pipe size (mm);
- xvii) Pipe grade (%);
- xviii) Pipe length (m);
- xix) Pipe capacity (m³/s); and
- xx) Flow velocity (m/s).

Separate tables should be provided to describe interim and ultimate conditions where staging of the development will occur and impose distinct conditions on the proposed wastewater collection system.

- e) With respect to the stormwater management system, this plan shall include the following:
 - i) Alignment, diameter, grade, pipe material, and direction of flow of all sewer mains;
 - ii) Location of all manholes, catch basins, and other appurtenances;
 - iii) Alignment, diameter, and direction of flow of all foundation drain discharge collection sewers with the location of cleanouts;
 - iv) Delineation, identification, and area of all local drainage areas contributing drainage to the proposed stormwater management system;
 - v) Location of all stormwater management facilities including all applicable information regarding normal water levels, high water levels, storage volumes, freeboards, pond bottom elevations, side slopes, contributing basin size inlet and outlet elevations and locations, overflow elevations and locations;
 - vi) Location of potential future extensions;
 - vii) Notation indicating the lowest allowable building opening elevation for lots adjacent to stormwater management facilities; and
 - viii) Stage-volume and stage-area curves for all stormwater management facilities.

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- f) Tables summarizing design calculations for the stormwater management system shall list the following information for each sewer main:
- i) Sewer main identification number;
 - ii) Upstream and downstream manhole identification numbers;
 - iii) Upstream and downstream manhole rim and invert elevations;
 - iv) Incremental drainage area directly served by sewer main (ha);
 - v) Cumulative drainage area served by sewer main (i.e. upstream sewer main drainage area plus incremental drainage area, in ha);
 - vi) Runoff coefficient, C, for drainage area directly served by sewer main;
 - vii) Incremental drainage area multiplied by the runoff coefficient for drainage area directly served by sewer main;
 - viii) Cumulative total of runoff coefficient multiplied by drainage area (i.e. upstream sewer main calculation plus incremental calculation);
 - ix) Inlet time (min);
 - x) Travel time (min);
 - xi) Rainfall intensity (mm/hr);
 - xii) Calculated design flow (m³/s);
 - xiii) Pipe size (mm);
 - xiv) Pipe grade (%);
 - xv) Pipe length (m);
 - xvi) Pipe capacity (m³/s); and
 - xvii) Flow velocity (m/s).
- Separate tables should be provided to describe interim and ultimate conditions where staging of the development will occur and impose distinct conditions on the proposed stormwater management system.
- g) Tables summarizing design calculations for the stormwater management system shall list the following information for each catch basin and lead:
- i) Catch basin identification number;
 - ii) Street name;
 - iii) Frame type;
 - iv) Depth of flow (mm);
 - v) Lead diameter (mm);
 - vi) Lead slope (%);
 - vii) Design flow rate (m³/s);
 - viii) Catch basin capacity (m³/s); and

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- ix) Lead capacity (m³/s).
- .10 Power, Gas, Telephone, and Cable Television Plan
- a) This plan shall indicate the alignments for power, gas, telephone, and cable television lines.
 - b) The location of any surface features related to these utilities (i.e. light standards, transformers, boxes, etc.) must be clearly identified.
 - c) The plan must include street names and house numbers where applicable.
 - d) The location of any surface features which may conflict with the arrangement of these utilities (i.e. driveways, hydrants, curb valves, manholes, catch basins, street furniture, etc.) must be illustrated.
 - e) Applicable utility company approvals must be shown on the plan or otherwise accompany the drawing submission.
- .11 Landscaping Plans
- a) Landscaping plans shall include the following:
 - i) Location of any commercial, institutional and multi-family within the Subdivision;
 - ii) Locations of driveways;
 - iii) Location of street furniture;
 - iv) Location of underground structures;
 - v) Location of driveways;
 - vi) Location of curbs and boulevards;
 - vii) Location of public sidewalks;
 - viii) Location of private approaches;
 - ix) Location of parking areas;
 - x) Location of proposed retaining walls;
 - xi) Proposed location of boulevard trees;
 - xii) Planting schedules, including botanical and common name of all proposed plant material, total quantity of each plant on public and private property, height and/or spread of each shrub or perennial at the time of installation, minimum caliper size of each tree at the time of installation;
 - xiii) Notes regarding root ball type and size, tree branching heights for boulevard trees, special conditions, or unique installation criteria;
 - xiv) Identification of existing vegetation, trees and/or other natural features to remain in place;
 - xv) Outline of planting beds and tree wells, including the type and depth of mulch;
 - xvi) Location of anticipated irrigation systems;
 - xvii) Details of hard and soft landscape installations;

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- xviii) Identification of existing plant material that will be retained;
 - xix) Identification of existing trees to be relocated;
 - xx) Identification of areas to be sodded and seeded, with the applicable seed mix specified;
 - xxi) Proposed mowed and non-mowed areas;
 - xxii) Location of proposed site amenities and fencing, with construction details and elevations;
 - xxiii) Location of trails with details, signage, and proposed drainage;
 - xxiv) Total measurements (in m2) of shrub beds, flower beds, islands, buffers, PULs, MRs, ERs, SWMFs, and parks;
 - xxv) Total measurements (in m2) of proposed seeded and sodded areas, and existing vegetation;
 - xxvi) Provide a breakdown of private and public landscaping; and
 - xxvii) Any other details that may relate to the final landscape design.
- b) The plan shall identify the following areas:
- i) Preservation Areas (ER);
 - ii) Preservation areas are portions of parks, which are to remain in the natural condition;
 - iii) Naturalization Zones;
 - iv) Naturalization zones are portions of parks, which are proposed for reclamation to as natural a state as possible. They include manicured areas and/or disturbed or partially disturbed natural areas;
 - v) Manicured Zones;
 - vi) Manicured areas are portions of parks that have defined ‘special use areas’. They imply some development as identified in the minimum standards and maintenance that is relatively intense compared to preservation and naturalization areas. Manicured areas include areas where larger numbers of park users are anticipated; i.e. sports fields, playgrounds, community uses; and
 - vii) Existing Environmentally Sensitive Areas, Historical Areas, Wetlands, Vacant Farmsteads, existing water bodies and wildlife corridor.
- c) This plan shall indicate the location of all street furniture including, but not necessarily limited to, signage (including identification of type), hydrants, bollards, light standards, power transformers, telephone boxes, cable boxes, mail boxes, bus shelters, benches, garbage cans, manhole covers, valve covers, playgrounds, trails, trees, retaining walls, and fencing.
- d) The plan shall include proposed elevations to the bottom rail of all developer fencing.

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- e) The plan shall indicate the permitted driveway locations for each lot. A standard detail drawing shall be included that illustrates the allowable offset from the adjacent property line.
- f) The plan should also illustrate sight triangles for all intersections.
- g) This plan shall be in accordance with the setbacks specified in these Municipal Engineering Standards.
- h) The landscaping plan shall be prepared, signed, and sealed by a landscape architect licensed to practice in the Province of Alberta by the Alberta Association of Landscape Architects.
- i) For small lots as approved by the City Engineer, Landscape Templates can be adopted in place of a stamped drawing by a landscape architect.

.12 Plan and Profile Drawings

Plan and profile drawings shall meet the following requirements:

- a) General
 - i) Plan and profile drawings shall be drawn to a scale of 1:500 horizontal and 1:50 vertical;
 - ii) There must be a clear delineation between proposed and existing features; and
 - iii) The drawings must show the location and identification of existing and proposed survey markers in the area.
- b) Road Right-of-Way Information

The following information must be included on the plan portion of the drawing:

 - i) Legal subdivision information including block and lot numbering;
 - ii) Alignment of proposed road right-of-way or easement including name or temporary designation;
 - iii) Alignments of adjacent roads, walks, lanes, interim connections, utility rights-of-way, easements, and reserves including identification by name or ownership;
 - iv) Existing and proposed surface infrastructure including curb, gutter, sidewalk, sidewalk connectors, trails, paraplegic ramps, bus stop pads, and boulevard area;
 - v) Dimension of right of way width measured relative to adjacent property lines;
 - vi) Dimensioned measurements of curb, gutter, sidewalk, and boulevard locations;
 - vii) Horizontal curve data for the centreline of each roadway including chainages of the beginning-of-curve (BC), end-of-curve (EC), delta angle, radius, chord length, and arc length. The radius of curb returns must be indicated. This information may be listed in table-format;
 - viii) Elevations, along the curb and gutter, of all changes in vertical alignment; and
 - ix) Elevations of the BC and EC for all curb returns including the grades and chainage around the curve.

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The following information must be included on the profile portion of the drawing:

- x) Existing ground profile along the centreline of the proposed roadway or utility;
- xi) Proposed lip of gutter profile with grade expressed in percentage, accurate to two decimal places;
- xii) Vertical curve data including chainages and elevations for beginning-of-vertical-curve (BVC), end-of-vertical-curve (EVC), point-of-vertical-intersection (PVI), external value (e), length of curve, elevation and chainage of the low point of sag curves and high point of crest curves, and rate of gradient change (k value); and
- xiii) Lip of gutter grade at all intersecting proposed and existing roads.

c) Water System Information

The following information must be included on the plan portion of the drawing:

- i) Horizontal alignment of proposed water mains with dimensioned measurements locating each from adjacent property lines;
- ii) Diameter of water mains;
- iii) Location of all related appurtenances including hydrants, tees, bends, crosses, valves (use different symbols for gate valves and butterfly valves), blow offs, and plugs; and
- iv) Location of all service connections and curb valves, with dimensioned measurements locating each individual service lateral from the property lot corner along with the service pipe invert elevation at the property line.

The following information must be included on the profile portion of the drawing:

- v) Vertical alignment of proposed water mains within the profile alignment;
- vi) Elevation, diameter, and utility type of existing and proposed utilities which cross or intersect the profile;
- vii) Top-of-pipe elevation at all tees, bends, crosses, plugs, and grade changes;
- viii) Pipe diameter, pipe type, pipe class, and bedding class;
- ix) Description of tie-in points of the proposed system to the existing system; and
- x) Identification of areas requiring special construction methods such as trenchless installation methods, shored construction, casings, or limited working space areas.

d) Wastewater Collection System and Stormwater Management System Information

The following information must be included on the plan portion of the drawing:

- i) Horizontal alignment of proposed sewer mains, with dimensioned measurements locating each from adjacent property lines;
- ii) Diameter and direction of flow of sewer mains;
- iii) Location of all related appurtenances including manholes, catch basins (including frame and cover type, elevation at gutter), plugs, cleanouts, inlet structures, and outlet structures;

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- iv) Sequential identification numbering of all mains, manholes, and catch basins. The City shall provide revised identification numbers for updating the record drawings;
 - v) Horizontal alignment, diameter, grade (in percentage, accurate to two decimal places), pipe type, pipe class, and length of all catch basin leads. Much of this information may be listed in table-format;
 - vi) Radii of curved sewers; and
 - vii) Location of all service connections with dimensioned measurements locating each individual service lateral from the property lot corner along with the service pipe invert elevation at the property line.

The following information must be included on the profile portion of the drawing:

- viii) Vertical alignment of proposed sewer mains and foundation drain discharge collection sewers within the profile alignment;
- ix) Elevation, diameter, and utility type of existing and proposed utilities which cross or intersect the profile;
- x) Diameter, grade (in percentage, accurate to two decimal places), pipe type, pipe class, bedding class, and length of sewer mains between each manhole;
- xi) Invert elevation of all pipes at each manhole;
- xii) Rim elevation at each manhole;
- xiii) Calculated design flow rate, design flow velocity, and total flow capacity for each section of sewer main. This information may be listed in table-format;
- xiv) Description of tie-in points of the proposed system to the existing system;
- xv) Identification of areas requiring special construction methods such as trenchless installation methods, shored construction, casings, or limited working space areas;
- xvi) Chainage of BC and EC, radii, and curve length for curved sewers;
- xvii) Identification of any unique manhole features including drop structures and safety platforms; and
- xviii) Locations of riser connections to the sewer mains.

.13 Detail Drawings

- a) Standard details and typical cross-sections must be included in the engineering drawings for each project.
- b) Standard details and typical cross-section shall be in accordance with the Engineering Standard Drawings, attached in Appendix A these Municipal Engineering Standards.
- c) Details and cross-sections shall be drawn to a scale that clearly portrays the required information with clarity and legibility.

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SECTION 3.0**3.0 ROADWAYS****PART I – DESIGN****3.1 General**

- .1 Within the Area Structure Plan process, all roadway, walkway, and utility corridor requirements will be established through cooperation between the Developer and the City's Engineering and Development Departments.
- .2 Roadway design shall conform to the requirements of the *Geometric Design Guide for Canadian Roads*, Transportation Association of Canada (TAC), latest edition. Other references for roadway design include TAC's *Metric Curve Tables* and *Design Vehicle Dimensions for Use in Geometric Design*, latest editions.
- .3 Design of traffic calming measures for roadways shall be in accordance with TAC's *Canadian Guide to Neighbourhood Traffic Calming*, latest edition. Traffic calming measures include vertical changes in the road (speed humps, speed bumps, speed tables, raised intersections), lateral changes in the road (chicanes, offset intersections, lateral shifts), constrictions (narrowing, pinch points, islands, parking), entrance features (gates, signs, surface treatments), and other measures intended to alter driver behaviour, improve conditions for non-motorized road users, and improve the quality of life for residents on traffic calmed streets.

3.2 Definitions

- .1 Asphalt Concrete Base (ACB): Base course for arterial, commercial roadways, collectors and locals.
- .2 Asphalt Concrete Overlay (ACO): Surface paving for arterials, commercial roadways, and collectors.
- .3 Asphalt Concrete Residential (ACR): Surface paving for residential roads.

3.3 Road Classification

- .1 Classification and designation shall be in accordance with TAC's *Geometric Design Guide for Canadian Roads*.
- .2 Roadways and walkways shall be classified during the subdivision planning stage.
- .3 Table 3.1 lists the required road cross-section and maximum operating speed for each road classification along with reference to the applicable Standard Drawing in Appendix A.

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Table 3.1 – Road Cross-Section and Maximum Operating by Classification

Road Classification	Roadway Curb-to-Curb Width (m)	Right-of-Way Width (m)
<i>Residential Roads:</i>		
Local	9.0	20.0
Cul-de-sac	9.0	20.0
Minor Collector	11.0	22.0
Major Collector	12.0	23.0
<i>Commercial Roads:</i>		
Minor Collector	11.0	22.0
Major Collector	12.0	23.0
<i>Arterial Roads:</i>		
Undivided	15.0	37.0
Divided	8.0 x 2	45.0

3.4 Roadway Geometric Design

.1 Vertical Geometrics

a) Grade

- i) Maximum grade shall be 6.0%. As per Table 2.1.3.1 in the *TAC Geometric Design Guide for Canadian Roads*, latest edition.
- ii) Minimum grade shall be 0.6% along gutters and 1.0% around curb returns and cul-de-sac bulbs. As per Table 2.1.3.1 in the *TAC Geometric Design Guide for Canadian Roads*, latest edition.
- iii) For roadways connecting to an intersection, maximum grade shall be 2% over 30 m from the curb return.
- iv) All roadways shall be crowned or shall have a cross fall for positive drainage. Refer to the applicable Engineering Standard Drawings in Appendix A.

b) Vertical Alignment

- i) Vertical curves shall meet the requirements in Table 3.2.

Table 3.2 – Vertical Curve Design Criteria (From Table 2.1.3.2 of TAC latest edition)

Design Operating Speed km/h	K-Value ¹	
	Crest K-Value	Sag K-Value
50	7	6
60	13	9
70	23	12

¹ $K = L/A$, where L equals length of vertical curve in metres and A equals algebraic difference in grade percentage.

- ii) The minimum length of a vertical curve shall be 50 m on local roads, 50 m on collector roads, 60 m on undivided arterial roads, and 70 m on divided arterial roads.

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- iii) Vertical curves are not required where the algebraic difference in grade is less than 1.5%.
- iv) For inverted vertical curves, a minimum grade of 0.5% shall be maintained along the gutter line.
- v) The City may stipulate additional requirements where collector or arterial roads require super elevation.

.2 Horizontal Alignment

- a) Roadway alignment shall be centered within the right-of-way.
- b) Straight or near-straight residential roadways shall have a maximum unimpeded length of 200 m, unless traffic calming measures are provided.
- c) Horizontal curves shall meet the requirements in Table 3.3.

Table 3.3 – Horizontal Curve Design Criteria (Table 2.1.2.3 from TAC latest edition)

Road Classification	Minimum Curve Radius (m)	Maximum Grade (%)	Minimum Tangent Length (m)	Minimum Intersection Spacing (m)
<i>Residential Roads:</i>				
Local	100	6	30	60
Cul-de-sac	100	6	30	60
Minor Collector	100	6	60	60
Major Collector	150	6	60	60
<i>Commercial Roads:</i>				
Minor Collector	100	6	60	60
Major Collector	150	6	60	60
<i>Arterial Roads:</i>				
Undivided	450	5	60	400
Divided	450	5	60	400

3.5 Intersections

- .1 The angle of intersection of two roadways is as follows: Ideal = 90 degrees; Minimum = 70 degrees; Maximum = 110 degrees.
- .2 Intersection design must incorporate good design practice with respect to sight distances and other safety considerations according to TAC guidelines.
- .3 Refer to Table 3.3. Intersections for local and collector roadways shall be spaced at least 60 m apart, as measured along the road centreline. The City shall review the appropriate location of intersections for arterial roadways.
- .4 Intersection spacing different from Table 3.3 shall be subject to the review and acceptance of the City.
- .5 Where the projected traffic volume on arterial roadways necessitates the provision of acceleration/deceleration turning lanes at an intersection, the Developer shall provide for the widening of the arterial road right-of-way, as required.

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- .6 Corner cuts for the intersection of two arterial roadways, the intersection corner cutoffs shall be a minimum of 15 m. For the intersection of a collector roadway with an arterial roadway, the intersection corner cutoffs shall be a minimum of 15 m. For the intersection of collector to collector roadways, the cutoff shall be 15 m. For the intersection corner where a collector meets a local the corner cut shall be a minimum of 9 m. For intersections where a local road meets a local road the corner cut shall be a minimum of 6 m.

3.6 Cul-de-sacs

- .1 Typical cul-de-sacs are a maximum of 120 m in length, as measured from the adjoining roadway's nearest curb line to the start of the cul-de-sac's bulb. Cul-de-sacs which exceed 120 m but that are less than 170 m in length require an additional hydrant and looping of the water main to the cul-de-sac. Cul-de-sacs which exceed 170 m in length require a minimum 6 m wide public utility lot (PUL) for emergency vehicle access and looping of the water main. Any PUL which is required for emergency vehicle access shall be developed to a standard acceptable to the City and shall include provisions for limiting public vehicle access. Refer to the Engineering Standard Drawings in Appendix A.
- .2 In the case where the cul-de-sac cannot be graded to drain towards the adjoining road, a PUL must be included to provide an outlet for overland flow.
- .3 Cul-de-sac bulbs shall have a minimum radius of 12 m from the centre to the curb face. Bulb road surfaces may be crowned or cross fall sloped for drainage, at a minimum grade of 1.0% and maximum grade of 3.0% outward from the centre of the bulb.

3.7 Driveways

- .1 Lot layouts shall be such that where possible driveways do not connect directly to any arterial roadways or major collector roadways with an estimated ultimate traffic volume of more than 4,000 vehicles per day. Trip generation used to estimate this traffic volume shall be based on a minimum of 12 trips per dwelling unit per day external to the subdivision.
- .2 A minimum clearance of 1.5 m shall be provided between the edge of the driveway and the outside edge of adjacent street furniture to either side. Street furniture placement shall be carefully considered to allow optimum driveway and apron width.
- .3 Driveways shall be in accordance with the Engineering Standard Drawings in Appendix A.
- .4 Driveways shall not be permitted to connect to an abutting road through a curb return area.
- .5 Driveways on corner lots shall connect to the adjacent roadway with less estimated traffic volume, located a minimum of 10 m from the front of curb of the adjacent roadway, unless special written permission is received from the City.

3.8 Pavement Structure

- .1 The recommendations of the geotechnical report shall form the basis of the pavement structure design.
- .2 Pavement structure thicknesses shall meet the minimum requirements provided in Table 3.4.

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Table 3.4 – Pavement Structure Minimum Thicknesses

Road Classification	Road Width (m)	Minimum Thickness		Type	
		Base Course (mm)	Asphalt Concrete (mm)	Base Course	Asphalt Course
<i>Residential Roads:</i>					
Local	9.0	250	75 / 50	Granular	ACB / ACR
Cul-de-sac	9.0	250	75 / 50	Granular	ACB / ACR
Minor Collector	11.0	300	125 / 50	Granular	ACB / ACO
Major Collector	12.0	300	125 / 50	Granular	ACB / ACO
<i>Commercial Roads:</i>					
Minor Collector	11.0	300	125 / 50	Granular	ACB / ACO
Major Collector	12.0	300	125 / 50	Granular	ACB / ACO
<i>Arterial Roads:</i>					
Undivided	15.0	300	150 / 50	Granular	ACB / ACO
Divided	20.5	300	150 / 50	Granular	ACB / ACO
Trail/Shared Use Path	3.0	150	75	Granular	ACO

- .3 The Design must include provision for draining of the granular sub-base and base course. The drain shall consist of a wick drain in accordance with the Engineering Standard Drawings in Appendix A.
- .4 When tying new pavement into existing pavement, a minimum 0.75 m wide strip shall be milled out of the existing pavement along the joint of the tie-in to the new pavement, and the joint paved to tie the two pavement surfaces together and prevent separation and differential settling.
- .5 Temporary roadways and accesses must be suitably designed for the required service life. The design of such temporary road infrastructure shall be subject to the review and acceptance of the City.

3.9 Noise Attenuation

- .1 A Noise Impact Assessment, signed and sealed by a professional engineer, must be provided in cases where a major arterial roadway and/or railway runs through or adjacent to a proposed residential development. The assessment must list the current noise levels, estimate future noise levels, and identify and implement noise attenuation measures required to achieve a maximum noise level of 65 dBA Leq over a 24-hour period.

3.10 Transit Stops

- .1 The City's Transit Department will aid with locating transit stops for the Development during the Area Structure Plan process.
- .2 Transit bays must be provided at the locations determined by the Transit Department.
- .3 Developers will be required to install bus shelters and pads on arterials roads and bus stops that are adjacent to any multi-family sites. Developers will be required to install bus bench pads in all other locations as identified by the City.

DRAFT – FOR INFORMATION ONLY**3.11 Roadway Signage**

- .1 The Developer shall be responsible to organize, order, install, and maintain all signs necessary to provide safe vehicle/pedestrian navigation through the Subdivision including, but not necessarily limited to, regulatory signage, street name signage, transit signage, construction warning signage, and construction development signage, whether temporarily and permanently installed.
- .2 Roadway signage layout and design shall conform to *TAC's Manual of Uniform Traffic Control Devices for Canada*, latest edition.

3.12 Roadway Lighting

- .1 Roadway lighting shall be designed in accordance with the following:
 - a) Lighting for local roadways shall conform to *Roadway Lighting, Illuminating Engineering Society of North America*, RP-8-00;
 - b) Lighting for collector and arterial roadways shall conform to *Guide for the Design of Roadway Lighting*, Transportation Association of Canada, latest edition.
- .2 Lighting at intersections shall conform to the design criteria for the higher classified road.

3.13 Pavement Markings

- .1 Introduction
 - a) The principles and standards governing pavement marking application are set out in “Part C; Divisions 1 through 4” of the *Canadian Manual of Uniform Traffic Control Devices*. The guidelines in this document incorporates specific City standards to meet local needs and conditions.
 - b) Four categories of pavement marking are discussed:
 - i) Longitudinal
 - ii) Transverse
 - iii) Symbols and Letters
 - iv) Parking
 - c) Additional types and styles of line marking have been proven through best practices in the industry, however at the time of revision of this document, the City utilizes the types of markings included in these standards on a consistent basis. Additional markings may be performed and added to the guidelines in later revisions.
 - d) It is important to note that these standards may be altered for unusual traffic conditions. However, such special situations should be considered exceptions to the rule. Engineering judgment and practical experience are necessary supplements to the use of these standards. Any changes to the written standards requires review and approval from City Engineer.
 - e) Users of the following standards are assumed to have a basic understanding of traffic engineering terms and be able to recognize the related traffic movements. These standards should be used as a first reference. Where no specific guidelines are provided, the *Canadian Manual of Uniform Traffic Control Devices* standards are to be used.

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.2 Longitudinal Markings

- a) Longitudinal markings are lines along the length of the roadway indicating to the driver proper position on the roadway (delineated travel lanes) and may indicate proper direction of travel (yellow centre line to the left).
- b) Directional Dividing Lines
 - i) Directional Dividing Lines are used to designate the separation between the portions of the pavement of a two-way road which are available for travel in opposing directions.
 - ii) The Directional Dividing Line shall be a solid 10 cm in width and yellow in color.
 - iii) Directional Dividing Lines shall be applied in Wetaskiwin:
 - For the entire length of roadway for an Arterial road, where no concrete divider is present.
 - A minimum of 30 m back along a Major Collector Roadway, where it meets an Arterial Roadway.
 - On Minor Collector roads where geometric conditions and/ or specific transit requirements warrant increased guidance to the motorist including, but not limited to, locations with existing:
 - Pavement width transitions;
 - Horizontal or vertical curves where sight line distances are of a concern.
 - At locations where a stop box or extended stop bar is distant from an existing concrete divider. The Directional Dividing Line will extend from the concrete divider to the front stop bar.
 - A minimum of 30 m in advance of any Railway Crossing.
 - iv) On most roadways, the Directional Dividing Line will coincide with the geometric centre of the pavement surface. In some cases, however, the Directional Dividing Line may be located in an off-centre position to make more efficient use of the roadway space. Typical examples of this exception include:
 - Pavement width transitions.
 - Added turning lanes at intersections.
 - An uneven number of lanes in each travel direction.
 - Zones with parking on one side of the roadway.
- c) Lane Lines
 - i) Lane Lines delineate the edge of travel lanes where there are 2 or more travel lanes on the same side of the Directional Dividing Line (same direction of flow). They are utilized to direct traffic into designated travel lanes as required.
 - ii) Lane Lines shall be used where more than one travel lane in the same direction is present and shall be placed:
 - Throughout the entire length of pavement on all arterial and major divided collector roads, where parking is not permitted.

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- On collector roads at approaches to signalized intersections where the pavement surface width allows for more than one travel lane and/ or directional guidance is required for traffic movement.
 - Lane Lines should extend back from a stop line for a minimum of 30 m.
 - Minimum Lane Width = 3.5 m measured from face of curb.
 - Maximum Lane Width = 4.2 m measured from face of curb.
- iii) Lane Lines shall be:
- Used to designate lane movements in the same direction of flow of traffic that carry on continually straight down the roadway.
 - 10 cm in width
 - White in color.
 - 3 m long segments with 6 m long gaps between the lane lines where lane changes are allowed.
 - Solid throughout, where lane changes are not allowed (example: Free Flow Lanes) Minimum distance of these solid sections shall be 60 m.
 - Terminated at the stop bar, or 4.65 m back from the perpendicular face of curb at an intersection.
 - Start from the back side of a crosswalk at an intersection or 3.65 m back from the perpendicular face of curb at an intersection.
 - When approaching an intersection, the last 3 m lane line shall be placed coming off of the stop bar and the next 2 to 3 lanes lines fitted as best possible to maintain the 3:6 line marking to gap ratio.
- d) Continuity Lines
- i) Continuity Lines indicate the continuation of the through-travel lane from dedicated turning lanes and from merging/diverging lanes.
- ii) Continuity Lines shall be:
- 20 cm in width
 - White in color.
 - Used at all acceleration and deceleration lanes
 - Used to separate auxiliary turn lanes from through lanes at intersections.
 - 3 m long segments with 3 m long gaps between the Lane Lines where lane changes are allowed.
 - Solid throughout, where lane changes are not allowed (example: Penalty Box).
- iii) Continuity Lines are not required for right turn cut off lanes, where no auxiliary turning lane exists.
- iv) For turning lanes or merging lanes that are created through pavement width transitions (the lanes are created through widening of the road), the 20 cm Lane Lines will run parallel with the 10 cm Lane Lines and shall start where the concrete face of curb falls away, keeping the minimum width of the straight thru lane.
- v) For turning lanes that are created from a previous straight thru lane (where 10 cm Lane Lines must turn into 20 cm Lane Lines) the 20 cm Lane Lines shall start a

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minimum of 12 seconds of travel time prior to the gore line of the turning movement (or from the stop bar if there is no island at the intersection).

- On a 60 km/hr roadway this distance = 192 m (Approximately 32 of the 20 cm Lane Lines.)
- On a 50 km/hr roadway this distance = 168 m (Approximately 28 of the 20 cm Lane Lines.)

- vi) When approaching an intersection, the last 3.0 m lane line shall be placed coming off of the stop bar and the next 2 to 3 lane lines fitted as best possible to maintain the 3:3 line marking to gap ratio.

e) Pavement Edge Lines (Shoulder Lines)

- i) Edge Lines or Shoulder Lines are used to indicate the limits of the travel lane, such as to separate the travel lane from a paved shoulder.
- ii) Edge Lines shall be:
- Continuous 10 cm solid White line when placed to the right of the travel lane, when not used at a merging or diverging zone.
 - Continuous 20 cm solid White line when placed to the right of the travel lane when used for merging or diverging zones.
 - Continuous 10 cm solid Yellow line when placed to the left of the travel lane.
- iii) Typical use of Edge Line markings include:
- Where paved shoulders are present
 - In merge and diverge zones
 - At pavement width transitions
 - At V-gutters
 - Where obstructions on the shoulder may be considered to constitute a hazard to the motorist in that lane.

f) Guide Lines

- i) Guide Lines provide travel path guidance to drivers as they proceed through an intersection or merge into proper travel lanes.
- ii) Guide Lines shall be 10 cm in width, 0.5 m in length with 0.5 m gaps, and:
- White when on the driver's right-hand side; or
 - Yellow when on the inside lanes' driver's left-hand side (i.e. centreline of roadway to centreline of roadway).
- iii) Guide Lines shall be used at the following locations:
- Where a multi-lane turn is present.
 - Where the uphill/downhill roadway grade requires Guide Lines for improved safety of traffic flow.
 - Where the roadway grade changes inside the intersection.
 - At intersections where approaches are not at 90 degrees to each other and driver error may occur.

.3 Transverse Markings

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- a) Transverse line markings are aligned crossing the roadway to indicate zones of pedestrian crossings or stop locations for vehicles.
 - b) Pedestrian Crosswalk Lines
 - i) Pedestrian Crosswalk Lines indicate a specific zone of pedestrian travel, and are used where there is a conflict between vehicular movement and pedestrian movement. Any intersection is a permissible pedestrian crossing, unless otherwise signed as such through traffic control devices.
 - ii) The City follows the guidelines expressed in the Transportation Association of Canada; *Pedestrian Crossing Control Manual*, latest edition, for the placement of all pedestrian crosswalks.
 - iii) Standard Pedestrian Crossings
 - Standard Pedestrian Crossings utilize two parallel lines running across the roadway to signify the safe crossing area for the pedestrian.
 - Standard Pedestrian Crossings:
 - Consist of 2 parallel lines running across the complete width of the roadway.
 - Shall be White in color.
 - Shall consist of 2, 10 cm wide lines.
 - Shall be a minimum of 3.0 m apart from centerline to centerline. The width may be increased based on location and pedestrian demand, as requested through the City.
 - Are to be located such that the crosswalk line (nearest to the centre of the intersection) must be a minimum of 0.65 m back from the extended line of the perpendicular roadway curb face.
 - Locations where Standard Pedestrian Crossings shall be used are:
 - At fully signalized intersections, including right turn cut offs.
 - At pedestrian activated signal crossings
 - At 4-way stop controlled intersections with sidewalks
 - At Collector / Arterial intersections where pedestrian and vehicle conflict is high.
 - Intersection locations where a warrant study has been performed and a pedestrian crossing is warranted.
 - iv) Zebra Bar Pedestrian Crossings
 - A Zebra Bar Pedestrian Crossing utilize multiple “bars” that flow parallel with the direction of traffic flow, but are placed crossing the width of the roadway to signify the safe crossing area for the pedestrian at locations where a motorist may not normally expect a pedestrian.
 - Zebra Bar Pedestrian Crossings shall be placed at:
 - Mid-block crossings
 - At pedestrian activated warning flashers
 - Where Standard Pedestrian Crossings may be upgraded to a Zebra Bar Crossing if Engineering deems it feasible and beneficial at locations where special circumstances may exist.
 - Zebra Bar Pedestrian Crossings shall be:
 - Placed with each bar running parallel with the roadway.

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- 60 cm in width
- 3.0 m in length, unless otherwise directed by the City
- White in color
- Placed in an effort to minimize vehicle tire exposure to the material.

c) Stop Bar Lines

i) Stop Bar Lines are used to indicate the point at where a vehicle must stop in compliance with a traffic signal, stop sign or other specific requirement to stop.

ii) Standard Stop Bar Lines

- Standard Stop Bar Lines are used at all locations other than Railway Crossing locations, where a Stop Bar Line is deemed necessary.
- Standard Stop Bar Lines shall be used:
 - At all signalized and multi-way stop controlled intersections.
 - At intersections of Arterial / Collector Roadways
- Standard Stop Lines shall be:
 - 30 cm in width
 - White in color
 - Applied to the complete distance (width of road) for all travel paths entering into the intersection.
 - Installed a minimum of 1.0 m back, from the nearest point (if the crosswalk runs at an angle) of the closest crosswalk line.
 - Applied perpendicular to the travel lanes of the roadway
 - If no crosswalk exists, the Stop Bar Line shall be placed a minimum of 4.65 m back from the extended line of the perpendicular roadway curb face, unless otherwise specified by the City.

iii) Railway Crossing Stop Bar Lines

- Stop Bar Lines used at all Railway Crossings.
- Railway Crossing Stop Bar Lines:
 - Consist of two solid 30 cm wide lines, 30 cm spacing between them.
 - Shall be White in color.
 - Shall be placed a minimum of 5.0 m back from the nearest point of the railway tracks to the nearest Stop Bar Line.
 - Placed perpendicular to the flow of traffic and roadway for the complete lane width of all lanes approaching the Railway Crossing.

d) Gore Areas

i) Gore Area markings are used to define the beginning and the end of merging and diverging area zones and the approaches to structures in the roadway.

ii) Gore Area marking shall:

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-
- Be solid 10cm wide Yellow Centre Line where traffic passes the Gore Area in opposing directions.
 - Extend from a point 10 m past the point of the physical barrier to a point where the lane widths in opposing travel directions are a constant width.
 - Be solid 10 cm wide White Lines where traffic passes by the Gore Area in the same direction on roadways with a speed limit of 70km/h or less.
 - Be unmarked inside the Gore Area Lines unless safety concerns warrant interior markings.
 - Extend from the point of the physical obstruction to a point where the lane width of the ramp and through lane reach 5.5 m and 3.7 m (or designed lane width), respectively, when in the same direction of flow.
- iii) For left turn slab-on islands, the pavement markings shall be:
- 10 cm in width
 - White in color
- e) Diagonal Lines
- i) Diagonal markings indicate roadway areas that are not to be used as part of the travel lane, or stopping area.
- ii) Chevron Lines
- The interior of Gore Areas may be marked with Diagonal Lines to guide traffic away from the object.
 - Where traffic is required to pass to the right of the area, the lines must be Yellow.
 - Where traffic is required to pass to the left of the area, the lines must be White.
 - Chevron Lines shall:
 - Be placed at an angle of 2:1 in the direction of travel (2 units along the direction of travel to 1 unit per perpendicular to the direction of travel).
 - 45 cm wide, unless otherwise specified by the City (where it they be requested to be 60 cm wide).
 - Have a minimum of 2.0 m distance between Chevron bars.
- iii) Stop Box Lines
- Stop boxes may be applied on approaches to signalized intersections where the potential for vehicle movement conflicts exist.
 - Stop Bar Lines shall be:
 - 10cm in width (the inside diagonal lines).
 - White in color (the inside diagonal lines).
 - Laterally defined by the curb and the roadway centerline. Alternatively, in instances of only a single lane Stop Box, defined by the Continuity Lines (which shall run as a solid 20 cm line from the Stop Line to the back line of the cross walk) and the centerline.
 - Longitudinally defined by the near side of the crosswalk and the stop line.
 - 2 intersecting diagonal lines inside the stop box, centered.

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- A minimum length of 6.0 m. This is the distance from back line of the crosswalk to the Stop Box Stop Line.
- Some multi-lane roads may require staggered Stop Boxes or a Stop Box for the inside lane only, rather than one, single, Stop Box across all lanes. Traffic movement conditions at the intersection should be considered in determining the appropriate Stop Box arrangement.

.4 Symbols and Letters

- a) The goal of the use of symbols is to obtain uniformity and to prevent confusion by utilizing symbols that have restrictive messages that are clearly evident to the driver.
- b) Arrows
 - i) Arrows are used to indicate necessary vehicle movement that is permitted in a travel lane. Use and placement of the arrows are dependent upon lane design and roadway speed. They shall be used in conjunction with other traffic control devices such as lane designation signs mounted overhead or to the side of the road.
 - ii) For Pavement Arrows please use standard City of Edmonton style of arrows as shown in the City of Edmonton, *Pavement Marking Guidelines* (Current Edition).
 - iii) Left or Right Turn Arrows
 - Turn arrows indicate a mandatory turn is necessary and the lane it is located in will end.
 - Turn arrows shall be used:
 - At intersections where a lane that was a through-only lane before the intersection is required to make a forced left or right turn.
 - At “unprotected” left turn lanes; i.e. where no curb is present between the left-turn lane and the traffic travelling in the opposing direction.
 - iv) Through-Left or Through-Right (Double) Arrows
 - Double Arrows indicate optional movements of continuing straight through or making a turn at the intersection.
 - Double Arrows shall only be used when necessary in the lane parallel with a forced left / right turn lane.
 - The tail of the parallel arrows (the turning movement and the double arrow) shall be aligned in the lane ways.
- c) Railway Crossing “X”
 - i) The Railway Crossing “X” is used to provide warning of an upcoming railway crossing.
 - ii) The Railway Crossing symbol shall be:
 - White in Color
 - Have a 30 cm line width
 - 6.0 m in length
 - 2.5 m in symbol width (from outside edge to outside edge at the top and bottom of the “X”)

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-
- Located 10 m past the Railway Crossing Warning Sign (closer to the RR tracks).
 - d) Disabled Parking Symbol
 - i) The disabled parking symbol is utilized to provide notification of a designated parking stall associated with required shown permitting.
 - ii) Are installed according to Standard Drawing 3.55
 - iii) Symbol shall be white in colour.
 - iv) Background shall be blue in colour.
- .5 Parking Line Markings
- a) Parking Lines may be used to delineate parking stalls.
 - b) Standard Parking Lines (including Angle Parking) shall be:
 - i) 10 cm wide, solid line (Yellow in colour).
 - ii) Minimum 5.8 m in length.
 - iii) Minimum 2.6 m in stall width
 - iv) Placed to leave a minimum drive aisle of 7.3 m in width.
 - c) A Parallel Parking Stall must be marked as a minimum of 2.6 m wide and 7.0 m in length. The first and last stall on the block may be 6m in length.
 - d) Disabled Parking Stalls shall be:
 - i) 10 cm wide, solid line (Yellow in colour).
 - ii) Minimum 7.0 m in length.
 - iii) Minimum 3.7 m in stall width.
 - iv) Clearly marked with the standard Disabled Parking Symbol.
 - v) Clearly marked with Traffic Control Devices showing the specific parking location or zone for the disabled.

PART II – MATERIALS

3.14 Sub-grade Materials

- .1 Sub-grade materials shall be free of deleterious material.

3.15 Granular Base Course and Granular Sub-Base

- .1 Granular materials for base courses shall conform to the following gradation (CAN/CGSB-8.2-M):

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Class	20	25	40	63	80	Bedding
Application	GBC	GBC	GBC	GBC	GSB	Sand
80.0 mm					100	
63.0 mm			100	100		
25.0 mm		100	70 - 94	55 - 75	46 - 85	
20.0 mm	100	82 - 97	60 - 90	50 - 70	40 - 81	
16.0 mm	84 - 95	70 - 93	55 - 85	45 - 65	32 - 76	
12.5 mm	60 - 90	60 - 86	50 - 80	40 - 60	30 - 70	
10.0 mm	50 - 84	52 - 79	44 - 74			100
5.0 mm	37 - 62	35 - 64	32 - 62	20 - 45	25 - 50	70 - 100
2.0 mm	26 - 50	24 - 50	20 - 50	14 - 38	19 - 42	
1250 µm	19 - 43	19 - 43	17 - 43	12 - 34	15 - 38	
630 µm	14 - 34	14 - 34	12 - 34	10 - 28	10 - 32	
400 µm	11 - 28	10 - 27	10 - 28	8 - 24	7 - 27	
315 µm	10 - 25	9 - 24	8 - 25	7 - 22	6 - 24	
160 µm	6 - 18	6 - 18	5 - 18	4 - 17	3 - 18	5 - 20
80 µm	2 - 10	2 - 10	0 - 10	0 - 10	0 - 10	0 - 12

- .2 Granular materials for base courses shall comply with the following:

Aggregate Property	Tolerance
Coarse aggregate ($> 5,000 \mu\text{m}$) with ≥ 2 fractured faces (by mass)	60% minimum
Plasticity index ($< 400 \mu\text{m}$)	6 maximum
Liquid Limit	25 maximum
Lightweight pieces (by mass)	2% maximum

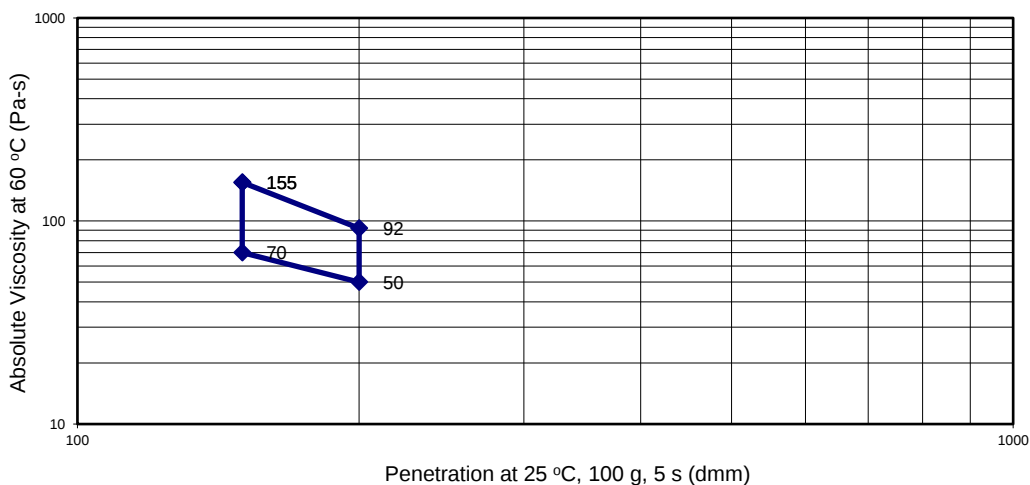
- .3 Crushed aggregate shall consist of sound, hard, and durable particles of sand, gravel, and rock. Crushed aggregate shall be free of flaky particles, soft shale, coal, ironstone, clay lumps, organic material, and other deleterious material.

3.16 Asphalt Cement

- .1 The asphaltic binder shall be prepared by the refining of petroleum, uniform in character, shall not foam when heated to 175°C , and shall meet the following requirements:
- Absolute viscosity, to ASTM-D2171, and penetration, to ASTM-D5, must fall within the area plotted on the following log-log scale chart:

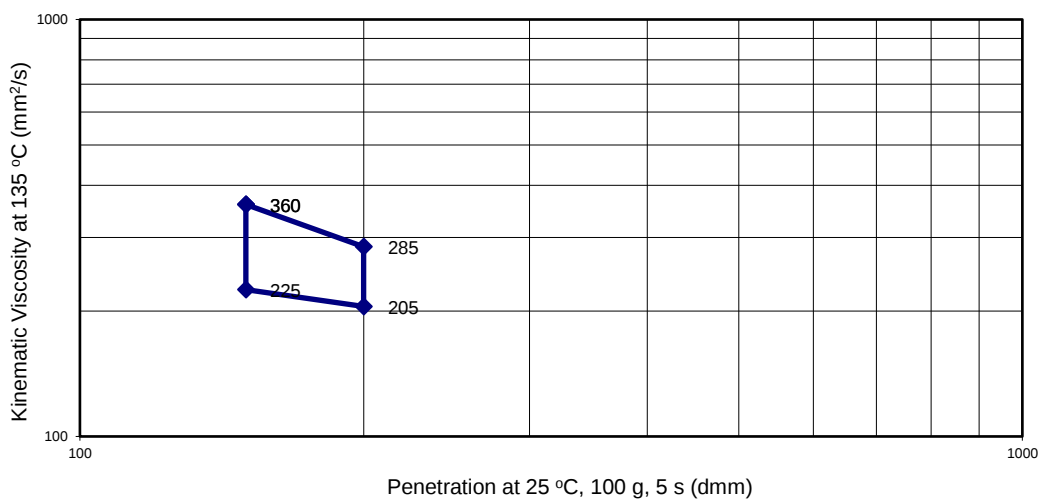
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Asphalt Cement Absolute Viscosity



Kinematic viscosity, to ASTM-D2170, and penetration, to ASTM-D5, must fall within the area plotted on the following log-log scale chart:

Asphalt Cement Kinematic Viscosity



- b) Flash point, by Cleveland Open Cup Method, to ASTM-D-92, minimum 205 °C.
- c) Solubility in Trichloroethylene, to ASTM-D2042, minimum 99.5%.
- d) Absolute viscosity tests, to ASTM-D2171, on residue from Thin Film Oven Test, to ASTM-D1754, shall yield a maximum ratio of absolute viscosity of residue to the absolute viscosity of the asphaltic binder of 4.0.
- e) Ductility at 25 °C, to ASTM-D113, maximum 100 cm.
- f) The temperature at delivery to the site shall be between 135 and 175 °C.

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3.17 Aggregate

- .1 Aggregate for ACO/ACR shall comply with the following gradation:

Sieve Size	ACO/ACR	ACB
25.0 mm		100
20.0 mm		80 - 95
12.5 mm	100	68 - 85
10.0 mm	75 - 90	60 - 80
5.0 mm	50 - 70	40 - 60
2.5 mm	35 - 50	30 - 50
1250 µm	25 - 40	25 - 40
630 µm	20 - 30	20 - 30
315 µm	14 - 23	15 - 23
160 µm	7 - 14	9 - 15
80 µm	4 - 8	4 - 8

- .2 Coarse aggregate is the total aggregate retained on a 5 mm sieve. Fine aggregate is the total aggregate which passes through a 5 mm sieve.
- .3 Aggregate shall comply with the following:

Aggregate Property	Type		
	ACB	ACO	ACR
Coarse aggregate (> 5,000 µm) with ≥ 2 fractured faces (by mass)	90% minimum	90% minimum	75% minimum
Plasticity index < 400 µm (by mass)	0%	0%	0%
L.A. abrasion wear (by mass)	32% maximum	32% maximum	32% maximum
Soundness loss (by mass)	16% maximum	16% maximum	16% maximum
Lightweight pieces (by mass)	2% maximum	2% maximum	2% maximum

- .4 Aggregate shall be sound, hard, and durable, free of elongated particles, soft shale, clay lumps, organic material, and other deleterious material.
- .5 Fine aggregate shall contain 75-85% (by mass) of manufactured or crushed fines. Pit run material shall be pre-screened to remove natural sand and then crushed to produce manufactured fines.
- .6 Where authorized by the City, mineral filler may be added as necessary to meet the specified gradation. Mineral filler may consist of Portland Cement, fly ash, ground limestone, or such other commercially ground stone dust, as accepted by the City. Mineral filler shall have a plasticity index of zero and shall conform to the following gradation:

Sieve Size	Minimum Percent Passing
400 µm	100
160 µm	90
80 µm	70
45 µm	62

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- .7 Recycled Asphalt Pavement (RAP); RAP is salvaged, milled, pulverized, broken, or crushed asphalt pavement removed from an existing pavement.

Total % Passing by Mass:

Sieve Size μm	ACB	ACO	ACR
160	9 -16	7 – 14	7 - 14
80	4 - 9	3 – 8	3 - 8

3.18 Asphalt Concrete Mix Design

The mix design shall be carried out by a qualified laboratory following the Marshall Method of Mix Design, and conforming to the following criteria:

Mix Type	ACB	ACR	ACO
Maximum size of aggregate	25 mm	12.5 mm	12.5 mm
Number of blows	75	50	75
Minimum stability	6.7 kN	4.5 kN	6.7 kN
Minimum retained stability	75%	75%	75%
Flow value	1.5 – 3.0 mm	2.0 – 4.0 mm	1.5 – 3.0 mm
Air voids (% of total mix)	4.0% $\pm$ 0.4%	3.0% $\pm$ 1.0	4.0% $\pm$ 0.4%
Voids filled	67 – 78%	73 – 85%	68 – 80%
Minimum crushed face count	70%	75%	75%
Minimum film thickness	6.0 μm	7.0 μm	7.0 μm

- .1 Tolerances

- a) Aggregate Gradation:

Sieve Size	Percent Passing by Mass	
	Individual Sample	Average of Last 3 Samples
20,000 μm	$\pm$ 5.0	$\pm$ 3.0
12,500 μm	$\pm$ 5.0	$\pm$ 3.0
10,000 μm	$\pm$ 5.0	$\pm$ 3.0
5,000 μm	$\pm$ 5.0	$\pm$ 3.0
2,500 μm	$\pm$ 4.0	$\pm$ 2.5
1,250 μm	$\pm$ 4.0	$\pm$ 2.5
630 μm	$\pm$ 3.0	$\pm$ 2.0
315 μm	$\pm$ 3.0	$\pm$ 2.0
160 μm	$\pm$ 2.0	$\pm$ 1.5
80 μm	$\pm$ 1.5	$\pm$ 1.0

- b) Asphalt Content:
i) $\pm$ 0.25 % from the mix design.
- c) Mixing Temperature:
i) $\pm$ 9 °C from the mix design.
- d) Tolerances for Air Voids in Mix

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Mix Type	ACB	ACR	ACO
Virgin Mix Air Voids, % of Total Mix	4.0 ± 1.0	3.0 ± 1.0	4.0 ± 1.0

- e) Minimum Film Thickness in Mix:

Mix Type	ACB	ACR	ACO
Min Film Thickness, µm:	6.0	7.0	7.0

- f) Voids filled in Mix:

Mix Type	ACB	ACR	ACO
Voids Filled, %:	67 - 78	73 - 85	68 - 80

- g) Maximum RAP (Recycled Asphalt Pavement) to be allowed by % of mix design:

Mix Type	ACB	ACO	ACR
Maximum RAP content if only using RAP in the mix (% by mass of total mix)	25	10	20

3.19 Prime Coats and Tack Coats

- .1 Prime coat shall conform to Table 3.5, or grade SS-l-1 anionic emulsified asphalt, conforming to Table 3.6.

Table 3.5 – Specifications for Medium and Rapid Curing Asphalts:

Asphalt Grade Requirements	ASTM Test	MC-30		RC-30		RC-70	
		Min	Max	Min	Max	Min	Max
Flash point, open tag, °C	D1310	38	-	-	-	-	-
Kinematic viscosity at 60 °C, mm ² /s	D2170	30	60	30	60	70	140
Distillation test:							
% by volume of total distillate to 360 °C							
190 °C	D402	-	-	15	-	10	-
225 °C		-	25	55	-	50	-
260 °C		40	70	75	-	70	-
315 °C		75	93	90	-	85	-
Residue from distillation to 360 °C							
Volume % by difference		50	-	50	-	55	-
Test on residue from distillation:							
Penetration at 25 °C, 100 g, 5 s, dmm	D5	120	250	80	120	80	120
Ductility at 25 °C, cm	D113	100	-	100	-	100	-
Solubility in trichloroethylene, % by mass	D2042	99.5	-	99.5	-	99.5	-
Water, % by mass or volume	D95	-	0.2	-	0.2	-	0.2
Delivery temperature, °C	-	35	55	35	55	55	75

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Table 3.6 – Specifications for Anionic Emulsified Asphalts:

Asphalt Grade Requirements	ASTM Test	SS-1	
		Minimum	Maximum
Absolute viscosity at 25 °C, Pa·s	D244	20	60
Residue by distillation, % by mass	D244	55	-
Settlement in 5 days, % difference by mass	D244	-	5
Storage stability test, 24 hr, % by mass	D244	-	1
Retained on No. 1000 sieve, % by mass	D244	-	0.10
Cement mixing test, % by mass	D244	-	2.0
Tests on residue from distillation:			
Penetration at 25 °C, 100 g, 5 s, dmm	D5	100	200
Ductility at 25 °C and 5 cm/min, cm	D113	60	-
Solubility in carbon tetrachloride, % by mass	D2042	97.5	-
Delivery temperature, °C		40	70

- .2 Asphalt coats shall be uniform in character and shall have a refined petroleum base.
- .3 The asphalt coat shall not foam when heated to the application temperature range.
- .4 All tests on coats shall be completed within 15 days of the date of delivery. The settlement test may be waived where the coat is applied within 5 days of delivery. The 24-hour storage test may be used in lieu of the 5-day settlement test. In the case of a dispute with respect to the results of these two tests, the 5-day settlement test shall govern.
- .5 Dilute SS-1 emulsified asphalt with an equal amount of water for a 50% concentration.
- .6 Application rates shall be as follows:

Asphalt Type or Grade	Application Rate
SS-1	0.5 ± 0.2 L/m ²
MC-30	1.5 ± 0.5 L/m ²
RC-30/70	0.3 ± 0.1 L/m ²

3.20 Paving Equipment

- .1 Asphalt Plant
 - a) The asphalt mixing plant shall conform to ASTM-D995 and shall be capable of consistently producing a homogeneous mixture in which all aggregate particles are uniformly and thoroughly coated with asphalt.
- .2 Tack or Prime Coat Distributor
 - a) Distributor shall be self-powered, equipped with a tachometre, pressure gauge, thermometre, adjustable-length spray bar, positive displacement asphalt pump with separate power supply, heating coils, and a burner for even heating of asphalt.
 - b) The distributor shall be capable of maintaining a constant speed and distributing a uniform application of liquid asphalt over an area 4 m wide at the specified application rate.

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- c) The distributor shall also be equipped with a hand spray wand connected to a pressure distributor and capable of providing uniform application of liquid asphalt manually.
- .3 Paver
- a) Paver shall be self-propelled with automatic screed controls to maintain grade from a reference string line and to control cross fall, smoothness, and joint matching.
 - b) The paver shall also be equipped with a vibratory screed with extensions and augers capable of uniformly spreading the mixture to specified widths and depths without segregation or tearing.
- .4 Rollers
- a) Rollers shall be self-propelled and reversible with static, steel-tired or pneumatic-tired rollers, or vibratory rollers. Pneumatic-tired rollers shall be equipped with wind skirts.
 - b) The rollers shall be equipped with wetting and scraping devices to prevent adhesion. Petroleum derivatives are not permitted for cleaning.
 - c) Rollers shall be capable of attaining the specified density and smoothness, and shall be able to obtain such within the available compaction time and compatible with the rate of hot-mix asphalt concrete placement.

3.21 Roadway Signage

- .1 Signage materials shall conform to TAC's *Manual of Uniform Traffic Control Devices for Canada*.
- .2 All roadway signage shall consist of diamond-grade reflective material for the lettering and background, except for black-coloured portions.
- .3 Street name signage shall be placed at each intersection and shall consist of white lettering on a green metal plate. Lettering sizes shall conform to the following requirements:
 - a) For local roadways, lettering shall be 100 mm (4") high, complement shall be 75 mm (3") high upon a 150 mm (6") tall plate; and
 - b) For collector and arterial roadways, lettering shall be 150 mm (6") high upon a 225 mm (9") tall plate.
- .4 For cul-de-sacs with the same name as the adjoining roadway, include address numbering (100 mm (4") high) on the street signage for the cul-de-sac at the adjoining intersection.

3.22 Pavement Marking

- .1 Equipment
 - a) Where the work is to be carried out on the City's walking pathway system, equipment must be of an appropriate size to protect the pathway structure, surrounding surfaces, and adjacent appurtenances. Only equipment mounted on a half-ton truck-type chassis, or smaller unit, will be permitted. The equipment may be self-propelled or walk behind and be equipped to apply the marking material according to the manufacturer's recommendations.

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- b) Where the work is to be carried out on the City's road network, equipment proposed by the Contractor for use in carrying out the Work shall be subject to the review and acceptance of the City.

.2 Marking Materials

- a) Marking materials shall be suitable for asphalt concrete surfaces and shall be available in both white and yellow colours. The material, while on the roadway surface and at any natural ambient temperature shall exist as a solid line with cold ductility that permits normal movement with the road surface without chipping or spalling. Propagation of a pavement crack through the lane marking material shall be excluded from this requirement.
- b) Paint
- i) White Paint – CGSB 1-GP-12.1C, White 513-301.
 - ii) Yellow Paint – To match CGSB 505-308 color chip.
 - iii) Reflectance: White – Min. 80%; Yellow – Min. 50% (ASTM- E1347).
- c) Cold and Hot Plastic Markings
- i) Colour:
 - Yellow: Conforming to CGSB Colour #505-308
 - White: Brilliant white or CGSB 1-GP-12.1 C, White 513-301.
 - ii) Water Absorption: Max. 0.5% (ASTM-D570).
 - iii) Impact Resistance: Min. 1.13 J at 25°C (ASTM-D256).
 - iv) Abrasion Resistance: Max. weight loss of 0.60 g (ASTM-D4060).
 - v) Chemical Resistance: No deterioration when in direct contact with asphalt cement in asphaltic materials or with sodium chloride or calcium chloride or other de-icing materials, and shall be resistant to the effect of ultraviolet light.
 - vi) Reflectance: White – Min. 70%; Yellow – Min. 45% (ASTM- E1347).
 - vii) Retroreflectivity: The initial reflectance for the in-place marking, measured 7 to 10 days after application, shall have the minimum reflectance values as follows:
 - Dry/Night: White – 200 mcd/lux/m², Yellow – 175 mcd/lux/m²
 - viii) Retained Retroreflectivity: The reflectance for longitudinal lines, for at least 36 months after placement, shall have the minimum reflectance values as follows:
 - Dry/Night: White – 75 mcd/lux/m², Yellow – 60 mcd/lux/m²
 - ix) Skid Resistance: Minimum vehicle skid resistance of the in place markings shall not be less than 45 based on Portable Skid Resistance Tester, Road Research Laboratory Road Note Number 27, British Standards Institution.
 - x) Curing Time: 10 to 35 min (controllable by installer).
 - xi) Cold Plastic Markings
 - Two component (cold-extruded and cold-curing) markings shall have a minimum specific gravity of 1.9 at 25°C (ASTM-D792).

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- The material shall be suitable for application on concrete and on new and old asphalt. Bond strength shall be sufficient for the material to remain in place for a minimum of 2 years when surface applied, and 3 years when “scratched” inlaid.
 - System 400 or accepted alternate.
 - xii) Hot Thermoplastic Markings
 - Hot-extruded markings shall have a minimum specific gravity of 2.0 at 25°C (ASTM-D792).
 - Glass sphere content: Min. 20%; Max. 30%, by mass of thermoplastic material.
 - The material shall be suitable for application on new asphalt and old asphalt. Bond strength shall be sufficient for the material to remain in place for a minimum of 2 years when surface applied, and 5 years when inlaid.
 - System 300 or accepted alternate.
 - d) MMA Spray Material
 - i) MMA Spray Material shall be manufactured for application by spraying onto pavement in liquid form with glass spheres dropped onto the material immediately after application, and shall have a minimum specific gravity of 1.6 at 25°C (ASTM-D792).
 - ii) Water Absorption: Max. 0.5% (ASTM-D570).
 - iii) Abrasion Resistance: Max. weight loss of 0.45 g (ASTM-D4060).
 - iv) Chemical Resistance: The compound shall not deteriorate by contact with sodium chloride, calcium chloride, or other chemicals used against formation of ice on roadways or streets, or because of oil content of pavement materials or from oil dropping from traffic. It shall be resistant to the effect of ultraviolet light.
 - v) Reflectance: White – Min. 75%; Yellow – Min. 50% (ASTM- E1347).
 - vi) Retroreflectivity: The initial reflectance for the in-place marking, measured 7 to 10 days after application, shall have the minimum reflectance values as follows:
 - Dry/Night: White – 200 mcd/lux/m², Yellow – 175 mcd/lux/m².
 - vii) Skid Resistance: Minimum vehicle skid resistance of the in place markings shall not be less than 45 based on Portable Skid Resistance Tester, Road Research Laboratory Road Note Number 27, British Standards Institution.
 - viii) Curing Time: 5 to 20 min (controllable by installer).
 - ix) Dura-Spray 600 or accepted alternate.
 - e) Fill Material
 - i) To be used for any removal and fill applications, or repair of line markings.
 - ii) LRS 424 or accepted alternate.
 - f) Glass Beads

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- i) Glass beads shall be a minimum 80% true spherical shape, clear of cloudiness, dark inclusions, trapped air, or other defects.
- ii) Index of Refraction: Minimum of 1.5 in accordance with CGSB 1-GP-71.
- iii) Gradation (ASTM-D1214):

Sieve Size	Percent Passing
850 µm	90 – 100
300 µm	15 – 50
180 µm	0 – 10

- g) Pre-Marking Paint:
 - i) Water based paint.

PART III – CONSTRUCTION

3.23 General

- .1 The following articles represent the minimum requirements for some typical, key construction procedures for roadway construction. These minimum requirements must be met or exceeded by the detailed construction specifications and drawings developed by the Consultant.
- .2 Construction activities must adhere to the provisions of the Erosion and Sediment Control Plan prepared for the Development.

3.24 Quality Assurance

- .1 The Developer must maintain detailed records of all inspections and testing as evidence of compliance of the work with these Standards. These records shall be provided to the City.
- .2 The Developer shall provide a written endorsement of the Contractor's compliance with these Standards with the application for the Construction Completion Certificate.

3.25 Quality Control Testing

- .1 The Contractor shall retain the services of independent testing laboratories or agencies to conduct all quality control testing. The proposed testing laboratory or agency shall be subject to the acceptance of the City.
- .2 The City may at any time require the Developer to provide evidence of certification by the testing agency the materials and performance of the work meet these Standards.
- .3 Minimum quality control test frequencies, specified as follows, are the minimum number required. The Contractor shall ensure that as many tests as necessary are performed to ensure that the work conforms to the requirements of these Standards, regardless of the minimum number specified.
- .4 Moisture Density Curves (ASTM-D698):
 - a) One for each type of material from each source to be compacted to a specified density. The maximum density shall be the dry unit mass of a soil sample at optimum moisture content as determined in accordance with ASTM-D698 Method A.

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.5 Sieve Analyses (ASTM-C136):

- a) Aggregate – one for each 1,000 tonnes of aggregate.

.6 Field Densities (ASTM-D2169 or ASTM-D2922):

- a) Fill – one for each 1,000 m² of compacted lift.
b) Sub-grade – one for each 1,000 m² of compacted lift.
c) Base Course – one for each 1,000 m² of compacted lift.

.7 Hot-Mix Asphalt Concrete Testing:

Note: The contractor must be prepared to provide the following test results if requested by the City of Wetaskiwin.

- a) A minimum of one for each 1,000 tonnes or one per production day, each with a minimum of three (3) Marshall specimens taken per test, and including the following minimum requirements for testing of each mix type:
- Asphalt content;
 - Air voids;
 - Stability;
 - Flow;
 - Film thickness;
 - Moisture content in mix;
 - Gradation in mix;
 - Plant discharge temperature; and
 - Asphalt storage temperature.
- b) Abrasion test, soundness test, sieve analysis, and crushed face count for each aggregate source.
- c) Plant inspections, materials sampling, and testing as follows:
- Weekly asphalt plant inspections during production will be conducted to verify plant calibrations, operation, production settings, temperatures, and handling procedures. Samples of materials and mixtures will be taken and tested.
 - Samples of asphalt cement will be taken weekly for each source and tested for penetration and kinematic viscosity.
 - A minimum of one (1) compacted Marshall specimen shall be tested for density for each 1,000 tonnes of hot-mix asphalt concrete, or for each production day, whichever is less.
 - A minimum of one (1) sieve analysis, to ASTM-C136, and crushed face count for every 1,000 tonnes of aggregate used in asphalt concrete production.
 - The testing agency shall test a trial batch of the job-mix formula to verify the mix design.

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.8 Asphalt Pavement

a) Density

- i) A minimum of one compacted Marshall specimen shall be tested for density for each 1,000 tonnes of hot-mix asphalt concrete, or for each production day, whichever is less.
- ii) Cores will be drilled from a compacted mat placed from the same load of hot-mix asphalt concrete from which the specimen was taken, and tested for density.
- iii) Pavement compaction will be accepted or rejected based on the ratio, in percent, of the core density to the density of the compacted Marshall specimen.
- iv) If the initial core density is below that specified, that initial core density will be discarded and three new cores will be taken within 10 m of the original core location, all within 2.5 m of each other. The average density of the three cores will represent the mat density in that area.

b) Thickness

- i) A minimum of one core shall be tested for thickness for each 1,000 m² of asphalt pavement, for each stage of paving. Staged paving being the process whereby a lift or lifts, forming part of the total pavement structure, are deferred to a future date.
- ii) A thickness deficiency at the completion of the first stage of paving may be accepted by the City provided the deficiency is less than 12 mm and the deficient thickness can be included in the subsequent stage of paving.
- iii) If the initial core thickness remains deficient at the completion of the final lift of paving, that initial core thickness will be discarded and three new cores will be taken within 10 m of the original core location, all within 2.5 m of each other. The average thickness of the three cores will represent the mat thickness in that area.

3.26 Site Preparation

- .1 Maintain slopes and adequate drainage during grading.
- .2 The mixing of fill material may be allowed if reviewed and approved by geotechnical engineer and the City Engineer.
- .3 Locate, mark, and protect all utilities and appurtenances (i.e. manholes, catch basins, valves, and hydrants).
- .4 Do not stockpile materials on municipal reserve (MR) or environmental reserve (ER) designated land unless written authorization of such has been provided by the City.

3.27 Clearing

- .1 Clearing shall only be permitted during periods which do not disturb nesting birds and other wildlife. Perform and document nesting check as mandated by Alberta Environment.
- .2 Cut, dig, remove, and dispose of all timber, brush, windfall, stumps, and rubbish except such trees and shrubs that are designated for preservation.

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- .3 Preserve such designated trees and shrubs from scarring, barking, or other injury during construction operations. Conduct root pruning as necessary as prescribed by a Certified Arborist.
 - .4 Leave ground surface in a condition suitable for stripping of topsoil.

3.28 Grubbing

- .1 Excavate, remove and dispose of all roots, stumps, submerged logs, corduroy and similar objectionable matter to a depth as determined by the geotechnical report.
- .2 Fill holes and level areas disturbed by grubbing. Leave ground surface in a condition suitable for stripping of topsoil.

3.29 Topsoil Stripping and Stockpiling

- .1 Strip all areas to be excavated for structures, pipes, or roadways to the limits shown on the construction drawings.
- .2 Strip the full depth of topsoil or organic material.
- .3 Frozen topsoil may be stripped by ripping provided a minimum of 2 passes are made, the first of which shall not exceed 50% of the topsoil depth.
- .4 Stockpile and windrow topsoil temporarily and dispose of stripped material that is unsuitable for replacement. Stockpile in a manner that will not endanger persons, the work, or adjacent property.
- .5 Do not stockpile material on municipal reserve (MR) or environmental reserve (ER) designated land unless written authorization has been issued by the City.
- .6 Ensure stockpiles of topsoil, common excavation, and borrow materials are sufficiently separated. Maintain a minimum of 1.0 m separation between topsoil and common excavation material when stockpiling.
- .7 Provide erosion and sediment control measures around stockpiles as required.
- .8 If the topsoil and subsoil are mixed and the topsoil is adversely affected, engage a soils specialist to determine the necessary remedial work and complete the required remedial work.
- .9 Protect completed portions of the work from damage. Repair damaged areas as required.
- .10 The City reserves the right to impose a time limit on the duration which a stockpile may be left in place. Upon expiry of the time limit, the stockpile must be removed and the underlying surface reinstated to the satisfaction of the City.

3.30 Excavation

- .1 Excavate the area to the required cross-section and to the required sub-grade elevation.
- .2 Where excavation exposes unsuitable materials below the sub-grade, excavate such materials using transition slopes no steeper than 10% along the alignment profile. Make the bottom of the cut level, with no loose material.
- .3 Where over-excavation occurs, reinstate grades by backfilling, compacting, and re-grading as required.
- .4 Excavate rock and haul to disposal areas.

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- .5 Excavate unsuitable material and haul to disposal areas.
 - .6 Location plans and remediation procedures for borrow pits must be in place and reviewed by the City prior to borrow activities being undertaken. Borrow pits must be identified on record drawings.

3.31 Fill and Grade

- .1 Place and spread fill material in successive horizontal lifts.
- .2 Compact each lift to a minimum 98% Standard Proctor Density, unless otherwise specified or directed by the City.
- .3 Each lift shall not exceed 150 mm in compacted thickness
- .4 Trim side slopes from top down, and finish true to the required alignment, grade, and shape.
- .5 Grades shall be within 30 mm of design grades.
- .6 Trim high areas, scarify low areas, compact, and re-grade as required to achieve specified grades and compaction.
- .7 Ensure cross falls and ditch bottoms are graded to promote positive drainage flow.

3.32 Shallow-Buried Utility Trenches

- .1 Shallow-buried utility trenches below roadways and sidewalks must be adequately backfilled and compacted to a minimum 98% Standard Proctor Density (SPD).
- .2 The Developer shall coordinate the location of all shallow-buried utility crossings with the respective utility companies. Such utilities that cross beneath roadways must be contained within suitable conduit with their locations suitably marked on the surface at each side of the roadway crossing.
- .3 Each lift shall not exceed 150 mm in compacted thickness

3.33 Sub-grade Preparation

- .1 Scarify and loosen sub-grade to a depth of 150 mm, or as otherwise specified or directed by the City.
- .2 Work the sub-grade until the soil is pulverized into pieces no larger than 25 mm across, exclusive of stones.
- .3 Scarify, shape, and compact the sub-grade as follows:
 - a) Compact the sub-grade to a minimum of 100% of the maximum density for each 150 mm lift of sub-grade under road, curb, gutter, curb ramps, lane crossings, and access crossings.
 - b) Compact the sub-grade to a minimum of 98% of the maximum density for each 150 mm lift of sub-grade under walks.
- .4 Additional sub-grade treatments (i.e. cement stabilization, granular sub-base, fabrics, geotextiles, etc.) may be required if recommended by the geotechnical report.
- .5 Leave the surface of the compacted sub-grade slightly higher than the required elevation; then trim to the required elevation.

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- .6 Total compacted thickness shall be 150 mm.
 - .7 Leave the finished surface even and free of depressions, humps, loose debris, and foreign material.
 - .8 Finished sub-grade surface shall be within 6 mm above the specified elevation or within 25 mm below the specified elevation. Trim any high spots and refinish to meet tolerance. Add acceptable material to low spots, scarify, and blend to the full sub-grade depth, compact to the required density, and refinish.
 - .9 Proof roll the finished sub-grade to confirm adequate bearing capacity of the sub-grade soils. Unstable areas shall be marked out with paint and corrected prior to paving.

3.34 Base Course

- .1 The Consultant shall inspect sub-grade prior to placement of the base course.
- .2 Place granular material and spread uniformly in lifts not exceeding 150 mm in thickness when compacted.
- .3 Scarify, shape, and compact the base course as follows:
 - a) Compact the base course to a minimum of 100% of the standard proctor density for each 150 mm lift of base course under road, curb, gutter, curb ramps, lane crossings, and access crossings.
 - b) Compact the base course to a minimum of 98% of the standard proctor density for each 150 mm lift of base course under walks.
- .4 Leave the surface of the compacted base slightly higher than the required elevation; then trim to the required elevation.
- .5 Total compacted thickness shall be in accordance with the construction drawings.
- .6 Leave the finished surface even and free of depressions, humps, loose debris, and foreign material.
- .7 Finished granular base surface shall have maximum 15 mm variation under a 3 m straightedge, and shall be within 6 mm above the specified elevation or within 15 mm below the specified elevation. Trim any high spots and refinish to meet tolerance. Add acceptable material to low spots, scarify, blend to the full sub-grade depth, respread, recompact to the required density, and refinish.
- .8 If segregation occurs, blade the lift and mix thoroughly before spreading and shaping to grade.

3.35 Protection of Prepared Base

- .1 Do not permit traffic over prepared surfaces.
- .2 If the site floods, immediately drain the surface by natural flow or by pumping to an approved filtration system prior to entry into any catchbasin, manhole or ditch that has been authorized by the City.
- .3 Repair any damaged areas to the satisfaction of the City.

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3.36 Asphalt Concrete Production

- .1 Asphalt concrete production and handling shall be in accordance with the *Asphalt Plant Manual, Asphalt Institute Manual Series No. 3 (MS-3)*.
- .2 The production rate shall be compatible with the rate of placement and compaction.

3.37 Paving

- .1 General
 - a) Refer to the *Asphalt Paving Manual, Asphalt Institute Manual Series No. 8 (MS-8)*, latest edition, for guidance with respect to good paving practice insofar as is consistent with the requirements of this section.
- .2 Preparation
 - a) Clean the surface to be paved.
 - b) Remove and dispose of all debris and accumulations of deleterious material.
 - c) Where necessary, raise valve boxes, manhole covers, catch basin grates, and other existing appurtenances to the finished grade of the pavement.
- .3 Prime and Tack Coats
 - a) Protect property and appurtenances adjacent to areas intended to be prime coated or tack coated. Remove any spattering stains or overspray caused during prime coating or tack coating to the satisfaction of the City.
 - b) Do not apply liquid asphalt when the prevalent weather is foggy, rainy, windy, or when the air temperature is 7 °C or less, unless authorized by the City.
 - c) For prime coats:
 - i) Do not allow traffic on prime coat within 6 hours of application or until the prime coat has cured.
 - d) For tack coats:
 - i) The prepared pavement surface shall be dry and free of dust and other material that may prevent satisfactory bonding of the tack coat.
 - ii) Apply tack coat within 24 hours of paving.
 - iii) Use traffic barriers to prevent tracking of uncured tack coat. Do not open the surface to traffic until the tack coat is properly cured.
 - e) Spray prime coat or tack coat in a uniform coat over the full area to be paved. For tack coats, spray the sides of gutters, catch basins, manholes, and other appurtenances.
 - f) Avoid spraying to an extent that ponding occurs.
 - g) Hand spray areas that may have been missed or which are inaccessible by the mechanical distributor.
 - h) Let the prime coat or tack coat completely cure before proceeding with paving.
- .4 Asphalt Paving

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- a) No paving activities can commence until the Consultant has inspected the prime coat or tack coat.
- b) Do not pave when rain or snow is imminent, or when the surface is wet, icy, snow-covered or frozen within 150 mm of the surface, unless authorized by the City.
- c) Do not pave when the air temperature is 7 °C or less, or during excessive wind conditions, unless authorized by the City.
- d) Transport of Asphalt Concrete
 - i) Transport the asphalt concrete in trucks with protective covers secured over the box to prevent funneling air movement under the cover during transport.
 - ii) Prior to loading asphalt concrete, thoroughly clean the box of any accumulation of asphaltic material or other deleterious material. Lubricate the inside box surfaces with a light coating of soap or other detergent solution. Petroleum derivatives are not permitted.
 - iii) Maintain transport vehicles clean of mud and other matter that may contaminate the paving area.
 - iv) Discharge asphalt concrete into the paver hopper without spilling and without the truck box bearing against the hopper.
- e) Mechanical Spreading
 - i) Spread the hot-mix asphalt concrete with the paver moving at a uniform speed compatible with the rate of compaction rolling.
 - ii) The spreading temperature shall be between 125 and 150 °C, as measured in the mat immediately behind the paver.
 - iii) Spread the asphalt concrete in one or more lifts, to a depth sufficient to obtain the following mat thickness:

Mix Type	Minimum (mm)	Maximum (mm)
ACO/ACR	40	75
ACB	75	125
 - iv) If segregation of the mixture occurs, immediately suspend spreading activities until the cause of segregation is determined and rectified.
 - v) Prior to roller compaction, remove fat spots, sandy accumulations, high spots, low spots, and any other irregularities, and repair with hot-mix asphalt concrete. Scratch the surface with rake tines to ensure adequate bonding of the added mix. Do not broadcast loose material that has been raked off onto the mat.
- f) Hand Spreading
 - i) Hand spread asphalt concrete in areas which are not accessible by the paver.
 - ii) Do not broadcast loose material.
 - iii) Hand place carefully to avoid segregation of the mixture. Use lutes and rakes to thoroughly loosen and uniformly distribute the asphalt concrete.
 - iv) Remove lumps that do not readily break down.

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- v) Heat hand tools to keep them free from adhesive buildup of asphalt.
 - vi) Before rolling, check the surface with a template or straightedge. Remove fat spots, sandy accumulations, high spots, low spots, and any other irregularities, and repair with hot-mix asphalt concrete.
 - g) **Compaction**
 - i) Following spreading of hot-mix asphalt concrete, compact the mat with rollers.
 - ii) Each mat of asphalt concrete for new road construction, base course and overlays shall be compacted to a minimum of 98% of the laboratory 75 Blow Marshall density unless otherwise authorized or directed by the City.
 - iii) The minimum in-place density for local and collector streets overlays shall be 97% of the the 75 Blow Marshall density.
 - iv) Develop and follow the most suitable pattern of rolling for the area to provide uniform compaction across the mat, including joints and edges.
 - v) Compact asphalt concrete until the specified density is obtained.
 - vi) Perform finish rolling to eliminate equipment marks and to provide a smooth, uniform, and tightly knit finished surface texture.
 - vii) Final rolling must be complete before the mat temperature drops to 80 °C.
 - viii) For areas inaccessible by rollers, use an acceptable vibratory plate compactor or hand tamper to compact the asphalt concrete. A small amount of water may be sprayed on the asphalt surface to aid in compaction using a vibratory plate compactor or hand tamper.

3.38 Joints

.1 Transverse Joints

- a) Plan the length of spreading to provide for a minimum 1 m offset of transverse joints in successive lifts and adjacent mats.
- b) Transverse joints shall be straight, have a vertical face painted with tack coat before placement of the adjacent mat, be thoroughly compacted, and shall meet surface tolerances.

.2 Longitudinal Joints

- a) Plan mats so that the surface longitudinal joint will be offset by a maximum of 150 mm from the centre of an indicated marking line between traffic lanes. The joint may be located in the centre of a traffic lane only where authorized by the City.
- b) Plan the width of spreading to provide for a minimum offset of 150 mm, in a dovetail pattern, of longitudinal joints is successive lifts.
- c) Create longitudinal joints while the edge temperature of the first of two adjacent mats is above 80 °C.
- d) Allow a 25 to 50 mm overlap between mats.

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- e) Upon placing two adjacent mats, roll a 150 mm wide strip along the adjoining edge. Roll the edge immediately to ensure bonding while the joint temperature is above 80 °C.
- f) For surface lifts in arterial, commercial, and collector roadways where the adjacent mat can not be placed before the joint temperature drops below 80 °C, carefully roll off the edge of a mat. Trim off the rolled asphalt to a width of 150 mm to provide a clean vertical face to the full depth of the mat. Paint the exposed face with tack coat immediately prior to placing the adjacent mat.
- g) Longitudinal joints shall be thoroughly compacted and meet surface tolerances.

3.39 Tolerances

.1 Smoothness, Grade, and Texture

The maximum variation under a 3 m straightedge shall be as follows:

- a) Longitudinal variation (parallel to direction of travel) ± 3 mm; and
- b) Transverse variation (transverse to direction of travel) ± 6 mm.
- c) The finished grade elevation shall be within 6 mm of the design grade elevation.
- d) The finished surface shall have a tightly knit texture, free of visible signs of deficiency, including:
 - i) Segregation;
 - ii) Areas exhibiting excess or insufficient asphalt;
 - iii) Improper matching of joints; and
 - iv) Roller marks, cracking, or tearing.
- e) If any smoothness or grade tolerance is exceeded, or if the surface texture requirements are not met, grind down and resurface defective areas to the satisfaction of the City.

.2 Mat Thickness

- a) In accordance with Article 1.17.6 of these Standards, where the average core thickness deficiency exceeds 6 mm from that specified in Article 3.37.4 e), the City may elect to reject the work. In special cases, the City may elect to accept the work with special provisions of compensation and/or warranty, or accept the work as provided.
- b) Where the mat thickness exceeds that specified, the mat may be accepted, with no special provisions, provided that all other requirements are met.
- c) Where the average core thickness deficiency is greater than 13 mm, grind down and resurface defective areas to the satisfaction of the City.

.3 Density

- a) In accordance with Article 1.17.6 of these Standards, where the average core density for a given pavement area is below that specified in Article 3.37.4g), the City may elect to reject the work represented by that pavement area. In special cases, the City may elect to accept the work with special provisions of compensation and/or warranty, or accept the work as provided.

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- b) Where the mat density exceeds that specified, the mat may be accepted, with no special provisions, provided that all other requirements are met.
- c) Where the mat density is less than 94.0%, grind down and resurface defective areas to the satisfaction of the City.
- d) Where the average core density is below that specified in Article 3.37.4g that area of asphalt concrete placement will be assessed a penalty factor in accordance with the following table:

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Density	Arterial Roads Pay Factor	Collector and Residential Roads Pay Factor	Density	Arterial Roads Pay Factor	Collector and Residential Roads Pay Factor
100.0%	100.0%	100.0%	96.0%	81.8%	90.9%
99.0%	100.0%	100.0%	95.9%	80.9%	90.9%
98.0%	100.0%	100.0%	95.8%	80.0%	89.1%
97.9%	99.1%	100.0%	95.7%	79.1%	88.2%
97.8%	98.2%	100.0%	95.6%	78.2%	87.3%
97.7%	97.3%	100.0%	95.5%	77.2%	86.3%
97.6%	96.4%	100.0%	95.4%	86.2%	85.3%
97.5%	95.5%	100.0%	95.3%	85.2%	84.3%
97.4%	94.5%	100.0%	95.2%	84.1%	83.2%
97.3%	93.6%	100.0%	95.1%	73.1%	82.2%
97.2%	92.7%	100.0%	95.0%	72.0%	81.1%
97.1%	91.8%	100.0%	94.9%	70.9%	80.0%
97.0%	90.9%	100.0%	94.8%	69.8%	78.9%
96.9%	90.0%	99.1%	94.7%	68.7%	77.8%
96.8%	89.1%	98.2%	94.6%	67.5%	76.6%
96.7%	88.2%	97.3%	94.5%	66.1%	75.2%
96.6%	87.3%	96.4%	94.4%	64.5%	73.6%
96.5%	86.4%	95.5%	94.3%	62.8%	71.9%
96.4%	85.5%	94.5%	94.2%	61.0%	70.1%
96.3%	84.5%	93.6%	94.1%	58.3%	68.2%
96.2%	83.6%	92.7%	94.0%	55.0%	65.3%

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96.1%	82.7%	91.8%	< 94.0%	0.0%	0.0%
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3.40 Roadway Signage

- .1 Roadway signage shall be completed as soon as possible following completion of roadway and curb/gutter paving.
- .2 Roadway signage shall be inspected during the City’s Construction Completion Certificate inspection and Final Acceptance Certificate inspection. The Developer is responsible for correcting any noted deficiencies before the City will issue the applicable certificate.
- .3 During the Warranty Period, the Developer shall be responsible for sign maintenance. The following table outlines the required maintenance response times, in working days, to be observed by the Developer:

Sign Description	Problem Description	Maximum Response Time For Temporary Sign Installation	Maximum Response Time For Repair Following Temporary Sign Installation
<i>Regulatory:</i> RA-1 RA-2 RB-1 etc.	Missing, damaged or knocked down - unreadable	24 hours	5 days
Regulatory	Damaged but clearly visible by driver	7 days	10 days
Street Name	Missing, damaged or knocked down Unreadable	5 days	5 days
Street Name	Damaged but clearly visible by driver	7 days	10 days
<i>Information:</i> IC-16 IC-10 ID-31 etc.	Missing	72 hours	10 days
Information	Damaged but clearly visible by driver	5 days	14 days
<i>Warning:</i> WA-1 WA-8 WA-5 etc.	Missing, damaged or knocked down	72 hours	10 days
Warning	Damaged but clearly visible by driver	5 days	7 days
Miscellaneous	Missing, damaged or knocked down	7 days	14 days

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3.41 Pavement Marking**.1 General**

- a) The Contractor shall assume all costs resulting from the use of patented materials, equipment, devices, or processes used on or incorporated in the Work, agrees to indemnify and save harmless the purchaser and his duly authorized representatives from all suits at law, or action of every nature for or on account of the use of any patented materials, equipment, devices or processes.
- b) All conflicting markings shall be removed (surface only or removed and filled) prior to the roadway opening with new marking placement.
- c) Do not apply markings until pre-markings have been approved by the City.
- d) Prior to commencing any work on a roadway, the contractor shall obtain all required On Street Construction Permits from the City.
- e) Contractor shall install temporary pavement markings prior to roadway opening with paint in accordance with section 3.22. Prior to FAC of the road, the contractor shall install permanent thermoplastic pavement markings in accordance with section 3.22.

.2 Pre-Marking

- a) Pre-marking must be done on a clean, dry pavement surface with pre-marking paint.
- b) Pre-marking shall be within 100mm accuracy of plan dimensions and indicate straight lines and smooth curves

.3 Traffic Control and Work Area

- a) The Contractor shall, at all times, provide warning and passage for all users of the pathway within the area of the Work. The Work shall be carried out as quickly as possible to prevent excessive delay and inconvenience.
- b) Vehicle movement shall not be permitted over applied markings until they have adequately hardened or dried.

.4 Workmanship

- a) Install painted pavement markings on a clean, dry pavement surface.
- b) Remove, or remove and fill, any and all conflicting road markings.
- c) Spraying will not be permitted during high wind conditions, or other adverse weather conditions.
- d) Faulty markings must be removed and replaced within 5 working days.
- e) The Contractor shall minimize overspray as much as possible.
- f) Contractor shall remove any spillage or overspray.

.5 Thickness Tolerances

- a) Cold Plastic Markings:

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- i) Surface Applied: 3 mm thick.
 - ii) “Scratch” / Inlaid Applied = 2 mm grind / 3 mm above surface.
 - iii) Where deficiencies occur in the work, involving average thicknesses greater than 3.0 mm or less than 1.8 mm, the Inspector may order removal and replacement or application of additional material.
 - iv) If surface dishing deeper than 0.5 mm occurs, the Inspector may order removal and replacement of material. Variations in asphalt surface profile may be taken into consideration.
- b) Thermoplastic Markings:
- i) Surface Applied: 3 mm thick.
 - Where deficiencies occur in the work, involving average thicknesses greater than 3.0 mm or less than 1.8 mm, the City may order removal and replacement or application of additional material.
 - If surface dishing deeper than 0.5 mm occurs, the City may order removal and replacement of material. Variations in asphalt surface profile may be taken into consideration.
 - ii) Inlaid Applied:
 - Longitudinal Markings: 5 mm Grind (below asphalt) / 2 mm above asphalt.
 - Transverse Markings: 10 mm Grind (below asphalt) / 2 mm above asphalt.
 - Where grind depth is less than 70 % specified, the City may order removal, re-grinding of asphalt and re-fill material.
 - If surface dishing is greater than 0.5 mm, the City may order the removal and replacement of material or additional material. Variations in asphalt surface may be taken into consideration.

3.42 Rejected Work

- .1 Completely remove and replace rejected work to the limits specified by the City.

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4.0 CURBS, GUTTERS, AND SIDEWALKS

PART I – DESIGN

4.1 General

- .1 Through the Area Structure Plan process, all sidewalk and walkway requirements will be established through cooperation between the Developer and the City's Engineering and Development Department.

4.2 Sidewalks and Walkways

- .1 Sidewalks and walkways through residential areas, commercial areas, and parks shall form an integrated pedestrian circulation system through the Development.
- .2 For all roadways, unless otherwise authorized or directed by the City, road-separated sidewalks will be located in accordance with the Engineering Standard Drawings in Appendix A.
- .3 Sidewalks shall be provided on both sides of the roadway. Consult the City for the site-specific sidewalk requirements commercial areas.
- .4 For cul-de-sacs, sidewalks are required as follows:
- a) Cul-de-sacs with a walkway connection through a public utility lot require a sidewalk on one side of the roadway. (The connection from the PUL to the para ramp may be monolithic.)
- .5 The Design should consider pedestrian access and allow for walkways through cul-de-sacs and other locations, as appropriate.
- .6 Sidewalks and concrete walkways shall be 1.5 m wide with a maximum grade of 6% longitudinally, 2% in the crossfall direction, and in accordance with the Engineering Standard Drawings in Appendix A.
- .7 All trails, shall be constructed of asphalt concrete in accordance with the Engineering Standard Drawings in Appendix A. Asphalt concrete shall meet the applicable articles of Section 3.0.
- .8 All trails are to be constructed to a width of 3.0 metres in width.
- .9 The horizontal alignment of sidewalks along roads shall be parallel to the centreline of the right-of-way wherever possible.
- .10 Sidewalk and walkway grading shall be done in accordance with the lot grading plan and shall be done in such a way as to avoid conflicts with the drainage pattern within the right-of-way. Walkway landings shall be provided in accordance with the following table.

Slope (%)	Maximum Length (m)	Maximum Height (mm)	Landings Required
≤ 5.00	N/A	N/A	N/A
5.00 to 6.0	12.0	750	Every 12 m

- .11 Changes in grade shall be gradual.

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- .12 No sidewalk or walkway shall be used as a drainage swale.
- .13 Paraplegic ramps shall be provided at all intersections with walkway access in accordance with the Engineering Standard Drawings in Appendix A.
- .14 Pedestrian protection (i.e. trees, shrubs, bollards, etc.) may be required at the intersection of primary walkways/trails and roadways, as directed by the City.
- .15 The City may require that benches, waste receptacles, and other street furniture be strategically placed along certain sidewalks or walkways.

4.3 Curb and Gutter

- .1 For all roadways, concrete curb and gutter shall be provided in accordance with the Engineering Standard Drawings in Appendix A.
- .2 Vertical face curb and gutter shall be provided along all roadways fronting parks and public utility lots (except for emergency accesses) unless other means of protecting vehicular access into these lands is provided. Curb access for City maintenance equipment must be provided, complete with staggered T-Bollards.
- .3 Where a transition section is required between differing types or sizes of curbs and gutters, the engineering drawings must include a detail showing how the transition is to be constructed.
- .4 Curb Returns
 - a) For local and collector roadway intersection curb returns, the minimum curb radius shall be based upon the vertical turning movement for the anticipated traffic, vehicle capacity analysis, and speed reduction. Typically, this will require a minimum radius 10 m for local roadway intersections where the road will not be a bus or truck route, and 15 m for all other collector and arterial roadway intersections.
 - b) If required the transition should occur at the para-ramps from straight face to rolled face.
 - c) Curb returns on local commercial roadways, collector roadways, and arterial roadways shall be constructed with a minimum radius of 15.0 m to accommodate truck turning movements.

PART II – MATERIALS**4.4 Portland Cement Concrete / Fillcrete**

- .1 Portland Cement
 - a) Portland cement shall conform to CAN/CSA-A3000-A5, Type GU.
- .2 Aggregate
 - a) Aggregate shall conform to CAN/CSA-A23.1 Clause 5.
 - b) Coarse aggregate is the total aggregate retained on a 5 mm sieve. Fine aggregate is the total aggregate passing through a 5 mm sieve and retained on a 2.5 mm sieve.
 - c) Ironstone content in coarse aggregate shall not exceed 1.0% by mass of the total coarse aggregate sample.

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- d) Ironstone content in fine aggregate shall not exceed 1.5% by mass of the total, dry, unwashed fine aggregate sample.
 - e) Where ironstone content testing results are greater than the maximum specified ironstone content, the concrete represented by the failed test shall be removed and replaced by the Contractor, at the Contractor's sole expense.
- .3 Water
- a) Water shall be clear, free from deleterious material that may inhibit proper mixing and curing of concrete, and in accordance with CAN/CSA-A23.1 Clause 4.
- .4 Air-Entraining Admixtures
- a) Air-entraining admixtures shall conform to ASTM-C260.
- .5 Chemical Admixtures
- a) Chemical admixtures, including water-reducing agents, retarders, and accelerators, shall conform to ASTM-C494.
 - b) The use of chemical admixtures shall only be permitted upon written authorization of the City.
- .6 Fly Ash
- a) Fly ash shall conform to CAN/CSA-A3000, A23.5, pozzolan Type F or Type Cl.
 - b) Up to 10% of the specified minimum cement content may be replaced with fly ash for concrete production between May 16 and September 30.
- .7 Curing Compound
- a) Curing compound shall conform to ASTM-C309, Type 2, Class B, white pigment, resin-based, liquid membrane-forming compound.
- .8 Joint Filler and Sealant
- a) Preformed joint filler shall conform to ASTM-D1751.
 - b) Joint sealant shall conform to ASTM-D1190, hot-poured elastic type.
- .9 Mix Design
- a) The mix design shall conform to the following:
 - i) Slump: 60 ± 20 mm;
 - ii) Entrained air limits: 5.5% - 8.0% by volume;
 - iii) Maximum aggregate size: 20 mm;
 - iv) Maximum water to cementing materials ratio: 0.45 by mass;
 - v) Minimum cement content:
 - 335 kg/m³ between April 15 and May 15 or between October 1 and October 15; or
 - 302 kg/m³ between May 16 and September 30.
 - vi) Maximum fly ash content:

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- None between April 15 and May 15 or between October 1 and October 15; or
 - 33 kg/m³ between May 16 and September 30.
- vii) Minimum 28-day compressive strength:
- 30 MPa for air content 5.5% to 8.0%;
- b) If concrete is to be placed by pumping, the specified slump and air content shall be met at the point of pump discharge.
- c) Concrete shall not be placed between October 16 and April 1 unless written authorization has been issued by the City. All concrete authorized to be placed during this period shall attain a minimum compressive strength of 27.0 MPa at 7 days, and shall be provided with cold-weather protection, in accordance with CAN/CSA-A23.1 Clause 23.2.3.4, sufficient to maintain concrete surface temperatures 10 °C or greater for 7 consecutive days following placement.
- d) For slip formed concrete, limit slump as follows:
- i) For curbs and gutters: 20 ± 10 mm; and
 - ii) For walks: 30 ± 10 mm.
- e) Type HE or Type HS cement may be substituted for Type GU cement upon the written acceptance of the City. Type HS cement may only be authorized for use between May 16 and September 30.
- .10 Fillcrete
- a) Supply fillcrete in accordance with the following table:

Compressive Strength at 28 Days (MPa)	Slump (mm)	Entrained Air (% by volume)	Maximum Aggregate Size (mm)	Minimum Cement (kg/m ³)
Minimum 0.15	100 ±25	Minimum 6.0	5	30
Maximum 0.40		Maximum 8.0		

- b) Portland Cement to CAN/CSA-A3000, A3001-03 of the following types, Type 10, Type 30 or Type 50.
- c) Fine Aggregate to CSA-A23.1, Clause 5.3.2 Table 1.
- d) Water to CAN/CSA-A23.1 Clause 4.2.2, clear free from injurious amounts of oil, acid, alkali, organic matter, sediment or other substances harmful to the mixing and curing of concrete.
- e) Air-Entraining Admixtures: to ASTM C260.

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- f) Chemical Admixtures: to ASTM C494 including water-reducing agents, retarders and accelerators. Chemical admixtures shall not be used unless permitted in writing from the City.
 - g) Fly Ash: to CAN/CSA-A3001-03 pozzolan type C.

4.5 Concrete Formwork**.1 Formwork Materials**

- a) Formwork materials shall be in accordance with CAN/CSA-S269.3; plain, reusable, pre-coated plywood sheets or formed steel panels.
- b) The use of forms that are dented, rough, out of shape, or otherwise unsuitable shall not be permitted.
- c) The use of earth forms is prohibited, except where specifically authorized by the City.

.2 Falsework Materials

- a) Falsework materials shall be in accordance with CAN/CSA-S269.1.

.3 Form Ties

- a) Form ties shall be removable or snap-off metal ties, fixed or adjustable length, and free of devices which may leave holes larger than 25 mm diameter in the concrete surface.

.4 Form Release Agents

- a) Form release agents shall be chemically active agents containing compounds that react with free lime in concrete resulting in water insoluble soaps.

.5 Void Forms

- a) Void forms, where required, shall be inert closed cell expanded polystyrene.
- b) “Frost Cushion” by Beaver Plastics, or accepted alternate by City.

.6 Form Stripping Agent

- a) The form stripping agent shall be colourless mineral oil, free of kerosene, with viscosity between 15 and 24 mm²/s at 40 °C, flashpoint minimum 150 °C, open cup method.

.7 Slipform Equipment

- a) Slipform equipment shall be of a design suitable to the Work, suitable for use with vibratory equipment, and capable of uniformly extruding, spreading, shaping, and consolidating freshly poured concrete into a dense, homogeneous formation.
- b) The equipment shall be self-propelled and capable of automatically controlling alignment and grade.

4.6 Reinforcement

Reinforcing for concrete structures, where required, shall conform to the following:

.1 Reinforcing Steel

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- a) Reinforcing steel shall be grade 400, billet steel, deformed bars in accordance with CAN/CSA-G30.18, unless otherwise specified or directed by the City.
 - b) Weldable, low alloy steel deformed bars, where specified, shall duly conform to CAN/CSA-G30.18.
- .2 Tie Bars
- a) Tie bars shall be grade 300, billet steel, uncoated, deformed bars in accordance with CAN/CSA-G30.18, unless otherwise specified or directed by the City.
 - b) Epoxy-coated tie bars, where specified, shall conform to ASTM-D3963.
- .3 Steel Dowels
- a) Steel dowels shall be clean, straight, free of flattened or burred ends, uncoated and in accordance with CAN/CSA-G30.18.
 - b) Epoxy-coated tie bars, where specified, shall conform to ASTM-D3963.
- .4 Cold-Drawn Steel Wire
- a) Cold-drawn steel wire shall be uncoated and in accordance with CAN/CSA-G30.3M.
 - b) Epoxy-coated cold-drawn steel wire, where specified, shall conform to ASTM-D3963.
- .5 Welded Steel Wire Fabric
- a) Welded steel wire fabric shall uncoated and in accordance with CAN/CSA-G30.5M.
 - b) Epoxy-coated welded steel wire fabric, where specified, shall conform to ASTM-D3963.
- .6 Tie Wire
- a) Tie wire shall be cold-drawn, annealed steel in accordance with CAN/CSA-G30.3.
- .7 Epoxy Coatings
- a) Epoxy coatings shall be in accordance with ASTM-D3963.
- .8 Galvanizing
- a) Galvanizing shall be in accordance with CAN/CSA-G164.
- .9 Plain Round Bars
- a) Plain round bars shall be in accordance with CAN/CSA-G40.21.
- .10 Chairs, Bolsters, Bar Supports, and Spacers
- a) Chairs, bolsters, bar supports, and spacers shall be suitable for strength and support of reinforcing and live loads during construction.

PART III – CONSTRUCTION

4.7 General

- .1 The following articles represent the minimum requirements for some typical, key construction procedures for sidewalk, curb, and gutter construction. These minimum requirements must be met or exceeded by the detailed construction specifications and drawings developed by the Consultant.

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- .2 Construction activities must adhere to the provisions of the Erosion and Sediment Control Plan prepared for the Development in accordance with Article 1.10.2.

4.8 Quality Assurance

- .1 Refer to Article 3.24 of these Standards.

4.9 Quality Control Testing

- .1 The Contractor shall retain the services of independent testing laboratories or agencies to conduct all quality control testing. The proposed testing laboratory or agency shall be subject to the acceptance of the City.
- .2 The City may at any time require the Contractor to provide evidence of certification by the testing agency the materials and performance of the work meet these Standards.
- .3 Minimum quality control test frequencies, specified as follows, are the minimum number required. The Contractor shall ensure that as many tests as necessary are performed to ensure that the work conforms to the requirements of these Standards, regardless of the minimum number specified.
- a) Moisture Density Curves (ASTM-D698): Refer to Article 3.25
 - b) Sieve Analyses (ASTM-C136): Refer to Article 3.25
 - c) Field Densities (ASTM-D2169 or ASTM-D2922): Refer to Article 3.25

Note: The contractor must be prepared to provide the following test results if requested by the City of Wetaskiwin.

- d) Portland Cement Concrete Testing:
 - i) Abrasion test, soundness test, sieve analysis, and crushed face count for each aggregate source.
 - ii) Plant inspections, materials sampling, and testing as follows:
 - Weekly concrete plant inspections during production will be conducted to verify plant calibrations, operation, production settings, and handling procedures. Samples of materials and mixtures will be taken and tested.
 - Slump testing, to CAN/CSA-A23.2-1C and CAN/CSA-A23.2-5C, to be taken between the 10% and 90% points of discharge of a concrete load, and conducted with every strength test, or as directed by the City.
 - Air content testing, to CAN/CSA-A23.2-1C and CAN/CSA-A23.2-4C or CAN/CSA-A23.2-6C, to be taken between the 10% and 90% points of discharge of a concrete load, and conducted with every strength test, or as directed by the City.
 - Ironstone content testing shall be conducted with every strength test, or as directed by the City.
 - Strength testing, to CAN/CSA-A23.1-9C and CAN/CSA-A23.2-2C, to be taken at a minimum frequency of one test for each 60 m3 of concrete, or fraction thereof, in any one day, or as directed by the City.
 - Cores, as necessary, to verify the finished concrete thickness.

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- A minimum of one (1) sieve analysis, to ASTM-C136, and crushed face count for every 1,000 tonnes of aggregate used in concrete production.
 - Conduct a complete petrographic analysis of the fine and coarse aggregate for the proposed mix design and provide results of abrasion loss, MgSO₄ soundness loss, cement-aggregate reactivity, and ironstone content testing.
- iii) All testing shall be performed by a technician certified by CSA or ACI.
- e) Fillcrete Testing (Unshrinkable Fill)
- i) The Contractor shall provide to the City a mix design and quality control test results from the supplier.
 - ii) The City shall be notified and the Contractor shall resubmit to the City a mix design whenever there is a change in materials, sources or proportions.
 - iii) Erg Slump Test: to CSA-A23.2-1C and CSA-A23.2-5C. Slump tests shall be taken between 10% and 90% points of discharge of a load with every strength test and as required by the City.
 - iv) Air Content test; to CSA-A23.2-1C and CSA-A23.2-4C. Air content tests shall be taken between 10% and 90% points of discharge of a load with every strength test and as required by the City.
 - v) Strength Tests: to CSA-A23.2-3C and CSA-A23.2-9C. Standard strength tests shall be conducted at a frequency of not less than one strength test per day per supplier, or as required by the City. The result of each compressive strength test shall be within the specified compressive strength range.

4.10 Site Preparation

- .1 Prepare the site in accordance with Article 3.26 of these Standards.

4.11 Clearing

- .1 Conduct clearing in accordance with Article 3.27 of these Standards.

4.12 Grubbing

- .1 Complete grubbing in accordance with Article 3.28 of these Standards.

4.13 Topsoil Stripping and Stockpiling

- .1 Strip and stockpile topsoil in accordance with Article 3.29 of these Standards.

4.14 Excavation

- .1 Complete any necessary excavation in accordance with Article 3.30 of these Standards.

DRAFT – FOR INFORMATION ONLY**4.15 Fill and Grade**

- .1 Fill and grade the area in accordance with Article 3.31 of these Standards.

4.16 Shallow-Buried Utility Trenches

- .1 Backfill and compact shallow-buried utility trenches in accordance with Article 3.32 of these Standards.

4.17 Sub-grade Preparation

- .1 Complete sub-grade preparation in accordance with Article 3.33 of these Standards.

4.18 Base Course

- .1 Construct any required base course in accordance with Article 3.34.

4.19 Protection of Prepared Base

- .1 Protect prepared surfaces in accordance with Article 3.35.

4.20 Formwork

- .1 Fabrication and Erection
 - a) Verify lines, levels, centres, and dimensions against the construction drawings prior to proceeding with fabrication and erection of formwork and falsework.
 - b) Fabricate and erect falsework in accordance with CAN/CSA-S269.1.
 - c) Fabricate and erect formwork in accordance with CAN/CSA-S269.3 in such a manner to produce finished concrete conforming to the shapes, dimensions, locations, levels, and tolerances specified herein and required by CAN/CSA-A23.1.
 - d) Align form joints and make watertight. Lay out forms in such a manner to minimize the number of form joints.
 - e) Do not place shores or mud sills on frozen ground. Provide suitable drainage through the site to prevent washout of soil supporting mud sills and shores.
 - f) Use 25 mm chamfer strips on exterior corners and 25 mm fillets on interior corners of concrete members, unless otherwise specified or directed by the City.
 - g) Form chases, slots, openings, drips, recesses, and expansion and control joints where required.
 - h) Build in anchors, sleeves, and other inserts as required. Ensure that anchors and inserts are installed such that they will be flush with the finished concrete surface.
- .2 Slipforming
 - a) Set and maintain a grade line by establishing a taut string or wire line, set against the survey control datum.
 - b) Provide stable support for the traveling slipform machine.
 - c) Protect adjacent work and property from damage. Repair any damaged caused during the performance of the Work to the satisfaction of the City, at the sole cost of the contractor..

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- d) Coordinate concrete delivery and placement to maintain uniform advancement of the slipforming operation without interruption. If progress is interrupted at any time, immediately suspend vibrating and tamping.
 - e) Maintain adequate slump to prevent slipformed concrete from sagging.
 - f) Slipformed surfaces shall be smooth, dense, and free of pockets and honeycombing.
 - g) Correct minor irregularities in the slipformed finish using hand finishing methods.
 - .3 Form Removal
 - a) Strip forms within 48 hours of concrete placement to facilitate finishing operations.
 - b) Re-shoring to remove forms shall be done in accordance with CAN/CSA-S269.1.
 - .4 Hand-Forming
 - a) Hand-form and place concrete at corners, curb crossings, and catch basins concurrent with slipforming operations. Where such concurrent work is impractical, complete hand-form areas within 7 days of slipforming adjacent work.
- 4.21 Reinforcing**
- .1 Fabrication, Shipping, and Handling
 - a) Fabricate reinforcing steel in accordance with CAN/CSA-A23.1 and ACI-315 – Details and Detailing of Concrete Reinforcement.
 - b) Protect epoxy- and paint-coated portions of bars with adequate covering during shipping and handling.
 - .2 Field Bending and Welding
 - a) Field bending and welding is not permitted.
 - b) Weld reinforcement in accordance with CAN/CSA-W186.
 - c) Field bending shall be performed without the use of heat, by applying slow and steady pressure.
 - d) Remove and replace any bars that develop cracks or splits.
 - .3 Placing Reinforcement
 - a) Place reinforcement in accordance with applicable shop drawings and CAN/CSA-A23.1.
 - b) Place sufficient chairs, tie wires, and supports to adequately maintain the position of the reinforcement during placement of the concrete, in accordance with the tolerances provided by the referenced CAN/CSA guidelines.
 - c) Use plain round bars as slip dowels in concrete where required. Apply asphalt paint to the end of the dowel intended to move with the hardened concrete. When the paint is dry, apply a coat of mineral lubricating grease.
 - d) The Consultant shall inspect reinforcement placement before concrete placement is permitted.
 - e) Ensure sufficient cover is achieved over reinforcement when placing concrete.

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- f) Reinforcing steel, anchor bolts, or other inserts shall not be inserted during concrete placement.
- .4 Field Touch-Up
- a) Touch-up all damaged and cut ends of epoxy-coated, painted, or galvanized reinforcing with compatible finish to provide a continuous finish.
- 4.22 Paving**
- .1 Concrete Delivery
- a) Concrete delivery shall be in accordance with CAN/CSA-A23.1 Clause 18.4.
 - b) Rotating drum trucks, capable of adequately agitating and mixing the concrete during transport, shall be used for concrete delivery.
 - c) Rotate the drum at mixing speed for at least 3 minutes immediately before discharge.
 - d) Retempering
 - i) Retemper the concrete mixture with water at the site when slump at the point of initial discharge is less than that specified, and only upon authorization of the Consultant.
 - ii) Retemper the concrete mixture with air-entraining admixtures at the site when entrained air in the concrete at the point of initial discharge is less than that specified, and only upon authorization of the Consultant. Only City-accepted air-entraining admixtures shall be used. A qualified technician shall coordinate the retempering process at the site. Only one opportunity shall be granted to retemper any one load to meet the required air content. If retempering fails to meet the specifications, the load shall be rejected. A load of concrete that has been rejected following a failed attempt at retempering with air-entraining admixtures shall not be retempered at the concrete plant and subsequently returned to the site for use in the Work.
 - iii) If the need for retempering with water or air-entraining admixtures becomes consistent, the Consultant or City may refuse to accept concrete loads that have been retempered, and may require the Contractor to revise the mix design accordingly before concrete production can continue.
 - e) On-site mix adjustments with cementitious materials, sand aggregate, or any chemical admixtures, other than air-entraining admixtures and superplasticizers, is strictly prohibited, unless authorized by the City in writing.
 - f) The use of air de-entraining admixtures, or any other chemical admixtures, including water-reducing agents, retarders, and accelerators, is strictly prohibited, unless authorized by the City in writing.
 - g) Where the ambient temperature is greater than 23 °C, the maximum concrete mix temperature shall not exceed 30 °C at the time of placement. If the concrete mix temperature exceeds 30 °C at the time of placement, all such concrete represented by that load shall be rejected.
 - h) Where the ambient temperature is less than 5 °C, the concrete mix temperature shall be between 15 °C and 30 °C at the time of placement. If the concrete mix temperature is

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outside of these specified limits at the time of placement, all such concrete represented by that load shall be rejected.

- i) Completely discharge the concrete load within 90 minutes of initial mixing of water, cement, and aggregate at the plant. The discharge time may be extended to up to 120 minutes with the use of hydration control admixtures, where accepted by the City. The supplier must submit sufficient evidence that the plastic concrete properties (slump, air content, and temperature) can be maintained through the extended discharge time period. Such evidence must be submitted for City review and acceptance at least ten (10) days in advance of scheduled concrete work at the site.
- j) Provide the Consultant with a delivery ticket for each concrete load, clearly indicating the following information:
 - Concrete supplier;
 - Concrete plant location;
 - Ticket number;
 - Truck number;
 - Mechanical date and time stamp of initial plant mixing;
 - Mix design identification;
 - Cement type;
 - Aggregate size;
 - Type and amount of admixtures;
 - Volume of water added;
 - Volume of concrete;
 - Site arrival time;
 - Start and end of discharge times; and
 - Any other information that may reasonably be requested by the City.

.2 Concrete Placement

- a) Place concrete in accordance with CAN/CSA-A23.1.
- b) Thoroughly clean all reinforcement and formwork before placing concrete.
- c) Moisten the sub-grade or sub-base surface, reinforcement, and formwork with water prior to placing concrete to minimize absorption of water from the concrete following placement.
- d) Do not place concrete during a rain event, when a rain event is imminent, nor when the weather is unsuitable for concrete placement.
- e) Pour concrete continuously and rapidly between predetermined construction joints to the approval of the Engineer.
- f) Use pencil vibrators for curb and gutter, and vibrating screeds for walks.
- g) Continuously place concrete for the duration of the scheduled pour. Arrange concrete delivery such that the discharge interval between loads is less than 30 minutes. Install a construction joint where the discharge interval exceeds 30 minutes.
- h) Curblines, curbs, curb ramps, and curb crossings shall be poured monolithically. The use of dowels and joint sealant at the back of the curb is strictly prohibited.

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- i) Curb and gutter shall be constructed in accordance with the Engineering Standard Drawings in Appendix A.
- j) Sidewalk shall be constructed in accordance with the Engineering Standard Drawings, in Appendix A.
- k) Sidewalk rehabilitation shall be constructed in accordance with the Engineering Standard Drawings, in Appendix A.

4.23 Finishing

- .1 Finishing
 - a) Perform initial and final concrete surface finishing in accordance with CAN/CSA-A23.1.
 - b) The finished concrete surface shall be glare-free and slip resistant.
 - c) The use of water to facilitate finishing operations is strictly prohibited. To aid in concrete finishing, the surface may be fogged with an evaporation reducer acceptable to the City.
 - d) Protect the work area from rain to avoid excessive moisture on the unfinished surface.
 - e) Finishing shall be performed by, or under the direction of, qualified concrete finishers.
- .2 Tool all edges to a width of 50 mm and round all edges to a 6 mm radius, unless otherwise specified or directed by the City.
- .3 Apply a brush final finish longitudinally along curb and gutter. Apply a brush final finish transversely along walks. Broom finish as follows:
 - a) Use a brush with nylon bristles that can form surface grooves no deeper than 3 mm.
 - b) Remove excess water from the brush bristles prior to brushing.
 - c) Brush in a uniform pattern over the entire surface in the specified direction.
- .4 For sidewalks, stamp the Contractor's name and year of construction in the plastic concrete at the limits of construction for each stage of the Development. Sidewalks must be also imprinted with "CC" and "CO" stamps, indicating the location of the curb valve for the water service and the location of the 3rd pipe cleanout for the storm service to each lot. In the case where there is no walkway in front of a lot, the stamps shall be placed on the top of the curb.

4.24 Crack-Control Joints

- .1 Crack-control joints are intended to control the location of shrinkage cracks in hardening concrete. Construct joints in accordance with the following:
 - a) Formed Joints
 - i) Form the groove by inserting a metal or fibre strip, or polyethylene film into the plastic concrete.
 - ii) Finish the edges to a 6 mm radius.
 - iii) Remove the insert immediately following the initial set of the concrete.
 - iv) Seal the joint with an acceptable sealant.
 - b) Tooled Joints

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- i) Form the groove by hand using a jointing tool with a thin metal blade to impress a plane of weakness into the plastic concrete.
 - ii) Finish the edges to a 6 mm radius.
 - iii) Seal the joint with an acceptable sealant.
 - .2 Joints shall be 3 to 5 mm wide at the following depths:
 - a) Minimum 50 mm deep to a maximum of 25% of the gutter depth for curb and gutter; and
 - b) Minimum 25 mm deep to a maximum of 25% of the walk thickness for walks.
 - .3 Joint spacing shall be a maximum of 3 m.
 - .4 Surface Dummy Joints
 - a) 5 mm wide by 10 mm deep and centered between contraction joints across walks.
 - b) For monolithic construction, place surface joints across the walk portion and contraction joints on the curb and gutter, both joints being on the same side.
 - c) Place a longitudinal joint on walks continuing through crossings where required.

4.25 Isolation Joints

- .1 Isolation joints are required next to immovable structures, where indicated on the construction drawings, and where directed by the Consultant or the City.
- .2 Construct the joint by sawing or forming to create a clean break through full cross-section of the concrete member.
- .3 Make the joint wide enough to allow a snug fit for the pre-formed joint filler.
- .4 Alternatively, place pre-formed joint filler against the structure and pour the concrete against the filler.

4.26 Construction Joints

- .1 Construction joints are required between concrete pours or for joining new concrete to existing concrete.
- .2 Review and confirm the location of all construction joints prior to commencing construction.
- .3 Construct the joint with a keyway, dowels, or tie bars as required.
- .4 Vertically trim existing concrete by sawcutting at least 50 mm deep and breaking.
- .5 Transverse Construction Joints
 - a) Use 10M deformed tie bars at 300 mm spacing, extending minimum 300 mm into both sides of the joint.
 - b) At the end of a joint pour, vary joint spacing as follows:
 - i) Where a joint pour ends within 300 mm of a required joint location, equally space the last two joints; and
 - ii) Where a joint pour ends within 800 mm of a required joint location, equally space the last three joints.

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- .6 Longitudinal Construction Joints
 - a) Use 10M deformed tie bars at 1,000 mm spacing, extending minimum 300 mm into both sides of the joint.
 - .7 Leave the joint in place until the concrete has set, then carefully remove the joint form to avoid damaging the fresh concrete.
 - .8 Finish the edges to a 6 mm radius.
 - .9 Roughen all formed construction joints to expose the aggregate of the hardened concrete. The Contractor may elect to apply a suitable retardant to the forms of the construction joint, and remove retarded surface mortar using low-pressure water jets or stiff brushes.

4.27 Sidewalk Joints Abutting an Existing Curb

- .1 Form a 10 mm wide by 30 mm deep slot between the back of the curb and the walk.
- .2 Fill the slot with an acceptable joint sealant.

4.28 Protection

- .1 Protect freshly placed concrete from freezing, premature drying, adverse weather conditions, tampering, and physical disturbance in accordance with CAN/CSA-A23.1 Clause 21.
- .2 Concrete shall be protected from freezing for a minimum of 4 days following placement, or for the time necessary to achieve 75% of the specified 28-day compressive strength, whichever is greater.

4.29 Curing

- .1 Membrane Curing
 - a) Membrane curing is required when the maximum daily air temperature is not expected to exceed 5 °C for 72 hours following concrete placement.
 - b) Cure exposed concrete surfaces using an acceptable curing compound applied with a pressurized spray nozzle.
 - c) Apply a continuous and uniform coating of the compound over the surface. Follow compound manufacturer's instructions for the optimal application dose rate.
- .2 Moist Curing
 - a) Moist curing shall only be used where directed by the City.
 - b) After the concrete has set, maintain a moist condition on the concrete surface by using wet burlap or polyethylene film over the surface for a minimum of 7 days.

4.30 Backfilling

- .1 Use only suitable excavated or borrow material for fill.
- .2 Backfill behind curb when appropriate for concrete placement and no later than 7 days. Backfill a minimum 300 mm width behind the curb in two 150 mm lifts. Compact each lift with mechanical tampers to a minimum 95% Standard Proctor Density. Backfill to the top of curb elevation, unless walk construction immediately follows.

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- .3 Backfill along the edge of the walk immediately following removal of formwork. Provide sufficient depth for topsoil placement as specified or directed by the City. Compact backfill a minimum of 300 mm out from the walk edge with mechanical tampers, to a minimum 98% Standard Proctor Density.

4.31 Tolerances**.1 Concrete****a) Surface Temperature**

- i) In accordance with Article 1.16.6 of these Standards, where the concrete surface temperature is found to be less than 0 °C during curing time, the City may elect to reject the work. In special cases, the City may elect to accept the work with special provisions of compensation and/or warranty, or accept the work as provided. The application of such shall apply to the area or extents represented by, or measured by, field testing.
- ii) Where the surface temperature is found to be less than 0 °C within 48 hours following placement, remove and replace defective areas to the satisfaction of the City.

b) Slump

- i) Where the measured slump from any load is determined to be deficient from that specified, a second test shall be performed on another portion of the same load. If the second test fails, the load will be rejected and the Contractor shall remove any portion of that load that may already have been poured.

c) Air Content

- i) For concrete where the air content is found to be less than specified, the City may authorize retempering of the concrete as defined in Article 4.22.1d).
- ii) For air content less than 4.0, no retempering shall be permitted and the load will be rejected. The Contractor shall remove any portion of that load that may already have been poured.

d) Strength

- i) In accordance with Article 1.16.6 of these Standards, where the concrete strength is found to be less than the minimum specified requirement, the City may elect to reject the work. In special cases, the City may elect to accept the work with special provisions of compensation and/or warranty, or accept the work as provided. The application of such shall apply to the area or extents represented by, or measured by, field testing.
- ii) Where the concrete strength is found to be less than 85% of the minimum specified requirement, remove and replace defective areas to the satisfaction of the City.
- iii) The Developer may, at its sole expense, elect to provide evidence of strength by coring and testing to CAN/CSA-23.2-14C, by a qualified independent testing agency, within 7 days of a failed 28-day cylinder test or within 3 days of a failed 7-day cylinder test. Three cores shall be drilled from the concrete area

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represented by the failed test at locations reviewed and accepted by the City. The average strength of the three cores will be used in the subsequent application of Article 4.31.1d).

- .2 Walk Surface, Gutter Surface, and Curb Top
 - a) Maximum 5 mm variation under a 3 m straightedge.
 - b) Where the specified tolerance is exceeded, correct such work to the satisfaction of the City.
- .3 Gutter Lip and Walk Grade
 - a) Maximum 5 mm variation from the designated elevation at any station as established from the corresponding survey stake.
 - b) Where the specified tolerance is exceeded, correct such work to the satisfaction of the City.
- .4 Gutter Lip Alignment
 - a) Maximum 10 mm variation over any 30 m section.
 - b) Where the specified tolerance is exceeded, correct such work to the satisfaction of the City.
- .5 Concrete Thickness
 - a) In accordance with Article 1.16.6 of these Standards, where the concrete thickness is found to be less than the minimum specified requirement, the City may elect to reject the work. In special cases, the City may elect to accept the work with special provisions of compensation and/or warranty, or accept the work as provided. The application of such shall apply to the area or extents represented by the core sample(s).
 - b) Where the thickness deficiency is found to be more than 15 mm of the minimum specified requirement, remove and replace defective areas to the satisfaction of the City.

4.32 Rejected Work

- .1 Completely remove and replace rejected work to the limits of the nearest crack control or construction joints.
- .2 All rejected products and work shall be adequately removed from the site and corrected to the satisfaction of the City.

DRAFT – FOR INFORMATION ONLY**5.0 WATER SYSTEM****PART I – DESIGN****5.1 General**

The water system shall be designed with sufficient capacity to convey peak flows. The Design must include hydraulic network analyses for the Development, updated for each subdivision stage. The City shall provide the necessary boundary conditions for the hydraulic analyses. The following *minimum* criteria shall apply to the Design, as applicable to the Development:

- .1 Average and Peak Demands:
 - a) Design Population: Equal to the ultimate estimated population for the design area.
 - b) Population Density for Residential Areas:
 - i) R1 Zoning (Single Dwelling) – 95 persons/ha
 - ii) R2 Zoning (Low Density Residential) – 105 person/ha
 - iii) R3 Zoning (Medium Density Residential) – 230 persons/ha
 - iv) R4 Zoning (High Density Residential) – 250 persons/ha
 - c) 25,000 L/ha/day for Commercial/Institutional.
 - d) Average Day Demand: Design Population x 350 L/capita/day.
 - e) Maximum Day Demand: Average Day Demand x 1.8.
 - f) Peak Hour Demand: Average Day Demand x 3.0.
 - g) Where the Development may have commercial users with appreciable water demands, such shall be duly considered in the hydraulic analyses.
- .2 Fire Demand:
 - a) Fire demand conditions shall be analyzed based on the criteria provided in *Water Supply for Public Fire Protection, A Guide to Recommended Practice*, Fire Underwriters Survey, latest edition.
 - b) For commercial, institutional, and multi-family residential lots with internal fire suppression systems, the Design must include hydraulic analyses to determine the required system configuration and sizes to provide direct flow to the fire suppression systems in combination with hydrant flows.
 - c) The Designer is responsible for satisfying themselves as to the available fire flow to, or near, the site prior to completing the Design. It shall be the Designer's responsibility to complete a hydrant flow test on a nearby hydrant to determine available fire flow. Hydrant flow tests must be coordinated through the City's Utilities department. A copy of the hydrant flow test results must be provided to the City with drawing submissions.

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- d) The Designer must ensure that the City's requirements are met with respect to onsite hydrant requirements based on the type of the proposed development and the layout of the site. The City will provide input in this regard during its review of the Design.
- .3 Water System Looping required:
- a) For all single family developments of 20 or more residential lots.
 - b) For all multi-family and commercial site developments.
- .4 Any proposed PUL or alley that can be utilized for looping will be looped.
- 5.2 Water Mains**
- .1 Pipe Diameter:
- a) Minimum 200 mm for residential developments unless its only purpose is to provide service, not fire protection to an area.
 - b) Minimum 300 mm for commercial developments.
- .2 Flow Velocity:
- a) Maximum 3.0 m/s.
- .3 Hazen-Williams Roughness Coefficient, C (based on the use of PVC pipe):
- a) 100 for pipes $\leq$ 200 mm diameter.
 - b) 120 for pipes $>$ 200 mm diameter.
- .4 Normal Operating Pressure:
- a) 350 kPa (50 psi) to 700 kPa (100 psi).
- .5 Peak Hour Demand Operating Pressure:
- a) Minimum 280 kPa (40 psi) at ground level at any point in the system (by hydraulic analysis).
- .6 Maximum Day Demand Plus Fire Flow Operating Pressure:
- a) Minimum 140 kPa (20 psi) at ground level at any point in the system (by hydraulic analysis).
- .7 Pipe Design
- a) Strength design shall be integral to the pipe selection process.
- .8 Horizontal Alignment
- a) Water mains shall be located within the road right-of-way, in accordance with the Engineering Standard Drawings in Appendix A.
 - b) For commercial, institutional and multi-family residential developments, the Consultant shall design typical cross-sections depicting the locations of the various necessary infrastructure to suit the particular development. Such cross-sections shall be subject to the review and acceptance of the City.

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- c) Water mains must be located at least 3.0 m horizontally from any sewer main, 1.8 m horizontally from any gas line, and 1.5 m horizontally from any catch basin or manhole, as measured between the nearest walls of the two mains.
- d) In accordance with Article 3.6.1, cul-de-sacs which exceed 120 m but that are less than 170 m in length require an additional hydrant and looping of the water main to the cul-de-sac through the Public Utility Lot (PUL).

In addition install isolation valve at both ends of the PUL. Cul-de-sacs which exceed 170 m in length require a minimum 6.0 m wide PUL for emergency vehicle access and looping of the water main.
- e) Without limiting the requirements of Article 3.6.1, PUL widths shall be a minimum of 4.0 m for a single utility and 6.0 m for two utilities. A 1.0 m easement is required on the lots to either side of a PUL.
- f) Curved water mains shall run parallel to the centreline of the road.
- g) Water mains through new subdivisions must be looped. The City may temporarily waive this requirement for a staged subdivision, up to 50 lots in size, where the Developer can demonstrate that the required fire flows can be provided through a single water feed to the stage. Looping must be provided within 1 year of temporarily servicing the subdivision.
- h) The maximum length of a dead-end line is 120 m. A hydrant shall be provided at the end of the dead-end, and each dead-end line must be equipped with an isolation valve.
- i) Where practical, combinations of maximum 45 degree bends shall be used over 90 degree bends. The use of 90 degree bends may apply in situations where limited space is demonstrated and will be reviewed on a case-by-case basis.

.9 Vertical Alignment

- a) Water mains shall be installed to provide a minimum depth of cover of 2.75 m, as measured from the top of the pipe to the final finished grade at the surface. A smaller depth may be approved by the City if insulation is provided as shown in the Engineering standard drawings.
- b) Mains shall be installed to provide adequate water service connection depth at the property line.
- c) At crossings of water mains with sewer mains, the following requirements shall apply:
 - i) Typically, water mains shall cross over sewer mains with sufficient vertical separation to allow for proper bedding and support of both mains. Vertical separation must be a minimum of 0.3m.
 - ii) Where it is necessary for a water main to cross under a sewer main, the water main shall be protected by providing the following:
 - A minimum vertical separation of 0.5 m, as measured between the nearest pipe walls of the two mains;
 - The sewer main shall be structurally supported to prevent joint deflection and settling; and
 - A full length of pipe shall be used for the water main at the crossing location. The pipe section shall be centered beneath the sewer main so

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that the nearest joints in the water main are equidistant from the crossing location.

- d) Where a transmission water main elevation profile has a crest with a change in elevation of greater than two pipe diameters, as measured from the obvert of the pipe at the lowest (sag) point to the invert of the pipe at the highest (crest) point, an air-release device, such as a blow-off or hydrant, shall be provided near the crest point to remove trapped air from the main. If a blow-off hydrant is designed for, then the hydrant must be labeled as a blow-off hydrant upon the drawings. If an air release device is required, then it is to be installed in a chamber with a minimum diameter of 1800 mm and include an isolation valve for the device.
- e) Flush points will not be permitted. All dead end streets will require a hydrant.

5.3 Hydrants

- .1 Hydrants shall be located within the road right-of-way in accordance with the Engineering Standard Drawings in Appendix A.
- .2 Refer to the Engineering Standard Drawings in Appendix A for a typical hydrant detail.
- .3 The edge of the hydrant barrel shall be a minimum of 0.3 m from the back of walk and a maximum of 3 m from the face of the curb. Hydrants shall not be perched above sewer mains.
- .4 The maximum distance between hydrants shall not exceed 150 m in single-family residential areas and 90 m in commercial, institutional and multi-family residential areas.
- .5 Wherever possible, hydrants shall be located at the projection of property lines to avoid potential conflict with driveways. At intersections, hydrants shall be located adjacent to corner cut-offs. Where hydrant placement must be immediately adjacent to a potential driveway location, the City may direct that bollards be installed to protect the hydrant.
- .6 For cul-de-sacs, a hydrant must be installed at or near the entrance intersection. Cul-de-sacs exceeding 120 m in length require a hydrant and looping of the water main in accordance with Articles 3.6.1 and 5.2.8.
- .7 Hydrants shall be located a minimum of 5 m from any sewer manhole measured from the edge of the hydrant barrel to the edge of the sewer manhole rim.
- .8 Hydrants shall be located such that the distance from any building to a hydrant shall not exceed 75 m of unobstructed distance. For commercial, institutional or multi-family residential buildings with standpipes, there must be a hydrant located within 45 m of the standpipe with unobstructed vehicle access provided between the hydrant and the fire department connection to the building.
- .9 If deemed necessary, the City may require additional hydrants be installed at high-value or high-risk properties.
- .10 All hydrants shall be off-line type. Hydrant leads shall include a valve, located on the boulevard area adjacent to the hydrant within the road right-of-way.

5.4 Water Main Valves

- .1 Wherever possible, water main valves shall be located at the projection of property lines to avoid potential conflict with driveways. At intersections, valves shall be located at the projection of the beginning of curb returns. Watermain valves shall be located above the watermain in accordance with the road cross sections shown in the Engineering Standard Drawings in Appendix A.

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- .2 Valves shall be located such that, in the event of a shutdown, no more than 1 hydrant will be out of service, no more than 3 valves shall be required to achieve the shutdown, and no more than 20 single-family residential units will be affected by the shutdown.
 - .3 Valves shall be the same size as the water main to which they connect.
 - .4 Provide a valve near tie-in locations for proposed future extensions of the water main. No services to be tied in past the boundary valve until further extension of the water main is constructed.
 - .5 When a branch connection off of an existing water main is required, the Design must provide for wet-tapping into existing water mains. Wet-tapping shall be accomplished through use of a tapping valve and sleeve while maintaining uninterrupted service through the existing water main. All tapping coupons are to be retrieved from the main.

5.5 Pressure Reducing Valves

- .1 Pressure reducing valves may be required to achieve the design pressure zone(s) through the subdivision.
- .2 Pressure reducing valve design shall be based on the hydraulic network analysis for the subdivision and consultation with the City.
- .3 Computed network pressures both up and down stream are to be supplied by Consultant with proposed pressure reducing valve drawing submission.

5.6 Water Service Connections

- .1 Each lot and multi-family unit shall have its own water service connection designed in accordance with the following articles and the Engineering Standard Drawings in Appendix A.
- .2 Service connections for commercial lots, institutional lots, and apartment developments shall be sized according to the anticipated user requirements.
- .3 Service connection pipe diameter shall be 25 mm. The Designer shall verify the minimum pipe diameter requirements for lots with extraordinarily long service connections and/or multi-floor buildings where available pressure may pose a problem for the building's plumbing fixtures. Commercial sites shall have a minimum diameter of 50mm.
- .4 Wherever possible, service pipes shall be aligned at right angles to the main. If installation is not at right angles to the main all connections, bends, tees, curb cocks, elevations, and locations shall be identified on the record drawings.
- .5 Water service connections shall have a depth of bury between 2.6 m and 2.8 m at property line, as measured from the pipe invert to the final finished grade, unless otherwise approved by the City.
- .6 Service connections shall be located such that they do not conflict with potential driveway locations, except on pie-lots on cul de sacs.
- .7 Water service connections shall include a main stop at the connection to the water main and a curb stop located at the property line, in accordance with the Engineering Standard Drawings in Appendix A. Curb valves shall be located off of paved surfaces.
- .8 Where the water service is 50 mm or smaller in size, the water and wastewater services may be located in a common trench. Where services are located in a common trench, provide minimum 300 mm horizontal and vertical separation between water and sewer services.

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- .9 Where the water service is larger than 50 mm diameter, water service pipes shall be located in a separate trench, at least 3 m from any sewer services and 1.8 m from any other buried utility lines.
 - .10 Service connections shall be extended into the lot to terminate 1.0m past the Utility-Right-of-Way.
 - .11 For service connections 100 mm in diameter and larger that connect to an existing water main, the Design must provide for wet-tapping into existing water mains. Wet-tapping shall be accomplished through use of a tapping valve and sleeve while maintaining uninterrupted service through the existing water main. Note: The tapping valve is to be left in 100 % open position, denso wrapped and cathodically protected. Tapping valve is to be buried with no operating stem and valve box to the surface unless requested by the City. Location of the tap to be identified on an as-built drawing with measurements to two permanent reference points and GPS coordinates.

PART II – MATERIALS**5.7 Water Mains**

Water mains shall be polyvinyl chloride (PVC) pipe, or accepted alternate. PVC fittings may be used for water mains. Any proposed alternative pipe must conform to all applicable American Water Works Association (AWWA), American Standards for Testing and Materials (ASTM), Canadian Standards Association (CAN/CSA), and National Sanitation Foundation (NSF) standards.

- .1 Pipe
 - a) PVC pipe shall meet CAN/CSA-137.3.
 - b) Nominal inside diameters shall be expressed as cast iron outside diameters (C.I.O.D.).
 - c) Pipe from 100 mm to 300 mm in diameter shall conform to AWWA-C900 with a minimum pressure class of 1,034 kPa (DR18).
 - d) Pipe from 350 mm to 900 mm in diameter shall conform to AWWA-C905 with a minimum pressure class of 690 kPa (DR25).
 - e) Strength design, considering trench and road loading, shall be integral to pipe design process.
 - f) PVC pipe shall have a joint with an integrally thickened bell end and flexible elastomeric hydro carbon resistant gasket. Joints shall conform to ASTM-D3139 with gaskets conforming to ASTM-F477.
 - g) Joint lubricants shall be in accordance with NSF Standards 14 and 61, and shall be compatible with gasket materials.
 - h) Pipe shall be installed within two years from the production data indicated on the certification. Uninstalled pipe shall remain capped during transport and while awaiting installation. Any pipe displaying discoloration from exposure to the elements must be discarded and will not be approved for installation.
- .2 Fittings
 - a) Polyvinyl Chloride (PVC)

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- i) PVC injection-molded fittings shall conform to AWWA-C900, C905, and C907, as applicable, and shall be certified to CAN/CSA-B137.3.
 - ii) Fitting diameter, class, and pressure rating shall match the water main.
 - iii) Use push-on type ends complete with one gasket for each bell.
 - iv) Gaskets shall conform to ASTM-F477.
 - .3 Mechanical Joint Restraints
 - a) Joint restraints shall conform to AWWA-C111 and ASTM-F1674.
 - b) All nuts, bolts and restraining rods (if applicable) shall be Type 304 stainless steel.
 - c) Diameter and pressure rating to match the pipe and fitting to which the restraint is being applied. The pressure rating of the restraint shall include a minimum safety factor of 2.0.
 - d) Gland shall be constructed of high strength ductile iron conforming to ASTM-A536.
- 5.8 Hydrants**
- .1 Hydrants shall conform to AWWA-C502.
 - .2 Post-type, dry-barrel fire hydrant with compression shutoff, cast iron body, bronze-mounted, and bottom connection with drip valve and drain.
 - .3 One-piece hydrant body. No above-grade segmented body designs shall be accepted.
 - .4 The minimum height from flange to bonnet shall be 600 mm.
 - .5 Five-sided, #5 operating nuts, counterclockwise to open.
 - .6 All external nuts and bolts, including the ground flange and all buried connections, shall be Type 304 stainless steel.
 - .7 New hydrant installations shall have a ‘quick connect’ 100 mm diameter Storz pumper connection and two 63.5 mm diameter hose connections to conform to Alberta Mutual Aid Thread standard. Connections must be a minimum of 415 mm above the ground flange. Hose connections must be at 90-degrees to each side of the pumper connection. Note that older hydrant models have a threaded 146 mm diameter pumper connection designed for a pressurized connection. Do not attempt a pressurized connection to the outer threads (> 146 mm) of a ‘quick connect’ 100 mm diameter Storz pumper connection. These threads are designed exclusively for the dust cap and are not pressure rated to support a pressurized hose connection. The operation of each hydrant connection shall be checked by Utilities during CCC & FAC inspections as well as during routine hydrant testing operations.
 - .8 Nipples shall be provided with caps, without chains or cables. Nipples shall be threaded into the hydrant head, rather than leaded in, unless a positive locking device is provided to prevent blowout of the nipples.
 - .9 The valve stem in the hydrant head shall be equipped with “O”-ring seals and a thrust bearing.
 - .10 The barrel of the hydrant shall be a minimum of 150 mm inside diameter. One-piece barrels shall be used wherever possible. If extension is necessary, it shall be placed on the top of the barrel, not the bottom. Barrels shall be of sufficient length to provide a minimum of 2.75 m of cover over the water main, unless otherwise approved by the City. Insulation will be provided for water main at depths less than 2.75m as shown in the Engineering Standard Drawings.

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- .11 Provide a bottom connection, flanged to the barrel, with a single-ring gasket and push-on joint suitable for connecting to PVC pipe, and complete with harnessing lugs. Bottom inlet connection to match size and type of water main.
- .12 The valve shall be mechanically connected to the barrel with mechanical joint restraints conforming to Article 5.7.3.
- .13 A gravel drainage pit, covered with polyethylene, shall be provided at the bottom of the hydrant as shown on the Engineering Standard Drawings in Appendix A.
- .14 A gate valve, in accordance with Articles 5.4 and 5.9, shall be provided with each hydrant lead.
- .15 Hydrant exterior must be factory coated with an asphaltic or epoxy coating.
- .16 All hydrants shall be painted Tremclad Yellow (No. 270-97X).
- .17 Hydrant dome, nozzle caps and pumper cap to be painted in accordance with the table below

Hydrant Flow Capacity		Dome, pumper and nozzle cap colour
US GPM	L/s	
1500 or greater	95 or greater	Safety Blue
1000-1500	60-95	Safety Green
500-1000	30-60	Safety Orange
<500	<30	Safety Red

- .18 Mueller/Canada Valve or accepted alternate.

5.9 Water Main Valves

- .1 Gate Valves
 - a) Gate valves shall be used for water mains.
 - b) Gate valves shall be resilient-seated type conforming to AWWA-C509.
 - c) Epoxy-coated cast iron body and disc.
 - d) All external nuts and bolts shall be Type 304 stainless steel.
 - e) Non-rising stem.
 - f) Bell ends, single-ring gasket, and push-on joints suitable for connecting to PVC pipe.
 - g) Valve size shall be equivalent to the pipe size.
 - h) Operating pressure shall be minimum 1,200 kPa, (170 psi) cold water service.
 - i) Provide a 50 mm square operating nut that turns counterclockwise to open.
 - j) Valve stem to be Type 304 stainless steel or accepted brass alternate for valves up to 300 mm in diameter.
 - k) Provide “O”-ring valve stem seals.
 - l) Valve Box and Extension

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- i) Valve boxes shall be two-section, cast iron, adjustable, sliding-type, complete with cast iron lid. Bottom section of valve box may be PVC (Type A). Top section must be cast iron. Refer to the Engineering Standard Drawings.
- ii) The internal spindle shall be one piece and extend to within 300 mm of the finished surface and shall include a top operating nut and rock disc.
- iii) Valve boxes shall be of sufficient lengths to provide for adjustments of 300 mm in the up or down direction.
- iv) Valve box extensions shall be cast iron, suitable for use with the valve boxes installed.
- m) Mueller, Norwood, or accepted alternate.

5.10 Pressure Reducing Valves

- .1 The Designer shall provide detailed technical specifications for any pressure reducing valves proposed in the Design to the City for review and acceptance.
- .2 Pressure reducing valves shall conform to all other applicable standards and guidelines.

5.11 Water Service Connections

- .1 Standard Water Service Pipe
 - a) For 25 mm nominal pipe diameter, water service pipe shall be K-type copper.
 - b) For pipe diameters greater than 25 mm, and up to 50 mm diameter, water service pipe shall be copper, or accepted alternate. 50mm pipe diameters can be HDPE or copper.
 - c) Copper water service pipe shall be Type K copper pipe conforming to ASTM-B88, and complying with AWWA-C800.
 - d) For water services larger than 50 mm nominal diameter, use pipe, fittings, and valves that are of the same pressure rating and material as the water main, in accordance with the applicable requirements of Articles 5.7 and 5.9.
- .2 Service Saddles
 - a) Service saddles shall be bronze or Type 304 stainless steel, tapered inlet thread, conforming to AWWA-C800.
 - b) Fasteners to be treated to prevent binding.
 - c) “O”- ring gaskets to be constructed of synthetic rubber suitable for potable water use, and shall provide pressure-tight seal on the water main.
 - d) Mueller, Cambridge Brass, Smith-Blair, or accepted alternate.
- .3 Couplings
 - a) Couplings to be compression type, conforming to AWWA-C800. Mueller, Cambridge Brass, or accepted alternate and must meet NSF 61 requirements.
- .4 Corporation Main Stops
 - a) For copper pipe, corporation main stops shall be copper flare or compression type, conforming to AWWA-C800.

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.5 Curb Stops

- a) For copper pipe installations, use non-draining curb stops, copper-to-copper type, conforming to AWWA-C800. Mueller, or accepted alternate and must meet NSF 61 requirements.
- b) ¼ Turn for ON / OFF operation.
- c) Must operate counterclockwise to the open position and installed with the arrow pointed in the direction of flow.
- d) Service Box
 - i) Service boxes shall be two-section, epoxy-coated, galvanized iron, 2 section sliding, adjustable type. Epoxy coated boot is to be denso-wrapped prior to placement of drainage pit washed rock.
 - ii) The top section of the service box (35 mm inner diameter) shall be 2,150 mm in length, threaded at the top for the City of Wetaskiwin brass cap, and shall provide a sliding fit inside of the bottom section of the service box (25 mm inner diameter) for adjustments of 300 mm in the up or down direction.
 - iii) The top section shall be installed to allow a minimum of 150mm adjustment both above and below finished grade without contacting either the lower service box section or the operating rod.
 - iv) The bottom section shall rest on a minimum 40 mm thick by 200 mm wide by 200 mm long channelized recycled plastic or treated lumber block.
 - v) The service box brass cap shall be threaded to allow connection to the box, and shall include a brass plug. The brass plug, shall be circular with a 6 x 19 x 9 mm slot and threaded to match the cap. Generic cast caps with brass pentagon plug COA 60-40 are acceptable.
 - vi) The operating rod shall be Type 304 stainless steel, top of operating rod to be sized to be brought to 300mm from finished grade.
 - vii) The bottom 25 mm of the rod cold-forged square and welded to a stainless steel clevis. The manufacturer's name shall be embossed onto the clevis.
 - viii) Mueller, Trojan, or accepted alternate.
 - ix) If a chair is utilized to support the curb stop, then the chair must be denso-wrapped to prevent metal on metal contact.

5.12 Cathodic Protection

- .1 All cast iron fittings, hydrants, and valves shall be denso-wrapped and cathodically protected with a 5.5 kg zinc anode.
- .2 Zinc anodes shall conform to ASTM B418, Type 2.
- .3 Lead wires shall be 2 m long, No. 10A WG/7.
- .4 Lead wires shall be connected with suitable clamps or welds in accordance with the manufacturer's recommendations.
- .5 All buried flange connections to be denso wrapped for additional protection.

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- a) Class I (Arterials and Collector Roads): Backfill with pit run gravel or sand over bedding up to existing ground elevation if lower than the designated subgrade depth, in lifts not exceeding 150 mm when compacted and compact each lift to 98% of the maximum density as determined by the Standard Proctor Compaction Test.
- b) Class II (Residential Roads, Lanes and Non-Paved Areas): Backfill with native or imported fill material over bedding up to the designated subgrade or existing ground elevation, whichever is lower, in lifts not exceeding 150mm when compacted. Compact each lift compacted to 98% of the maximum density as determined by the Standard Proctor Compaction Test..
- c) Fillcrete over bedding to designated subgrade elevation.

Uniformly place fillcrete from the top of bedding to the designated or pre-existing subgrade elevation.

Protect fillcrete from freezing or other adverse weather conditions for a minimum of 24 hours following placement.

Fillcrete that is exposed to significant infiltration of water within 24 hours of placement must be removed and replaced.

A minimum of 150 mm of granular base course must be placed on the fillcrete surface before allowing any vehicular traffic over the fillcrete. Granular base course may be placed 24 hours following the placement of the fillcrete.

PART III – CONSTRUCTION**5.14 General**

- .1 The following articles represent the minimum requirements for some typical, key construction procedures for water system construction. These minimum requirements must be met or exceeded by the detailed construction specifications and drawings developed by the Consultant.

5.15 Quality Assurance

- .1 The Developer must maintain detailed records of all inspections and testing as evidence of compliance of the work with these Standards. These records shall be provided to the City upon request.
- .2 The City may at any time require the Developer to provide evidence of certification by the testing agency the materials and performance of the work meet these Standards.
- .3 The Developer shall provide a written endorsement of the Contractor's compliance with these Standards with the application for the Construction Completion Certificate.

DRAFT – FOR INFORMATION ONLY**5.16 Quality Control Testing**

- .1 The Contractor shall retain the services of independent testing laboratories or agencies to conduct all quality control testing. The proposed testing laboratory or agency shall be subject to the acceptance of the City.
- .2 Minimum quality control test frequencies, specified as follows, are the minimum number required. The Contractor shall ensure that as many tests as necessary are performed to ensure that the work conforms to the requirements of these Standards, regardless of the minimum number specified.
 - a) Field densities (ASTM-D2167 or ASTM-D2922):
 - i) Pipe Bedding - one for each 25 m of pipe installed.
 - ii) Pipe Zone Backfill - one for each 25 m of pipe installed.
 - iii) Trench Backfill - one for every 100 m of trench of 1.0 m fill depth.
 - iv) If any density test results is less than the required compaction, two more tests shall be taken for the depth and length of backfill or bedding represented by the failed test. If the average of the three tests results in a density less than required, the depth and length of backfill or bedding represented by the failed tests shall be reworked, the soil moisture modified as necessary, re-compacted, and re-tested until the required compaction is met.
 - b) Moisture density curves (ASTM-D698):
 - i) Pipe Bedding - one for each 1000 tonnes or change in material.
 - ii) Pipe Zone Backfill - one for each 1000 tonnes or change in material.
 - iii) Trench Backfill - one for each 1000 tonnes or change in material.
 - c) Sieve analyses (ASTM-C136):
 - i) Pipe Bedding - one for each 1000 tonnes or change in material.
 - ii) Pipe Zone Backfill - one for each 1000 tonnes or change in material.
 - iii) Trench Backfill - one for each 1000 tonnes or change in material.

5.17 Site Preparation

- .1 Prepare the site in accordance with Article 3.26 of these Standards.

5.18 Clearing

- .1 Conduct clearing in accordance with Article 3.27 of these Standards.

5.19 Grubbing

- .1 Complete grubbing in accordance with Article 3.28 of these Standards.

5.20 Topsoil Stripping and Stockpiling

- .1 Strip and stockpile topsoil in accordance with Article 3.29 of these Standards.

DRAFT – FOR INFORMATION ONLY**5.21 Operating Existing Valves and Hydrants**

- .1 City of Wetaskiwin Utilities personnel are the only authorized personal that are authorized to operate existing valves and hydrants.
- .2 The City of Wetaskiwin Engineering Office and the City's utilities Department will receive a minimum of two working days notice prior to any required valve operations
- .3 If water supply is required for construction, the City's Utilities Department shall be responsible for calculating the water used. This calculation shall be submitted to the City at the time of C.C.C. The Developer shall be responsible for the cost of the water used 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 Apply to the City's Engineering Services Department and complete a Site Servicing Permit form for any valve or hydrant operations at least one (1) week in advance. Upon acceptance of the application, Utilities personnel shall be dispatched to open or close existing valves or hydrants.
- .5 If water supply is required for construction, apply to the City's Utilities department to use a hydrant for water supply. The City shall provide a water metre to install on the designated water source hydrant(s) for the duration of the work. For City Projects, the water usage will be charged to the contractor and will not be the City's responsibility. Alternatively, the contractor can purchase a water card for \$25.00 at City Hall. There will be an additional charge for water consumption. Comply with all of Utilities requirements with respect to using City hydrants for water supply.

5.22 Trench Excavation

- .1 Refer to the Engineering Standard Drawings in Appendix A.
- .2 Where applicable, any recommendations of the geotechnical report regarding trenching methods shall be duly incorporated into the construction specifications and drawings, and observed by the Contractor.
- .3 Where required, temporary protective structures, bracing, shoring, and sheeting are the responsibility of the Contractor and shall be designed by a Professional Engineer registered in Alberta.
- .4 Observe safety regulations of the Occupational Health and Safety Act with regard to protection of the work, property, and structures adjacent to the Work and maintenance of the trench widths.
- .5 Existing pipelines shall be exposed by hand digging or hydro-vacuuming. No mechanical excavation shall be undertaken within 1.0 m of the anticipated location of an existing pipeline. Hydro-vacuuming is the preferred method of confirming the location of existing utilities near the surface.

5.23 Alignment and Grade

- .1 Lay pipe to the required alignment and grade, with fittings, valves, hydrants, and all other appurtenances at the locations identified on the construction drawings or otherwise directed by the City.

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- .2 Provide minimum 2.75 m depth of cover on water mains, unless otherwise authorized by the City in writing. Where depth of cover is less than 2.75 m, provide insulation in accordance with the Engineer Standard Drawings and identify all insulated areas on plan of record drawings.
 - .3 Acceptable tolerances are as follows:
 - a) Alignment - the centreline of the pipe shall not be more than 100 mm off the given alignment.
 - b) Elevation - the pipe invert shall not be more than 50 mm off the elevation indicated on the construction drawings.
 - .4 Maintain, and provide to the City upon request, grade sheets for the installation of the pipe.
 - .5 No deviation shall be made from the required alignment or grade without the written consent of the City.

5.24 Pipe Bedding and Pipe Zone Backfill

- .1 Refer to the Engineering Standard Drawings in Appendix A for pipe bedding details.
- .2 For Trench Backfill details refer to section 5.13.1:
 - a) Place a cradle of concrete bedding under the pipe and the full width of the trench to the depth shown on the Engineering Standard Drawings in Appendix A.
 - b) Place sand bedding under the pipe and the full width of the trench to the depth shown on the Engineering Standard Drawings in Appendix A and compact to 95% of Standard Proctor Density.
 - c) Place selected native soil or sand above the bedding and compact to 95% of Standard Proctor Density to 300mm above the top of the pipe.
 - d) Create a cradle for the pipe in the native soil with a 90 degree support angle as shown on the Engineering Standard Drawings in Appendix A. Fill with ordinary backfill compacted to 95% of Standard Proctor Density to 300mm above the top of the pipe.
- .3 Provide bell or coupling holes as required and support the pipe uniformly and continuously throughout its length.
- .4 Backfill in the pipe zone shall be sand complying with the gradation specified in section 5.13.1.
- .5 Granular bedding and pipe zone backfill shall be placed and compacted in uniform lifts not exceeding 150 mm in depth.

5.25 Pipe Installation

- .1 General
 - a) Follow manufacturer's instructions for pipe installation. Where manufacturer's instructions and these specifications are in conflict, notify the City who will provide judgment on which method will govern the Work.
 - b) Lay and join PVC pipe in accordance with AWWA-M23.
 - c) Disinfect in accordance with Article 5.32.3.
- .2 Laying Pipe

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- a) Lay pipes on prepared bedding with excavated joint holes that allow the joint ends to be kept clean of soil and bedding material, to facilitate completing the joint and to avoid load concentration on the bells or couplings.
 - b) Lay pipes with the bell ends facing in the direction of the laying operations.
 - c) Cut pipes where necessary to install fittings and valves. Make cuts in accordance with the manufacturer's recommendations using recommended cutting tools. Cut pipes squarely and accurately.
 - d) Test bolting of all mechanical couplings and restraints on completion using a torque wrench. Torque shall conform to the pipe or fitting manufacturer's recommendations.
 - e) Pipe deflections at joint shall not exceed those specified by the pipe manufacturer.
 - f) Do not lay pipe in water or when, in the opinion of the City, trench conditions are unsuitable.
 - g) Cover open ends of installed pipe, when pipe laying is not in progress, to keep out trench water.
- .3 Joining Pipe
- a) Join pipe in accordance with the manufacturer's recommendations.
 - b) Clean and check the sealing surfaces to ensure that they are smooth, concentric, and free from imperfections that might affect the sealing performance of the gasket.
- .4 Connecting to Existing Mains
- a) Notify the City in writing at least five (5) days prior to connecting to an existing water main.
 - b) Provide the City with a work plan and contingency plan detailing the procedures to be observed in the event of problems during the connection process or other emergency.
 - c) Prior to connection to existing infrastructure within the City's road right of way an approved Site Servicing Permit (SSP) must be obtained and an On Street Construction Permit (OSCP) is required.
- .5 Plugging of Dead Ends
- a) Insert standard plugs into the bell ends of fittings or pipe bells at dead ends.
- 5.26 Setting Hydrants**
- .1 Install hydrants at the required locations and at the required directions.
 - .2 Set hydrants plumb with hose nozzles parallel or at right angles to the street centreline.
 - .3 Set hydrants with ground flanges above final curb and sidewalk grades.
 - .4 The body to barrel flange connection to be a minimum of 50mm and a maximum of 150 mm above finished grade.
 - .5 Provide a coarse gravel drainage pit, complete with filter cloth, where hydrant barrels can be drained to the surrounding soil.

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- .6 Hydrant ports shall be left open except where the hydrant is located in areas of high water tables and/or where the possibility of contamination exists, as indicated by the geotechnical report. At these locations, the port shall be closed and the hydrant shall be labeled “Plugged”.
- .7 Construct hydrant thrust blocks so that drains are not plugged and does not cover flanges, nuts or bolts.
- .8 Allow concrete to cure for a minimum of 8 hours before backfilling unless otherwise approved by the City.
- .9 Support hydrants with suitable concrete blocking.
- .10 Provide compacted backfill, in accordance with Article 5.31.7, for a minimum 1.5 m radius around all hydrants.

5.27 Setting Fittings and Valves

- .1 Install fittings and valves at the required locations.
- .2 Support all fittings and valves with blocking as shown on the Engineering Standard Drawings in Appendix A.
- .3 Install valve boxes plumb and support valve boxes to prevent the transmission of strain or shock to the valve.
- .4 Set the top of valve boxes flush with finished grades.
- .5 Provide compacted backfill, in accordance with Article 5.31.7, for a minimum 1.5 m radius around all valves.

5.28 Thrust Blocks and Mechanical Joint Restraints

- .1 Install thrust blocks at all dead ends and at all fittings, valves, and hydrants, in accordance with the Engineering Standard Drawings in Appendix A, or where otherwise directed by the City.
- .2 Place concrete thrust blocks against solid ground with a minimum bearing area as shown on the Engineering Standard Drawings in Appendix A, or as directed by the City.
- .3 Pour the concrete in a manner that will leave pipes, fittings, valves, and hydrants accessible for repair.
- .4 Allow concrete to cure for a minimum of 8 hours before backfilling unless otherwise approved by the City.
- .5 Valve and fittings shall be mechanical restrained if required and should be installed as follows:

Working Pressure	Diameters Requiring Restraint
Up to 700 kPa	300 mm and up
700 to 1,000 kPa	200 mm and up
1,000 to 1,380 kPa	All sizes

- .6 Install mechanical restraints in accordance with manufacturer’s instructions.

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- .1 Single-family residential water services, in accordance with Article 5.6, shall conform to the following.
- .2 Services crossing under roads shall be augered unless the development has received written approval from the City to utilize uniform backfill and open cut installation. The application of open cut service installations and uniform backfill must be recommended in writing by the Geotechnical Engineer and provided to the City. At a minimum, the uniform backfill zone shall extend from property line to property line and be at least 1.5 m in vertical depth across the full right of way. The uniform backfill zone shall have maximum 300 mm lift thickness and achieve minimum 98% S.P.D. as monitored and tested by the Geotechnical Engineer. At the end of cul-de-sacs and for lots located adjacent to the mains, open trenching installation of the services may be permitted with the written authorization of the City.
- .3 Services installed by open trench or through auger pits shall be bedded in accordance with Article 5.25.
- .4 Pipe zone backfill shall be placed to 300 mm above the crown of the highest service in the trench or auger pit.
- .5 Service connections shall be extended into the lot to terminate 1.0m past the Utility-Right-of-Way. Extend the house water service whip to surface and cap the end of the service in accordance with the Engineering Standard Drawings in Appendix A.
- .6 Install red-painted stakes, 50 mm by 100 mm in size, extending from the termination point of the service point to a minimum of 0.5 m above the finished surface elevation.
- .7 Backfill trenches and auger pits in accordance with Article 5.31.
- .8 Augering and Boring
 - a) Auger or bore services under existing roads, sidewalks, curbs, and gutters.
 - b) Auger holes and bore holes shall be large enough to pass service pipes through without disturbing joints.
 - c) Fill the auger or bore hole around the pipe with a dry or slurry mixture of sand and cement.
- .9 Tapping Water Mains
 - a) Tapping of PVC water mains shall be in accordance with AWWA-C605 and AWWA-M23 and in accordance with the specific pipe manufacturing guidelines.
 - b) Drill and tap water mains that are under pressure using a tapping machine.
 - c) Dry-tapping may be used for service connections to new water mains with written approval from the City Engineer. Wet-tapping may be used to tie-in a new service to an existing water main; all coupons must be recovered from the main and accounted for.
 - d) Direct taps to water mains may be used where the tap diameter is 25 mm diameter or smaller and the water main is 300 mm diameter or smaller. Service saddle taps must be used where the tap diameter is greater than 25 mm diameter or where the water main is larger than 300 mm diameter.

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- e) Do not tap a curved pipe where the bend radius is less than 300 times the pipe outside diameter.
 - f) Tap into the upper half of water main and incline upward 0° to 30° from the crown of the main. Stagger multiple taps at least 600 mm apart; with adjacent taps offset 30° with respect to each other. Taps shall be greater than 300 mm from any coupling or saddle.
 - g) Insert the main stop in accordance with the manufacturer's instructions.
- .10 Pipe Installation
- a) Provide 300 mm diameter “goose-necks” in the water service at the corporation main stop and as required to maintain a minimum 300 mm clearance over wastewater and stormwater service pipes. Refer to the Engineering Standard Drawings in Appendix A.
 - b) Lay pipe slack in the trench.
 - c) Copper services should be one continuous section of pipe. In the event that the service pipe length exceeds the length of a standard roll of copper pipe, use only double union couplings to connect two sections of copper pipe. Wherever possible, locate double unions outside of paved areas and near curb valves. Record drawings must identify the services which contain unions.
- .11 Curb Valves and Services Boxes
- a) Support curb valves on a minimum 40 mm thick by 200 mm wide by 200 mm long recycled plastic or treated lumber block.
 - b) CC shall sit on denso wrapped CC chair.
 - c) Set the services box plumb and adjusted to grade.
 - d) Brace service boxes sufficiently during backfilling operations.
 - e) Mark the curb stop location with a 50 mm x 100 mm x 1,500 mm, fluorescent red painted marker, set 1 m into the finished ground surface.
- .12 Testing
- a) The water service pipe, from the main to the curb stop, will be included in the hydrostatic pressure test, as specified in Article 5.32.
- .13 Record of Services
- a) Maintain red-line markups as the as-constructed location and elevation of all service connections for preparation of the record drawings. Record drawings must indicate the locations and elevations of water mains, corporation main stops, curb valves, and pipes in relation to property lines.

5.30 Cathodic Protection

- .1 Install cathodic protection on all cast iron fittings, valves and hydrants in accordance with the Engineering Standard Drawings in Appendix A, and the manufacturer's instructions.
- .2 Embed zinc anodes into the trench wall to provide a minimum 50 mm native material compacted around the anode.

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- .3 A minimum of 3 L of water shall be poured on each anode to initiate operation of the anode prior to backfilling.

5.31 Trench Backfill

- .1 Trench backfill is defined as backfill above the pipe zone.
- .2 Place backfill in a dry trench.
- .3 Place backfill by rolling down a slope in the trench or lower by machine. Prevent backfill from dropping vertically.
- .4 Backfill as close as possible to pipe laying operations so that trenches are left open no longer than absolutely necessary.
- .5 Protect all open excavations when construction is not ongoing with fencing, barricades, flashing lights, etc., and provide watchmen for site security and public safety if required by the City.
- .6 Plan the backfilling operation so that exposure of the backfill material to frost is kept to a minimum. Use no large frozen chunks of soil as backfill.
- .7 Classes of Trench Backfill
- .8 Classes of Trench backfill
- a) Class I (Arterials and Collector Roads): Backfill with pit run gravel or sand over bedding up to existing ground elevation if lower than the designated subgrade depth, in lifts not exceeding 150 mm when compacted and compact each lift to 98% of the maximum density as determined by the Standard Proctor Compaction Test.
 - b) Class II (Residential Roads, Lanes and Non-Paved Areas): Backfill with native or imported fill material over bedding up to the designated subgrade or existing ground elevation, whichever is lower, in lifts not exceeding 150mm when compacted. Compact each lift compacted to 98% of the maximum density as determined by the Standard Proctor Compaction Test..
 - c) Fillcrete over bedding to designated subgrade elevation.
 Uniformly place fillcrete from the top of bedding to the designated or pre-existing sub-grade elevation.
 Protect fillcrete from freezing or other adverse weather conditions for a minimum of 24 hours following placement.
 Fillcrete that is exposed to significant infiltration of water within 24 hours of placement must be removed and replaced.
 A minimum of 150 mm of granular base course must be placed on the fillcrete surface before allowing any vehicular traffic over the fillcrete. Granular base course may be placed 24 hours following the placement of the fillcrete.

5.32 Hydrostatic Pressure Testing and Cleaning

All new water mains must pass a hydrostatic pressure test and be thoroughly cleaned before they shall be accepted by the City and placed into service. All water main testing shall be in accordance with AWWA C651.

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.1 Test Preparation

- a) The Developer's contractor shall supply all testing equipment and personnel to perform hydrostatic pressure testing.
- b) Notify the City at least 24 hours in advance of filling the line for testing. Failure to notify the City may result in the tests being deemed unacceptable.
- c) Testing shall not be done under winter conditions unless the line can be safely drained or immediately placed into operation.
- d) Concrete thrust blocks must be cured prior to commencing testing activities. Minimum of 3 days in the case of high early strength concrete or a minimum of 7 days in the case of normal concrete.
- e) Ensure all corporation main stops are open and all curb valves are closed.
- f) Ensure the test section is isolated and open all main valves within the test section.
- g) Maximum length of water main test sections shall be 450 m, unless otherwise authorized or directed by the City.

.2 Pressure Testing

- a) At the point of the test, apply hydrostatic pressure of 1.5 times the operating pressure or 690 kPa, whichever is the greater, and at no point in the test section shall the hydrostatic pressure be less than 1.25 times the operating pressure.
- b) When the test pressure is achieved, the test will begin.
- c) Mark the gauge and level of water in the storage barrel at the beginning of the test. These will be used to calculate leakage at the end of the test.
- d) Maintain the test pressure, within ± 20 kPa, for two hours.
- e) During the test, inspect all exposed pipe, fittings, and appurtenance locations for signs of leakage or distress.
- f) At the end of the test, pump the test section back to the test pressure.
- g) The leakage allowance for PVC pipe will be determined by the Consultant using the following formula:

$$L = \frac{ND\sqrt{P}}{128,300}$$

Where: N = number of joints in the test section;
D = nominal pipe diameter in mm; and
P = average test pressure in kPa.

- h) The number of joints is estimated from the total length of pipe installed plus 1 joint allowance for each water service connection.
- i) An additional allowance is made when testing against closed metal-seated valves. This allowance is 0.0012 L per hour per mm of nominal valve size.
- j) If the total volume of makeup water used to pump the test section back up to the test pressure exceeds the allowable leakage, inspect the test section for and repair leaks or defective pipes, or remove trapped air and repeat the test.

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- k) Repair and re-test until leakage is within the specified limits.
- l) Upon successful completion of testing procedures, complete any remaining backfilling and surface restoration.

.3 Disinfection

- a) Submit a detailed work plan for disinfection procedures to the City for review at least two (2) weeks prior to conducting such activities. The work plan must provide sufficient detail regarding water supply source, disinfection procedures, flushing procedures, discharge location, discharge de-chlorination procedures, and testing locations for chlorine residual and bacteriological testing.
- b) Only the City may operate existing utility systems. There are no exceptions.
- c) Disinfect the water main in accordance with AWWA-C651. The preferred method of disinfection is with calcium hypochlorite tablets, further described in the following.
 - i) Use 5-gram tablets and place one at each end of the water main, at 150 m intervals, at each hydrant lead, in each hydrant, and at other appurtenances to provide an average dose of 25 mg/L in the water main.
 - ii) Attach the tablets to the top inside of each piece of pipe during construction using Le Page's white, waterproof glue.
 - iii) The number of tablets required can be calculated from:

$$N = 6.28 \times 10^{-6} (D^2)(L)$$

Where: N = number of tablets required;

D = nominal pipe diameter in mm; and

L = length of pipe being disinfected in m

- iv) Slowly fill the water main, maintaining flow velocity below 0.3 m/s, to prevent premature dislodging of the tablets.
- v) Upon complete filling of the water main, allow minimum 12 hours of contact time at water temperatures greater than 5°C.
- vi) After 12 hours, test the chlorine residual and take bacteriological test samples. The free chlorine residual must be greater than 20 mg/L and the samples must successfully pass bacteriological testing prior to the water main being placed into normal operation. Should the test sample fail either of these testing procedures, the water main will be flushed and disinfected. This process shall be repeated until water samples pass these tests.
- d) Disinfection may be carried out simultaneously with pressure and leakage testing, provided the provisions of AWWA-C651 are followed.
- e) If repairs are made on any section of pipe, disinfection shall be repeated.

.4 Flushing

- a) Flush water mains clean of all dirt, debris, and other deleterious material prior to placing the water mains into normal operation.

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- b) The flushing flow rate shall be sufficient to achieve a minimum flow velocity of 0.8 m/s through the pipe.
- c) Flush water mains and safely discharge the water so that no downstream damage occurs.
- d) Discharge flushing water in a manner and to locations acceptable by the City. Sufficiently de-chlorinate flushing water in accordance with Article 5.32.5 prior to discharge.
- e) Where flushing is insufficient to clear material buildup in the water main, the Contractor shall undertake foam swabbing of the water main.

.5 De-Chlorination

- a) Flushing water must be sufficiently de-chlorinated prior to release. The maximum allowable free chlorine residuals that must be achieved prior to release are as follows:
 - i) 2.0 mg/L to sanitary sewers;
 - ii) 0.5 µg/L to storm sewers; or
 - iii) 0.00 mg/L to watercourses.
- b) No disposal of flushing water shall be permitted until the proposed de-chlorination procedures have been reviewed and accepted by the City.
- c) The preferred de-chlorination method includes utilizing a continuously fed neutralizing chemical introduced to the chlorinated water as it is flushed from the water main and before the water enters the receiving environment. Alternatively, a de-chlorination tank system may be used.
- d) Acceptable de-chlorination chemicals include sodium thiosulphate, sodium sulphite, and sodium bisulphate.
- e) Follow the instructions of the de-chlorination chemical supplier for mix ratios required for chlorine neutralization, application methods, and safety procedures.

5.33 Inspection of Valves and Hydrants

- .1 Upon completion of backfilling and surface restoration, check the operation of all valves and hydrants.
- .2 Hydrants are required to pass a pressure test at time of inspection.

5.34 Placing Water Mains into Service

- .1 Testing and cleaning, in accordance with Article 5.32, must be completed prior to placing a new water main into service.
- .2 Chlorine residual and turbidity values must meet the requirements provided by the Guidelines for Canadian Drinking Water Quality and Alberta Environment before placing the main into service.
- .3 Notify and arrange for a representative of the City's Utilities Department to conduct all necessary valve operations. Only the City may operate boundary valves; there are no exceptions. Open one boundary valve slowly, releasing air from the new main through hydrants or air release valves until the pressure is equalized and stable, then slowly open other boundary valves.

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- .4 Maintain a watch for a break in the new water main. In such an event, isolate the water main so that service interruptions will be minimal.
- .5 The Contractor is required to obtain water samples for bacteriological testing. Take bacteriological samples in accordance with AWWA C651.
- .6 In cooperation with the City, maintain a watch for leaks on the water main within 3 days of commissioning. Promptly repair any leaks which are detected.
- .7 If any water sample fails bacteriological testing, the City will issue directions for remedial action.

5.35 Hydrant Flow Testing

- .1 The Developer shall be responsible for providing all labour and materials to complete selective hydrant flow testing of new water mains to verify available flows and pressures within the new water distribution network in comparison with the design calculations and hydraulic analyses.
- .2 The Consultant must be present for all testing and shall be responsible for preparing and endorsing the test results.
- .3 The City must be notified at least one (1) week in advance of hydrant flow testing. Utilites to be contacted for assistance in operating the hydrant(s).
- .4 The results of the hydrant flow testing shall be summarized in a written report in a format acceptable to the City, and submitted to the City with the Developer's application for the Construction Completion Certificate.
- .5 Where the actual flows do not meet minimum fire and service requirements, all hydrants installed under the Design must be flow tested and the Developer shall be responsible for completing all necessary corrective measures to meet the required service level.
- .6 Hydrant dome, nozzle caps and pumper cap to be painted in accordance with the table below

Hydrant Flow Capacity		Dome, pumper and nozzle cap colour
US GPM	L/s	
1500 or greater	95 or greater	Safety Blue
1000-1500	60-95	Safety Green
500-1000	30-60	Safety Orange
<500	<30	Safety Red

5.36 Environmental Protection

- .1 The Contractor shall comply with all Alberta Environment and Environment Canada laws and regulations.
- .2 The Contractor shall immediately notify the City of any conflicts between any provision of applicable safety requirements or authorities. The City shall direct the Contractor on which provision shall apply to the Work in question.
- .3 The Contractor shall submit the following material to the City at least five (5) business days in advance on work commencing on the Site:
 - a) A signed copy of the Contractors ECO plan that must include as a minimum;

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- b) Spills and releases;
 - c) Air emissions and pollutions;
 - d) Noise;
 - e) Erosion and sedimentation control;
 - f) Water management;
 - g) Pesticide use; and
 - h) Waste management.
 - .4 All reports under the Environmental Protection and Enhancement Act shall be copied to the City.
 - .5 Spills and releases
 - a) The Contractor shall ensure that spills and releases are immediately reported to the appropriate regulatory agencies (Alberta Environment 1-800-222-6514) as required by law.
 - b) For environmental emergencies please call 911 first.
 - c) If the Contractor caused a spill or release into the environment, the Contractor shall satisfactorily clean the area and if necessary, remediate the affected area. The Contractor is responsible for identifying a satisfactory level of cleanup in consultation with the City of Wetaskiwin and relevant regulatory agencies.
 - d) Water Management
 - i) Water management includes all storm runoff, dewatering, wastewater and potable water releases into the environment.
 - ii) When working near a water line the Contractor shall have on site at all times an appropriate method for de-chlorination that will sufficiently reduce the chlorine levels to 0.0 mg/L by the time the potable water reaches an active body of water.
 - iii) The discharge of wastewater into the sanitary/stormwater system or water bodies is regulated by a number of federal, provincial and municipal laws or bylaws. The City of Wetaskiwin's bylaw includes the Wastewater Bylaw (Bylaw 1890-17). The requirements in the Wastewater Bylaw have been adopted and are enforced by Alberta Environment and the City of Wetaskiwin.
 - iv) The Contractor is responsible to implement proper wastewater management practices, and comply with all regulatory requirements.



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6.0 WASTEWATER COLLECTION SYSTEM

PART I – DESIGN

6.1 General

The wastewater collection system shall be designed with sufficient capacity to convey peak flows, including an allowance for inflow and infiltration (I/I). The following *minimum* criteria shall apply to the Design, as applicable to the proposed development:

- .1 Average and Peak Flows in Residential Areas:
 - a) Population Density:
 - i) R1 Zoning (Single Dwelling) – 95 persons/ha
 - ii) R2 Zoning (Low Density Residential) – 105 person/ha
 - iii) R3 Zoning (Medium Density Residential) – 230 persons/ha
 - iv) R4 Zoning (High Density Residential) – 250 persons/ha
 - b) Average Sewage Generation Rate: 320 L/capita/day.
 - c) Peaking Factor: $1 + \frac{14}{4 + \sqrt{P}}$, where P = contributing population in 1,000s.
- .2 Average and Peak Flows in Commercial and Institutional Areas:
 - a) Average Commercial and Industrial Sewage Generation Rate: Minimum of 20,000 L/ha/day.
 - b) Peaking factor will vary with the nature of the development. The Consultant shall conduct an analysis of the proposed commercial and institutional developments to estimate the peaking factor. Regardless of the results of the analysis, a minimum peaking factor of 3.0 shall apply.
- .3 Inflow/Infiltration (I/I) Allowance:
 - a) Inflow: 0.4 L/s for every manhole located within a sag area on a roadway with some form of water inflow control in place.
 - b) Infiltration: 0.28 L/s/ha.
- .4 All infrastructure shall be designed in accordance with The City of Wetaskiwn Bylaw No. 1896-18 also known as the “Wastewater Bylaw.”

6.2 Gravity Sewer Mains

- .1 Pipe Diameter:
 - a) Minimum 200 mm for residential areas and 250 mm for industrial/commercial areas.
- .2 Flow Velocity:

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- a) Minimum 0.6 m/s.
- b) Maximum 3.0 m/s.
- .3 Manning's "n":
 - a) $n = 0.013$
 - b) $n = 0.012$ for SaniTite HP pipe
- .4 Required Sewer Capacity:
 - a) Estimated Design Flow / 0.86
- .5 Pipe Slope
 - a) Minimum slope shall conform to the following table.

Pipe Diameter (mm)	Minimum Slope (%)
200	0.40
250	0.28
300	0.22
375	0.15
450	0.12
≥ 525	0.10

- b) The minimum slope of the first upstream section of sewer main shall have a minimum slope of 0.6%.
- c) For curved sewer installation, consider the following table that addresses degree of curvature of sewer mains and the impact on the percent increase to the minimum pipe slope and minimum manhole spacing and incorporate into the design.

C/L Sewer Radius (m)	Increase Minimum Pipe Slope (%)	Minimum Manhole Spacing (m)
92-100	50	92
100-150	40	95
150-200	30	105
200-250	20	115
250-300	10	120
> 300	0	120

- .6 Pipe Design
 - a) Strength design shall be integral to the pipe selection process.
- .7 Horizontal Alignment
 - a) Sewer mains shall be located within the road right-of-way, in accordance with the Engineering Standard Drawings in Appendix A.

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- b) For commercial, institutional and multi-family residential developments, the Consultant shall design typical cross-sections depicting the locations of the various necessary infrastructure to suit the particular development. Such cross-sections shall be subject to the review and acceptance of the City.
- c) Sanitary sewer mains must be located at least 3.0 m horizontally from any water main and 1.8 m horizontally from any storm sewer main or gas line, as measured between the nearest pipe walls of the two mains.
- d) Without limiting the requirements of Article 3.6.1 of these Standards, Public Utility Lot (PUL) widths shall be a minimum of 4.0 m for a single utility and 6.0 m for two utilities. A 1.0 m easement is required on the lots to either side of a PUL.
- e) Curved sewers shall run parallel to the centreline of the road.
- f) Pipe deflection shall be as per manufacturer specifications.

.8 Vertical Alignment

- a) Mains shall be installed to provide a minimum depth of cover of 2.75 m, as measured from the top of the pipe to the final finished grade at the surface, unless otherwise approved by the City. In cases where this depth of cover cannot be provided, insulation in accordance with the Engineering Standard Drawings shall be provided.
- b) Mains shall be installed to provide adequate sewer service connection depth at the property line for each individual lot service.
- c) At crossings with water mains, refer to Article 5.2.9c).
- d) At crossings with storm sewer mains, the following requirements shall apply:
 - i) Typically, storm sewer mains shall cross above sanitary sewer mains with sufficient vertical separation to allow for proper bedding and support of both mains.
 - ii) Where it is necessary for a storm sewer main to cross under a sanitary sewer main, the storm sewer main shall be protected by providing the following:
 - A minimum vertical separation of 0.3 m, as measured between the nearest pipe walls of the two sewer mains;
 - The sanitary sewer main shall be structurally supported to prevent joint deflection and settling; and
 - A full length of pipe shall be used for the sanitary sewer main at the crossing location. The pipe section shall be centered above the storm sewer main so that the nearest joints in the storm sewer main are equidistant from the crossing location.

6.3 Manholes

- .1 The maximum distance between manholes shall not exceed 120 m. The distance between manholes for curved sewers is based on the table in Section 6.2.5(c).
- .2 Manholes are required at all changes in pipe diameter, grade, and direction, at junctions, at the ends of mains, and at either end of a curved sewer.

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- .3 Manholes must be located to accommodate access by maintenance equipment and vehicles including PUL's and offsite locations / installations.
 - .4 Wherever possible, manholes shall be located on the projection of property lines to avoid conflict with driveways.
 - .5 At manholes where changes in pipe diameter occur, the crowns, or obverts, of the mains shall be placed at the same elevation. Regardless of the design flow and pipe slope, pipe diameter shall not be permitted to be decreased through the downstream direction.
 - .6 For straight-run manholes, a minimum drop of 12 mm shall be provided between the manhole inlet and outlet. For corner-run manholes, a minimum drop of 50 mm shall be provided between the manhole inlet and outlet.
 - .7 For corner-run manholes, designed to achieve a necessary change in direction of the sewer main, the angle of direction change shall not exceed 90°. This may be further restricted in cases where the estimated sewer flows through the main are not high enough to achieve sufficient cleansing velocity. For sewer mains greater than 600 mm in diameter, changes in flow direction at manholes shall not exceed 45° (degrees).
 - .8 Drop structures are required at manholes with a vertical separation of 750 mm or greater between the inlet and outlet mains. Internal drop structures may be used for sewer mains of 250 mm diameter or less. External drop structures must be provided for sewer mains greater than 250 mm diameter. Refer to the Engineering Standard Drawings in Appendix A for further information on drop structures.
 - .9 Do not locate manholes within sag areas or depressions where surface ponding might occur on hard surfaces (asphalt or concrete). Where such is unavoidable, provision must be made to suitably seal the manhole from surface runoff inflow including a F-90 frame and covers. F-90 frame and covers are not to be used in landscaped areas.

6.4 Wastewater Service Connections

- .1 Each lot and multi-family unit shall have its own wastewater service connection designed in accordance with the following articles and the Engineering Standard Drawings in Appendix A.
- .2 Service connections for commercial lots, institutional lots and apartment developments, shall be sized according to the anticipated user requirements.
- .3 Wastewater service connections for residential lots shall be a minimum of 150 mm diameter and installed at a minimum 2% grade continuously from the service connection at the main to the service termination at the end of the front lot easement. Sags in gravity service connection pipes that hold standing water will be rejected by the City and require re-installation at the Developers expense. The terminus of the 150 mm wastewater service shall be reduced to 100 mm and capped at the end of the front of lot easement.
- .4 Wastewater service connections for commercial and multifamily shall have a minimum 150 mm and a minimum slope to maintain a cleansing velocity (0.6 metres per second)."
- .5 Wastewater service connections shall have a depth of bury of 3.0 m at the property line, as measured from the pipe invert to the finished final grade unless otherwise approved by the City. In cases where this depth cannot be achieved, insulation will be required in accordance with the Engineering Standard Drawings.

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- .6 Where a sewer service must connect to a sewer main exceeding 4.5 m in depth below the finished surface, a riser shall be installed to 3.0 m depth of bury at the sanitary main. Transition of pipe run to the drop structure must utilize long radius type bends. No single bend is to exceed 45 degrees.
- .7 Where bends are required, long radius-type bends shall be used. Alternatively, a combination of 22.5° bends and straight lengths of pipe may be used.
- .8 Service connections shall be located such that they do not conflict with driveway locations. (When possible in cul de sac locations.)
- .9 Lot services shall be located as shown on the Engineering Standard Drawings in Appendix A, with the water service located nearest the driveway, followed by the wastewater service located furthest from the driveway on the lot.
- .10 Where the water service is 50 mm or smaller in size, the water and wastewater services shall be located in a common trench. Where services are located in a common trench, provide minimum 300 mm horizontal and vertical separation between water and sewer services.
- .11 Where the water service is larger than 50 mm diameter, water service pipes shall be located in a separate trench, at least 3 m from any sewer services and 1.8 m from any other buried utility lines.
- .12 Service connections shall be extended into the lot to terminate 1.0m past the Utility-Right-of-Way.
- .13 At the end of cul-de-sacs, the three lots nearest to the manhole shall have their sewer services connected to the manhole just above the benching.
- .14 Where the service length, measured from the main to the proposed building, will exceed 30 m, provide a cleanout at the property line. Cleanouts shall be in accordance with the Engineering Standard Drawings in Appendix A.
- .15 Service connections for commercial, institutional and multi-family residential lots shall be designed with consideration of the depth requirements for servicing of these lots and the potential impact on the depth requirement for the downstream sewer main.
- .16 For commercial, institutional and multi-family residential lots, a sampling manhole shall be provided on the wastewater service connection, either inside of the road right-of-way or at an accessible location upon private property (minimum 1.5m inside private property). The sampling manhole shall be installed at the time that the lot is developed.

6.5 Unapproved Connections

- .1 Weeping tiles, roof leaders, and other stormwater or groundwater handling appurtenances shall not be permitted to tie-in to the wastewater collection system. Refer to Section 7.0 for the requirements pertaining to these systems.

6.6 Lift Stations and Sewage Force Mains

- .1 Wherever possible, every reasonable effort should be made in the design to provide a drainage system for the Development that relies solely on gravity for conveyance in order to minimize the overall operation and maintenance requirements and life cycle costs of the system.

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- .2 Where absolutely necessary, the City may accept design proposals which include lift stations and force mains to convey wastewater and/or stormwater out of the Development.
- .3 The Consultant shall consult with the City while conducting the Design to obtain the City's preliminary comments and input regarding any proposed lift station and force main. The City may have additional requirements of the Design in this respect.
- .4 General Lift Station Requirements
 - a) Pumps should be non-clog type, capable of passing a 75 mm solid.
 - b) Pumping capacity shall be designed for peak flows with 100% redundancy.
 - c) Backup power generation capability is required at all new lift stations, fuel source to be diesel.
 - d) The backup generator and station controls shall be located in a suitable building located adjacent to the lift station. The station shall be architecturally compatible with the Development and located such that it is readily accessible by City Utilities staff.
- .5 Force mains shall be designed and constructed in accordance with the same requirements for water mains, as specified in the applicable articles of Section 5.0.
- .6 The Design shall fully describe the details regarding any proposed lift station and force main system. The City may request additional details regarding the design in order to ascertain its acceptability.

PART II – MATERIALS

6.7 Gravity Sewer Mains

Gravity sewer mains shall be polyvinyl chloride (PVC) or concrete pipe.

- .1 PVC Pipe and Fittings
 - a) PVC pipe shall be acceptable for up to 900 mm diameter sewer mains.
 - b) PVC pipe and fittings shall meet CAN/CSA-B182.2 with locked-in elastomeric ring gasket and integral bell system joint type.
 - c) Minimum pipe dimension ratio shall be DR35. Strength design, considering trench and road loading, shall be integral to pipe design process.
 - d) Pipe shall be installed within two years from the production date indicated on the certification. Any pipe displaying discoloration from exposure to the elements must be discarded and will not be approved for installation.
 - e) Joint lubricants shall be compatible with gasket material.
- .2 Concrete Pipe and Fittings
 - a) Non-Reinforced Circular Concrete Pipe and Fittings
 - i) Non-reinforced concrete pipe shall be acceptable for 200 mm to 375 mm diameter sewer mains where strength design, considering trench and road loading, for the pipe is suitable.

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- ii) Pipe and fittings shall meet CAN/CSA-A257.1, Class 3, and designed for flexible rubber gasket joints to CAN/CSA-257.3, and constructed with Type HS sulphate resistant Portland cement to CAN/CSA-A3000.
 - b) Reinforced Circular Concrete Pipe and Fittings
 - i) Reinforced concrete pipe shall be acceptable for sewer mains with a diameter of 250 mm and up.
 - ii) Pipe and fittings shall meet CAN/CSA-257.2, concentric reinforcing, designed for flexible rubber gasket joints to CAN/CSA-257.3, and constructed with Type HS sulphate resistant Portland cement to CAN/CSA-A3000.
 - iii) Strength design, considering trench and road loading, shall be integral to pipe design process. D-load shall be as determined by load analysis.
 - c) Lined Pipe and Fittings
 - i) Reinforced concrete gravity sewer mains greater than 750 mm in diameter must be lined with a suitable liner, non-susceptible to surface damage from H₂S induced corrosion.
 - ii) Liner shall be PVC or HDPE and shall be cast into the interior pipe wall.
 - iii) Liner shall be free of cracks, cleavages, or other defects adversely affecting the protective characteristics of the material.
 - iv) The lining shall be repairable at any time during the life of the pipe or the structure.
 - v) In accordance with ASTM-D412, the minimum tensile strength across welded joints shall be 14 MPa.
 - vi) Liner shall be T-Lock, as manufactured by Ameron Protective Lining Products, or accepted alternate.
 - vii) Alternate pipe materials, non-susceptible to surface damage from H₂S, may be proposed and will be reviewed by the City.

6.8 Manholes

- .1 Manholes shall be minimum 1,200 mm in diameter and in accordance with the Engineering Standard Drawings in Appendix A.
- .2 Manhole materials shall be reinforced concrete, constructed of Type HS sulphate resistant cement.
- .3 Precast manhole sections, adjusting neck rings, and manhole steps shall conform to CAN/CSA-A257.4 and ASTM-C478.
- .4 New installation wastewater manholes shall be supplied with pre-benched manhole bases and pre-cored service connections complete with watertight gaskets, Duraseal or accepted alternate. The only exceptions to the requirement for pre-benched or pre-cored wastewater manholes are perched manholes and pipe diameters that are greater than 525 mm.

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- .5 Manhole joints shall meet the requirements of CAN/CSA-257.3 and ASTM-C443. Furthermore, all joints shall be sealed with a non-shrink grout both inside and outside for the full circumference of the manhole. D-lok gasket or equivalent can be used as an alternative.
- .6 Manhole steps shall be standard safety type, constructed of hot-dipped iron in accordance with ASTM-A615 and ASTM-A123 or aluminum, forged of 6061-76 aluminum alloy, with a minimum tensile strength of 200 MPa.
- .7 Frames and Covers
- a) Type F-80 and type F-90 manhole frame and covers shall be made from ductile iron, conform to ASTM A536, be Class 60-40-18 and conform to the Engineering Standard Drawings in Appendix A. (Class 80-55-06 is an acceptable alternative).
 - b) Type F-39 manhole frame and covers shall be made from grey cast iron, conform to ASTM A48, be Class 20B and conform to the Engineering Standard Drawings in Appendix A. (Class 35B is an acceptable alternative).
 - c) Frames for manholes on paved surfaces that are in sag locations shall be Type F-90 complete with rubber gasket seal and solid cover.
 - d) Frames for manholes on paved surfaces that are not in sag locations shall be Type F-80 floating type with solid cover.
 - e) Frames for manholes not on paved surfaces shall be Type F-39 with solid cover.
 - f) All Type F-39, F-80, and F-90 covers shall be imprinted with the City of Wetaskiwin name.
 - g) All frame and covers shall be supplied by Trojan Foundry Ltd., Norwood Foundry Ltd., or accepted alternate.
 - h) Frames and covers shall be hot dipped galvanized according to CSA G164-M.
- .8 Perched manholes, or accepted alternate, are required for sewer mains from 600 mm to 1,050 mm in diameter and shall be in accordance with the Engineering Standard Drawings in Appendix A.
- .9 Tee-riser manholes, or accepted alternate, are shall be used for sewer mains greater than 1,050 mm in diameter and shall be in accordance with the Engineering Standard Drawings in Appendix A.
- .10 For manholes exceeding 7 m in depth, the City may stipulate requirements for additional manholes.
- .11 The City may require lockable covers be provided where safety or security risks may be a concern.

6.9 Wastewater Service Connections

- .1 Single-family residential sewer services shall be PVC pipe conforming to Article 6.7.1.
- .2 Wye-type in line fittings shall be used to connect service connections to sewer mains for all new construction. Tee-type fittings may be permitted provided that the fitting is position such that the service connection discharges into the upper half of the sewer main. Strap-on or inserted tee type service saddles shall be permitted for service connections to existing mains.

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- .3 Sewer services for all other developments, in accordance with Article 6.4, shall comply with Article 6.7.

6.10 Force Mains

Force mains shall be PVC or high density polyethylene (HDPE) pipe.

- .1 PVC Pipe and Fittings
- a) PVC pipe and fittings shall conform Article 5.7 of these Standards.
- .2 HDPE Pipe and Fittings
- a) HDPE pipe shall be classified as PE3408, conforming to CSA B137.1 for 150 mm diameter and smaller, and CGSB-41-GP-25M for 200 mm diameter and larger.
 - b) Minimum acceptable pipe diameter shall be 100 mm.
 - c) Pipe material shall conform to ASTM-D1248 Type III, Class C, Category 5.
 - d) Pipe Design:
 - i) The pipe shall be designed in accordance with ASTM-F714.
 - ii) Minimum acceptable pipe class shall be DR-26.
 - iii) Strength design, considering trench and road loading, shall be integral to pipe design process.
 - e) Fittings:
 - i) HDPE or cast iron fittings may be used in conjunction with HDPE pipe.
 - ii) Suitable cathodic protection shall be provided for all cast iron fittings.
 - iii) Fittings shall be designed and manufactured to operate at not less than the design working pressure of the pipe system for which it is to be installed.
- .3 Valves
- a) Valves for force mains shall conform to Article 5.9 of these Standards, and must be suitable for wastewater applications.

6.11 Bedding and Backfill

- .1 Refer to Article 5.13 of these Standards.

PART III – CONSTRUCTION**6.12 General**

- .1 The following articles represent the minimum requirements for some typical, key construction procedures for wastewater collection system construction. These minimum requirements must be met or exceeded by the detailed construction specifications and drawings developed by the Consultant.

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6.13 Quality Assurance

- .1 Refer to Article 5.15 of these Standards.
- .2 All PVC pipe shall be tested by the manufacturer and marked in accordance with CAN/CSA-B182.2.

6.14 Quality Control Testing

- .1 Refer to Article 5.16 of these Standards.

6.15 Site Preparation

- .1 Prepare the site in accordance with Article 3.26 of these Standards.

6.16 Clearing

- .1 Conduct clearing in accordance with Article 3.27 of these Standards.

6.17 Grubbing

- .1 Complete grubbing in accordance with Article 3.28 of these Standards.

6.18 Topsoil Stripping and Stockpiling

- .1 Strip and stockpile topsoil in accordance with Article 3.29 of these Standards.

6.19 Trench Excavation

- .1 Refer to Article 5.22 of these Standards.

6.20 Alignment and Grade

- .1 Lay pipe to the required alignment and grade, with manholes and all other appurtenances at the locations identified on the construction drawings or otherwise directed by the City.
- .2 Provide minimum 2.75 m depth of cover on sewer mains, unless otherwise authorized by the City in writing. Where depth of cover is less than 2.75 m, provide insulation.
- .3 Acceptable tolerances are as follows:
 - a) Alignment – the centreline of the pipe shall not be more than 100 mm off the specified alignment.
 - b) Elevation – the pipe invert shall not be more than 6 mm plus 0.01 mm per mm diameter of the pipe off the specified elevation.
 - c) Joints – for concrete pipe, deflections at joints shall not exceed that specified by CAN/CSA-A257. For PVC pipe, deflections at joints shall not exceed those recommended by the manufacturer.
- .4 All pipe shall be laid sloping in the desired direction with no reversed grades on any pipe lengths.
- .5 Maintain, and provide to the City upon request, grade sheets for the installation of the pipe.
- .6 No deviation shall be made from the required alignment or grade without the written consent of the City.

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- .1 Refer to Article 5.24 of these Standards.

6.22 Pipe Installation

- .1 General
- a) Follow manufacturer's instructions for pipe installation. Installation of PVC pipe and fittings shall be in accordance with CAN/CSA-182.11.
 - b) Do not allow contents of existing sewers or sewer connections to flow into the trench.
 - c) Do not use heavy vibratory equipment for compaction of backfill until at least 1 m of backfill has been placed over the pipe.
 - d) When pipelaying is complete, the sewer must be thoroughly cleaned of all dirt, stones, rubbish, and debris. Deleterious material shall be prevented from entering the installed lines and traveling into the existing system.
 - e) Do not install PVC pipe and fittings in areas that are, or may be, contaminated with organic solvents, petroleum products, or other materials which may negatively effect the structural integrity of the PVC product.
- .2 Laying Pipe
- a) Lay pipe with the bells upgrade, and proceed upgrade.
 - b) Produce a smooth, uniform invert.
 - c) Plug lifting holes with non-shrink grout.
 - d) For connections to existing sewer pipes, submit a field-jointing plan to the City for review and acceptance prior to commencing the field joint.
- .3 Joining Pipe
- a) Join pipe in accordance with the manufacturer's recommendations.
 - b) Clean and check the sealing surfaces to ensure that they are smooth, concentric, and free from imperfections that might affect the sealing performance of the gasket.
 - c) Lubricate sliding surfaces and couple the pipes immediately.
- .4 Connecting to Existing Mains
- a) Notify the City in writing at least one (1) week prior to connecting to an existing sewer main within the City's road right of way. Apply to the City's Engineering Services Department and complete a Site Servicing Permit (SSP). Include a work plan identifying necessary flow control and a contingency plan detailing the procedures to be observed in the event of problems during the connection process or other emergency. Written acceptance must be received from the City at least 24 hours before connecting to existing mains.
- .5 Manhole Break-Ins
- a) Break-in holes shall be made by a circular coring machine through the manhole wall. If a circular coring machine is not feasible, then a break-in can be completed by carefully

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chiseling the hole. Blunt tools, including sledgehammers, shall not be used to put holes in manholes.

- b) Break-in holes shall not exceed a reasonable size to permit the smooth movement of the new pipe into the manhole.
- c) All due care shall be taken to avoid damage to surrounding areas of the manhole. Any areas of the manhole that have been damaged during the break-in shall be repaired by the Contractor to the satisfaction of the City.
- d) Following installation of the new pipe, the break-in area shall be suitably repaired and grouted, providing a watertight seal around the pipe.
- e) The flow channel in the manhole shall be modified to provide a smooth continuation of flow from the break-in pipe through the manhole.

.6 Plugging of Dead Ends

- a) Insert standard plugs into the bell ends of fittings or pipe bells at dead ends.

6.23 Setting Manholes

.1 General

- a) Bases shall be placed on solid, unfrozen ground.
- b) Construct manhole unit plumb and true to alignment and grade.
- c) External drop structure assemblies shall be encased in concrete.
- d) Plug all lifting holes with non-shrink grout. D-lok gasket or equivalent can be used as an alternative.
- e) Seal all interior and exterior manhole barrel joints with suitable non-shrink grout. D-lok gasket or equivalent can be used as an alternative.
- f) Alternative applications such as Boa-Tape and Riser-Wrap are considered acceptable joint sealing measures for the exterior joints on manhole barrel sections.
- g) Ladders shall be installed plumb and be continuous from 300 mm above the manhole base benching up to 600 mm below the rim elevation (finished ground elevation).
- h) Benching shall provide smooth inverts on regular curves through the manhole.

.2 Manhole Completion

- a) Backfill around the manhole with class I backfill or fillcrete, as specified in Article 5.13, or fillcrete. Sand backfill shall be placed and compacted to minimum 98% Standard Proctor Density in uniform lifts not exceeding 150 mm in depth.
- b) Wherever possible, set the conical tops such that the vertical side is on the right hand side of the manhole, when looking upstream.
- c) Ensure manhole rungs are aligned to one another and to access point.
- d) In grassed areas, provide 300 mm depth clay cap around the manhole.
- e) Place frame and cover on top section to elevation indicated, and adjust tops flush finished grades.

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- f) If vertical adjustment is required for final grade, use concrete grade rings to a maximum depth of 450 mm with a maximum of 3 grade rings in total.
- g) Grade rings must not be staggered horizontally more than 100mm beyond plumb with the edge of the top barrel section.
- h) Seal all interior and exterior grade ring joints with suitable non-shrink grout. Rubber gasket each joint.
- i) The application of water proofing membrane type is an acceptable alternative to grouting the exterior of grade ring joints.
- j) Do not grout floating frame and covers (F-80 and F-90) to grade rings.

6.24 Wastewater Service Connections

- .1 Single-family residential wastewater services, in accordance with Article 6.4, shall conform to the following.
- .2 Services crossing under roads shall be augered unless the development has received written approval from the City to utilize uniform backfill and open cut installation. The application of open cut service installations and uniform backfill must be recommended in writing by the Geotechnical Engineer and provided to the City. At a minimum, the uniform backfill zone shall extend from property line to property line and be at least 1.5 m in vertical depth across the full right of way. The uniform backfill zone shall have maximum 300 mm lift thickness and achieve minimum 98% S.P.D. as monitored and tested by the Geotechnical Engineer. At the end of cul-de-sacs and for lots located adjacent to the mains, open trenching installation of the services may be permitted with the written authorization of the City.
- .3 Services installed by open trench or through auger pits shall be bedded in accordance with Article 6.21.
- .4 Pipe zone backfill shall be placed to 300 mm above the crown of the highest service in the trench or auger pit.
- .5 Service connections shall be extended into the lot to terminate 1.0m past the Utility-Right-of-Way.
- .6 Sanitary service connections shall be:
 - a) Minimum 150 mm diameter
 - b) The 150 mm diameter service from the main shall be reduced to 100 mm diameter and plugged/capped at 0.15 m inside the lot easement boundary.
- .7 Install red-painted stakes, 38 mm by 89 mm in size, extending from the termination point of the service point to a minimum of 0.5 m above the finished surface elevation.
- .8 Backfill trenches and auger pits in accordance with Article 5.31.
- .9 Augering and Boring
 - a) Refer to Article 5.29.8.
- .10 Connection to the Sewer Main
 - a) Install in-line tee-type fittings in accordance with the manufacturer's recommendations.

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- b) Where the main pipe is greater than 450mm a insert tee can be used.
 - c) Where the use of strap-on type service saddles has been authorized by the City, install in accordance with the manufacturer's recommendations.
 - d) Apply construction adhesive or similar non-destructive sealant, to ensure a watertight seal.
- .11 Pipe Installation
- a) Refer to Article 6.22.
- .12 Cleanouts
- a) Install cleanouts in accordance with the Engineering Standard Drawings in Appendix A.
- .13 Record of Services
- a) Refer to Article 5.29.13.
- 6.25 Trench Backfill**
- .1 Refer to Article 5.31 of these Standards.
- 6.26 Sewer Main Inspection and Testing**
- .1 Any sewer mains that fail to pass inspection and testing, or having obstructions, breaks, or any other defects including zero grade or back grade shall be repaired, re-inspected, and re-tested to the satisfaction of the City, at the Developer's sole expense.
- .2 Prior to applying to the City for a Construction Completion Certificate and placing sewer mains into operation, the sewer mains shall be thoroughly cleaned of all debris and inspected by CCTV.
- .3 Closed-Circuit Television (CCTV) Inspection
- a) CCTV inspection of all installed sewer mains must be completed.
 - b) One copy of the written CCTV inspection report, including still photographs (showing typical pipe details, joints, and service connections, and any defects) and video footage of inspection must be provided to the City with the application for the Construction Completion Certificate.
 - c) Video footage must be in full colour DVD-video format, unless otherwise accepted by the City.
 - d) Where the CCTV inspection shows infiltration present within any uncommissioned sewer main, the City may require an infiltration or exfiltration test be completed.
- .4 Testing
- a) Where testing is required, the City will determine if the test shall be an infiltration or exfiltration test.
 - b) The City will direct which sections of the main shall be tested.
 - c) The Developer shall provide all water, materials, equipment, and labour required for the testing. Equipment shall include plugs, metres, and other measuring equipment that is acceptable to the City, to measure exfiltration or infiltration.

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- d) Infiltration testing shall be performed by plugging the upstream end of the test section and measuring flow at the downstream end.
- e) Exfiltration testing shall be performed by plugging both ends of the test section and filling the test section to provide a hydrostatic head of 600 mm above the top of the highest point in the test section.
- f) The test duration shall be 4 hours.
- g) The allowable leakage shall be as follows:

Type of Pipe	Allowable Leakage
Concrete Pipe	60 L/mm dia./km/day
PVC Pipe	5 L/mm dia./km/day

- h) No additional leakage allowance will be made for manholes.

6.27 Sewer Service Inspection and Testing

- .1 All CCTV inspections of services must be preceded by the addition of no less than 100 liters of water so areas of sagging can be completely identified.
- .2 All sewer services shall be visually inspected using a CCTV at the time of installation to ensure consistent alignment and grade. The Consultant and City must witness all such tests.
- .3 For service connections longer than 30 m, three (3) months prior to the expiry of the Warranty Period, the Developer shall be responsible for conducting CCTV inspection of the service connections, in accordance with the applicable requirements of Article 6.26.2.
- .4 Any sewer services that fail to pass inspection and testing, or having obstructions, breaks, or any other defects, shall be repaired, re-inspected, and re-tested to the satisfaction of the City, at the Developer's sole expense.
- .5 The Consultant must provide a written report confirming satisfactory inspection and testing of each sewer service. The report shall be provided with the application for the Construction Completion Certificate.

6.28 Final Inspection

- .1 Three (3) months prior to the expiry of the Warranty Period, the Developer shall be responsible for arranging for an additional CCTV inspection of the installed sewer mains, in accordance with the applicable requirements of Article 6.26.2.
- .2 Any sewer mains having obstructions, breaks, sags, or any other defects, shall be repaired, re-inspected, and re-tested to the satisfaction of the City, at the Developer's sole expense, prior to application for the Final Acceptance Certificate.
- .3 One copy of the written CCTV inspection report, including still photographs and video footage of inspection must be provided to the City with the application for the Final Acceptance Certificate.
- .4 The Final Acceptance Certificate shall not be issued by the City until the CCTV reports and footage has been reviewed and accepted by the City.

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7.0 STORMWATER MANAGEMENT SYSTEM

PART I – DESIGN

7.1 General

- .1 The City's stormwater management objectives are as follows:
 - a) Prevent all property damage and flooding, and minimize disruption to public activity due to runoff from a 1:5 year return frequency, or more frequent, rainfall event;
 - b) Prevent significant damage, physical injury, and loss of life due to runoff from a 1:100 year return frequency, or more frequent, rainfall event; and
 - c) Ensure that new infrastructure is designed with climate change adaptation to reduce the systems vulnerability to sudden changes and offset the effects of global warming.
 - d) Improve stormwater quality, through filtering of contaminants, prior to discharge to receiving watercourses and prevent erosion of the receiving watercourse.
- .2 Refer to Article 7.11 for details regarding stormwater management system design for infill or redevelopment projects.
- .3 In general, storm drainage system elements should be designed to accommodate runoff flow rates and volumes as listed below:

System Elements	Design Basis (rainfall return period)
Minor drainage system components servicing areas of 30 ha and less	5 years.
Minor drainage system trunk sewers servicing areas greater than 30 ha	5-year runoff rate plus 25%.
Major drainage system conveyance elements	100 year runoff rate plus 20%.
Major drainage system storage	Generally, designs are to be based on elements providing the volume equivalent of 120 mm depth of water over the total catchment area. Designs are to be evaluated considering the most critical storage event as may result from selected design and historical rainfall events.

- .4 **The Design must limit post-development peak runoff flows from the Development to 2.5 L/s/ha or to match pre-development runoff flows, whichever is lower.**
- .5 The City's stormwater management system consists of two distinct conveyance systems: a minor system and a major system (i.e. the dual drainage concept). Under this concept, the minor system is designed for drainage and the major system is designed for flood control. The minor system consists of buried storm sewers and the major system generally consists of roadways and open channels.

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- .6 In addition to the minimum requirements set forth by these Standards, the requirements of the *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems, Part 5 Stormwater Management*, Alberta Environment, latest edition, must be duly addressed by the Design. Wherever feasible and applicable, Alberta Environment's stormwater quality best management practices (BMPs) shall be applied within the Design. In accordance with Alberta Environment's *Municipal Policies and Procedures Manual* (April, 2001), stormwater management techniques to improve water quality shall be included to effect a minimum of 85% removal of sediments of particle size 75 µm or greater.
- .7 Effluent from sanitary sewers or any other potentially contaminated drainage from commercial sites shall not be discharged into storm sewers.
- .8 The Design shall provide for the interception, conveyance, and storage of all overland drainage which enters the Development from surrounding, undeveloped areas for the indefinite future or interim period until development of such areas occurs. Furthermore, the stormwater management system shall be designed to ensure the Development does not adversely affect the existing drainage pattern of surrounding areas, whether during or following construction.
- .9 Where a capacity deficiency is determined within stormwater management infrastructure located downstream of the Development, the Developer and the City shall negotiate a potential solution through the Development Agreement process.

7.2 Minor System General Design Criteria

The following *minimum* criteria shall apply to the Design for the minor system, as applicable to the proposed development:

- .1 General
 - a) The minor system shall be designed to accommodate runoff generated by a 1:5 year rainfall event and flows from the foundation drain discharge system. Storm sewer mains shall be designed to accommodate, without surcharge, the anticipated design flow.
 - b) Storm services will not be used. The City encourages surface discharge of sump pumps and onsite storm water management.
 - c) The minor system shall accommodate design flows such that:
 - i) An equivalent width of one traffic lane remains free from inundation at design flows on local and collector roadways;
 - ii) An equivalent width of one traffic lane in each direction remains free from inundation at design flows on arterial roadways; and
 - iii) No surcharging of sewer pipes occurs.
 - d) The application of computer simulation modeling is highly recommended to be employed for the Design, however, the Rational Method may be used for the detailed design of minor drainage systems that drain areas of 65 ha or less. Computer simulation modeling shall be required for the Design where the minor drainage systems drain areas larger than 65 ha. Computer simulation modeling shall be completed using a computer program acceptable to the City and in accordance with acceptable standard design practices. Modeling results shall be fully detailed in the Design Report to be submitted with the application for the Development Agreement.

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- e) All infrastructure shall be designed in accordance with The City of Wetaskiwn Bylaw No. 1896-18 also known as the “Wastewater Bylaw.”

.2 Design Flows

- a) The Rational Method shall be employed to estimate design flows for areas smaller than 65 ha, as follows:

$$Q = \frac{CiA}{360}$$

Where: Q = runoff rate (m³/s)
C = runoff coefficient
i = rainfall intensity (mm/hr)
A = contributing area (ha)

b) Runoff Coefficient

- i) Where the site-specific conditions of ultimate site development are unknown, runoff coefficients may be selected from the following table on the basis of the zoning or proposed land uses for the Development.

Land Use	Runoff Coefficient, C	Imperviousness Range (%)
Parks, Reserves, Grassed Areas	0.15	10 – 50
Single Family Residential	0.50	40 – 60
Multi-Family Residential	0.70	50 – 100
Commercial	0.70	50 – 100
Paved Areas and Roofs	0.95	90 – 100

- ii) Where the site-specific conditions of ultimate site development are known, runoff coefficients shall be consistent with the imperviousness (imp) for each respective land use and shall be calculated using the following formula for design rainfall events with a return period of 10 years or less.

$$C = (0.95 \times \text{imp}) + 0.1(1.0 - \text{imp})$$

- iii) To apply the preceding formula to determine the runoff coefficient for a design rainfall event with a return period greater than 10 years, modify the calculated runoff coefficient in accordance with the following table.

Return Period (t _R)	Runoff Coefficient Multiplier
10 year < t _R ≤ 25 year	1.1
25 year < t _R ≤ 50 year	1.2
t _R > 50 year	1.25

c) Rainfall Intensity

- i) Rainfall intensity (i) is determined from the appropriate Intensity-Duration-Frequency (IDF) curve based on the time of concentration (t_c), as calculated by the following formula:

$$t_c = t_i + t_t$$

Where: t_c = time of concentration (min)

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 t_i = inlet time (min)

 t_t = travel time (min)

- ii) Inlet time, t_i , is the time for drainage to travel from the extreme limits of the catchment to the first point of inflow into the storm sewer being designed. Inlet time is dependent on the imperviousness, ground slope, and size of the catchment. A maximum inlet time of 15 minutes shall apply to single-family residential areas. Inlet time must be less than 15 minutes for commercial, institutional and medium/high density residential areas due to a larger percentage of the area being impervious. For conceptual or preliminary designs, inlet time can be estimated from the catchment area and imperviousness using the following table:

	Design Inlet Time (t_i)	Imperviousness		
		30%	50%	> 70%
Area	$t_i \leq 8.0$ ha	8.0 min	8.0 min	5.0 min
	$8.0 < t_i < 40$ ha	9.2 min	9.2 min	6.0 min
	$t_i \geq 40$ ha	10.4 min	10.4 min	7.3 min

- iii) Travel time, t_t , is the time for drainage to travel through the conveyance system from the point of inflow to the design location. Travel time is dependent on the pipe material, pipe slope, and the design flow rate.
- iv) Rainfall data shall be as provided by the official Regional Station located at the Edmonton City Centre Airport. From the Edmonton City Centre Airport IDF curve data for 1984-2010, rainfall intensity, i , can be calculated using the following formula, derived from a least squares solution of the raw data:

$$i = \frac{a}{(t_c + b)^c}$$

Where: i = rainfall intensity (mm/hr)

t_c = time of concentration (min)

a, b, c = constants from the following table

Constants	Rainfall Event Return Frequency						
	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	200 Year
a	460.81	521.52	549.94	664.78	730.54	808.33	906.23
b	7.152	6.024	4.477	3.649	2.927	2.587	2.503
c	0.810	0.749	0.713	0.697	0.677	0.652	0.629

- d) Catchment Area

- i) Catchment area is the area, in ha, of the catchment contributing inflow into the storm sewer being designed.

7.3 Gravity Sewer Mains

.1 Pipe Diameter:

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- a) Minimum 300 mm
 - .2 Flow Velocity:
 - a) Design mean flow velocity 0.9 to 1.0 m/s
 - b) Minimum 0.6 m/s
 - c) Maximum 3.0 m/s
 - .3 Manning’s “n”:
 - a) $n = 0.013$
 - .4 Pipe Slope:
 - a) Minimum slope shall conform to the following table:

Pipe Diameter (mm)	Minimum Slope (%)
300	0.22
375	0.15
450	0.12
≥ 525	0.10
 - b) The parameters for curved sewers are summarized in Section 6.2.5.c.
 - .5 Pipe Design
 - a) Strength design shall be integral to the pipe selection process.
 - .6 Storm Trunk Sewer Mains
 - a) Storm trunk sewers are defined as storm sewer mains which serve drainage areas greater than 30 ha.
 - b) Storm trunk sewers shall be designed to accommodate, without surcharge, the anticipated design flow multiplied by a safety factor of 1.25 in order to account for potential future changes in land use and ensure trunk sewers do not surcharge before upstream lateral storm sewers.
 - c) In cases where a storm trunk sewer will receive both uncontrolled flow from a drainage area greater than 30 ha *and* controlled discharge from stormwater management facilities, the storm trunk sewer shall be designed to accommodate the anticipated uncontrolled design flow multiplied by a safety factor of 1.25 plus the design maximum outflow rates from the stormwater management facilities.
 - d) The minimum diameter of trunk sewers shall be 1200mm.
 - .7 Horizontal Alignment
 - a) Storm sewer mains shall be located within the road right-of-way, in accordance with the Engineering Standard Drawings in Appendix A.
 - b) For commercial and multi-family residential developments, the Consultant shall design typical cross-sections depicting the locations of the various necessary infrastructure to suit the particular development. Such cross-sections shall be subject to the review and acceptance of the City.

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- c) Storm sewer mains must be located at least 3.0 m horizontally from any water main and 1.8 m horizontally from any sanitary sewer main or gas line, as measured between the nearest pipe walls of the two mains.
- d) City owned and operated storm sewer mains that must cross through, or be located within, private property or any other property controlled by other authorities, shall be protected by easements, secured by the Developer, in the name of the City as the grantee. Easements shall be of sufficient width to provide a minimum clearance of 0.6 m from the edge of the easement to the nearest side of the sewer main, and shall be a minimum of 4.0 m wide for a single utility and 6.0 m for two utilities for maintenance purposes. Manholes, catch basins, and other point infrastructure should not be located within easements unless specifically authorized by the City.
- e) Without limiting the requirements of Article 3.6.1 of these Standards, Public Utility Lot (PUL) widths shall be a minimum of 4.0 m for a single utility and 6.0 m for two utilities. A 1.0 m easement is required on the lots to either side of a PUL.
- f) In scenarios where roadways are designed on a long radius curvature, curved sewers shall run parallel to the centreline of the road. Long radius-type bends combined with straight pipe sections shall be used to achieve the curve. Excessive pipe bends may be subject to the provision of manholes at the discretion of the City.

.8 Vertical Alignment

- a) Sewer mains shall be installed to provide a minimum depth of cover of 1.80 m, as measured from the top of the pipe to the final finished grade at the surface. Depth shall be adequate to provide the minimum depth of cover over sump pump discharge collection sewers and catch basin leads.
- b) At crossings with water mains, refer to Article 5.2.9.c.
- c) At crossings with sanitary sewer mains, refer to Article 6.2.8.d.

7.4 Manholes

- .1 The maximum distance between manholes shall not exceed 120 m for sewers less than 1,200 mm in diameter. For sewers 1,200 mm in diameter or greater, the maximum distance between manholes shall not exceed 150 m.
- .2 Manholes are required at all changes in pipe diameter, grade, and direction, at junctions, at the ends of mains, and at either end of a curved sewer. The distance between manholes for curved sewers less than 1,200 mm in diameter is based on the table in Section 6.2.5.c.
- .3 Wherever possible, manholes shall be located on the projection of property lines to avoid conflict with driveways.
- .4 At manholes where changes in pipe diameter occur, the crowns, or obverts, of the mains shall be placed at the same elevation. Regardless of the design flow and pipe slope, pipe diameter shall not be permitted to decrease through the downstream direction.
- .5 For straight-run manholes, a minimum drop of 12 mm shall be provided between the manhole inlet and outlet. For corner-run manholes, a minimum drop of 50 mm shall be provided between the manhole inlet and outlet.

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- .6 For corner-run manholes, designed to achieve a necessary change in direction of the sewer main, the angle of direction change shall not exceed 90°. This may be further restricted in cases where the estimated sewer flows through the main are not high enough to achieve sufficient cleansing velocity. For sewer mains greater than 600 mm in diameter, changes in flow direction at manholes should not exceed 45°, unless a suitable transition manhole is provided.
- .7 Internal drop structures are required at manholes with a vertical separation of 1500 mm or greater between the inlet and outlet mains. Refer to the Engineering Standard Drawings in Appendix A, for further information on drop structures.

7.5 Catch Basins

- .1 The maximum distance between catch basins along roadways shall not exceed 120 m.
- .2 Catch basins shall be located such that no ponding shall occur during the 1:5 year, or more frequent, rainfall event.
- .3 Provide sufficient catch basins such that the flow depth in gutters does not exceed the top of curb during the 1:5 year rainfall event.
- .4 At intersections, locate catch basins with sufficient inlet capacity on the upstream side in order to prevent drainage from passing through the intersection.
- .5 At curb returns, locate catch basins on the upstream side of crosswalks.
- .6 At sag locations and depressions, locate catch basins with sufficient inlet capacity such that ponding does not exceed 150 mm for a minor event.
- .7 Wherever possible, catch basins shall be located on the projection of property lines to avoid conflict with driveways.
- .8 Catch basins shall have a minimum barrel diameter of 900 mm and minimum sump depth of 500 mm.
- .9 For residential subdivisions, catch basins and leads shall not be located beyond the limits of the public rights-of-way. Where the lots are authorized to grade to the back, in accordance with Article 7.10.3, a catch basin must be provided where the drainage easement ties-in to the nearest public right-of-way.

7.6 Catch Basin Leads

- .1 Catch basin leads shall be designed to accommodate, without surcharge, the anticipated design flow for a 1:5 year storm event.
- .2 Pipe Diameter:
 - a) Minimum 250 mm.
- .3 Flow Velocity:
 - a) Minimum 0.6 m/s.
 - b) Maximum 3.0 m/s.
- .4 Manning's "n":
 - a) $n = 0.013$

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- .5 Slope:
 - a) Minimum 1.0%
 - .6 Catch basin leads shall be a maximum of 30 m in length unless a catch basin manhole is provided at the upstream end of the catch basin lead.
 - .7 Catch basin leads shall be installed to provide a minimum depth of cover of 1.50 m, as measured from the top of the pipe to the final finished grade at the surface unless otherwise approved by the City. Insulation may be required where this depth cannot be achieved.
 - .8 Catch basin leads must be connected to a catch basin manhole or to a manhole on the storm sewer main. No direct connections to storm sewer mains shall be permitted.

7.7 Bioretention / Rain Gardens

- .1 Bioretention is a stormwater management practice that uses plants and soils to filter, retain, infiltrate and distribute stormwater runoff. In general, a bioretention system consists of pretreatment, flow entrance, ponding area, plant materials, a mulch cover, a filter medium and an overflow outlet. The system may also include an under drain if the in-situ soils have a low infiltration rate.
- .2 Bioretention is to be used in redevelopment projects and new developments that have the appropriate space in the road right of way.
- .3 Provide temporary erosion and sedimentation control measures to prevent soil erosion or displacement of bulk materials and discharge of soil-bearing water runoff or airborne dust to adjacent properties, water conveyance systems, and walkways, according to requirements of authorities having jurisdiction. Provide additional sediment control to retain excavated material, backfill soil amendments and planting mix within the project limits as needed. All rain garden areas shall be protected for sediment at all times during any construction.

7.8 Oil and Grit Interceptors (OGIs)

- .1 OGIs are to be installed in a new residential subdivision where the site discharges to a natural drainage course without downstream treatment by a storm water management facility prior to release to the natural drainage course.
- .2 OGIs are to be installed on new or redeveloped commercial, institutional and industrial sites. This requirement is independent of the presence of a storm water management facility prior to release to the natural drainage course.
- .3 Even in the presence of a storm water management facility prior to release to the natural drainage course, the City may require OGIs to be installed within a development at the discretion of the City Engineer. Development scenarios are evaluated on a case by case basis and consider site specific factors including, but not necessarily limited to, upstream drainage contributions from collector or arterial roadways, business types, presence or storage of hydrocarbons, hours of operation, total parking area, and location within the overall storm water infrastructure system.
- .4 OGIs shall use the hydraulic energy of the conveyed stormwater to separate, trap, and store stormwater pollutants.
- .5 OGIs must be capable of trapping fine sand, silt, clay and organic particles in addition to larger sand and gravel particles, and small floatables.

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- .6 OGI shall be capable of removing 85% of the average annual total suspended solids (TSS) load and 95% of the floatable free oil without scouring previously captured pollutants.
- .7 The Design shall provide calculations substantiating removal efficiencies and shall include correlation to field monitoring results for the proposed OGI system.
- .8 OGIs shall be installed in a location that is accessible for maintenance vehicles. Where remote OGI locations are proposed the City will require a pathway with sufficient width and structural integrity to provide maintenance equipment access. The current maintenance equipment utilized by the City weighs 60,000 pounds, is 11.5m long and 2.5m wide.

7.9 Lift Stations and Stormwater Force Mains

- .1 Refer to Article 6.6 of these Standards.

7.10 Major System General Design Criteria

The following *minimum* criteria shall apply to the Design for the major system, as applicable to the proposed development:

- .1 General
 - a) The major system shall be designed to accommodate runoff generated by a 1:100 year rainfall event plus 20%.
 - b) The maximum depth of peak flows and ponding shall not exceed 150 mm on arterial roadways.
 - c) Apply computer simulation modeling and the Rational Method in accordance with Article 7.2.1.
 - d) The Design must include an analysis of the capacity and characteristics of the downstream receiving drainage course and identification of any measures to be completed to prevent downstream flooding and/or for erosion and sediment control.
 - e) All infrastructure shall be designed in accordance with The City of Wetaskiwn Bylaw No. 1888-17 also known as the “Surface Drainage Bylaw.”
- .2 Conveyance Components
 - a) Major system conveyance components must provide continuous overland flow routes to a designated receiving watercourse.
 - b) Overland flow routes shall accommodate design flows plus anticipated overflows from stormwater management facilities.
 - c) The depth of peak flows and ponding for major system conveyance components (i.e. roadways, channels, etc.) shall be limited to prevent significant hazard to the public, property damage, and erosion.
 - d) The maximum depth of peak flows and ponding along major system conveyance components shall be a minimum of 350 mm below the lowest anticipated landscape grade or opening along adjacent lots and buildings.
 - e) Manning’s n:
 - i) $n = 0.013$ for roadways.

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- ii) $n = 0.050$ for grassed boulevards.
 - f) Arterial roadways shall not form a part of the major system conveyance system. Where the nature of the terrain imposes unreasonable difficulty in achieving this objective, the City may authorize the use of an arterial roadway as part of the major system conveyance system provided that all other applicable conditions are met. Such situations shall be reviewed by the City on a case-by-case basis.
 - g) Concrete Swales
 - i) Within public right-of-ways and easements, swales may be employed for the collection and conveyance of runoff to appropriate points of interception or release. Minimum width of such right-of-ways or easements to be 3 m.
 - ii) Swales shall be in accordance with the Engineering Standard Drawings in Appendix A.
 - h) Culverts
 - i) Culverts may be provided to connect swales and drainage channels across roadways and other surface improvements.
 - ii) Culverts shall be a minimum 400 mm diameter.
 - iii) Refer to the Engineering Standard Drawings in Appendix A.
 - iv) Energy dissipation and sediment and erosion control must be considered in culvert design.
 - v) Culverts must include gratings for public safety. Gratings shall have a maximum clear bar spacing of 150 mm and shall be suitably anchored to the outfall structure. Grated outlet structures must be designed with twice the required hydraulic capacity in order to prevent plugging, and designed for a maximum flow velocity of 1.0 m/s through the grating. Gratings must be designed to allow maintenance access.
 - vi) The ends of the culvert shall be finished with the placement of rip-rap.
- .3 Lot and Landscape Grading
- a) Lots shall be designed to drain from back to front. Where the nature of the terrain imposes unreasonable difficulty in achieving this objective, the City may authorize an alternate approach, provided all other applicable conditions are met. Such situations shall be reviewed by the City on a case-by-case basis. The City may require the installation of suitable flow velocity and erosion controls, and the establishment of a suitable easement along the back of the lots.
 - b) A minimum grade of 10% shall be provided out to a minimum of 2 m around all buildings.
 - c) A minimum grade of 1.5% and maximum grade of 10% shall be provided on all landscaped areas.
 - d) A minimum grade of 1.5% and maximum grade of 8% shall be provided on all driveways.

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- e) Lot and landscape grading shall be designed such that the maximum depth of peak flows and ponding shall be a minimum of 150 mm below the lowest anticipated finished ground elevation at buildings. A suitable overflow route or sufficient ponding volume must be provided from or at all ponding areas to achieve this minimum freeboard and limit ponding to a maximum depth of 350 mm.
- f) Reverse slope driveways or other lot improvements that may capture runoff and fail to drain during major rainfall events shall be avoided.

.4 Storage Components

- a) Major system storage components, also referred to as stormwater management facilities, which are to be owned and operated by the City, shall be designed based on the critical volume determined for each stormwater management facility from the 1:100 year rainfall event plus 20%, and as prescribed by applicable Alberta Environment standards and guidelines. The design of these facilities must incorporate calculations for a range of rainfall durations to assess which will result in the critical volume for the catchment area.
- b) Commercial, institutional, and high-density residential developments (including apartment and high-density multi-family sites) require onsite stormwater management facilities. These stormwater management facilities shall be designed based on the critical volume determined from the 1:25 year rainfall event. Suitable overland flow routes shall be provided from the facility to accommodate overflows for more significant rainfall events. **The Design must limit post-development peak runoff flows from the Development to 2.5 L/s/ha.**
- c) Where one or more stormwater management facilities are proposed in an Area Structure Plan, the Developer shall consult with the City regarding site-specific requirements for each facility. Such may include special landscaping, fencing, lighting, recreational, and operation and maintenance requirements. The City may also have specific requirements for stormwater quantity or quality control, which must be adequately addressed by the Design.
- d) The geotechnical report shall be integral to the design of stormwater management facilities.
- e) Suitable warning signage shall be provided around all stormwater management facilities for public safety.
- f) Where stormwater management facilities will be constructed in phases, the Design shall fully detail how such phasing shall be achieved and how the interim system shall operate.
- g) Landscaping in and around stormwater management facilities shall incorporate bark chips or other floatable decorative landscaping materials only above the 1:100 year flood line and have a maximum of 75 mm of wood chip mulch. Biodegradable erosion blankets shall be used below the 1:100 year flood line.
- h) Detailed operation and maintenance manuals shall be provided for all stormwater management facilities in accordance with Article 1.18.
- i) Wet Ponds
 - i) Wet ponds temporarily store stormwater runoff to restrict post-development peak discharge rates and promote settling of solid particles. Where storage is required for residential subdivisions, wet ponds or constructed wetlands are recommended

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and should be incorporated into the Schools, Parks, and Open Spaces plan of the Area Structure Plan.

- ii) Wet ponds, which are to be owned and operated by the City, shall be located within a designated PUL. Lands subject to inundation under the design rainfall event shall be included within the PUL.
- iii) A combination of pathway and reinforced turf shall be designed to provide pond access for maintenance vehicles to reach the ponds inlet/outlet structure, inlet pipe and/or treatment unit as well as providing a working area.
 - The access road is to be the most direct route between the road/lane and the storm structure.
 - The access design and working area are to be site specific and approved by the City subject to the following conditions:
 - Base structure equal or greater than a lane (consideration may be given to the base being in a wet condition),
 - Reinforced turf product acceptable for turf growth and ease of maintenance,
 - Minimum access width of 4.5 meters,
 - Working area of up to 500 sq. m. at inlet structures,
 - Turf reinforcement product to be installed per manufacturer's instructions,
 - Pond slope along access may require adjustment to meet typical road requirements,
 - A minimum centerline radius of 10.25 m to be provided on curved portions of the vehicle access road including any portions of pathway that may be used.
- iv) Minimum surface area of the pond at normal water level shall be 2 ha.
- v) Minimum depth of the pond at normal water level shall be 2.5 m.
- vi) Minimum width of the water surface at the normal water level shall be 25 m.
- vii) Inlets and Outlets
 - Inlets and outlets must be located as far from each other as possible in order to avoid hydraulic short-circuiting and maximize detention time and circulation through the facility.
 - Inlets and outlets shall be fully submerged with pipe obverts a minimum of 1.0 m below the normal water level and inverts a minimum of 150 mm above the lake bottom.
 - The facility's normal operating level shall be at or below the pipe invert at the nearest manhole on the inlet storm sewer main.
 - The facility's anticipated high water level during a 1:5 year rainfall event shall be at or below the pipe obvert at the nearest manhole on the inlet storm

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sewer main. This will typically require the installation of a drop structure on the inlet storm sewer main.

- Sediment basins shall be provided at inlets for control of heavy solids.
- An emergency overflow must be provided to redirect flows in excess of the design peak flow for the facility. The overflow shall tie-in to a suitable overland flow route.

- viii) Pond design shall provide for semi-annual turnover under average annual precipitation conditions.
- ix) The facility's normal water level shall be a minimum of 500 mm below the lowest basement weeping tile of the buildings located adjacent to the facility.
- x) Sideslopes must meet recommendations of the geotechnical report and shall be a maximum of 5:1 on the pond exterior and 5:1 on the pond interior.
- xi) Refer to the Engineering Standard Drawings in Appendix A for a typical wet pond cross-section.
- xii) The pond bottom and sideslopes shall be constructed of materials as recommended by the geotechnical report.
- xiii) A manhole shall be provided adjacent to the pond that is hydraulically connected to the wet pond to allow direct measurement of the water level of the pond.
- xiv) Alberta Environment stormwater quality best management practices must be addressed by the design for the facility.
- xv) Erosion control must be provided around the perimeter of wet ponds. Such shall be compatible with adjacent land use and provide for low maintenance and public safety.
- xvi) All-weather vehicle access must be provided to all inlet, outlet, and control structures, and other works in or around the facility which may require maintenance, with suitable provision for launching boats into the pond.
- xvii) Control manholes, fountain gates or alternatives to be provided.

j) Dry Ponds

- i) Dry ponds temporarily store stormwater runoff to restrict post-development peak discharge rates and only contain standing water during design rainfall events. The city will only allow the use of dry ponds based on the approval of the City Engineer. Where storage is required for commercial or high-density residential developments, the City may accept dry ponds if the use of wet ponds or constructed wetlands are impractical.
- ii) Dry ponds, which are to be owned and operated by the City, shall be located within a designated PUL. Lands subject to inundation under the design rainfall event shall be included within the PUL.
- iii) Maximum active storage depth of the pond shall be 1.5 m.
- iv) Inlets and Outlets

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- Inlets and outlets must be located as far from each other as possible in order to avoid hydraulic short-circuiting and maximize detention time and circulation through the facility.
 - Inlets and outlets to dry ponds must include gratings over openings for public safety. Gratings shall have a maximum clear bar spacing of 150 mm and shall be suitably anchored to the inlet/outlet. Grated outlet structures must be designed with twice the required hydraulic capacity in order to prevent plugging, and designed for a maximum flow velocity of 1.0 m/s through the grating. Gratings must be designed to allow maintenance access.
 - Inlet and outlets structures must be protected with suitable fencing and guardrails.
 - The facility's anticipated high water level during a 1:5 year rainfall event shall be at or below the pipe obvert at the nearest manhole on the inlet storm sewer main. This will typically require the installation of a drop structure on the inlet storm sewer main.
 - Sediment basins shall be provided at inlets for control of heavy solids.
 - Outlets shall include a slide gate or other suitable feature to control outflow from the facility.
 - Outlet capacity shall be sufficient to drain dry pond in a reasonable amount of time following a storm event as approved by City Engineer.
 - An emergency overflow must be provided to redirect flows in excess of the design peak flow for the facility. The overflow shall tie-in to a suitable overland flow route.
- v) Pond design shall include provisions for maintenance of the dry pond between rainfall events.
- vi) The pond shall be graded to promote proper drainage of the facility between rainfall events. Minimum slope of the pond bottom shall be 2%.
- vii) Sideslopes must meet recommendations of the geotechnical report and shall be in accordance with the Engineering Standard Drawing.
- viii) The pond bottom and sideslopes shall be constructed of materials as recommended by the geotechnical report.
- ix) Landscaping of the pond shall be compatible with adjacent land use and provide for low maintenance. The minimum requirement is to have trees, shrubs and native grass seed mix that is drought tolerant and capable of withstanding wet conditions.
- x) Stormwater quality best management practices must be addressed by the design for the facility.
- xi) All-weather vehicle access must be provided to all inlet, outlet, and control structures, and other works in or around the facility which may require maintenance.
- k) Constructed Wetlands
- i) Constructed wetlands store stormwater runoff for extended periods of time to restrict post-development peak discharge rates and improve stormwater quality. Constructed wetlands are specifically recommended for any storage facilities that

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- are located immediately upstream of a receiving watercourse, at the end of a storm sewer main.
- ii) Constructed Wetlands, which are to be owned and operated by the City, shall be located within a designated PUL. Lands subject to inundation under the design rainfall event shall be included within the PUL.
 - iii) A minimum drainage area of 5 ha is required to generate constant or periodic flow to the constructed wetland.
 - iv) The City prefers that fewer, larger wetlands be constructed rather than a series of smaller constructed wetlands.
 - v) Use a variety of water depth, 0.1m to 0.6m with an average permanent water depth of 0.3m to encourage emergent vegetation.
 - vi) The surface area of the constructed wetland shall be a minimum of one hectare at the NWL.
 - vii) The surface area is typically 3% to 5 % of the drainage area.
 - viii) The minimum length to width ratio should provide an effective flow path length at low flow that three times the relative wetland width in order to increase residence time.
 - ix) A 2.4m to 3.0m deep forebay is required at each major inlet to trap suspended solids before stormwater enters the constructed wetland. Provide Maintenance access at forebays to permit removal of sediments. Sideslopes of the forebay are to be a maximum of 7:1.
 - x) A 2.4m to 3.0m deep permanent pool will be provided at the outlet. Sideslopes of the forebay are to be a maximum of 7:1.
 - xi) A variable water level control structure is required on the outlets for maintenance and water management purposes. The control structure should be capable of maintain water levels between 0.5m below NWL and 0.5m above water level.
 - xii) Inlets and outlets should be located to avoid short-circuiting and maximize the flow path.
 - xiii) Requirements for the design of constructed wetlands for stormwater management shall be reviewed on a case-by-case basis in order to address site-specific stormwater quantity and quality requirements within existing environmental factors.
 - xiv) Minimum requirements of current Alberta Environment standards and guidelines pertaining to the design of constructed wetlands shall expressly apply.
 - xv) Refer to the Engineering Standard Drawings in Appendix A for a Constructed Wetland schematic.
- l) Underground Storage Facilities
- i) Underground storage facilities include various proprietary systems for storing surface runoff in buried storage vaults. Such facilities are not preferred and shall only be allowed upon the discretion and written acceptance of the City.

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- .1 Refer to Article 1.23 for submission requirements.
- .2 The Design shall provide for the interception, conveyance, and storage of all overland drainage which enters the Development from surrounding areas for the indefinite future or interim period until infill or redevelopment of such areas occurs. Furthermore, the stormwater management system shall be designed to ensure the Development does not adversely affect the existing drainage pattern of surrounding areas, whether during or following construction.
- .3 Peak allowable outflow rate from the onsite collection system to the receiving storm sewer system shall be 35 L/s/ha or equal to the available conveyance capacity of the receiving sewer during a 1:5 year rainfall event, whichever is less.
- .4 Sewers
 - a) Pipe Diameter:
 - i) Minimum 150 mm.
 - b) Flow Velocity:
 - i) Minimum 0.6 m/s.
 - ii) Maximum 3.0 m/s.
 - c) Manning's "n":
 - i) $n = 0.013$
 - d) Slope:
 - i) Minimum slope shall be in accordance with the table provided in Article 7.3.4.a.
 - e) Pipe Design
 - i) Strength design shall be integral to the pipe selection process.
 - f) Depth of Cover
 - i) Sewer mains shall be installed to provide a minimum depth of cover of 1.80 m, as measured from the top of the pipe to the final finished grade at the surface.
- .5 Lot and landscape grading shall be designed such that the maximum depth of peak flows and ponding shall be a minimum of 300 mm below the lowest anticipated opening elevation at buildings. A suitable overflow route or sufficient ponding volume must be provided from or at all ponding areas to achieve this minimum freeboard and limit ponding to a maximum depth of 350 mm.

7.12 Storm Outfalls

- .1 Outfall pipe obvert shall be above the high water level of the receiving channel under the 1:5 year rainfall event. Outfall pipe invert shall be above the normal ice level of the receiving channel under average annual precipitation conditions. Where these requirements cannot be reasonably achieved, the outfall pipe obvert shall be 1.0 m below the normal water level of the receiving channel under average annual precipitation conditions.

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- .2 Drop structures and energy dissipation works shall be included where necessary to prevent erosion. Further erosion protection works including, but not necessarily limited to, rip rap and filter fabric treatment, shall be required at the end of storm outfalls into the downstream channel.
- .3 For concrete sewer pipe, pipe joints shall be grouted inside and out, or otherwise sealed with a suitable product or method to improve joint integrity, for at least 10 pipe lengths upstream from the outfall.
- .4 Storm outfalls must include gratings over outlets for public safety. Gratings shall have a maximum clear bar spacing of 150 mm and shall be suitably anchored to the outfall structure. Grated outlet structures must be designed with twice the required hydraulic capacity in order to prevent plugging, and designed for a maximum flow velocity of 1.0 m/s through the grating. Gratings must be designed to allow maintenance access.
- .5 Storm outfall structures must be protected with suitable fencing and guardrails.
- .6 Storm outfalls shall be located such that there is minimal impact to adjacent property. Landscaping around outfalls shall be compatible with adjacent land use and provide for low maintenance, using native plant material and a grass seed mix.
- .7 All-weather vehicle access must be provided to all storm outfalls for maintenance purposes.

PART II – MATERIALS

7.13 Storm Sewer Mains, Catch Basin Leads

Storm sewer mains, catch basin leads, and shall be polyvinyl chloride (PVC) or concrete pipe conforming to the following:

- .1 PVC Pipe and Fittings
 - a) PVC pipe shall be acceptable for sewer mains up to 900 mm diameter.
 - b) PVC pipe and fittings shall meet CAN/CSA-B182.2 with locked-in elastomeric ring gasket and integral bell system joint type.
 - c) Minimum pipe dimension ratio shall be DR35. Strength design, considering trench and road loading, shall be integral to pipe design process.
 - d) Pipe shall be installed within two years from the production date indicated on the certification.
 - e) Joint lubricants shall be compatible with gasket material.
- .2 Concrete Pipe and Fittings
 - a) Non-Reinforced Circular Concrete Pipe and Fittings
 - i) Non-reinforced concrete pipe shall be acceptable for 200 mm to 375 mm diameter sewer mains where strength design, considering trench and road loading, for the pipe is suitable.
 - ii) Pipe and fittings shall meet CAN/CSA-A257.1, Class 3, and designed for flexible rubber gasket joints to CAN/CSA-257.3, and constructed with Type HS sulphate resistant Portland cement to CAN/CSA-A3000.
 - b) Reinforced Circular Concrete Pipe and Fittings

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- i) Reinforced concrete pipe shall be acceptable for sewer mains with a diameter of 250 mm and up.
 - ii) Pipe and fittings shall meet CAN/CSA-257.2, concentric reinforcing, designed for flexible rubber gasket joints to CAN/CSA-257.3, and constructed with Type HS sulphate resistant Portland cement to CAN/CSA-A3000.
 - iii) Strength design, considering trench and road loading, shall be integral to pipe design process. D-load shall be as determined by load analysis.
 - .3 SaniTite HP Sewer Pipe and Fittings
 - a) SaniTite pipe shall be acceptable for 300 mm to 750 mm diameter sewer mains.
 - b) SaniTite pipe shall meet CSA-B182.13 with gasketed integral bell & spigot joints
 - c) Shall have a minimum pipe stiffness of 320 kPa when tested in accordance with ASTM D2412

7.14 Culverts

- .1 Corrugated metal pipe (CMP) shall be acceptable for culverts and temporary inlets and outlets for stormwater management facilities.
- .2 CMP shall conform to CAN/CSA-G401 with welded or coupled joints.
- .3 Standard precast concrete box culverts shall be acceptable and shall conform to ASTM C 1433.
- .4 If the required pipe diameter is 1500 mm or greater a precast box culvert will be used.

7.15 Manholes

- .1 Manholes shall be minimum 1,200 mm in diameter and in accordance with the Engineering Standard Drawings in Appendix A.
- .2 Catch basin manholes shall be minimum 1,200 mm in diameter and in accordance with the Engineering Standard Drawings in Appendix A.
- .3 Manhole materials shall be reinforced concrete, constructed of Type HS sulphate resistant cement.
- .4 Precast manhole sections, adjusting neck rings, and manhole steps shall conform to CAN/CSA-A257.4 and ASTM-C478.
- .5 New installation stormwater manholes shall be supplied with pre-benched manhole bases and pre-cored service connections complete with watertight joints, Duraseal or accepted alternate. The only exceptions to the requirement for pre-benched or pre-cored stormwater manholes are perched manholes, pipe diameters that are greater than 525 mm and manhole diameters greater than 1800 mm.
- .6 Manhole joints shall meet the requirements of CAN/CSA-257.3 and ASTM-C443. Furthermore, all joints shall be sealed with a suitable non-shrink grout on the inside and outside for the circumference of the manhole including grade rings. Alternative applications such as Boa-Tape and Riser-Wrap are considered acceptable joint sealing measures for the exterior joints on manhole barrel sections.

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- .7 Manhole steps shall be standard safety type, constructed of hot-dipped iron in accordance with ASTM-A615 and ASTM-A123 or aluminum, forged of 6061-76 aluminum alloy, with a minimum tensile strength of 200 MPa. The top manhole step shall be a maximum of 800mm from finished grade.
- .8 Frames and Covers
- a) Type F-80 and type F-90 manhole frame and covers shall be made from ductile iron, conform to ASTM A536, be Class 60-40-18 and conform to the Engineering Standard Drawings in Appendix A. (Class 80-55-06 is an acceptable alternative).
 - b) Type F-39 manhole frame and covers shall be made from grey cast iron, conform to ASTM A48, be Class 20B and conform to the Engineering Standard Drawings in Appendix A. (Class 35B is an acceptable alternative).
 - c) Frames for manholes on paved surfaces shall be Type F-80 floating type with solid cover.
 - d) Frames for manholes not on paved surfaces shall be Type F-39 with solid cover.
 - e) All Type F-39 and F-80 covers shall be imprinted with the City of Wetaskiwin's name.
 - f) All frame and covers shall be supplied by Trojan Foundry Ltd., Norwood Foundry Ltd., or accepted alternate.
 - g) Frames and covers shall be hot dipped galvanized according to CSA G164-M.
- .9 Perched manholes, or accepted alternate, are required for sewer mains from 600 mm to 1,050 mm in diameter and in accordance with the Engineering Standard Drawings in Appendix A.
- .10 Tee-riser manholes, or accepted alternate, are required for sewer mains greater than 1,050 mm in diameter and in accordance with the Engineering Standard Drawings in Appendix A.
- .11 For manholes exceeding 7 m in depth, the City may stipulate requirements for additional manholes.
- .12 The City may require lockable covers be provided where safety or security risks may be a concern. Where required, such shall be subject to the review and acceptance of the City.

7.16 Catch Basins

- .1 Catch basins shall be minimum 900 mm in diameter with a minimum sump depth of 500 mm in accordance with the Engineering Standard Drawings in Appendix A.
- .2 Catch basin materials shall be reinforced concrete, constructed of Type HS sulphate resistant cement.
- .3 Catch basin steps shall be standard safety type, constructed of hot-dipped iron in accordance with ASTM-A615 and ASTM-A123 or aluminum, forged of 6061-76 aluminum alloy, with a minimum tensile strength of 200 MPa.
- .4 Frames and Covers
- a) Frames and covers shall be made of iron conforming to ASTM-A48 and in accordance with the Engineering Standard Drawings in Appendix A.
 - b) Top inlet, round top frames and covers shall be Type F-38 or Type F-39 open grate type, or accepted alternate.

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- c) Side inlet frames and covers for straight-faced curb shall be two-piece Type F-51, or accepted alternate.
- d) Side inlet frames and covers for rolled-faced curb shall be Type K-7, or Type DK-7, or accepted alternate.
- e) Frames and covers shall be hot dipped galvanized according to CSA G164-M.

7.17 Bioretention / Rain Gardens

- .1 Earth bottoms of excavations to be undisturbed soil, level free from loose, soft or organic matter.
- .2 Native topsoil texture shall be a naturally produced sandy loam soil within the following parameters, and suitable for the germination of seeds and the support of vegetative growth.
 - a) Contain no toxic elements or growth inhibiting materials
 - b) Finished surface free from:
 - i) Debris and stones over 50mm diameter.
 - ii) Course vegetative material, 10mm diameter and 100mm length, occupying more than 2% of soil volume.
 - iii) Consistence: friable when moist
 - iv) Segregate subsoil and unsuitable soil.
 - c) Existing site soil shall be used only after approved by the Engineer or Project Landscape Architect.
- .3 Use plants according to the plant list, with all plant material conforming to CNLA standards. No substitutions of plant material are allowed without the prior approval of the engineer.
- .4 Mulch is to have the following characteristics:
 - a) Type and size: Shredded bark mulch; the mulch shall be aged a minimum of one year and no lengths greater than 200mm.
 - b) Consistency: Material should have no more than 5% by volume of soil, sawdust, peat moss, or needles. Coniferous content not to exceed 40%.
 - c) Sanitation: No mulch from diseased or infested plant material is allowed unless it can be shown the material presents no risk to tree health.
 - d) The contractor shall supply a sample of the bark mulch for approval by the engineer prior to installation.
- .5 Round Wash Mulch is to have a minimum diameter of 20 mm and a maximum diameter of 40 mm.

7.18 Oil and Grit Interceptors

- .1 Oil and grit interceptors shall be as manufactured by Stormceptor, CDS Technologies, or accepted alternate.

7.19 Stormwater Force Mains

- .1 Refer to Article 6.10 of these Standards.

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7.20 Bedding and Backfill

- .1 Refer to Article 5.13 of these Standards.

PART III – CONSTRUCTION**7.21 General**

- .1 The following articles represent the minimum requirements for some typical, key construction procedures for stormwater management system construction. These minimum requirements must be met or exceeded by the detailed construction specifications and drawings developed by the Consultant.

7.22 Quality Assurance

- .1 Refer to Article 6.13 of these Standards.

7.23 Quality Control Testing

- .1 Refer to Article 5.16 of these Standards.

7.24 Site Preparation

- .1 Prepare the site in accordance with Article 3.26 of these Standards.

7.25 Clearing

- .1 Conduct clearing in accordance with Article 3.27 of these Standards.

7.26 Grubbing

- .1 Complete grubbing in accordance with Article 3.28 of these Standards.

7.27 Topsoil Stripping and Stockpiling

- .1 Strip and stockpile topsoil in accordance with Article 3.29 of these Standards.

7.28 Trench Excavation

- .1 Refer to Article 5.22 of these Standards.

7.29 Alignment and Grade

- .1 Lay pipe to the required alignment and grade, with manholes and all other appurtenances at the locations identified on the construction drawings.
- .2 Provide minimum 1.80 m depth of cover on sewer mains, unless otherwise authorized by the City in writing. Where depth of cover is less than 1.80 m, provide insulation.
- .3 Acceptable tolerances are as follows:
 - a) Alignment – the centerline of the pipe shall not be more than 100 mm off the specified alignment.

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- b) Elevation – the pipe invert shall not be more than 6 mm plus 0.01 mm per mm diameter of the pipe off the specified elevation.
 - c) Joints – for concrete pipe, deflections at joints shall not exceed that specified by CAN/CSA-A257. For PVC and SaniTite pipe, deflections at joints shall not exceed those recommended by the manufacturer.
- .4 All pipe shall be laid sloping in the desired direction with no reversed grades on any pipe lengths.
 - .5 Maintain, and provide to the City upon request, grade sheets for the installation of the pipe.
 - .6 No deviation shall be made from the required alignment or grade without the written consent of the City.

7.30 Pipe Bedding and Pipe Zone Backfill

- .1 Refer to Article 5.24 of these Standards.

7.31 Pipe Installation

- .1 Refer to Article 6.22 of these Standards.

7.32 Setting Manholes

- .1 Refer to Article 6.23 of these Standards.

7.33 Setting Catch Basins

- .1 General
 - a) Bases shall be placed on solid, unfrozen ground.
 - b) Construct catch basin unit plumb and true to alignment and grade.
- .2 Catch Basin Completion
 - a) Backfill around the catch basin with class I backfill, or fillcrete. Backfill shall be placed and compacted to minimum 98% Standard Proctor Density in uniform lifts not exceeding 150 mm in depth.
 - b) If vertical adjustment is required for final grade, use concrete grade rings to a maximum depth of 450 mm with a maximum of 3 grade rings in total.
 - c) Grade rings must not be staggered horizontally more than 100mm beyond plumb with the edge of the top barrel section.
 - d) Place frame and cover to the elevation indicated, and adjust tops flush finished grades.

7.34 Trench Backfill

- .1 Refer to Article 5.31 of these Standards.

7.35 Sewer Main Inspection and Testing

- .1 CCTV inspection to be completed for all sewer mains, catch basin leads (greater than 6 m in length).
- .2 Refer to Article 6.26 of these Standards.



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7.36 Final Inspection of Sewer Mains

- .1 Refer to Article 6.28 of these Standards.

8.0 LANDSCAPING STANDARDS – GENERAL

8.1 Landscaping Objectives

- .1 The landscape design and construction standards should provide the Consultants, Developers and Industry with an outline of the minimum acceptable standards for the implementation of landscape requirements within the City. The City of Wetaskiwin places a high value on landscaping and greenery in both natural and developed areas. Landscaping and screening provide many aesthetic, ecological, economic, health and safety benefits.
- .2 The City's landscaping objectives are as follows:
 - a) Establish a functional relationship between the landscape design and existing and proposed utilities, land uses, flood and drainage patterns, cultural needs, recreational needs, and vehicular and pedestrian circulation systems;
 - b) Provide landscaping which is contiguous with surrounding natural areas, enhancing the natural beauty of the region;
 - c) Provide a safe environment, accessible by all residents;
 - d) Maximize the hardiness and appropriateness of plant material, specifically with respect to level of maintenance, durability, survivability with respect to vandalism, future availability for replacements, refurbishment, and reclamation potential; and
 - e) Serve ecological functions through environmental design strategies such as: water conservation and ground water recharge, increasing the amount of permeable surface area to minimize drainage concerns, conserve energy through strategic shading and the use of wind breaks, protect and improve air quality, and create or maintain habitat for wildlife.

8.2 Landscaping Standards

- .1 General

Sections 9 through 15 present the minimum acceptable requirements for the design and construction of some typical, key landscaping system components. These minimum requirements must be met or exceeded by the detailed construction specifications and drawings developed by the Consultant.
- .2 Qualifications for Landscape Contractors
 - a) Landscape contractors shall be reputable, experienced and have current membership in the Landscape Alberta Nursery Trades Association. Contractor must be willing to provide proof of their experience.
 - b) Certified Landscape Trade Journeymen and ISA-certified Arborists are required where applicable.
 - c) All work shall be done under the direction and supervision of a foreman with at least 5 years' experience.
 - d) All work shall conform to best management practices (BMP) and the Canadian Standards for Nursery Stock (Latest edition).

8.3 Definitions

The following definitions are used throughout the document:

“shall”, “should”, “may”	The word “shall” denotes a mandatory requirement. The word “should” or “may” denotes an optional or suggested recommendation.
Appropriate Maintenance	Shall mean maintenance, which is suitable to the time of year, soil conditions and weather condition of the plant material to ensure it is capable of sustaining healthy and vigorous growth.
Arborist	Shall mean one who is versed in the art of arboriculture, including tree surgery, the prevention and cure of diseases and the control of insect pests.
Berm	A mound of earth used to buffer or screen a land use with landscaping.
Borrow Material	Includes topsoil, clay, silt, sand, gravel, and peat within the area of the Work.
Buffer	Land area used to visibly separate one use from another through screening and distance.
Caliper	The diameter or thickness of the trunk of a nursery-grown tree as measured no less than 150 mm above the ground level for trees with a caliper up to 100 mm.
City Representative	The person(s) designated to act on behalf of the City.
City’s Right to Stop Work	Shall mean the City has the general and absolute right upon providing written notice to the contractor, to halt or terminate the work at any time.
Clearing	Removal and proper disposal of exposed objectionable matter from an area. This may include but is not limited to trees, roots, grass, underbrush, rubble, any type of structures, etc.
Common Excavation	Includes topsoil, clay, silt, sand, gravel, and peat within the area of the Work.
Conifer	A plant with foliage that persists and remains green year-round, commonly known as evergreens.
Construction Completion Certificate (CCC)	The written acceptance certificate issued by the City acknowledging the completion of construction of a municipal improvement. Once the CCC is issued, the maintenance period commences.
Consultant	The consultant acting on behalf of the developer to coordinate the preparation of all engineering and landscape detailed design drawings including specifications as may be required as per these Standards.

Critical Root Zone	An area on the ground around a tree that is within the drip line of a tree.
Deciduous	Means a plant with foliage that is shed annually.
Developer Representative	The developer, the landscape architect or person(s) designated by the developer who has the authority to approve or reject the contractor's work, request inspections and have the authority to exchange other open space development information with City representatives.
Diameter Breast-Height (DBH)	The standard measurement of tree size (for trees existing on site). The tree trunk is measured 1.4 m (4.5 feet) above ground. If the tree splits into multiple trunks below 1.4 m, measure the trunk at its most narrow point beneath a split.
Drip Line	A vertical line extending from the outermost branches of a tree to the ground.
Environmental Reserve (ER)	Shall mean land owned by the municipality to be preserved in its natural state. Environmental reserve consists of swamps, gullies, coulees, natural drainage courses and areas subject to flooding, steep slopes and strips not less than 6 m in width at the edge of any lake, river, stream or other body of water in accordance with the <i>Municipal Government Act</i> .
Fill	An earth structure built up by successive lifts of a specified material at specified densities.
Final Acceptance Certificate (FAC)	Is the written acceptance certificate issued by the City for the municipal improvements, once any and all repairs, defects, and deficiencies have been completed and the Maintenance Period has expired. This certificate releases any further guarantee or maintenance responsibilities by the Developer for the local improvements specified in the certificate.
Floodplain (100 year)	Land in the floodplain subject to a 1% or greater statistical occurrence probability of flooding in any given year.
Intensive Use	Shall mean an area of high use such as trails, play equipment areas, spray parks, sports fields and other recreation facilities.
Land Disturbing Activity	Any activity which may result in soil erosion from water or wind and the movement of sediments into waters or onto lands within the development zone, including but not limited to clearing, dredging, grading, excess transportation and filling of land but not including agriculture practices.
Landscape Architect	The consultant acting on behalf of the developer or prime consultant to coordinate the preparation of all landscape drawings, inspect all onsite work and coordinate with Engineering and Development Services for the issuance of CCC's Construction Completion Certificate and FAC's

Final Acceptance Certificate. The Landscape Architect shall also be responsible for the co-ordination of all base plan preparation with other consultants to ensure all utilities, survey and base plan detailing is consistent with other engineering and architectural drawings forming part of the engineering drawing submission. At all times the Landscape Architect will ensure all standards, specifications and procedures herein contained are strictly enforced. The Landscape Architect must be a member in good standing of the AALA (Alberta Association of Landscape Architects) and currently licensed to practice in Alberta.

Landscape Development

Shall mean all landscaping or its protection in public spaces or environmental reserve.

Lot

A portion of a subdivision or any other parcel of land intended as a unit for transfer of ownership, or lease to, or separate use of, another, or for development. The word “lot” includes, but is not limited to, “plot” or “parcel”.

Lot Area

The area contained within the property lines of a lot, excluding space within any street right-of-way, but including the area of any easement.

Maintained Parks

Shall mean parks that require ongoing maintenance such as grass cutting, irrigation, trash removal and regular maintenance.

Municipal Reserve (MR)

Shall mean land owned by the municipality for development of parks and school grounds in accordance with the *Municipal Government Act*. And are intended for active or passive park and recreation areas for the use of the general public. Municipal reserve lands may not be sold, leased, or otherwise disposed of without removing the MR designation. Municipalities may remove the designation only after giving notice, holding a hearing, and considering the views of those affected. The land may then be sold or used for any purpose. Proceeds from the disposal of municipal reserves may be used for park or recreation purposes only.

Natural Area

An area of natural vegetation that is generally undisturbed, unmaintained, and is self-perpetuating. It includes not only trees, but also native shrubs, ground covers, wildflowers, vines, and grasses.

**Open Spaces, Green Spaces
or Public Open Spaces**

Shall mean any parcel of land retained as permanently vegetated land, which is set aside and designated as reserve for public use.

Prepared Sub-grade

The soil immediately beneath a pavement structure that has been prepared as specified for the construction of a pavement structure.

Public Utility Lot/Lanes

Shall mean land designated for utilities, successes or other engineered facilities.

Recreation Facility

Shall include, but not limited to, tennis courts, play structures or equipment, sports fields, outdoor ice rinks, spray parks, skate parks and trails.

Soil Volume	Adequate below-ground space for root development, nutrient availability, moisture, and anchorage.
Stormwater Management Facilities	Shall mean to develop effective drainage systems that balance the objectives of maximizing drainage efficiency and minimizing adverse environmental impacts.
Temporary Protection	Shall mean fencing, barricades, signage or other adequate means of protection for a particular area such as newly seeded or sodded areas, partially constructed play structures and existing plant material to be preserved.
Unsuitable Material	Includes peat, roots, stumps, topsoil, frozen soil, garbage, or other material deemed unsuitable for fill by the City.
Weeds	Shall mean all plants, and seeds, designated “Noxious” or “Prohibited Noxious” under the Weed Control Regulation of the Alberta Weed Control Act, latest edition.

8.4 Park Development Guidelines

- .1 Park Types –Please contact the City directly for details with respect to Park Development.

8.5 Boulevard Development Guidelines

- .1 Boulevard areas are to be graded, top-soiled, and sodded.
- .2 Generally, provide two boulevard trees along the front of each lot and five along the flank of corner lots, dependent on lot size. To be confirmed with City.
- .3 Coordinate boulevard landscaping with the location of street furniture to avoid conflicts.

8.6 Entrance Feature, Island, and Median Development Guidelines

- .1 Landscape design for special entrance features, islands, and medians shall be subject to the review and acceptance of the City. Entrance features shall be low maintenance.
- .2 Shrubs will be massed within planting beds and planted appropriate to species. Shrubs shall meet the following:
 - a) Deciduous: minimum 450 mm height.
 - b) Coniferous: minimum 300 mm spread, subject to availability.
- .3 Trees shall meet the requirements specified in Section 11.0.
- .4 Trees shall be positioned within planting beds or tree wells.
- .5 Manicured planting beds shall incorporate a minimum 150mm high “Black Diamond” or equivalent edger subject to City approval.
- .6 All manicured planting beds shall incorporate a minimum of 100 mm organic mulch (i.e. wood chip mulch) or 75mm depth inorganic mulch (i.e. decorative crushed granular, crushed shale, or washed rock). Mulch shall be pulled away from the bases of tree trunks and shrub stems as per landscape engineering standard drawing.
- .7 Islands shall not be grassed unless specifically directed or authorized by the City.

- .8 Free-standing architectural features (i.e. signs, sculptures, entry gates, etc.) shall not be located within grassed areas.
- .9 All paving stones, paving stone headers, concrete, or other special hard surfaced verge or walk shall be subject to the review and acceptance of the City.
- .10 Typical cross-section details for island and median planting plans shall show all underground infrastructures.
- .11 Retaining walls shall be engineered.

8.7 Walkway Design Guidelines

- .1 Areas adjacent to walkways and trails must be graded, top-soiled, and have sod placed for first 0.5m next to trail/walkway and grass seed for the remainder.
- .2 Provide a minimum of five trees for every 40 m of walkway. Shrubs may be substituted at the rate of seven shrubs for every one tree. No more than a maximum of 45m between plantings.
- .3 Trees shall meet the requirements specified in Section 11.0.
- .4 Shrubs must meet the requirements of Article 8.6.2.

8.8 Major Utility Right-of-Way Design Guidelines

- .1 Major utility right-of-ways shall include landscape improvements. Where the utility authority does not approve of landscaping within their right-of-ways, the requirement for all or a portion of the landscaping may be waived, subject to the authorization of the City.
- .2 Right-of-way landscape improvements may range from low maintenance naturalization to more formal landscape designs, depending on the existing landscape character established within the right-of-way.
- .3 Healthy, vigorous trees within or abutting the right-of-way shall be preserved. Any trees that are requested to be removed are subject to City approval.
- .4 Landscape improvements for major utility right-of-ways shall be in accordance with the applicable articles of these Design Standards and subject to the review and acceptance of the City and the applicable utility authorities.

8.9 Public Utility Lot Design Guidelines

- .1 PULs shall be graded, top-soiled, and seeded or sodded.
- .2 Provide a minimum of 80 trees per hectare within the PUL. Shrubs may be substituted at the rate of seven shrubs for every one tree.
- .3 Trees shall meet the requirements specified in Section 11.0.
- .4 Shrubs must meet the requirements of Article 8.6.2.
- .5 Healthy, vigorous trees within or abutting the PUL shall be preserved. Any trees that are requested to be removed are subject to City approval.
- .6 Pedestrian access may be required to be provided within a PUL to ensure connectivity for trail users.

8.10 Stormwater Management Facilities in Parks Design Guidelines

- .1 Dry ponds and areas surrounding new stormwater management facilities must be graded, topsoiled, and seeded or sodded.
- .2 Plant materials will be selected with consideration to hydrological characteristics, soil characteristics, facility side slopes, and intended park use.
- .3 Provide a minimum of 80 trees per hectare within the public lands around the facility, above normal water level. Shrubs may be substituted for trees at a rate of seven shrubs for one tree.
- .4 Trees shall meet the requirements specified in Section 11.0.
- .5 Shrubs must meet the requirements of Article 8.6.2.
- .6 Inlets and outlets shall be landscaped with mass planting and large rocks, or acceptable alternative concrete revetment, to provide visual screening and security buffering for the public. No filter fabric shall be used.
- .7 Where possible, relatively flat open areas should be designed to encourage active recreational uses.
- .8 Special or unique park features (i.e.: artificially pumped dry streams, special play courts, bridges, and other architectural or structural features) must be designed by suitable, accredited professionals, as applicable. All such features which are to be located below the 1:5 year flood line shall be designed to withstand this event to the satisfaction of the City. Such features will be subject to a maintenance reserve, to be established by the Developer.

8.11 Naturalization Design Guidelines

- .1 Existing natural and naturalized areas affected by Subdivision development, which cannot be protected during construction, shall be restored with native plant materials consistent with the surrounding environment, new drainage patterns, soil conditions, and ecological rehabilitation. In such cases, the City shall be consulted during the design to assist in planning, the selection of appropriate replacement plant materials, and the retaining of wildlife corridors.
- .2 The Developer's landscape architect shall design an appropriate mix of native trees, shrubs, ground covers, and native seed mixes, consistent with these Design Standards, to rehabilitate affected naturalized and natural areas.
- .3 The landscape architect shall, when required, coordinate this restoration with other consultants to implement geotechnical, structural, and bioengineering principles and recommendations.
- .4 Landscape drawings shall identify all existing plant communities to be established and all other information necessary to implement the proposed landscape improvements.
- .5 The landscape architect shall specify all tree, shrub, and ground cover sizes. No minimum or maximum sizes are specified. A tree mix of 60% coniferous and 40% deciduous is recommended.
- .6 To establish healthy growing environments, 10% of all plant materials shall be of larger sizes.
- .7 Forestry stock, seedlings, deciduous tree whips, propagated cuttings, and rooted cuttings are acceptable for use, subject to City inspection and acceptance prior to installation.
- .8 All plant material to be nursery stock or obtained from the City, Provincial Government sources, or existing stands. Appropriate certification shall be provided.
- .9 Appropriate plant installation specifications and details shall be included on landscape drawings.

- .10 Herbicides may be used to eradicate vegetation on natural slopes prior to planting of trees and shrubs, subject to the review and acceptance of the City. No chemical treatment shall be permitted within 30 m of any body of water.

8.12 Environmental Reserve Design Guidelines

- .1 At no time shall encroachment into any natural area or designated buffer area occur without express written consent from the City. Environmental reserves shall be temporarily fenced and otherwise protected from adjacent construction.
- .2 Any environmental reserve areas damaged during construction must be rehabilitated to the satisfaction of the City.

8.13 Multiple Family, Institutional, Commercial or Capital Development Site Design Guidelines

- .1 The front properties of a development shall be used for ornamental plantings only. Property owners are required to landscape the boulevard and the property from the back of the sidewalk up to their property line that is adjacent to the public roadway. Deciduous trees must be planted at regular intervals, and coniferous trees must be planted in clusters of 3, 5, or 7 etc. Trees must be located a minimum of 2 m from property line. Sightlines must be considered for the building and any site signage appurtenances. Maintenance shall be the responsibility of the Developer/Owner, and not the City.
- .2 In order to reduce incompatible characteristics of abutting properties with different land use districts, minimum landscaping standards shall be applied to planting buffers on the interior property lines of the most intense land use.

8.14 Fencing Design Guidelines

- .1 Uniform fencing shall be provided and installed by the developer adjacent to and at the following locations:
- i) Arterial roadways;
 - ii) Parks and playfields;
 - iii) Public walkways and public utility lots;
 - iv) School sites;
 - v) City owned lands (i.e. firehall sites, etc.);
 - vi) Multiple family sites;
 - vii) Neighbourhood commercial sites;
 - viii) Institutional sites; and
 - ix) Other areas as required by the City.

8.15 Site Amenity Design Guidelines

- .1 Furniture may be provided by the Developer and placed at strategic locations through the Subdivision. Refer to Section 14.0. The City shall maintain the right to stipulate specific requirements for furniture.

8.16 Trail and Special Pavement Design Guidelines

- .1 Special pavements (i.e. paving stones, special pavement surface treatments) may be provided by the Developer, subject to the review and acceptance of the City. Patterned concrete pavement may be used, providing written permission is received from the City.

8.17 General Guidelines – Construction Inspection Process

- .1 The Developer's Landscape Architect shall ensure that the contractor(s) shall adhere to the following procedures through the construction process:
 - a) Ensure that utility locates are performed prior to any construction, including Alberta First Call and other appropriate authorities.
 - b) Review and approve all below grade utilities flagged before construction commences.
 - c) Protect existing landscaped areas including natural areas, sod, trees and shrubs.
 - d) Arrange for a project initiation meeting on site with Engineering and Development Services to ensure there is a clear understanding of the City's requirements during construction, establish a construction start date, and agree upon the progress schedule and subsequent inspection stages.
 - e) Approve rough grading, topsoil spreading, new seeding and sodding, new tree locations.
 - f) Approve plant materials prior to installation.
 - g) Coordinate review of topsoil and recommend amendments as required. Contact City to review topsoil.
 - h) Direct the review and inspection of all construction and installation while in progress.
- .2 The City will inspect plant materials prior to installation for vigor and form requirements and the existence of disease or pests if requested.
- .3 The Developer's Landscape Architect shall notify the City's representative 2 business days in advance at each stage of construction when the work is ready for inspection.
- .4 Contractor(s) shall provide details of the source location in writing if requested by the City.
- .5 The failure of construction to comply with approved plans and specifications will be considered sufficient cause to stop work or invoke the security clauses of the Development Agreement. Construction deficiencies shall be rectified to meet the appropriate plans and specifications, at the Developer's expense.
- .6 The Developer's Landscape Architect shall submit a request to the City in writing for plant material substitutions. If approved, the Developer's Landscape Architect shall identify the approved changes on the red line or the record drawing, as appropriate.
- .7 The Developer's Landscape Architect shall submit to the City a request in writing for permission to use collected plant materials.
- .8 Every precaution shall be taken not to damage, injure or mark existing structures or landscaping on City owned property. Should the Developer, its consultants, contractors, employees, or equipment incur any damage, it shall be restored at the Developer's expense to the satisfaction of the City. If remediation work is not done by the Developer, the work will be complete by the appropriate City department or delegate at the Developer's expense.

- .9 The Developer shall ensure that adjacent property is protected from dust, sand, and wet soil during construction. It is the Developer's responsibility to ensure all debris is removed from adjacent lands, and construction damage is repaired to its original condition.

8.18 Additional Guidelines – Construction Completion Certificate

In addition to the guidelines provided in Article 1.19, the following guidelines apply to the Construction Completion Certificates (CCCs) for landscaping activities.

- .1 When landscape construction work is satisfactorily complete, the Developer's Landscape Architect shall submit a request for a CCC inspection of the work completed. The request shall include a maintenance schedule and four (4) copies of the approved or redline drawings at an 11x17 size.
- .2 CCCs are to be attained for the following improvements (and any others listed in the subdivision conditions):
 - a) Turf and Plantings for Boulevards, including planting islands and entrance features.
 - b) Turf and Planting for MR, ER, SWMF, Arterial Roads.
 - c) Parks, Park Amenities and Playground Equipment.
 - d) Hard Surfaces and Special Pavements.
 - e) Fencing.
- .3 In preparation for acceptance of the development by the City, CCCs shall be issued subject to the following conditions and procedures:
 - a) A stage needs to be a minimum of 80% complete prior to a CCC inspection for landscaping. Boulevards must be 100% complete prior to a CCC inspection for landscaping.
 - b) The Developer's Landscape Architect, contractor(s), and the City Representatives shall attend the CCC inspections. Attendees shall be requested to sign a CCC form to show agreement with any noted deficiencies.
 - c) CCC inspections for seeded areas will occur upon germination.
 - d) Following the CCC inspection, the City will forward a copy of the inspection report listing all deficiencies to the Landscape Architect, or delegate, and the contractor.
 - e) All deficiencies identified during the CCC inspection shall be repaired or corrected within a maximum of 3 weeks, unless otherwise indicated by the City. Upon the correction of all listed deficiencies, the Landscape Architect or Delegate will request a re-inspection. If all deficiencies are corrected, the City will approve the CCC. If deficiencies are not corrected by the agreed date, the Developer's Landscape Architect must request a new CCC inspection. The maintenance period will commence from the CCC approval date.
 - f) The Developer shall maintain all work prior to the CCC and during the maintenance period after the CCC approval dates.
- .4 CCC inspections may be requested at any time. At the discretion of the City and weather permitting and site amenities can be inspected year round, provided snow cover, temperature, and other considerations do not prevent the ability to perform a thorough inspection. If an inspection occurs after October 15 of any year an additional 6 months of warranty is required.

8.19 Maintenance Period

- .1 Upon issuance of the CCC, the maintenance period shall be:
 - a) Pathways/Trails – 2 year.
 - b) Signage – 2 years.
 - c) Sod – 2 years, or as soon as germination is completely knitted.
 - d) Seed – 2 years, or 95% germination.
 - e) Plant Material – 2 years for all trees (less than 75 mm caliper) and shrubs on public property (Note: 1 year for trees on private property, or as otherwise indicated on the Development Permit), 2 years for all perennials.
 - f) Trees (75 mm caliper or greater) – minimum 3 years (subject to extension proportional to increase in caliper size, subject to review and direction of the City).
 - g) Fences – 2 years.
 - h) Site Amenities – 2 years.
 - i) Landscaping (Development Permit) – 2 years Private property, 2 years Public property.

If a CCC inspection occurs after October 15 of any year an additional 6 months of warranty is required.

- .2 Maintenance shall include but not be limited to pruning, watering, cultivating, weeding, mulching, tightening and repair of guy wires and stakes, resetting plants to proper grades or upright position, restoration of the planting saucer, application of such sprays or other materials as necessary to keep plantings free of insects, diseases and in vigorous and viable condition.

8.20 Additional Guidelines – Final Acceptance Certificate

In addition to the guidelines provided in Article 1.22, the following guidelines apply to the Final Acceptance Certificates (FACs) for landscaping activities.

- .1 After the required maintenance period has come to an end, the Developer's Landscape Architect shall submit a request for an FAC inspection. The request shall include maintenance logs and four (4) copies of the approved record landscape drawings at an 11x17 size.
- .2 FACs are to be attained for the following improvements (and any others listed in the subdivision conditions):
 - a) Turf and Plantings for Boulevards, including planting islands and entrance features.
 - b) Turf and Planting for MRs, ERs, SWMFs, arterial roads, PULs, parks, islands, and entrance features.
 - c) Parks, Park Amenities and Playground Equipment.
 - d) Hard Surfaces and Special Pavements.
 - e) Fencing.
- .3 In preparation for acceptance of the development by the City, and FAC shall be issued subject to the following conditions and procedures:

- a) The Developer's Landscape Architect, Contractor(s), and City Representatives shall attend the FAC inspection. Attendees shall be requested to sign the FAC form to show agreement with any written deficiencies.
 - b) Following the FAC inspection, the City will forward a copy of the inspection report listing all deficiencies to the Landscape Architect or delegate.
 - c) All deficiencies identified on the FAC inspection shall be repaired or corrected within an agreed upon timeframe. Upon correction of all listed deficiencies the Landscape Architect or delegate will request a re-inspection. If all deficiencies are corrected, the City will approve the FAC. If deficiencies are not corrected by the agreed date, the Developer's Landscape Architect must request a new FAC inspection. The maintenance period expires upon FAC approval.
- .4 FAC inspections may be requested between June 1 and September 30, weather permitting, at the discretion of the City and provided snow cover, temperature, and other considerations do not prevent the ability to perform a thorough inspection.
- .5 If tree and shrub replacements are required, a maximum of 25% of the plant material can be replaced during the deficiency correction period. Quantities exceeding 25% of replaced plant material will result in a FAC rejection. The application can be submitted for inspection the following growing season. This ensures the plant material has grown over a winter season.

DRAFT – FOR INFORMATION ONLY**9.0 LANDSCAPING STANDARDS – SUB-GRADE AND TOPSOIL****PART I – DESIGN****9.1 Design Guidelines**

- .1 Provide a minimum 2% gradient across all reserve parcels, medians, traffic islands, boulevards, public utility lots (PUL), right-of-ways (ROW) and storm water dry ponds.
- .2 Excessive fill that compromises the site design will not be acceptable.
- .3 Geotechnical testing may be required where questionable sub-grades exist.
- .4 Joint Use Site Guidelines:
 - a) School building envelope to have same grades as sports field envelope (i.e. 2%).
 - b) School building envelopes and adjacent road grades must be at the same elevation.
 - c) School building envelope is to have topsoil applied to a minimum depth of 250 mm.
 - d) For every one metre in elevation in excess of 2% slope, a minimum increase of three metres will be required on site.
 - e) If non-engineered fill is to be incorporated in an MSR site, documenting the limit and depth of the fill area and confirming the fill area is outside the building envelope, shall be provided at CCC.

9.2 Drainage Guidelines

- .1 Where possible drainage is to be picked up within the reserve parcels, PUL/ROWs and stormwater dry ponds in grass swales.
- .2 Drainage shall not be directed into existing tree stands.
- .3 Grass swales are to drain at a minimum 2% gradient.
- .4 The City reserves the right to limit the amount of off-site drainage onto a reserve parcel and PUL/ROW when, in their opinion, such drainage will compromise the integrity of the site.
- .5 All trapped lows must be approved by the City prior to construction. Trap lows must not compromise the use of the site and must be integral part of the design.
- .6 All drainage swales that empty onto reserve parcels, boulevards, PULs, ROWs, and stormwater dry ponds shall have concrete splash pads. Concrete splash pads shall be installed at a 10% pitch or erosion fabric will be required at their end.
- .7 Residential and commercial lots shall not use MRs to convey drainage.
- .8 For further drainage guidelines please reference Bylaw No. 1888-17 Surface Drainage.

PART II – GENERAL**9.3 Limits**

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- .1 The City shall waive the site clearing of wetland areas after a Natural Area Assessment, and has the authority through public and private sources for the acquisition of significant natural areas that cannot be preserved through other means.
 - .2 Only strip the area specified, and preserve and protect the remaining.
 - .3 The Contractor shall review the area proposed for clearing with the City prior to commencing the work.
 - .4 Clearing shall not exceed the limits of right-of-ways, permanent easements, and/or working easements and natural areas to be protected under the City's Municipal Development Plan.

9.4 Examination

- .1 Report to the City, in writing, any conditions or defects encountered in the site before or during any construction upon which the work of this section depends and which may adversely affect its performance.
- .2 Do not commence work until those conditions or defects have been investigated and corrected.
- .3 Commencement of work shall imply acceptance of existing surfaces and conditions and no claims for damages or extras resulting from such conditions or defects will be accepted later, except in cases where such conditions could not have been known prior to commencement of work.
- .4 Protect all existing trees and planting areas.

9.5 Samples

- .1 Samples of topsoil may be requested for approval by the City.
 - a) Sample and soil analysis report to be provided prior to construction.
 - b) Submit required sample of topsoil to the testing laboratory and indicate intended use, type of mulches applied, type of sub-soil and quality of drainage.
 - c) Obtain approval of the topsoil in writing from the City. Topsoil testing shall be done on the source of topsoil. Four samples shall be taken (i.e. one within every 25% vertical increment of the stockpile) at a depth of one foot. The location of the samples within each vertical increment shall be determined by the City.
 - d) Submit for the City's approval the name of the testing company who will conduct the soil analysis. The proposed testing laboratory is subject to approval by the City.
 - e) Submit two (2) copies of the soil analysis report, including the location of the topsoil stockpile or source and recommendation for correction to the City. Test the topsoil for NPK, a particle size analysis (soil texture), soluble salt content, organic matter, pH, and micro/macro nutrient status. Recommendations should clearly state the type, quantity and application procedure for amendment.

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- f) Should the source of topsoil be exhausted, test topsoil from new source, submit soil analysis report and recommendations for correction and obtain the approval of the City.
 - .2 Retain approved samples on site until work has been inspected and approved.
 - .3 All work shall conform to approved samples.

9.6 Substitutions

- .1 A topsoil substitute may be accepted when it is more appropriate for the planting site than natural topsoil or un-altered topsoil. The specification for the material proposed shall be submitted to the City's representative for review. Such documentation shall be supplemented by research from a recognized horticultural agency or institution supporting the topsoil substitute's use and effectiveness and including guidelines for its long-term management. Topsoil substitutes shall only be used after written approval
- .2 The stone content specification of 8.6.14.e, Topsoil below does not apply to substitutes
- .3 The following information shall also be provided:
 - a) The status for the topsoil substitute or its components of all the characteristics listed under the Samples section above.
 - b) Grading analysis of the mineral content.
 - c) Identify and rate of use of any tackifier or gluing agent.

9.7 Product Delivery, Storage and Handling

- .1 Stockpile topsoil in locations designated by the City.
- .2 Stockpiling on future MR lands is not permitted, unless written permission is granted by the City.
- .3 Do not spread topsoil in a muddy condition.

9.8 Inspections

- .1 The Contractor shall have an approved set of drawings and specifications available prior to calling the City for inspection
- .2 The City shall approve both rough grade prior to placing of topsoil and finished grade at appropriate times before contractor proceeds with next phase of work. For all joint use sites and community parks, as well as dry ponds containing sports field in MR and MSR sites, the Contractor shall:
 - a) At Sub-grade Inspection:
 - i) Supply grade stakes at all corners of sports fields as well as along their centre line.
 - ii) Supply grade stakes at the toe and heel of all slopes and swales. Spacing of the stakes is to be determined by the City prior to their installation.
 - iii) Be available for a joint site inspection with the City and have on site a survey crew fully equipped to provide any additional elevations as may be requested.
 - b) At Finished Grade Inspection:

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- i) Supply grade stakes at the corners, centre and quarter points of sports fields, break of slopes and along drainage channels.

PART III – PRODUCTS

9.9 Fill

- .1 Fill materials shall exclude all matter likely to breakdown and cause subsidence.
- .2 Fill materials shall be free of stones, clods, sticks, sod, roots, organic matter, frozen lumps, concrete, any toxic materials (e.g.: salt, oil, etc.), debris and other foreign material.
- .3 Fill shall not contain quack grass rhizomes.

9.10 Peat Moss

- .1 Peat moss shall be of good horticultural quality, homogeneous, and free of foreign material, lumps, clay, wood, stumps, rocks, quack grass, and noxious weeds.
- .2 Peat moss shall be pulverized and shall pass through a 37 mm screen.
- .3 The peat moss shall have a pH between 4.5 and 6.0, conductivity not exceeding 1.5 mS/cm, maximum sulphate of 200 ppm, and no lime present.

9.11 Sand

- .1 Sand for horticultural use when tested by laboratory sieves shall be uniformly graded and meet the following grading requirements:

Passing	Cumulative % by Weight
2.5 mm	100
1.25 mm	90-100
0.8 mm	80-90
315 micro-m	30-60
160 micro-m	2-10
63 micro-m	1 maximum

- .2 Sand shall be natural and coarse (except for the removal of very fine particles and gravel). Sand shall be free from vegetation, clay balls and other foreign material. Care shall be taken in the selection of material from the pit to produce a uniform product.

9.12 Crushed Gravel

- .1 Crushed gravel shall be maximum size 25 mm complying with the following gradation.

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Sieve Size	Percent Passing
25 mm	100
19 mm	95-100
9.50 mm	60-80
4.75 mm	40-60
2.00 mm	25-45
425 micro-m	10-25
75 micro-m	2-10

- .2 Volume of rock in topsoil not to exceed 20%.

9.13 Topsoil

- .1 The following topsoil requirements are for boulevard and parks projects. For projects with specialized plant communities including, for example, species demanding unusually acid or alkaline soils (calcifuges or calcicoles), an appropriate soil specification shall be submitted to the City for review and acceptance.
- .2 Topsoil shall be loose, loamy, friable soil, free from subsoil, refuse, roots, stones > 25mm, slag, clay, stones, lumps, quack grass and other perennial weeds and roots, rhizomes, noxious odors, chemical contaminants, live plant roots, or other foreign materials.
- .3 If the seed bank of an imported topsoil yields quack grass, noxious weeds, or restricted weeds as designated by the Weed Designation Regulation of the Weed Control Act of the Province of Alberta, or sufficient weeds of any type to choke the desired vegetation, up to three repetitions of cultivation, germination and appropriated translocated herbicide application will be required.
- .4 Topsoil pH to be between 6.0 and 7.5. Use lime or sulphur, as indicated by analysis of topsoil, to bring pH to the required range.
- .5 Stone content shall not exceed 10% by dry weight. The maximum stone size, in any direction, shall not exceed 25 mm.
- .6 Topsoil shall be free from weeds and weed seeds, and shall be in a reasonably moist condition.
- .7 Topsoil shall be capable of sustaining vigorous plant growth.
- .8 Soil mix for tree, shrub, and flower beds shall consist of black topsoil, a fertile friable natural loam containing not less than 4 – 6 % of organic matter for clay loams and not less than 2% for sandy loams and mixed with native material.

PART IV - EXECUTION

9.14 Site Preparation

- .1 Locate and protect all existing trees and shrubs
 - a) All existing trees and shrubs and the areas under their canopies to protect the root zone shall be fenced with timber posts of a height of 1,800 mm above ground level. Rails and either boards or snow fence at the discretion of the City to protect against any damage, including leakage of toxic fluids or compaction of the soil through pedestrian, or vehicular traffic, or use as a storage or lay-down area.

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- b) The Developer and/or Owner of the project will be responsible for any such damage including by third parties if enabled by lack of protection by Contractor.
 - .2 Complete trench backfilling before beginning grading.
 - .3 Maintain slopes and adequate drainage during grading.
 - .4 Do not allow mixing of topsoil and subsoil material.
 - .5 Locate, mark, and protect all utilities and appurtenances (i.e. manholes, catch basins, valves, and hydrants).

9.15 Clearing

- .1 Clearing shall only be permitted during periods which do not disturb nesting birds and other wildlife. Perform and document nesting check.
- .2 Cut, dig, remove, and dispose of all timber, brush, windfall, stumps, and rubbish except such trees and shrubs that are designated for preservation. Designated areas to be preserved shall be protected as per the ISA “Tree preservation During Construction” regulations. (www.treesaregood.com)
- .3 Preserve such designated trees and shrubs from scarring, barking, or other injury during construction operations. Maintenance charges for scarring, barking, or other injury to trees or shrubs will be assessed in accordance with the ISA “Tree Preservation during Construction” regulations.
- .4 Trim branches from timber and salvage usable timber. Salvaged timber shall be the property of the City.
- .5 Where grubbing is not to be done, all trees, roots, and existing stumps shall be cut off flush with the original ground surface.
- .6 Cut, remove, and dispose of dangerous trees overhanging and off the right-of-way as per Contracted Arborist.
- .7 Pull down, remove, and relocate or dispose of any structures, fences, and /or any physical obstructions.
- .8 Dispose of branches and debris in accordance with Article 9.16.
- .9 Leave ground surface in a condition suitable for stripping of topsoil.

9.16 Disposal

- .1 Remove and dispose of surplus materials as directed by the City.
- .2 All materials on site whether stockpiled, stored, or excavated are the property of the City, and the City reserves the right to keep any, part, or all of the material.
- .3 The Contractor shall dispose of all waste materials at sites located by the Contractor and approved by the City.
- .4 Waste materials at site shall be disposed of offsite at authorized public disposal sites at all times.

9.17 Salvage

- .1 Remove merchantable timber as defined by the Alberta Forest Service.

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- .2 Merchantable timber, in general, includes trees with a bottom diameter of 150 mm or greater and a top diameter of 100 mm or greater.
 - .3 All timber of materials salvaged shall be the property of the City.
 - .4 The City will designate trees to be salvaged. Trim branches from salvaged timber, cut into 3m lengths and pile neatly in stockpiles.
 - .5 Disposed of branches and debris in accordance with Article 9.16.
 - .6 Salvageable items, as designated by the City, are to be deposited in the City's storage yard.

9.18 Grubbing

- .1 Excavate, remove and dispose of all roots, stumps, submerged logs, corduroy and similar objectionable matter to a depth as determined by the geotechnical report.
- .2 Fill holes and level areas disturbed by grubbing. Leave ground surface in a condition suitable for stripping of topsoil.

9.19 Topsoil Stripping and Stockpiling

- .1 Strip the site to the limits shown on the Drawings, or strip those areas specified or ordered in writing.
- .2 Strip all areas to be excavated for structures, pipes, or roadways to the limits shown on the Drawings or directed by the City. Retain all subsoil in areas shown on the Drawings to be dedicated as municipal reserve and other lands to be retained as green space. For sustainability different types of soil fertility shall be considered not different levels.
- .3 Strip the full depth of topsoil or organic material only for structures, pipes, or roadways. Sustain as much native topsoil for intended green infrastructure.
- .4 Topsoil shall only be stripped in dry weather and ground conditions to prevent damage to its crumb structure.
- .5 Frozen topsoil may be stripped by ripping provided a minimum of 2 passes are made, the first of which shall not exceed 50% of the topsoil depth.
- .6 Stockpile and windrow topsoil temporarily and dispose of stripped material that is unsuitable for replacement. Stockpile in a manner that will not endanger persons, existing vegetation, living nature, or adjacent property.
- .7 Ensure stockpiles of topsoil, common excavation, and borrow materials are sufficiently separated. Maintain a minimum of 1.0 m separation between topsoil and common excavation material when stockpiling.
- .8 If the topsoil and subsoil are mixed and the topsoil is adversely affected, the Contractor shall, at the Contractor's own expense, engage a soils specialist to determine the necessary remedial work, and shall perform the required work.
- .9 Disposal of unsuitable material shall be in accordance with Article 9.16.
- .10 Developer shall locate and protect all utilities; survey control monuments, plant material root systems that are designated to remain, including natural features, pavement, concrete and structures.

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- .11 Plant material on City or private land shall not be removed without the written approval from the City and consultation with an approved city personnel three (3) months prior to construction.
 - .12 All areas disturbed during the development process must be rehabilitated to its original state or better, as approved by the City.
 - .13 Plant material to be preserved on the site shall be of high quality worthy of preservation. All plant material to be approved by the City representative and a certified Arborist.
 - .14 All trees presently growing on the site, which are to remain, shall be protected to avoid any damage to them during construction operations. Refer to the ISA (International Society of Arboriculture) regulations “Avoiding Tree Damage during Construction”. Trees approved for removal shall be cut and stumps removed to a minimum depth of 600 mm below proposed finished grades and disposed of offsite.
 - .15 Burying of such material on the site shall be permitted only if approved by the City. The Developer shall identify these burial locations on the record drawing.
 - .16 “Close cut” clearing (hand clearing) shall be utilized adjacent to areas to be preserved to ensure no damage to existing plant material and root systems.
 - .17 Existing grades around plant material are to be retained. If grades are raised or lowered around preserved plant material, the developer will be responsible for constructing proper soil retention to ensure the health of the plant material.
 - .18 The Developer will replace all plant material that has died or suffered as a result of construction or grade changes in preserved areas.

9.20 Excavation, Fill and Grade

- .1 Excavate to the required sub-grade elevation.
- .2 Remove and dispose rocks and any other unsuitable materials.
- .3 Grades shall be within 25 mm of design grades.
- .4 Place and spread fill material in successive horizontal lifts.
- .5 Compact each lift to a minimum 98% Standard Proctor Density, unless otherwise specified or directed by the City.
- .6 Each lift shall not exceed 150 mm in compacted thickness.
- .7 Trim side slopes from top down, and finish true to the required alignment, grade, and shape.
- .8 Trim high areas, scarify low areas, compact, and re-grade as required to achieve specified grades and compaction.

9.21 Sub-grade Preparation

- .1 Work the soil with cultivating and mixing equipment until the soil is pulverized into pieces no larger than 25 mm across, exclusive of stones.
- .2 Grade sub-grade to even running contours as shown on the approved drawings and given levels with a tolerance of ± 75 mm, scarify to 300 mm and roll to create a firm smooth surface.
- .3 Remove all debris from the sub-grade and ensure it is not contaminated and free of all deleterious materials.

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- .4 The final sub-grade surface shall be sloped so that there is no runoff onto adjacent property or ponding.
 - .5 Fine grade to ensure positive drainage away from buildings and sidewalks.
 - .6 Compact finished sub-grade and all fill material to 85% standard proctor dry density for areas under turf or planting.
 - .7 Leave the surface of the compacted sub-grade slightly higher than the required elevation; then trim to the required elevation.
 - .8 Leave the finished surface even and free of depressions, humps, loose debris, and foreign material.
 - .9 Do not permit vehicular traffic over the prepared sub-grade.
 - .10 Sub-grade shall be inspected by the City prior to topsoil placement.

9.22 Topsoil Placement

- .1 Do not place topsoil when sub-grade or topsoil is frozen, excessively wet or dry, or in a condition that inhibits proper grading, cultivation, or compaction.
- .2 Spread topsoil uniformly over prepared sub-grade to achieve a minimum compacted depth of 250 mm for sodded and seeded areas, unless otherwise specified or directed by the City.
- .3 Cultivate topsoil to a minimum depth of 250 mm, breaking down lumps. Remove stones larger than 25 mm, weeds, roots, and other foreign material from the site.
- .4 Manually spread topsoil around trees and plants to prevent damage by grading and leveling equipment.
- .5 Float the area until the surface is smooth. Cut smooth and flush all areas adjacent to catch basins.
- .6 Fine grade to eliminate rough or low areas and to ensure positive drainage.
- .7 Boulevards – The finished topsoil level shall conform to the adjacent curb and sidewalk elevations and must provide for adequate drainage of sidewalk areas after turf establishment.
- .8 Buffer Strips – The finished topsoil level shall slope uniformly from the property line towards the back of the sidewalk at not less than 2%.
- .9 Public Utility Lots and Walkways – Where a sidewalk is present, a swale shall be provided at a distance of at least 1m from the edge of the sidewalk. The grade must be sloped away from the sidewalk at a minimum grade of 2%.
- .10 Medians and Islands – The finished topsoil level shall be even from curb to curb with crowning to accommodate drainage.
- .11 Compact topsoil with rollers to the satisfaction of the City.
- .12 Final topsoil grades for seeded areas shall be flush to finished grades at surface structures (i.e. manholes, sidewalks, driveways, and curbs).
- .13 Apply topsoil to the following minimum depths measured at right angles to the Sub-grade after leveling with a tolerance of 25 mm over a distance of 2.4 m:
 - a) Min 250 mm for seeded areas.

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- b) Min 250 mm for sodded areas.
 - c) Min 650 mm for planting beds.
 - .14 When abutting an existing turf area, cut the existing turf to form a straight, non-jagged joint with the new seeded or sodded area.
 - .15 Rehabilitate any damage caused by topsoil spreading activities.
 - .16 Control dust so as to have no impact on surrounding land uses.
 - .17 Clean all adjacent walks, streets and properties as a result of work done under this section at the end of each working day or as directed.
 - .18 The Consultant shall inspect the topsoil preparation prior to the Contractor proceeding with seeding or sodding.

9.23 Spreading of Topsoil – Natural Areas, ERs

In addition to the requirements provided in Article 9.22, comply with the following:

- .1 In restoration the depth and finish grade of the topsoil should be tied to the depths and finish of the pre-existing native profile. This should be specified in the restoration plan and approved by the City.
- .2 Rough grade topsoil to ensure positive drainage and to emulate the pre-development drainage patterns and rates.

10.0 LANDSCAPING STANDARDS – PATHWAYS AND TRAILS

PART I – DESIGN

10.1 Objectives

- .1 The following guidelines are intended to assist in the development of a high-quality and fully integrated pathway system. The guidelines include legal requirements, official policies, established standards and practices and desirable standards and is a local supplement to the existing standards in “Guidelines for Design of Bikeways” by the Roads and Transportation Association of Canada.
- .2 The objective of the planning guidelines is to lay out a pathway network which links together residential area parks, natural areas, riverbanks, and public recreational facilities.

10.2 Pathway Classifications

PATHWAY CLASSIFICATION			
Location	Max. Width (m)	Min. Width (m)	Surface
Major River	3	3	Asphalt
Major Collector Roads	3	3 / 1.5	Asphalt/Concrete

- .1 **Regional Pathway System:**
 The regional pathway system is a citywide linear network that facilitates non-motorized movements for recreation and transportation purposes. The regional pathway is hard-surfaced, typically asphalt and located off-street. It is a multi-use facility and no one user or type of user is to be given preference. It should be designed as a continuous facility that connects individual communities to:
 - a) Citywide and Regional Parks and recreation facilities;
 - b) Natural features, including water courses, escarpments, ravines, parks and associated open space;
 - c) Regional joint use sites, commercial districts, employment centers, adjacent communities and key cultural attractions;
 - d) Local pathway, bikeways and trail systems; and
 - e) Transit routes.
- .2 **Local Pathway**
 A local pathway is a pathway that provides secondary routes within communities, linking residential areas to facilities such as neighborhood parks, schools and other local community designation. Local pathway may also serve as links to the regional pathway system.
- .3 **Tertiary Pathway**
 A tertiary pathway is a pathway generally located in natural areas or in parks in addition to a regional or local pathway. As a management tool they identify intended public routing and can formalize desire lines to minimize impact on the natural environment.

10.3 Planning Guidelines

- .1 Alignments
 - a) Pathway shall be shown schematically in an Area Structure Plan.
 - b) Pathways, where desirable should be routed along the edges of environmentally significant areas or into locations with less sensitivity in natural environmental parks in order to minimize the impact on the park or natural area and reduce future damage and desire lines.
- .2 Street Crossings
 - a) Route pathway to street intersections where possible.
 - b) Mid-block crossing are discouraged and permitted on local streets only. If mid-block crossings are to be provided, appropriate line markings must be provided, and signage is to be installed by the City.
 - c) Avoid necessity for building mid-block pedestrian overpasses on major streets.
 - d) Adjust subdivision layout to minimize quantity of crossings.
 - e) Line up pathway entrances to ensure visual continuity.
- .3 Play Equipment Sites
 - a) Regional pathway should not be within at least 5 m from play area surfaces.
 - b) Provide a minimum 2 m wide asphalt link from the play equipment site to a local or regional pathway.
- .4 Parking Lots
 - a) Route pathway to facilitate pedestrian access to buildings on site.
 - b) Provide asphalt links from parking lots to pathway.
 - c) Locate pathway entrance at street.
- .5 Natural Areas
 - a) Align trails around significant areas and sites; never through.
 - b) Avoid damage to natural features, vegetation and wildlife habitat.
 - c) Increase back sloping gradient to 2:1 to minimize fill coverage.
 - d) Send proposed design plans for all natural areas and Environmental Reserve parcels to the City for approval.

10.4 Design Guidelines

The objective of the design guidelines is to produce a safe and enjoyable pathway incorporating the needs of multiple users (i.e. walkers, child strollers, runners/joggers, people with disabilities, cyclists, in-line skaters and skateboarders), and therefore, stringent attention must be given to design details. Where location and design considerations prevent transportation and recreation functions from being accommodated together, the recreation function should be given a higher priority.

- .1 Safety Clearance and Setback requirements

- a) Regional and Local Pathways:
 - i) Provide 1.0 m clear of all obstacles on both sides.
 - ii) Provide 3.0 m clear of all obstacles overhead.
 - iii) Avoid locating pathway over manholes.
 - iv) Ensure a 2.5 m minimum clearance from park water services.
 - v) Set back pathway a minimum of 1.0 m from face of curb.
 - b) Tertiary pathways:
 - i) Provide minimum 0.5 m clear of all obstacles on both sides (i.e. trees, signs, light poles etc.).
 - ii) Provide minimum 2.1 m clear of all obstacles overhead (i.e. tree branches, bridges, etc.).
- .2 Safety Railings
- a) Regional and Local Pathways:
 - i) Safety railings shall be installed when pathway is within 2.0 metres of the top of a 2:1 slope or steeper, and the slope is greater than or equal to 1.0 metre in depth.
 - ii) Under exceptional circumstances, and subject to approval by the City after an appropriate risk assessment, safety railing may not be required. If a risk assessment is required, it shall be provided by the City at no cost to the Developer.
 - iii) Minimum railing height and design to be in accordance with the City's Engineering Standard Drawings in Appendix A, or equivalent as approved by City.
 - iv) Chain link fence is only acceptable when the fabric is attached to, but not protruding, above the top rail. Attachment shall be with a knuckle finish.
 - v) Wooden fences are not preferred.
 - b) Tertiary Pathways:
 - i) Minimum railing height and design to be in accordance with the City's Engineering Standard Drawings in Appendix A, or equivalent as approved by City.
 - ii) Typically constructed of galvanized steel or wood
 - iii) Install where a trail is within 1 m of the top of a 2:1 slope or steeper, and the slope is greater than or equal to 1 m in depth.
 - iv) Chain link fence is not preferred, and is only acceptable when the fabric is attached to, but not protruding above, the top rail. Attachment shall be with a knuckle finish.
- .3 Pathway Entrances/Wheelchair Ramps
- a) For pathway entrances and wheelchair ramps, extend pathway to street curb in all cases.

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- b) Ensure pathway joins streets at right angles.
 - c) Provide bollards where the entrance to a pathway is on a street. Provide a staggered T-Bollard layout that deters motor vehicle access from the street but allow convenient access for cyclists, pedestrians, and wheelchairs. Staggered T-Bollards shall be provided where required for maintenance equipment access.
 - d) Line up entrances for visual continuity where pathway route crosses street.
 - e) Ensure catch basins or manholes are not located at pathway entrances or wheelchair ramps.
- .4 Sight-Lines
- a) Where possible, ensure no obstructions to visibility within 5.0 m of junction with other pathway and streets (trees, shrubs, utility boxes, fences etc.).
- .5 Maximum Grades
- a) Over 8%: re-route.
 - b) 5% to 8%: no longer than 50 m (keep bicycles and pedestrians separate and avoid curves and constrictions). Where such portion of a pathway network meets a roadway, provide staggered T-Bollards at the pathway entrance to prevent bikers from accidentally entering the roadway.
 - c) 3% to 5%: no longer than 200 m.
 - d) Under 3%: acceptable (required if wheelchair accessible).
 - e) If the longitudinal grade of a pathway exceeds 3% over the 20 m approaching a connecting roadway, then staggered T-Bollards are required.
- .6 Design Speed
- a) Flat terrain: do not exceed 35 km/hr.
 - b) Downgrades: do not exceed 50 km/hr.
- .7 Super-elevation
- a) On curves 2%.
 - b) Maximum 5%.
- .8 Stopping Sight Distances
- a) Stopping sight distance is described below:
 Minimum SSD – $v^2 / \{225 (f+g)\} - 0.695v$
 Where: SSD = Stopping sight distance
 v = bicycle design speed (typically 30 km/hr)
 f = coefficient of friction = 0.25
 g – grade m/m (rise or decent/run)

 The following table may also be used to obtain appropriate stopping sight distances:
NOTE: A stopping site distance of 35.0 m is considered standard guideline.

	Level	Ascending	Descending
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Gradient	0%	2.5%	5%	2.5%	5%
SSD	35 m	33.5 m	32.5 m	36.5 m	38 m

.9 Minimum Design Curve Radii

- a) Minimum design curve radii is as follows:

$$\text{Minimum } r = \frac{v^2}{127(e+f)}$$

Where:

- r = minimum radius
- f = coefficient of friction
- e = super elevation
- v = bicycle design speed (typically 30 km/hr)

The following table may also be used to obtain appropriate minimum radius for asphalt pathway with 2% banking.

NOTE: A minimum design curve radii of 5.0m is considered standard guideline.

Speed	10 km/hr	15 km/h	20 km/hr
Radius	2 m	9.5 m	5%

.10 Stairs

- a) Stairs are not acceptable within a pathway or trail network.

.11 Lighting

- a) Provide on local and regional pathway as required by the City.
b) Provide on river pathway in the downtown part of the City.

.12 Pedestrian Bridges and Overpasses

- a) Railing height as per building code.
b) Minimum deck width 3.0 m between railings.
c) Submit concept drawings to the City, however, final approval will come from appropriate bridge engineer. Ensure all drawings are signed by a Professional Engineer.

.13 Vehicular Bridges and Overpasses

- a) In general, ensure sidewalks for pedestrians and widened shoulder lanes for cyclists are provided along both sides of structure.
b) Where bridge is part of pathway system, ensure combined pathway as sidewalk is provided along both sides of structure.
c) Railing height as per building code.
d) Minimum pathway width to be 3.0 m.
e) Submit concept drawings to the City, however, final approval will come from appropriate bridge engineer. Ensure all drawings are signed by a Professional Engineer. The developer is to ensure that the proposed structure conforms to all applicable City Bylaws and provincial Building Codes.

.14 Pedestrian Underpasses

-
- a) Minimum height 3.0 m and minimum width 3.0 m.
 - b) Ensure drainage is kept in concrete swale along on one side.
 - c) Ensure area is well-lit.
 - d) Desirable maximum length 50 m; provide break in underpass within median of divided roadways.
- .15 Bridges
- a) Railing height as per building code.
 - b) Minimum deck width: 1.5 m between railings.
 - c) Material examples: log stringers, laminated wooden beams, prefabricated steel and pre-cast concrete.
 - d) Submit concept drawings to the City. Ensure all drawings are stamped by a Professional Engineer.
- .16 Amenities
- a) In general, provide one trail entrance every 150 m or as needed.
 - b) One park bench every 400 m; one trash receptacle every 400 m. Environmentally sensitive areas should be assessed on an individual basis.
 - c) Garbage receptacles as identified by the City Engineer.
- .17 Signage
- a) Provide standard identification signs with pathway name and pathway entrances.
 - b) Provide standard hazard warning signs where appropriate.
 - c) Provide center line pavement marking on regional and river pathway and on separated bicycle pathway (75 mm wide, yellow).
 - d) Provide double center line pavement marking as hazardous locations (50 + 50 mm wide, yellow).
- .18 Pavement Markings
- a) Refer to Article 3.13.
- .19 Recommended References
- a) “Guidelines for Design of Bikeways,” Roads and Transportation Association of Canada.
 - b) “Recreational Pathway,” National Capital Commission, Ottawa.
 - c) “Technical Handbook of Bikeway Design,” Velo, Quebec.
 - d) “Planning & Design Criteria for Bikeways in California,” California Department of Transportation.
 - e) “Trail Manual” Parks Canada, 1978.
 - f) “Recreation Trails,” Alberta Recreation and Parks, 1989.
 - g) “Trail Design, Construction and Maintenance Manual,” Ontario.

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- h) “Trail Building & Maintenance,” Appalachian Mountain Club.
 - i) “Sentiers Quebec,” Comité Québécois des Sentiers de Randonnée. 1979.
 - j) “Cross Country Ski Trail Development,” Alberta Recreation and Parks, 1979.

PART II – GENERAL

10.5 Examination

- .1 Report to the City, in writing, any conditions or defects encountered in the site before or during any construction upon which the work of this section depends and which may adversely affect its performance.
- .2 Do not commence work until those conditions or defects have been investigated and corrected.
- .3 Commencement of work shall imply acceptance of existing surfaces and conditions and no claims for damages or extras resulting from such conditions or defects will be accepted later, except in cases where such conditions could not have been known prior to commencement of work.
- .4 Protect all existing trees and planting areas.

10.6 Samples

- .1 Samples of sub-base and asphalt may be requested by the City. Sieve analysis (ASTM-D698) will be required for sand and crushed gravel. Submit one test result per 1,000 tonnes of material.
- .2 Retain approved samples on site until work has been inspected and approved.
- .3 All work shall conform to approved samples.

10.7 Inspection

- .1 The contractor shall have an approved set of drawings and specifications available prior to calling the City for an inspection.
- .2 The contractor shall obtain approval for the pathway alignment and sub-base (i.e. compaction and depth of gravel) prior to surfacing with asphalt.
- .3 Regional pathway within the Streets right-of-way and doubling as sidewalks shall be inspected and maintained by the City.
- .4 Regional pathway that are constructed in lieu of sidewalks and meander in and out of the streets right-of-way shall be inspected and maintained by the City.
- .5 All Regional pathways, except those noted in items above, shall be inspected and maintained by the City.

PART III – PRODUCTS

10.8 Sub-Base

- .1 Refer to section 3.0 and to drawing 10.1 and drawing 10.2 to include 150 mm depth of 20/25 gravel.

10.9 Asphalt Concrete

- .1 Surface: Type ACR refer to drawing 10.1 and 10.2

10.10 Pavement Marking

- .1 Refer to Article 3.22.

10.11 Signage

- .1 Coordinate to ensure all signs contain the City of Wetaskiwin logo is consistent on all signage.
- .2 Information Signs
- a) Information signs to conform to Alberta Transportation “Highway Guide And Information Sign Manual” (Current Edition)
 - b) Foundation post shall be 200 mm x 200 mm full dimension recycled plastic, 3.66 m long. Set post in 400 mm diameter concrete footing with fillcrete in accordance with Article 5.13.5.
 - c) Appearance post shall be 200 mm x 200 mm full dimension recycled plastic, 1.9 m long.
 - d) Fastening hardware to be galvanized steel.
 - e) Signboard cap to be 19 mm extruded aluminum channel, or approved alternate, and painted to match the signboard.
- .3 Playground Signs
- a) Signboard shall be 19 mm Crezon. Signboard back and edges shall be primed with an exterior primer and painted using a white exterior alkyd paint.
 - b) Sign shall be 300 mm x 350 mm in size.
 - c) Wording and lettering to be submitted to the City for review and approval prior to fabrication.
 - d) Sign designs provided by manufacturers that match and attach to equipment may be considered.

PART IV - EXECUTION**10.12 Asphalt Pathway Paving**

- .1 Conform to the applicable requirements for asphalt paving outlined in Articles 3.23 to 3.39.

10.13 Pavement Marking

- .1 Conform to the applicable requirements for pavement marking outlined in Article 3.41.

10.14 Signage

- .1 Refer to Engineering Standard Drawings in Appendix A for installation details.
- .2 All signs are to be maintained free of defects for during the Warranty Period.



Municipal Engineering Standards

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11.0 LANDSCAPING STANDARDS – PLANT MATERIAL

PART I – DESIGN

11.1 Minimum Setback Requirements

- .1 Trees shall be spaced from infrastructure in accordance with the **minimum** setbacks provided in the following table measured from outer edge of the infrastructure to outer edge of the tree:

Infrastructure Designation	* Setback Distance for Trees
Fence Lines	2.5 m
Median and Road Curb Face	2.0 m
Driveways	1.5 m
Fire Hydrants	1.8 m
Street Lights (Arterial Roadways)	5.0 m
Street Lights (Collector and Local Roads)	3.0 m
Buried Utilities (power, cable, telephone, traffic signals)	1.0 m
Power Hardware	3.5 m
Telephone Pedestals	1.5 m
Water Valves	1.8 m
Buried Gas Mains and Services	1.5 m
Street Corners (distance from intersecting curb)	12.0 m
Yield and Stop Signs (Arterial Roadways)	7.0 m
Yield and Stop Signs (Collector and Local Roadways)	5.0 m
Bus Stop Signs and other signs	5.0 m
Sidewalks and Trails	2.0 m
* Minimum tree setbacks can be adjusted by the City based upon the species and placement.	

- .2 Trees shall not be planted in any location from which the tip of any branch will grow closer to overhead power lines than 2.4 m laterally or 4.5 m vertically.
- .3 Boulevard trees shall be diversified to minimize pests and disease, and shall be planted at equal intervals, which may vary depending on their ultimate size, in accordance with the following:
- Large and medium size trees: 10 to 13 m spacing.
 - Small size trees: 7 to 10 m spacing.

11.2 Tree Selection

- .1 Tree selection shall be consistent with the following requirements:
- Adequate, year-round sightlines shall be maintained for pedestrian and vehicular safety.
 - Minimum 1.8 m branching height for all trees adjacent to roadways and walkways.
 - The following tree species are acceptable for landscaping within public areas. Proposed alternates shall be subject to the review and acceptance of the City.
 - Due to climate change and the increasing risks of new pests, the City recommends planting a variety of species on any residential block (i.e. larger species for larger

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boulevards, and smaller species for a smaller boulevard, alternating species along a block, patterned plantings etc.).

e) No fruit-bearing species are permitted adjacent to sidewalks or trails.

.2 Refer to the following chart for recommended deciduous trees:

Large Trees				
Botanical Name	Common Name	Approx. Height at Planting	Min. Caliper at Planting	Acceptable Locations
<i>Acer negundo</i>	Manitoba Maple	3.7 - 4.6 m	60 mm	Open Spaces
<i>Acer saccharinum</i>	Silver Maple	3.7 - 4.6 m	60 mm	Boulevards
<i>Acer x freemanii</i> 'Autumn Blaze'	Autumn Blaze Maple	3.7 - 4.6 m	60 mm	Boulevards
<i>Betula papyrifera</i>	Paper Birch	3.7 - 4.6 m	60 mm	Open Spaces (Moist)
<i>Fraxinus pennsylvanica</i> 'Bergeson', 'Patmore', 'Prairie Spire', and 'Summit'	Bergeson, Prairie Spire, and Summit Green Ash	3.7 - 4.6 m	60 mm	Boulevards
<i>Fraxinus mandshurica</i> **	Manchurian Ash	3.7 - 4.6 m	60 mm	Boulevards
<i>Fraxinus Americana</i>	White Ash	3.7 - 4.6 m	60 mm	Open Spaces
<i>Fraxinus</i> 'Northern Gem' and 'Northern Treasure'	Northern Gem and Northern Treasure Hybrid Ash	3.7 - 4.6 m	60 mm	Boulevards
<i>Tilia americana</i>	Basswood	3.7 - 4.6 m	60 mm	Open Spaces
<i>Ulmus americana</i>	American Elm	3.7 - 4.6 m	60 mm	Boulevards/Medians
<i>Ulmus Americana</i> 'Brandon'	Brandon Elm	3.7 - 4.6 m	60 mm	Boulevards/Medians
<i>Salix pentandra</i>	Laurel-Leaf Willow	3.7 - 4.6 m	60 mm	Open Spaces (Moist)
<i>Salix alba</i>	White Willow	3.7 - 4.6 m	60 mm	Open Spaces (Moist)
<i>Salix alba</i> 'Vitellina'	Golden Willow	3.7 - 4.6 m	60 mm	Open Spaces (Moist)
Medium Trees				
Botanical Name	Common Name	Approx. Height at Planting	Min. Caliper at Planting	Acceptable Locations
<i>Aesculus sp</i>	Buckeye	3.7 - 4.6 m	60 mm	Open Spaces
<i>Aesculus glabra</i>	Ohio Buckeye	3.7 - 4.6 m	60 mm	Open Spaces
<i>Aesculus hippocastanum</i>	Horse Chestnut	3.7 - 4.6 m	60 mm	Open Spaces
<i>Juglans cinerea</i>	Butternut	3.7 - 4.6 m	60 mm	Open Spaces
<i>Populus tremula</i> 'Erecta'	Swedish Aspen	3.7 - 4.6 m	60 mm	Medians
<i>Populus x canescens</i> 'Tower'***	Tower Poplar	3.7 - 4.6 m	60 mm	Open Spaces
<i>Populus x Assiniboine</i>	Assiniboine Poplar	3.7 - 4.6 m	60 mm	Open Spaces
<i>Malus</i> 'Spring Snow'	Spring Snow Flowering Crab	3.7 - 4.6 m	60 mm	Open Spaces
<i>Prunus maackii</i> * **	Amur Cherry	3.7 - 4.6 m	60 mm	Open Spaces
<i>Prunus pennsylvanica</i> * **	Pincherry	3.7 - 4.6 m	60 mm	Open Spaces
<i>Quercus macrocarpa</i> *	Burr Oak	3.7 - 4.6 m	60 mm	Boulevards
<i>Acer ginnala</i>	Amur Maple	3.7 - 4.6 m	60 mm	Open Spaces
<i>Sorbus Americana</i> *	American Mountain Ash	3.7 - 4.6 m	60 mm	Open Spaces
<i>Sorbus aucuparia</i> *	European Mountain Ash	3.7 - 4.6 m	60 mm	Open Spaces
<i>Tillia cordata</i>	Little Leaf Linden	3.7 - 4.6 m	60 mm	Open Spaces
<i>Tillia x flavescons</i>	Dropmore Linden	3.7 - 4.6 m	60 mm	Open Spaces
<i>Ulmus davidiana</i>	Discovery Elm	3.7 - 4.6 m	60 mm	Boulevards

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Small Trees				
Botanical Name	Common Name	Approx. Height at Planting	Min. Caliper at Planting	Acceptable Locations
<i>Crataegus x mordensis</i> 'Snowbird'*	Snowbird Hawthorn	3.0 - 3.7 m	60 mm	Open Spaces
<i>Malus x astringens</i> Cultivars*	Rosybloom Crabapple	3.0 - 3.7 m	60 mm	Open Spaces
<i>Maackia amurensis</i> *	Amur Maackia	3.0 - 3.7 m	60 mm	Open Spaces
<i>Sorbus decora</i> *	Showy Mountain Ash	3.0 - 3.7 m	60 mm	Open Spaces
<i>Prunus virginiana</i> var. <i>melanocarpa</i> Cultivars*	Chokecherry	3.0 - 3.7 m	60 mm	Open Spaces
<i>Prunus virginiana</i> 'Schubert'***	Schubert Chokecherry	3.0 - 3.7 m	60 mm	Boulevards
<i>Syringa reticulata</i>	Japanese Tree Lilac	3.0 - 3.7 m	60 mm	Islands

*Fruit or nut bearing trees are not permitted near sidewalks or trails. These trees should be planted in beds to reduce maintenance. Only selective use Chokecherry trees will be permitted. Alternate trees in Boulevard)

** Prone to disease (Cotton Psyllid, Bronze Leaf, Black Knot)

.3 Refer to the following chart for recommended coniferous trees:

Note: This list is acceptable for buffers and open spaces only.

Botanical Name	Common Name	Min. Height at Planting	Mature height
<i>Abies</i> sp.	Fir	2.4 m	8 – 10 m
<i>Picea</i> spp.	Engleman, Norway, White and Colorado Spruce	2.4 m	15 m
<i>Pinus</i> sp.	Scot, White, Lodgepole, Ponderosa Pine	2.4 m	15 m
<i>Larix</i> sp.	Siberian Larch, Tamarack	2.4 m	3 – 10 m

.4 Refer to the following chart for recommended deciduous shrubs:

Botanical Name	Common Name	Min. Height at Planting	Mature ht./spr.
<i>Berberis</i> spp.	Barberry	400 mm	0.6–6 m/0.6–6 m
<i>Caragana</i> spp.	Caragana	400 mm	0.6–6 m/0.6–9 m
<i>Cornus</i> spp.	Dogwood	400 mm	0.4–3 m/1.2–3 m
<i>Euonymus</i> spp.	Winged and Dwarf Narrow-leaved Burningbush	400 mm	0.6–1.5/0.6–1.5 m
<i>Hippophae</i> spp.	Sea Buckthorn	400 mm	Up to 4 m
<i>Hydrangea</i> spp.	Hydrangea	400 mm	0.6–2.4 m/0.6–2.4 m
<i>Lonicera</i> spp.	Honeysuckle	400 mm	0.6–3.7 m/1–3 m
<i>Philadelphus</i> spp.	Mock Orange	400 mm	0.6–1.5 m/0.3–1.5 m
<i>Physocarpus</i> sp.	Ninebark	400 mm	0.4–3 m/0.6–3 m
<i>Potentilla</i> sp.	Potentilla	400 mm	0.6–1 m/1 m
<i>Ribes</i> spp.	Currant	400 mm	1.2–2.1 m/1.2–2.1 m
<i>Rosa</i> spp.	Rose	400 mm	0.6–3 m/0.6–1.8 m
<i>Sambucus</i> spp.	Elder	400 mm	0.9–7.6 m/0.9–5.5 m
<i>Spirea</i> spp.	Spirea	400 mm	0.4–1 m/0.6–2.4 m
<i>Syringa</i> spp.	Lilac	400 mm	0.9–3 m/1.5–5 m
<i>Corylus cornata</i>	Beaked Hazelnut	400 mm	0.4–3 m/1.2–3 m
<i>Viburnum</i> spp.	Cranberry	400 mm	0.6–3 m/1–3 m

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- .5 Refer to the following chart for recommended coniferous shrubs:

Botanical Name	Common Name	Min. Spread at Planting	Mature size
<i>Juniperus spp.</i>	Common, Horizontal, Pfitzer, Savin Juniper	300 mm	0.3 – 1 m
<i>Juniperus scopulorum</i>	Rocky Mountain Juniper	300 mm	Up to 5 m
<i>Picea abies var.</i>	Compact, Gregoryana, Nest Spruce	300 mm	1.5 m
<i>Picea pungens var.</i>	Globe, Hoopsii, Koster Spruce	300 mm	Up to 3 m
<i>Pinus sylvestris var.</i>	Sentinal, Green Compact Pine	300 mm	Up to 2 m
<i>Pinus mugo var.</i>	Mugo Pine var.	300 mm	0.6 – 3 m

11.3 Planting Season

- .1 Planting must be done between May 1 and October 15 and during the normal planting season for the type of plant being installed.

PART II – GENERAL

11.4 Scope

- .1 Supplying trees, shrubs, groundcovers and other associated materials; planting, transplanting, plant maintenance and inspection.

11.5 Substitutions

- .1 All requests for substitutions of mulch shall be vetted through the consultant responsible for preparing the contract drawings. Such requests shall be forwarded to the City for approval prior to installation.

11.6 Product Delivery, Storage, and Handling

- .1 Plant material shall be handled with care and skill to prevent injury to trunk, branches and roots.
- .2 All branches shall be carefully tied-in in such a way as to prevent damage, breakage or bruising before transporting and the plants protected during shipment by tarpaulin(s) or other suitable covering to prevent excessive transpiration. All points of contact between plant material and conveyance vehicle shall be padded.
- .3 When the temperature exceeds 20°C, plants shall not be shipped without authorization from the developer's landscape architect/City's representative. When temperature exceeds 25°C, planting of plant material is not permitted. If trees are shipped at the above referenced temperature, the City has the authority to issue a Stop Work Order.
- .4 Plants shall be transported at a reasonable speed to prevent transpiration.
- .5 Plants with broken or abraded trunks or branches or with broken or cracked root balls, or which are badly desiccated, or bare root plants that have broken dormancy are subject to rejection.
- .6 Roots or root balls of all plants shall be adequately protected at all times from the sun and from drying winds and frost.

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- .7 All balled and burlapped plants which cannot be planted immediately upon delivery shall be set on the ground and shall be well protected with soil, wet moss or other acceptable material not longer than 24 hours. Bare root plants that cannot be planted immediately shall be planted or heeled-in in trenches, immediately on delivery. All plants shall be kept moist until planting begins.
 - .8 Damaged plants supplied by contractors shall be replaced at no cost to the City.

11.7 Inspections

- .1 The City will inspect the marked tree locations upon 24 hours' notice and notify the developer of any revisions that may be required, or will approve the proposed tree locations as marked.
- .2 The Developer shall notify the City prior to the start of a planting project to facilitate inspections during the process. The Developer shall also notify the City when the planting project is completed. The City's representative will conduct an inspection of the planted trees, upon 24 hours' notice, and notify the Developer of any deficiencies that may require correction.

PART III - PRODUCTS**11.8 Plant Materials**

- .1 Trees, Shrubs, Vines, Groundcovers
 - a) All plants shall be nursery grown under cultural practices recommended by the Canadian Nursery Trades Association unless specific instructions have been issued by the landscape architect and accepted by the City, for the collection from native stands, woodlots or other unmaintained areas.
 - b) All nursery-grown material shall meet the horticultural standards of and comply with all applicable sections of the latest edition of the *Canadian Standards for Nursery Stock*, by the Canadian Nursery Trades Association. All such material shall have been transplanted and/or root pruned regularly to create a fibrous ball but neither transplanted nor root pruned within the nine (9) months prior to delivery.
 - c) Any trees dug from native stands, wood lots, orchards or neglected nurseries and which have not received proper cultural maintenance as advocated by the Canadian Nursery Trades Association, shall be designated as "collected plants". The use of "collected plants" will not be permitted, unless special written permission is received from the City.
 - d) All plants shall be typical of their species or variety and shall have a single central leader and balanced branching habit. They shall be structurally sound, healthy and vigorous, well branched and densely foliated when in leaf. They shall be free from disease and insect pests, eggs or larvae, rodent damage, sunscald, frost cracks and other abrasions or scars to the bark. They shall show vigorous bark on all edges and all parts shall be moist and show live, green cambium tissue when cut.
 - e) All plant materials shall have been grown in the climate of Canadian Horticultural Zone 2 or 3 for at least two (2) years. Plant material brought in from other provinces and/or states must be accepted by the City prior to planting.
 - f) Trees purchased from outside Northern Alberta (north of Red Deer) must be grown on for two years prior to planting.

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- g) Plant sources and history must be supplied to the City prior to planting.
- h) Trees shall have one sturdy, reasonably straight, and vertical trunk and a well-balanced crown with a fully developed leader, unless that would be uncharacteristic of the species and with the exception of *Malus baccata* plus associated hybrids and cultivars (flowering crabapples) single, central leaders. *Prunus padus commutata* (Mayday) and *Prunus virginiana* ‘Schubert’ (Schubert Chokecherry) shall have leaders which are single for at least 1.5 m. All trees with weak crotches shall be rejected.
- i) All trees shall be free of disease, insect infestation, rodent damage, sunscald, frost cracks, and other abrasions or scars to bark. All trees must be certified pest and disease free. All parts of the tree shall be moist and show live, green cambium tissue when cut. No more than 1/3 of the total height of the tree shall be clear trunk.
- j) Trees with branches which may grow to interfere with vehicular or pedestrian traffic are not acceptable in boulevards where the clear stem shall be not less than 1.8 m.
- k) Shrubs shall have a natural form typical of the species with interfering branches removed and shall have the number of canes as specified in the *Canadian Standards for Nursery Stock*, by the Canadian Nursery Trades Association.
- l) Vines shall have at least three runners, each of 300 mm minimum length.
- m) Ground covers shall have well developed tops of a size proportional to the roots, typical of the species.
- n) Plants that have been sheared to produce an untypical shape or shoot density are not acceptable.
- o) All plant dimensions shall be measured when the branches are in their normal position. ‘Height’ and ‘spread’ refer to the main body of the plant and not the dimension from base of root ball to branch tip or from branch top to branch tip. The ‘Caliper’ of a tree shall be measured 0.9 m to 1.2 m above the soil collar of the tree as it stood in the nursery and refers to the diameter of the tree at breast height (DBH).
- p) All plant material shall conform to the measurements specified in the landscape plan, unless the City authorizes a substitution. If larger plants are used, the ball of earth shall be increased in proportion to the size of the plant. Refer to Canadian Standards for Nursery Stock (CSLA).

.2 Digging of Plants

- a) Dry soil shall be watered two or three days before digging trees or shrubs.
- b) All plants shall be dug and delivered to the site as specified on the Plant List.
- c) Tree spades used for lifting plants shall have sharp blades.
- d) Immediately after digging, the root systems of all plants shall be kept moist to prevent drying out until planted on the site.
- e) Deciduous trees and shrubs in full leaf and dug in late spring or early summer shall be hardened off before replanting by placing in a cool, sheltered area as soon after digging as possible, placed close together, tops kept moist by syringing and balls by sprinkling or wetting down with water. Root balls shall be covered with wood chips, damp straw or canvas and held in this position for 24 to 48 hrs before planting.

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- f) All plants specified as ‘Balled and Burlapped’ (B/B) shall be dug while dormant and moved with solid balls wrapped in burlap.
- g) No plants shall be used when the ball of earth surrounding the roots has been cracked or broken preparatory to or during the process of planting, or when the burlap, staves and ropes, required in connection with their transplanting, have been removed.

.3 Root Ball

- a) The size of root ball for trees must be greater than the minimum size below
- b) Deciduous trees:

Caliper	Root Ball Diameter
60 mm	800 mm
75 mm	900 mm
100 mm	1,200 mm
125 mm	1,500 mm
150 mm	1,800 mm
200 mm	2,300 mm
250 mm	2,440 mm

For this table, the caliper shall be measured 150 mm above the soil collar of the tree. For deciduous trees of caliper exceeding 250 mm, root ball diameter shall be increased 150 mm for every additional 25 mm of caliper.

- c) Coniferous trees:

Height	Root Ball Diameter
2.25-2.50 m	1,200 mm
2.50-2.75 m	1,400 mm

The height shall be measured from the soil collar of the tree. For coniferous trees over 2.75 m in height, root ball diameter shall be increased 150 mm for every 300 mm in height.

11.9 Edger

- .1 Manicured planting beds shall incorporate a spade cut edge.
- .2 Weed liner will not be permitted.

11.10 Fertilizer

- .1 For the first application, soluble fertilizer shall be delivered mixed as specified for tree and shrub growth in the topsoil backfill report from an acceptable soils laboratory.

11.11 Tree Stakes, Ties, and Guys

- .1 Tree stakes shall be “T” bars of steel, 40 mm x 40 mm x 5 mm thick and 2.1 m in length. “U”-bar stakes may be used where accepted by the City.
- .2 Stakes shall be primed with one brush coat of zinc-rich paint to CGSB1-GP-1816 and the top 300 mm shall be color coded in accordance with the City’s rotating annual-color schedule.

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- .3 Tree ties shall be 10-gauge galvanized wire inserted into a 200 mm length of 10 mm diameter polyethylene tubing to protect the tree at the support point.
 - .4 Guys shall be double lengths of 9-gauge galvanized wire.

11.12 Water

- .1 Water shall be clean and free of any substance that may inhibit vigorous growth of the plants.

PART IV - EXECUTION**11.13 Planting Operations – Trees and Bare Root Plants**

- .1 Plants shall be installed in accordance with the Engineering Standard Drawings in Appendix A, as applicable.
- .2 Tree pits in boulevards shall be dug in such a way that the minimum separation between the edge of the sidewalk and the edge of the excavation is 225 mm. In narrow boulevards pits may be elliptical rather than circular in plan, and dug two to three times wider than the root ball.
- .3 The depth of planting beds and pits shall be adjusted to permit a layer of native soil under balls or roots of all plants to ensure they are firmly bedded. If the sides and bottom of the planting pit are glazed or consist of dry and heavy clay, a hand spade shall be used to scarify the soil to encourage root elongation before planting.
- .4 Planting pit surfaces, whether sides or base, which are of dry clay or glazed shall be scarified to facilitate root elongation and moisture movement.
- .5 In poorly drained sites, trees and shrubs shall be planted so the top of the root ball is above grade.
- .6 Plants shall be set in the center of pits, plumb, straight, and at such a level that after settlement the crown of the plant will be no lower than the surrounding finished grade.
- .7 Topsoil backfill of tree pits shall be carefully tamped around the root ball for the first one third to half of the hole depth to help stabilize the ball. The loose soil shall be worked down into the remainder of the pit with a hand spade while being flooded with water to ensure all air pockets are eliminated and filled with muddy soil.
- .8 If the sides of the root ball have become crusted through drying-out or digging under wet conditions, the top half of the affected area shall be slit with a sharp spade or shovel to facilitate root extension from the ball surface into the backfill soil.
- .9 After a burlap wrapped root ball is in the planting pit, half backfilled, the wire basket shall be cut back to expose the top third of the root ball, and basket and burlap shall be removed. The remaining burlap shall be slit along the sides with a sharp knife. No burlap shall be allowed to remain visible after planting to wick moisture away from the soil ball into the atmosphere. Heavy or treated burlap or plastic shall be cut open before the tree is planted to prevent formation of a moisture barrier around the ball. When burlap wrapped plant material is being planted in clay soils, the burlap shall be cut open. The wire basket may be removed completely contact City Public Works for details.
- .10 After the tree is planted, a circular soil dike, 100 mm in height, shall be constructed just outside the root ball's surface area to prevent run-off during watering.

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- .11 For all trees with trunks exposed to lawn mowing operations, a 100 mm depth of deciduous wood chip mulch shall be placed around the trunk base and extended a further 300 mm radially from the trunk to avoid mower damage, pest disease, and bark rot from occurring.
- .12 Install 100 mm depth of mulch over the top of the root ball and extended a further 300 mm radially from the tree trunk to discourage winter damage of the bark by rodents and to allow air circulation to the root system.
- .13 If trees must be relocated, conform to the guidelines.

11.14 Planting Operations – Shrubs

- .1 Shrubs shall be planted in topsoil beds of minimum 650 mm depth.
- .2 Planting topsoil shall be firmly tamped in place around root balls of shrubs and bare root plants while ensuring that the plant remains vertical. Particular care shall be taken to ensure that no air pockets remain under or around the roots. Planting topsoil shall be thoroughly watered immediately after tamping.
- .3 No planting, except ground covers, vines, and herbaceous plant material, shall be placed closer than 400 mm at maturity to the edge of shrub beds, hard surfaces, or building foundations.

11.15 Stakes, Ties, and Guys

- .1 Trees shall be supported by stakes and ties or by guy wires in accordance with the following schedule:

- a) Coniferous Trees

Height	Staking Method
< 1.5 m	2 steel stakes and 2 ties
1.5-3.0 m	2 steel stakes and 2 ties
3.0-3.5 m	3 guy wires and 3 anchors
3.5-4.5 m	4 guy wires and 4 anchors
> 4.5 m	Refer to deciduous trees > 200 mm

- b) Deciduous Trees – Bare Root

- i) To 75 mm caliper, use 2 steel stakes and 2 ties.

- c) Deciduous Trees – Balled and Burlapped or Tree Spade

Caliper	Staking Method
< 75 mm	2 steel stakes and 2 ties
75-200 mm	3 guy wires and 3 anchors
≥ 200 mm	4 guy wires and 4 anchors

- .2 Connection of Ties and Guy Wires to Trees:

- a) All exposed portions of tree stakes are to be rust free, scaled, primed and painted brown. Tree stakes are to be a minimum of 2.0 linear metres in length, plain T-posts (1.33 lbs/ft) complete with 1 1/2" x 1 3/8" x 84" punched with 7 holes.

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- b) All ties and guy wires shall be looped around the tree trunk and attached to stakes or anchors in such a way that they can be kept taut to form an open “Figure-8”, branches are protected from undue strain, and the tree’s bark is protected from damage.
 - c) Where the guy wires encircle the trunk or branches they shall be encased in new, 12 mm diameter, two-ply, reinforced, black-rubber hose.
 - d) Where a tripping hazard may be present, fluorescent warning flags shall be attached to guy wires.
- .3 Bare Root Tree Staking
- a) The stakes shall be driven vertically a minimum depth of 600 mm into the undisturbed soil of the base of the tree pit before the plant is placed in position.
 - b) When two stakes are used they shall be located at northeast and southeast of the tree.
- .4 Balled and Burlapped Trees and Tree Spade Plants Staking
- a) The stakes shall be driven vertically a minimum depth of 300 mm into the undisturbed soil and shall be located just outside the root ball or tree plug to avoid any root damage.
 - b) When two stakes are used they shall be located at northeast and southwest of the tree.
- .5 Tree stakes and guy wire shall be removed following the 2 year maintenance period after combined review by City and Consultant. They shall be removed by the contractor prior to the FAC inspection.

11.16 Pruning

- .1 Immediately following planting, any dead, broken, or interfering branches shall be pruned together with any diseased branches which have not caused the plant’s rejection. No plants having disease are to be planted and may be rejected by the City.
- .2 Pruning must be completed by a fully ISA certified arborist.
- .3 The amount of pruning shall be limited to the minimum necessary and exceed no more than one third of the living foliage in one season. Under no circumstances shall more than 25% of the foliage from an individual tree be removed.
- .4 One section of any bad fork or weak crotch which has not caused the plant’s rejection shall be removed at transplanting time.
- .5 The manner of pruning shall preserve the natural character of the plant. This is subject to pruning 25 % of crown maximum.
- .6 Due to the risk of Dutch Elm Disease, elm trees shall only be pruned between the period of October 1 and March 31, when the Elm Bark Beetle is inactive.
- .7 Pruning tools shall be clean and sharp.
- .8 All pruning cuts shall be clean and leave no stubs or rough wood and be in accordance to the ANSI Z133.1 Standards. Small cuts shall be close to the branch collar and parallel to the adjoining branch or trunk. On large limbs, flush cuts shall be avoided and cuts made at the collar shall have the lower part slanting slightly away from the trunk to leave a smaller wound.
- .9 Tree trunks conduct moisture and nutrients from the roots to the crown of the tree. This function takes place in the outer part of the woody stem called the sapwood. If the sapwood is cut, bruised,

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- or scarred in such a way that it may affect the uptake of moisture and nutrients, the tree shall be replaced. If the affected area is small enough not to limit the uptake of moisture and nutrients, the affected area shall be shaped with a sharp, clean knife so as not to retain water, which may cause decay.
- .10 Bark that is cut, bruised, or scarred shall be cut back to living tissue with a clean edge. The affected area shall be shaped with a sharp knife so as not to retain water.
 - .11 Wound surfaces shall not be treated with wound-dressing products unless otherwise specified or directed by the City.
 - .12 As a rule, growth is maximized if pruning is done just before the period of rapid growth in the spring. Prune during proper times in accordance with the following guidelines:
 - a) Shade Trees – October 15 to April 15
 - b) Birch and Maple – June 15 to July 15
 - c) Fruit trees – March 15 to April 15
 - d) Evergreens – April 15 to May 15
 - e) Elm Trees – In according to provincial legislation

11.17 Construction Completion Inspection

- .1 The Construction Completion Certificate (CCC) for subdivision landscaping shall be issued following a satisfactory inspection by the City's representative, developer's representative and contractor which all plant material has been supplied and installed in accordance with the approved drawings and any approved substitutions and is alive and healthy. The maintenance period of two (2) years begins to run from the date of the satisfactory inspection. All plant material requiring wood chip mulch shall be installed prior the Construction Completion Certificate and topped up prior to the Final Acceptance Certificate. Exceptions shall be considered in areas with sump pump discharge problems, only with the City's approval.
- .2 The Construction Completion Certificate (CCC) for commercial, institutional, multi-family and capital projects shall be issued following a satisfactory inspection by the City's representative, owner or project manager and landscape contractor, at which all plant material has been supplied and installed in accordance with the approved drawings and any approved substitutions are alive, healthy, disease and pest free. The maintenance period of two (2) years on private property and two (2) years on public property begins to run from the date of the satisfactory inspection. All plant material requiring wood chip mulch shall be installed prior the Construction Completion Certificate and topped up prior to the Final Acceptance Certificate.

11.18 Warranty

- .1 Replace any plants that die or appear to be dying during the Warranty Period. In case of any doubt regarding the condition and satisfactory establishment of a rejected plant, the Developer may elect to maintain such a plant through another complete growing season at the end of which the rejected plant, if found to be dead or in an unhealthy or badly impaired condition, shall be replaced by the Developer. Any replaced plant material shall have a maintenance period of one (1) year, unless otherwise authorized the City.

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11.19 Maintenance

- .1 Maintenance shall include all measures and activities necessary to establish and maintain plants in an acceptable, vigorous, and healthy growing condition for the duration of the Warranty Period.
- .2 Refer to Section 15.0.

11.20 Final Inspection

- .1 At the time of final inspection, all the plants shall be alive, healthy and in good condition, root balls and shrub beds shall be weed-free with the specified depth of mulch throughout.
- .2 Tree stakes and guy wires shall be removed immediately prior to final inspection, unless otherwise stated by the City.

12.0 LANDSCAPING STANDARDS – MULCH

PART I – DESIGN

Not applicable.

PART II - GENERAL

12.1 Examination

- .1 Report to the City, in writing, any conditions or defects encountered on the site before or during any construction upon which the work of this section depends and which may adversely affect its performance.
- .2 Do not commence work until those conditions or defects have been investigated and corrected.
- .3 Commencement of work shall imply acceptance of existing surfaces and conditions and no claims for damages or extras resulting from such conditions or defects will be accepted later, except in cases where such conditions could not have been known prior to commencing work.

12.2 Samples

- .1 Samples of mulch may be requested for approval by the City.
- .2 Retain approved samples on site until work has been inspected and approved.
- .3 All work shall conform to approved samples.

12.3 Substitutions

- .1 All requests for substitutions of mulch shall be vetted through the consultant responsible for preparing the contract drawings. Such requests shall be forwarded to the City for approval prior to installation.

12.4 Product Delivery, Storage, and Handling

- .1 Supply mulch as specified on approved landscape drawings and specifications.
- .2 Protect mulch stockpile on site from contamination of airborne herbicides, pesticides, fertilizers and other hazardous chemicals.
- .3 Avoid the placement of mulches in excessively wet conditions or when frozen.
- .4 All organic mulches shall be generally free of diseases, moulds, fungi and insect infestations.
- .5 All organic mulches shall be free of inorganic materials such as metal, glass, rock and other foreign materials.

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12.5 Substitution

- .1 All mulches shall be supplied and installed as specified Substitutions will not be allowed unless approved by the City.

12.6 Inspection

- .1 Samples of mulch shall be approved by the City prior to installation.
- .2 Retain approved samples on site until work has been inspected.
- .3 All work shall conform to approved samples.
- .4 Give timely notice, in writing, to the Consultant when materials are available for inspection.
- .5 Remove all rejected materials from site immediately.

PART III – PRODUCTS**12.7 Organic Mulches**

- .1 Deciduous/coniferous wood chip mulch shall consist of chipped ash, elm, maple, poplar, birch, and other deciduous woods plants or coniferous wood containing bark, wood, and needles.
- .2 Mulch may contain bark, wood (and leaves in summer) and/or needles, and may contain seed.
- .3 Mulch shall be free of non-organic material, wood preservatives, and diseased wood.
- .4 Chip size shall be 50 to 75 mm.
- .5 Mulch shall contain no more than 5% by dry weight of soil, sawdust, and peat moss.

12.8 Inorganic Mulches

- .1 Clean crushed gravel, pea gravel, crushed clay brick, and crushed shale to a minimum sieve size of 25mm. The city will determine the maximum sieve size.
- .2 Inorganic mulches shall be free of organic material.

12.9 Prohibited Mulches

- .1 The following mulches are prohibited: sawdust and shavings, peat moss, manures or raw composts, paper products, plastics, rubbers, aluminum foils, gelatinous sprays, plywood and other lumbers containing chemical adhesives or wood preservatives.

PART IV - EXECUTION**12.10 Installation**

- .1 Plants must be watered before mulch is installed.
- .2 During application all mulches shall be kept at least 250 mm away from tree trunks and bases of shrubs.
- .3 Apply mulches in areas as per drawings and spread by hand rake to a settled depth of 100 mm.

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12.11 Preparation

- .1 Tree wells and planting beds shall be free of weeds prior to mulch installation.

12.12 Clean Up

- .1 Immediately after installation, remove all mulches and other debris from the roadways, walkways and surrounding areas, leaving the area neat and tidy. Clean all areas, which are contaminated as a result of landscape construction operations.
- .2 Maintain all areas neat and tidy at all times until acceptance.

12.13 Maintenance

- .1 Refer to Section 15.0.



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13.0 LANDSCAPING STANDARDS – SEED AND SOD**PART I – DESIGN**

Refer to Section 8.0.

PART II – GENERAL**13.1 Examination**

- .1 Report to the City, in writing, any conditions or defects encountered on the site before or during any construction upon which the work of this section depends and which may adversely affect its performance.
- .2 Do not commence work until those conditions or defects have been investigated and corrected.
- .3 Commencement of work shall imply acceptance of existing surfaces and conditions and no claims for damages or extras resulting from such conditions or defects will be accepted later, except in cases where such conditions could not have been known prior to commencing work.

13.2 Samples

- .1 Samples of grass seed may be requested for approval by the City.
- .2 Retain approved samples on site until work has been inspected.
- .3 All work shall confirm to approved samples.

13.3 Product Delivery, Storage, and Handling

- .1 Deliver seed in the original containers, tagged with identification as to the analysis of the seed mixture, percentages of seed, year of production, net weight, and date.
- .2 Deliver seed to the site only when ready for seeding.
- .3 During transportation, protect sod with tarpaulins to prevent sun scalding and drying out, and to ensure arrival in the site in a healthy condition.
- .4 All manufactured items subject to deterioration shall be stored in a weatherproof place on site in such a way that their effectiveness is not impaired.
- .5 Sod should be installed on the day of arrival at the site. If delays in installation occur due to weather, protect sod on the site from sun, keep moist, and store in a cool location until installation.
- .6 Handle sod carefully to prevent tearing or breaking.
- .7 Fertilizer shall be delivered mixed, in standard size unopened containers, showing weight, analysis, and name of manufacturer. These containers shall be stored in a weatherproof place to keep the fertilizer dry.
- .8 Follow manufacturer's delivery, storage, and handling instructions.

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13.4 Substitution

- .1 All requests for substitutions of seed mixes shall be vetted through the Consultant. Such requests shall be forwarded to the City for review and approval prior to installation.

13.5 Inspection

- .1 The City will inspect all seed and sod installations.
- .2 Prior to the commencement of installation, all materials may be inspected and approved whether at the source of local supply or on site at the discretion of the City. Previous approval will not impair the right of the City during the course of construction to reject sod which has been damaged or which, in any way, does not conform to the specifications. Any rejected seeding or sodding will be noted on a site instruction form and be presented to the contractor for follow-up.
- .3 Give timely notice, in writing, to the Consultant when materials are available for inspection.
- .4 At the time of inspection, all turf shall be alive and in a healthy, satisfactory growing condition.
- .5 Remove all rejected materials from site immediately.

PART III - PRODUCTS

13.6 Grass Seed

- .1 All grass seed mixes shall have a minimum purity of 98% and minimum germination of 95%.
- .2 All seed must be from a recognized seed firm having membership in the Canadian Seed Trade Association. Seed must meet the requirements for the Seeds Act for Canada No. 1 grade seed and seed shall be certified No. 1 grade. The City may request germination tests, purity tests, and/or weed seed analyses to confirm conformance.
- .3 Seed Mixes:
 - a) Percentage content of seed blends is by weight.

Sturgeon Riparian Blend		
Botanical Name	Common Name	Percent of Mixture
Elymus trachycaulus spp. Subsecundus	Awed or Bearded Wheatgrass	20%
Elymus lanceolatus	Northern Wheatgrass	20%
Festuca hallii	Plains Rough Fescue	20%
Stipa curtiseta	Western Porcupine	20%
Festuca saximontana	Rocky Mountain Fescue	10%
Koeleria macrantha	Junegrass	10%

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Wet Meadow Mix		
Botanical Name	Common Name	Percent of Mixture
<i>Poa palustris</i>	Fowl Bluegrass	25%
<i>Elymus trachycaulus</i> ssp. <i>Subsecundus</i>	Awed Wheategrass	20%
<i>Deschampia caespitosa</i>	Northern Tuffed Hairgrass	15%
<i>Tisetum spicatum</i>	Spiked Trisetum	15%
<i>Puccinellia distans</i>	Alkali Grass	15%
<i>Beckmania syzigachne</i>	Beckmann's Sloughgrass	10%
Parks and Boulevards Mix		
Botanical Name	Common Name	Percent of Mixture
<i>Poa pratensis</i> ssp.	Blend of three varieties of certified Kentucky Bluegrass	55%
<i>Festuca rubra</i> sp.	Creeping Red Fescue	35%
<i>Lolium perenne</i>	Perennial Ryegrass	10%
Naturalization and Low Maintenance Mix		
Botanical Name	Common Name	Percent of Mixture
<i>Festuca ovina</i>	Sheep Fescue	35%
<i>Festuca duriuscula</i> L. var <i>Duriuscula</i>	Hard Fescue	35%
<i>Poa compressa</i> L. var <i>Rubens</i>	Ruben's Canada Bluegrass	30%
Salt Tolerant Mix		
Botanical Name	Common Name	Percent of Mixture
<i>Puccinellia distans</i> 'Fults'	Fults Distans Alkali Grass	50%
<i>Poa secunda</i>	Sandberg Bluegrass	15%
<i>Lolium perenne</i> L.	Citation III Perennial Rye	15%
<i>Agropyron cristatum</i> L.	AC Parkland Crested Wheatgrass	20%

.4 Acceptable cultivars:

Seed	Acceptable Cultivar
Kentucky Bluegrass	A34, Able 1 Alpine, America, Banff, Baron, Challenger, Cheri, Cynthia, Midnight, Nugget, Ram 1, Touchdown, Washington
Creeping Red Fescue	Jasper, Fortress, Boreal, Shademaster, Flyer
Wheat Grass	AEC Hillcrest Awed, Elbee Northern, Walsh Western
Perennial Ryegrass	Streambank, Sodar Streambank
	Fiesta II, Palmer, Manhattan

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13.7 Sod

- .1 Sod shall conform to the specifications of the Canadian Nursery Sod Growers of Landscape Alberta Nursery Trades Association, be vigorous and healthy with a strong fibrous root system, free from disease, insect pests, stones, burns, dry or bare spots, and tears.
 - a) Sod shall be machine stripped at a uniform thickness of 15 mm ($\pm$ 5 mm), delivered and installed within a period of 24 hours, unless a suitable preservation method is authorized prior to delivery. Sod thickness shall be determined at the time of stripping and shall exclude top growth and thatch.

- b) Sod shall conform to the following mix:

Seed	Percent of Mixture
Kentucky Bluegrass ¹	70-90%
Creeping Red Fescue	10-30%

¹ – Must contain a minimum three certified Kentucky Blue grass cultivars.

- c) Other grasses and clover shall not be apparent in the sod and there shall be no more than one broadleaf weed or ten other weeds for every 45 m².
 - d) Wooden pegs required to hold sod in place shall have dimensions of approximately 15 mm x 35 mm x 300 mm. Metal pegs will not be accepted.

13.8 Binder

- .1 Use Turfmaster Hydro Seal or equivalent, compatible binder additive at the manufacturer's recommended rate, sufficient to mix a consistent slurry.
- .2 Binder shall be mixed and supplied by a recognized supplier and shall have tested rates of purity.

13.9 Mulch

- .1 Mulch shall be wood cellulose fibre containing no contaminants.
 - a) Fibre shall be supplied by a recognized supplier and shall a certified weight and composition.
 - b) Minimum application rate is 16.0 kg of air dry fibre per 100 m².
 - c) Fibre shall be measured as it is fed into the seeder.

13.10 Fertilizer

- .1 Use standard commercial fertilizers with guaranteed chemical analyses.
- .2 Fertilizers shall be clearly labeled and supplied in unopened, moisture-proof containers.
- .3 Fertilizer requirements are as follows:

Type 1 – Rate 3.5 kg/100 m ²	
Total Nitrogen	19%
Available Phosphoric Acid	19%
Potash	19%

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Type 2 – Rate 3.5 kg/100 m ²	
Total Nitrogen	10%
Available Phosphoric Acid	30%
Potash	10%

Type 3 – Rate 3.5 kg/100 m ²	
Ammonia	12%
Phosphate	51%
Sulphate	0%

- .4 Fertilizers shall be granular, water-soluble type.
- .5 The City may require changes to the fertilizer feed rates if an analysis of the topsoil shows this to be necessary.

13.11 Water

- .1 Water shall be clean and free of any substance that may inhibit vigorous growth of the plants.
- .2 The Contractor prior to submission of his/her bid or quotation shall investigate the type and distance of water supply available.
- .3 A permit shall be required if water is to be obtained from a City hydrant.

PART IV – EXECUTION

13.12 Preparation

- .1 Remove weeds and debris from topsoil.
- .2 Verify grades and check that topsoil has been placed as required.
- .3 Notify the City prior to commencing seeding or sodding operations. Installation of fertilizer, seed or sod indicates acceptance of topsoil conditions.
- .4 Apply fertilizer according to the manufacturer's instructions or as directed by the City.
- .5 Apply fertilizer with a spreader at the designated rate.
- .6 Mix fertilizer thoroughly into the upper portion of the topsoil.
- .7 Float and level out the finished topsoil surface.

13.13 Seeding

- .1 Seeding or sodding must be done between May 1 and September 30, unless otherwise approved by the City in writing depending on weather conditions.
- .2 Do not seed when prepared topsoil is covered with frost, snow, or standing water.
- .3 Conduct seeding operations in low wind conditions only. Do not carry out seeding operations when wind velocities pose the risk to cause seed mix to be blown. Suspend and delay seeding operations if the City determines wind conditions are unsuitable.
- .4 Proceed with seeding operations in accordance with sound horticultural practices.

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.5 Hand broadcast seeding is unacceptable except for site-specific repair work and pre-authorized work in naturalization areas.

.6 Mechanical Seeding

- a) For slopes flatter than 3H:1V, apply Parks and Boulevards Mix, unless otherwise specified, by mechanical dry spread (Brillion or Cyclone type) at a rate of 24 kg/1,000 m².
- b) Apply in two passes, each pass at a rate of 12 kg/1,000 m² and perpendicular to each other.
- c) Lightly roll seeded area after seed application is complete.
- d) Spread Type 3 fertilizer evenly over the area and at the rate specified.
- e) Thoroughly harrow the site after fertilizing.

.7 Hydro Seeding

- a) For slopes 3H:1V or steeper, apply Naturalization and Low Maintenance Mix, unless otherwise specified, by hydro seeder.
- b) Mix seed with water, mulch, and fertilizer in the following application rates:

Ingredient	Quantity
Grass Seed	2.0 kg/100 m ²
Mulch	16 kg/100 m ²
Water	160 L/100 m ²
Fertilizer	3.5 kg/100 m ²

- c) Thoroughly mix seed, water, mulch, fertilizer, and binder (where specified) in a slurry.
- d) Uniformly apply the slurry mixture and cover with an acceptable mulch.

.8 Seed Germination, Dry Seed, and Hydro Seed Applications

- a) If 95% of seed fails to germinate within two (2) growing months, re-cultivate and re-seed until germination takes place.
- b) Approximately six (6) weeks after germination, apply supplementary fertilizer 27-14-0 at a rate determined by topsoil analysis, or such other fertilizer as may be required by the City.

13.14 Sodding

- .1 Firm the sod-bed by rolling before application.
- .2 Thoroughly irrigate the soil prior to placing sod. Sod shall not be laid on soil that is dry and powdery.
- .3 Cut sod by suitable methods and in accordance with the recommendations of the Landscape Alberta Nursery Trades Association.
- .4 Handle sod carefully when loading and installing to prevent tearing or breaking.
- .5 Slopes Flatter than 3H:1V.

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- a) Lay sod evenly in staggered rows with edges and ends butted tightly.
 - b) On slopes, lay sod with the longer dimension oriented downhill.
 - c) Blend edges of sod with existing grass or cultivated areas.
 - d) Where sod butt joins surface paving or other surface features (i.e. manholes, catch basins, sidewalks, curbs, driveways, roads), position the sod turf crown flush with the finished hard surface.
 - e) Top dress seams and edges as required with topsoil.
 - f) Water the sod and upper 200 mm of topsoil with water spray. Do not cause erosion.
 - g) Let sod and soil dry out sufficiently to prevent damage, and then roll sod with a roller to ensure good bonding between the sod and the topsoil, and to smooth out humps and depressions.
 - h) Immediately after rolling, saturate sod and upper 200 mm of topsoil with fine spray. To prevent grass and soil from drying out, continue adequate watering for 8 to 10 days after laying, or until roots are well established.
 - i) Four (4) weeks after laying, and following initial cutting, apply organic supplementary fertilizer 27-14-0 at a rate determined by topsoil analysis, or such other fertilizer as may be required by the City.
- .6 Slopes 3H:1V or Steeper
- a) If sodding is required on any slope 3H:1V or steeper, sod may be pegged with short wooden pegs, 25 pegs per 10 m², to prevent sod from slipping.
 - b) Pegs to be set flush with the ground.
 - c) In addition, the provisions of Article 13.14.4 shall duly apply to sodding on slopes 3H:1V or steeper.

13.15 Clean-up

- .1 Immediately after planting, remove all debris and excess material from the site, leaving the area neat and tidy. Clean all areas, which are contaminated as a result of planting operations.
- .2 Maintain all areas neat and tidy at all times until acceptance.

13.16 Construction Completion Inspection

- .1 At time of the construction completion inspection, all sodded areas shall have a healthy, even stand of grass, free of diseases, weeds, thin, burned-out patches or non-flush joints and shall be not more than 65 mm in height.
- .2 At time of the construction completion inspection, all areas to have been seeded must have evenly spread topsoil, and seed and spread evenly.

13.17 Maintenance

- .1 During the Warranty Period, areas showing deterioration, bare spots, or thin areas shall be re-seeded or re-sodded. Seed shall be properly germinated and/or sod properly knitted prior to final inspection.

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.2 Refer to Section 15.0.

13.18 Final Inspection

.1 Final inspection of seeded or sodded areas will be made prior to the end of the Warranty Period.

.2 At the time of inspection, all the areas shall be alive and in a healthy, satisfactory growing condition, and free from weeds. Any deficiency in this respect shall be remedied at the contractor's own expense.

.3 Seeding

- a) Grass shall be cut to 65 mm at the time of the inspection throughout the area for which the FAC is sought.
- b) No bare soil visible when the grass is observed from a standing position, nor burned spots.
- c) Grass shall be free of disease and growing vigorously with no footprints, deep ruts, soil lumps or grass clippings visible.
- d) No restricted weeds, noxious weeds, or prohibited noxious weeds, as defined by the Weed Control Act of Alberta, shall be present. No more than one broadleaf weed or ten other weeds per 45 m².
- e) City Public Works (780-361-4436) shall be notified of damage by burrowing animals in time for their eviction, repair of damages, and maintenance to develop the conditions required for FAC, before the inspection takes place.
- f) Third party damage that occurs within the maintenance period is the responsibility of the Developer and their contractor.

.4 Sod

- a) Grass shall be cut to 65 mm at the time of the inspection throughout the area for which the FAC is sought.
- b) No bare soil visible when the grass is observed from a standing position, no burned spots.
- c) Grass free of disease and growing vigorously, no footprints, deep ruts, soil lumps or grass clippings visible.
- d) Sod has knitted and no cracks are visible between joints.
- e) No restricted weeds, noxious weeds, or prohibited noxious weeds, as defined by the Weed Control Act of Alberta, shall be present. No more than one broadleaf weed or ten other weeds per 45 m².
- f) Third party damage that occurs within the maintenance period is the responsibility of the Developer and their contractor.

14.0 LANDSCAPING STANDARDS – SITE AMENITIES & FENCING

PART I – DESIGN

14.1 General

- .1 Refer to Section 8.0 for required locations of site amenities and fencing.
- .2 Site amenities, screen, uniform and solid fences are to be designed to compliment other proposed architectural and urban amenities, and meet the following objectives:
 - a) Safety and security;
 - b) Delineation of private and public lands;
 - c) Pedestrian barrier; and
 - d) Visual continuity.
- .3 All site amenities, including site furniture, must be reviewed and approved by the City prior to installation.
- .4 All site furnishings should be of a consistent style and type within the community and/or development phase.
- .5 Screen, uniform, and solid fences are to be structurally designed to achieve a minimum life expectancy of 20 years.
- .6 Uniform wood fencing gates shall be installed on all residential lots that back onto a public park. Gates shall be located approximately at the corner of each lot, near the property pin, and shall be constructed to open into the private property. Gates shall not be provided on residential lots that back onto MRs or ERs.
- .7 Uniform fencing, if provided, shall be subject to the review and acceptance of the City. Such fencing shall be located 150 mm inside of the residential lot property line and shall be consistent in appearance throughout the Subdivision.
- .8 Solid fences shall have no gaps between boards, or between posts and boards, and shall a 75 mm gap between the bottom of the fence board and finished grade.
- .9 Chain link fence shall be constructed and installed in accordance with industry standards.
- .10 Optional amenities are non-standard infrastructure development (i.e. ornamental fencing, water features, gazebos, sculptured, entrance features / signs, decorative fixtures etc.) in a public park or road right-of-way. City branding may be required to be included on the amenity, as per direction from the City.
 - a) The intent to construct optional amenities must be identified at the Preliminary design stage via a letter of intent or other mechanism.
 - b) If a Developer or homeowners'/community association intends to construct an optional amenity they must enter into a Maintenance Agreement with the City. The Maintenance

Agreement must be executed prior to FAC approval. Encroachment agreements of License of Occupation may also be required.

- c) Maintenance manuals shall be submitted to the City prior to FAC approval for all optional amenities associated with irrigation and/or water systems.

14.2 Minimum Setback Requirements

- .1 Site amenities shall be spaced from infrastructure in accordance with the minimum setbacks provided in the following table:

Infrastructure Designation	Setback Distance
Benches	0.5m – 0.75m from back of walkway
Trash Receptacles	250 mm from back of walkway

PART II – GENERAL

14.3 Examination

- .1 Report to the City, in writing, any conditions or defects encountered on the site before or during any construction upon which the work of this section depends and which may adversely affect its performance.
- .2 Do not commence work until those conditions or defects have been investigated and corrected.
- .3 Commencement of work shall imply acceptance of existing surfaces and conditions and no claims for damages or extras resulting from such conditions or defects will be accepted later, except in cases where such conditions could not have been known prior to commencing work.

14.4 Samples

- .1 Upon request provide product and material samples to the City.
- .2 All work shall confirm to approved samples.

14.5 Product Delivery, Storage, and Handling

- .1 During transportation, protect site amenities and fencing materials from damage and weathering.
- .2 On delivery, store all materials off the ground and protect from adverse conditions to prevent deterioration, damage or impairment of the structure.
- .3 Handle site furnishings carefully to prevent paint damage or breaking.
- .4 Follow manufacturer's delivery, storage, and handling instructions.

14.6 Substitution

- .1 All requests for substitutions shall be vetted through the Consultant responsible for preparing the contract drawings. Such requests shall be forwarded to the City for approval prior to installation.

14.7 Inspection

- .1 The City will inspect all site amenity and fence installations.
- .2 Prior to the commencement of installation, all materials may be inspected at the discretion of the City. Previous approval will not impair the right of the City during the course of construction to reject amenities which has been damaged or which, in any way, does not conform to the specifications. Any rejected amenities will be noted on a site instruction form and be presented to the contractor for follow-up.
- .3 Give timely notice, in writing, to the Consultant when materials are available for inspection.
- .4 Remove all rejected materials from site immediately.

PART III - PRODUCTS**14.8 General**

- .1 Site amenities to be provided shall conform to the City's standards.

14.9 Benches

- .1 All bench styles and material are subject to the approval of the City prior to installation.
- .2 Victor Stanley, Model CM-14 (Black) – Main Street.

14.10 Waste Receptacles

- .1 All waste receptacle styles and material are subject to the approval of the City prior to installation.
- .2 Victor Stanley, Model PRS-36 (Black) – Main Street.

14.11 Picnic Tables

- .1 All picnic table styles and material are subject to the approval of the City prior to installation.

14.12 Bollards

- .1 All bollard styles and material are subject to the approval of the City prior to installation.
- .2 Bollards shall be installed by developer in open spaces such that Public Parks, PUL's, MR's or SWMF's are protected from unauthorized public access by vehicles.
- .3 Landscape design should consider opportunities to supplement or even replace bollards as a deterrent to unauthorized public access by vehicles to open spaces.

14.13 Optional Amenities

- .1 Optional amenities are non-standard infrastructure development (i.e. ornamental fencing, water features, gazebos, sculptured, entrance features / signs, decorative fixtures etc.) in a public park or road right-of-way.
- .2 All optional amenities are subject to the approval of the City prior to installation.

- .3 Bike Rack – Victor Stanley, BKR-36 (Black) – Main Street

14.14 Wood Fencing

- .1 All lumber shall be #1 Construction Grade Spruce, Pine or Fir (SPF) dressed, conforming to C.S.A. 0141 – 1970 for nominal size. All timber and lumber must be straight sound and free of splits, warps, checks, large knots or other defects. Rough sawn lumber will be used only where detailed and shall be sawn straight, square and true. All lumber in contact with the ground must be pressure treated.
- .2 Posts and rails to be ACQ pressure treated wood.
- .3 Screws to be hot dipped galvanized or all weather treated for pressure treated applications.
- .4 Nails, spikes, bolts, lag screws, etc. are to be hot dipped galvanized in accordance with CSA-G164 – M1981, and the size and/or weigh specified.
- .5 Fillcrete for post footings shall be in accordance with Article 5.13.5.

14.15 Chain Link Fencing

- .1 Chain Link Fabric
 - a) Chain link fabric to be galvanized or vinyl-coated, in accordance with the following:
 - i) Galvanized: Pre-galvanized wire to 490 g/m², 3.5 mm diameter (9 gauge).
 - ii) Vinyl-Coated: Pre-galvanized wire to 490 g/m², 4.26 mm diameter after coating.
 - b) Fabric height: 1.2, 1.5, 1.8, 2.1 or 2.4 m as specified.
 - c) Selvage: twisted top and knuckled bottom.
- .2 Fence Framework
 - a) Conforming to CGSB CAN2-138.2M.
- .3 Posts and Rails
 - a) Hot-dip galvanized welded steel pipe, standard weight (Schedule 40, ASTM A120), zinc-coated at minimum 550 g/m² and with the following minimum dimensions:
 - b) Caps – only rounded caps are accepted.

Post and Rail Minimum Dimensions					
Fabric Height (m)	1.2	1.5	1.8	2.1	2.4
Line post outside diameter, OD (mm)	48.3	48.3	60.3	60.3	60.3
Length (m)	2.0	2.3	2.6	2.9	3.2
Terminal Post (End, gate, corner, straining) OD (mm)	73.0	73.0	88.9	88.9	88.9
Length (m)	2.3	2.6	2.9	3.2	3.5
Rail and brace OD (mm)	-	-	42.2	42.2	42.2

- .4 Bottom Tension Wire

- a) 5 mm diameter (6-gauge) steel wire, zinc-coated at minimum 490 g/m².

.5 Fittings

- a) Conforming to ASTM F626, as follows:

Fitting Standards			
Component	Min. Dimensions (mm)	Min. Zinc Coating g/m ²	Fabricated From:
Post Cap and Rail End	Varies	366	Pressed steel or cast iron
Top Rail Sleeve	2.0 thick x 175 long	366	Round steel tubing
Tie Wire and Clip	3.5 diameter (9 gauge aluminum)	122	Round steel tubing
Tension and Brace Bands	2.0 thick x 19.0 wide	366	Pressed steel
Tension Bar	5.0 thick x 16.0 wide	366	Steel strip
Turnbuckle	Varies	366	Steel
Barb Arm	2.0 thick (14 gauge)	366	Pressed steel

.6 Gate Fabric

- a) To match fence fabric in Article 14.15.1.

.7 Gate Frame

- a) Conforming to Article 14.15.2 with minimum 42.2 mm outside diameter.
b) To be electrically welded at all joints and hot-dip galvanized after welding.
c) If braces are required, use truss rod and turnbuckle adequate for gate size.

.8 Gate Fittings

- a) Malleable iron hinges, latch and latch catch, all galvanized as specified in Article 14.15.2.
b) Latch catch to have provision for a padlock that can be attached and operated from either side of gate.
c) Hinges shall permit gate to open 90° or 180° as specified.

.9 Double Gate

- a) To have centre rest with drop bolt for closed position and chain hook to hold gates open, all galvanized in accordance with Article 14.15.3.

.10 Concrete for Post Footing

- a) Fillcrete for post footings shall be in accordance with Article 5.13.5.

PART IV - EXECUTION

14.16 Site Amenities

- .1 All site amenities to be installed in accordance with the applicable Engineering Standard Drawings in Appendix A and the manufacturers' instruction.

14.17 Fencing

- .1 All fencing to be installed in accordance with the applicable Engineering Standard Drawings in Appendix A and the approved construction documents.
- .2 Wood Fences
 - a) Posts will be rejected when structural integrity is compromised, or when the following conditions apply:
 - i) Cracks are 50% of the depth of the post in the face it occurs;
 - ii) Cracks exceed 25% of the width of the post on the face it occurs, or are wider than 12 mm; or if
 - iii) Mechanical damage is evident.
 - b) Cracks from 6 to 12 mm are to be re-stained with fence stain, ensuring that the stain penetrates the wood.
 - c) Board spacing shall be tight, ensuring that the spacing between boards does not exceed 12 mm when the boards are dry.
 - d) Fence boards, including stringers, shall be stained prior to installation.
 - e) Fence posts shall be stained prior to installation of the stringers and fence boards.
 - f) Nailer strips shall be fastened to the posts.
 - g) On double-board fencing, fascia boards shall be fastened to the fence boards.
 - h) For noise attenuation, on double-board fencing, adjust yard side pressure treated bottom stringer to provide no gap on ground. Bottom of double-board fencing on road side to be 75 mm above ground.
 - i) Standard wood screen fence to be 75 mm above grade.
- .3 Chain Link Fences
 - a) Maximum spacing of posts shall be 3 m on centre.
 - b) Install line, corner, and terminal posts plumb, set in concrete footings in accordance with the following table:

Fence Height	Component	Concrete Depth	Hole Dia. at Top
1.2, 1.5, and 1.8 m	Line Posts	760 mm	250 mm
	Gate and Corner Posts	900 mm	300 mm
2.4, 3.0, and 3.6 m	Line Posts	900 mm	250 mm
	Gate and Corner Posts	1060 mm	300 mm

- c) Set top of concrete flush with finished grade. Slope and trowel-finish top to ensure water runoff.
- d) Position bottom of fabric 25 mm above finished grade with bottom tension wire between posts.
- e) Align top of posts to ensure that the top rail varies gradually with changes in ground elevation.
- f) Pass top rail through line post tops to form continuous bracing. Install 150 mm long couplings mid-span at pipe ends.
- g) For fences 1.8 m and taller, brace each gate and corner post back to adjacent line post with horizontal brace rail. Install brace rail, one bay from corner and gate post.
- h) Attach fabric to corner and gate posts with tension bars and clips. Stretch fabric between posts at maximum intervals of 3.0 m.
- i) Install straining posts every 90 m.
- j) Install gates with fabric to match the fence. Install two hinges per leaf.
- k) Install centre rests set in concrete, and cane bolts at centre of double-gate openings.
- l) Welded gate frame joints shall be painted with one coat of zinc paint.
- m) Cut fabric for crawl holes, selvage knuckle end closed top and bottom. Place two-part frames around opening in fabric and bolt together.

14.18 Construction Completion Inspection

- .1 The Construction Completion Certificate for site amenities and fencing shall be issued following a satisfactory inspection by the City's representative, developer's representative and contractor which all material has been supplied and installed in accordance with the approved drawings and any approved substitutions. The maintenance and warranty period commences from the date of the issuance of the CCC.

14.19 Maintenance

- .1 During the maintenance and warranty period, the contractor shall maintain the fencing and site amenities and repair all damage immediately upon notice.
- .2 Refer to Section 15.0 for requirements.

14.20 Final Acceptance Inspection

- .1 Final inspection of site amenities and fencing will be made prior to the end of the maintenance period. All fencing and site amenities shall conform to the construction documents and be free of deficiencies.
- .2 Wood fences shall have touch ups completed and board replaced as required at time of FAC inspection (paint to match existing fence colour).



Municipal Engineering Standards

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15.0 LANDSCAPING STANDARDS – MAINTENANCE

PART I – DESIGN

The Developer is responsible for maintenance from the receipt of the CCC to the receipt of the FAC.

PART II - GENERAL

15.1 Reference Standards

- .1 International Society of Arboriculture standards (current edition)
- .2 Canadian Nursery Trades Association (current edition)

15.2 Regulatory Requirements

- .1 Provide the City with copies of permits and licenses required by regulatory authorities, including applicator's current chemical license number for all herbicides, pesticides or any chemical application used on site.

15.3 Damage to Property

- .1 The contractor shall repair and pay for damages caused by contractor's personnel and equipment during the maintenance period.
- .2 The contractor shall immediately report any damage caused through maintenance activities to City.
- .3 Obtain approval of City for repairs and replacements. Return grass areas, plant materials, equipment and buildings to their original condition prior to damage. Scalping of turf and mechanical damage to trees, including tearing of bark, shall be considered as damage.
- .4 Complete repairs and replacements within seven (7) days from date of approval given for repair or replacement.
- .5 The Developer shall be responsible to repair any third party damage to the development during the Maintenance Period.

15.4 Hours of Work

- .1 Consult with the City to determine optimum times for landscape maintenance.
- .2 The Contractor shall provide the City, in writing with at least three (3) days advance notice, of intent to spray for weed and insect control.

15.5 Maintenance Log

- .1 That contract shall keep a daily maintenance log throughout maintenance period.

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- .2 The contractor must submit maintenance logs & provide copies of permits and licenses required by regulatory authorities, including applicator's current chemical license number for all herbicides, pesticides or any chemical application used on site to City on a monthly basis.
 - .3 The following information shall be included in the log:
 - a) Detail of activities.
 - b) Areas in which the activities were carried out.
 - c) Approximate time for start-up and completion of each activity.
 - d) Outstanding issues to be dealt with.
 - e) Notes regarding any plant material to be replaced.
 - f) Details regarding applications of chemicals. Include target weed or insect, mode, type, and rate of application of chemical, date, time, weather conditions and results.
 - g) Daily entries are to be signed by a valid maintenance crew member for that day.

15.6 Maintenance Season

- .1 The maintenance season, also referred to as the growing season, shall commence May 1st and end October 30th, or as otherwise determined directed by the City.
- .2 Garbage pickup and litter control shall be undertaken year-round.

PART III - PRODUCTS

15.7 Water

- .1 Water shall be clean and free of any substance that may inhibit vigorous growth of the plants.
- .2 A permit shall be required if water is to be obtained from a City hydrant.

15.8 Fertilizer

- .1 Plant Materials:
 - a) For the first application, soluble fertilizer shall be delivered mixed as specified for tree and shrub growth in the topsoil backfill report from an acceptable soils laboratory.
 - b) Fertilizer: complete commercial fertilizer, minimum of 50% of elements derived from organic sources.
 - c) Soluble fertilizer shall be mixed at the rate of 3.2 kg per 45 L of water.
- .2 Seed and Sod:
 - a) Fertilizers shall be clearly labeled and supplied in unopened, moisture-proof containers.

- b) Fertilizer requirements are as follows:

Type 1 – Rate 3.5 kg/100 m²	
Total Nitrogen	19%
Available Phosphoric Acid	19%
Potash	19%

Type 2 – Rate 3.5 kg/100 m²	
Total Nitrogen	10%
Available Phosphoric Acid	30%
Potash	10%

Type 3 – Rate 3.5 kg/100 m²	
Ammonia	12%
Phosphate	51%
Sulphate	0%

- c) Fertilizers shall be granular, water-soluble type.
- d) The City may require changes to the fertilizer type, blend, and feed rates if an analysis of the soil shows such to be necessary.

15.9 Topsoil

- .1 Refer to Section 9.0.

15.10 Plant Protection Materials

- .1 Rodent protection: approved chemical repellent and/or tree wraps at the contractors expense.

15.11 Weed Control

- .1 Chemicals: contractor responsibility as required by site conditions and in accordance with current regulations.
- .2 Contractor to provide signage 48 hours prior to spraying. City to be given 72 hours notice prior to spraying.

15.12 Pest and Disease Control

- .1 Chemicals: contractor responsibility as required by site conditions and in accordance with current regulations.
- .2 Contractor to provide signage 48 hours prior to spraying. City to be given 72 hours notice, in writing, prior to spraying.

PART IV - EXECUTION

15.13 Schedule and Workmanship

- .1 Schedule timing of operations to growth, weather conditions and use of site. The following *minimum* schedule should apply:
 - a) Mow every fifteen (15) days.
 - b) Pick-up onsite litter and debris every fifteen (15) days.
 - c) If required, apply chemical weed control three (3) times per growing season: June 15, July 15, and August 15. Use of non-chemical weed control is preferred.
 - d) Manual weed control a minimum of every fifteen (15) days.
 - e) Water trees and shrubs every fifteen (15) days, or more frequently when required.
 - f) Water seed/sod if required to ensure establishment and healthy growing conditions.
 - g) Waste receptacles to be emptied every seven (7) days, or more frequently when required. Within the months of January, February, March, April, November, and December, waste receptacles shall be emptied every fifteen (15) days, or more frequently when required.
 - h) Pruning as required during approved dates, or when requested by the City.
 - i) Fertilize as required during approved dates, see Article 15.16.
- .2 Do each operation continuously and completely.
- .3 Provide equipment and material necessary for maintenance to acceptable horticultural standards.
- .4 Coordinate maintenance practices with the City. Maintenance schedules may have to be altered to deal with site activities.

15.14 Spring Clean-Up

- .1 Complete spring clean-up as soon as working conditions are favourable, and no later than May 15.
- .2 Maintained Turf Areas:
 - a) Rake and remove dead vegetation, leaves, and debris.
 - b) Roll lightly where grass has lifted due to frost action.
 - c) Heavy rake with flexible grass rake on areas with "snow mold".
 - d) Power sweep all boulevards and turf areas to remove sand/gravel and salt. All sand/gravel and salt is to be removed from site.
- .3 Planting Beds:
 - a) Clean shrub beds, tree pits, and tree wells of debris and dead plant material.
 - b) Loosen up top layer of mulch without mixing it into the soil beneath, ensuring that mulch is drawn approximately 250 mm from plant material.

15.15 Turf Maintenance

- .1 Aerating
 - a) Aerate areas where the soil has become compacted due to pedestrian traffic and/or other causes.
- .2 Topdressing and Reseeding:
 - a) The first cutting is to occur when grass has reached a height of 75 mm over 75% of the seeded area.
 - b) After mowing, rake thoroughly to remove all loose and dead grass, stones, and debris.
 - c) Spread topsoil to maximum thickness of 15 mm, filling any burned out, thin, washed out areas, and bare spots.
 - d) Overseed all damaged or burnt out areas with a seed mixture equivalent to existing grasses. Seed at rate of 3 kg/100 m².
 - e) Rake seed into topsoil and roll lightly.
 - f) Water all seed to ensure penetration of 80 mm and at frequent intervals to maintain vigorous growth.

15.16 Fertilizing

- .1 Use only mechanical equipment.
- .2 Check calibration of spreader to ensure that specified rate is used.
- .3 Spread 50% of fertilizer in one direction, then 50% at right angles.
- .4 Apply 16-20-0 fertilizer at rate of 3 kg/100 m², in early spring as soon as frost is out of ground, prior to May 31.
- .5 Apply 27-14-0 fertilizer at rate of 3 kg/100 m² during the first two weeks of July.
- .6 Apply 16-20-0 fertilizer at rate of 3 kg/100 m² during the last two weeks of August.
- .7 Water immediately after fertilizing according to manufacturer's recommendations; obtain moisture penetration of 80 mm minimum.

15.17 Seed/Sod Watering

- .1 Apply sufficient water during growing season to ensure continuous healthy growth, with sufficient time between watering to promote deep root growth. Apply water in soft spray to avoid "packing" of soil. Do not impede use of sidewalks and other paved areas.
- .2 Ensure all water trucks do not use the pathways/trails or grassed areas as access routes. Any damage resulting from the use of these surfaces shall be reported immediately to the City, and the contractor shall repair or have all the damages repaired at its own expense. If not reported, it will be treated as third party damage, and the repair shall be the responsibility of the Developer.

15.18 Mowing - Maintained Areas

- .1 Maintain all turf with sharp mowers at 60 mm height during the growing season.
- .2 Do not cut more than 1/3 of the blade in any one mowing.
- .3 Remove papers, rocks, and other foreign material prior to cutting.
- .4 Change direction of cut with each separate mowing, wherever practical.
- .5 Do not remove grass clippings from turf areas unless volume is such as to be harmful to turf areas or unsightly.
- .6 Remove clippings from sidewalks, roads, windows, and buildings during the same mowing.
- .7 Remove all clippings from planting beds.
- .8 The City shall be the "sole judge" for variations in mowing operations during dry or wet weather.
- .9 Edge along hard surfaces and lawn abutments, once monthly during June, July, August, and September.

15.19 Tree and Shrub Maintenance

- .1 Cultivation of Plant Beds
 - a) Remove weeds bi-monthly, including their roots.
 - b) Collect and dispose of paper, refuse, and dead plants.
 - c) Prune all suckers from the base trunk and inside crown of tree.
 - d) Top up all mulch in beds and trees wells as required to maintain a minimum depth of 100 mm.
 - e) Maintain edge of all beds with a 90-degree vertical edge cut, 100 mm deep around the perimeter of the bed.
 - f) Ensure that crowns of shrubs and bottom branches are not covered with mulch.
- .2 Staking
 - a) Keep stakes and guy wires taut (where required), and plants plumb for the duration of the maintenance period.
- .3 Pruning
 - a) Immediately following planting, any dead, broken, or interfering branches shall be pruned together with any diseased branches which have not caused the plant's rejection.
 - b) Pruning must be completed by a ISA certified arborist.
 - c) The amount of pruning shall be limited to the minimum necessary and exceed no more than 25% of the living foliage in one season.
 - d) One section of any bad fork or weak crotch which has not caused the plant's rejection shall be removed at transplanting time.
 - e) The manner of pruning shall preserve the natural character of the plant.

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- f) Due to the risk of Dutch Elm Disease, elm trees shall only be pruned between the period of October 1 and March 31, when the Elm Bark Beetle is inactive.
 - g) Pruning tools shall be clean and sharp.
 - h) All pruning cuts shall be clean and leave no stubs or rough wood and be in accordance to the ANSI Z133.1 Standards. Small cuts shall be close to the branch collar and parallel to the adjoining branch or trunk. On large limbs, flush cuts shall be avoided and cuts made at the collar shall have the lower part slanting slightly away from the trunk to leave a smaller wound.
 - i) Bark that is cut, bruised, or scarred shall be cut back to living tissue with a clean edge. The affected area shall be shaped with a sharp knife so as not to retain water.
 - j) Wound surfaces shall not be treated with wound-dressing products, unless otherwise specified or directed by the City.
 - k) As a rule, growth is maximized if pruning is done just before the period of rapid growth in the spring. Prune at proper times in accordance with the following:
 - i) Shade Trees – October 15 to April 15
 - ii) Birch and Maple – June 15 to July 15
 - iii) Fruit trees – March 15 to April 15
 - iv) Evergreens – April 15 to May 15
 - v) Elm Trees – October 1 to March 31
 - l) Do not prune a leader unless a lateral can be trained to take its place prior to the end of the maintenance period.

.4 Fertilizing

- a) Fertilizing of Spring-planted trees and shrubs shall commence the following Spring. For Autumn-planted trees and shrubs, fertilizing shall commence the second Spring following planting. Liquid fertilizer shall be injected in the topsoil backfill and slightly outside the area of the planting pit. Trees under visible stress shall be fertilized as necessary to encourage vigorous and healthy growth.
- b) Soluble fertilizer shall be injected around the planting pit at 800 mm intervals, and at a depth of 300 mm. At each site, 4.5 L of fertilizer solution shall be injected. Following the initial fertilization, subsequent applications shall be made annually.
- c) Fertilization shall occur a maximum of two (2) times within the two year maintenance period.
- d) Fertilization shall occur before June 15 and after plant material is dormant after two hard frosts. Good times to fertilize are generally March and June, or mid-October when leaves are coloring.

.5 Watering

- a) Ensure all water trucks do not use the pathways/trails or grassed areas as access routes. Any damage resulting from the use of these surfaces shall be reported immediately to the

owner and the contractor shall repair or have all the damages repaired at their own expense. If not reported, it will be treated as third party damage, and the repair shall be the responsibility of the Developer.

- b) Watering plants when required and in sufficient quantities to saturate the root system. During extended hot periods, with daily maximum temperatures exceeding 25°C, watering of plant material shall be increased to maintain vigorous and healthy growth. The frequency of watering shall be gradually reduced over the maintenance period. All plants shall be thoroughly watered just before the ground freezes in the fall
- c) Watering shall be conducting as necessary, subject to the following minimum schedule: once immediately following planting, once per week for the first month, once per month during the Summer, and three times in Autumn to freeze trees and underlying soil to prevent drying out.
- d) As a general guide water shall be applied initially at a rate of 29 L per m² of root ball. Care shall be taken to avoid over watering and drowning new root growth.
- e) Trees shall be watered at a rate of 1.2 L per mm of caliper per week, consistent with the following table. Do not over water trees.

Tree Caliper	Litres per Week
60mm	72.0
75mm	90.0
100mm	120.0
125mm	150.0
150mm	180.0
175mm	210.0
200mm	240.0

.6 Replacements:

- a) All plant materials found dead or not in a healthy, satisfactory growing condition or which, in any other way, does not meet the requirements of the specifications, shall be replaced in a immediately by the contractor at the contractor's expense.
- b) All required replacements shall be by plants of the same size and species as specified on the plant list and shall be supplied and planted in accordance with the approved landscape drawings and specifications.
- c) Trees that settle more than 25 mm below the surrounding ground level shall be lifted, and the maintenance period shall reset for the full warranty term.

15.20 General Considerations for Chemical Applications

- .1 Ensure proper, positive identification of infestations and consult with the City before taking corrective action.
- .2 Prior to chemical applications, obtain written approval from City. Notify the City of intent at least three days in advance.

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- .3 Determine susceptibility of plant species to chemical damage prior to any chemical application.
 - .4 Use equipment and containers free of harmful residues not related to specific control measures applicable to situation.
 - .5 Perform disease, weed and insect control in accordance with Provincial chemical application regulations.
 - .6 Prepare and apply chemical according to manufacturer's instructions. Minimize drift at all times.
 - .7 Carry out treatment with due regard to climatic conditions' effect on surroundings and occupants of buildings.
 - .8 Confine application to the specific area to be treated.

15.21 Weed Control

- .1 Apply chemical to eradicate weeds within site.
- .2 Repair and pay for damage caused by application of herbicides.
- .3 Effectiveness of treatment program is to be determined by inspection by the City's field representative.
- .4 Repeat as required.

15.22 Insect and Disease Control

- .1 Make weekly inspection of lawns and plants for insect and disease infestations. Apply chemicals based on development stage of insects' life cycles.
- .2 Repair and pay for damages caused by application of chemicals.
- .3 Effectiveness of treatment program is to be determined by inspection by the City's field representative.
- .4 Repeat as required.

15.23 Autumn Preparations

- .1 Rake all leaves and remove from site.
- .2 Deep-water trees and shrubs between October 15 and 31, and as required during warm periods between November 1 and February 1 to prevent desiccation of plant materials.
- .3 Protect plants from rodent damage. (Rodent protection to be removed prior to FAC)
- .4 Protect coniferous plants with burlap wrap during winter months, if warranted.
- .5 Ensure all catch basins, swales, and ditches within the landscape area are clear and draining freely.

15.24 Cleanliness of Grounds

- .1 Keep grounds in clean and tidy condition.
- .2 Immediately report vandalism and damage to the City.



Municipal Engineering Standards

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APPENDIX A

ENGINEERING STANDARD DRAWINGS

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APPENDIX B

**ON STREET CONSTRUCTION PERMIT (OSCP) (B-1)
STANDARDS REVISION REQUEST FORM (B-2)**

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