



MUNICIPAL DEVELOPMENT STANDARDS



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SECTION I – GENERAL CONDITIONS AND PROCEDURES

A. Scope

1. These Municipal Development Standards shall apply to the design and installation of infrastructure and landscaping within the City. They apply to the design and installation of storm and sanitary sewers, water mains and roads, together with their respective connections and appurtenances and any other services, which are required to be designed and/or installed. They also apply to installation of any landscaping related requirements.
2. These Development Standards do not cover the design or installation of street lighting, power, gas, telephone and television services, but does include coordination with the various utility companies and Canada Post for community mailbox locations.
3. The Detail Drawings, as referred to in various sections, shall form an integral part of these design standards.

B. Definitions

1. “*City*” means the municipal corporation of the City of Spruce Grove, City Engineer, division, department or designate as the context applies.
2. “*Construction Completion Certificate*” shall mean an assurance in writing issued by the Developers Engineer that construction of the Municipal Improvements have been completed in accordance to the Development Agreement.
3. “*Consulting Engineer*” means professional engineer responsible for designs, drawings and other documents prepared, normally for a Developer.
4. “*Developer*” means the *proponent* of a land development proposal or designate acting on their behalf.
5. “*Development Agreement*” means an agreement between a Developer or property owner, and the City that defines the terms and conditions under which a development must be carried out.
6. “*Development Permit*” means the document authorizing a development that is issued by a development officer, under the City’s land use bylaw.
7. “*Final Acceptance Certificate*” shall mean an assurance in writing issued by the Developers Engineer that the improvement and maintenance has been completed as herein required.
8. “*Municipal Improvement*” includes roads, utility works, landscaping, and other surface or underground infrastructure to be owned and/or operated by the City.

C. Engineering/Landscape Design

1. The Developer shall retain an APEGA registered Consulting Engineer, Consultant and an AALA accredited Landscape Architect (if landscaping is required), who shall be responsible for the design and preparation of the drawings and specifications for all infrastructure (except lighting, telephone, power, natural gas, and cable TV) and landscaping as required within the municipal

boundary of the City. Which shall be designed in accordance with these Municipal Development Standards that are available from the City.

2. The Design Drawings shall show all existing and proposed infrastructure. It shall be the Consulting Engineer or Landscape Architect's responsibility to coordinate with the utility companies and Canada Post, the location of their existing and proposed services.
3. The Design shall address the requirements of all the plans and policies of the City including, but not limited to the following:
 - Crosswalk Policy
 - Tree Protection Policy
 - Spruce Grove Forest Management Plan
 - City Addressing Policy
 - Open Spaces Bylaw
 - Surface Drainage Bylaw
 - Traffic Bylaw

D. Development Agreement Request and Drawing Submission

1. Upon completion of the Design Drawings, a qualified Consulting Engineer or Landscape Architect shall apply to the City by submitting a Development Agreement Request Form (Appendix A-1), together with all information and supporting documentation as outlined on the request form.
2. All proposed street names are to be approved by the City Planning department. Once the street names have been approved they must be used on the development drawings. Proposed street names shall not be shown on drawings.
3. The Consulting Engineer or Landscape Architect shall bring to the attention of the Developer the need for any rights-of-way outside the subdivision that the Developer may have to obtain.

E. Design Review

1. The City shall review all design drawings, specifications and relevant data. Any revisions discussed with the Consulting Engineer or Landscape Architect shall be incorporated in the final design drawings. The City will review the drawings with respect to adherence to the Municipal Development Standards, but will not accept responsibility for engineering omissions and errors on or relating to the design drawings and specifications. Any revisions required by the City shall be communicated to the Developer's Consulting Engineer or Landscape Architect. Such revisions shall be incorporated into the final design drawings to be re-submitted to the City for final review. The City may require additional documentation or design changes to ensure City policy is followed and public safety is protected.
2. All subsequent revisions submitted to the City shall be through CityView, printed sets of the plans may be required upon request.

F. Design Final Review

1. Upon completion of all revisions, the Consulting Engineer or Landscape Architect shall submit the plans through CityView, printed sets of the plans may be required upon request.

2. When the design is reviewed and determined to be in accordance with City standards by the City, an electronic signed copy of the design drawings shall be returned to the Consulting Engineer or Landscape Architect indicating of the City's review.
3. No work shall be commenced within any new parcel of land on any of the infrastructure to be provided by the Developer, until the City has reviewed, signed and returned the Design Drawings, and all approvals by Alberta Environment or any other outside agencies are obtained.
4. Redline revisions can be used to propose minor amendments to active, reviewed development plans (engineering/landscape) to reflect any engineering or field changes (deletions, substitutions, relocations). If changes are deemed in excess of the intent of a redline drawing, the City at their sole discretion, may require a full re-submission of the construction drawings as per Section I.I.3 below. Redline revision submissions will be completed through CityView, printed copies of the plans may be requested.

G. Right-of-Way Documents

Where easement documents and/or right-of-way plans are deemed necessary, they shall be prepared by a registered Land Surveyor at the Developer's expense and registered against the affected parcel titles.

H. Construction Approval

1. Upon receipt of reviewed and written approval for drawings and specifications, the Developer may proceed to install municipal infrastructure subject to:
 - a. Satisfactory execution of a Development Agreement or a Development Permit if applicable;
 - b. Receipt of security;
 - c. All conditions of City Policy 7,005 – Information Requirements for Redistricting Bylaws have been met.
2. The City must be notified of the time and date of a start-up meeting so that a representative may attend.
3. Underground subdivision services shall **not** be permitted to operate as part of existing Municipal Services until the respective subdivision services have been inspected, tested and approved by the City, including fire protection.
4. Prior to the issuance of any Development Permit within any new development the City requires fire protection and an all-weather/all season access be constructed, and to meet the following minimums:
 - a. Approved Construction Completion Certificate for Underground Utility Improvement;
 - b. Curb & gutter in place on both sides of road;
 - c. Subgrade constructed to the approved drawings for all roadways, including alleys;
 - d. Compacted granular base course as follows:
 - Roadways; to design depth and filled to gutter elevations.
 - Alleys; to design depth.
 - e. Temporary turnarounds constructed as per approved drawings.
 - f. Street and regulatory signage, whether permanent or temporary.

I. Engineering and Landscape Inspection

1. The Consulting Engineer or Landscape Architect shall be responsible for the layout, inspection and approval of materials. The Consulting Engineer/Landscape Architect or authorized representatives shall be available at all times to inspect the site during the installation of infrastructure.
2. In addition to inspection carried out by the Consulting Engineer or Landscape Architect, the City will periodically inspect the work and assist in coordinating the subdivision works with any related Municipal works. The City shall bring the use of any unacceptable materials or practices to the attention of the Developer and/or the Consulting Engineer. If remedial action is not taken to the satisfaction of the City, the City may order the work to cease. No work shall proceed after a cease work order until the City has provided written acknowledgement that proposed adjustments to the work by the Developer and/or Consulting Engineer are acceptable to the City.
3. If the Consulting Engineer or Landscape Architect wishes to make any changes in design either before or during the execution of the work, they shall first submit a redline showing the proposed revisions to the City. If approval is granted for the revision, the original drawing shall be immediately revised and new drawings issued. These two operations may be carried out simultaneously and the work can only proceed after receiving written approval from the City.
 - a. Three (3) business days required for simple redline, up to one (1) week for more complicated redline changes. Standard drawing review times will be required for redesign work. Every effort will be made to limit any affects to ongoing construction.

J. Testing and Inspection

1. It shall be the responsibility of the Consulting Engineer to ensure that the Contractor disinfects and tests all water mains and tests all sewer prior to the acceptance by the City.
2. Inspection of both the sanitary sewer and storm sewer is to be completed as per Sections IV and V respectively and the CCTV supplied to the City prior to the issuance of both Construction Completion Certificate and Final Acceptance Certificate.
 - a. CCTV inspections and reports must include both the main and, at a minimum, a pan and tilt at each service connection.
3. All material testing records and other reports must be submitted by the Developer or Consulting Engineer and reviewed by the City prior to operating the constructed works as part of the City municipal services. The exception to this is for Storm Water Management Facilities.

K. Municipal Acceptance

Until the City has completed inspections for the acceptance of the subdivision, and the signage (temporary or permanent) and all fire code requirements are in place, all accesses into the area must be barricaded.

Requirements for Construction Completion Certificates (CCC) and Final Acceptance Certificates (FAC) shall be as follows:

1. Upon satisfactory completion of the construction of each Municipal Improvement or group of improvements as per the Development Agreement, and after all the deficiencies have been corrected, the City shall issue a CCC to the Developer, notifying:

- a. Acceptance of the work by the City;
 - b. The maintenance period expiry date.
2. Each group of Municipal Improvements (underground, surface or landscaping) included under the same Development Agreement shall be CCC'd/FAC'd at the same date. Separate CCC's/FAC's will not be provided for improvements included within the same Development Agreement, unless otherwise agreed upon by the City. Additional fees may apply.
 3. Storm Water Management Facilities (SWMFs) will be issued CCC upon satisfactory completion of the construction of the ultimate design. "Interim" SWMFs are not eligible for CCC approval.
 4. FAC maintenance periods will be as per the Development Agreement and CCC Request Form (Appendix A-2). The Developer shall be responsible for, and at his own expense, the remedy of any defect, fault or deficiency in completed work during the maintenance periods.

Landscaping FAC will not be granted if any replaced trees have not experienced at least one full growing season. If any trees have been replaced with less than one full growing season remaining before FAC inspection, the City may grant a "conditional" FAC at which time the City will begin regular maintenance only on trees that have been accepted. FAC will only be granted once ALL trees and landscaping have been accepted.

5. Upon completion of the maintenance period and after receipt of required reports and as-built drawings, as outlined in FAC Request Form (Appendix A-3)), final inspection and correction of all deficiencies thereof, the City will issue a Final Acceptance Certificate.
6. Consulting Engineer/Landscape Architect shall, on behalf of the Developer, submit a CCC or FAC Request Form (Appendix A-2 and A-3) to the City in order to coordinate an inspection date and time. The City will review all reports and information provided with the CCC/FAC Request Form (Appendix A-2 and A-3) and schedule an inspection within thirty (30) days of receiving it.
7. Unless otherwise approved by the City, the deadline for CCC inspections for both Underground Utilities and Surface Improvements will be October 15th.
8. Inspections for Surface Improvements, where the warranty period is due to expire after September 1st can, at the approval of the City, be conducted three (3) months in advance of expiration. All FAC's for Surface Improvements must be completed and signed off by the City no later than October 15th.
9. Fencing, entrance features, masonry pillars, and retaining walls will be inspected separately from other landscaping. At least thirty (30) days prior to any fencing FAC inspection, the Landscape Architect shall provide the City with as-built survey data showing the bottom-of-fence elevations as outlined in Section X.D.11.
10. Unless otherwise approved by the City, the landscaping FAC inspections must be completed by September 15th.
11. Prior to scheduling a CCC inspection of the Underground Utilities, the City will require confirmation from the Consulting Engineer and/or the City's Public Works department that a flushing meter was obtained from the City for all flushing operations of new lines, as per Section III.H.1. Where verification cannot be provided or confirmation that a meter was not obtained and deployed, the Developer's contractor will be required to obtain a meter from the City and repeat

all flushing operations. A report of total volume of all water used for system line filling and flushing operations must be provided to the City prior to scheduling of a CCC inspection.

12. During the CCC or FAC inspection, the Consulting Engineer/Landscape Architect will record a list of any deficiencies, which will be signed on-site by the City and the Consulting Engineer/Landscape Architect at the conclusion of the inspection.
13. Upon completion of the inspection, the Consulting Engineer/Landscape Architect will provide the City with a copy of the list of recorded deficiencies, as well as an 11x17 reduction of the approved drawings showing locations of each deficiency.
14. All deficiencies must be corrected within the same construction season and signed off within six (6) months from the time of the initial inspection or a full re-inspection will be required.
15. The City will execute all copies of certificates supplied by the Consulting Engineer/Landscaping Architect and issue/return all, minus the City copy, of the approved documents. If the City rejects a submitted certificate, the reason for rejection will be noted and the City will retain one copy with the others returned for remediation of the reason for rejection. Additional inspections or approvals, with associated fees may apply.

L. ~~As-Built Drawings~~ Record Drawings

1. As-built Record Drawing Requirements and Tolerances

Record drawings shall be developed by updating the most recent IFC or approved redline drawings to incorporate all changes and deviations encountered during construction. These updates shall ensure that the final drawings accurately represent the completed infrastructure. All modifications must comply with the City of Spruce Grove Municipal Development Standards and approved design specifications. The record drawings shall be based on the final survey conducted by the consultant and/or verified field measurements and must be verified and stamped by a professional engineer prior to submission.

If the recorded as-built measurements exceed the specified tolerances, the drawings must be revised and redrawn to accurately reflect the final constructed condition.

Record drawings shall include, but are not limited to, the following changes indicated in red:

Surface Improvements:

- Elevation: 25mm;
- Slope: 0.1%;
- Infrastructure alignment: 0.15m;
- Road names;
- Street furniture locations;
- Rim elevations.

Underground Utilities:

- Mainline alignment: 0.30m;
- Manhole base alignment: 0.5m;
- Invert elevation: 25mm;
- Valve and Fitting location: 0.30m;
- All slope changes;
- Pipe materials.

2. Service and Appurtenance Information

As-built record drawings submission shall include Service and appurtenance information in a separate spreadsheet, which shall contain:

- Invert elevations, northing and easting coordinates of sanitary, water and storm services at Plug, Property Line, and Mainline Tee.
- Surface elevations, northing and easting coordinates of Valves, manholes, and cleanouts

3. Submission Requirements

1. First Submission Redline As-built:

- The consultant shall submit the initial drawings to the City within six (6) months of the issuance of the Construction Completion Certificate (CCC), with all changes shown in red.

2. City Review Process:

- The City will review and provide comments within 45 days of submission. Upon receiving the updated redline drawings, provided no further changes are required, the City shall notify the consultant to issue IFR drawings.

3. Issued for Record (IFR):

- All approved changes from the Redline process must be changed to black for final submission, which shall include:
 - A complete set of as-built drawings in PDF and CAD formats.
 - The submission must be stamped and approved by a qualified professional.
 - The final drawings shall comply with the City of Spruce Grove's record drawing standards, as outlined in Appendix C.

4. All drawings must be spatially aligned using surveys integrated with GPS in to the City of Spruce Grove's control monuments network thus following the spatial reference system:

- Horizontal Datum and Projection - NAD83 / Alberta 3TM ref meridian 114 W (EPSG:3776)
- Area: Alberta - 115.5°W to 112.5°W
- Vertical Datum CVD28 (1928 Canadian Vertical Datum)

5. Alberta Survey Control Monuments (ASCM's) must be verified and identified on the drawing.

6. All utilities should be labeled with attribute data using the object data in AutoCAD software (pipe diameters, inverts, catch basin types, valve types, etc.)

7. Final Acceptance Certificate (FAC) Requirement:

- FAC inspections will not be scheduled until the Issued for Record as-built drawings and service and appurtenance information have been submitted to the City.

SECTION II – PREPARATION OF ENGINEERING DRAWINGS

A. Design Drawings

The Consulting Engineer or Landscape Architect shall submit Design Drawings to the City for review as outlined in the Development Agreement Request Form (Appendix A-1).

B. Drawing Size, Material and Basic Layout

1. The standard drawing size of 590mm x 840mm will be used.
2. Use plan profile sheets with profile located at the bottom of the sheet.
3. All drawings must be legible when printed to 11" x 17" paper.

C. Scales

When practical, Drawing Scales shall be:

- Overall Plans 1:1000
- Plan/Profile Horizontal 1:500 Vertical 1:50

D. General Requirements

1. Elevations shall be relative to the geodetic datum.
2. A north arrow, adjacent lots and drawing numbers, street names, and the legal description of the parcel being subdivided shall be shown on the drawing. In general, the north arrow should be oriented towards the top of the plan or in the range from the top to towards the left side of the plan.
3. Drawing Requirements – The following overall drawings shall form a part of the whole design set:
 - a. Cover Sheet
This will show the name of the subdivision, stage of development and names of the Developer and Consulting Engineer.
 - b. Index Drawing
This drawing will be prepared on a scale of 1:1000 or a reduction thereof to fit the standard size sheet and will indicate that portion of the street, which relates to a particular plan/profile sheet.
 - c. Road, Sidewalk, Driveway and Walkway Drawing
This drawing will be drawn to a scale of 1:1000 and will indicate all locations and widths of roads, sidewalks, walkways and driveways and locations of catch basins shall be shown.
 - d. Lot Grading Drawing
This drawing shall be drawn to scale of 1:1000 and will indicate the original contours, ~~proposed finished lot corner elevations, proposed lot grades,~~ sewer connection inverts and directions of surface drainage flows **and proposed finished grades which shall include lot corners, property grade breaks, ditches, concrete swales, alleys and walkways. If the**

distance between grade breaks exceeds 20m, spot elevations shall be provided at 20m intervals. The drawing must also indicate if the lots have engineered fill, special foundation requirements, and minimum footing and building openings for buildings adjacent to storm water management facilities.

- e. Sanitary Sewer, Storm Sewer & Water main Overall Drawing
This drawing will be drawn to a scale of 1:1000 and will indicate the alignments and locations of mains, size of mains, direction of flows and locations of appurtenances.
- f. Sanitary and Storm Sewer Overall Drawings
These drawings will be drawn to a scale of 1:1000 and will show the catchment areas and design tables on their respective drawings. All manholes, labels, pipe sizes with flow directions and catchment area outlines and areas are to be shown on the plan. The design tables are to show each pipe with catchment area, design data, pipe flow data and capacity percentages.
- g. Shallow Utilities Drawing
This drawing indicates the alignments of power, gas, telephone and cable television and shall be drawn to the same scale as the Index Drawing.
- h. Overall Street Furniture Drawing
This drawing shall be drawn to a scale of 1:1000 and will indicate all surface features, i.e.; power poles, hydrants, valves, pedestals, community mail boxes, future driveway locations, service locations, traffic control and street identification signage, etc.
- i. Detailed Plan/Profiles
Generally all underground infrastructure and surface improvement profiles are shown on the same drawing. All material types used in the design shall be detailed on the design drawings.
- j. Erosion and Sedimentation Control Plan
This drawing indicates and defines all procedures intended to control erosion and sedimentation during both the construction and maintenance periods.
- k. Legal Plans
Plan of subdivision and plan of easement to show all proposed legal line work for the proposed development.
- l. Landscape and Fence Drawings
Landscape drawings are required where any landscaping and/or fencing is required. Landscape drawings shall include a "Key Plan" drawn at a scale of 1:1000 to show development boundaries, and an "Overall Landscape and Fencing Plan" drawn at a scale of 1:750 or 1:500 to show locations of trees, plant beds, seed or sod, fencing, wood fence step-downs, bollards, landscape amenities, sidewalks and trails, waterlines and shallow utilities. Enlargements of plant beds containing shrubs or perennials shall be drawn at a scale of 1:250. Standard details shall be included for tree planting, shrub planting, bollards and fencing (chain link, wood screen and wood step-down). Drawings shall also indicate Plant List, seed mix specifications, fence colours, utility setbacks and maintenance periods.

Landscape drawings may be submitted after approval of design drawings but must be received by the City prior to application for CCC of underground utilities.

SECTION III – WATER SYSTEM

A. Network

The water distribution network design in a new development shall conform to the Water Distribution System as outlined in the City's most current "Water Master Plan".

The minimum size of distribution main shall be:

1. Residential 200mm diameter except for cul-de-sacs which serve ten (10) or few lots where the minimum size shall be 150mm diameter.
2. Industrial/Commercial/Institutional 250mm diameter

B. Mains and Design

1. Design

New developments will be designed and constructed such that the water distribution and transmission systems through the area will be looped. For the initial stages of a larger development the City, at its' sole discretion, may waive this requirement if there are less than 200 lots.

Cul-de-sacs exceeding 170m in length require looping. Cul-de-sac length is measured along the road centerline from the face of curb, of the cross-street, closest to the start of the cul-de-sac to the face of curb at the end of the bulb.

- a. The design population shall be the ultimate population in the area under consideration.
- b. An analysis shall be made for Peak Hour Demand and the mains sized such that there shall be a minimum residual pressure of 280kPa at ground level at any node in the network.
- c. Separate analysis shall also be made for Peak Demand plus a fire flow of 18,000 L/min at a node adjacent to high value property, (e.g. a school or shopping centre) and also where the said fire flow shall be at a node furthest from the source of supply into the network. All residential hydrants to have a 5100 L/min fire flow. The residual pressure in all cases for the node under consideration shall not be less than 140 kPa at ground level.
- d. For future reference to the City, a set of printouts plus accompanying schematic diagrams of the network system showing notation used for the pipes and nodes and also the diameters and lengths of the pipes may be requested together with the design plans.
- e. Flushing points shall not be located nor drain within a temporary turn-around.

2. Alignments

Water mains in streets shall generally be located as illustrated on Detail Drawings CS-01 to CS-03. Water mains will generally be located on the side of the right-of-way having the most number of lots and shall continue at the same alignment the entire length of the street.

Water mains must maintain a 0.30 m minimum clearance above and 0.50 m below storm and sanitary sewers

3. Depth of Bury

Water mains shall be designed at a minimum depth of 2.8m from the road, alley or utility to the top of the main. The design of water systems shall take every effort to avoid the need for insulation, should insulation be required it must follow detail GL-02 or the manufacturer instructions, whichever is more stringent.

C. Pipe and Fittings

1. All polyvinyl chloride pressure pipe and fabricated fittings shall conform to CSA B137.3 Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications. The pipe shall be made from clean, virgin approved class 12454-B PVC compound conforming to ASTM resin specification D1784. PVC water pipe shall be blue in colour and shall utilize integral bell gasket joints. Pipe to be delivered in 6.1m nominal lengths.
 - a. PVC Class Pipe and Fittings: To AWWA C900, pressure class 150.
 - b. PVC series pipe is to be designated for a pressure rating of 1620kPa (235psi) and shall be designated DR18 with cast iron outside diameters. The pipe shall be hydrostatic proof tested at 280kPa (40.0psi). Fabricated fittings shall comply with Uni-Bell Pipe Specifications UN-B-12, CSA B137.3, and designed for a pressure for 1620kPa.
 - c. PVC molded fittings to CSA B137.2 Class 150.
2. Cast iron fittings from 150mm to 1200mm in diameter shall conform to the following specifications: ASA A21.10 and AWWA C-110. Fittings shall be supplied with bell and spigot joints complete with rubber gaskets and shall conform to the following specifications: ASA A21.10 and AWWA C-111. Cast iron fittings shall be encased in polyethylene in accordance with AWWA C-105.
3. Cast Ductile Iron Couplings to be Robar couplings or approved equivalent, complete with stainless steel nuts and bolts, compatible with outside diameters of pipe to be coupled in locations approved by the City.
4. All sub-surface bolted connections in contact with the soil shall be made using stainless steel nuts and bolts, covered in Denso™ paste and shall be wrapped in Denso™ Tape (i.e. hydrants, valves, dresser couplings, etc.). Nuts and bolts shall be ANSI Type 303 or 304 stainless steel conforming to ASTM specification 320.
5. Thrust blocking shall be concrete having a minimum compressive strength of 20 MPa at 28 days. Concrete shall be made using Type HS sulfate resistant cement. (See details WR-05 and WR-06)
6. Timber blocking shall be either hemlock or fir, which has been pressure treated for ground contact.

D. Hydrants

1. General

Hydrants shall be located at a maximum spacing of 150m in single family residential areas and 120m in multi-family, commercial and industrial areas. Hydrant location shall be such that the distance to any building does not exceed 75m. Additional hydrants shall be installed at high value properties if deemed necessary by the City. Cul-de-sacs longer than 120m require an additional hydrant. Hydrants shall be located at the projection of lot lines. Where hydrants are installed at intersections, they shall be installed at the beginning of the curb return.

If a flush point is required at the end of a stage a hydrant must be installed to facilitate flushing. The hydrants must not be located within a temporary turn-around area, and if the hydrant is in good condition it can be re-used in the next phase of construction. A hydrant must be installed at the entrance to all new areas or subdivisions to facilitate the fighting of fires.

Hydrants are to be protected by bumper posts in areas where there is potential of them being damaged (detail WR-09) and are to be clear of trees, bush and other potential debris (detail WR-11).

All hydrants are to have the drain holes plugged. The Developer shall empty the water from all hydrants for freeze protection before and during winter months, until FAC has been issued. The Developer must acknowledge all hydrants have been plugged during installation at the time of CCC. (See detail WR-01)

2. Dry Barrel Hydrants

Dry Barrel Hydrants to AWWA C502 with two (2) 65mm threaded hose outlets (threads to local standard Alberta Mutual Aid Thread), one (1) 125mm "Storz" internal lug type 3, 316 Stainless Steel pumper quick connect coupler, 150mm riser barrel, 125mm bottom valve and 150mm connection for main and to match existing hydrants in community. Hydrants to open counter clockwise. Hydrants to be Canada Valve or McAvity.

- a. Valve stem seal to be complete with "O" ring seals.
- b. All exterior bolts to be 316 stainless steel for road salt resistance.
- c. Operating nuts to be three (3) sided with each side being an arc 36.5mm long to local standards.
- d. Bottom connection to push-on type joint.
- e. Wrap all exterior bolts with Denso Mastic and Denso Tape.
- f. The hydrant depth of 2.8m includes a 600mm hydrant extension and breakaway flange.
- g. After installation, hydrants, barrels and caps to be painted to the following specification:
 - CGSB 1-GP-59M General Paint 16-202 Hi Vis Yellow
- h. Barrels shall be supplied with internal cathodic protection. Internal cathodic protection to be photographed at installation and photos provided to the City as part of the CCC package.

The City will inspect random hydrants for cathodic protection during CCC and FAC processes. See detail WR-07.

E. Valves and Valve Boxes

1. General

Valves shall be located such that:

- a. No more than 20 dwelling units are affected by a shutdown.
- b. No more than 2 hydrants are taken out of service during a shutdown.
- c. No more than 3 valves are required to affect a shutdown.
- d. Valves are required at each end of PULs and/or easements containing water mains. These valves can be located in the roadway.
- e. Back flow valves are required on all water services to commercial, industrial and institutional buildings or lots. The location of back flow valves must be shown on drawings.
- f. Valves shall be located at the projection of lot lines.

See Details WR-02 and WR-03.

2. Gate Valves

AWWA C509, standard iron body, epoxy coated, bronze mounted, resilient seat with non-rising stems, suitable for 1 MPa with push-on type coupling joints.

- a. All exterior bolts to be 304 stainless steel and wrapped in Denso™ Mastic and Denso™ Tape.
- b. Valves to open counter clockwise.

3. Valve Boxes

Cast iron or PVC valve boxes: three (3) piece sliding type A or screw type B adjustable over a minimum of 450mm complete with valve operating extension rod, 25mm x 25mm cross section, of such length that when set on valve operating nut, top of rod will not be more than 150mm below cover. Base to be large round type with minimum diameter of 300mm. Top of box to be marked "WATER". Set screws shall be removed prior to final adjustments.

4. Hot Tap Connections

When a hot tap connection is made to an existing water main, the hot tap valve may not be the main line valve. An additional valve will be required. Valve casing and operating rod for a hot tap valve should not be installed. (See detail WR-04) The location of the hot tap valve shall be identified on the as-built drawings. The Developer must notify the City of the date and time of the expected connection a minimum of 72 hours prior to a hot tap connection operation to allow a City representative to be present during the connection.

F. Cathodic Protection

1. All couplings, fittings and valves must be cathodically protected with 2.3kg (5lb) zinc anodes and all hydrants must be externally cathodically protected with a 5.5kg (12lb) zinc anode and an internal hydrant barrel anode. (See details WR-07 and WR-08)
2. Anodes shall be packaged in a permeable cloth bag or cardboard chip type tube containing a backfill mixture.
3. Connect wires to fittings with a Cadweld.
4. A certificate of compliance is required from manufacturer stating that the specifications as noted above have been met.
5. A minimum of 2 litres (0.5 gallons) of water is to be poured on each 2.3kg (5lb) anode, and 3 litres (0.75 gallons) on each 5.5kg (12lb) anode, to initiate the anode operation. An alternative is to soak the above anodes in water for a minimum of ten (10) minutes.

G. Backfilling

1. Pipe Bedding and Installation

- a. All pipes shall be selected to withstand the proposed imposed loads. Backfill material in the pipe zone shall be sand, free from organic material, and shall conform to the following gradation specification:

Sieve Size (mm)	Percent (%) Passing
10.0	100
5.0	70 – 100
0.16	5 – 20
0.08	0 - 12

- b. The trench width in the pipe zone (to 300mm above top of pipe) shall be kept to a practical minimum and shall be a minimum of two (2) times the outside diameter of the pipe or 450mm (whichever is greater). See Detail GL-03.
- c. The bedding and initial backfill shall extend to 300mm above the top of pipe for the full width of the trench. The minimum depth of bedding below the pipe shall be 100mm.

2. Trenching and Backfilling

- a. All trenching shall be in conformance with Occupational Health and Safety regulations or in accordance with the specific recommendations of a Professional Engineer registered in the Province of Alberta.
- b. Development documents shall ensure contractors are aware of and familiar with all safe procedures for pipeline and utility crossings as per the Utility Safety Partners.
- c. The Developer shall have a geotechnical report prepared by a Professional Engineer relating to pipe foundations and trenching conditions as part of the detail design of sewer systems. This report shall contain specific recommendations relating to site conditions that may be unsuitable for pipe support or pose trenching conditions that will require use of structural support.

- d. Where suitable foundations exist for pipe support, Class B bedding shall be the minimum standard of pipe support. (See detail GL-01)
- e. Backfilling within the pipe zone shall be done uniformly on both sides of the pipe in 100mm layers to a minimum of 97% of a STANDARD Proctor density.
- f. Backfilling above the pipe zone shall be compacted as follows:
 - Backfill material above the pipe zone shall be free from organic material and shall be compacted in maximum 300mm layers.
 - To within 1.5m of finished ground, material shall achieve a density equal to 95% of a STANDARD Proctor density or greater. Moisture content shall be limited to a maximum of 5% over the optimum moisture content for the material.
 - Within the uppermost 1.5m of finished ground, material shall achieve a density equal to 98% of a STANDARD Proctor density or greater. Where sanitary/storm/water mains/services are being placed parallel, the uppermost 1.5m of trench material shall be placed and compacted uniformly across all adjoining trenches after servicing.
 - Shallow bury Utility trenches shall be considered to be in the uppermost 1.5m and shall achieve the above standard.
 - Frozen material shall not be acceptable backfill.
 - Compaction testing will be based on a minimum of one (1) density test per 100 lineal metres of trench for each 0.6m of depth. If a density test indicates insufficient compaction at any depth, then two (2) more densities, which are proportionally representative of the trench length, will be taken at that depth. Then if the average of the three (3) tests is below the required density, the area will be re-compacted to meet the specified density.
 - If the above compaction standards cannot be achieved because of abnormal weather or wet ground conditions, the City Engineer may, at their sole discretion, establish a more appropriate standard for the individual case upon receipt of an acceptable proposal from the Developer's engineer.
 - If there is pavement restoration required it must follow the asphalt pavement requirements of section VII.K. and detail drawing GL-04.

H. Testing

1. Disinfection of Completed Water Main

Before being placed in service, and before certification of completion by the City, all new water systems, renewal/upgrading construction, extension to existing systems or valved section of such extensions, any replacement in the existing water systems, or any exposed section of the existing systems, shall be disinfected according to AWWA Standard C651-14 and tested for bacteria content and chlorine residual to the satisfaction of the City.

Prior to chlorination, all construction must be thoroughly flushed. Before flushing can begin, the Developer's Consulting Engineer or contractor must notify the City's Public Works office to obtain

a flushing meter that is to be used at all times during this operation. The sole purpose of the flushing meter is to account for non-metered water loss calculations. This is for information purposes only, NOT FOR BILLING PURPOSES. Extreme care must be taken during these operations to ensure no contamination of the adjacent works occurs prior to, during, and subsequent to any flushing and chlorination. Note that special measures must be taken during flushing of heavily chlorinated water from service lines.

ALL flushing water must be dechlorinated prior to discharge to the sanitary or storm sewers. Flushing to sanitary sewers is preferred and to storm sewers only with prior approval from the City. De-chlorination resulting levels must be logged and provided to the City.

A standard disinfection procedure consists of:

- a. Preventing contaminating materials from entering the water during storage, construction or repair.
- b. Removing, by flushing and other means, those materials that may have entered the water main.
- c. Chlorinating any residual contamination that may remain, and flushing the chlorinated water from the main.

Sampling for chlorine residual includes two test: high concentration chlorine residual at the beginning and end of the primary disinfection period; and sampling for low concentration chlorine residual once the water main has been flushed. The best location for sampling residual chlorine is at the bacteriological sampling locations.

It is mandatory that boundary valves are to be operated by City staff only.

2. Bacteriological Tests

Refer to AWWA applicable standards with additional requirements for the minimum acceptable bacterial level as follows:

- a. A sample must show the absence of coliform organisms; and
- b. The total bacteria count shall not be greater than 300 organisms per millilitre.
- c. If 1 to 10 coliform organisms are detected in the initial sampling, then the site should be re-sampled. If the presence of coliforms is confirmed then the disinfection and bacteriological sampling cycle shall be repeated.
- d. If there are 10 or more coliform organisms and/or the total bacteria count is greater than 300, the disinfection-bacteriological sampling cycle shall be repeated.
- e. It shall be the responsibility of the Developer to ensure that water from newly constructed water mains will not be used for drinking or other domestic purposes until the mains have been disinfected, and samples have been taken and certified by an approved laboratory as being free from bacterial contamination.

3. Cross Connection/Back Flow Device

Back flow devices must be installed in all commercial, industrial and institutional buildings to prevent the potential risk of contaminants entering the distribution system through back flow or

back siphonage. All back flow devices must be tested and records maintained and submitted to the City Public Works department on an annual basis.

4. Combined Pressure and Leakage

Prior to any combined pressure and leakage testing, the Developer must give twenty-four (24) hours notice to the City to witness the test. All distribution mains shall be subject to a pressure test of not less than 1035 kPa and must last for a minimum duration of two (2) hours. Test sections shall not exceed 450m of distribution main.

The allowable leakage shall be determined by the following formula from AWWA Manual No. M23 (PVC pipe – Design and Installation):

$$\text{Allowable leakage: } L_m = \frac{HJD \sqrt{P}}{128300}$$

where: J = number of joints

D = diameter of pipe in mm

P = average test pressure, kPa

H = test duration in hours

*Leakage allowance for new construction of materials other than PVC shall be in accordance with the applicable AWWA Standard or as specified by the City.

I. Sampling Stations

1. Sampling stations shall be installed where specified by the City. The location shall be coordinated with the Developer upon review of development proposal drawings.
2. Sampling station design (detail WR-12) must include at minimum the following:
 - Sampling stations shall be minimum 2.8 metre bury depth with ¾ inch FIP inlet, and a ¾ inch nozzle.
 - All stations shall be enclosed in a lockable, non-removable, aluminum cast housing.
 - When enclosure is opened the station shall not require a key to operate and the water shall only contact brass along its flow path.
 - All working parts shall be constructed of brass and be serviceable without excavation required.
 - Exterior piping shall be brass or galvanized material.
 - A copper vent tube shall be provided to enable purging of water from the station to prevent freezing and to minimize potential bacterial growth.

SECTION IV – SANITARY SEWER COLLECTION SYSTEM

The sanitary sewer collection system in a new development shall conform to the City's most current "Sanitary Sewer Master Plan".

The minimum size of the main shall be 200mm diameter.

A. Mains and Design

1. Design Flows

The design flows for sanitary sewers shall be computed as follows:

a. Total Design Flow

Total design flow (Q) shall be calculated as per the Sanitary Sewer Master Plan, as follows:

$$Q = 1.2 * (Q_R + Q_{CI} + Q_{II})$$

Where:

Q_R = Peak dry weather residential flow,

Q_{CI} = Peak dry weather commercial/industrial flow,

Q_{II} = Peak inflow & infiltration.

b. Residential Dry-Weather Flow

$$Q_R = P * ADWF * PF$$

Where:

P = Population

ADWF = Average dry-weather flow

PF = Harmon's Peaking Factor

Where an Area Structure Plan (ASP) is available, residential populations shall be determined as provided in the ASP.

Where an Area Structure Plan is not available, an average population of 60 people per gross hectare shall be used for planning purposes.

Gross hectare includes lots, parks and streets.

Average dry-weather flow rate = 300 L/c/day.

$$PF = 1 + (14 / (4 + p^{0.5})), \text{ to maximum of } 3.5$$

Where:

p = population in 1000's

c. Commercial and Industrial Dry-Weather Flow

$$Q_{CI} = ADWF * PF$$

Where:

ADWF = Average dry-weather flow

PF = Peaking Factor = 3.5

A minimum average dry-weather flow generation rate of 0.2 L/s/ha shall be used, but should be increased if heavy water users are expected.

d. Inflow/Infiltration

Storm inflow/infiltration rate $Q_{II} = 0.28 \text{ L/s/ha} \times (\text{Catchment area ha})$

No weeping tiles shall be connected to the sanitary sewer.

No sanitary manholes are allowed in sag locations. All manhole frame and covers in roadways are to be model NF-80.

Inflow/infiltration rates in existing neighbourhoods developed before 2012 shall be estimated as per Sanitary Sewer Master Plan unless indicated otherwise by site-specific flow monitoring and modeling.

e. Pipe Size and Grade

Pipes shall be sized to have a pipe full capacity greater than or equal to the Design Flow outlined above and shall be calculated using the Manning equation with an “n” value of 0.013.

Sanitary sewers shall be designed for a minimum velocity of 0.6 m/s and a maximum velocity of 3.0 m/s subject to the following sizes, and a minimum size of 200mm diameter.

Sewer Size (mm)	Minimum Slope (%)
200	0.4
250	0.28
300	0.22
375	0.15
450	0.12
525	0.10
600	0.10

2. Alignments

Sanitary Sewers in streets shall generally be located as illustrated on Detail Drawings CS-01 to CS-03. The minimum separation between parallel mains is 3.0m.

3. Curved Sewers

Although it is recommended that the sanitary sewers be laid in a straight alignment between manholes, curved sewers will be permitted with the following restrictions:

- a. The sewer shall be laid as per the manufacturer's recommendation or following the table below, whichever is greater.

Centerline Sewer Radius (m)	Increase in 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	125
>300	0	135

- b. The curve shall run parallel to the street centre line.
- c. Lengths of pipe shall be such that deflections at each joint shall be less than the allowable maximum recommended by the manufacturer.

4. Depth of Bury

Sanitary Sewers shall be designed at a minimum depth of 2.8m from the road, alley or utility lot grade to top of pipe. The design of sanitary sewer systems shall take every effort to avoid the need for insulation, should insulation be required it must follow detail GL-02 or the manufacturer instructions, whichever is more stringent. The depth shall be such as to provide gravity flow from all basements into the system. Additionally, Sanitary Sewers shall be designed to eliminate the need for service risers where ever possible.

Any deep service connections, greater than 4.0m at the main, need prior approval of the City.

5. Material

Approved materials for use are as follows:

- a. Concrete Pipe conforming to ASTM C14, ASTM C76 and manufactured with sulfate resistant cement.
- b. PVC Pipe conforming to ASTM D3034 minimum Class SDR35. PVC pipe shall be any colour except blue.
- c. Lift stations, low pressure sewers and force mains are to be avoided wherever possible. Should they be required, the design criteria must be agreed to by the City before the system is designed and constructed.

B. Manholes

1. Manholes shall be provided at the following locations:

- a. At a maximum spacing of 150m;
- b. At the end of each line;
- c. At all grade changes;

- d. At all alignment changes;
- e. At all junctions;
- f. At changes in pipe diameter.

See details SY-01 and SY-05.

2. Drop Manholes

An interior drop manhole is required when the difference in elevation between the incoming and outgoing inverts is greater than 600mm and the incoming pipe diameter is 300mm or less. (See Detail SY-02 and SY-03) Where the incoming sewer pipe is greater than 300mm the design of the drop shall be specific to the drop conditions and address flow impingement, air circulation and flow velocity.

3. Sampling Manholes

Sampling manholes are required on all non-residential/multi-family sites; multi-family and condominium developments to the satisfaction of the City. Manholes are to be located within public property minimum 300mm from property line. Multi-family is defined as residential development containing three (3) or more dwellings contained on one site on a single service line. Condominium development is defined as a group of housing units where individual owners have full certificate of title to the unit along with an undivided interest in the common property serving the development.

4. Types of Manholes

- a. Standard 1200mm diameter precast manhole shall be used. (Detail SY-01)
- b. Precast manhole vaults may be used if approved by the City.
- c. All Sanitary manholes shall be supplied with the TF/NF-80 frame and cover (Detail SY-05) and shall be located outside of ponding areas. Single hole in manhole cover shall be plugged. Where sanitary manholes are completely unavoidable in low areas or potential ponding areas, alternative design must be submitted to the City for approval prior to construction. All municipal castings for the City shall conform to:
 - ASTM A48 / A48M – 03 (2008), gray iron castings
 - ASTM A536 – 84(2009), ductile iron castings
 - AASHTO M306 – 10, HS-20 proof load test (178kN), tests certified by a professional engineer licenced in Canada or the United States of America.
 - Reference to Federal Specifications in AASHTO M306-10 is deleted.
- d. T-Riser manholes can be used on 1200mm and larger concrete sewers. The base on the T-Riser must be bedded in concrete as per manufacturer requirements. See Detail SM-03
- e. Perched manholes shall be avoided where possible. Where necessary, ensure the base is a minimum of 300mm thick and has two layers of 10M bars, 150mm spacing both ways, with the layers separated by 150mm in cast in place bases. Any perched manhole deeper than 6m shall have detailed design confirmation of structural design of the base. See Detail SM-02.

C. Backfilling

See Section III.G

D. Testing

1. Closed circuit television inspection (CCTV)

- a. All new or modified sewer mains and service laterals shall be CCTV inspected performed to the standard practices as set out in the North American Association of Pipeline Inspectors (NAAPI) guidelines, and to be performed within 45 days of the issuance of the CCC and FAC. Sewers shall be cleaned and flushed prior to each CCTV inspection. CCTV reports must include both the main and, at a minimum, a pan and tilt view up each service connection.
- b. A CCTV inspection report in both written and electronic format (pdf) along with clear pipe video footage shall be submitted to the City for review. The report shall include typical still images of the pipe as well as problem areas encountered. Electronic media for video footage to be acceptable to the City. Reports or footage that is deemed insufficient or unclear will be rejected and must be re-submitted to the City with acceptable quality.
- c. The City may require further testing to confirm sewers have been constructed correctly.
Where closed circuit television (CCTV) or visual walk-through inspections show evidence of deflection, the Developer may be required to complete a mandrel test with maximum allowable deflection of 7.5% at FAC.

SECTION V – STORMWATER MANAGEMENT SYSTEM

The stormwater management system in a new development shall conform to the City's most current version of the "Stormwater Master Plan".

A. Mains and Designs

The design formula for storm run-off shall be the Rational Method for catchments of 65ha and smaller. All larger catchments and storm pond design shall be based on computer model. The preferred computer model software is PCSWMM. Run-off from residential downspouts (roof leaders) may be required in the design of the minor system at the request of the City.

1. The following shall be used for the Rational Method:

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

Where: Q = Discharge in m³ per second
C = Run-off coefficient
A = Area in hectares
I = Intensity of rainfall (mm/hr)

2. Intensity of Rainfall

The intensity of rainfall shall be determined by using the current City of Edmonton's IDF curves.

3. Run-off Coefficient

Minimum run-off coefficient's for various land uses are listed below. A lower run-off coefficient value may be accepted if suitable justification is provided by the Developer.

Land Use	Run-off Coefficient (C)
Grassed Area, Parks	0.10
Single Family Homes	0.55
Duplex Homes	0.60
Multi-Family Residential	0.65
Industrial	0.70
Neighborhood Commercial	0.90
Large Commercial	0.90
Pavement, Roof Areas	0.95

Typical run-off coefficients for zoning codes are provided below. This table is provided to guide preliminary planning engineering work only and designers must evaluate suitable C values as final land uses are determined subject to City review.

Land Use Zone	Typical Run-off Coefficient (C)
R1, GPL, RE1, RE2, RMHS	0.55 – 0.65
R2, RMHC, HLC	0.60 – 0.75
C1, C2, M1	0.70 – 0.90
C3, C4	0.85 – 0.90
PS	0.35 – 0.75
P1	0.10 – 0.30
P2, UR	0.10 – 0.15
DC	Analysis Required

4. Inlet Time

A maximum inlet time of 10 minutes will be used.

5. Pipes shall be sloped to carry the design flow at a minimum velocity of 0.75 m/sec. Where velocities in excess of 3 m/sec are attained, special provision shall be made to protect against displacement by erosion or impact.

6. Pipe Sizing

Pipe sizing shall be determined by utilizing Manning's Formula, using an "n" value of 0.013. The minimum size of the storm sewer shall be 300mm diameter. Design slopes based on a minimum velocity of 0.75m/s for pipe flowing at least half full and a minimum of 0.10%.

Sewer Size (mm)	Minimum Slope (%)
300	0.30
375	0.22
450	0.18
525	0.10
600 and larger	0.10

7. Minor/Major Storm Systems

The minor system shall be designed to accommodate the 1:5 year storm event and not cause ponding of water. The major system shall be designed as overland flow to accommodate the 1:100 year storm. The major system shall utilize roads, ditches and swales designed to allow the flows to drain to a storm water management facility and prevent flooding of private property. Ponding in trapped sags shall be limited to 0.3m in the 1:100 year 4 hour storm event.

8. Lot Drainage

Laneless subdivisions shall drain from the rear of the lot towards the front and onto the street.

If drainage to the rear of a laneless lot cannot be avoided the drainage patterns at the rear of the lot shall be contained by a typical concrete swale and protected by a 2.0m wide easement (see Detail TN-04) until it can reach a public road or catch basin. Design runoff is to be contained within the swales in straight sections as well as at any bends in swales. The design capacity of the swale for the 1:100 year storm shall include analysis of the concrete swale plus landscaped area that forms part of the conveyance channel around the concrete swale within the easement.

All concrete swales to have a minimum of 0.6% slope. Alignments of swale are to avoid 90 degree bends. Where bends are required, a specific design is required to contain the design flow within the concrete swale. The design elements may require a high backed swale to contain the flow at the corner. All swale flow shall not drain across sidewalks but be captured in a catch basin before crossing a sidewalk or drain into a landscaped area designed to handle the expected flows.

Swales located within private property must be concrete. Grass or rip-rap swales are not acceptable.

Detailed design calculations, model results and design details must be submitted to the City for review. Catchment areas are to be shown on the detailed drawings.

In any location where swales are near retaining walls or where the swale, if overtopped, would drain onto an adjacent lot, the designer shall use a high-back swale or contact the City for special approval prior to design completion. These situations are to be avoided in design.

In the case where alleys are provided, drainage will be allowed to the alleys. All lots shall provide positive drainage. Lot drainage shall conform to one of the options outlined on Detail SM-07A and SM-07B. **For industrial lots only, common property lines shall have a minimum grade of 1.5%.**

9. Alignment

Storm sewers shall generally be located in the road right-of-way at a distance of a minimum 3m from the centreline of the right-of-way.

Storm sewers may be installed in a curvilinear alignment provided that:

- a. The sewer is laid in a simple curve of radius equal to or greater than 60m.
- b. The curve shall run generally parallel with the right-of-way centreline.
- c. Deflection shall be kept within the manufacturer's specifications.
- d. The minimum grade shall be 50% greater than straight alignments.
- e. Manholes shall be placed at the beginning and end of curves and spaced at intervals not exceeding 90m

10. Depth of Bury

~~All minimum cover over storm sewer mains shall be 1.8m.~~

All storm sewer mains and services shall have a minimum cover of 1.8m measured from the finished grade to the top of the pipe. Similarly, catch basin leads must maintain a minimum depth of cover of 1.5m.

When the minimum depth of cover cannot be achieved, insulation shall be provided to protect the storm infrastructure from frost penetration. Insulation must conform to the requirements specified in Detail GL-02 or the manufacturer's instructions, whichever is more stringent. Designs incorporating insulation must be reviewed and approved by the City prior to construction.

11. Material

All material used for storm sewer mains shall be of approved standards as listed below:

a. ***Non-Reinforced Concrete Pipe***

Shall conform to standard specifications for Non-Reinforced Concrete sewer (ASTM C14), complete with rubber gasket, and manufactured using sulfate resistant cement.

b. ***Reinforced Concrete Pipe***

Shall conform to standard specifications for Reinforced Concrete Sewer (ASTM C76), complete with rubber gasket, and manufactured using sulfate resistant cement.

c. ***PVC Pipe***

Shall conform to standard specifications for solid wall, SDR 35 PVC pipe (ASTM D3034). No profile wall pipe is to be used.

12. Roof Leader Stormwater Collection

a. **Residential**

Collection of roof leader runoff water is to be incorporated into the residential lot storm service line **only where** requested by the City. Sewer piping shall be designed to carry the expected runoff from 1:5 year 4hr storm in non-surcharged pipe flow. Service pipes to lots must be sized based on the expected flows. Design calculations for the typical lot must be shown on the drawings along with roof size, runoff model information, design flow and pipe velocity flow and full flow.

b. **Non-Residential**

Collection of roof leader water is to be incorporated into the non-residential lot storm service. Storm sewer pipe and service laterals must be sized to accommodate expected flows. Design calculations for the typical lot be shown on the drawings.

13. Sump Pump Discharge Collection System

a. **General**

A sump pump discharge collection system is required in all new developing areas. The system must be provided to property line in all newly developed single-family detached, semi-detached, and multi-unit residential lots. The system shall be dedicated to the collection of weeping tile flows and other storm water (i.e. roof leaders when requested by the City). The system will be installed to the maximum depth the receiving storm sewer system will allow.

Detail drawings SE-05 to SE-07 outline how the sump pumps shall be connected at building(s) to ensure proper sump discharge to the storm service.

b. **Alignment**

The system will be generally installed 3.0m from the centreline of the road where there is no storm sewer to connect the service lines.

c. **Sizing and Material**

Minimum pipe size and grade:	250mm – 0.38% if tied to roof leaders 200mm – 1.0%
Service connection minimum size and grade	150mm – 2.0%

Material to be PVC SDR35 and the system must be sized for required capacity, the above is the minimum requirements.

B. Manholes

1. Manhole Location

Manholes shall be provided at the following locations:

- a. at a maximum spacing of 150m for all mains;
- b. special study required to determine optimum spacing for mains 1500mm and above;
- c. at changes in pipe diameter;

- d. at grade changes;
- e. at alignment changes;
- f. at the end of each line.

The maximum spacing of storm sewer manholes may be required to be reduced by 50% on curvilinear alignments.

All manholes shall be supplied with the TF/NF-80 floating frame and cover (see Detail SM-06).

All municipal castings for the City shall conform to:

- ASTM A48/A48M-03 (2008), gray iron castings
- ASTM A536 – 84 (2009), ductile iron castings.
- AASHTO M306 – 10, HS-20 proof load test (178kN), tests certified by a professional engineer licensed in Canada or the United States of America.
- Reference to Federal Specifications in AASHTO M306-10 is deleted.

2. Types of Manholes

- a. Standard 1200mm diameter precast manholes shall be used on mains 600mm in diameter or less, as shown on Detail SM-01.
- b. A “Perched” manhole shall be used on mains 625mm to 1050mm in diameter, as shown on Detail Drawing SM-02.
- c. A “T-Riser” manhole shall be used on mains 1200mm in diameter and larger, providing that there is no deflection in alignment or change in grade. (See Detail Drawing SM-03)

The City must approve all precast manhole vaults.

3. Oil and Grit Separator Manholes

Oil and grit separator (O & GS), manholes are to be installed where required by the City to protect storm water quality. Water quality devices to be sized based on expected storm flows and contaminant loading. Design assumptions and calculations to be submitted for review with each proposed installation.

O & GS manholes shall be installed, at a minimum, at the entrance to the City storm facilities. The City may request that O & GS manholes be installed at private lots where sediment is generated. These devices are intended to protect the City's infrastructure from excess sediment loads.

C. **Catchbasins**

1. Catchbasins

Surface drainage shall not run a distance greater than 150m in streets or 200m in alleys, utility lots and walkways. Catchbasins shall be set back from intersections and shall not conflict with future driveways. Catchbasins shall be depressed into the curb and gutter as per detail drawing TN-10.

Catchbasins will be required at the end of concrete swales, as deemed necessary by the City, to avoid surface drainage across walkways and/or trails.

2. Catchbasin Leads

Catchbasin leads shall connect directly to manholes. Single catchbasins require 250mm diameter leads and all leads shall have a minimum 2% grade. Capacity of the catchbasin leads shall be confirmed and the 250mm size shall be increased as needed.

The length of a catchbasin lead shall not exceed 30m. Catchbasin leads shall be concrete or solid wall PVC (SDR35) within local and collector residential roads.

Catchbasin leads are required to discharge into a manhole or a catchbasin manhole and shall not be directly connected to a downstream catchbasin.

3. Twinned Catchbasins

If a twinned catchbasin is required to drain an area, the twinned unit shall consist of a catchbasin and a catchbasin manhole interconnected by means of a 250mm pipe or larger if required. The lead from the catchbasin manhole to the mainline manhole shall be a minimum of 300mm diameter and have a minimum grade of 2%. The capacity of the lead shall be sufficient to carry the design flow to the catchbasins.

4. Types of Catchbasins and Catchbasin Manholes

All catchbasins shall be built with a 900mm barrel (see Detail SM-04), Catchbasin manholes shall be built with a 1200mm barrel (see Detail SM-05).

All catchbasin rings must have the same alignment as the barrel. No staggering or stepping of rings allowed.

The following is a list of accepted catchbasin frames and covers. Other catchbasin assemblies may be used upon approval by the City.

- F-39
- F-51 with side inlet
- F-36 (1 piece)
- DK-7
- K-7
- F-38

All municipal castings for the City shall conform to:

- ASTM A48 / A48M-03 (2008), gray iron castings
- ASTM A536 – 84 (2009), ductile iron castings
- AASHTO M306 – 10, HS-20 proof load test (178kN), tests certified by a professional engineer licensed in Canada or the United States of America.
- Reference to Federal Specifications in AASHTO M306-10 is deleted.

D. Testing

Test all storm sewers as per Section IV.D.

E. Storm Water Management Facilities

1. Storm PUL

All stormwater storage facilities are to be designed to contain the design storm runoff wholly within the designed PUL.

2. Design

The Storm Water Management Facility (SWMF) shall be designed to contain runoff in excess of predevelopment rates on a temporary basis. Ponds are to be designed to accommodate the 1:100 year 24 hour duration storm using the Huff Distribution.

Predevelopment rates shall be used as follows:

- a. 1.8 l/sec/ha for the area draining into Dog Creek south of Highway 16A;
- b. 2.5 l/sec/ha for all other areas.

SWMF shall be designed and constructed for water quality to reduce the Total Suspended Solids (TTS) to at least 85% for a particle size of 75µm.

Detail drawings SM-08 to SM-12 contain details on culverts, inlets/outlets, rip rap and screens that may be required for the ponds.

A temporary ditch leading to the SWMF shall have, at minimum, a sediment trap and slope stabilization measures. The discharge pipe shall have Class A bedding underneath the last two(2) joints including the flared end.

3. Dry Ponds

- a. Should only be used when topological or planning constraints exist that limit the use of wet ponds or wetlands.
- b. Should only be used when downstream water quality system is in place.
- c. Designed to store the 1:100 runoff event to predevelopment flow rates.
- d. Maximum active retention storage depth of 1.5m.
- e. Maximum water level should be below the adjacent footing levels.
- f. Maximum slopes of 5:1.
- g. Minimum freeboard of 0.5m.
- h. Minimum building opening 0.5m above freeboard.
- i. Minimum bottom of pond slope of 1%.
- j. Must be inspected before placement of soil coverage. Soil must be placed within 30 days following the inspection:
 - a. Topsoil and seed/hydroseed
 - b. Tackifier on clay

- k. Must be landscaped and constructed to restrict erosion. Turf will be established to the satisfaction of the City prior to FAC inspection.

4. Wet Ponds

- a. Designed to store the 1:100 runoff event to predevelopment flow rates.
- b. Maximum slope above active storage zone is 4:1.
- c. Maximum slope in active storage zone is 5:1.
- d. Minimum permanent pool depth of 2.0m.
- e. Maximum active detention storage depth of 2.0m. The maximum water level should be below the adjacent footing levels.
- f. Minimum freeboard of 0.5m.
- g. Minimum building opening 0.5m above freeboard.
- h. May require downstream water quality system. The establishment of vegetative zones in and around a wet pond can enhance the pollutant removal capacity.
- i. Must be inspected before placement of soil coverage. Soil must be placed within 30 days following the inspection:
 - a. Topsoil and seed/hydroseed
 - b. Tackifier on clay
- j. Must be landscaped in accordance to Section X.B. Turf will be established to the satisfaction of the City prior to FAC inspection.
- k. Prior to allowing water into pond, warning signs must be posted on the perimeter of wet ponds to prohibit activities that may present a danger to public health and safety or interfere with the operation of the facility. (See Detail Drawings SN-05 to SN-07)

5. Constructed Wetlands

- a. Designed to store the 1:100 runoff event to predevelopment flow rates.
- b. Maximum slope above active storage zone is 4:1.
- c. Approximately 10% of the wetland surface area should be a 1.5m – 2.0m deep fore bay upstream of the wetland area for settle-able solids removal.
- d. Average active water depth of 0.3m with 1.0m deep zones for flow redistribution.
- e. Bottom slope of 1%.
- f. Maximum active pool depth of 1.5m. The maximum water level should be below the adjacent footing levels.
- g. Minimum freeboard of 0.5m.

- h. Minimum building opening 0.5m above freeboard.
- i. Must be landscaped in accordance with Section X.B.
- j. Prior to allowing water into pond, warning signs must be posted on the perimeter of wetlands to prohibit activities that may present a danger to public health and safety or interfere with the operation of the facility. (See Detail Drawings SN-05 to SN-07)

F. Storm Water on Private Development

Storm water management shall be practiced on all non-residential sites as required. Each site shall be evaluated and discharges to existing SWMF shall be to the approval of the City. See also Oil & Grit Separators section above.

G. Backfilling

See Section III.G.

SECTION VI – SERVICE CONNECTIONS

Service connections shall be placed as illustrated in Details SE-01 to SE-04.

The minimum size of service for single-family detached, semi-detached and street oriented row housing units shall be as follows:

Water	20mm diameter
Sanitary	100mm diameter
Storm	150mm diameter

Service connections for commercial, industrial, institutional and multi-family developments shall be a minimum of:

Water	25mm diameter
Sanitary	150mm diameter
Storm	150mm diameter

Services connections must be sized according to the anticipated site requirements and shall include sewer mains, water mains, catch basins, catch basin leads, catch basin manholes, and manholes as required to manage onsite drainage and servicing.

A. General

1. Services larger than those indicated will be required when, in the opinion of the City, the length of the service pipe or other conditions warrants.
2. The size and location of services to non-residential, row housing developments and multi-unit residential buildings shall be subject to the approval of the City.
3. Each single-family detached, semi-detached and street oriented row housing units must have a separate service.
 - a. Depth of Bury
Water and Sanitary Service lines shall be designed to have a minimum depth of bury from invert of service to finished grade of 2.6m.
 - b. Alignment
The sanitary, storm and water services shall be laid in a single trench to the alignments shown in Details SE-01 and SE-02. The water service cc shall be marked on the sidewalk in front with a stamp in the concrete, as per detail drawing TN-11.

Where the water service is larger than 50mm, water service pipes shall be located in a separate trench, at least 3m from any sewer services and 2m from any other buried utility lines.

B. Water Service Connections

1. General
Wherever possible, tap main under pressure. Service connections shall be tapped into the upper portion of the water main at a minimum angle of 45° from horizontal. Tappings shall have a minimum spacing of 600mm. Use tapping machine to tap and thread CC into the main. Use

special care to prevent cuttings from falling into the main. Lay the service on 75mm of clean inorganic sand to the designated location of the curb stop. Attach curb stop and set service box to grade. Brace boxes securely to keep plumb during backfilling. Test for operation both before and after pressure test.

A 5.5kg zinc anode shall be clamped to the service line and CC consistent with Detail SE-03.

Maximum size of tapping without utilizing service clamps shall be:

- 20mm tap on a 150mm Main
- 25mm tap on a 200mm Main

Once a building has the water service connected it must have a water meter installed. Detail drawing WR-10 has the meter setting guidelines.

2. Materials

a. Water Service Pipe shall be copper, PEXa (cross linked polyethylene), PEX-AL-PEX (x-linked polyethylene and aluminum), or acceptable alternative

- For pipe greater than 25 mm, and up to 50 mm diameter, water service pipe shall be copper, or acceptable alternative,
- Copper water service pipe shall be Type K copper pipe conforming to ASTM-B88, and complying with AWWA-C800
- PEX-AL-PEX water service pipe shall conform to ASTM-F1281 and CAN/CSA-B137.10, or accepted alternate
- PEXa water service pipe shall conform to AWWA C 904, ASTM F876, CSA B137.5, NSF 14, NSF 61 and PPI TR-4, and shall be:
 - Manufactured using the high-pressure peroxide method of crosslinking.
 - Rated for 200 psi @ 73.4°F (1379 KPa @ 23°C)
 - Compatible for use with AWWA C800 when using the manufacturers recommended stainless steel insert.
 - Having the minimum markings: PEXa 3306, CSA B137.5, ASTM F876, F2023 and F2080, NSF-pw.
 - 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 4.5.1.1.1 and 4.5.1.1.3.
 - Water service connections may require insulation if crossing storm or sanitary lines, and/or other shallow utilities. Urecon or accepted alternate. If insulation is required, design detail of insulation must be provided to the City for review.

b. Main Stops

- For copper pipe, main stops shall be compression type, conforming to AWWA-C800. Must meeting NSF 61 requirements.
- For PEX-AL-PEX and PEXa pipe, main stops shall conform to AWWA-C800. Cambridge Brass, or accepted alternate.

c. Curb Stops

- Cambridge Brass 202NL-H3H3, 202NL-H4H4, 202NL-H5H5, 202NL-H6H6, 202NL-H7H7;
- Ford B44-333 for 20mm and B44-444 for 25mm;

- Mueller, Oriseal Mark II 25155N;
- Conforming to AWWA-C800

All curb stops boxes to be epoxy coated with stainless steel rods.

- d. Service Saddles
40mm and 50mm only, bronze body with stainless steel straps
 - Robar #2706
 - Romac #202BS
- e. Material for Water Service that are 150mm and larger shall be PVC in accordance with AWWA C-900.
- f. CC Chairs
 - To suit curb stop manufacturer 20mm – 50mm.
- g. Service Clamps
 - Required where main stop exceeds 20mm (for 150mm diameter mains) and 25mm (for 200mm to 400mm diameter mains).
 - To be made from stainless steel.

C. Sewer Service Connections

1. General

In all new construction connect services to mains with manufactured tee or wye fitting placed in mains. Install service line at a uniform gradient as specified on a minimum of 75mm clean, inorganic sand. Support service lines adequately to prevent dislocation, buckling or settlement. Where water lines must be laid below sewer lines, ensure backfill over the water line is a minimum of 97% Standard Proctor density to prevent settlements. When a connection cannot be made directly into the house, plug the end of the sewer service to prevent entry of water and dirt.

Install services to existing sewers by cutting into mains and installing manufactured tee between saddle and main with mortar or other means acceptable to the City.

Services being tied directly into manholes cannot go through ladder rungs. Services must be aligned to avoid conflict with manhole ladder. A maximum of two (2) services may be installed to a manhole, with up to four (4) only being allowed at the end of cul-de-sacs.

Bends in the sewer service are permitted at these locations only:

- a. 45° bend with wye or 22.5° bend with tee connector at main.
- b. 45° bend at top of riser.
- c. 22.5° maximum bend at property line for house service connection.

2. Risers

Where services are required to connect to mains in excess of 4.25m deep, install risers and properly plug in accordance with Drawing SY-04. Firmly support risers and anchor to the trench wall to minimize the possibility of damage to the riser backfilling operations.

3. Materials

Sewer service shall be PSM PVC SDR35 conforming to CSA Specifications B182.2 or the latest revision thereof.

4. Backfill

See Section III.G.

D. Shallow Utility Services

The City requires a minimum separation of 1.5m between power and any water/sanitary services.

It is the Developers responsibility to ensure that utility trenches are adequately compacted. Within the roadway, including trails and walkways, 98% Standard Proctor Density is required; 95% in all other areas.

SECTION VII – ROADS

A. Classification and Design

Road classification and designation shall be in accordance with the classification system outlined in the Transportation Association of Canada Geometric Design Guide for Canadian Roads (TAC GDG). The following are minimum requirements to be used in the design of the roads.

The following is a list summarizing Street Classifications:

STREET CLASSIFICATION	STANDARD DRAWING NO.	RIGHT-OF-WAY WIDTH
Local Residential	CS-01	18.0
Minor Collector – Residential	CS-02	20.0
Major Collector – Residential	CS-02	24.0
Rural Industrial Collector	CS-03	30.0
Urban Industrial/Commercial Collector	CS-03	24.0
4-Lane Divided Arterial	CS-04	54.0
Alley/ Lane	CS-05	6.0

B. Design Criteria

Horizontal road alignment design shall be in accordance with TAC GDG and as supplemented in these Standards.

All roads shall be crowned or have a cross fall as shown on the applicable standard drawing. The minimum gutter grade shall be 0.6% and the maximum gutter grade shall be 6.0%. These minimum and maximum grades shall only be used when necessary. All lanes shall have a minimum grade of 0.75% and a maximum grade of 6.0%. Commercial and ~~lane~~ Alley crossings shall conform to detail drawings TN-07 and TN-08. Intersections shall be designed to provide smooth vehicle passage and provide drainage of the asphalt surface.

The maximum distance that any lot must be from a point of access is 120m. Any road longer than 120m needs a secondary point of access.

1. Vertical Curves

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

"K" VALUE		
Design Speed (km/hr)	Crest (m)	Sag (m)
50	7	13
60	11	18
70	17	23

$K = L/A$
L = Length of vertical curve in metres
A = Algebraic difference in grades (%)

*The minimum length of vertical curve shall be 45m.

2. The following geometric standards shall be used for urban roads:

CLASSIFICATION	DESIGN SPEED (KM/HR)	POSTED SPEED (KM/HR)	CURB RETURN RADIUS (m)	MIN INTERSECTION SPACING (m)
Local Residential	50	50 40	10	As needed
Minor Collector	50	40	10	60
Minor/Major Collector	50 /60	50/ 40 *	10	60
Minor Arterial	60	50	15 *	200
Major Arterial	70	60	15 *	400
4 Lane Arterial	70	60	15**	400
Rural Industrial	60	50	15**	60
Urban Industrial Collector/Commercial	60	50	15**	60

*Based on design calculations. Posted speed limit to be determined at the time of development.

DESIGN SPEED (km/hr)	MINIMUM RADIUS OF CURVE (m)
50	100
60	150
70	200

Curb Return Radii designated with ** should be confirmed with expected design vehicles' turning radii.

C. Access Management and Construction

Residential driveway accesses shall not access arterial roads or major collector roads which have projected traffic volumes of 4,000 vehicles per day, based on minimum of twelve (12) trips per dwelling per day external to the subdivision.

A single-lot property is permitted only one driveway. The number of driveways that will be permitted for Industrial, Commercial or multi-family lots (complexes with five or more dwelling units) depends on several factors:

- The density and type of land use
- The classification of the adjacent roadway
- The types of operations that will be permitted at the driveway
- The location and operating activity of existing driveways or local road connections

The implementation of joint accesses and/or common internal drives is encouraged.

All driveways should have a grade which falls between 5-8%, and must have a minimum grade of 2.0% and a maximum grade of 10.0%. Justification of steeper driveways must be provided to the City for approval prior to construction. Where lot grades are such that a driveway with a grade of greater than 10% is anticipated, garage foundation upstand walls may be required to lower the slope. Detail TN-16 and TN-17 shows the driveway tie-in to the roadway and required property line clearances.

Driveways adjacent to alleys must be framed and poured flush to within ¼" of the edge of pavement of the alley. All driveways exceeding ½" difference in elevation will be required to be removed and replaced.

Driveway extensions are to be concrete only within the road right-of-way and must be poured flush to within ¼" of the back of sidewalk or curb & gutter, whichever is being tied into. All driveway extensions within City right-of-way exceeding ½" difference in elevation will be required to be removed and replaced.

All driveways must meet tolerances noted at FAC and FAC will not be granted until all deficient driveways are corrected.

A minimum clearance of 1.0m 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.

Driveways shall not be permitted to connect to an abutting road through a curb return area **unless otherwise approved by the City. Whenever possible,** driveways on corner lots shall connect to the adjacent roadway with the least estimated traffic. ~~volume and be located a minimum of 10m from the front of curb of the adjacent roadway, that is, locate driveways outside of curb returns.~~

D. Pedestrian Accommodation at Intersection

All intersections shall be designed to address the needs of pedestrian movements. Alignments of sidewalks shall be coordinated with the overall geometry of the intersection to provide pedestrian access through the intersection. Where required at major intersections or mid-block crossings, crossing request buttons shall be located adjacent to sidewalks no greater than 150mm from the edge of walk or designated walking corridor across islands or medians. The button shall also be coordinated with other required signal and light poles. Crossing request buttons shall be accessible to all pedestrians whether standing or sitting. (See detail SN-09)

Audible signals are to be used at signalized intersections with high volumes of turning vehicles, unusual geometry, or high pedestrian activity into private lots. The City shall coordinate the audible signal locations with The Canadian National Institute for the Blind (CNIB).

E. Transportation Impact Assessments

Where the City determines that a new development may have a potential to create a significant impact on the transportation system or potential safety concerns, the developer may be required to conduct a Transportation Impact Assessment (TIA). This assessment should, as a minimum, include the following:

1. Background Information
 - a. Proposed development, including the name of the development/developer, location, type, size and staging.
 - b. Description of the Study Area, including a key map and site plan.
 - c. Horizon Years, Intended Phasing and Peak Period identification.
2. Existing Infrastructure Condition and Road Geometry
 - a. Existing roadway infrastructure conditions.
 - b. Existing intersection configurations and road geometry.
 - c. Existing traffic conditions (AADT, AM peak, and PM peak).
3. Traffic Projections
 - a. Existing/background traffic review;
 - i. Background traffic and annual traffic growth rate.
 - ii. Other area developments.
 - iii. Anticipated transportation network improvements.
4. Build Year
 - a. AM and PM peak projected background traffic.
 - b. Projected AM and PM development traffic (site generated, pass by/internal trips, and total trips).
 - c. Combined (background + development) AADT, AM and PM peak traffic.
5. Staging Year
 - a. AM and PM peak projected background traffic.
 - b. Projected AM and PM development traffic (site generated, pass by/internal trips, and total trips).
 - c. Combined (background + development) AADT, AM and PM peak traffic.
6. 20 Year Horizon (Post-Buildout)
 - a. AM and PM peak projected background traffic.
 - b. Projected AM and PM development traffic (site generated, pass by/internal trips, and total trips).
 - c. Combined (background + development) AADT, AM and PM peak traffic.
7. Trip Generation Rates
 - a. Traffic volumes generated by the proposed development shall be estimated using the latest edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual, unless local and more reliable trip generation data is available.
 - b. Adjustments to trip generation rates and generated traffic volumes to account for internal traffic, pass-by traffic and increased modal splits are permitted. All assumptions for Trip Distribution and Trip Assignments shall be clearly documented, justified and approved by the City.
8. Analysis
 - a. *Capacity Analysis*
 - i. Capacity analysis shall be completed for the AM and PM peak hours for all intersections within the study area for Background Volumes and Total Volumes for all analysis horizons. The City accepts both the Highway Capacity Manual (HCM) and Canadian Capacity Guide (CCG) methodologies of intersection analysis. Specific software package Synchro 9.0 or higher.
 - ii. The City's measures of effectiveness are:

- Average vehicle control delay.
 - Volume to Capacity (V/C) Ratio.
 - Level of Service (LOS), and;
 - 95th percentile queue lengths.
- iii. The City's performance thresholds are a maximum V/C ratio of 0.85, maximum LOS "D" and the 95th percentile queue length being contained within the existing/proposed storage bays (excluding taper length). These thresholds may be adjusted in cases where the base/existing scenario exceeds the typical thresholds, or other circumstances support the adjustment at the approval of the Engineering Department. For the 20 year analysis horizon, a maximum V/C ratio of 0.90 and LOS "E" may be considered acceptable, with approval of the Engineering Department.
- iv. A summary table should be provided in the text of the report. Detailed capacity analysis outputs should be provided in the appendix.
- b. *Geometric Analysis*
The following should be assessed to ensure conformance with TAC Guidelines:
- i. Separation of accesses from intersections.
 - ii. Provision or need of turning lanes, acceleration/deceleration lanes, etc.
 - iii. Separation of major private accesses (i.e. commercial driveways), or groups of private accesses from major intersections.
 - iv. Stopping sight distances, intersection sight distances, and intersection sightline triangle.
 - v. Location of any proposed trail crossings of the road network.
- c. *Signal Warrant Analysis*
The Canadian Traffic Signal Warrant Procedure from the Manual of Uniform Traffic Control Devices for Canada (MUTCDC) shall be used when determining the warrants for signalized intersections.
- d. *Illumination Warrant Analysis*
All intersections/accesses must be assessed to determine the requirement for full lighting, partial lighting, delineation lighting, or no lighting. Lighting warrants shall be determined based on TAC's Guide for the Design of Roadway Lighting.
- e. *Pedestrian Crossing Control*
The latest version of TAC's Pedestrian Crossing Control Guide shall be referred to for mid-block pedestrian crossing requirements.
- f. *Operational Analysis*
Intersection plans should be provided illustrating that the design vehicle can safely pass through the intersection. If the design vehicle is unable to properly make a specific turning movement with respect to the development, recommended revisions to the intersection layout are required.
- g. *Safety Analysis*
Potential safety or operational concerns associated with the following should be identified:
- i. Weaving, merging, queuing
 - ii. Conflicts with pedestrians, cyclists, heavy vehicles, and transit
 - iii. Corner clearances
 - iv. Sight distances
 - v. Access conflicts

h. *Parking Review*

The proposed parking supply should be compared to the minimum requirements as per the City of Spruce Grove Land Use Bylaw. Rationale and analysis for supplying parking greater or lower than the specified requirements shall be identified. Shared Parking assessment should be included when necessary.

9. Other Considerations

- a. Discussion of conformance to or deviation from City guidelines, Master Plans, studies or previous design reports including all existing and approved developments, as well as any justifications for deviations.

Assessment should include pedestrian and cyclist networks, and provision for transit requirements.

10. Conclusion and Recommendations

The TIA should summarize the findings of the various analyses conducted, including potential issues, and clearly outline the recommendations.

11. Appendices

Appendices must include all Synchro outputs for the analysis. These outputs shall be submitted in both digital and hard copy formats.

F. Noise Attenuation

A Noise Impact Assessment, signed and sealed by a professional engineer, must be provided where major arterial roadways or railways run through or adjacent to a proposed residential development. The assessment must outline the current noise levels, future noise levels, and identify noise attenuation measures required to achieve a maximum noise level of 65 dBA Leq over a 24 hour period.

G. Roundabout

1. Roundabouts shall be the preferred option for intersection designs on arterials and collector roads in new development areas where signalization is warranted. The City may accept the installation of a new signalized intersection if engineering rationale can be provided showing a roundabout was considered and the reason signalization was chosen.
2. If an intersection warrants a signal or all way stop in the future, the roundabout shall be the preferred option. Where there is an existing signalized or four-way stop control intersection and there are operational and safety problems with the current traffic control, then a roundabout shall be considered.
3. Roadway design, capacity analysis, traffic engineering, access management, typical signage, and landscaping with respect to roundabouts shall be carried out in accordance with the City's Municipal Development Standards, detail drawing CS-06 and CS-07, and detail drawing SN-08 provides cross-walk information, as well as the latest version of TAC's Canadian Roundabout Design Guide.

H. Cul-De-Sacs

1. The normal maximum length of a cul-de-sac is 120m. Where cul-de-sacs exceed 170m, a provision must be made for a 6m public utility lot for emergency access and water looping at the end of the cul-de-sac. The Developer is to provide the recommended structure for emergency access vehicles based on their Geotechnical Engineer's design for the conditions of the site.
2. The length of a cul-de-sac shall be measured along the centerline of the roadway, starting from the closest projected face of the curb of the intersecting street to the face of curb at the furthest point of the cul-de-sac bulb (As per detail TN-12).
3. Cul-de-sac islands are not permitted.
4. Layout of cul-de-sacs shall be as per Detail TN-12. Maintain the offset from the face of curb to the property line throughout the cul-de-sac as shown on the detail.

I. Temporary Turn Arouds

For areas that are phased there must be temporary turnarounds at the dead end of any road. These are considered temporary if the road will be further developed in the near future. If the road will be a dead end for five (5) or more years then it is not considered temporary and a permanent cul-de-sac shall be constructed.

The bulb of the temporary turn around shall be as per Detail TN-12A and must have surface drainage to an existing storm system. The temporary turnaround shall be constructed with the same gravel structure and must connect seamlessly with the incoming roadway. Gravel surface is acceptable while the road is being maintained by the Developer and shall be built up to match the finished asphalt elevation for a smooth transition.

It must be a paved surface, minimum of 50mm of asphalt, before the issuance of any final acceptance certificate, unless there is a signed Development Agreement for the adjacent phase of the subdivision. Consideration may be given to allowing the temporary turnaround to remain as a gravel surface for up to three (3) years if it meets the grading and drainage requirements and is developer maintained. Should there be maintenance issues, the developer will be required to pave the temporary turnaround. This must be requested in writing.

For any end of road structures or temporary turn arounds barricades must be placed to prevent any vehicular traffic from entering the adjacent lands or any areas that are restricted. The spacing must be such that it allows pedestrians to walk but disallows any vehicles to access. Spacing must be approved by the City.

J. Emergency Access

1. The primary access to a site will be connected to a roadway that has a minimum 9.5m width.
2. Spruce Grove Fire Services reserves the right to request additional access points as emergency access routes or secondary public accesses depending on the operational requirements, topography etc. of each site.
3. An additional temporary access is required when there are more than 100 lots, or the ability to have more than 100 households, with only one primary access to the subdivision.
4. All access routes, whether emergency or secondary shall be connected to a public thoroughfare and not to an alley or pedestrian pathway.

5. Emergency Access/Multi-Use Trails; these trails shall have the same structure as multi-use trails but will have a width of 3.0m to allow for the passage of emergency vehicles or emergency egress from an area. Ramps on each end of these trails are to have a pan width equal to the trail width plus curb let downs on each side.
6. Further details on street design parameters, drive isle, route requirements, and parking restrictions are included in the Fire Services Access Standard.

K. Walkways, Curbs and Gutters

1. Types of Pedestrian Walkways

The Developer shall use the following types of walkways for pedestrian movements:

a. **Sidewalks**

Sidewalks are typically 1.5m in width for separate sidewalks or 1.25m width for rolled monolithic sidewalk curb and gutter. Sidewalks shall be cementitious concrete.

b. **Multi-Use Trails**

Multi-use trails are 2.5m in width and constructed with asphaltic cement surfacing, as per drawing detail LG-07. These trails shall be used where higher pedestrian traffic and cyclists are expected to share the trail. These trails shall generally be used on major collector roadways in urban areas and on all arterial roadways. Multi-use trails in Commercial/Industrial areas shall be used where identified in the Walkability Plan.

Sidewalks and multi-use trails shall be tied into each other in accordance with detail drawing TN-16.

2. Walkability Plan

Developer will submit to the City a Walkability Plan for the subdivision area. Sidewalks, curb and gutters shall be installed according to the Walkability Plan, the standard drawings (TN-01 to TN-03, TN-05 to TN-09), and to approved grades and cross-sections. Sidewalks are not required in cul-de-sacs with less than (ten) 10 lots.

The Walkability Plan should include the need for sidewalks on both sides of local residential streets as follows:

- a. Where, in the opinion of the City, residential densities require sidewalks on both sides for capacity and/or safety;
- b. Where, in the opinion of the City, local residential streets provide logical pedestrian linkages to amenities such as, but not limited to, schools, parks, natural areas, transit stops and commercial areas.

3. Materials

The concrete for sidewalks, curb and gutters shall meet the following requirements:

Maximum Size of Course Aggregate	25mm
Slump	25-75mm

Air Content (%)	Minimum 28 Day Compressive Strength (MPa)
5.5 to 5.9	30.0
6.0 to 8.0	$42 - (2 * \text{Air Content})$
Greater than 8.0	26.0

After October 1st, the concrete shall reach 30MPa in seven (7) days.

All materials and admixtures used in the construction of the sidewalks, curb and gutters shall conform to applicable CSA and ASTM standards and specifications.

Curing compound shall be placed on the concrete. It shall be a resin base, impervious membrane and shall conform to ASTM C309 Type I. It shall be sufficiently free from permanent colour to result in no profound change in colour than that of natural concrete.

Aggregates must be less than 1.0% ironstone by weight and have less than 0.5% low density granular material as identified in CSA A23-1-14. Other deleterious substances shall be limited as per CSA A23.1-14.

The Asphaltic cement for the multi-use trail shall meet the applicable requirements of Section VII.L.8

4. Placing of Materials

The subgrade and granular base shall extend 150mm beyond the edges of all multi-use trails and emergency accesses.

a. Concrete

All subgrade shall be cement modified using a minimum of 10 kilograms of Portland cement per square metre per 150mm of compacted depth. The subgrade shall be compacted to 100% Standard Proctor density. For separate sidewalks only, the top 150mm of subgrade shall be compacted to 98% Standard Proctor density, at a moisture content not more than three percent (3%) greater, or one percent (1%) under, the optimum moisture content. ~~The requirement for cement is to be determined by a geotechnical engineer at the time of construction.~~ **Additional requirement for cement is to be determined by a geotechnical engineer at the time of construction.** The subgrade shall be free from any deflection under heavy loading. (See Section VII.L.2 "Proof Rolling of Subgrade").

Prior to placing any concrete, a minimum of 150mm of 20mm granular base course shall be placed and compacted to a minimum of 100% Standard Proctor density on the prepared subgrade.

The subgrade and granular base shall extend 150mm beyond edges of Separate Sidewalks.

The concrete shall be vibrated into place according to the standard drawing cross-sections. Backfilling behind the sidewalks, curb, and gutters shall be done soon after placement of the concrete. It shall be done carefully as not to damage the concrete. Heavy equipment used for road construction shall not be used near the concrete for a period of seven (7) days or until concrete has reached a compressive strength of 70% of the specified 28-day strength.

b. Asphalt Concrete

All trails are to be constructed of asphalt concrete in accordance with the applicable standards in section VII.L.

5. Testing

- a. Compaction testing of the subgrade shall be done a minimum of one (1) field density test per 100 linear metres of subgrade. Additional testing may be required at the direction of the City.
- b. Concrete testing (including slump, air content, temperature, and compressive strength cylinders) ~~shall be made for a minimum of one (1) test per each 50m³ of concrete placed and a minimum of one (1) compo test for each day of placing.~~ **is required for each day of pouring - for every 50m³ placed or any portion thereof.**
- c. Asphalt cement testing shall be done in accordance to section VII.L.9.
- d. All testing shall conform to applicable CSA and ASTM standards and specifications
- e. Concrete materials used in the construction of municipal infrastructure must meet the specified compressive strength requirements as per the approved mix design. In the event of a deficiency in the 28-day compressive strength test results, pay factors will be applied based on the following criteria:

CYLINDER STRENGTH (% of specified strength)	PAY FACTOR (%)
97.0	100.0
96.0	99.2
95.0	98.2
94.0	96.9
93.0	95.4
92.0	93.6
91.0	91.7
90.0	89.4
89.0	86.7
88.0	83.5
87.0	79.7
86.0	75.5
85.0	70.0
Under 85.0	Remove and replace

If the compressive strength falls more than 15% below the specified requirement, the City reserves the right to reject the work and require the removal and replacement of the deficient concrete at the developer's expense. Exceptions may be granted upon written approval from the City Engineer, provided alternative measures are proposed and accepted.

L. Roadway Construction

1. Common Excavation/Subgrade Preparation

All subgrade shall be cement modified using a minimum of 10 kilograms of Portland cement per square metre per 150mm of compacted depth, this is to be verified in the Geotechnical Report.

The subgrade shall be prepared for the entire width of the carriageway, plus the full width of any curb and gutter, monolithic curb, and sidewalk, plus 300mm back of curb or monolithic sidewalk.

The top 150mm of subgrade shall be compacted to 100% of Standard Proctor density or in accordance with the recommended density as per the Geotechnical Report, at a moisture content

not more than three percent (3%) greater, or one percent (1%) under, the optimum moisture content.

2. Proof Rolling of Subgrade

Proof rolling or load testing shall be performed on the subgrade after compaction testing is completed and approved to help detect isolated unstable areas. The City shall be given sufficient notice of the date and time of the proof roll test so that a representative from the City may witness the test. The following procedures shall be followed:

- a. Proof roll the entire surface with as many passes as necessary, by slowly driving a fully loaded tandem truck or equivalent over the area.
- b. The Consulting Engineer, the contractor and the City shall closely observe this operation and mark out areas where weakness is indicated.
- c. Weak areas shall receive additional compacting effort or be replaced with suitable material until satisfactory results are achieved.

3. Pit Run Gravel Subgrade

When the native subgrade material is unstable or in situ material is too wet to provide a proper base for the pavement structure, pit run gravel shall be used. The pit run gravel shall be used to obtain a working platform for the pavement structure. The pit run gravel shall be placed and compacted uniformly to 97% Standard Proctor density.

The pit gravel shall conform to the following gradation specification:

Sieve Size (mm)	% Passing
80	100
25	40 – 90
16	35 – 85
10	28 – 71
5	22 – 63
1.25	14 – 45
0.315	8 – 27
0.160	5 – 19
0.080	2 – 10

4. Pavement Structure

A Geotechnical Report must include specific recommendations for pavement structure construction based on in-situ conditions and projected traffic volumes. The following are minimum requirements of pavement structures (50mm is required for final lift of asphalt, except for alleys):

STREET CLASSIFICATION	MINIMUM PAVEMENT STRUCTURE
Local Residential	115mm Asphaltic Concrete 250mm Crushed Granular Base
Minor Collector	125mm Asphaltic Concrete 300mm Crushed Granular Base
Major Collector	150mm Asphaltic Concrete 300mm Crushed Granular Base

Arterial	200mm Asphaltic Concrete 300mm Crushed Granular Base
Industrial	175mm Asphaltic Concrete 300mm Crushed Granular Base
Residential Alley	115mm Asphaltic Concrete 250mm Crushed Granular Base

5. Granular Base Course

The granular base course shall be placed on the completed subgrade in layers not exceeding 200mm. See section VII.L.8.a for gradation specifications. It shall be compacted to a minimum of 100% Standard Proctor density.

The crushed gravel base course shall be free from clay, loam or other deleterious materials

The granular base shall be prepared for the entire width of the carriageway, under the full width of the curb and gutter, or monolithic curb, gutter and sidewalk and 300mm back of curb or monolithic sidewalk.

6. Wick Drain Connections

Wick drains are to be used in all local and collector roads and are to be connected to catchbasins as shown in Detail SM-13. Wick drains should be cut no less than 300mm inside catchbasins and visible to City inspectors.

7. Prime Coat/Tack Coat

Prime coats shall be the application of bituminous material to the subgrade or previously prepared gravel base course prior to placing bituminous surfacing materials. The bituminous material for priming the base course shall be liquid asphalt. The asphalt types may vary from M.C. 30 to M.C. 250; from SS-1 to SS-1h or an emulsified asphalt primer suitable to the conditions of the base. The rate of application may vary from 0.5 L/m² to 1.5 L/m².

Tack coats shall be the application of bituminous material to a previously constructed paving surface of any type in preparation of placing bituminous surfacing materials, against curb and gutter faces, manholes, valves and other appurtenances within the roadway that is to be paved. The asphalt for the tack coat may vary from SS-1 to SS-1H; from R.C.30 to R.C.250 depending on conditions suitable for the base. The rate of application shall be 0.25 L/m² to 0.90 L/m².

Permit prime coat and tack coat to cure prior to placing asphaltic concrete paving mixtures.

8. Asphaltic Concrete Pavement

The contractor shall supply to the City an asphalt mix design based on LT/HT or ACR/ACO mix at least 10 business days before the start of production for approval. Other mix designs may be accepted if submitted with a Geotechnical Report, signed by a Geotechnical Engineer, and submitted PRIOR to the start of production. It may take up to 15 days to approve alternative mix designs.

- LT or ACR shall be used for paving alleys, local roadways and trails.
- HT or ACO shall be used to pave arterials, industrial/commercial roadways and collector roadways.

Design mix asphalt of FAC lift shall match that of the CCC.

The asphaltic concrete pavement shall conform to the following list of properties:

a. Aggregate Gradation Specification

SIEVE SIZE (mm)	% PASSING			
	Base Course*	ACR/ACO	LT	HT
20.0	100			
12.5	-	100	100	100
10.0	63 - 86	75 - 90	97 - 100	97 - 100
5.0	45 - 68	50 - 70	50 - 75	32 - 75
2.5	-	35 - 50	35 - 55	23 - 55
1.25	25 - 45	25 - 40	24 - 45	16 - 45
0.315	13 - 26	14 - 23	14 - 26	8 - 26
0.160	9 - 18	7 - 14	7 - 15	5 - 15
0.080	4 - 10	4 - 8	4 - 8	3 - 8

*20mm Granular Base Course (GBC) to be used for all roads. The GBC shall have at least 60% of material retained on the 5mm sieve with at least two (2) fractured faces. The gravel shall have a liquid limit of the minus 0.4mm sieve fraction not greater than 25% and a plasticity index not greater than 6%.

b. Asphalt Concrete Mix Design

Criteria	Base Course	ACR	ACO	LT	HT
Max Size of Aggregate, mm	20	12.5	12.5	10.0	10.0
Number of Blows	75	50	75		
Minimum Stability, kN	6.7	4.5	6.7		
Number of Gyration Gyrations N_{design} Gyrations $N_{maximum}$				75 115	100 160
Density at $N_{maximum}$ (% G_{mm})				98.0 max	98.0 max
Bailey CA-CUW (max)				60 - 85	60 - 105
Minimum Tensile Strength Ratio, %	75	75	75	80	80
Flow Value, 0.254 mm unit	6 - 12	8 - 16	6 - 12		
Air Voids, % of total Mix	4.0 ± 0.4	3.0 ± 0.4	4.0 ± 0.4	3.0 ± 0.4	4.0 ± 0.4
Voids Filled, % of total mix	67 - 78	73 - 85	68 - 80	73 - 85	70 - 80
Minimum film thickness, μm	6.0	7.0	7.0	7.5	7.5

Hot plant mix asphaltic concrete shall be placed with time remaining so that the compaction shall be completed during daylight hours. It shall be placed when the temperature is at a minimum of 2°C and rising. On first lift, the gravel shall be at its optimum moisture content with no ponding or saturated conditions in the gravel. For hot mix applied to existing asphalt surfacing, the surface is to be dry.

Asphaltic cores shall be taken by an approved testing laboratory and shall be used in determining the following:

- i. Thickness
- ii. % compaction
- iii. In place air voids.

The asphaltic concrete pavement shall be placed and compacted to a minimum laboratory design density as specified to the following minimum density (% of Marshall Density) for the type of paving. Should asphalt densities be less than specified, the City may require allowances for future maintenance costs.

Minimum Density	Type of Paving
98%	New paving and all stages in staged paving except 2 nd stage residential ≤ 50 mm.
96%	Second stage residential mat ≤ 50 mm.
97%	Alley Paving
97%	Overlay mat (minimum thickness of 50 mm)

9. Testing

Quality control testing shall be done during the road construction at the following minimum intervals:

- a. Subgrade preparation – field density one (1) test per 1000m²
- b. Sub-base construction – field density one (1) test per 1000m²
- c. Asphaltic concrete placement:
 - i. One (1) sample of asphalt for complete Marshall testing including: oil content, stability flow, air voids and VMA for each 2000m² or a minimum of one (1) per day of placing.
 - ii. In place asphalt core testing for thickness, density and air voids at one (1) per 1000m².

All testing shall be done in accordance with applicable CSA and ASTM standards and specifications.

10. Thickness Tolerance

Deficient Thickness; if the initial core thickness is deficient at the completion of a lift of paving, that initial thickness is discarded, and three (3) new cores will be taken within 10m of the original core location at a minimum spacing of 2.5m between cores. All cores to be taken from the same mat that the original core sample was taken. The average thickness of the three (3) new cores will represent that area.

If the average core thickness is deficient, the area of asphalt pavement will be assessed a pay factor according to the following table. The pay factor will be applied to the price of the quantity of hot mix in that mat area placed with the current stage of paving.

Thickness Deficiency (mm)	Pay Factor (5)
6.0	100.00
7.0	97.0
8.0	93.7
9.0	90.0
10.0	85.5
11.0	80.5
12.0	75.0
13.0	68.0
14.0	60.0
15.0	50.0
Over 15.0	Grind and Resurface

11. Density Specimen Sampling and Testing for LT and HT Asphalt Mix Designs

a. LT and HT Asphalt Mix Designs

For LT and HT Asphalt density the City will follow the current City of Edmonton's density tolerance standards and deficient density penalty pay factors.

b. Other Asphalt Mix Designs

Deficient Density; a single core is initially taken representing the quantity of hot-mix in not more than 1000m² of mat, with a minimum of one (1) core taken from a day's production. If the initial core density is below specified, that initial density is discarded, and three (3) new cores will be taken within 10m of the original core location at a minimum spacing of 2.5m between cores. All cores to be taken from the same mat that the original core sample was taken. The average density of the three (3) new cores will represent that area.

If the average core density is below the specified density, the represented area of mat may be accepted subject to a pay factor according to the following table. The pay factor will be applied to the price of the quantity of hot mix in that mat area.

98% Required		97% Required		96% Required	
Actual Density (%)	Pay Factor (%)	Actual Density (%)	Pay Factor (%)	Actual Density (%)	Pay Factor (%)
98.0	100.0	97.0	100.0	96.0	100.0
97.9	99.9	96.9	99.9	95.9	99.7
97.8	99.8	96.8	99.7	95.8	99.3
97.7	99.6	96.7	99.4	95.7	98.9
97.6	99.4	96.6	99.1	95.6	98.4
97.5	99.1	96.5	98.7	95.5	97.8
97.4	98.7	96.4	98.2	95.4	97.1
97.3	98.3	96.3	97.7	95.3	96.4
97.2	97.8	96.2	97.1	95.2	95.6
97.1	97.2	96.1	96.3	95.1	94.6
97.0	96.5	96.0	95.5	95.0	93.4
96.9	95.8	95.9	94.6	94.9	92.2
96.8	95.0	95.8	93.6	94.8	90.7
96.7	94.2	95.7	92.5	94.7	89.1
96.6	93.3	95.6	91.3	94.6	87.3
96.5	92.3	95.5	89.9	94.5	85.1
96.4	91.1	95.4	88.4	94.4	82.6
96.3	89.8	95.3	86.7	94.3	79.5
96.2	88.5	95.2	84.8	94.2	75.5
96.1	87.1	95.1	82.7	94.1	69.7
96.0	85.5	95.0	80.3	94.0	60.0
95.9	83.8	94.9	77.6	Under 94.0	Remove and replace
95.8	82.0	94.8	74.3		
95.7	80.0	94.7	70.6		
95.6	77.7	94.6	66.0		
95.5	75.4	94.5	60.0		
95.4	73.0	Under 94.5	Remove and replace		
95.3	70.3				
95.2	67.2				
95.1	63.7				
95.0	60.0				
Under 95.0	Remove and replace				

Actual Density = % of Marshall Density Pay Factor = % of Contract Price

M. Roadway Illumination

All designed illumination levels are to comply with or exceed the Illumination Engineering Society of North America (IESNA) guidelines.

All street lighting fixtures shall be a Fortis Alberta approved LED type.

Crosswalk Lighting shall be designed to maximize the contrast and vertical illuminance of pedestrians on or near the crosswalk from the perspective of approaching drivers. Crosswalk Lighting shall include the approach and exit area outside of the crosswalk, and across the entire crosswalk

N. Roadway Signage

Roadway signage to be designed and installed in accordance with the Manual of Uniform Traffic Control Devices for Canada prepared by the Transportation Association of Canada, the City's Crosswalk Policy, and detail drawings SN-01 to SN-04 and SN-08 to SN-09.

Roadway signage shall be inspected at the time of Construction Completion Certificate inspection and at Final Acceptance Certificate inspection. The Developer is responsible for correcting any deficiencies prior to the City issuing the applicable certificate.

In the event that permanent signage cannot be installed prior to Construction Completion Certificate (CCC) inspection, the Consulting Engineer may apply for permission from the City to install temporary traffic control signage for a specified period of time. Temporary signage must be to the satisfaction of the City.

During the warranty period, the Developer shall be responsible for sign maintenance. The following table outlines the required maintenance response time, 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	5 days	7 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

All sign posts shall be Telespar.

Fortis approval is required prior to attaching any signage to light standards or Fortis Alberta owned infrastructure or facilities. Approvals from Fortis must be submitted to the City for all signage shown on design drawings that are attached to Fortis Alberta infrastructure or facilities.

O. Transit Stops

Transit stops shall be installed, as required, in accordance with Details TN-13 and TN-14. Transit stop location (before or after an intersection) should consider visibility, safety, transit operation, bus signal priority, intersection operations, parking restrictions, passenger demand, pedestrian access, and/or roadside constraints. The location of concrete pads for transit stops shall be designed in conjunction with new development staging and to be coordinated with the City's Transportation and Transit plans and initiatives.

Developers will be required to install transit pads in all locations as identified by the City during subdivision development as per standard detail TN-15.

P. Canada Post/Community Mailbox Locations

Developers to construct concrete bases for all community mailbox locations to the satisfaction of Canada Post. No post boxes to be installed on asphalt pathways and/or within 5m of a cross walk.

Q. Pedestrian Bridges

Pedestrian Bridges are defined as bridges that carry pedestrian or bicycle traffic and do not carry motorized vehicles. The minimum design load must include the expected Pedestrian Load and Maintenance Vehicle Loads as per the requirements of CHBDC (Canadian Highway Bridge Design Code).

Where it is expected that pedestrians may stop and congregate on Pedestrian Bridges consult the Alberta Building Code for barrier design.

SECTION VIII – EROSION & SEDIMENTATION CONTROL

An Erosion and Sedimentation Control (E&SC) plans are required to define all procedures intended to control such during both the construction and all maintenance periods. In conjunction with the E&SC Guidelines (Appendix B), the following shall be included in the E&SC plans:

1. Limits of soil disturbance;
2. Construction details (installation, inspection, and maintenance guidance and schematics) of all E&SC measures; ~~to be installed during the project complete with supporting RUSLE calculations. Details must be specific to each phase of construction and must be indicated when they will be installed and removed. If any or all measures are not intended to stay for the full duration of the project, details must include the phase/s applicable.~~ Separate phased drawings may be required;
3. The locations and dimensions of existing storm infrastructure onsite and for the surrounding area (i.e. catchbasins, storm pipes, drainage swales, storm water ponds);
4. Erosion control matting or approved equal on slopes steeper than 4:1, and any other area where ~~excessive~~ **substantial** erosion may occur;
5. Location and details of stabilized ~~of all~~ construction ~~access entrance~~ **access entrance and mitigation plan** to limit tracking of sediment ~~onto adjacent areas offsite~~;
6. **Existing and proposed** stockpiles shall be clearly marked on the drawings, **including volume and maximum height**. Protection measures for stockpiles shall be provided ~~depending on locations and proximity of sediment transport to surrounding areas~~ **as necessary**;
7. Details for implementation of landscaping and other practices, if required, for permanent site stabilization (i.e. erosion control blankets, turf reinforcement mats, seeding, sodding, retaining walls, riprap and paving);
8. The following notes should be added directly to all E&SC drawings:
 - a. Prior to construction start-up, it is mandatory for the project proponent or prime contractor to schedule a pre-construction meeting to discuss scheduling, roles and responsibilities, stabilized entrances, temporary storage facilities, pollution, and all existing and future E&SC practices to be implemented.
 - b. The following information must be on-site and available upon request:
 - i. The E&SC report and/or drawings, including any amendments.
 - ii. Documentation (including photos and inspection records) detailing implementation and maintenance of E&SC practices.
 - c. Inspections of all E&SC practices must be completed and documented ~~at a minimum of every seven (7) days~~ **from Spring to Fall, or as outlined in the E&SC Guidelines, as well as and at any event throughout the year that could cause substantial erosion and sediment release. at all critical times when erosion and sediment releases could occur**. Inspections must be completed and documented within 24 hours of significant snowmelt, and heavy or prolonged rainfall;

- d. Deficiencies ~~documented during the inspections of E&SC practices~~ must be corrected within fourteen (14) days; ~~and maintenance documented.~~
- e. Prior authorization is required by the City for pumping or directing impounding surface water and/or groundwater into ~~a storm sewer~~ **or onto City infrastructure**. Please contact the City Engineering Department for information regarding dewatering;
- f. In an event of unexpected offsite release, incident must be reported to the City within 24 hours of occurrence;
- g. Developers and property owners are responsible for Erosion and Sediment Control until all improvements have been issued a Final Acceptance Certificate (FAC) or as outlined in the E&SC Guidelines;
- h. The City reserves the right to require additional E&SC measures or remediations as deemed necessary **at any point during the project duration**, which may potentially result in extended maintenance period. **Any alternative proposal to City's request shall be backed up with RUSLE calculations.**

SECTION IX – NATURAL AREA AND TREE PROTECTION

Natural Area and Tree protection standards are as follows:

1. A natural area is an area identified in the Municipal Development Plan, or at the time of redistricting, for conservation, preservation or restoration of all natural features, biodiversity and ecological processes. Natural areas may include wetlands, stands of trees or other natural features. Passive and appreciative recreation activities may take place in these areas such as walking, bird watching and picnicking.
2. Any proposed development which would adversely affect a natural area as identified in the Municipal Development Plan requires a natural areas assessment. The scope of this assessment will be determined by the Planning and Development department through discussions with the proponent.
3. In order to protect the roots, and therefore the health of the trees, no activities including grading or placement of soil, storage of materials or equipment, shall occur over the roots of any tree designated for protection. In addition, activities within the designated buffer zones as determined in the natural areas assessment shall be limited to remediation of those buffers and augmentation of vegetation as directed by a certified arborist.
4. Temporary protective fencing at least 1.2m in height shall be in place around any trees or natural areas to be retained prior to any clearing, grubbing, grading, or other construction related activities. This fencing shall be in place until the completion of construction activities.
5. At a minimum, protective fencing shall be placed outside of the root zone for those trees that will be retained on the site as identified by a certified arborist. Where a buffer is required in the natural areas assessment, the protective fencing shall be located on the outside of the buffer setback.
6. Failure to erect the protective barrier may result in a fine being issued or stop order issued against the property owner.
7. If the required boundary fencing has been damaged, it shall be repaired and replaced immediately.
8. When construction activities must occur within a natural area's buffer or within a tree route zone, such as the extension of a drainage channel or required main utility line, additional mitigation measures and a specific plan for those construction activities must be prepared by a certified arborist.
9. Disturbance of a natural area, buffer or any other area to be left undisturbed shall be reported to the City for resolution.

SECTION X – LANDSCAPING

A. Boulevard and Median Requirements

General Conditions are as follows:

1. Boulevard trees are required on minor and major collector roads. Boulevard trees shall be spaced a maximum of 10m apart from one another, unless otherwise approved by the City.
 - One tree per 10m (each side) for *Ulmus Americana*
 - One tree per 8m (each side) for *Ulmus Americana* 'Brandon', *Fraxinus* and *Quercus*
 - One tree per 6m (each side) for *Tilia* and Ornamentals
2. Coniferous trees should not be used in collector road boulevards.
3. Minimum branching height for boulevard trees (deciduous) shall be 1500mm, with a caliper of 60mm.
4. Black Ash, Poplars, Aspen (with the exception of Swedish Columnar), Willow, Birch and fruit-bearing trees are not acceptable as boulevard trees. All Green Ash shall be seedless.
5. Trees shall be set back a minimum of 1.5m from the median curb or collector road curb, unless otherwise approved by the City.
6. All planting beds are to have a minimum of 100mm depth coniferous wood chip mulch.
7. Where possible, trees shall be set back a minimum distance, measured from the centre of the tree trunk, as follows:

Distance from light poles and power furniture	3.5m
Distance from fire hydrants	3.5m
Distance from stop and yield signs	3.5m
Distance from transit zones	3.5m
Distance from other signs	2.0m
Distance from shallow underground utilities	1.0m
Distance from sanitary and storm sewers	1.5m
Distance from watermains	1.5m
Distance from collector road median curb face	1.5m
Distance from minor collector road blvd curb face	1.4m
Distance from major collector road blvd curb face	1.5m
Distance from driveways	1.2m
Distance from sidewalks	1.0m
Distance from beginning of curve return	7.5m

8. All collector boulevards are to be graded and shall be sodded on 100mm depth topsoil.
9. Local road boulevards which are adjacent to backs of private lots must be graded, top-soiled and sodded.
10. Local road boulevards which are separated from private lots by a public walkway or sidewalk must be graded, top-soiled and sodded. Trees may be planted within these separate boulevards if approved by the City.

11. Local road boulevards adjacent to sides of private lots but not separated by a public walkway or sidewalk must be top-soiled and landscaped with sod (and trees if approved by the City) if side yard screen fencing is provided by the Developer.
12. Boulevard sod adjacent to flankage fencing must extend to front curb, edge of public sidewalk, and edge of rear alley where applicable.
13. Landscape designs for median islands may include trees, shrubs, ground covers, soil mix for planting beds, mulch, topsoil and sod if approved by the City.
14. Turf area within road islands will be allowed only at the discretion of the City.
15. All paving stone and paving stone headers, concrete or other special hard-surfaced treatment shall be constructed to the satisfaction of the City.

B. Storm Water Management Facility Requirements

General conditions for landscaping of storm water management facilities are as follows:

1. Storm water management facilities must be landscaped to maintain slopes consistent with Section V.E.
2. Landscaping shall include extensive planting of native plant materials, both submergent and emergent. Design should include shoreline fringe areas and perimeter planting to provide water filtration and retention, safety and aesthetics.
3. Trees to be planted at a frequency of 75 trees per plant-able hectare (area between NWL and property line). Appropriate shrubs may be substituted at a rate of five shrubs to one tree if site conditions dictate.
4. Deciduous trees require a minimum caliper of 60mm.
5. Coniferous trees shall be a minimum height of 1.8m and a maximum height of 2.4m. Root balls shall measure between 80cm and 90cm in diameter, with trunks centered on the rootball and must be balled and burlapped or basketed according to the digging standards outlined in Section 3.4 of the Canadian Standards for Nursery Stock as set by the Canadian Nursery Landscape Association.
6. Landscaping must be designed and constructed to restrict erosion. Matting or approved equal shall be used on banks, culverts, slopes and any other areas where excessive erosion may occur.
7. The design shall incorporate an extensive naturalized grass buffer area between the normal and high water lines to facilitate sustainable landscaping, maximize pollutant removal, and improve soil stability. Mow limits separating naturalized grass from mowed grass areas shall be clearly identified on landscape drawing.
8. All storm water management facilities shall be topsoiled and seeded or sodded consistent with Section X.C, Section X.I and Section X.J.

9. Naturalized grass shall be vigorous, healthy and naturalized by FAC inspection. Mowing may be completed only to establish plant health and must maintain a minimum height of 100-150mm during establishment.
10. Mulch may not be placed below the 1:5 year water line.
11. Signage is required, prior to allowing water into ponds, in accordance with details SN-05, SN-06 and SN-07 at main entrances and other areas as required by the City to prohibit activities that may present danger to public health or safety, or interfere with the operation of the facility.
12. The City may require trails and site furniture to be installed in the facility.

C. Topsoil and Grading

General conditions are as follows:

1. Stockpiled topsoil (on-site or imported) shall be natural, fertile agricultural soil capable of sustaining vigorous plant growth. Care shall be taken to ensure topsoil is not compacted when stockpiled. It shall be best quality, free of any foreign material, lumps, clay, stumps, tree roots, rocks, quack grass and noxious weeds.

Sand	Minimum 35% by dry mass
Clay	Maximum 30% by dry mass
Silt	Minimum 35% by dry mass
Organic Matter	Between 5% and 10% by dry mass
Toxic Chemicals	none
pH Value	5.5 – 7.5
Electrical Conductivity	Less than 2mhos/cm ²

2. Native on-site topsoil may be used provided it meets the above requirements or is amended with approved soil amendments. Amendments shall be approved by Developer's Consultant. Native topsoil must be free of roots, branches, clay, stones larger than 25mm, subsoil, other debris, and screened (not shredded) through a 5mm screen.
3. Soils analysis shall be performed by a soils test lab accredited by the *Standards Council of Canada in the Canadian Association for Environmental Analytical Laboratories (CAEAL)*. Such analysis shall be performed on samples from each topsoil source and shall determine nitrogen, phosphorus, potash, soluble salt content, electrical conductivity, pH value and physical values of sand, clay, silt and organic matter. Recommendations for amendments to be requested from soils lab.

Prior to fine grading, planting, seeding or sodding, the Developer's Consultant shall submit the soils test analysis reports to the City and soil amendments will be determined on a site-by-site basis with City approval.

4. Soil mix for planting beds must meet the topsoil specifications listed above and be a 3-1-1 mix of topsoil, sand and peat. Other composted soil mixes may be accepted, as approved by the Developer's Consultant.
5. Topsoil shall be fine graded to a tolerance of ± 25 mm and to ensure positive drainage.

6. Topsoil shall be compacted to firmness sufficient to show a heel print of not more than 3mm deep. The upper 50mm shall be of a fine texture and free of stones or lumps 6mm or larger. Sufficient allowance shall be made for settlement.
7. Ensure interface edges between walkways, trails, existing turf, playgrounds, site furnishings, natural stands and all surrounding property receive required amounts of topsoil for the landscape application and form a smooth even transition with positive drainage. Provide a minimum of 1.5m from the path edge to any fence, site furnishings or other solid items for snow ploughing storage space.
8. Cut smooth falls to catch basin and manhole rims, and finish flush.
9. Do not bury refuse or foreign material of any kind on site. Excavate and remove immediately from site all soil contaminated by oil, gasoline or any other substance harmful to healthy, vigorous plant growth.
10. Retaining walls are to be avoided where possible. If a retaining wall is required, it must be designed by a Consulting Engineer and must consider not only final use but also construction equipment loading. Details of retaining wall fencing installation, surface drainage, sub-surface drainage behind and under the wall and foundations must be provided.

D. Fencing

All fence locations and styles shall be included in development agreements and generally be as follows:

1. Chain link fencing is required where private lots are adjacent to Municipal Reserve (MR) areas, Environmental Reserve (ER) areas, Storm Water Management Facilities and any "Open Space Area" as defined in the City of Spruce Grove's Open Space Area Bylaw.
2. Fencing is required adjacent to roadways at playground zone areas, as specified in the most recent version of *Alberta Traffic Guidelines for School and Playground Zones*. Fence type to be chain link, post and rail, or equivalent as approved by the City.
3. Screen fencing is required where:
 - a. The side or rear yard of private property is adjacent to a collector or arterial road, and where the rear property line of private property is adjacent to a local road.
 - b. Private property is adjacent to walkways and trails, unless otherwise approved by the City.
 - c. The side yard of a private property is adjacent to a landscaped local road boulevard.
4. Side yard fencing adjacent to roadways, lanes and Public Utility Lots shall step-down in height towards the front of the private property, in accordance with detail LG-06.
5. No portion of any Developer fence shall include gates or any provision for future gates, unless approved by the City.
6. Double-board (or equivalent) noise-rated fencing may be required by the City in areas where noise berming on arterial roads is insufficient. A noise study for determination of noise mitigation fencing and berming requirements shall be prepared where residential development

is adjacent to arterial roads and/or business zones. Noise separation recommendations of the study shall be incorporated in the development grading and fencing design.

7. Where double-board noise attenuation fence is required, the bottom of fence must be installed at design grade with no clearance below fence.
8. Screen fencing may be wood, precast concrete or other materials approved by the City. All metal components and fasteners used for fencing shall be rust and corrosion-resistant.
9. All wood screen fencing shall receive two coats of stain, unless otherwise approved by the City. Lumber posts shall be pressure treated. If the design of the wood screen fence is to be left unstained (if approved by City), all lumber shall be pressure treated. All nails used for wood fencing shall be hot-tipped galvanized "ardox".
10. All chain link components shall be galvanized. Posts, rails, fittings and wire shall be powder-coated to match mesh colour. Mesh shall be vinyl-coated.
11. All fences shall be installed inside private property, with a clearance of 150mm from property line to edge of post.
12. No portion of fence shall encroach utility easements.
13. All fences shall maintain a clearance of 50mm between bottom of fence and finish grade (design grade), with an allowable tolerance of plus or minus 50mm. Prior to any fence CCC inspection, the Landscape Architect shall provide the City with as-built survey data showing the bottom-of-fence elevation. On wood fencing, the bottom-of-fence elevation is the lowest edge of the bottom stringer. On chain link fencing, the bottom-of-fence elevation is the bottom tension wire.
14. All fences shall be installed in accordance with details LG-04, LG-05, and LG-06 unless otherwise required or approved by the City.
15. Where developer fencing is installed within a residential lot that has already been graded with topsoil or landscaped with sod, there must be a minimum clearance of 50mm between bottom of fence and topsoil, or 25mm between bottom of fence and sod.

E. Bollards

All bollard locations and styles shall be included in the design drawings, and generally be as follows:

1. Bollards shall be installed in locations required to prevent unauthorized vehicular traffic to open space areas, public utility lots, etc.

Emergency access and maintenance access style bollards will be required at entrances to public utility lots. ~~See Standard Detail LG-08 to LG-10.~~ Unless otherwise approved by the City, bollards must be installed as per Standard Details LG-08, LG-09, and LG-10. Alternate swing bollard styles may be proposed to the City for consideration.

2. The Landscape Architect shall contact the City for current bollard installation detail and style requirements and these shall be shown on landscape drawing submissions to the City for approval.

3. For PUL's etc, that straddle subdivision stage boundaries, the bollard plan shall show coordination and placement of bollards. Detailed placement of bollard and sidewalks or asphalt pathways in PUL's shall be presented on design drawings for City review.
4. Boulders may be used instead of fixed bollards for restricting vehicular access consistent with Section X.M.

F. Trails

All trail locations and styles shall be included in area structure plans and development agreements and generally be as follows:

1. All asphalt trails shall be installed in accordance with detail TN-18.
2. Trail signage, when required by the City, shall be consistent with detail LG-03.

G. Site Furniture

When required, site furniture shall be installed as follows:

1. Site furniture shall be powder-coated to prevent rust and corrosion.
2. Unless otherwise approved by the City, waste receptacles shall be Haul-All HBIS container, part number HBIS-N. Colour to be RAL-6026.
3. All waste receptacles shall be emptied on a weekly basis by the Developer's contractor for the duration of the Landscape FAC maintenance period.
4. Unless otherwise approved by the City, waste receptacle shall be installed on a 900mm x 1500mm concrete base pad, which shall be in accordance with specifications further outlined in this Section. Pre-cast mounting pads must meet these minimum dimensions. Haul-All HBI-572 and Haul-All HBII-572 pre-cast mounting pads will not be accepted as these do not meet minimum dimension requirements.
5. All furniture shall be installed level, plumb, straight, and centered in accordance with manufacturer's specifications.
6. All site furniture must be installed on a concrete base pad. Concrete shall be 30MPa Type HE with a 5.5-8% air content, with 10M rebar spaced 300mm x 300mm, and poured to a depth of 150mm.
7. Concrete shall receive a broom finish and sawcut control joints on a 2500mm grid.
8. Where concrete base pad is to be poured adjacent to existing concrete, a 15mm fibre joint will be installed for expansion, and 10M dowels spaced 750mm O.C. will be drilled into existing concrete and embedded into new pour.
9. Where concrete base pad is to be poured adjacent to existing asphalt, the adjacent asphalt edge will be sawcut to a flush 90 degree vertical edge.
10. Benches shall be anchored to concrete base pad. Tamper-proof locking nuts shall not be used.
11. Proposed bench type/model shall be clearly indicated on Landscape drawings. The City may refuse any bench type/model and request the Developer to install a typical bench type/model currently used by the City, if one exists.

H. Trees, Shrubs and Planting

General planting conditions shall be as follows:

1. Trees are to be low maintenance, hardy plant species common to Northern Alberta climate.
2. All plant material shall meet horticultural standards of the Canadian Nursery Landscape Association (CNLA) regarding grading, quality and nomenclature or other standards.
3. Nursery-grown plants shall have a healthy, well-developed root system and be true to type, structurally sound, well-balanced, healthy and vigorous, of normal growth habits, and densely foliated when in leaf.
4. Only elm grown in Alberta is acceptable. Proof of origin is required.
5. Minimum coniferous tree height shall be 1.8m and maximum coniferous tree height shall be 2.4m. Root balls shall measure between 80cm and 90cm in diameter, with trunks centered on the root ball and must be balled and burlapped or basketed according to the digging standards outlined in Section 3.4 of the Canadian Standards for Nursery Stock as set by the Canadian Nursery Landscape Association.
6. Minimum deciduous tree caliper shall be 60mm.
7. Minimum branching height for boulevard trees (deciduous) shall be 1500mm.
8. Black Ash, Poplars, Aspen (with the exception of Swedish Columnar), Willow, Birch, and fruit-bearing trees are not acceptable as boulevard trees. All Green Ash shall be seedless.
9. Trees not planted within planting beds must have a one-metre diameter rings of 100mm depth coniferous wood chip mulch covering the exposed root ball. Mulch shall be pulled away from the tree trunk for a distance of one or two inches to prevent disease growth at the base of the tree.
10. Materials used for tree ties should have a flat, smooth surface and be elastic to allow for slight movement of the tree. Suitable materials include rubber strips or webbing and belting.
11. Tree stakes shall be 2100mm-long, primed and painted metal T-bar stakes, 40mm X 40mm X 5mm thick. The top 300mm of the tree stake shall be painted based on the year of the tree installation as follows:

White	Yellow	Green	Blue
2021	2022	2023	2024
2025	2026	2027	2028
2029	2030	2031	2032

12. Tree ties and stakes shall be removed by the Developer upon issuance of Final Acceptance by the City.
13. All trees and shrubs shall be installed in accordance with details LG-01 and LG-02. At any time prior to installation of trees and shrubs, the City may require that a different tree or shrub planting detail be used.

14. Trees shall be watered regularly throughout the maintenance period. Tree pruning shall be performed by an "I.S.A. Certified Arborist" as defined by the *International Society of Arboriculture*.

I. Seeding

General seeding conditions are as follows:

1. Use only Certified Canada No. 1 varieties in accordance with the Canadian Seeds Act and Regulations and having minimum purity of 97% and germination of 75%, and be mixed to the following by weight:

General Parks Mix (200kg per hectare)

- 25% Creeping Red Fescue – minimum 2 varieties
- 30% Kentucky Bluegrass – minimum 2 varieties
- 20% Domestic Wheatgrass – single variety
- 15% Chewings Fescue – single variety
- 10% Perennial Ryegrass – single variety

Boulevard Mix (225kg per hectare)

- 30% Turf-type Tall Fescue – single variety
- 20% Hard Fescue – single variety
- 20% Domestic Wheatgrass – single variety
- 20% Creeping Red Fescue – minimum 2 varieties
- 10% Perennial Ryegrass – single variety

Naturalization Mix and Storm Water Management Facilities (150kg per hectare)

- 30% Slender/Awned/Bearded Wheatgrass
- 25% Mountain Brome
- 25% Sheep Fescue
- 5% Green Needle Grass
- 5% Western Wheatgrass
- 5% Northern/Streambank Wheatgrass
- 5% Fringed/Nodding Brome

2. Developer shall provide the City with seed tags indicating analysis of seed mixture, percentage of pure seed by weight, year of production, net mass, date tagged, and location.
3. Drill seeding shall be to a depth of 10mm.
4. Seed mixes for special conditions to be developed on an as needed, site-specific basis as approved on landscape drawings.
5. Seed to be installed on 150mm depth topsoil.
6. Prior to and during establishment of turf, weeds must be controlled at all times.
7. Maintain all seeded areas in a healthy, vigorous, growing condition until Final Acceptance by the City, as per Section IX.K.
8. If seed fails to germinate within four (4) growing months, cultivate and reseed until germination takes place. Re-seed on a regular basis; all areas which show deterioration, are bare, burned out, are thin or washed out throughout maintenance period as per Section IX.K.8.

9. Seeded areas will be accepted when permanent grass cover has been established, the turf is free of bare and dead spots, is relatively weed-free, and no soil is visible when the grass has been cut to 65mm height on the third cutting.

J. Sodding

General sod requirements are as follows:

1. Nursery grown, minimum 70% Kentucky Bluegrass blend (minimum of three (3) varieties, blended equally) and 25% Creeping Red Fescue, of Certified Canada No. 1 Seed.
2. Sod to be healthy and vigorous with a strong, fibrous root system, free of stones, burned or bare spots, disease, insect infestation, netting, and contain no more than 1% weeds and other grasses.
3. Cut in accordance with recommendations of Nursery Sod Growers Association of Alberta, approximately 0.5m² in area and 13-25mm in soil thickness.
4. Sod to be installed on 100mm depth topsoil.
5. Roll sod to remove depressions and irregularities. Correct any areas that settle. Maintain all sodded areas in a healthy vigorous growing condition until issuance of Final Acceptance by the City.
6. Dry sod will be rejected. Water sod as necessary to ensure vitality.
7. Prior to and during establishment of turf, weeds must be controlled at all times.
8. Maintain all sodded areas in a healthy vigorous growing condition until issuance of Final Acceptance by the City, as per Section X.K.
9. Depending on sod condition, additional supplementary fertilizer may be required based on soil analysis.

K. Turf Maintenance, Fertilizing and Weed Control

Turf maintenance, fertilizing and weed control conditions are as follows:

1. It is preferred that all landscape maintenance work described in this section shall be executed by a "Landscape Industry Certified Technician" or a "Lawn Care Technician" as defined by the *Canadian Nursery Landscape Association (CNLA)* and in strict accordance with specifications and best horticultural practice.
2. Program timing of maintenance operations to growth, weather conditions and use of site.
3. Seeded areas requiring mowing are to be cut when grass covers 70% of the area and is less than 100mm in height. Grass is to be maintained at 65mm in second year. Naturalized areas are not required to be maintained at a specific height but are to be cut at a frequency required to control and minimize weeds.
4. Mow sodded areas regularly to maintain height at 65mm.

5. Trim edges of sodded areas neatly, by hand clipping, if necessary, and remove all clippings from planting bed, tree saucers and pavement.
6. Re-sod or top-dress areas which show deterioration or which are thin, bare or burned out.
7. Repair all damages resulting from erosion, washouts or any other cause.
8. Top-dressing for reseeding of turfed areas shall be a 2-1-1 mix of peat moss, sand and either soil or compost. Scarify base areas prior to soil mix and seed application.
9. Formulation ratio of fertilizers used at time of seeding, sodding and as a supplementary nutrition during maintenance/guarantee period to be determined from soil test results.
10. All seeded and sodded areas to be irrigated as required during maintenance/guarantee period.
11. Weeds to be controlled throughout construction and maintenance period includes but not limited to; dandelion, jimsonweed, quackgrass, horsetail, morning glory, rush grass, mustard, lambsquarter, chickweed, crabgrass, Canada thistle, tansy ragwort, scentless chamomile, Bermuda grass, bindweed, bent grass, perennial sorrel, brome grass, red root pigweed, buckweed, toadflax, foxtail, and perennial sow thistle, leafy surge, field scabious and common tansy and all noxious and restricted weeds as identified under the Alberta Weed Control Act.
12. Developer's Consultant shall keep copies of written monthly maintenance logs reporting dates of maintenance trips, work performed, materials used, written confirmation of watering dates, and written confirmation of dates and types of fertilizer. The City may request copies of these logs at any time during the maintenance period, or as a condition of Municipal acceptance (FAC).

L. Park (MR) Requirements

General conditions for landscaping of parks and municipal reserves are as follows:

1. Park spaces must be landscaped to maintain slopes no steeper than 5:1, unless otherwise approved by the City.
2. Trees to be planted at a frequency of 75 trees per plantable hectare. Shrubs may be substituted at a rate of five shrubs to one tree to a maximum of 20% of the total number of required trees, if site conditions dictate.
3. Shrubs within a planting bed shall be spaced at 75% mature spread with no overlap. The City may request variances from the required quantities listed above.
4. Deciduous trees require a minimum caliper of 60mm.
5. Coniferous trees shall be a minimum height of 1.8m and a maximum height of 2.4m. Root balls shall measure between 80cm and 90cm in diameter, with trunks centered on the rootball and must be balled and burlapped or basketed according to the digging standards outlined in Section 3.4 of the Canadian Standards for Nursery Stock as set by the Canadian Nursery Landscape Association.
6. Minimum tree set back distances shall be consistent with Section X.A.7

7. Perennials in planting beds will be reviewed on an individual basis and accepted at the discretion of the City. Only low maintenance, non-invasive, and hardy perennials will be accepted, at the discretion of the City.
8. Annuals will not be permitted, unless otherwise approved by the City. Annuals may be approved in planting beds on a temporary basis, when maintained by the Developer. Annuals must be removed prior to FAC approval, with the area rehabilitated as indicated and approved on landscape drawings.
9. All parks shall be topsoiled and seeded or sodded consistent with Section X.C, Section X.I and Section X.J.
10. Parks containing playgrounds must be graded in such a way that all surface runoff from park landscaping will drain away from the playground.
11. Trees closer than 3.0m measured from tree centre must be grouped together in a mulch bed.
12. Tree spacing and species selections should consider site specific CPTED principles and sightline concerns.
13. For maintenance purposes, a minimum clearance of 2.0m shall be provided between planting bed and pavement edges, and between planting bed edges and private property lines.
14. The City may require trails, site furniture, and additional signage to be installed in parks, as necessary. Locations of all site furniture and signage shall be clearly identified on Landscape Plan.
15. Waste receptacles shall not be placed within 4.0m of the edge of any bench.
16. Bollards shall be installed in locations required to prevent unauthorized vehicular traffic to parks. The City may require additional bollards at areas deemed likely access points for vehicles.
17. "Dog on-leash" signage and additional signage indicating proper use of park are required to be installed on Trail Sign Posts at all trail entrances within each park. The Consultant shall contact the City for specific signage requirements and typical design currently used by the City. Trail Sign Posts are to be installed in accordance with detail LG-02. The City may require additional signage to be installed at locations deemed to be main entrances into the park, regardless of whether or not a trail is located there.

M. Boulders

General boulder requirements are as follows:

1. Boulders may be used instead of fixed (non-swinging) bollards to restrict vehicular access into park areas, or to provide interest to the landscape.
2. Any rock with a minimum 600mm diameter can be considered a boulder, regardless of shape.
3. Boulders are to be immovable by hand and located in visible areas to minimize public safety hazards.

4. If boulders are used in place of fixed (non-swinging) bollards to prevent vehicular access, clearance between boulders cannot exceed 1.5m between the edges of each boulder.

N. Playgrounds

General playground requirements are as follows:

1. Design and installation of playgrounds must conform to or exceed the current CAN/CSA Z614-2014 standards.
2. All posts are to be metal unless otherwise approved by the City. Platforms shall not be wooden.
3. Slides may be plastic or metal. Wherever possible, slides should be oriented to face east or north.
4. Solid rubber wear mats are required at swing and slide bases. Proposed wear mat style must be approved by the City.
5. Safety surfacing is to be installed to a minimum depth of 300mm.
6. Safety surfacing shall be engineered wood fibre, unless otherwise approved by the City. Synthetic safety surfacing materials such as rubber mulch or rubber tile may be considered. Sand or pea gravel will not be accepted as safety surfacing.
7. Geotextile will be required underneath safety surfacing and must cover the entire subgrade of playground footprint.
8. The subgrade within the playground footprint shall be sloped with a minimum 1% grade for drainage and compacted to 98% SPD.
9. Each playground shall include a drainage system. Wherever possible, drainage system will incorporate perforated subdrain pipe c/w geotextile sock, which ties into existing storm sewer line. Drainage systems tied-in to storm lines shall be clearly indicated on both Engineering Plans and Landscape Plans. Alternate drainage systems such as French drains which daylight to ground may be considered where site dictates, if approved by the City.
10. Drainage system details, including cross-section and plan-view layout shall be clearly shown on Landscape drawings.
11. Concrete edger will be required around the perimeter of the playground. Concrete edger shall be 152mm wide and minimum 355mm deep. Concrete shall be 30MPa with 10M rebar placed at top and bottom.
12. Top of concrete edger shall be installed flush with landscaped areas adjacent to playground, unless otherwise approved by the City.
13. Two 8ft long x 6ft wide poured-in-place concrete bench pads are required to be poured adjacent to the concrete edger. Bench pads may be combined to form one single larger pad, as approved by the City. Concrete shall conform to base pad specifications outlined in Section X.G.
14. The Consultant shall contact the City for current typical bench model to be used for playgrounds.

15. Once the playground installation is complete, the playground contractor will be required to provide the City of Spruce Grove with documentation from a certified playground inspector stating that the playground meets these CSA standards.
16. Playground signage conveying park name and address, as well as intended age range(s) of playground must be placed adjacent to playground.
17. The Consultant shall contact the City to perform on-site checks (informal inspections) at key milestones throughout the playground construction process. These milestone checks shall include:
 - Forming of concrete edger and bench pads (prior to pouring concrete)
 - Installation of drainage system
 - Grading of subgrade and placement of geotextile
 - Drilled and cleaned-out footing holes with equipment posts centered-in-place
 - Concrete footings after poured, but prior to installation of safety surfacing.A Playground CCC Inspection will be conducted on completed playgrounds, including all equipment, safety surfacing, and playground edger.
18. Construction fencing shall be erected around the playground perimeter prior to construction and shall remain in place until adjacent turf has been established to a level deemed satisfactory by the City, and the Playground CCC Inspection has been approved by the City.