Morinville Municipal Design Standards

2023 FINAL

June 2023

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1.1 OVERVIEW

1.1.1 Intent of Use

The Town of Morinville Municipal Design Standards are a document to be used by developers and engineers working on projects within the municipal boundaries of the Town as a guide to development, design and construction. They have been developed with the intent to provide the minimum approach to design and construction within the Town, while also being consistent with industry standards and other municipalities in the region.

Where a variation to these standards may achieve a better technical, environmental, economical, or operational solution, a proposal should be presented for acceptance to the Town. Where the Applicant wishes to deviate from these Standards, the onus shall be on the Applicant to justify the proposal and resolve any concerns to the satisfaction of the Town. The Applicant shall prepare and submit for review a report and/or concept design through the variance application process and shall complete the form located in the Appendices.

The Town reserves the right to make the final decision regarding the interpretation of the intent of these Standards as required to address current conditions, construction methods and the scope of development.

1.1.2 References

The Town documents developed to support the Municipal Design Standards that are referenced herein and are applicable to the development of projects include the Land Use Bylaw, Municipal Development Plan, and Area Structure Plan (ASP) documents. These documents can be found on the Town's Website www.morinville.ca for reference.

1.1.3 Definitions

The following terms are used throughout the document, and have been defined below to clarify the meaning assigned to them herein:

a) "Applicant" shall mean a person or corporation who has applied for approval of a proposed development subdivision or to service an existing parcel of land, whether as the owner or an agent for the owner of the land included therein.
b) "Town" or their authorized representative shall mean a Town employee who for the time being is acting for the Town in their respective positions, or any person engaged by the Town to act for the Town.
c) "Consulting Engineer" of "Consultant" shall mean the professional engineer or other professional retained by the Applicant to be responsible for the design, layout and supervision of installation, preparing record drawings and performing those duties in connection with the provision of Municipal Services as set out in these design standards. The Consulting Engineer must be licensed to practice in the Province of Alberta.
d) "Contractor" shall mean any person, persons or corporation which shall undertake the installation of Municipal Improvements on behalf of either the Applicant or the Town.
e) "Developer" shall mean the person or entity that has executed a Development Agreement with the Town, in which Agreement the Developer has undertaken to comply with the specified technical standards and requirements of the Town.
f) "Developer's Responsibilities" any specification statement referring to acts to be performed or materials to be furnished by the Applicant, Consulting Engineer or Contractor shall be construed to be directed to the Developer, who shall in turn ensure that the acts are performed or materials are

furnished by the Applicant, Consulting Engineer or Contractor. The Developer shall be responsible to the Town for compliance with the Design Specifications by his Contractor.

g) "Municipal Improvement" is any addition or modification or proposed addition or modification to a service or facility the Town of Morinville will ultimately be responsible for. These items are noted in Section 1.2.3.7.

h) "Municipal, Municipality or Town" shall refer to the Town of Morinville.

1.1.4 Freedom of Information and Protection of Privacy Act

The *Freedom of Information and Protection of Privacy Act* is in effect for Morinville and it gives any person a right of access to the records in our custody or control, subject to limited and specific exceptions. All documents and information, including correspondence, agreements, plans, and specifications that are written, photographed, recorded, or stored in any manner by Morinville may be subject to the access and privacy provisions of the Act.

Applicants and their agents, consultants, and contractors shall identify all information that they consider confidential, and the basis for confidentiality (including those parts of their submission that relate to trade secrets, commercial, financial, labour relations, scientific and technical information). While Morinville will endeavour to use Sections 15 and 16 of the *Freedom of Information and Protection of Privacy Act* to protect the confidentiality of the information identified by the Applicant or its representatives as confidential, other sections of the Act may apply and the information may have to be disclosed to members of the public who request access to records in Morinville's custody and control.

1.2 DEVELOPMENT PROCESS

1.2.1 Overall Responsibilities

The Applicant/Developer will be responsible for complying with the requirements outlined in these Standards and all other applicable legislation, statutory requirements, regulation, codes, standards, agreements, permits, and licenses.

a) Approvals by other Authorities are the responsibility of the Developer. The development of new areas or redevelopment of existing areas within Morinville requires subdivision and/or development approval in accordance with procedures and requirements of the *Municipal Government Act.* Environmental requirements, both federal and provincial, are the responsibility of the developer and/or engineer designing the work to apply and attain any necessary approvals. Third party approvals (utilities and/or pipelines) may require approvals for crossing or proximity of work to their infrastructure, and will be the responsibility of the developer and/or engineer.

b) The Applicant is responsible to arrange and negotiate any and all land to accommodate the proposed municipal improvements, easements across private lands, private utility crossing agreements and other similar agreements which may be needed with land owners in the area, and shall be transferred to the Town of Morinville.

c) All required Road ROW, Utility ROW, PUL and ER lands for the development shall be registered in a road or subdivision plan.

d) Any information supplied by the Town on existing infrastructure shall be confirmed in the field by the Applicant as the Town does not guarantee the accuracy or completeness of any information provided.

e) The Developer shall engage qualified professionals to undertake all phases of the development process including planning, conceptual design, detailed design, general engineering services during construction, resident layout and construction inspection, quality control assurance, and as-built recording for the proposed development.

f) Where two or more applicable standards govern the design, the more restrictive shall apply.

1.2.2 Variance Request Process

a) Where the Applicant wishes to deviate from these Standards, either during planning, design, or construction, they shall submit a Variance Request Form as included in the Appendices.
b) The Applicant shall include any supporting information in sufficient detail to show that the proposed change will provide better technical, environmental, economical, operating, performance life, or aesthetic results.
c) The proposal shall be signed and stamped by a professional engineer, landscape architect, or other industry professional as applicable to the Design.
d) The Town will review such a proposal on a case-by-case basis and any authorization is only valid for the development under consideration. Costs incurred by the Town for external reviews pertaining to submissions or appeals shall be the responsibility of the Developer.
e) No departure from these Standards shall be permitted except with written authorization from the Town. A variance approval will be issued recording such a revision.
f) Notwithstanding review and acceptance of any such proposal by the Town, the Applicant shall remain fully responsible for the design.

1.2.3 Development Planning and Subdivision

1.2.3.1 Development Applications

Development applications shall be made in accordance with the local development guidelines and procedures required at the time of the application. The Applicant is advised to coordinate a pre-application meeting with the Town to review processes and requirements.

1.2.3.2 Development Brief

Development of new areas or redevelopment of existing areas may require a subdivision and/or development approval in accordance with procedures and requirements set out in the Subdivision and Development Regulation approved pursuant to the Municipal Government Act.

The Town wishes to be kept informed regarding the proposed subdivision and/or development. To this end, the Developer should present a Development Brief to the Town prior to their development application so that it can be reviewed and commented on. This will allow the Developer to modify their application if necessary to take into account any requirements that might arise as a result of the review of the Development Brief. This will also establish the basis for any requirements that will have to be articulated in the development agreement.

1.2.3.3 Development Brief Submission Requirements

The Developer shall submit a statement indicating the type of subdivision proposed (fee simple or bare land condominium or some other form), how the proposed development conforms to the Town's Municipal Development Plan and other statutory plans and/or natural growth directions, total area, total developable area, total Reserves, detailed land uses, public rights-of-way, utility rights-of -way, applicable densities, number of parcels, number of dwellings, and number of densities of development forms (e.g. Number of single family residential lots, acreage and floor area of commercial developments, etc.).

The Town may require that an Area Structure Plan be prepared by a qualified planner for the area in which the proposal is intended.

The Developer should outline any innovative designs, procedures or techniques which are proposed to be incorporated into the development.

The Developer shall submit a Conceptual Servicing Plan of development to the Town. The plan should include all pertinent information regarding all Municipal Improvements including standards of construction, requirements for capacity of water mains, sewer mains, storm drainage, roadways, street patterns, utility easements and other significant aspects relating to the proposed development. The Conceptual Servicing Plan shall be in accordance with the Town's existing Municipal Servicing Plan(s) or existing municipal servicing concepts.

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

a) Contours of existing land surface relative to geodetic elevation datum. Contour interval not greater than 0.5meter;
b) Extent and size of water mains;
c) Extent, size, and critical elevations of sanitary sewer mains;
d) Extent, size and critical elevations of storm drainage systems;
e) Carriageway types, widths and initial intersection elevations, emergency access routes; and
f) Environmental Reserves, Municipal Reserves, & required easements
g) Identification of any recreational programming, such as playgrounds, sports facilities, dog parks, etc.
h) Any other information that the Developer considers necessary to aid the Town in assessing and considering the proposed development.

At the discretion of the Town, the Developer may need to provide technical reports that support the conceptual servicing plan including:

a) Environmental report including Environmental Site Assessments (if conditions warrant).
b) Biophysical Assessment
c) Geotechnical/Hydrogeological report
d) Noise Impact Study
e) Traffic Impact Analysis for all developments the result in more than 100 peak hour trips.
f) Hydraulic Network Analysis including an analysis on the average day, maximum day and peak hour demand scenarios as well as fire flow scenario.
g) Wastewater System Evaluation including an evaluation on the available capacity in downstream systems
h) Stormwater Management Analysis including evaluating conformance with approved storm basin studies and required storage volumes and allowable discharge rates
i) Any other technical reports that may be required at the discretion of the Town.

The Applicant is advised to meet with the Town to review which technical reports will be necessary and to confirm details of the required scope, content, and collect any relevant background information the Town may be able to provide. General requirements for technical reports are outlined in the Appendices.

1.2.3.4 Staging Plan

Developments proposed in stages shall have conceptual servicing plans identifying the stages and any interim requirements. Interim facilities shall be designed to the requirements of the Town and the Municipal Standards and may be subject to other conditions in the development agreement specific to the project.

1.2.3.5 Subdivision Requirements

The Developer shall design their subdivision and/or development in accordance with the following:

a) The design of the subdivision and/or development shall conform to the provincial legislations and Town regulations, Town's Municipal Development Plan, Land Use Bylaw, Master Water, Sewer, and Drainage Plans, and Transportation concepts.
b) The proposed subdivision and/or development shall consider the overall development of the Town, future subdivision and development of adjacent areas, and consideration of existing services to prevent overloading. The inclusion of oversize services to provide sufficient capacity for future developments shall be carried out at the expense of the Developer or as agreed to in a Development Agreement. Staging and sequencing of development should be identified prior to detailed design.
c) Prior to the submission of detailed plans, the Developer should seek the necessary approvals to accommodate proposed zoning, density, lot sizes, and rights-of-way.
d) Rights-of-way and/or easements shall be provided for all utilities not located on streets, lanes, or utility lots, including rights-of-way for back of lot drainage, ditches or watercourses accommodating surface runoff and shallow utilities. Subdivisions requiring curves on roads should reflect right-of-way boundaries with the same curves or sufficient size corner cut-offs to accommodate the curves as well as utilities and municipal services required to be installed in the boulevard.
e) The Developer shall submit a tentative plan of subdivision for the Town's review and approval prior to the submission of detailed plans.

1.2.3.6 Development Agreement

The Developer will be required to enter into a Development Agreement with the Town prior to servicing of a site. A stripping and grading development permit may be required from the Town as a condition of the Development Agreement. The Development Agreement will not be executed until all required submissions have been reviewed and accepted by the Town.

The Developer will be required to provide itemized cost estimates for all Municipal Improvements. Payment of Levies and CIACs (Contribution in Aid of Construction) may be required.

If it becomes necessary to revise the Design Drawings after the Development Agreement has been executed, the Developer shall obtain the Town's written acceptance of such revision prior to construction proceeding**.**

Further information of the Development Agreement process and requirements shall be obtained through meeting with the Town.

1.2.3.7 Scope of Municipal Improvements

The Development areas shall incorporate all aspects of Municipal Improvements into the Plans. Municipal Improvements shall be interpreted to include the following:

a) Water mains: including all fittings, valves, and hydrants;
b) Water service connections: to the property line, or as otherwise directed;
c) Sanitary sewer mains;
d) Sanitary service connections: to the property line, or as otherwise directed:
e) Storm drainage systems;
f) Sump pump services to the property line, or as otherwise directed;
g) Carriageways: developed to an asphaltic concrete surface;
h) Curbs and gutters: both sides of carriageways;
i) Sidewalks adjacent to roadways as outlined in standard details;
j) Driveway aprons;
k) Multiways;
l) Lanes: developed to an asphaltic concrete surface;
m) Pre-grading: the entire subdivision;
n) Landscaping: boulevards, buffer strips, parks, reserves, utility lots, traffic islands, berms, multiways, walkways and easements;
o) Street lighting;

p) Electric power distribution;
q) Traffic signs, traffic control devices and street signs;
r) Natural gas distribution system;
s) Telephone network;
t) Television cable;
u) Fibre optics communication systems; and
v) Fencing: buffer strips, parks, municipal and school reserves, walkways stormwater management facilities as required, pipeline rights-of-way, other utility lots as required and easements as required.
w) Plus such other improvements, municipal trunk mains, offsite tie-ins, or connecting services called for in the development agreement.

1.2.4 Development Engineering Design

1.2.4.1 Design Requirements

a) Design Standards

(i) All Municipal Improvements shall be designed and installed as per approved design drawings and in accordance with the construction standards outlined in this document.
(ii) These design standards do not cover the design or installation of street lighting, ornamental lighting, power, gas and communications, but do include coordination with the various utility companies. New development areas shall construct street lighting to the specifications outlined in the most *current Fortis Alberta Street Lighting Catalogue* or industry best practice.
(iii) The Standard Details as referred to in various sections shall form an integral part of these design standards.
(iv) No departure from these design standards shall be permitted except with the written approval by the Town.
(v) Materials installed shall be tested to confirm compliance with the most recent standard of either AWWA, ASTM, or CSA.
(vi) The Applicant shall retain a Consultant who shall be responsible for the design and preparation of drawings and specifications for all services as required within the Town of Morinville. All submitted designs shall be stamped and signed by the Consultant.
(vii) The Design Drawings are to conform to the plan requirements listed in Section 1.3 – Engineering Design Drawings.
(viii) The Design Drawings shall show all existing and proposed services. It shall be the Consultant’s responsibility to coordinate with the utility companies to establish the location of their existing and extensions of proposed services.
(ix) All proposed streets shall be named on the drawings. Names shall be approved by the Town prior to the submission of drawings.

b) Municipal Services

(i) Servicing Regulations: The type and extent of servicing shall be in accordance with the Development Agreement and the "Approved" plans, specifications and regulations for each municipal improvement.
(ii) Service Connections: All lots shall be serviced with sanitary, water, storm, power, telephone, cable T.V., gas, and highspeed internet. Services shall extend directly into the lot and shall not route through adjacent parcels. Cross lot servicing will not be permitted.
(iii) Canada Post Mailboxes:The location of Canada Post's infrastructure shall be coordinated with Canada Post by the Developer with the locations incorporated in the submitted landscaping plans.

c) In-Fill and Redevelopment

Applications for a development agreement and/or development permits for infill and redevelopment projects must be accompanied by a design report, lot grading plan, and overall utility plan. For some minor residential infill sites, the lot grading plan and overall utility plan may be combined onto one singular plan and Landscaping plans may not be required at the Town's discretion. Please note that Secondary Suites are to be contained all within parcel as per LUB definition. There is no tie into Town infrastructure.

(i) Design Report

- One (1) hard copy and one (1) digital copy of the report must be provided for the Town's review.
- The report should define the methodology utilized by the Consultant, clearly demonstrate conformance of the Design with these Standards, and contain all pertinent information regarding the Design.
- The report shall include:

  - Project background, site information, context plan, aerial photos, existing site photos, and applicable zoning.
  - Changes to the project as a result of Concept/Pre-Design submission, or subsequent discussions.
  - Identification of design elements that deviate from Town standards and guidelines.

- The report shall be signed and sealed by a professional engineer, licensed to practice in the Province of Alberta.

  - Lot Grading Plan, as per Section 1.3
  - Overall Utility Plan, as per Section 1.3
  - The plan shall identify sump pump discharge location and include a note stating "No groundwater or stormwater shall be discharged to the wastewater collection system."
  - Landscaping Plan, as per Section 1.3
  - Erosion and Sediment Control Plan, as per Section 1.3

- Each infill and redevelopment site will be unique in its utility servicing requirements. As such, the Town may request additional details regarding the design in order to ascertain its acceptability.
- The development agreement and/or development permit will not be issued until the design report, lot grading plan, overall utility plan and landscaping plan have been submitted, reviewed, and accepted by the Town.
- Record drawings must be provided to the Town once the project is complete.

1.2.4.2 Engineering Design Review

a) The Consultant shall submit the Detailed Design Drawings and corresponding digital files (PDF) to the Town for review. AutoCAD files are to be submitted upon the request of the Town. The Town's review of the Detailed Design Drawings is only for general compliance with the Town's Development standards as detailed in this document. The Detailed Design shall incorporate all requirements of Municipal Improvements.
b) Incomplete submissions, submissions with excessive errors, or submissions lacking appropriate authentication, may be rejected and returned by the Town without review.
c) The Town shall endeavor to review the plans and specifications promptly, however, the Developer shall schedule their submissions of plans and specifications such as to allow the Town not less than twenty-one (21) days for its review of the documents.
d) Review approval does not, in any manner, imply approval of the technical aspects of the reviewed design. The review only covers compliance with respect to these Standards and is not a warranty of the design.

e) No work will be started within any parcel of land or on any of the services to be provided by the Applicant until the Town has provided approval to proceed.

1.2.4.3 Right of Way Documents

a) Where easement or right-of-way documents are deemed necessary, they shall be prepared and registered at Land Titles by a registered Land Surveyor at the Applicants expense. All Right of Way documents shall be registered and submitted to the Town prior to issuance of Final Acceptance Certificate.
b) The Consultant shall bring to the attention of the Applicant and the Town the need for any rights-of-way outside the subdivision which the Applicant may have to obtain.

1.2.4.4 Crossing Agreements

a) Where a crossing of oil and gas pipeline, railway, or power transmission lines, or other 3rd party, are deemed necessary, crossing agreements shall be obtained at the Applicants expense.
b) All crossing agreements shall be transferred to the Town prior to issuance of Construction Completion Certificate.
c) The Town shall have an opportunity to review crossing agreements before they are signed to ensure the applicable clauses are not restrictive on the operating, maintenance, and eventual lifecycle replacement of Municipal Infrastructure pertaining to the crossing.
d) It is the responsibility of the Applicant to complete a title search with the Alberta Energy Regulator (AER), or current governing body, to determine the existence of any wells or pipelines in use or abandoned.

1.2.5 Development Construction

1.2.5.1 Before Construction

The following items must be completed and approved by the Town before construction can start:

a) Conceptual Servicing Plan;
b) Tentative Plan of Subdivision, all necessary Rights-of-Way plans, Crossing Agreements, and documents of the stage proposed for development;
c) Final detailed design plans and specifications;
d) Signed Development Agreement and/or development permit must be issued; and
e) All Municipal, Provincial, and Federal permits (eg. Letter of Authorization received from Alberta Environment, Water Act, Roadside Development Permits, stripping and grading permit from the Town)

    (i) The Developer shall submit the Extension to a Waterworks, Wastewater, or Storm Drainage System – Notification Form to the Town that has been signed and stamped by a professional engineer.
    (ii) The Developer is responsible to submit to the Director of Alberta Environment the Letter of Notification for any proposed extension to a Waterworks, Wastewater, or Storm Drainage System, or the Letter of Authorization under the Code of Practice shall be submitted to Alberta Environment by the Applicant with a copy given to the Town.
    (iii) If all aspects of the Water, Wastewater, and Storm Drainage designs do not meet the Standards and Guidelines, the project will require written authorization by the Director of Alberta Environment.
    (iv) Written confirmation from the Town to Alberta Environment in support of the Letter of Authorization shall not be issued by the Town until the Town has reviewed and approved final detailed plans and specifications and the final rights-of-way plan.

f) A pre-construction meeting shall be coordinated by the Consultant and the developer, Town, contractor, and all franchise utility representatives.

1.2.5.2 During Construction

The following procedures shall be followed during the course of construction:

a) The Developer's Engineer shall inspect and monitor all construction including the installation of the franchise utilities. The Developer's Engineer shall conduct sufficient field inspections that they can certify the work has been installed in accordance with the intent of the approved plans and specifications.
b) The Developer shall appoint an accredited material testing firm to carry out quality control testing to ensure that construction is in accordance with the approved design. The frequency of testing shall be in accordance with the requirements found within the City of Edmonton Design and Construction Standards, latest edition thereof, for each respective aspect. All tests results shall be supplied to the Town as soon as they become available. Failure to receive test results will be considered sufficient cause to stop the work. Where testing indicates that the required standards have not been met, the deficient areas shall be re-worked and subsequently retested on either side of the failed test until the standards have been met. The Town shall be notified at least 72 hours prior to any testing and may witness the test. The Consultant may meet with the Town to determine impacts of non-compliance test results. At the discretion of the Town, remedial action for non-compliance may include but not limited to acceptance, acceptance with deficiency pay allowance, or removal and replacement at no cost to the Town. The Consultant shall ensure all stages of construction pass testing prior to proceeding to the next stage.
c) Any of the services to be installed by the Developer shall be installed in such a manner as to least interfere with existing services. Any additional costs incurred by the Town shall be charged to the Developer who will reimburse the Town promptly for such additional expenditures incurred.
d) The Developer shall file a request for a connection to existing facilities with the Town at least 72 hours prior to starting work on this connection. In the event existing services must be cut off, the Developer will notify all affected customers of this fact. The Developer must have all material, equipment and labour on hand as necessary to complete this connection in the shortest possible time before they will receive approval to make this connection. Depending upon the length of service interruption, the Developer may have to provide temporary services to the affected customers.
e) In the event that a road must be partially or fully closed for a crossing or connection, the Developer shall provide all detours, signs, flagmen, barricades, etc. necessary to provide for the orderly control of traffic around the construction area. The Town must be notified at least 72 hours in advance of any road closures and appropriate permits obtained by the Developer, from the Town.
f) Any existing facilities disturbed during construction shall be returned as a minimum requirement to their original condition. Where it is necessary to excavate an existing road or lane for the purpose of providing an open trench crossing (for a water or sewer main, gas main, telephone cable, etc.) such excavation must be reinstated to the satisfaction of the Town. The Developer shall be responsible to repair any trench settlements which may occur within two years from installation of the service.
g) Town staff only will operate any existing valves on the water distribution system.
h) All legal control and elevations shall be tied into the existing Alberta Survey Control System within the Town. The Developer shall be responsible to preserve all existing Alberta Survey Control System monuments within or adjacent to their proposed subdivision. Should it be necessary to destroy a monument, or should an existing monument be disturbed, as a result of the development or because of any of the Developer's or his agent's actions, a replacement monument shall be arranged for by the Town, the total cost of which shall be borne by the Developer. Replacement monuments shall be completed and paid for prior to issuance of a Final Acceptance Certificate for paved roads.
i) The Town has the right to monitor and inspect the work at any time and have full access to the site during construction. The Town shall abide by the safety requirements as stipulated by the Prime Contractor on the site.
j) Protect all existing landscaped areas, including trees, sod, and shrubs.

k) Protect all adjacent properties from dust, sand, and erosion and sedimentations during construction. The Developer's responsibility to ensure all debris is removed from adjacent lands and to ensure no nuisances are caused by construction on adjacent properites.
l) Weekly progress meetings are to be coordinated by the Consultant with the Town and all other project stakeholders.
m) Should the Development require haulting of more than 50 tandem loads of materials in or out of the site, the Developer shall provide a truck haul plan to the Town, including provision for road cleaning of tracked mud and debris.

1.2.5.3 Post Construction

Prior to final acceptance of the development by the Town, the following conditions and procedures shall be completed:

a) Construction Completion Certificate (CCC):

(i) A maximum of three (3) Construction Completion Certificates shall be issued by the Town for the development: one for underground utilities, one for surface improvements; and one for landscaping and fencing. The following inspections and reviews shall be carried out prior to the issuance of a Construction Completion Certificate.

- A pre-inspection by the developers representative and Contractor to ensure completeness
- A joint inspection of all completed improvements by all parties including the Developer's representative, Town representative and Contractor.
- An inspection may only be scheduled during periods of suitable weather and seasonality.
- The Developer shall arrange and pay for:
  - Power washing and broom sweeping of all streets in the development area.
  - Water truck at time of inspection to inspect overland drainage
  - Hydrovac and cleanout of all Catchbasins and manholes
  - Provide traffic control for safe inspection and labor for heavy lifting, as requested by the Town.
- A review by the Town of all materials testing results.
- All applicable water systems reporting
- A review by the Town of all closed circuit video inspection (CCTV) reports on sanitary and storm sewer construction (submitted in electronic format).
- No Building permits shall be issued until the subdivision plan is registered, all essential services have been provided, completed and inspected as specified in the Development Agreement or Development Permit, and a Construction Completion Certificate (CCC) has been issued by the Town. An exception may be considered for the construction of a "show home".
- The applicant shall be responsible for, at his own expense to remedy any defect, fault of deficiency in the completed works during a twenty-four (24) month maintenance period. The maintenance period shall commence from the date of issuance of the Construction Completion Certificate.
- The applicant shall complete the standard Construction Completion Certificate located in the Appendices.

(ii) On application from the Developer or the Developer's Engineer, the Town may issue a Conditional Construction Completion Certificate that would allow submission of the as-built information to be delayed to not later than six (6) months form the effective date of the Conditional Construction Completion Certificate, the effective date of the Conditional

Construction Completion Certificate shall be amended to be six (6) months prior to the date of submission. The date of submission shall be considered as being the date when all required as-built information has been turned over to the Town, including the correct number and type of copy required.

(iii) All Local Improvements shall carry a guarantee for all materials and workmanship. The time period covered by any guarantee shall be termed "Maintenance Period". The length of the "Maintenance Period" shall be two (2) years from the date of the Construction Completion Certificate.

(iv) The following documentation shall be submitted by the deadlines shown:

Table 1.1: Inspection Table

Item	Deadline
Pressure and Leakage Test Results	Prior to CCC Inspection
Chlorine Residual Test Results	Prior to CCC Inspection
Bacteriological Test Results	Prior to CCC Inspection
CCTV Data and Report	Prior to CCC Approval
Material Testing Results Report	Prior to CCC Approval
Operating and Maintenance Manuals	Prior to CCC Approval
URW Documentation & Crossing Permits	Prior to CCC Approval
Infrastructure Asset Report	Prior to CCC Approval
Hydrant Flow Test Results	Prior to CCC Approval
Water Facility Reports (Valves, Hydrants, etc)	Within 90 days of CCC Approval
Service Connection Reports	Within 90 days of CCC Approval
As-Built Drawings	Within 90 days of CCC Approval

b) Final Acceptance Certificate (FAC)

(i) The following inspections and reviews shall be carried out prior to the issuance of a Final Acceptance Certificate.

- A pre-inspection by the developers representative and Contractor to ensure completeness
- Within sixty (60) days prior to the scheduled date of expiration of the maintenance period, a joint inspection of all completed improvements by all parties including the Developer's representative, Town representative and Contractor.
- The Developer shall arrange and pay for:
  - Power washing and broom sweeping of all streets in the development area.
  - Water truck at time of inspection to inspect overland drainage
  - Hydrovac and cleanout of all Catchbasins and manholes
  - Provide traffic control for safe inspection and labor for heavy lifting
- The correction of identified deficiencies and re-inspection
- A review by the Town of all closed circuit video inspection (CCTV) reports on sanitary and storm sewer construction (submitted in electronic format).
- Provision of a one (1) year materials warranty by the paving contractor on the final asphalt lift.
- A land surveyors report on the evidence and replacement of property legal posts and plans indicating the establishment of Alberta Survey Control Monuments (ASCM). Developer shall be responsible for the replacement of legal survey markers by a licensed legal surveyor.
- Any further testing, arising out of the foregoing submissions, which the Town may request at their discretion

– The applicant shall complete the standard Final Acceptance Certificate located in the Appendices.

(ii) Until such time as a "Final Acceptance Certificate" has been issued, the Town will not assume actual take-over of the subdivision and the Developer shall continue to guarantee all materials and workmanship for the Municipal Improvements and landscaping maintenance.

1.3 ENGINEERING PLAN STANDARDS

Detailed design drawings shall provide a complete description of the existing and proposed infrastructure, provide sufficient information to construct the proposed infrastructure, and indicated any provisions for future extension of utilities and systems.

All Drawings shall include the following:

a) A title block with adequate project identification
b) Drawing scale
c) North arrow direction
d) Date of issue and revision tracker
e) Professional stamps and permits, as applicable

Every drawing shall have legible lettering and utilize metric units.

A standard drawing set shall include the following Plans:

1.3.1 Overall Plans:

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

1.3.1.1 Cover Sheet: This will show the name of the subdivision, revision number, list of drawings, the location, stage and year of development and names of the developer and consulting engineer.

1.3.1.2 Index Plan: This plan 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. Index plan will include any ASCM data and locations used for the development of the drawings.

1.3.1.3 Lot Grading Plan: An overall plan shall be drawn to a scale of 1:1000 and will indicate at a minimum:

a) the original contours
b) proposed finished lot corner elevations at back corners of the lot
c) proposed top of curb elevations at front corners of the lot
d) proposed lot grades
e) directions of surface drainage flows
f) catchbasins, manholes and rim elevations
g) storage areas, ponding depths and overflow locations
h) hydrants
i) street lighting standards
j) pedestals
k) transformer
l) mailbox locations.

1.3.1.4 Individual detailed plot plans in a 210 mm x 280 mm (82" x 11") format summarizing the above mentioned information is required for each lot prior to issuance of a Building Permit. Plot plans are to be prepared by a legal surveyor or professional engineer.

1.3.1.5 Road, Sidewalk and Walkway Plan

a) This plan will be drawn to a scale of 1:1000 and will indicate:

(i) all locations, names and widths of roads,
(ii) sidewalks and walkways
(iii) show detail of typical road cross-section including:
(iv) road structure
(v) height of crown in millimetres
(vi) wick drains
(vii) locations of catch basins
(viii) cross-section details

1.3.1.6 Sanitary Sewer, Storm Sewer and Watermain Overall Plan

a) This plan will be drawn to a scale of 1:1000 and will indicate:

(i) the alignments and locations of mains
(ii) size of mains
(iii) direction of flows
(iv) locations of appurtenances. All manholes, fire hydrants and water valves shall be numbered to conform to the Town's numbering system.

1.3.1.7 Sanitary Basin Plan

a) Show and label sanitary mains and manholes
b) Sanitary main flow arrows
c) Sanitary catchment boundaries
d) provide tables indicating the design factors used for sanitary sewer design along with the hydraulic design calculations for each manhole to manhole section in each system including downstream manholes
e) identify within the overall development the stage represented by the drawings being submitted.

1.3.1.8 Storm Basin Plan

a) show and label storm mains and manholes
b) Show main flow arrows
c) Storm catchment boundaries
d) provide tables indicating the design factors used for storm sewer design along with the hydraulic design calculations for each manhole to manhole section in each system including downstream manholes
e) provide plans indicating the overall development area showing the storm sewers, storm water management and storage facilities and all receiving channels or drainage facilities
f) provide a table showing minimum bottom of footing elevations where lots border a storm pond
g) identify within the overall development the stage represented by the drawings being submitted
h) indicate the location and direction of major overland flows and receiving water course
i) show overall surface drainage including roads, P.U.L.s, back of lot swales and parks
j) show storm catchment areas
k) show storm pond cross-sections complete with labelled side slopes
l) show normal and high water levels for storm pond

1.3.1.9 Erosion and Sediment Control Plan

a) Site runoff direction
b) Road names
c) Stockpile locations (if applicable)
d) Stripping and grading limits
e) Silt fence locations
f) Interim storm discharge locations
g) Swales/ditches
h) Silt fence detail

1.3.2 Detailed Plan/Profile:

Generally all underground services and surface improvement profiles shall be shown on the same drawing. The following information shall be included on the detailed plan/profile drawings.

1.3.2.1 Requirements for Water

a) Show the location of hydrants, valves, tees, crosses, and other fittings tied to the nearest iron pin. Hydrants and valves are also to be dimensioned to two property lines.
b) Show the offset of the main from the property line and locate the end of the main to the nearest iron pin.
c) Indicate extent of work required in making connections to existing watermains.
d) Indicate the size, type, class of pipe and class of bedding on the plan.
e) A profile of the watermain shall be required showing invert elevations at all grade changes. Storm and sanitary mains shall also be shown on this profile.
f) Valves and fire hydrants to be numbered to conform to Town standards.
g) Indicate clearance at crossings.

1.3.2.2 Requirements for Sanitary and Storm Sewer

a) The following information shall be shown on the profile:

   (i) Size, type, class of pipe and class of bedding.
   (ii) Sewer profiles shall be drawn showing length and percent grades between manholes.
   (iii) Invert elevations at both inlet and outlet of manholes.
   (iv) Storm sewer pipe capacity, design flow and velocity calculated for a 1:5year rainfall event. Full flow and partial flow velocities to be included.
   (v) Sanitary sewer pipe capacity, design flow and velocity.

b) The following information shall be shown on the plan:

   (i) Dimension of manholes, cleanouts, and other appurtenances to property lines.
   (ii) Pipe offsets from property line.

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

   (i) Manholes shall be numbered in accordance with Town standards.
   (ii) Where the sanitary sewer or water and storm sewer are to be installed in a common trench, detail a typical cross section showing distance between pipes, class of pipe and bedding.

1.3.2.3 Requirements for Roads

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

b) The plan should be referenced to the cadastral coordinate system with appropriate ties to Alberta Survey Control Monuments (ASCM) for layout purposes.
c) Show the road width and the curb offsets measured from the property line to the curb face.
d) Chainages of the BC and EC of horizontal curves shall be shown together with the delta angle, radius, tangent length and arc length for each curb. If the plan is referenced to the cadastral coordinate system, coordinates shall be provided for the BC, EL and CC of each curve.
e) The percent grade to two decimal places shall be shown on the profile together with the following information on vertical curves:

(i) The chainage coordinate and elevations of BVC, EVC and PVI;
(ii) K valve of vertical curve;
(iii) The length of vertical curve;
(iv) The elevation and chainage of the low spot of sag curves, or the high spot of crest curves.
(v) Road profiles shall show the centreline pavement and lip of gutter elevations.
(vi) The profile shall be shown at true centreline length and projected above or below the plan in as close relationship as possible.
(vii) Locate catch basins (using road chainage) and show leads between the catch basin and the mainline manhole.

1.3.3 Standard Details

Provide all applicable standard details located in Section 4.0.

1.3.4 Shallow Utility Plan

1.3.4.1 Shallow utility plan to include:

a) alignments for gas, power, and communications
b) all road crossings complete with the number and size of conduits
c) location of water and sewer service locations
d) location of all infrastructure surface features including hydrants, catch basins, manholes, valves, street lights, pedestals, transformers and project fencing

1.3.5 Record Drawings

1.3.5.1 General

a) The record drawings shall clearly show the location of all services as installed using offsets from property lines.
b) On record drawings submitted to the Town, the following information shall be included on each drawing: (1) Date of completion; (2) Name of Contractor; (3) Date on which record details were added.
c) Record drawings are to include: (1) two sets of signed and sealed drawings in paper print format. (2) an electronic PDF file of the signed and sealed drawings (3) an electronic file in AutoCAD format compatible with the Town’s software.
d) The Record drawings are to be submitted to the Town within two (2) months of the installations.

1.3.5.2 Storm and Sanitary Sewer

a) Size, pipe material, pipe class and location of mains;
b) Location of manholes, cleanouts, and other appurtenances numbered in accordance with the Town's number system.
c) Grades, lengths and inverts of mains.
d) Storm sewer pipe capacity, design flow and velocity calculated for a 1:5year rainfall event. Full flow and partial flow velocities to be included.

e) Sanitary sewer pipe capacity, design flow and velocity.
f) Design calculations for storm and sanitary sewer flows.

1.3.5.3 Water

a) Size, type and location of pipe;
b) Location of valves, tees, hydrants and other appurtenances number in accordance with the Town's number system.
c) Profile of pipe.

1.3.5.4 Road, Curb, Sidewalks

a) Location of curbs, sidewalks and elevations of curbs;
b) Lip of gutter profiles for each curb;
c) End of curb, sidewalks and pavement;
d) Type of road structure.

1.3.5.5 Water and Sanitary Service Connections

a) Provide a table indicating the lot and block number of each service along with type of service (single or double) distance from both front property pins, invert elevation of the sanitary sewer service at the main and at the property line and diameter of water service.
b) Details shall be provided for any service which is not 90 degrees to the main. Servicing charts shall be provided immediately upon issuance of a Construction Completion Certificate.
c) Records shall be provided within 4 months of construction completion or prior to the issuance of the first occupancy permit within the development.
d) Developer shall complete the Service Connection Form as found in the appendices.

1.3.5.6 Individual Plot Lot Plans

a) Individual lot plans shall be submitted for each lot. Lot plan shall be in 210 mm x 280 mm (8½" x 11") format. The Town will review and approved plans following a visual inspection of the lot grading.

1.4 MUNICIPAL OPEN SPACE STANDARDS

1.4.1 Introduction

1.4.1.1 Intent and Scope

a) The Town aims to provide a high quality outdoor experience for its residents through the development of public open spaces. Working with the development industry, residents and other stakeholders, The Town strives to implement suitable open space that meets demands for recreation, and improves the appearance of the public realm. Open spaces that range from highly manicured parks to natural areas serve our residents and wildlife with recreational, aesthetic, ecological, health and safety benefits. Balancing human use with ecological protection is essential, ensuring that people maximize their enjoyment of the outdoors while adequately protecting natural ecosystems.
b) Users of this document must refer to the Legislative Officer or Town Administration to ensure they are referring to this standard document in its latest edition.
c) The intent of these standards is to outline minimum requirements for all development within public open space, most typically proposed through subdivision. This document provides minimum acceptable standards to developers and other interested parties requiring knowledge of the principles governing the development of public open space in the Town. This helps to establish consistency and predictability in development costs, implementation and long term care of public open space. These standards also ensure consistency in the appearance of public open space.

d) Concurrent to applying the standards to development proposals, applicants must also review and conform to the Morinville Municipal Design Standards, in its latest edition. In areas with conflict the Engineering Standards prevail at the discretion of the CAO. The Town's acceptance of any design covers only compliance of the design to these standards and is not a warranty of any design or acceptance of liability over the design or construction.

1.4.1.2 Overall objectives of the MOSS include:

a) ensuring the development of public open space can be implemented in a cost efficient manner, while maximizing user experience. Development of public open space must provide attractive landscapes, while implementing landscapes that can be easily maintained;
b) selecting plant material, hard surfacing and other materials that are suitable to the climatic conditions of the Town;
c) maximizing public safety;
d) serving ecological functions through environmental design strategies such as water conservation and groundwater recharge, increasing permeable surfaces to alleviate drainage concerns, conserving energy, protecting and improving air quality, etc.;
e) increasing biodiversity within the Town, respecting the need to enhance habitat for wildlife and to provide opportunities for nature appreciation by residents; and
f) implementing standard practices, procedures and specifications to help the development industry, residents and other stakeholders understand base level requirements and procedures to follow during development.

1.4.2 Definitions and Acronyms

a) **AAA** – Alberta Association of Architects
b) **AALA** – Alberta Association of Landscape Architects
c) **AIA** – Alberta Institute of Agrologists
d) **Administration** – the collective staff of the Town of Morinville, and in the context of drawing review represented by the Director of Planning and Economic Development
e) **APEGA** – Alberta Association of Professional Engineers and Geoscientists of Alberta
f) **Applicant** – a person or corporation who has applied for approval of a proposed development subdivision or to service an existing parcel of land, whether as the owner or an agent for the owner of the land included therein.

g) **ASCM** – Alberta Survey Control Markers
h) **ASP** – Area Structure Plan
i) **Bare Root** - the root system of nursery stock without a ball of earth
j) **Boulevard** – the area of public land between the curb of a roadway and the adjacent private property line. This area usually contains underground utilities, and often includes a public sidewalk, signs, trees, hydrants and other above grade utilities
k) **BMP** – best management practice
l) **Branch** – the major lateral shoots emanating from a tree trunk, as compared to twigs or spurs which are minor shoots emanating from a trunk or branch
m) **Caliper (Cal.)** – the above ground diameter of a distinct part of a nursery stock item, measured as DBH (diameter at breast height). Term is commonly abbreviated by "Cal." Measurements for DBH are typically taken approximately 1.5m off the ground
n) **Cane** – the major shoots emanating directly from the basal area of a shrub
o) **CCC** – Construction Completion Certificate shall mean a certificate issued by an Applicant or Consultant and executed by the Town, confirming that work is complete and operational, that all deficiencies have been resolved to the satisfaction of the Town, and that the warranty period for the work has commenced
p) **Certified Plants** – designated free of injurious pests or diseases
q) **CNLA** – Canadian Nursery Landscape Association, which publishes the Canadian Standards for Nursery Stock

r) **Collar** – the region of the plant where root and shoot meet, generally at the soil line
s) **Consultant** – a professional individual or firm acting on behalf of the Applicant or Developer to coordinate, prepare and execute conceptual drawings and design briefs, design drawings, specifications, and construction management processes
t) **Container** – the pot in which nursery stock is grown or sold, and can be made of any or a combination of plastic, cloth, wood, paper, etc.
u) **CPSI** - Canadian Playground Safety Institute
v) **DBH** – diameter at breast height, more specifically the measurement of a tree's trunk diameter at approximately 1.5m from the ground used to determine the size of deciduous trees
w) **Environmental Reserve** - land owned by the Town to be preserved in its natural state. Environmental Reserve consists of swamps, gullies, coulees, natural drainage courses and areas subject to flooding, steep slopes and strips not less than 6m in width at the edge of any lake, river, stream or other body of water in accordance with the *Municipal Government Act*
x) **ER** – Environmental Reserve
y) **ESC** – Erosion and Sediment Control
z) **FAC** – Final Acceptance Certificate shall mean a certificate issued by an Applicant or Consultant and executed by the Town, confirming that work is complete and operational, that all deficiencies have been resolved to the satisfaction of the Town, and that the warranty period for the work has been completed. At time of FAC execution, open space amenities become the responsibility of the Town as per Development Agreement
aa) **Green Spaces, Public Open Space, or Open Spaces** – any parcel of land designated to be retained as permanently vegetated land or surfaced with materials compatible with prescribed public uses that is set aside and designated as reserve for public use
bb) **Height (ht.)** – in the context of plant material, the vertical distance between the ground and the top of the stem of a plant, measured in its natural position
cc) **HWL**- high water level
dd) **Intensive Use** – an area of high use such as trails, play equipment areas, spray parks, sports fields and other recreational amenities
ee) **LANTA** - Landscape Alberta Nursery Trades Association
ff) **Lot** – a portion of a subdivision or any other parcel of land intended to be or actually transferred for ownership, or lease to, some entity for the purpose of development. The term 'lot' is interchangeable with 'parcel'
gg) **LUB** – Morinville Land Use Bylaw, in its latest edition
hh) **MDP** – Municipal Development Plan, in its latest edition
ii) **MR** – Municipal Reserve. Land that is under ownership of the Town for the development of parks and school sites in accordance with the *Municipal Government Act*. MR lands may not be sold, leased or otherwise disposed of without removing the MR designation. Municipalities may remove the designation only after giving notice, holding a hearing, and considering the views of those affected. The land may then be sold or used for any purpose. Proceeds from the disposal of municipal reserves may be used for park or recreation purposes only
jj) **Natural Area** - an area of natural vegetation that is generally undisturbed, unmaintained, and is self-perpetuating. It includes not only trees, but also native shrubs, ground covers, wildflowers, vines, and grasses. May be either naturally occurring, or human created areas
kk) **NWL-** normal water level
ll) **Plug** – in the context of plant material, a cylinder of soil in which a plant is grown
mm) **Prepared Subgrade** – the soil immediately beneath a pavement structure or finished surface of soil that has been modified and prepared as specified for the construction of a structural surface above
nn) **PUL** – Public Utility Lot
oo) **Root Ball** – the intact ball of earth containing the roots of a plant
pp) **Shall / Should / May** – the word 'shall' denotes a mandatory requirement. The words 'should' or 'may' denote an optional or suggested recommendation
qq) **SPD**- Standard Proctor Density. The laboratory testing method of determining the optimal moisture content at which a given soil will become most dense and achieve its maximum dry density.
rr) **SWMF** – Storm Water Management Facility
ss) **Trunk** – the distinct part of a stem, or stems of a tree, before branching occurs

tt) **Weeds** – any plant and seed material that is designated “noxious” or “prohibitive noxious” under the Weed Control Regulation of the Alberta Weed Control Act, in its latest edition

1.4.3 Reference Documents: Statutory and Non-Statutory Documents

Users of the MOSS must also refer to. at minimum, the following other standards, plans and documents in the process of developing public open space. These are listed in alphabetical order and not in any order of significance:

a) Area Structure Plans (ASP) for the pertinent area of development;
b) Community Standards Bylaw, in its latest edition;
c) Edmonton Garrison Heliport Zoning Regulations (SOR/2004-86);
d) Municipal Development Plan (MDP);
e) Province of Alberta *Municipal Government Act*, Chapter / Regulation: M-26 RSA 2000;
f) Province of Alberta *Weed Control Act*, Statutes of Alberta, 2008 Chapter W-5.1;
g) Parks, Recreation, Culture and Trails Master Plan;
h) Stormwater Management Guidelines for the Province of Alberta – Alberta Environmental Protection, January 1999 (or its latest edition);
i) Morinville Land Use Bylaw, in its latest edition; and
j) Transportation Master Plan.

1.4.4 Drawing Submissions

1.4.4.1 Drawing Submission Procedures

a) Drawing Requirements

(i) The Applicant must provide complete drawing sets that represent the full extent of development for landscape improvements. Drawings for all open space improvements must be submitted concurrently with Engineering drawings. Drawing reviews by the Town are for the sole purpose of determining compliance with the MOSS and other applicable plans. The Town’s review and acceptance of any submissions do not relieve the Applicant of their responsibility for errors and omissions or their responsibility of meeting all requirements of the MOSS and any other Municipal, Provincial or Federal rules and regulations.

(ii) Drawings for all submissions must be sealed and signed by a Professional Landscape Architect (AALA), Professional Engineer (APEGA), Professional Agrologist (AIA), or Professional Architect (AAA) that is registered and in good standing with their Provincial Association. The signing professional must be competent in all facets of design that are included in the drawing set. Should more than one professional seal be applied to any drawing for interdisciplinary work, the drawing must clearly identify which professional seal covers what aspects.

(iii) Any Erosion and Sediment Control (ESC) plans must be certified by any of a Professional Engineer (P.Eng.) or Certified Professional in Erosion and Sediment Control (CPESC), in good standing with their respective professional association.

(iv) A current member of the Canadian Playground Safety Institute (CPSI) or Professional Landscape Architect (AALA) must certify drawings and information packages for any playground equipment.

(v) Along with all submissions for approval, the Applicant shall submit documentation to the Town that permission has been received from appropriate authorities for crossing of pipelines, railways, highways, or other facilities that require approval.

(vi)

b) Drawing Submissions

(i) Drawing submissions must be made at the following points of design development and implementation:

- design brief at the onset of development proposals. This shall be the basis for the initial discussion between the Applicant and Town, to avoid plans that are unacceptable and to avoid unnecessary expenditure;
- preliminary submission with design development no less than 90% complete;
- any interim drawing submissions required to address comments provided by the Town;
- final submission of drawings upon addressing all comments from the Town; and
- as-built drawings for all aspects of built improvements.

c) Drawing Review

(i) The Applicant will be responsible for any review costs deemed appropriate by the Town. Costs include, but are not limited to:

- specialized consulting expertise required by the Town to review development proposals, concept plans, and drawings, for expertise that is not currently in-house to the Town;
- review of complex submissions or deviations from municipal standards;
- where excessive errors and omissions are encountered;
- where insufficient information is provided; and
- where improper procedures are followed.

(ii) The cost of review may take several forms, including:

- a lump sum fee charged to the Applicant; or
- an invoiced cost by specialized consultant, plus mark-up for handling and administration.

(iii) Each and every submittal by the Applicant will be reviewed by the Town and the Applicant will be informed of the anticipated review costs. The Applicant shall reimburse the Town prior to review of re-submissions.

d) Approval of Submissions

(i) Upon any submission by the Applicant to the Town, Administration shall inform the Applicant within 15 working days after receipt of the submission, whether or not the submission has been accepted. If not accepted, formal comments will be provided to the Applicant for revision to the satisfaction to the Town. The 15 working day review process will begin again on the receipt of any re-submission.

(ii) Once submissions are accepted by the Town, a letter indicating the submission name and date of submission will be provided by the Town to the Applicant, indicating acceptance and any conditions of this acceptance.

(iii) Whenever it is necessary, for any reason, to make changes to the design drawings after they have been approved, two full sized prints of each original drawing affected shall be submitted with the proposed changes shown in red, accompanied by a letter outlining the reasons for the required changes. The Town will inform the Applicant within five working days after receipt if the proposed changes meet with the approval of the Town. One copy of the requested change will be signed and returned, accompanied by a letter authorizing the changes to be made on the original approved detailed design drawings. No changes are to be made to any original approved drawings without following this procedure.

1.4.5 Submission Formats

The Town will accept, at minimum, the following submission formats:

a) **design brief** – a written letter that may include narratives, diagrams, conceptual drawings or precedent images representing proposed development for public open space. This letter will indicate how the proposed development aligns or conflicts with any of the documents listed in Section 1.3, amongst others. The design brief will also identify, if applicable, the amount of MR to be provided in the current phase of development and the overall MR dedication required for the overall development. This design brief may be required at the discretion of the Development Authority to inform, or be appended to, the development agreement. Geotechnical engineering reports may be required to support some of the rationale for design elements proposed within the design brief. Other technical reports such as tree retention plans prepared by an appropriate professional may be required, to the discretion of the Town;
b) **preliminary submission** – digital .pdf drawings, at half scale (ANSI B / 279x432mm/11x17inch) bound in a single .pdf package, printable black and white, and a file size to not exceed 10MB. Should file sizes exceed 10MB, three hard copies (ANSI B / 279x432mm) of drawing sets will be accepted in lieu of a digital file. All drawings are to be produced in landscape format. Geotechnical engineering reports may be required to support some of the rationale for design elements proposed within the design drawings or to ascertain that standard details within the MOSS are suitable to actual site conditions;
c) **interim drawing submissions** – digital .pdf drawings, at half scale (ANSI B / 279x432mm) bound in a single .pdf package, printable black and white, and a file size to not exceed 10MB. Should file sizes exceed 10MB, three hard copies (ANSI B / 279x432mm) of drawing sets will be accepted in lieu of a digital file. All drawings are to be produced in landscape format;
d) **final submission** – digital .pdf drawings, at full size (A1 / 594x831mm) bound in a single file.. Two hard copies at full size (A1 / 594x831mm) bound in a single package. One CD or flash drive containing base plan information in AutoCAD compatible format, including all model space information (paper space sheet layouts are not required); and
e) **as-built drawings** – digital .pdf drawings, at full size (A1 / 594x831mm) bound in a single file. One hard copy at full size (A1 / 594x831mm) bound in a single package. One CD or flash drive containing base plan information in AutoCAD compatible format, including all model space information (paper space sheet layouts are not required).

Drawing title blocks, legends and orientation - Drawing title blocks shall contain the following information, at minimum:

a) Morinville logo;
b) project name or name of development, including any phase or stage number / letter;
c) description of drawing;
d) the submission type and date on the sidebar legend, including a list of all previous submissions and dates must be included on any subsequent submission;
e) legal land description of the subject property, and in the case of multiple descriptions a list of each applicable parcel to that specific drawing;
f) name of any consultant;
g) listing of all utilities shown on the plan(s) and the required setback to each utility as prescribed by the pertinent utility provider or owner;
h) identification of the individual(s) preparing and / or reviewing the drawings, noting two or three letter initials for each individual;
i) legend that describes all line types, hatches, etc. used in the drawing;
j) drawing scale, and in the case of multiple scales shown on the drawing the words “as noted”; and
k) drawing number.

All drawings in plan view must show a north arrow located at the top left of each viewport. Preference will be to have north straight up where possible, or to the right as an alternate preference. North orientation shall be consistent as much as possible throughout the drawing package.

1.4.5.2 Drawing Units

All drawings are to include dimensions and any measurements in metric units only.

1.4.5.3 Text

All lettering on drawings must be minimum 2.5mm in height at full scale drawing size (A1 / 594x831mm) and have line weights no less than 0.18mm in thickness.

1.4.5.4 Drawings Required

The following drawings, at minimum, shall be required in open space design drawings:

a) Location and Index Plan

All of this information may be included on a single drawing or on separate drawings depending on the size of the project and on individual preference. The location plan should show:

(i) street names or nearby roads;
(ii) phasing (if applicable) for past and current stages;
(iii) limits of proposed development for the current drawing package, etc.; and
(iv) list of drawings in the package, required only for packages that exceed six pages.

b) Existing Conditions Plan

Any existing site features including:

(i) existing topography and overall drainage patterns;
(ii) natural features, such as vegetation, watercourses, pipelines, railways, easements, etc.; and
(iii) the context of surrounding development, including road or trail connections, grades, etc.

c) Grading Plan

Plans that demonstrates proposed grading to include:

(i) spot elevations at all property corners within or nearby the site;
(ii) proposed contours at suitable intervals and locations depending on the scale of drawing;
(iii) arrows showing generic pattern of flows as well as percentage slopes; and
(iv) any temporary site access, laydown areas, parking, stockpile locations, equipment storage (during construction) and site boundaries.

d) Hard Surface Plan

(i) existing and proposed trails, sidewalks and other hard surfaces denoting surface type and correlated with pertinent technical details; and
(ii) parking lots including spot elevations of all corners, contours showing change in slope and percentage slope over surfaces.

e) Fencing Plan

(i) types, height and location of various fences;
(ii) location of property lines, and notes stating where fence alignments are proposed compared to property lines;
(iii) locations and widths of gates, if applicable; and
(iv) locations of bollards along PULs, walkways, MR entrances, multiways, etc.

f) Planting Plan

(i) all turf, perennial plants, ground covers, shrubs, and trees;

(ii) total measurements (in sq.m.) of shrub beds, flower beds, islands, buffers, PULs, MRs, ERs, SWMFs, parks, etc.;
(iii) total measurements (in sq.m.) of proposed seeded and sodded areas, existing vegetation;
(iv) existing and proposed utilities, including proposed planting setbacks from each of these utilities that conform to minimum setbacks prescribed by each utility owner;
(v) all existing vegetation to remain, any existing vegetation to be relocated on site, areas of existing ground to remain, etc.;
(vi) plants to be drawn to 2/3 of the mature spread or diameter, as published in the Canadian Standards for Nursery Stock in its latest edition, a publication of the Canadian Nursery Landscape Association (CNLA);
(vii) a plant schedule, with a graphical key that correlates the plant list with all species on that page. Plants must be coded with maximum three letters and must include the total number of plants that are keyed on the overall page. The plant schedule will include the number of each species, the name of each plant in both common and botanical (latin) name, the size of plants (height for coniferous trees, DBH for deciduous trees, height for deciduous shrubs, spread or height for coniferous shrubs and container size for perennials) and any conditions of the proposed plant (such as number of canes, minimum and maximum branching heights, etc.). The Canadian Standards for Nursery Stock in its latest edition must also be referred to in classifying plant sizes, conditions and other attributes noted on the plant schedule;
(viii) areas to be seeded or sodded, and including the proposed seed mix for each area. The legend shall demonstrate what each seeded area hatch type represents. Each seed mix must also include proposed seed rates and type of application;
(ix) mulches for plant beds or other landscaped areas, including mulch type and proposed depth;
(x) location of any trails, driveways and other hard surfaces; and
(xi) a chart showing the total amount of MR on site, and a calculation demonstrating the rationale for the number of trees and shrubs proposed for each area.

g) Furniture Plan

(i) location of proposed site furnishings, such as benches, waste receptacles, picnic tables, pedestrian scaled lighting, etc.
(ii) lighting is required for MUT’s and stubbing must be completed for lighting along trails for MUT’s.

h) Irrigation Plans

Irrigation is not a minimum requirement for the Town for any new development. Special circumstances may lead to a proposed irrigation system for any of the public open spaces proposed in plans. Irrigation plans shall demonstrate:

(i) types of irrigation application used, such as drip, broadcast, etc. irrigation;
(ii) stubbing of sanitary water and power; this is for irrigation or park washrooms;
(iii) location of each irrigation head and extent of coverage for each unit;
(iv) location and diameter of all water supply lines;
(v) location of all blow-out valves, controller units, junction boxes, control valves, etc; and
(vi) power supply and lines for the irrigation system.
(vii) ADD

i) Erosion and Sediment Control

Erosion and sediment control (ESC) plans must include, at minimum and must consult with engineering standards:

(i) protection measures for all existing natural features, such as watercourses, vegetated areas to remain, etc.;

(ii) inlet protection measures, demonstrating how catch basins and other utilities that lead to SWMFs are protected in advance of turf and other groundcovers being established and protected from erosion and sedimentation;
(iii) temporary erosion control measures used to protect the site from erosion during the course of construction;
(iv) permanent erosion control measures, such as blankets, mulches, etc. that are used to minimize or prevent erosion from taking place on site;
(v) sediment control measures such as silt fences, sediment socks, straw bales, etc. used to collect sediment once under transport;
(vi) wind protection measures to prevent transport of sediment via the air, particularly addressing stockpiles and areas of soil that will remain bare for extended periods of time; and
(vii) listing of best management practices for ESC planning, such as tracking, equipment washing, contouring, etc.

ESC plans should include a list of estimated units for each proposed ESC measure along with notes describing best management planning strategies such as having ESC products on hand during construction.

j) Construction Details and Specifications

When a detail is available, Applicants must import drawing details from Section 10.0 – Standard Drawing Details directly, and include both the title block and all graphical information without modification.

1.4.6 Landscape Construction and Municipal Approvals

1.4.6.1 Survey Control and Monuments

a) The Applicant shall be responsible for all required surveying for all proposed work. During the course of construction, the Applicant and its contractors are responsible to maintain any existing or installed survey monuments throughout the course of construction. The Town may ask for evidence of compliance to any surveys prior to granting CCC for any work. Any destroyed or damaged survey control monuments may only be replaced by a licensed legal surveyor.
b) The Applicant will be responsible for providing new ASCMs for new development. These monuments must be installed in locations that do not adversely affect the use of any public open space. A licensed legal surveyor must also install legal pins throughout the development. All fencing inspections will require evidence of legal pins to ensure fencing is located with the appropriate setback from property lines. Prior to accepting the construction of any fence, the Town will require a letter from a qualified professional certifying that all fences have been installed within a tolerance of 50mm of the proposed finished grade of all property corners and grade changes.

1.4.6.2 Materials

a) New Materials

(i) With exception to the reuse of plant material, only new material shall be used in the construction of municipal infrastructure.

b) Defective Materials

(i) Any materials that are found to be defective in manufacture, or that are damaged during the course of handling, storage or construction shall be replaced by the Applicant at its own expense. The Town will take no responsibility for any materials stored temporarily on public land.

1.4.6.3 Construction Activities

a) All construction must adhere to all Municipal, Provincial and Federal laws, statues, bylaws, acts and legislation and meet the following general requirements:

(i) Occupational Health and Safety

- The Applicant and all associated parties (Developer, Contractor, Consultants, etc.) shall comply with the provisions of the Occupational Health and Safety Act. All subcontractors at the worksite shall also comply with the requirements of this Act. Any Contractors shall be the general representative and agent to the Applicant for the purposes of insuring compliance with safety regulations for both itself and subcontractors. The Contractor shall bring to the attention of subcontractors the provisions of the Occupational Health and Safety Act.

(ii) Prime Contractor

- The Town considers the Applicant the Prime Contractor for the work site, and the Applicant is responsible for ensuring compliance with the Occupational Health and Safety Act by all employers and employees on the work site. Any Contractor shall have either full certification in the Alberta Labour approval “Certificate of Recognition” (C.O.R.) Program appropriate to their industry or a Temporary Letter of Certification (T.L.C.) issued by the Alberta Construction Safety Association.

(iii) Contractor Certification

- All landscape contractors involved in planting trees and shrubs shall be reputable, experienced and have current membership in the Landscape Alberta Nursery Trades Association (LANTA). Contractors must provide proof of membership upon request by the Town.
- All work must be completed under the direction and supervision of a foreman with at least five years of directly related construction experience.

(iv) Notice to Proceed

- The Applicant may request a notice to proceed for construction of open space development improvements upon:

  - The Town’s acceptance of all required drawing and specification deliverables for open space improvements as well as Engineering improvements;
  - satisfactory execution of a Development Agreement;
  - payment of any required securities for the development;
  - proof by the Applicant that all crossing agreements, permits and approvals from rail / pipeline companies, Provincial and Federal regulatory agencies, etc. are in place; and
  - meeting all Provincial health and safety requirements.

- The Applicant must notify the Town, in writing, no less than two weeks in advance of commencing any construction. The Town will advise the Applicant of the need for any public notification, signage, or other advertising related to the schedule of construction activities.

(v) Stockpiles and Staging Areas

- The Town must grant approval any proposed stockpile locations, both on site and any other public open space within the Town limits. The Applicant must also provide notice of locations of any equipment and materials staging areas within the project site. The Town

will have discretion on the location of any staging areas, and also on requiring that construction areas, stockpiles or staging areas be fenced for both public safety as well as aesthetic reasons.

(vi) Utility Locates

- Prior to any construction, the Contractor must coordinate utility locates to verify the locations of any underground infrastructure. Copies of utility locate drawings provided to the Contractor must be retained on file and made available at all times during the course of construction, and at the time of CCC inspections. Should utility conflicts limit tree planting in road rights of way / boulevards, these trees must be placed in the nearest MR or Multiway area, in addition to the tree requirement for that new area. An on-site utility locate will be required at CCC to satisfy the Town that any conflicts exist.

(vii) Certifications and Validation

- Copies of all seed tags from seed material used on site must be retained by the Applicant and provided to the Town at the CCC inspection as validation of seed rate and blend. The Applicant must also provide certification through a letter indicating the source of all shrubs, trees and sod used on site. Copies of any topsoil tests, materials tests and compaction tests must be provided to the Town for review and acceptance.

(viii) Damages

- Every precaution must be taken to not damage any existing site feature during the course of construction. Should any party under any agreement to the Applicant such as Contractor, Consultant, employee, etc. incur any damages, it shall be restored at the Applicant's expense to the satisfaction of the Town.
- The Applicant shall ensure that all adjacent properties are not adversely affected by construction activities, such as dust, sand and wet soil during construction. The Applicant must make all reasonable efforts to minimize any disturbance to adjacent property owners by limiting noise, construction traffic, etc. during any construction.

1.4.7 Construction Observations

The Applicant is responsible to assign a qualified professional or professional consulting firm to oversee the implementation of all aspects of open space development. The assigned Consultant acting on behalf of the Applicant must be fully competent and licensed in good standing with its applicable professional organization. During construction, this Consultant will be responsible for:

a) ensuring Contractors comply with all local, Provincial and Federal requirements related to health and safety, environmental protection and corporate certification as described elsewhere in these standards;
b) ensuring compliance with all required setbacks and monitoring site locations provided by Alberta First Call or other similar utility location agencies;
c) arranging for a project startup meeting prior to any construction and any required site meetings that may be required during construction. Town representatives shall be invited to attend these meetings;
d) approving rough and finished grades for all work, and approving the location of all proposed site features such as trails, trees and shrubs;
e) ensuring plant material conforms to all required standards, prior to installation, and receiving validation of the plant material source(s);
f) making regular records on the progress of construction, which shall be made available to the Town upon request; and
g) coordinating all applications and inspections as required.

1.4.8 Construction Completion Certificate

1.4.8.1 CCC Application

Prior to applying for CCC, the Applicant and its Consultant(s) must fully inspect all work completed and ensure that all construction techniques and materials conform to the approved drawings, specifications and all Municipal, Provincial and Federal standards, bylaws, guidelines, Acts and Legislation. A CCC request application must be submitted to the Town requesting an inspection for the entire phase of development – a copy of this application can be found in the Appendicies. Three 11x17 hard copies of all pertinent drawings must accompany each CCC request application. The Town prefers that all aspects of the open space development be inspected at the same time, however may accept inspecting items with no warranty period such as fencing, furniture and signage (See Section 3.8.8 – Landscape Maintenance) from those aspects that do require a maintenance period.

1.4.8.2 CCC Inspection

Within 15 calendar days of receiving a request for CCC inspection, the Town will arrange for an inspection to review all aspects included in the CCC request application. CCC inspections may happen at any time, however will be to the discretion of the Town if site conditions due to snow cover, temperature and other considerations are cause to delay or suspend an inspection. If an inspection occurs after October 15th of any calendar year, warranty for all plant material will not begin until May 15th of the following year. Seeded areas will not be inspected until which time initial germination has occurred.

The Applicant must provide a representative to attend all inspections.

1.4.8.3 Standard CCC Records

The Applicant shall be responsible for taking notes and providing copies of all documentation to attendees of each inspection. A copy of a standard inspection form can be found in the Appendices. Copies of all forms must be distributed digitally and in hard copy to the Town within three working days of ay inspection.

1.4.9 Final Acceptance Certificate

1.4.9.1 Record Drawings

No more than three months prior to any anticipated FAC inspection, the Applicant must provide record drawings for any stage of development. As-builts shall include an accurate record of all improvements as constructed, or changed during the course of the maintenance period. Any approved design information that was altered since drawing approval will be struck through and replaced with field verified data. All changes will be shown in red text. The Applicant must provide two hard copies of record drawings, along with a digital submission of drawings in AutoCAD compatible format.

In addition to the information required for detailed drawings, record drawings shall include, at minimum, the following additional information:

a) date of construction completion;
b) date which as-built drawings were completed;
c) name of contractor(s);
d) construction start and completion dates; and
e) all street names and addresses for properties within the scope of work.

Upon review and acceptance of record drawings by the Town, the Applicant shall convert red line markups to black and prepare project record drawings. After verification by the professional member, the Applicant shall provide one copy of the record drawings in AutoCAD compatible format and one set of signed .pdf files of all drawings. FAC inspection request forms will not be accepted until which time any final record drawings have been accepted by the Town.

1.4.9.2 FAC Application

Prior to applying for FAC, the Applicant and its Consultant(s) must fully inspect all work completed and ensure that all construction techniques and materials conform to the approved drawings, specifications and all Municipal, Provincial and Federal standards, bylaws, guidelines, Acts and Legislation. An FAC request application must be submitted to the Town requesting an inspection for the entire phase of development – a copy of this application can be found in Appendix A – Standard Forms. the Town prefers that all aspects of the open space development be inspected at the same time.

1.4.9.3 FAC Inspection

Within 15 calendar days of receiving a request for FAC inspection, the Town will arrange for an inspection to review all aspects included in the FAC request application and shown on the record drawings. FAC inspections will only occur when all plant material is in full leaf, and allowable full timing will be to the discretion of the Town. The Applicant must provide a representative to attend all inspections.

2.0 DESIGN STANDARDS

2.1 Roadway Design

2.1.1 Roadway Geometric Design Standards

Road classification and designation shall be in accordance with the classification system outlined in the Transportation Association of Canada (TAC) manual – Geometric Design Standards for Canadian roads and Streets. The following are general minimum requirements and shall be used in the design of streets.

a) Street cross-sections shall be as defined by Table 2.2 and Standard Details.
b) Concrete curb and gutter shall be constructed on all streets in accordance with Standard Details.
c) Separate sidewalks shall be 1.5 m wide and shall be constructed in accordance with the Standard Details. Monolithic curb, gutter and sidewalks shall have a 1.5 m sidewalk width in accordance with Standard Details. Sidewalks shall be clear of all obstructions including surface utilities. Sidewalk locations shall be in accordance with Standard Details. Wider sidewalks may be required in areas of high pedestrian activity, as determined by the Town.
d) Rear residential lanes (alleys) shall have a surfaced width of 5.0 m within a 6.0 m right-of-way. Where rear lane traffic activity is expected to be high, such as for certain commercial developments, a wider surfaced width and right-of-way may be required as determined by the Town.
e) All driveways shall be constructed to give a minimum of 1.5 m clearance from any structure, e.g. hydrants, light standards, service pedestals and shall be constructed in accordance with Standard Details.
f) Curb Ramps shall be constructed in accordance with Standard Details.

2.1.1.1 Vertical Alignment

a) Minimum gutter grades around all curves and along all tangents shall not be less than 0.6%. Minimum gutter grades on curb returns shall be 1.0%.
b) Maximum gutter grades shall not exceed those defined by Table 2.1.
c) All roadways shall be crowned or shall have a crossfall as shown on the applicable Standard Details. The standard crossfall rate is 2.5%.
d) All vertical curves shall be designed to meet or exceed the following minimum requirements:

Table 2.1: Minimum Requirements for Vertical Curves

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

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

e) Vertical curves shall not be required where the algebraic difference in grades is less than 1.5%
f) The maximum superelevation is shown in Table 2.2.
g) Paved rear lane (alleys) shall have a minimum longitudinal centre swale grade of 0.8% with an inverted 3.0% crown.

Table 2.2: Summary of Recommended Design Standards For Streets

Classification	Traffic Volumes (vpd)	Target Speed (Design Speed) - (km/h)	Right-of- Way Width (m)	Pavement Widths (m)	Travel Lanes	Parking	Maximum Gradients (%)	Maximum Superelevation (m/m)
Divided Arterial	5,000-12,000	60 (70)	45.0	8.0 x 2	4	Not Permitted	5	.04 - .06
Undivided Arterial	5,000-12,000	60 (70)	31.0	16.0	4	Not Permitted	5	.04 - .06
Major Collector	2,000-5,000	40 (60)	23.0	12.0	2	Discretionary	6	n/a
Minor Collector	1,000-2,000	40 (50)	21.0	11.0	2	Discretionary	6	n/a
Local Residential	Up to 1,000	40 (50)	18.0	9.0	2	Permitted	6	n/a
Local Cul de Sac	N/A	40 (50)	18.0	8.5	2	Permitted	6	n/a

*On-street parking shall be evaluated in areas of high residential density, areas with low opportunity for safe passing, and areas where sightlines may create passing challenges.

Classification	Minimum Radius of Curvature (m)	Minimum Intersection Spacing (m)	Minimum Corner Cuts at Intersections	Sidewalks	Lighting Poles and Other Obstructions	Access
Arterials	170	150	30 m Radius	Separate + Shared Use Path	2.5 m min. from face of curb	Restricted
Collectors	150	60	10 m	Separate walks; both sides	2.0 m min. from face of curb	Some Restrictions
Local Residential	90	60	6 m	Separate; min one side	2.2 m min. from face of curb	Permitted

Notes:
a) Land for noise attenuation will be in addition to the road right-of-way requirement.
b) Additional travel lane width may be required to accommodate cyclists.

2.1.1.2 Horizontal Alignment

a) The minimum radius is relative to the road classification, the design speed and the maximum superelevation (see Table 2.1)
b) All horizontal curves shall be designed to meet the minimum design requirements shown in Table 2.1.
c) Minimum face of curb radius for cul-de-sacs is 12 m in residential areas and 15 m in industrial areas.
d) Maximum cul-de-sac length shall be 120 m.

2.1.1.3 Curb Returns

a) Curb returns at residential local street intersections shall be constructed to a radius of 10.0 m.
b) Curb returns at residential collector street intersections shall be constructed to a radius of 12.5 m.
c) In industrial/commercial areas the radius should be 15 m to accommodate truck turning movements.
d) For arterial street intersections the curb returns shall be designed in consideration of the type and volume of the turning traffic. Two and three centred curves with or without islands may be required.
e) Curb ramps are required at all intersections which have sidewalks.
f) Low profile curb and gutter shall be required along both sides of residential roads.
g) Vertical face curb and gutter shall be required along park areas, commercial and multi-family sites.

2.1.2 Road Structures

2.1.2.1 Asphaltic Concrete Pavement

a) All roadways shall be paved with hot mix asphalt. A geotechnical report with recommended pavement designs shall be conducted by a Professional Engineer employed by a recognized engineering agency and submitted to the Town for review. The consultant must conduct materials sampling from the development area and perform specific tests to determine the structural requirements for pavement design.
b) Pavement design shall be based on the following criteria applied to Asphalt Institute and American Association of State Highway Officials (AASHO) design methods.

Table 2.3: Summary of Recommended Design Standards For Streets

Road Classification	Design Traffic Number (DTN)	Equipment Standard Axle Loads (ESAL)
Local Residential	2.7	30,000
Local Industrial/Commercial	20.5	150,000
Minor Collector	13.7	100,000
Minor Collector	41	300,000
Major Collector	27.5	200,000
Major Collector	82	600,000
Minor Arterial	135	1,000,000
Major Arterial	410	3,000,000

c) All asphalt surfacing shall be in two stages with the second lift scheduled within sixty (60) days of the date of Final Acceptance. The final lift shall proceed only after all other surface and underground deficiencies have been rectified and the roadway has passed a roll test.
d) The Town reserves the right to request the Developer to engage a geotechnical engineering agency to carry out CBR tests on the subgrade prior to paving to confirm adequacy of design.
e) Alternative pavement designs, such as soil cement base, may be approved by the Town. Approval of alternate pavement designs must be obtained in writing from the Town prior to submission of design drawings.
f) Minimum acceptable road structures shall be as indicated on standard detail drawings.

2.1.2.2 Prime Coats and Tack Coats

a) Prime coats shall be the application of bituminous material to subgrade or previously prepared gravel base course prior to placing bituminous surfacing materials.
b) Tack coats shall be the application of bituminous material to a previously constructed paving surface of any type in preparation of placing bituminous surfacing materials, and against curb gutter faces, manholes, valves and other appurtenances in the street to be paved.

2.1.3 Sidewalks, Pathways, and Emergency Vehicle Access

a) Residential streets should have boulevard sidewalks on both sides of the road, and at a minimum of one side of the road for cul-de-sacs.
b) Minimum sidewalk width shall be 1.5m.
c) Multi-Use Paths shall be located as directed by the Town and shall be asphalt surface, no less than 3.0m wide unless approved for special circumstances. Any multi-use paths that are designated as an emergency vehicle access shall be designed to a local road structure.. Multi-use paths access controls shall come with lockable swing gates at roadway crossings.
d) All developed areas shall take into consideration a secondary emergency access. Any development in excess of 100 principle dwelling units or a dead-end street in excess of 120m is required to have a secondary emergency access route. A secondary emergency access may also be required depending on site specific terrain factors or other accessibility factors, which will be determined at the discretion of the Town. The secondary emergency access shall be constructed in the early stages of development in conjunction with the primary access.

2.1.4 Traffic Control, Signage & Pavement Markings

a) Plans shall be provided to the Town which depict the locations and details of all traffic control devices (traffic signs and traffic signals), street name signs and pavement markings.
b) All traffic control devices and pavement markings shall be designed and installed in accordance with the "Manual of Uniform Traffic Control Devices for Canada" as issued and revised from time to time by the Transportation Association of Canada (TAC). Designs shall incorporate best practices for enhanced traffic and pedestrian safety measures including flashing pedestrian crosswalk signs.
c) Guide and information signing shall be designed and installed in accordance with the latest version of the “Highway Guide and Information Sign Manual” provided by Alberta Transportation.
d) Street signing shall be standard aluminum, white on black, with a minimum vertical dimension of 150 mm or to match the current street sign style, as directed by the Town.
e) Street naming convention shall be coordinated with the Town.

2.1.5 Street Lighting

2.1.5.1 General

The following design and construction standards shall be applied for street lighting within all developments in the Town of Morinville:

a) Fortis Underground Electrical Distribution System (UEDS)
b) Transportation Association of Canada Guide for the Design of Roadway Lighting
c) Lighting requirements for industrial development shall be determined with the Town during the initial planning stages of the proposed development.
d) Street light luminaires shall meet Fortis requirements.
e) Design and construction of street lighting at Alberta highway intersections shall also consider Alberta Transportation design and construction requirements.

2.1.5.2 Location

a) The Developer shall coordinate the location of street lights to ensure that they do not interfere with the other utilities and driveways.
b) Street lights placement shall be offset from the projection of common property lines between two lots.
c) Street lights shall be offset from roadway and sidewalks in accordance with TAC Geometric Design Guide clear zone design specifications.
d) All streetlighting cables shall be installed underground.
e) Street lights shall be provided for each internal park area that does not abut onto a lighted street. A street light shall be located at the point where each walkway opens out onto the park area.
f) All street light standards shall be galvanized and shall be painted in a manner comparable to the existing standards within the Town.

2.1.5.3 Costs

a) Any capital contribution that the utility company may charge for installation of underground street lighting shall be paid by the Developer.
b) Any capital investment reimbursement provided by the utility company shall be provided to the Town.

2.2 Water

The water system shall be designed for peak flow and fire flow requirements. Water system design shall include a hydraulic network analysis for the development, given the boundary conditions, as provided by the Town (if available) otherwise the Developer will need to conduct their own assessment to determine boundary conditions.

2.2.1 Consumption

Per capita consumption shall be:

a)	Residential Average Daily Demand -	360 L/person/d
b)	Commercial/Light Industrial Average Daily Demand	22,500 L/hectare/day
c)	Maximum Daily Demand	2.0 x Average Demand
d)	Peak Hourly Demand	4.0 x Average Demand

An analysis shall be made for Peak Hour Demand and mains shall be sized such that there will be a minimum residual pressure of 280 kPa (40 psi) at ground level at any location in the system.
Where the size of the area to be developed warrants, or if required by the Town, a network analysis shall be carried out and all relevant information shall be submitted with the design documents.

2.2.2 Fire Demand

The system shall be designed to meet the criteria contained in “Water Supply for Public Fire Protection, 1999" (or latest edition) as produced by the Fire Underwriters Survey.
The minimum design fire flow for any watermain providing fire protection shall be as follows, plus allowance for peak day demand:

a) Commercial 250 l/s
b) Urban Services (Institutional), Public Education Services 180 l/s
c) Medium and High Density Residential 180 l/s
d) Low Density Residential 115 l/s

The minimum residual pressure at any location in the distribution system at ground level under fire flow conditions shall be 140 kPa (20 psi).

2.2.3 Operating Pressure

The normal operating pressure range for residential distribution shall be between 350 kPa (50psi) to 550 kPa (80psi).

2.2.4 Flow Velocity

Velocities not to exceed 3.0 m/s under all operating conditions.

2.2.5 Roughness

The Hazen & Williams coefficient of friction (C) for watermain sizing shall be C=130 for pipes less than or equal to 200mm diameter, and C=150 for pipes greater than 200mm in diameter, based on PVC piping.

2.2.6 Mains

a) The minimum size of distribution main shall be 200mm diameter for single detached residential, 200 mm for multi unit development and 300 mm for industrial/commercial. 150mm diameter watermains may be allowed in cul-de-sacs upon approval of the Town. Oversizing may be required by the Town.
b) Mains shall be installed to provide a minimum depth of 2.75 m of cover below final finished surface grade.
c) Mains shall be located within the road right-of-way in accordance with the standard detail roadway sections.
d) A minimum of 3 m separation shall be maintained between a watermain and any sewer main.
e) Water distribution systems in new subdivisions shall be looped internally and shall have more than one primary feeder main supplying the distribution system in the development area. The Town may waive this requirement temporarily provided the Developer can demonstrate that the necessary fire flows can be delivered via the single connection. In any event, a maximum of 50 lots may be serviced temporarily without looping of the system. The Developer shall provide looping internally within the subdivision as well as a second connection to the development within two (2) years of the issuance of a Construction Completion Certificate on the first phase of development.
f) In cul-de-sacs, the watermain shall be looped except where the overall length of the cul-de-sac from the intersection curb line to the end of the bulb is 120m or less and servicing fewer than 21 units. A flush point shall be provided at the termination point of all dead end lines.

2.2.7 Hydrants

a) The maximum allowable spacing between fire hydrants shall be 150m in low density residential areas, 120m in medium/high density residential and school areas, and 90 m in industrial/commercial areas.
b) Hydrant locations shall be such that the distance to any building shall be not greater than 75 m.
c) Hydrants on the distribution mains shall be installed:

    (i) At the projection of property lines except:
    (ii) Where the hydrants are installed at the intersections, they shall be installed at the beginning of curb returns
    (iii) Where the hydrants are installed on a cul-de-sac, they shall be installed at the intersection of the cul-de-sac and adjacent collector roadway.

d) Hydrants shall be located to conform with curb and sidewalk design and shall be located as follows:

    (i) Areas with no sidewalk - hydrant is to be no more than 2.2 m from face of curb.
    (ii) Areas with monolithic sidewalk - hydrant is to be no more than 0.75 m from back of walk.

(iii) Areas with separate sidewalk - hydrant is to be no less than 1.0 m and no more than 2.2 m from face of curb.
(iv) Hydrants shall comply with design standard details. Where no detail exists for a hydrant condition, position of hydrant shall be reviewed and confirmed with the Town.

e) Additional hydrants shall be installed at high value properties if deemed necessary by the Town.
f) All hydrants shall be on a minimum of 150 mm feeder line with a gate valve. Such feeder line shall be a maximum length of 7.5 metres from the main, otherwise a larger diameter line shall be considered.

2.2.8 Valves

a) Valves on the distribution mains shall be installed:

(i) At the projection of property lines at mid-block.
(ii) At the projection of property lines at intersections.

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

(i) No more than one hydrant is taken out of service.
(ii) No more than three valves are required for a shutdown.
(iii) No more than one standard Town block is taken out of service by a shutdown.
(iv) Valves shall be installed in accordance with the Standard Details.

2.2.9 Thrust Blocks

All valves, hydrants, tees, bends and end plugs shall be thrust blocked in accordance with the Standard Details. Where practical, combinations of maximum 45 degree bends shall be used over 90 degree bends.

2.3 Wastewater

2.3.1 Gravity Sewer

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

2.3.1.1 Generation Rates

a) Average Sewage Flow 350 L/persons/d
b) Commercial, Industrial and Institutional:

Average Sewage Flow	Commercial: 22500 L/ha/d Industrial: 16875 L/ha/d
Peak Flow	3.0 x Average Flow

2.3.1.2 Peaking Factors

Peaking Factor (Harmon's Formula) $\frac{1 + 14}{(4 + p^{½})}$

Where p equals the tributary population in 1,000's.

2.3.1.3 Inflow/Infiltration

a) Infiltration 0.28 L/s/ha

(i) An allowance of 0.28 litres/second/hectare shall be applied to all sewer design flow capacity calculations. This allowance would apply to the total drainage area on the basis of upstream area calculations (manhole to manhole).
(ii) An allowance shall be made for inflow through manholes in sags by the addition of 0.4 litres/second for each manhole.

2.3.1.4 Manning's Roughness Coefficient

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

2.3.1.5 Sewer Capacity

a) The total design sewer capacity shall be the combination of:

(i) peak dry weather flow
(ii) infiltration allowance
(iii) inflow for sag manholes

b) New sewers shall be designed with full flow capacity not exceeding 80% of the sewer diameter based on a maximum utilization of 86% of the pipe hydraulic capacity

$$\text{Full Sewer Flow Capacity} = \frac{\text{Estimated Total Design Peak Flow Rate}}{0.86}$$

c) Sanitary sewers may have to be oversized to conform to the Town's Master Plan and Statutory Documents.
d) There shall be no connection of roof drainage and weeping tile systems to the sanitary sewer system.

2.3.1.6 Flow Velocity

a) Minimum flow velocity shall be 0.6m/s
b) Maximum flow velocity shall be 3.0m/s

2.3.1.7 Pipe Slope

a) Minimum pipe slopes shall be:

Pipe diameter (mm)	% gradient
200	0.40
250	0.28
300	0.22
375 and larger	0.15

b) Curved sewer design gradients shall be increased by a factor of 1.5.
c) Short laterals (cul-de-sacs) and uppermost sections shall be 1.0% minimum.

2.3.1.8 Mains

a) The minimum size for sanitary sewer mains shall be 200 mm diameter for residential and 250 mm for industrial/commercial areas.
b) Mains shall be installed to provide a minimum depth of 2.75 m to obvert below final finished grade at the surface or shall be insulated to the satisfaction of the Town.
c) Mains shall be installed to provide adequate sewer service connection depth at the property line.

d) All sanitary sewers shall generally be located along the centreline of the road right-of-way. Mains shall be located within the road right-of-way in accordance with the road cross sections.
e) Sanitary sewers shall be located a minimum of 3.0m horizontally from any watermain and 2.0m horizontally from any gas line.
f) Curved sewers will be permitted with the following restrictions:

(i) The sewer shall be laid as a simple curve with a radius equal to or greater than 90 m or the manufacturers minimum recommended radius, whichever is larger.
(ii) Manholes shall be located at the beginning and end of the curve.
(iii) Manholes shall be located at intervals not greater than 90 m along the curve.
(iv) The main shall run parallel to the curb or street centreline.
(v) Curved sewer design gradients shall be increased by a factor of 1.5.

g) Water main crossings shall be as follows:

(i) Normally pass over sanitary sewers. Where the water main passes under a sanitary sewer, maintain a minimum separation of 0.5m (crown to sewer invert).
(ii) Oblique crossings shall not be permitted (less than 80°)
(iii) Designed to provide structural support for both pipes with pipe joints located equidistant from the intersection of the crossing

2.3.1.9 Manholes

a) Manholes shall be located at the end of each line, at all changes in pipe size, grade and alignment.
b) The maximum distance between manholes shall not exceed 120 m.
c) The downstream invert in a manhole shall be a minimum of 30mm lower than the lowest upstream invert. At a change in direction, the drop shall be 60mm.
d) Manholes shall be installed as shown on the Standard Details.
e) Drop manholes are required for invert grade differences greater than 750 mm in sanitary sewer manholes. For 200 mm and 250 mm mains, internal drops may be used at the discretion of the Town. Benching is required for invert grade differences 300 mm or less. No more than two internal drops in one manhole.

2.3.2 Force Mains

a) Wherever possible, every reasonable effort should be made in the design to provide a drainage system for the Development that relies solely on gravity for conveyance.
b) Forcemains shall be HDPE or non water pressure rated PVC, capable of handling the pumping system forces. Surge analysis calculations are to be used in developing the forcemain system to confirm issues related to water hammer or transient pressures are mitigated. The level of detail for the surge analysis is relative to the risks.
c) The velocity of flows in the system during normal operation shall be between 0.9 m/s and 2.0 m/s. Velocities exceeding 2.0 m/s will require approval by the Town.
d) Forcemains shall have air release valves located at the high points of the system, and drain valves located at the low points. Valves must be placed in concrete manhole chambers and in accessible locations for maintenance. Forcemains shall not be installed flat to avoid ponding when not in use. Minimum cover shall be provided as per applicable sewer design standards.

2.4 Storm

2.4.1 Overall Objective

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

b) The minor system comprises piping, manholes, catch basins and outfall structures. The minor system shall convey runoff from snowmelt and rainfall events to an adequate receiving water (river, stream, lake or pond) without sustaining any surface ponding or excessive surface flows for events up to and including a 1 in 5-year return period.
c) The major system comprises the street system, detention facilities, parkland and any other land required to convey runoff from events up to and including a 1 in 100-year return period to the receiving water. The major system shall be evaluated in a manner sufficient to determine that no flooding that may cause significant property damage (e.g. flooding of buildings) occurs during the 100 year event.
d) The storm drainage system shall be designed to meet the following level of service:

(i) Avoid all property damage and flooding and minimize inconvenience to the public due to runoff from 1 in 5 year and more frequent rainfall events.
(ii) Avoid significant property damage from a 1 in 100 year return frequency rainfall event.
(iii) Avoid loss of life and injuries and minimize damage to property, through control of runoff during unusual or infrequent storm events with high-intensity rainfall and large runoff volume.
(iv) Avoid degradation of receiving watercourses, by implementing erosion and sediment control measures.

2.4.2 Stormwater Runoff Analysis

The Rational Method may be used for detail design of minor storm systems with catchment areas less than 65 ha. The Rational Method shall not be used to design stormwater management storage facilities. For areas greater than 65 ha, a computer model shall be developed.

2.4.2.1 Rational Method

The rational method is defined as:

$Q = CIA / 360$

Q = discharge in m^3/s
C = runoff coefficient
I = average rainfall intensity in mm/hr
A = drainage area in hectares

Rainfall Intensity

- Rainfall IDF curves for the City of Edmonton for selected return frequency events are presented in Table 2.2.
- The value of the design rainfall intensity, for the rational formula is selected from the appropriate intensity duration frequency (IDF) curve, with a duration chosen to coincide with the Time of Concentration, Tc. The Time of Concentration for runoff flow is the time required for runoff flow to become established and reach the design location from the furthest point within the contributing catchment area.
- Determination of Tc requires estimation of two components, the "inlet time" and "travel time".
- The inlet time is the time for flow from the extreme limits of the catchment to reach the first point of inflow into the defined conveyance system. It is dependent upon the imperviousness and the size of the catchment.
- The travel time is the length of time required for flow to travel within the conveyance system from the point of inflow to the design location.
- Appropriate values for inlet time may be selected from Table 2.7. This specifies values with respect to imperviousness and size of the catchment.

IDF Curves – Intensity Table

Edmonton 11 Rain Gauges Upper Bound - IDF Period: 1984-2015
Maximum Years of Record = 32
IDF Intensity (mm/hr)

Time		Return Frequency						
Minutes	Hours	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr
5		66	89	108.6	138	162.2	188.4	217.8
6		61.3	83.2	101.9	129.9	152.9	178.1	206.8
7		57.2	78.3	96.1	122.9	144.7	169	197.1
8		53.8	73.9	91.1	116.7	137.5	160.9	188.4
9		50.8	70.1	86.6	111.1	131.1	153.7	180.6
10		48.2	66.7	82.6	106.2	125.3	147.2	173.5
11		45.8	63.7	79	101.7	120.1	141.3	167
12		43.8	61	75.7	97.7	115.4	136	161.1
13		41.9	58.6	72.7	93.9	111.1	131.1	155.6
14		40.2	56.3	70	90.6	107.1	126.6	150.5
15	0.25	38.7	54.3	67.6	87.4	103.5	122.4	145.9
16		37.2	52.4	65.3	84.6	100.2	118.6	141.5
17		36	50.7	63.2	81.9	97	115	137.5
18		34.8	49.1	61.2	79.4	94.1	111.7	133.7
19		33.7	47.6	59.4	77.1	91.4	108.6	130.1
20		32.6	46.2	57.7	74.9	88.9	105.7	126.8
21		31.7	44.9	56.1	72.9	86.6	102.9	123.6
22		30.8	43.7	54.6	71	84.3	100.4	120.7
23		30	42.6	53.2	69.2	82.2	97.9	117.9
24		29.2	41.5	51.9	67.5	80.3	95.6	115.2
25		28.5	40.5	50.7	65.9	78.4	93.5	112.7
26		27.8	39.5	49.5	64.4	76.6	91.4	110.3
27		27.1	38.6	48.4	63	74.9	89.5	108
28		26.5	37.8	47.3	61.6	73.4	87.6	105.9
29		25.9	37	46.3	60.3	71.8	85.8	103.8
30	0.5	25.4	36.2	45.3	59.1	70.4	84.2	101.8
31		24.8	35.5	44.4	57.9	69	82.5	100
32		24.3	34.8	43.6	56.8	67.7	81	98.1
33		23.9	34.1	42.7	55.7	66.4	79.5	96.4
34		23.4	33.5	41.9	54.7	65.2	78.1	94.8
35		23	32.9	41.2	53.7	64.1	76.8	93.2
36		22.5	32.3	40.4	52.7	63	75.5	91.6
37		22.1	31.7	39.7	51.8	61.9	74.2	90.2
38		21.8	31.2	39.1	50.9	60.9	73	88.7
39		21.4	30.7	38.4	50.1	59.9	71.9	87.4
40		21	30.2	37.8	49.3	58.9	70.8	86
41		20.7	29.7	37.2	48.5	58	69.7	84.8

Time		Return Frequency						
Minutes	Hours	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr
42		20.4	29.2	36.6	47.8	57.1	68.7	83.5
43		20	28.8	36.1	47	56.3	67.7	82.4
44		19.7	28.3	35.5	46.3	55.5	66.7	81.2
45	0.75	19.4	27.9	35	45.7	54.7	65.8	80.1
46		19.2	27.5	34.5	45	53.9	64.8	79
47		18.9	27.1	34	44.4	53.2	64	78
48		18.6	26.8	33.5	43.8	52.5	63.1	77
49		18.4	26.4	33.1	43.2	51.8	62.3	76
50		18.1	26.1	32.6	42.6	51.1	61.5	75
51		17.9	25.7	32.2	42.1	50.4	60.7	74.1
52		17.6	25.4	31.8	41.5	49.8	60	73.2
53		17.4	25.1	31.4	41	49.2	59.3	72.3
54		17.2	24.8	31	40.5	48.6	58.5	71.5
55		17	24.5	30.6	40	48	57.9	70.7
56		16.8	24.2	30.3	39.5	47.4	57.2	69.9
57		16.6	23.9	29.9	39	46.9	56.5	69.1
58		16.4	23.6	29.6	38.6	46.3	55.9	68.3
59		16.2	23.3	29.2	38.1	45.8	55.3	67.6
60	1	16	23.1	28.9	37.7	45.3	54.7	66.8
61		15.8	22.8	28.6	37.3	44.8	54.1	66.1
62		15.7	22.6	28.3	36.9	44.3	53.5	65.5
63		15.5	22.3	27.9	36.5	43.9	53	64.8
64		15.3	22.1	27.6	36.1	43.4	52.4	64.1
65		15.2	21.8	27.4	35.7	42.9	51.9	63.5
66		15	21.6	27.1	35.3	42.5	51.4	62.9
67		14.8	21.4	26.8	35	42.1	50.9	62.3
68		14.7	21.2	26.5	34.6	41.7	50.4	61.7
69		14.5	21	26.3	34.3	41.3	49.9	61.1
70		14.4	20.8	26	33.9	40.9	49.4	60.5
71		14.3	20.6	25.8	33.6	40.5	49	59.9
72		14.1	20.4	25.5	33.3	40.1	48.5	59.4
73		14	20.2	25.3	33	39.7	48.1	58.9
74		13.9	20	25	32.7	39.4	47.6	58.3
75	1.25	13.7	19.8	24.8	32.4	39	47.2	57.8
76		13.6	19.6	24.6	32.1	38.6	46.8	57.3
77		13.5	19.5	24.4	31.8	38.3	46.4	56.8
78		13.4	19.3	24.1	31.5	38	46	56.4

Time		Return Frequency						
Minutes	Hours	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr
79		13.2	19.1	23.9	31.2	37.6	45.6	55.9
80		13.1	19	23.7	31	37.3	45.2	55.4
81		13	18.8	23.5	30.7	37	44.8	55
82		12.9	18.6	23.3	30.4	36.7	44.5	54.5
83		12.8	18.5	23.1	30.2	36.4	44.1	54.1
84		12.7	18.3	22.9	29.9	36.1	43.7	53.6
85		12.6	18.2	22.7	29.7	35.8	43.4	53.2
86		12.5	18	22.6	29.4	35.5	43.1	52.8
87		12.4	17.9	22.4	29.2	35.2	42.7	52.4
88		12.3	17.8	22.2	29	35	42.4	52
89		12.2	17.6	22	28.7	34.7	42.1	51.6
90	1.5	12.1	17.5	21.8	28.5	34.4	41.8	51.2
120	2	9.9	14.3	17.8	23.3	28.2	34.3	42.2
180	3	7.4	10.7	13.3	17.4	21.1	25.8	31.8
240	4	6	8.7	10.8	14.1	17.2	21.1	26
300	5	5.1	7.4	9.2	11.9	14.6	18	22.2
360	6	4.5	6.5	8	10.4	12.8	15.8	19.5
420	7	4	5.8	7.2	9.3	11.5	14.1	17.4
480	8	3.6	5.3	6.5	8.4	10.4	12.8	15.8
540	9	3.4	4.9	6	7.7	9.5	11.8	14.5
600	10	3.1	4.5	5.5	7.1	8.8	10.9	13.5
660	11	2.9	4.2	5.1	6.6	8.2	10.2	12.6
720	12	2.7	3.9	4.8	6.2	7.7	9.6	11.8
780	13	2.6	3.7	4.5	5.8	7.3	9	11.1
840	14	2.4	3.5	4.3	5.5	6.9	8.6	10.5
900	15	2.3	3.3	4.1	5.3	6.5	8.1	10
960	16	2.2	3.2	3.9	5	6.2	7.8	9.6
1020	17	2.1	3.1	3.7	4.8	6	7.4	9.2
1080	18	2	2.9	3.6	4.6	5.7	7.1	8.8
1140	19	1.9	2.8	3.4	4.4	5.5	6.8	8.4
1200	20	1.9	2.7	3.3	4.2	5.3	6.6	8.1
1260	21	1.8	2.6	3.2	4.1	5.1	6.4	7.8
1320	22	1.7	2.5	3.1	3.9	4.9	6.2	7.6
1380	23	1.7	2.4	3	3.8	4.8	6	7.3
1440	24	1.6	2.4	2.9	3.7	4.6	5.8	7.1

Table 2.4: IDF Curves – Intensity Table-Summary

Edmonton 13 Rain Gauges Upper Bound - IDF Period: 1984-2015
Maximum Years of Record = 32
IDF Intensity (mm/hr)

Time		Return Frequency						
Minutes	Hours	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr
5	0.083	66	89	108.6	138	162.2	188.4	217.8
10	0.167	48.2	66.7	82.6	106.2	125.3	147.2	173.5
15	0.25	38.7	54.3	67.6	87.4	103.5	122.4	145.9
20	0.333	32.6	46.2	57.7	74.9	88.9	105.7	126.8
25	0.417	28.5	40.5	50.7	65.9	78.4	93.5	112.7
30	0.5	25.4	36.2	45.3	59.1	70.4	84.2	101.8
35	0.583	23	32.9	41.2	53.7	64.1	76.8	93.2
40	0.667	21	30.2	37.8	49.3	58.9	70.8	86
45	0.75	19.4	27.9	35	45.7	54.7	65.8	80.1
50	0.833	18.1	26.1	32.6	42.6	51.1	61.5	75
55	0.917	17	24.5	30.6	40	48	57.9	70.7
60	1	16	23.1	28.9	37.7	45.3	54.7	66.8
120	2	9.9	14.3	17.8	23.3	28.2	34.3	42.2
180	3	7.4	10.7	13.3	17.4	21.1	25.8	31.8
240	4	6	8.7	10.8	14.1	17.2	21.1	26
360	6	4.5	6.5	8	10.4	12.8	15.8	19.5
720	12	2.7	3.9	4.8	6.2	7.7	9.6	11.8
1440	24	1.6	2.4	2.9	3.7	4.6	5.8	7.1

Table 2.5: IDF Parameters

$Rate = a*(t+c)^b$	Return Frequency						
Parameters	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr
a (t in min)	337	498.1	665.2	909.9	1027.7	1200.5	1498.1
b	-0.732	-0.735	-0.748	-0.757	-0.742	-0.733	-0.735
c (min)	4.3	5.4	6.3	7.1	7	7.5	8.8
R^2	0.994	0.997	0.998	0.998	0.998	0.997	0.994

Table 2.6: Chicago Distribution (Modified): 4-Hr Design Storm Data (mm/hr)

Edmonton 11 Rain Gauges Upper Bound, IDF-Period: 1984-2015
Maximum Years of Record = 32
Chicago Type Distribution - Design Storm (5-Minute Increment)

Time	Return Frequency						
(min)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr
0	0	0	0	0	0	0	0
5	1.73	2.52	3.01	3.82	4.92	6.25	7.76
10	1.82	2.65	3.18	4.04	5.19	6.58	8.18
15	1.93	2.8	3.36	4.28	5.49	6.97	8.67
20	2.05	2.98	3.58	4.56	5.84	7.41	9.22
25	2.18	3.18	3.83	4.89	6.25	7.92	9.87
30	2.34	3.42	4.13	5.27	6.73	8.52	10.63
35	2.53	3.7	4.48	5.74	7.31	9.24	11.54
40	2.76	4.04	4.91	6.31	8.01	10.12	12.65
45	3.05	4.47	5.45	7.02	8.89	11.22	14.04
50	3.42	5.03	6.15	7.95	10.03	12.63	15.85
55	3.91	5.77	7.1	9.2	11.57	14.54	18.28
60	4.61	6.83	8.45	11	13.76	17.26	21.74
65	5.69	8.47	10.55	13.82	17.18	21.48	27.11
70	7.61	11.37	14.32	18.89	23.26	28.94	36.59
75	12.07	18.13	23.11	30.69	37.26	45.9	57.82
80	47.05	65.15	80.55	103.56	122.26	143.62	169.27
85	47.05	65.15	80.55	103.56	122.26	143.62	169.27
90	21.85	32.56	41.62	55.17	66.01	80	99.06
95	13.85	20.82	26.6	35.36	42.79	52.54	66.05
100	10.28	15.44	19.62	26.01	31.74	39.26	49.58
105	8.26	12.37	15.62	20.63	25.34	31.48	39.81
110	6.95	10.38	13.03	17.15	21.18	26.4	33.37
115	6.03	8.98	11.22	14.72	18.26	22.81	28.81
120	5.35	7.95	9.89	12.93	16.1	20.14	25.42
125	4.83	7.15	8.86	11.55	14.43	18.08	22.79
130	4.4	6.51	8.04	10.46	13.1	16.44	20.7
135	4.06	5.99	7.37	9.57	12.02	15.1	18.99
140	3.77	5.55	6.82	8.83	11.12	13.98	17.57
145	3.53	5.19	6.35	8.21	10.36	13.04	16.36
150	3.31	4.87	5.95	7.68	9.71	12.23	15.33
155	3.13	4.6	5.6	7.22	9.14	11.52	14.44
160	2.97	4.35	5.3	6.82	8.65	10.91	13.65
165	2.83	4.14	5.03	6.46	8.21	10.36	12.96
170	2.7	3.95	4.79	6.15	7.82	9.87	12.34
175	2.58	3.78	4.58	5.87	7.47	9.44	11.79
180	2.48	3.62	4.38	5.61	7.15	9.04	11.29

Time	Return Frequency						
(min)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr
185	2.38	3.48	4.21	5.38	6.86	8.68	10.83
190	2.3	3.35	4.04	5.17	6.6	8.36	10.42
195	2.22	3.23	3.9	4.98	6.36	8.06	10.04
200	2.14	3.12	3.76	4.8	6.14	7.78	9.69
205	2.08	3.02	3.64	4.64	5.94	7.53	9.37
210	2.01	2.93	3.52	4.49	5.75	7.29	9.07
215	1.95	2.84	3.41	4.35	5.57	7.07	8.8
220	1.9	2.76	3.31	4.21	5.41	6.86	8.54
225	1.85	2.69	3.22	4.09	5.26	6.67	8.3
230	1.8	2.62	3.13	3.98	5.12	6.49	8.07
235	1.75	2.55	3.05	3.87	4.98	6.33	7.86
240	1.71	2.49	2.97	3.77	4.86	6.17	7.66

Table 2.7: Huff Distribution: Design Storm for Lake Drawdown Analysis Only

Edmonton 11 Rain Gauges Upper Bound, IDF-Period: 1984-2015
Maximum Years of Record = 32
Storm Duration = 24 hours
Huff Distribution (First-Quartile 50% Probability), mm/hr

Time		Return Frequency						
Minutes	Hours	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr
0	0	0	0	0	0	0	0	0
15		0.29	0.42	0.52	0.66	0.83	1.03	1.28
30		0.59	0.85	1.03	1.32	1.66	2.07	2.55
45		0.88	1.27	1.55	1.98	2.49	3.1	3.83
60	1	1.18	1.7	2.06	2.64	3.32	4.14	5.1
75		1.57	2.26	2.75	3.52	4.42	5.51	6.8
90		2.35	3.39	4.12	5.27	6.62	8.26	10.18
105		3.12	4.52	5.49	7.03	8.82	11	13.56
120	2	3.9	5.64	6.85	8.78	11.02	13.74	16.94
135		4.68	6.77	8.22	10.53	13.22	16.48	20.33
150		5.21	7.53	9.14	11.71	14.7	18.33	22.6
165		5.35	7.74	9.39	12.03	15.11	18.84	23.23
180	3	5.49	7.94	9.65	12.36	15.51	19.34	23.85
195		5.64	8.15	9.9	12.68	15.92	19.85	24.47
210		5.78	8.36	10.15	13	16.32	20.35	25.1
225		5.69	8.23	9.99	12.8	16.07	20.04	24.7
240	4	5.45	7.87	9.56	12.25	15.37	19.17	23.64
255		5.2	7.52	9.13	11.69	14.68	18.3	22.57
270		4.95	7.16	8.7	11.14	13.98	17.44	21.5
285		4.71	6.81	8.26	10.59	13.29	16.57	20.43
300	5	4.47	6.46	7.84	10.05	12.61	15.72	19.39
315		4.23	6.11	7.42	9.51	11.93	14.88	18.35
330		3.99	5.77	7	8.97	11.26	14.04	17.31
345		3.75	5.42	6.58	8.43	10.58	13.2	16.27
360	6	3.51	5.07	6.16	7.89	9.91	12.36	15.24
375		3.29	4.76	5.78	7.4	9.29	11.59	14.29
390		3.07	4.44	5.39	6.91	8.67	10.82	13.34
405		2.85	4.13	5.01	6.42	8.06	10.05	12.39
420	7	2.64	3.81	4.63	5.93	7.44	9.28	11.44
435		2.43	3.51	4.27	5.47	6.86	8.56	10.55
450		2.28	3.3	4	5.13	6.44	8.03	9.9
465		2.13	3.08	3.74	4.79	6.01	7.5	9.24
480	8	1.98	2.86	3.47	4.45	5.59	6.97	8.59
495		1.83	2.64	3.21	4.11	5.16	6.44	7.94

Time		Return Frequency						
Minutes	Hours	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr
510		1.71	2.48	3.01	3.85	4.84	6.03	7.44
525		1.65	2.39	2.9	3.72	4.67	5.82	7.17
540	9	1.59	2.3	2.79	3.58	4.49	5.6	6.91
555		1.53	2.21	2.69	3.44	4.32	5.38	6.64
570		1.47	2.12	2.58	3.3	4.14	5.17	6.37
585		1.41	2.03	2.47	3.16	3.97	4.95	6.1
600	10	1.34	1.94	2.36	3.02	3.8	4.73	5.84
615		1.28	1.86	2.25	2.89	3.62	4.52	5.57
630		1.22	1.77	2.15	2.75	3.45	4.3	5.3
645		1.16	1.68	2.04	2.61	3.28	4.09	5.04
660	11	1.1	1.6	1.94	2.48	3.12	3.89	4.79
675		1.05	1.52	1.84	2.36	2.96	3.7	4.56
690		1	1.44	1.75	2.24	2.81	3.5	4.32
705		0.94	1.36	1.65	2.11	2.65	3.31	4.08
720	12	0.89	1.28	1.56	1.99	2.5	3.12	3.84
735		0.86	1.24	1.51	1.93	2.42	3.02	3.73
750		0.83	1.2	1.46	1.87	2.35	2.93	3.61
765		0.8	1.16	1.41	1.81	2.27	2.83	3.49
780	13	0.78	1.12	1.36	1.75	2.19	2.73	3.37
795		0.75	1.08	1.31	1.68	2.11	2.63	3.25
810		0.71	1.03	1.25	1.6	2.01	2.51	3.1
825		0.68	0.98	1.19	1.53	1.92	2.39	2.95
840	14	0.65	0.93	1.13	1.45	1.82	2.27	2.8
855		0.61	0.88	1.07	1.37	1.72	2.15	2.65
870		0.59	0.85	1.03	1.32	1.66	2.07	2.55
885		0.58	0.84	1.02	1.31	1.64	2.04	2.52
900	15	0.57	0.83	1.01	1.29	1.62	2.02	2.49
915		0.57	0.82	1	1.28	1.6	2	2.46
930		0.56	0.81	0.98	1.26	1.58	1.97	2.43
945		0.55	0.8	0.97	1.24	1.56	1.95	2.4
960	16	0.55	0.79	0.96	1.23	1.54	1.92	2.37
975		0.54	0.78	0.95	1.21	1.52	1.9	2.34
990		0.53	0.77	0.94	1.2	1.5	1.88	2.31
1005		0.53	0.76	0.92	1.18	1.49	1.85	2.28

Time		Return Frequency						
Minutes	Hours	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr
1020	17	0.52	0.75	0.91	1.17	1.47	1.83	2.25
1035		0.51	0.74	0.9	1.15	1.45	1.8	2.22
1050		0.51	0.73	0.89	1.14	1.43	1.78	2.2
1065		0.5	0.72	0.88	1.12	1.41	1.76	2.17
1080	18	0.49	0.71	0.86	1.11	1.39	1.73	2.14
1095		0.49	0.7	0.85	1.09	1.37	1.71	2.11
1110		0.48	0.69	0.84	1.08	1.35	1.68	2.08
1125		0.47	0.68	0.83	1.06	1.33	1.66	2.05
1140	19	0.46	0.67	0.82	1.05	1.31	1.64	2.02
1155		0.46	0.66	0.8	1.03	1.29	1.61	1.98
1170		0.44	0.64	0.78	1	1.25	1.56	1.92
1185		0.43	0.62	0.75	0.97	1.21	1.51	1.86
1200	20	0.42	0.6	0.73	0.93	1.17	1.46	1.8
1215		0.4	0.58	0.71	0.9	1.13	1.41	1.74
1230		0.39	0.56	0.68	0.87	1.1	1.37	1.68
1245		0.37	0.54	0.66	0.84	1.06	1.32	1.63
1260	21	0.36	0.52	0.63	0.81	1.02	1.27	1.57
1275		0.35	0.5	0.61	0.78	0.98	1.22	1.51
1290		0.33	0.48	0.59	0.75	0.94	1.17	1.45
1305		0.32	0.46	0.56	0.72	0.9	1.13	1.39
1320	22	0.31	0.44	0.54	0.69	0.86	1.08	1.33
1335		0.29	0.42	0.51	0.66	0.83	1.03	1.27
1350		0.28	0.4	0.49	0.63	0.79	0.98	1.21
1365		0.27	0.38	0.47	0.6	0.75	0.93	1.15
1380	23	0.25	0.36	0.44	0.57	0.71	0.89	1.09
1395		0.24	0.34	0.42	0.53	0.67	0.84	1.03
1410		0.22	0.32	0.39	0.5	0.63	0.79	0.97
1425		0.21	0.3	0.37	0.47	0.59	0.74	0.91
1440	24	0.2	0.28	0.35	0.44	0.56	0.69	0.85

2.4.2.2 Design Inlet Time

	Impervious (%)		
Catchment Area (A)	**30**	**50**	**>70**
A = 8ha or less	8	8	5
8 ha < A < 40 ha	9.2	9.2	6
A = 40 ha or more	10.4	10.4	7.25

a) Runoff Coefficients

(i) The value of the design rainfall intensity, I, for the rational formula is selected from the appropriate intensity duration frequency (IDF) curve, with a duration chosen to coincide with the time of concentration. The time of concentration for runoff flow is the time required for

runoff flow to become established and reach the design location from the furthest point within the contributing catchment area.

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

$$C = \frac{CpAp + Ci\,Ai}{Ap + Ai}$$

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

Table 2.8: Storm Runoff Coefficients & Imperviousness According to Zoning

Land Use Classification	Runoff Coefficient (C)[1]	Impervious (%)
Single Detached Residential, Low density residential	0.5	40 - 65
Multi Attached Residential Medium/High density residential	0.65	40 - 90
Urban Services (Institutional)	0.65	40 - 90
Industrial	0.5	40 - 70
Commercial	0.9	40 - 100
Parks & Recreation	0.3	10 - 50

1. Minimum design values to be used without specific area analysis. To be used only or calculation of peak runoff rates by the rational method.
2. Typical ranges based on land use bylaw site coverage limits and typical paving practices.

Table 2.9: Runoff Coefficients and Impervious According to Land Use

Land Use	Runoff Coefficient (C)[1]
Asphalt, concrete, roof areas	0.95
Gravel	0.65
Grass/Soft Landscaping	0.20
Clay Soil	0.40

1. Minimum design values to be used without specific area analysis. To be used only or calculation of peak runoff rates by the rational method.

2.4.2.3 Computer Modelling

a) For areas greater than 65 ha:

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

(ii) The selection of an appropriate computer model shall be based on an understanding of the principles, assumptions, and limitations in relation to the system being designed. SWMM models are preferred for the design of drainage systems.

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

2.4.3 Minor Systems

2.4.3.1 Mains

a) Storm sewer pipe shall be designed to convey the design flow when flowing full with the hydraulic gradeline at the pipe crown
b) Manning's 'n' = 0.013.
c) Minimum flow velocity = 0.60m/s
d) Maximum flow velocity = 3.0m/s
e) Curved sewers will be permitted with the following restrictions:

(i) The sewer shall be laid as a simple curve with a radius equal to or greater than 90 m or the manufacturers minimum recommended radius, whichever is larger.
(ii) Manholes shall be located at the beginning and end of the curve.
(iii) Manholes shall be located at intervals not greater than 90 m along the curve.
(iv) The main shall run parallel to the curb or street centreline.
(v) Curved sewer design gradients shall be increased by a factor of 1.5.

2.4.3.2 Manholes

a) Not to exceed 120m spacing.
b) Minimum of 1200mm diameter.
c) Located at all changes in pipe diameter, gradient or at ends of mains.
d) The downstream invert in a manhole shall be a minimum of 30mm lower than the lowest upstream invert. At a change in direction, the drop shall be 60mm.
e) All pipe crown elevations shall match at manhole junctions.
f) Safety platforms at intermediate levels are required for manholes greater than 5.0m in depth.

2.4.3.3 Catchbasins

a) Not to exceed 120m spacing.
b) Catchbasins to be a minimum of 900mm dia.
c) Catchbasin lead minimum size shall be 250mm.
d) Minimum lead gradient of 1.0%.
e) Maximum lead length of 30m.
f) Minimum depth of cover to top of pipe of 1.5m.
g) Sumps shall have a depth not less than 500mm
h) Safety steps to be included on any Catchbasin over 900mm dia.
i) Frame and cover types shall be used for various curb types and applications as follows:

Table 2.10: Summary of Recommended Design Standards For Streets

Frame and Cover Type	Curb Type	Allowable Application
K-7 or DK-7	Rolled curb	Residential areas
F-36 or F-51	Straight face	Catch basin only
F-38	No curb	Swales and lanes
F-39	No curb	Paved or Landscaped areas

j) Catch basins shall be evaluated to ensure they have sufficient capacity to collect flows. Calculations shall be provided as part of the engineering drawing submission.
k) All leads shall connect to a manhole or catchbasin manhole. In-line main connections are not permitted on municipal systems.

2.4.3.4 Culverts

a) Parks and pathways = 300mm minimum dia.
b) Commercial and rural = 600mm minimum dia.
c) Culverts and bridge designs should consider backwater effects over a range of flows.
d) The design shall take into account nominal design capacity and its performance during the 100 year event.
e) Access point manholes shall be used for any culvert greater than 30m in length
f) Culverts shall have sloped ends and include rip-rap and adequate erosion protection.

2.4.3.5 Outfalls

a) Outfall structure shall be placed at the end of all storm sewers discharging to an open channel, watercourse, river or other receiving water body such as a lake. The purpose of the structure is to reduce velocities and prevent erosion. All outfall structures must meet all necessary Provincial and Federal regulations. It is the responsibility of the Developer to obtain the necessary approvals and permits from the above mentioned Authorities.
b) The outfall structure may be a chute, spillway, stilling basin or plunge pool with headwall. A cut off wall is required at the end of the outfall apron to prevent undermining of the structure.
c) Obverts of outfall pipes shall be at least 150 mm above the 5 year flood level in the receiving stream. Inverts of outfall pipes shall be above winter ice level. Otherwise, outfall pipes shall be submerged below the bottom of ice level. In addition, outfalls shall be located to avoid damage from moving ice during breakup.
d) If the downstream channel is relatively flat, the apron shall be 150 mm to 225 mm above the channel invert to prevent collection of debris on the apron.
e) Rip rap and a filter layer shall be placed downstream of the outfall structure where required to prevent erosion.
f) Weeping tile shall be placed under the structure to reduce any water pressure behind the headwall.
g) Grills shall be placed over all storm sewer outlets to prevent access.
h) Railings shall be placed along the headwall and wing walls of the outfall structure.
i) Outfalls shall be landscaped to blend in with surrounding areas.

2.4.3.6 Receiving Waters

a) Measures shall be incorporated in new developments to prevent any increase in the amount of downstream erosion.
b) If a development will cause downstream erosion despite the use of on-site peak run-off rate controls, appropriate measures shall be constructed in the downstream areas.
c) Preservation of watercourse aesthetics and wildlife habitat shall be considered in erosion and bank stability work.

2.4.4 Major System

2.4.4.1 Wet Ponds or Engineered Wetlands

a) Soils investigation specific to the stormwater management facility shall be undertaken to determine appropriate design factors.
b) Shall be constructed of impervious soils to minimize water loss during dry weather periods.
c) The facility design shall consider the aesthetic implications of shape, grading and landscape features.
d) An emergency overflow system shall drain to a receiving stream, if possible, for storms greater than the 100 year event.
e) The effects of the maximum pond water levels shall be considered in the design of the minor system and lot grading. The hydraulic gradeline elevations for the minor system piping shall be calculated starting from the maximum pond level during the 5 year storm event.

f) The pond's outlet capacity shall be that the pond shall drain and reach normal water level within 72 hours of reaching maximum water level during the 100 year event. All inhabited building space, including basements, shall be constructed above the 100 year flood level.
g) An overflow channel and overland drainage route must be provided to the satisfaction of the Town and the design of the pond and permitted water level fluctuations must ensure that:

(i) The lowest basement weeping tile of any building on a lot adjacent to the lake shall be a minimum of 300 mm above the 1:100 year high water level.
(ii) The lowest manhole invert shall be at or above the normal water level elevation.
(iii) The pipe obvert at the lowest manhole immediately upstream of the pond shall be above the high water level during a one in five year storm event.
(iv) A minimum distance of six meters shall be maintained from any basement wall to the 1 in 100 year high water level.
(v) The inlet to the pond must be above the normal water level or below ice level.
(vi) The minimum surface area at normal water level shall be 2 hectares.
(vii) The minimum depth of the pond, at normal water level, will be 2.5 meters.
(viii) The lake bottom and side slopes will be composed of an impervious material.
(ix) No dead bay areas will be permitted.
(x) Shoreline erosion protection is required.
(xi) The design will incorporate a semi-annual turnover at average annual precipitation.
(xii) Submerged inlets/outlets are preferred and will be constructed such that the tops are a minimum of 1.0 m below normal water level.
(xiii) Inlets/outlets not submerged will require fencing along adjacent shoreline for 5.0 m in each direction from the center line of pipe. All inlets/outlets will be provided with a grate permanently fixed to the structure.
(xiv) Every pond will be sterilized during construction to prevent weed growth.
(xv) Minimum width of the water surface at the normal water level will be 25 meters.
(xvi) A silt trap will be provided at the inlet of each pond.
(xvii) Side slopes above normal water shall have a maximum slope of 7.1.
(xviii) Side slopes from 1.0m below NWL to pond bottom shall be a maximum of 3:1.

h) An operation and maintenance document is to be provided to the Town prior to FAC. The document is to include operation, maintenance, service and repair instructions complete with parts lists for all mechanized and electrical equipment incorporated into the design.

2.4.4.2 Dry Ponds

All dry ponds shall be off-line storage areas designed to temporarily detain excess runoff. The dry ponds shall:

a) Not exceed 1.5 m depth of water for the 1 in 100 year event.
b) Have flow bypass for flows from minor events.
c) Have a bottom with a minimum longitudinal slope of 1%.
d) Have a bottom with a minimum lateral slope of 1.0%.
e) Have a French drain where longitudinal slopes are less than 2%.
f) Have side slopes flatter than 7 (horizontal) to 1 (vertical).
g) Have length, width and depth dimensions that are acceptable to the Town.
h) Have the bottom and sides sodded or grassed.
i) Have trash bars on inlets and outlets to preclude access by children.
j) Address all safety issues (particularly during operation).

2.4.4.3 Lot Grading and Surface Drainage Design

a) The major drainage system shall be assessed with respect to the 1 in 100 year return period event.
b) The grading of streets and the layout of the major drainage system shall be assessed, relative to the following guidelines, during the 100 year event:

(i) Continuity of the overland flow routes between adjacent developments shall be maintained.
(ii) Arterials should have at least two lanes which are not inundated parallel with the direction of flow. Where the major system crosses an arterial, the depth of flow should be less than 0.05 m.
(iii) Collectors should have at least one lane which is not inundated parallel with the direction of flow. Where the major system crosses a collector; this depth of flow should be less than 0.10 m.
(iv) Local roads should have a depth of water no more than 0.05 m above the crown. Where the major system crosses a local road, the depth of flow should be less than 0.15 m.
(v) The depth of water at curbside should be less than 0.35 m for all roadways.
(vi) Ponding limits and maximum depths shall be shown on the drainage plans.

c) The grading of lots shall meet the following requirements:

(i) Designs shall provide that maximum flooding or ponding shall be 600mm below the lowest anticipated ground elevation at buildings. Overflow routes and provisions shall be designed such that the maximum ponding depth is not more than 300mm.
(ii) Generally all residential lots shall be designed to drain to the front. The ground adjacent to the building is to be at a minimum slope of 10% or more for 1.5m, draining water away from the building to the property lines. Outside this zone, surface grades shall be generally 2.0% to 6.0% with a minimum grade of 2.0% drainage throughout. Maximum grades are not to exceed 20%.
(iii) Where the rear portion of one lot drains through an abutting lot, the slope of the downstream lot shall be 3.0% or greater, and a 2m wide drainage easement shall also be provided.
(iv) Drainage from lots shall be by the formation of swale depressions along the proposed property lines. Swales shall be completed in accordance with approved engineering drawings.
(v) Swales draining more than three lots from one side or six lots from two sides shall have a 500mm wide concrete gutter along the invert (50mm channel depth, 200mm thickness concrete). Swales collecting and conveying flows from more than two properties are not to be routed along the side yard of a single family or duplex lot. The minimum gradient for concrete swales is 0.75%. Swales without a concrete channel shall have a minimum longitudinal gradient of 2.0%.
(vi) Roof drainage down spouts shall discharge to the ground surface. A splash pad, provided by the house builder, shall be placed at each down spout location or other such approved device and orientated to ensure discharge occurs at least 1.5m from the face of the building.

2.5 Services

2.5.1 Sanitary and Water Services

a) The minimum size of service connections to a single detached dwelling shall be as follows:

(i) Sanitary Sewer 100 mm diameter
(ii) Water Service 25 mm diameter

b) Non-residential developments or multi-family units shall have services sized to meet specific requirements. Each individual residence shall have separate services.
c) The minimum grade on a sewer service shall be 2.0%.
d) Connection to a main sewer line shall be by means of a saddle at the top quadrant of the main.
e) Where bends are utilized, the long radius type or a combination of bends and straight pipe shall be used.
f) For water services size 50 mm and smaller, the tapping shall be at the 2 to 3 o'clock position on the distribution main.
g) Watermains shall be tapped under pressure if already in service.
h) All water services must utilize service clamps.

i) Park areas may require a water service. The size, type, and other requirements shall be determined by the Town.

2.5.2 Sump Pump Connections System

a) All new development with basements or weeping tiles are required to have the sump pump discharge collection system be a component of the storm drainage system.
b) The Consultant shall estimate the weeping tile flows as a component of the geotechnical/hydrogeological investigation.
c) Where significant flows are anticipated from the sump pumps, these flows shall be added to the flows used to size the storm systems.
d) Where high flows are expected such that sump pump will be required to pump continuously or run excessively, then the Developer shall present recommended alternatives to the Town.
e) All sump pump connection systems shall come with an auxiliary surface discharge in the event of freezing conditions.

2.6 Utilities

2.6.1 Natural Gas Service

2.6.1.1 Right-of-Way

a) Where required, the Developer shall provide rights-of-way and easements of sufficient size and location to satisfy the gas company. Refer to Standard Details for preferred locations.
b) All easements shall be registered in the name of Town of Morinville.

2.6.1.2 Installation

a) The Developer and the gas company. shall obtain Town approval for the method installation including excavation and backfilling requirements.
b) The Developer shall coordinate the location of gas services to ensure that they do not interfere with other utilities.
c) Where gas distribution is installed at the front of lots, gas service to individual lots shall be installed such that the gas meter can be placed at the side or the rear of the dwelling. Where gas meters are placed at the side of the dwelling unit, the gas meter shall be placed on the side of the dwelling opposite the driveway. Gas meters shall not be permitted at the front of the dwelling unit.
d) An Excavation Permit must be obtained from the Town for any excavation on Town property.

2.6.1.3 Costs

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

2.6.2 Communications/Cable Service

Communication/cable services to be installed shall be underground.

Where possible, services to be located in the same trench as power.

2.6.2.1 Rights-of-Way

a) Where required, the Developer shall provide rights-of-way and easements of sufficient size and location to satisfy the communication/cable company.
b) All easements shall be registered in the name of the Town of Morinville.

2.6.2.2 Installation

a) The Developer and the communication/cable company shall determine the method and by whom the trenches for cables shall be dug and compacted.
b) The Developer shall coordinate the location of service boxes to ensure that they do not conflict with driveways or interfere with other utilities. Alignments to be approved by the Town.
c) An Excavation Permit must be obtained from the Town for any excavation on Town property.
d) Service pedestals to be located on the intersection of lot lines where possible.

2.6.2.3 Costs

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

2.6.3 Power Service

Power services to be installed by the power company and shall be underground. Where possible, power and communications/cable shall run in a common trench.

2.6.3.1 Rights-of-Way

a) Where required, the Developer shall provide rights-of-way and easements of sufficient size and location to satisfy the power company
b) All easements shall be registered in the name of the Town of Morinville.
c) See Standard Details for preferred alignments in road right-of-ways.

2.6.3.2 Installation

a) The Developer and the power company shall obtain Town approval for the method of installation including excavation and backfilling requirements.
b) The Developer shall coordinate the location of power service boxes and transformers to ensure that they do not conflict with driveways or interfere with other utilities. Alignments to be approved by the Town.
c) An Excavation Permit must be obtained from the Town for an excavation on Town property.

2.6.3.3 Costs

a) Any capital contribution that the utility company may charge for installation of electrical services, shall be paid by the Developer.

2.7 Pump Stations

2.7.1 Location and Design Considerations

All new lift stations shall be located on a separate Public Utility Lot (PUL) with appropriate land-use designation and must have a legal and physical address. The final legal plans must be submitted to the Town.

Special consideration should be given to the location of lift stations relative to existing or proposed adjacent development, in order to minimize the facilities aesthetic impact in terms of visibility, odour and noise. The location of pump stations in the immediate proximity of school sites and playgrounds should be avoided if possible. Safety and security measures are to be given special consideration in such cases.

Direct access to power and roadways shall be provided with a suitable loading area, parking and turning movements for the typical design vehicle and general function of the station.

The lift station shall be situated at a functional location for the drainage system to limit excess piping and forcemain length.

Lift stations are to be located outside the limits of any area subject to surface ponding or inundation by surface flow during major runoff events so that they are accessible in all weather conditions. The location of the lift station shall be protected from flooding with the surface elevation 500mm above the 1:100 year flood event.

An Emergency Response Plan will be required with features included in the design where required.

In the event of a mechanical or electrical failure, redundancy of pumps and backup power will be the primary response, with alarm notification of failures sent to operators through the communications system. Further levels of emergency response shall be reviewed for implementation such as a gravity overflow to a suitable pipe system that does not impact backup to the upstream system. Portable pumping and piping requirements to a suitable downstream system should be identified. Site plan design shall identify overflow of the station during complete failure of all levels of emergency backup that minimizes impact to the environment.

Site access to the station for maintenance and emergency vehicles shall be provided.

Design shall limit the operational need to enter into the wet well, however fall arrest system design shall be incorporated throughout the lift station system.

2.7.2 Configuration

Two types of lift stations shall be permissible:

a) Wet well and dry well - Lift stations should preferably be built with a wet well and dry well configuration, where pumps are installed in a dry well with pump suction from the wet well
b) Wet well only - Wet well only configurations are allowable for smaller stations with pump sizes less than 75kW, and depth less than 8.0m

Design of systems where interim and ultimate staging requirements for development are required shall be designed to ultimate structure size with interim functional elements to facilitate effective use during interim periods whenever possible. Lift stations with staging requirements shall allow for equipment upgrades to be completed without disruption to ongoing flow requirements.

All stage plans shall be provided in the Design Report for review. All stages of the system must be designed in detail prior to the initial stage approval.

2.7.3 Design Flows

Pumping system shall be designed to exceed the peak design flow determined for sanitary systems, and shall be designed to meet the allowable release requirements determined for stormwater systems

Design flows shall be calculated in accordance with the Morinville Municipal Design Standards.

2.7.4 Pumps, Piping and Valves

Redundancy – Lift stations shall have a minimum of two pumps, where one pump is capable of handling the peak flow requirements. When two pumps are used, pumps shall be identical and interchangeable. When three pumps are used, peak flow requirements can be satisfied by the two smallest pumps operating in parallel.

Pumps shall be able to alternate usage automatically. Impellers shall be non-clog, capable of passing 75mm solids.

All pumps must be able to be serviced locally, with regional access to spare parts.

Each pump shall have a dedicated inlet pipe

All pipe within lift station shall be stainless steel or epoxy coated steel. Pressure pipes shall have a minimum pressure rating of 900kPa.

All brackets, hangars and supports shall be non corrosive. Nuts and bolts shall be stainless steel.

All equipment shall have adequate spacing and clearances for access and maintenance or replacement.

Check valves are required on each pump discharge line, prior to an isolation valve. Isolation valves are required on the discharge line after the check valve, and on the suction side. Air release valves are required at the high points of the discharge system. Drain valves are required at the low points of the discharge system, and must drain back to the wet well.

2.7.5 Station Structures

Wet well sizing shall be designed with the operation of the pumps considered such that pump run times do not exceed 1 hour per cycle.

Inlet piping shall be designed to prevent surcharge upstream, and to minimize turbulence to mitigate air entrainment and odour.

Dry well structures shall be accessible for maintenance in accordance with Occupational Health and Safety Standards.

Design shall account for potential buoyancy issues.

All wet well/dry well configuration lift stations as well as all sanitary lift stations shall require a superstructure. Equipment sizing for operational requirements may also dictate superstructure need.

When superstructures are required, architectural requirements shall meet relevant land use bylaws and be reviewed with the Town to comply with additional surrounding aesthetic needs.

Superstructures shall include a wash station for facility cleaning and appropriate storage for supplies such as tools, spare parts, or safety equipment.

Lift stations shall be secure facilities. Building/hatch door locks shall be as indicated by the Town. Superstructures shall be secured with a building entry alarm system compatible with the Town needs. No external controls should be accessible, unless a security chain link fence is provided. All below grade lift stations shall have fencing to provide additional security.

All lift stations must have provisions for pump removal. When a superstructure is provided, overhead girder mounted cranes are to be included in the facility design for pump removal. Smaller stations can be accommodated through use of an appropriately rated davit system for pump removal.

2.7.6 HVAC and Electrical

Mechanical systems shall be designed to provide proper ventilation, heating and odour control. Ventilation shall be continuous to prevent buildup of moisture and gases. Heating of the lift station spaces shall be required to prevent freezing of any functional areas. All lift station mechanical systems shall comply with AEP Wastewater Systems Standard and Guidelines.

Backup power shall be provided for all stations capable of supporting the entire load for the building. Diesel generators are required unless exemption is granted from the Town. Diesel fuel shall be stored in an appropriately sized double walled tank, sufficient for 24 hours of operation. Automatic load transfer switch shall be provided to automatically transfer station loads to standby power generator in the event of utility power failure.

A hazardous area classification shall be completed and all building electrical work shall be completed in accordance with the Canadian Electrical Code. Electrical equipment such as pumps and motors shall be able to be locked out for maintenance.

TVSS unit, digital power meter, and UPS systems will be required unless exemption is granted from the Town.

2.7.7 Controls and Alarms

Pumps shall be controlled for continuous, unattended operation and to cycle through duty/assist/standby operations. Each pump cycle will be controlled by sensors for start/stop requirements. Level sensors shall be hydrostatic level and radar, with a high level float backup. A detailed control philosophy is to be submitted for review by the Town for approval.

SCADA for lift stations shall have sensors and measurement devices connected to a PLC that communicate through internet to the Town's system. A local touch screen operator interface (HMI) shall be provided for local monitoring and setpoints entry. All SCADA systems shall be developed in consultation with the Town to ensure site specific requirements are met. Backup radio/cell systems shall be required, unless exemption is granted from the Town. Minimum alarms for lift stations include wet well high level, wet well low level, pump failure, ventilation failure, building/cabinet low temperature, intrusion. Wet well level sensors shall include dual sensor systems as backup in case of primary failure.

2.7.8 Operations and Maintenance

Design of lift stations should provide for functional and safe operations and maintenance activities.

The design for lift stations should include the preparation of an Operation and Maintenance Manual for the facility.

2.8 Municipal Open Space Design

2.8.1 Boulevards

2.8.1.1 Surfacing

a) Any areas not covered in paved surfaces (sidewalks, roadways, trails, curbs, etc.) must be graded, topsoiled and sodded. Seeding is not permitted. All hard surface trails, sidewalks and other walking surfaces within boulevards are covered within the Municipal Engineering Standards. May propose options to the Town for approval for maintenance free boulevards (rock, artificial naturalization etc)

b) If boulevard trees are proposed for installation in tree wells including a tree grate and surrounded entirely by paved surface in areas with grates only, the detail from Section 10.12 – Drawing 111 – Structural Soils must be used for all tree planting.

2.8.1.2 Vegetation

a) In single family residential areas, minimum two trees along the front of each lot and five trees along the side yard of corner lots must be implemented. Should utility conflicts limit tree planting, these trees must be placed in the nearest MR or Multiway area, in addition to the tree requirement for that new area. During the course of construction an on-site utility locate will be required at CCC to validate that any conflicts exist.
b) In multi-family or commercial areas, boulevard trees are required at no more than 8m spacing in all boulevards, with exception to driveway locations. Should utility conflicts limit tree planting, these trees must be placed in the nearest MR or Multiway area, in addition to the tree requirement for that new area. During the course of construction an on-site utility locate will be required at CCC to validate that any conflicts exist.
c) Shrubs may not be planted in boulevard areas. Shrubs are only permitted in road right of way as described in Section 2.8.2 – Entrance Feature Areas, Roadway Islands, Medians.

2.8.1.3 Mulching

a) All trees must have a ring of mulch beneath each tree, as per standard details shown in Section 10.4 – Drawing 103 – Tree Planting. Where trees are installed equal to or less than 2.0m apart, continuous mulch beds are required.

2.8.1.4 Utility and Infrastructure Setbacks

a) The following utility setbacks shall apply for all tree plantings, measured from the center of the tree trunk:

Utility & Infrastructure	Min. Setback
power lines	1.0m
fence lines	2.5m
power hardware	3.5m
telephone pedestals	1.5m
water mains, services, valves	1.8m
sewer mains, manholes, services	2.0m
street corners	7.5m
street lights	5.0m
median and road curb faces	2.0m
fire hydrants	2.0m
driveways	2.0m
yield and stop signs	3.5m
bus stop signs	3.5m
parking and all other signs	2.0m
buried gas mains and services	1.5m
other underground utilities	1.0m

b) Hydrovac or hand dug holes for trees will not be permitted as a means to relax the above noted setbacks. Trees must not be planted in any location from which the tip of any branch at maturity will grow closer to overhead power lines than 2.4m laterally or 4.5m vertically.
c) In addition to complying with these setbacks, the Applicant must comply with any other setbacks and permitted activities on utilities such as pipelines, which will have other prescribed distances.

2.8.1.5 Fencing

a) All rear and side yard private property lines that interface with boulevards must be fenced with a min. 1800mm ht. uniform wood screen fence, as per Section 10.8 – Drawing 107 – Wood Screen Fence. Property lines that interface with arterial roads must be fenced with a min. 1800mm ht. wood screen fence or alternatively either a 1800mm height. or 2400mm ht. sound attenuation fence, as per Section 10.9 – Drawing 108 – Sound Attenuation Fence, at the full discretion of the Town. All fences are to be built min. 150mm inside private property. No fencing may be installed on public property.
b) Step down wood screen fencing, as per Section 10.17 – Drawing 116 – Step Down Wood Screen Fence, is required at the front of lot for any fence segments flanking a boulevard.

2.8.2 Entrance Feature Areas, Roadway Islands, Medians

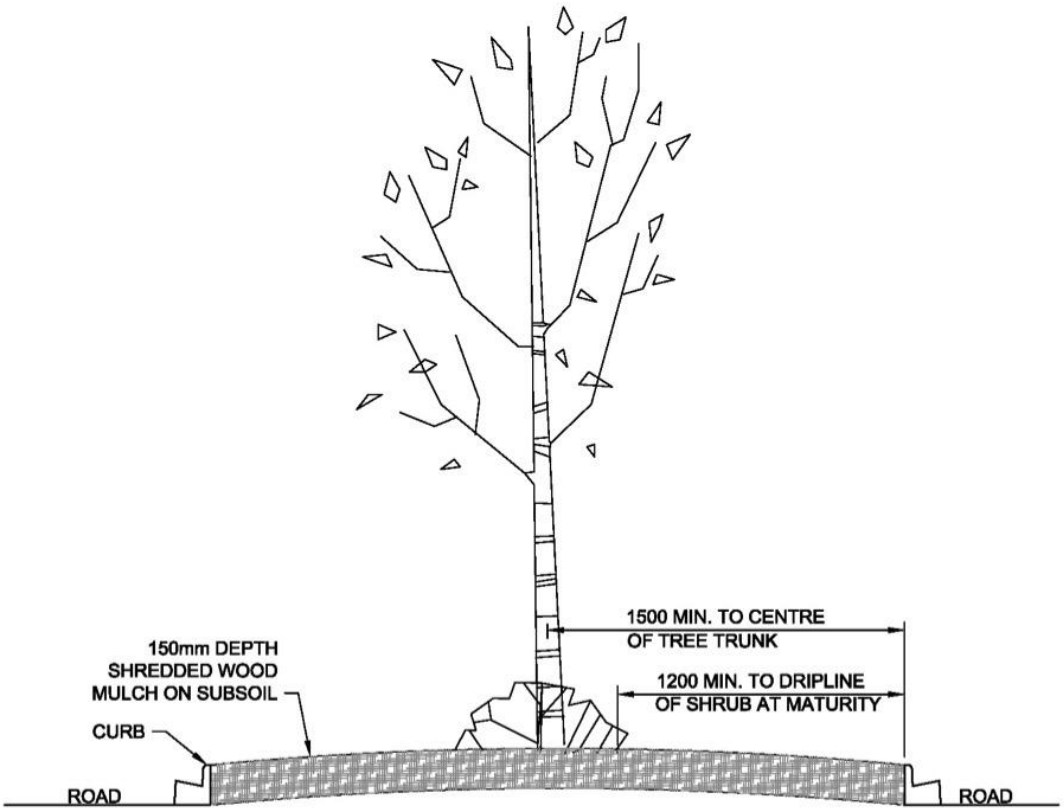
2.8.2.1 Entrance Feature Areas

Beyond community welcome signs, entrance features are not permitted on public land. See Section 2.8.11.2 – Community Entrance Features for additional information on entry feature placement. Plantings surrounding entrance features may be implemented at the discretion of the Town. All designs for special entrance features shall be subject to review by the Town as a special consideration. Plant materials will not be part of planting count requirements for any open space. Entrance feature planting shall be low maintenance, and can only consist of trees and shrubs. Shrubs must be massed within planting beds, with deciduous shrubs minimum 500mm ht. and coniferous shrubs minimum 400mm spd.

2.8.2.2 Roadway Islands

Roadway islands must be entirely mulched and filled with low lying shrubs that have a maximum mature height of 750mm. Islands may not have any plantings within 1.2m of the outside curb of the island, measured to the drip line of the plant material at its maturity. All islands must be filled with adequate topsoil, positively drained from the middle of the island outward to the curb in all directions, and covered in min. 150mm depth shredded wood chip mulch. Only deciduous trees that have a minimum branching height of 1.75m may be planted in roadway islands. Trees may not be planted within 1.5m from any curb, and can only be planted in islands min. 3.0m dia.

The following diagram demonstrates the minimum setbacks for medians and islands.



MEDIAN AND ISLAND SETBACKS

2.8.2.3 Medians

a) Medians that are less than 3.0m wide must be entirely mulched or covered in concrete surfacing, and may not contain any plant material. Medians equal to or greater than 3.0m wide must be and filled with low lying shrubs that have a maximum mature height of 750mm. Medians may not have any plantings within 1.2m of the outside curb of the island, measured to the drip line of the plant material at its maturity. Islands that are 3.0m or greater in width may include portions in sod where plantings are not included. Only deciduous trees that have a minimum branching height of 1.75m may be planted in roadway islands. Trees may not be planted within 1.5m from any curb, and can only be planted in medians equal to or greater than 3.0m in width.
b) The above diagram in demonstrates the minimum setbacks for medians and islands.

2.8.3 Municipal Reserve

2.8.3.1 Surface Grading Requirements

a) Rough grading must be completed without damaging any roots or branch systems of any plant material to be retained. A minimum grade of 1.5% is required to provide positive drainage for all MR areas. Exceptions may be made for sportsfields that require flatter grades. The maximum allowable slope for any hills or berms shall be 5:1, unless otherwise approved by the Town. Any fill materials must be free of sticks, stones and other debris larger than 50mm and any other material that may be subject to rot or corrosion.

b) Topsoil may not be buried in any areas of MR, unless a letter is provided by a Geotechnical Engineer certifying that materials have been compacted sufficiently as to prevent long-term settlement and accepted by the Town.

2.8.3.2 Turf

a) All MR areas must be topsoiled and seeded or sodded. A minimum of 150mm depth topsoil is required for turf areas. Prior to installing topsoil, the subgrade must be compacted within the range of 70 to 90% SPD, and free of any rocks, roots or other debris at the surface. Over compacted subgrade must be scarified and reworked prior to installing topsoil.

2.8.3.3 Plant Material

a) All MR areas require 75 trees per hectare, measuring the entire land parcel and excluding the area of any proposed buildings or parking lots (ie. in the instance of school sites). Trees may be substituted with shrubs at a rate of five shrubs to one tree. Perennials are permitted within MR areas, however are not to be included in the total plant count.
b) A diversity of plant material is encouraged. As a general guideline, the Town recommends a mix of 60% deciduous and 40% coniferous trees in MR areas. Should shrubs be specified, the Town recommends a mix of 80% deciduous and 20% coniferous shrubs. The following minimum plant sizes are required:

   (i) deciduous trees min. 60mm Cal.;
   (ii) coniferous trees min. 2.5m ht.;
   (iii) deciduous shrubs min. 450mm ht.; and
   (iv) coniferous shrubs min. 600mm spd.

2.8.3.4 Existing Vegetation Protection

a) Existing grades around plant material are to be retained. If existing grades around plant material to remain are altered, either raised or lowered, the Applicant will be responsible for constructing remedial measures, to compensate for the grade changes. If the grades in the surrounding area to plant material to be retained are altered so as to adversely affect retained plant material, the Applicant will be responsible for all remedial work. Plant material must not suffer from any grade changes. The Applicant will also be responsible for replacing all plant material that has died or suffered as a result of construction or grade changes.
b) Plant material to be preserved on the site shall be of high quality and worthy of preservation. All plant material to be preserved shall be approved by the Town. All plant material to remain on site shall be protected during all work on the site. Protection will be required for trunks, branches and root systems of all plant material to be saved.
c) Passage of heavy equipment, stockpiling of gravel, soil or building materials and spillage of gasoline, oil, solvents and other chemicals will not be allowed under the tree canopy or within 30m of tree stands. Temporary fencing will be required around all plant material to be preserved. A tree protection strategy must be included within detailed drawings.

2.8.3.5 Trails and Furniture

a) MRs may contain either gravel, paved asphalt or concrete trails. The following includes minimum trail widths:

   (i) gravel trails min. 1.5m;
   (ii) paved asphalt trails min. 2.5m; and
   (iii) concrete trails min. 1.5m.

b) Trails anticipated to have intensive use or in MR areas that have winter time activities possible, asphalt trails will be required. Gravel trails are only permitted in areas of MR with only summer time activities. Trail lights are required for trail development.
c) Pedestrian furniture must be installed in MR areas, including benches and waste / recycling receptacles. Furniture should be installed in highly visible areas, along trails and on furniture pads as shown in Section 10.0 – Landscape Standard Drawing Details. The following is the standard furniture for all open space development in Town:

   (i) benches – “Classic Riverside Centre Arm”, supplied by Classic Displays, 80cm height, 65cm width, 180cm length c/w cast aluminum ends and stainless steel hardware;
   (ii) waste / recycling receptacles – “Glasdon Jubilee”, supplied by Classic Displays, 115.8cm height, 59.8cm width, 55.3cm depth and 130L capacity c/w Durapol body, doors, apertures, and frame. Must include liners for both fixtures.

d) Furniture shall not be installed until which time all trails have been installed, and surrounding turf has been established to avoid causing premature intensive use of certain areas.
e) There is no maintenance period for any pedestrian furniture. The Town will assume responsibility of waste removal upon satisfactory CCC inspection of all furniture.

2.8.3.6 Fencing

a) All private property that interfaces with MR parcels must be fenced with a continuous 1500mm ht. black powder coated chain link fence, as per Section 10.6 – Drawing 105 – Chain Link Fence. The Applicant has discretion on installing gates along back of lots for any private property fence line, which if installed must be centered along the rear property line. Gates to be constructed as per Section 10.7 – Drawing 106 – Chain Link Gate. All fences are to be built min. 150mm inside private property. No fencing may be installed on public property.

2.8.4 Multiways

2.8.4.1 Multiway Placement

a) Multiways must correspond with areas previously identified in both or either of the pertinent ASP as well as the Recreation, Parks and Open Space Master Plan.
b) As identified in Section 2.0 – Drawing Submissions, the Applicant must provide an overall plan of the entire development, including future phases of development, to demonstrate how multiways will link to the surrounding multiway system in the community. This plan shall be provided with each drawing set and updated as subsequent phases of development are proposed.

2.8.4.2 Trail Type in Multiways

a) Trails are required in all multiways, and must be min. 3.0m paved asphalt surfaced as per Section 10.19 – Detail 118 – 3.0m Asphalt Trail. Trails should be generally centered within the multiway, however may deviate to create visual interest and to work around any existing site features that require setback.

2.8.4.3 Plant Material

a) All multiway areas require 75 trees per hectare. Trees may be substituted with shrubs at a rate of five shrubs to one tree. Perennials are not permitted in multiways.
b) A diversity of plant material is encouraged. As a general guideline, the Town recommends a mix of 40% deciduous and 60% coniferous trees in multiway areas. Should shrubs be specified, the Town recommends a mix of 80% deciduous and 20% coniferous shrubs. The following minimum plant sizes are required:

(i) deciduous trees min. 60mm Cal.;
(ii) coniferous trees min. 2.25m ht.;
(iii) deciduous shrubs min. 450mm ht.; and
(iv) coniferous shrubs min. 600mm spd.

c) Additional information on plant material can be found in Section 5.0 –
d) Plant Selection.

2.8.4.4 Furniture

a) Bench and waste / recycling receptacles are required at a minimum spacing of 150m within multiways. Refer to standard specifications and details for more information on seating nodes and furniture.

2.8.4.5 Fencing

a) All private property interfaces with multiways must be fenced with a continuous 1500mm ht. black powder coated chain link fence, as per Section 10.6 – Drawing 105 – Chain Link Fence. The Applicant has discretion on installing gates along back of lots for any private property fence line, which if installed must be centered along the rear property line. Gates to be constructed as per Section 10.7 – Drawing 106 – Chain Link Gate. All fences are to be built min. 150mm inside private property. No fencing may be installed on public property.
b) Step down wood screen fencing, as per Section 10.17 – Drawing 116 – Step Down Wood Screen Fence, is required at the front of lot for any fence segments flanking a multiway for which a wood screen fence is proposed. Approval must be obtained for wood screen solid fencing.

2.8.5 Public Utility Lots / Walkways

a) The Town will entertain various widths of proposed pedestrian walkways, which would be designated as PUL. The purpose of walkways interior to a development is primarily to accommodate underground utilities, as well as connectivity for pedestrians and emergency vehicles.
b) Three types of permitted walkways and their associated landscape treatment are as follows:

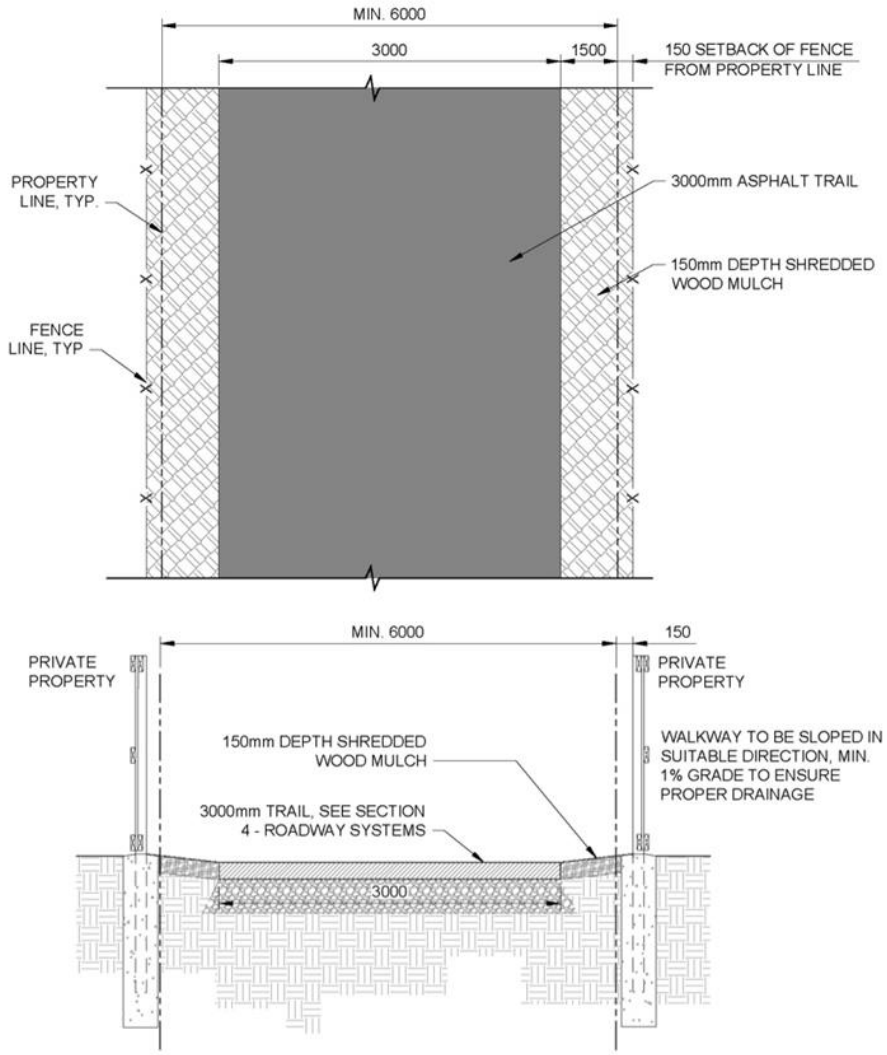
2.8.5.2 4m Walkway With 3m Width Asphalt Trail

a) This type of walkway does not contain utilities and is intended to provide pedestrian access for areas of high traffic, such as connections to public facilities (ie. schools, parks). The diagram below demonstrates permitted treatments. Uniform wood screen fencing that is 1800mm ht. must flank either side of the walkway, and must be placed 150mm inside private property. Ground treatment between the paved surface and each fence must be shredded wood chip mulch at a depth of no less than 150mm, placed on compacted and uniformly graded subgrade. All surface water must flow longitudinally along the PUL / walkway and must not lead into private property in any circumstance. The asphalt trail must be centered inside the walkway, and knock–down bollards (See Section 10.13 – Drawing 112 – Knock-Down Bollard) must be installed at either end of the walkway.

2.8.5.3 4m Walkway with 2m Width Concrete Trail

a) This type of walkway / Public Utility Lot contains underground utilities and is intended to provide connections for both utilities and pedestrians. A minimized walkway of 2m in width reduces costs of replacing segments of walkway should underground line replacement or repair be required, and is also suitable for areas of low traffic volume. The diagram below demonstrates permitted treatments.
b) Uniform wood screen fencing that is 1800mm ht. must flank either side of the walkway, and placed 150mm inside private property. Ground treatment between the concrete surface and each fence must be shredded wood chip mulch at a depth of no less than 150mm, placed on compacted and uniformly graded subgrade. All surface water must flow longitudinally along the PUL / walkway and

must not lead into private property in any circumstance. The concrete trail must be centered inside the walkway. Knock-down bollards (See Section 10.13 – Drawing 112 – Knock-Down Bollard) must be installed at either end of the walkway.

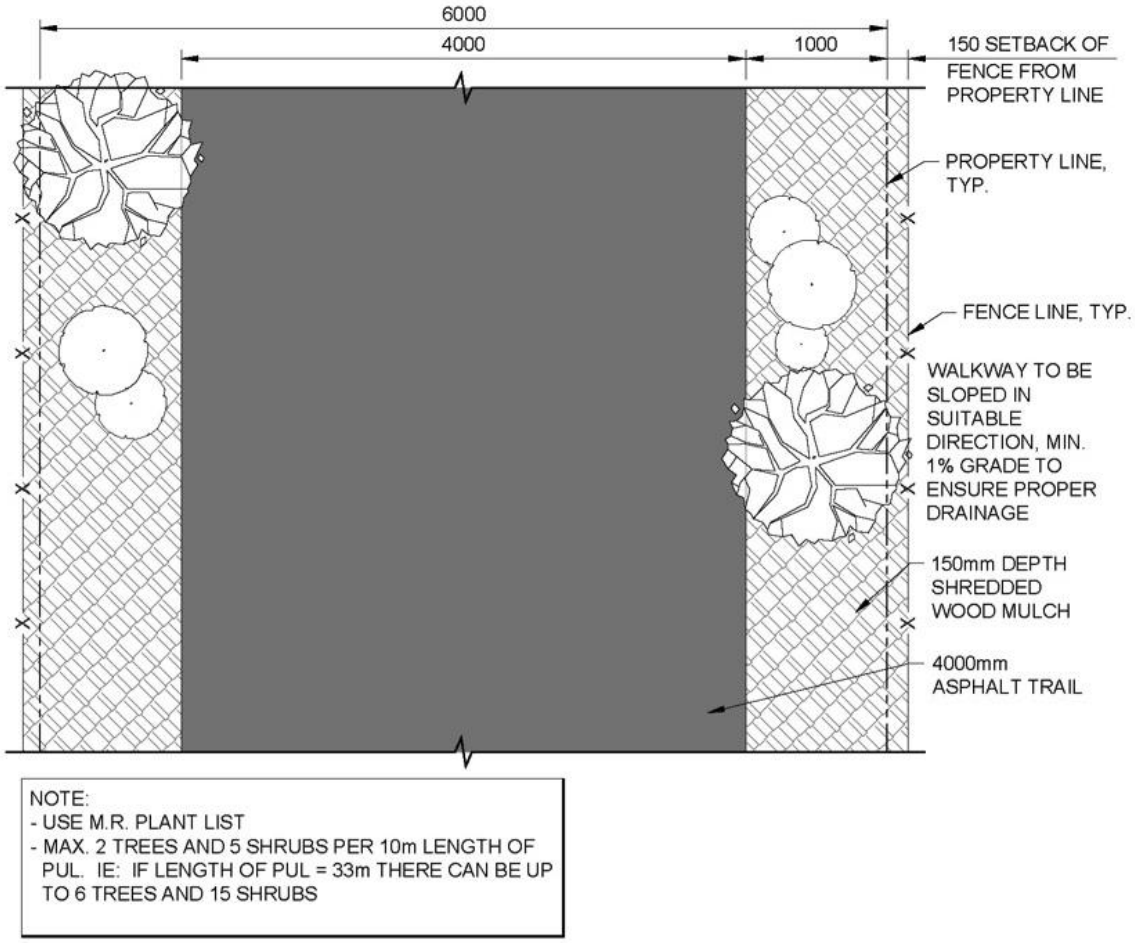


6000mm WALKWAY CONNECTION WITHOUT UTILITIES

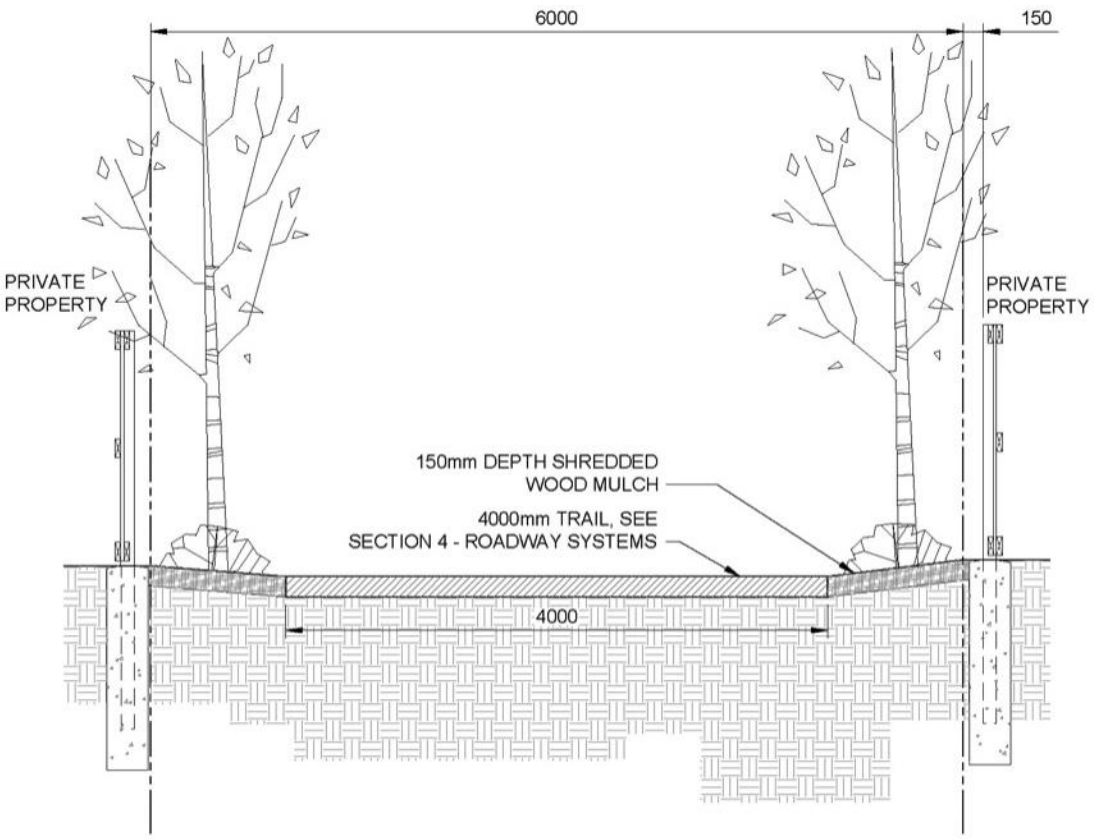
2.8.5.4 Emergency Access Walkway Connection

a) This type of walkway / Public Utility Lot may or may not include utilities, and provides a linkage for both pedestrians and emergency vehicles. Emergency access may be required in a plan of a subdivision where secondary roadway links are not available to some areas of development, and will be directed by the Town during subdivision plan preparation. The diagram below demonstrates permitted treatments. These walkway / PULs are min. 6m in width, with a 4m wide asphalt trail centred in the walkway. Asphalt profiles are to accommodate heavy equipment travel. Uniform wood screen fencing that is 1800mm ht. must flank either side of the walkway, and be placed 150mm inside private property. Ground treatment between the concrete surface and each fence must be shredded wood chip mulch at a depth of no less than 150mm, placed on compacted and uniformly graded subgrade. Planting beds including no more than two trees and five shrubs per 10m length of walkway / PUL. As an example, a walkway 33m in length can contain up to 6 trees and 15 shrubs.

Any plant material must be pyramidal in form as to not encroach on either the asphalt trail or private property at maturity. All surface water must flow longitudinally along the PUL / walkway and must not lead into private property in any circumstance. Knock-down bollards (See Section 10.13 – Drawing 112 – Knock-Down Bollard) must be installed at either end of the walkway, with a pair of bollards at either end due to the 6.0m width and the need to prevent vehicle access around bollards.



EMERGENCY ACCESS WALKWAY CONNECTION



EMERGENCY ACCESS WALKWAY CONNECTION

2.8.5.5 Fencing

a) All rear and sideyard private property lines that interface with walkways must be fenced with a min. 1800mm ht. uniform wood screen fence, as per Section 10.8 – Drawing 107 – Wood Screen Fence. All fences are to be built min. 150mm inside private property. No fencing may be installed on public property.
b) Step down wood screen fencing, as per Section 10.17 – Drawing 116 – Step Down Wood Screen Fence, is required at the front of lot for any fence segments flanking a PUL / walkway.

2.8.6 Parking Lots

a) Parking lots may be implemented in MR areas, to serve amenities such as sports fields. Parking lots must be paved asphalt surface, including the following:

(i) overhead lighting;
(ii) precast concrete curb stops;
(iii) waste / recycling receptacles;
(iv) stalls of min. 3.0m width in an optimal configuration;
(v) painted lines noting all parking stalls; and
(vi) handicap parking stalls as per the LUB.

2.8.7 Stormwater Management Facilities

2.8.7.1 Growth Constraints

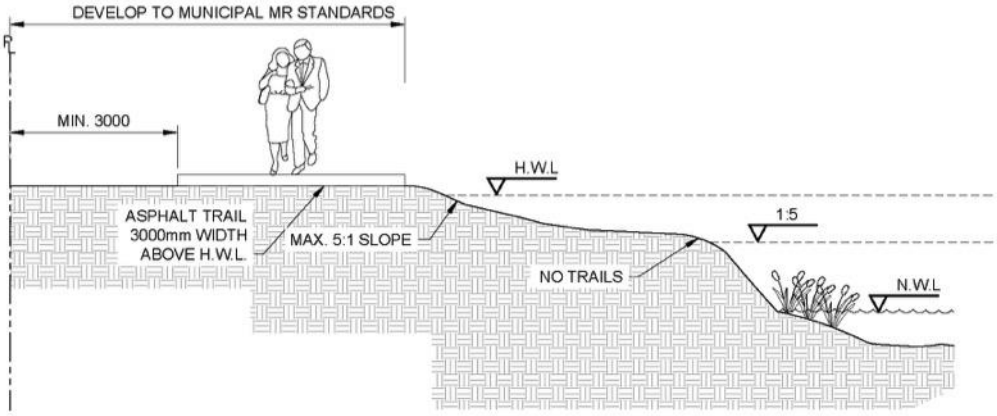
a) Portions of Morinville are located within the Edmonton Garrison heliport safety zone, as further defined in the Edmonton Garrison Heliport Zoning Regulations (SOR/2004-86). Reference to these standards can be located via the Government of Canada website. Restrictions may be applied to the design, development and maintenance of any SWMF that falls within the heliport safety zone. Applicants of any SWMF or feature containing open water must demonstrate compliance with the Edmonton Garrison Heliport Zoning Regulation in its latest edition, and design any such feature accordingly. The Town will require clearance in the form of written correspondence from the Government of Canada for any developments within this safety zone. It is understood that a primary concern is any urban feature, whether created or naturally occurring, that may pose threats of bird hazards as it relates to interference with any airborne equipment.

2.8.7.2 SWMF Configurations

a) SWMFs must be designed to be naturalized. The Town's preference is that SWMFs be developed in the configuration of a constructed wetland. Other SWMF configurations such as dry ponds, wet ponds or confined channel systems must be approved by the Town in advance of commencing designs.
b) Elements of constructed wetlands can include, but are not limited to:

(i) open water areas at depths of 1500 to 2500mm depth below normal water level, representing 40-60% of the total area within the normal water level;
(ii) emergent vegetation areas at depths of 200 to 300mm depth below normal water level, representing the balance of the total area within the normal water level that is not open water. Emergent vegetation zones are to be planted using either live soils from donor wetland, or planted plugs of live bare root plants. Planted plugs must be included in soft landscape detailed drawings. Benches of shallow areas to have emergent vegetation shall undulate in width, and shall not be less than 5m (with exception to areas near inlet / outlet structures);
(iii) grades below NWL should be designed in such a way that maximizes retention time of stormwater passing through the system. Avoid the ability for water to shortcut between inlet and outlet structures;
(iv) side slopes above normal water level to not exceed steepness of 5:1;
(v) including recreational amenities within SWMFs, such as trails and pedestrian furniture is highly encouraged. Asphalt trails may only be developed above the 1:5 flood elevation, and must be asphalt paved and min. 3000mm in width. Gravel trails 2000mm in width may be developed below the HWL, but must be above the 1:5 flood elevation. No trails can be implemented whatsoever below the 1:5 flood elevation;
(vi) areas of SMWFs above the Freeboard elevation are to be built to Municipal Reserve standards, including the recommended plant species and planting densities. The Applicant may negotiate MR credit for portions of areas above freeboard elevations that have sufficient size for open play, that receive the required landscape improvements as credit for Municipal Reserve, and have slopes not exceeding 2.0%;
(vii) asphalt trails developed above HWL must be at least 3000mm away from any adjacent property line;
(viii) any other features such as lighting, pedestrian furniture, etc. must be placed above the HWL;
(ix) the diagram below indicates permitted slopes, setbacks, widths, etc.; and
(x) safety signage that indicates potential "thin ice" conditions in winter months (approximately November through April) and "no swimming" in summer months (approximately May through October). Refer to Section 10.1 – Drawing 100 for more information related to SWMF safety signage.

c) In addition to the minimum requirements set forth by these standards, the requirements of the Stormwater Management Guidelines for the Province of Alberta, as published by Alberta Environment in its latest edition, must be incorporated into the SWMF design. Where feasible and applicable, Alberta Environment's stormwater BMPs shall also be applied within the design.



STORM WATER MANAGEMENT FACILITY

2.8.7.3 Fencing

a) All private property which interfaces with SWMF parcels must be fenced with a continuous 1500mm ht. black powder coated chain link fence, as per Section 10.6 – Drawing 105 – Chain Link Fence. When private lots are immediately adjacent to a proposed trail within a SWMF, the Applicant has discretion on installing gates along back of lots for any private property fence line, which if installed must be centered along the rear property line. No gates to be installed where there are no trails. Gates to be constructed as per Section 10.7 – Drawing 106 – Chain Link Gate. All fences are to be built min. 150mm inside private property. No fencing may be installed on public property.

2.8.8 Environmental Reserves (ER)

a) No design elements will be permitted by the Town within any designated ER. ERs must be temporarily fenced during the course of adjacent construction to protect any parts of these ecosystems from disturbance.

2.8.9 Landscape Signage

2.8.9.1 Park Identification Signage

a) Park identification signage is required at the primary entrance of all named MR parcels. Both the naming of all park spaces and the installation of signage will be the responsibility of the Town.

2.8.9.2 Stormwater Management Facilities

a) The Developer shall be responsible for the installation of the following signage near the public entrance to all SWMF parcels:

(i) Danger Thin Ice as per Drawing 100 in Section 10.1. Signs must be in place during months of frozen conditions, being approximately November 1st to April 30th;

(ii) No Swimming as per Drawing 100 in Section 10.1. Signs must be in place during months of frozen conditions, being approximately May 1st to October 31st; and
(iii) safety signage to be customized to on site conditions to make the public aware of safety risks associated with amenities such as lift stations, outfall structures, electrical components, etc. Any customized signage must be approved by the Town during the course of drawing approval.

2.8.10 Plant Selection

2.8.10.1 Minimum Requirements

a) Plant Counts
b) Section 3.0 – Landscape Amenities in Public Open Space describes the minimum amount of plant units required for each type of public open space. The Town encourages a diversity of plants to be selected for all public open spaces.
c) Local Grown Plant Material
d) All plant material must be certified plants, sourced from an Alberta-based nursery or growing operation. Proof of source may be requested by the Town prior to delivery and installation.

2.8.10.2 Preferred Species

a) The following trees and shrubs are preferred species for public open space development. The Town will entertain any other proposed species however may require clarification or more research by the Applicant to justify the selection and to demonstrate local hardiness and suitability. All proposed plant material must be hardy to minimum Zone 3b, referring to the Plant Hardiness Zone by Municipality charts published by Natural Resources Canada, Government of Canada. All plant material must be certified plants, sourced from an Alberta-based nursery or growing operation. Proof of source may be requested by the Town prior to delivery and installation. Any proposed substitutions after drawing approval will require approval by the Town.
b) Tree selection criteria include:

(i) trees that provide adequate, year-round sightlines maintained for pedestrian and vehicular safety;
(ii) minimum 1.8m branching height for all trees adjacent to roadways and walkways;
(iii) trees with a single and sturdy vertical trunk with a well-balanced crown and fully developed leader, unless uncharacteristic for that species;
(iv) trees with a single and prominent central leader and balanced branching habit. They must be tree from disease and insect pests, eggs or larvae, rodent damage, sunscald, frost cracks and other abrasions or scars to the bark;
(v) plant material that is structurally sound, healthy and vigorous, well branched and densely foliated when in leaf;
(vi) alternating patterns of trees along streetscapes to avoid a monoculture of trees in a particular area; and
(vii) no fruit bearing trees or oak trees to be placed near any sidewalk or trail near streets or boulevards but will be considered in along trails in open spaces.

c) Trees must have minimum root ball diameters compared to the following caliper sizes:

Deciduous Trees	
Caliper	**Root Ball Dia.**
60mm	800mm
75mm	900mm
100mm	1200mm
125mm	1500mm
150mm	1800mm

Deciduous Trees Coniferous Trees	
Height	**Root Ball Dia.**
2.25-2.50m	1200mm
2.50-2.75m	1400mm
2.75-3.00m	1700mm
3.00-3.25mm	2000mm

2.8.10.3 Streetscapes and Boulevards

a) Recommended tree spacing of 6-8m dependent on species and application.

Botanical Name	Common Name
Deciduous	
Acer x freemanii - cultivars	Autumn Blaze/ Sienna Glen Maple
Acer rubrum - cultivars	Northwood/ Autumn Spire/ Red Rocket Maple
Acer saccharinum	Silver Maple
Fraxinus mandshurica 'Mancana'	Manchurian Ash
Fraxinus nigra 'Fall Gold'	Fall Gold Black Ash
Fraxinus pennsylvanica - cultivars	Prairie Spire/ Patmore Green Ash
Malus ssp - cultivars	Gladiator/ Pink Spire/ Royalty/ Shaughnessy Cohen/ Spring Snow/ Starlite/ Thunderchild
Quercus macrocarpa	Burr Oak
Syringa reticulata	Boulevard/ Ivory Silk Japanese Lilac
Tilia Americana – cultivars	Redmond/ True North/ American Sentry Linden
Tilia cordata 'Greenspire'	Greenspire Littleleaf Linden
Tilia x flavescens 'Dropmore'	Dropmore Linden
Ulmus Americana	American Elm
Ulmus Americana "Brandon"	Brandon Elm
Coniferous	
Picea abies	Norway Spruce
Picea glauca	White Spruce
Picea pungens	Green Colorado Spruce
Pinus cembra	Swiss Stone Pine
Pinus sylvestris	Scots Pine
Pinus uncinata	Mountain Pine

2.8.10.4 MR, Parks and General Landscapes

a) MR areas to be planted at a density of 75 trees per hectare. Plant material listed above may also be included.

Botanical Name	Common Name
Trees	
Deciduous	
Acer negundo - cultivars	Manitoba Maple (male hybrids only)
Acer tataricum	Tatarian Maple
Aesculus glabra	Ohio Buckeye
Crataegus x mordenensis – cultivars	Snowbird/ Toba Hawthorn
Celtis occidentalis	Hackberry
Elaeagnus angustifolia	Russian Olive
Hippophae rhamnoides	Sea Buckthorn
Juglans cinera	Butternut
Malus spp.	Crabapples
Prunus cerasus – cultivars	Evans/ Northstar/ Carmine Jewel Cherry
Prunus maackii	Amur Cherry
Prunus nigra 'Princess Kay'	Princess Kay Plum
Pyrus ssp.	Golden Spice Pear
Salix alba sericea	Silky White Willow
Salix alba vitellina	Golden Willow
Salix pentandra	Laurel Leaf Willow
Sorbus – Mountain ash species and cultivars	*Sorbus americana* *Sorbus aucuparia* *Sorbus decora*
Coniferous	
Abies lasiocarpa	Subalpline Fir
Abies sibirica	Siberian Fir
Larix siberica	Siberian Larch
Picea abies pyramiodalis	Columnar Norway Spruce
Pinus aristata	Bristlecone Pine
Pinus contorta var. latifolia	Lodgepole Pine
Pinus ponderosa	Ponderosa Pine
Shrubs	
Deciduous	
Acer ginnala	Amur Maple
Amelanchier alnifolia	Saskatoon Berry
Alnus hirsute 'Horizon'	Prairie Horizon Alder
Aronia melanocarpa	Chokeberry
Forthsythia ovata	Northern Gold Forsythia
Hydrangea arborescens	Anabelle Hydrangea
Lonicera tatarica	Tatarian Honeysuckle
Philadelphus ssp.	Blizzard/ Minnesota Snowflake Mockorange
Prunus x nigrella 'Muckle'	Muckle Plum
Prunus tomentosa	Nanking Cherry
Prunus triloba 'Multiplex'	Double Flowering Plum
Rosa ssp.	All landscape and shrub roses from the Explorer/ Parkland/ Morden and Artist Series. Hansa and Theresa Bugnet are prohibited.
Shepherdia argentia	Silver Buffaloberry

Botanical Name	Common Name
Syringa – Lilac species and cultivars	*Syringa bailbelle* *Syringa meyeri* *Syringa patula* *Syringa x hyacinthiflora* *Syringa x prestoniae* *Syringa vulgaris*
Weigela florida	Weigela
Coniferous	
Abies balsamea 'Nana'	Dwarf Balsam Fir
Juniperus – Juniper species and cultivars	*Juniperus communis* *Juniperus horizontalis* *Juniperus x media* *Juniperus sabina* *Juniperus scopulorum*
Chamaecyparis pisifera filifera	Japanese False Cypress
Microbiota decussata	Russian Cypress
Picea – Dwarf spruce cultivars	*Picea abies 'Nidiformis'/ 'Ohlendorfii' 'Pendula'* *Picea pungens 'Glauca Globosa'*
Taxus cuspidate densiformis	Yew
Thuja occidentalis – Cedar species and cultivars	Cedar
Perennials	
Anenome sylvestris	Windflower
Aruncus diocus	Goatsbeard
Astilbe ssp.	Astilbe
Bergenia cordifolia	Sazafrage
Delphinium grandiflorum	Delphinium
Echinacea purpurea	Purple Coneflower
Hemerocallis spp.	Daylily
Iris germanica	Bearded Iris
Leucanthemum maximum	Shasta Daisy
Monarda didyma	Bee Balm
Paeonia ssp.	Peony
Phlox paniculata	Tall Garden Phlox
Rudebeckia fulgida/ hirta	Coneflower
Sedum spectabile	Stonecrop
Grasses	
Calamagrostis x acutiflora	Feather Reed Grass
Elymus glaucous	Lyme Grass
Festuca ovina glauca	Fescue
Helictrotrichon sempervirens	Blue Oat Grass
Molina caerulea	Moor Grass
Panicum virgatum	Switch Grass
Phalaris arundinacea	Ribbon Grass

2.8.10.5 Naturalized Areas

Botanical Name	Common Name
Trees	
Deciduous	
Alnus crispa	Green Alder
Alnus incana	Mountain Alder
Betula papyrifera	Paper Birch
Cratageus succulenta	Fleshy Hawthorn
Populus balsamifera	Balsam Poplar
Populus tremuloides	Trembling Aspen
Prunus besseyi	Western Sandcherry
Prunus virginiana melanocarpa	Western Chokecherry
Coniferous	
Abies lasiocarpa	Subalpine Fir
Larix laricina	Tamarack
Picea glauca	White Spruce
Pinus banksiana	Jack Pine
Pinus contorta var. latifolia	Lodgepole Pine
Shrubs	
Deciduous	
Amelanchier alnifolia	Saskatoon Berry
Cornus sericea	Red-Osier Dogwood
Corylus cornuta	Beaked Hazelnut
Eleagnus commutata	Wolf Willow
Ribes americanum	Native Current
Ribes oxyancanathoides	Native Gooseberry
Rosa acicularis	Prickly Rose
Rosa woodsii	Wild Rose
Rubus idaeus	Wild Raspberry
Salix discolor	Pussy Willow
Salix exiqua	Sandbar Willow
Sambucus racemosa	Red Berried Elder
Shepherdia argentia	Silver Buffaloberry
Sherpherdia canadensis	Russet Buffaloberry
Viburnum opulus	High Bush Cranberry
Coniferous	
Juniperus communis	Common Ground Juniper
Perennials	
Arctostaphylos uva-ursi	Kinnikinnick
Eupatorium maculatum	Spotted Joe-Pye Weed

2.8.10.6 Stormwater Management Facilities

a) Planted at a density of 75 trees per hectare of stormwater management facility area, measured by all areas in dry ponds and above the normal waterline for wet ponds and constructed wetlands. Plant materials will be selected with consideration to hydrological characteristics, soil characteristics, facility side slopes, sun and wind exposure and intended park use.

Botanical Name	Common Name
Above 1:100 year Floodline	
Trees	
Deciduous	
Populus balsamifera	Balsam Poplar
Populus tremuloides	Trembling Aspen
Populus x jackii 'Northwest'	Northwest Poplar
Quercus macrocarpa	Burr Oak
Ulmus Americana	White Elm
Salix alba vitellina	Golden Willow
Salix pentandra	Laurel Leaf Willow
Coniferous	
Larix laricina	Tamarak
Picea glauca	White Spruce
Below 1:100 year Floodline	
Trees	
Alnus incana	Alder
Fraxinus nigra	Black Ash
Shrubs	
Aronia melanocarpa	Chokeberry
Cornus stolonifera	Red-Osier Dogwood
Salix amygdalioides	Peach Leaf Willow
Salix discolor	Pussy Willow
Salix exigua	Sandbar Willow
Spirea alba	Meadowsweet
Viburnum trilobum	High Bush Cranberry
Submergent and Aquatics	
Alisma plantago	Water Plantain
Carex ssp.	Sedges
Nuphar varigatum	Yellow Pond-lily
Pontamogeton zosteriformis	Flatstem Pondweed
Sagittaria ssp.	Arrowhead
Scirpus ssp.	Bull Rush
Sparganium ssp.	Bur-reed
Typha latifolia	Cattail

2.8.10.7 Non-Permitted Species

a) Bare root plant material will not be accepted in any circumstance. Small plants such as emergent vegetation and other perennials must be specified at minimum to have a plug of soil at the root system.
b) The following species of plants are not permitted for planting in proposed developments, due to growing conditions including insect and disease problems:

Botanical Name	Common Name
Deciduous	
Populus tremuloides erecta	Swedish Aspen
Prunus padus commutata	Mayday
Prunus virginiana 'Shubert'	Shubert Chokecherry
Coniferous	
Picea pungens glauca	Colorado Blue Spruce

2.8.11 Special Amenities

2.8.11.1 Playgrounds

a) Placement

Playgrounds may be proposed inside any MR parcel. Playgrounds shall be situated with the following guidelines:

(i) good visibility from nearby roadways;
(ii) a distance no less than 15m from any private property;
(iii) with surrounding ground slope no more than 2.5%; and
(iv) along a paved asphalt trail with good access from surrounding areas.

b) Edging and Base Fill Material

All edging materials to conform with either of two drawing details, Section 10.15 – Drawing 114 or Section 10.16 – Drawing 115, including a cast in place concrete curb with optional fill material of sand or engineered wood fiber. Alternates will only be considered for accessibility reasons. Applicants must be aware that the concrete curbing thickness deviates between the two options.

c) Furniture

Each playground structure shall include at minimum two benches, two waste receptacles and two picnic tables as per standards furniture details and specifications.

2.8.11.2 Community Entrance Features

a) Location

Community entrance features may be proposed by the Applicant for review and acceptance by the Town. Any entrance feature must be built entirely on private property and no portion of the structure, base, or overhand may be placed on public property. Applicants must register legal easements for any entrance feature on title of the private property upon which it is located. The Applicant must demonstrate to the Town that this legal easement has been put in place prior to the construction of any permanent entrance feature.

b) Maintenance

The design for special entrance features shall be subject to the review and acceptance by the Town. Entrance features must be low maintenance, and be composed of materials that will remain available for years to come should any maintenance be required. The Town will also require evidence of an agreement for the long-term care, damage recovery or replacement of any entrance feature for a term no less than 30 years. The Applicant shall be fully responsible for establishing this maintenance reserve to the satisfaction of the Town.

2.8.11.3 Canada Post – Community Mailboxes

If applicable to the subdivision, the Applicant will submit an overall subdivision layout plan (Area Structure Plan) to Canada Post, Delivery Planning Department to establish the location, size, and details of community mailboxes. For further information and requirements consult Canada Post's "Postal Delivery Standards Manual, Planning for Postal Service." Upon approval of location and details by Canada Post, community mailboxes are to be shown on all applicable detailed drawings.

Open space development drawings must identify the location and size of any Canada Post Community Mailboxes within the public realm, and ensure that any proposed amenities such as benches, plantings, utilities, etc. do not conflict with proposed mailbox locations. Mailbox locations must be shown on applicable planting plans.

3.0 CONSTRUCTION SPECIFICATIONS

3.1 Roadways

3.1.1 Subgrade

This section specifies the requirements for working and compacting subgrade soil.

3.1.1.1 DEFINITIONS

a) **Prepared Subgrade** - Soil immediately below a pavement structure or slab, compacted to a depth of 150 mm, 300 mm or as specified.
b) **Maximum Density -** The dry unit mass of a soil sample at optimum moisture content as determined in a laboratory according to ASTM D698 Method A.
c) **Testing Frequency -** The quality assurance laboratory will take a minimum of one field density test for each 1,000 m^2 of compacted subgrade lift according to ASTM D1556, ASTM D2167, or ASTM D2922 for comparison with a maximum density determined according to ASTM D698 Method A, or as directed by the Engineer.

3.1.1.2 MATERIALS

a) Use only compacted dry material with no deleterious material approved by the Engineer.

3.1.1.3 EQUIPMENT

a) Use equipment designed for and capable of disking, scarifying, spreading, spraying water, compacting and trimming soil to specified depth.

3.1.1.4 SUBGRADE PREPARATION

a) Loosen soil to required depth. Work soil with cultivating and mixing equipment until soil is pulverized into pieces no larger than 25 mm maximum dimension, exclusive of stones.
b) Remove soft or other unstable material that will not compact properly and fill resulting depressions with approved material.
c) Shape and compact subgrade to meet the following tolerances:

    (i) 6 mm maximum variation above subgrade elevation.
    (ii) 25 mm maximum variation below subgrade elevation.

d) Do scarifying, blading, moisture adjustment, compacting or other methods of work as necessary to provide a thoroughly compacted subgrade shaped to grades and cross sections indicated or directed.
e) Finish side slopes to a neat condition, suitable for seeding, true to lines and grades indicated.

    (i) Remove boulders encountered in cut slopes and fill resulting cavities.
    (ii) Hand finish slopes that cannot be finished satisfactorily by use of machine.

3.1.1.5 PROOF ROLLING

a) For proof rolling, use a single axle dual wheeled truck loaded to minimum 9100 kg on the rear axle. Tires to be inflated to a minimum 275 kPa.
b) Engineer may authorize use of other acceptable proof rolling equipment.
c) Proof roll subgrade at the level directed by the Engineer.

d) Where proof rolling reveals areas of defective subgrade, remove and replace to requirements of this section at no extra cost to the Owner.

3.1.1.6 MAINTENANCE

a) Maintain road surfaces until next course of material is placed or until project or that portion thereof is accepted. Repair and retest as required by the Engineer, if damaged.

3.1.1.7 REQUIRED DENSITY

a) A minimum of 100% of the maximum density for each 150 mm of subgrade under pavement structure, and a minimum of 95% of the maximum density for each 150 mm of subgrade under concrete walks, curb ramps, slab and private crossings.

3.1.2 Granular Base

This section specifies requirements for supplying, producing, placing and compacting crushed gravel or quarried stone as a granular base to lines, grades and typical cross-sections indicated on plans or as directed.

3.1.2.1 MATERIALS

a) Gradation to be within the limits specified for the two (2) types of granular material specified hereinafter when tested to ASTM C136 and ASTM C117, (AASHTO T11 and T27) and having a smooth curve without sharp breaks when plotted on a semi-log grading chart to ASTM E11-70.

(i) 20 mm minus Gravel

Sieve Size	% Passing by Weight
20.0 mm	100
16.0 mm	84-95
12.5 mm	60 – 90
10.0 mm	50-84
5.0 mm	37-62
2.00 mm	26-50
0.400 mm	11-28
0.080 mm	2 - 10

(ii) 63 mm minus Gravel

Sieve Size	% Passing by Weight
63.0 mm	100
25.0 mm	55-75
20.0 mm	50-70
16.0 mm	44-65
12.5 mm	38-60
6.3 mm	23-47
5.0 mm	20-45
2.0 mm	14-38
0.400 mm	8-24
0.080 mm	0-10

(iii) Liquid Limit:

ASTM D423 (AASHTO T89)

Maximum 25

(iv) Plasticity Index:

ASTM D424 (AASHTO T90)

Maximum 6

(v) Los Angeles Abrasion;

ASTM C131 (AASHTO T96)

Max. percentage loss by weight: 45

(vi) Crushed Fragments: At least 60% of fragments within each of following size ranges to have at least 1 freshly fractured face:

Passing		Retained on
50.0 mm	to	38.0 mm
38.0 mm	to	19.0 mm
19.0 mm	to	5.0 mm

3.1.2.2 PLACING

a) Do not place granular base until finished subbase or subgrade surface is inspected and approved.
b) Place material only on a clean unfrozen surface, properly shaped and compacted and free from snow and ice.
c) Begin spreading base material on a crown line or on high side of a one-way slope.
d) Place using methods, which do not lead to segregation or degradation of aggregate.
e) For spreading and shaping material, use spreader boxes having adjustable templates or screeds, which will place material in uniform layers of required thickness.
f) Place material in uniform layers not exceeding 150 mm when compacted or to such other depth as approved by Engineer.
g) Shape each layer to a smooth contour and compact to specify density before succeeding layer is placed.
h) Remove and replace that portion of a layer in which material becomes segregated during spreading.

3.1.2.3 COMPACTING

a) Compact to a density not less than 100% of Standard Proctor.
b) Shape and roll alternately to obtain a smooth, even and uniformly compacted base.
c) Apply water as necessary during compacting to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.
d) In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.

3.1.2.4 FINISH TOLERANCES

a) Finished base surface shall be within ±13mm of established grade but not uniformly high or low.
b) Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.1.2.5 PROOF ROLLING

a) For proof rolling, use a single axle dual wheeled truck loaded to a minimum 9100 kg. on the rear axle. Tires to be inflated to a minimum 275 kPa.
b) Engineer may authorize use of other acceptable proof rolling equipment.
c) Proof roll top of base upon completion of fine grading and compaction.
d) Where proof rolling reveals areas of defective subgrade:

   (i) Remove base, subbase and subgrade material to depth and extent directed.
   (ii) Backfill excavated subgrade with approved common or borrow material and compact.
   (iii) Replace sub-base material and compact.
   (iv) Replace base material and compact.
   (v) There shall be no payment for the repair of granular base caused by defective subgrade.

e) Where proof rolling reveals defective base or subbase, remove defective materials to depth and extent directed and replace with new materials at no extra cost to the Owner.

3.1.2.6 MAINTENANCE

a) Maintain finished base in a condition conforming to this section until succeeding material is applied or until acceptance by the Engineer.

3.1.3 Asphaltic Concrete Pavement

This section specifies requirements for producing and placing hot mix asphaltic concrete for pavement base, surface or overlay including supply of aggregates and bituminous binder.

3.1.3.1 DEFINITIONS

a) Overlay: paving over an existing pavement for rehabilitation purposes and not as part of a new pavement structure (pavement thickness varies).
b) Paving: paving where a lift or lifts form part of the total pavement structure (pavement thickness is specified).

3.1.3.2 QUALITY ASSURANCE

a) Source Sampling

   (i) At least two weeks prior to commencing work, inform the Engineer of proposed source of aggregates and provide access for sampling.

b) Delivery and Storage

   (i) Deliver and stockpile aggregates. Stockpile minimum 50% of total amount of aggregate required before commencing asphalt production.
   (ii) When necessary to blend aggregates from one or more sources to produce required gradation, do not blend in stockpiles.
   (iii) When dryer drum mixing plant is used, stockpile fine aggregate separately from coarse aggregate.
   (iv) Provide approved storage, heating tanks and pumping facilities for asphalt cement.

c) Quality Control Plan

   (i) Before beginning hot mix asphalt production, submit quality control plan, including the following recommended tests and frequency for each mix type produced to Engineer:

- Three Marshall specimens per test
- Asphalt content
- Air Voids
- Stability and flow
- Film thickness
- Moisture content in the mix
- Gradation in mix
- Plant discharge temperature
- Asphalt storage temperature
- Frequency: A minimum of two tests per day in full production (4 hours or more)

d) Thickness Cores

(i) The quality assurance laboratory will take a minimum of one core per 1,000m^2 of asphalt pavement and determine the thickness of the entire mat.

(ii) If the initial core thickness is deficient at the completion of paving, that initial thickness is discarded and three new cores will be taken within 10 m of the original core location at a minimum spacing of 2.5 m between cores. The average thickness of the three new cores will represent that area.

e) Density Specimen Sampling and Testing

(i) The quality assurance laboratory will determine the density of laboratory compacted Marshall Specimens at a minimum frequency of one Marshall Density for every 1,000 tonnes of hot mix, or day's production, whichever is less.

(ii) Drill cores from a compacted mat placed from the same load of hot mix from which Marshall specimens were taken, or from suspect compacted mat, and test for density.

(iii) A single core is initially taken representing the quantity of hot mix asphalt in not more than 1,000 m^2 of mat, with a minimum of one taken from a day's production. If the initial core density is below specified, that initial density is discarded and three new cores will be taken within 10 m of the original core location at a minimum spacing of 2.5 m between core holes. The average of the three new cores represents that area.

(iv) Pavement compaction will be accepted on the basis of the ratio (in percent) of the core density to the density of the Marshall specimen. If cores were drilled from a mat where no Marshall specimen was taken, acceptance will be based on the ratio of the core density to the average of all Marshall specimens to date.

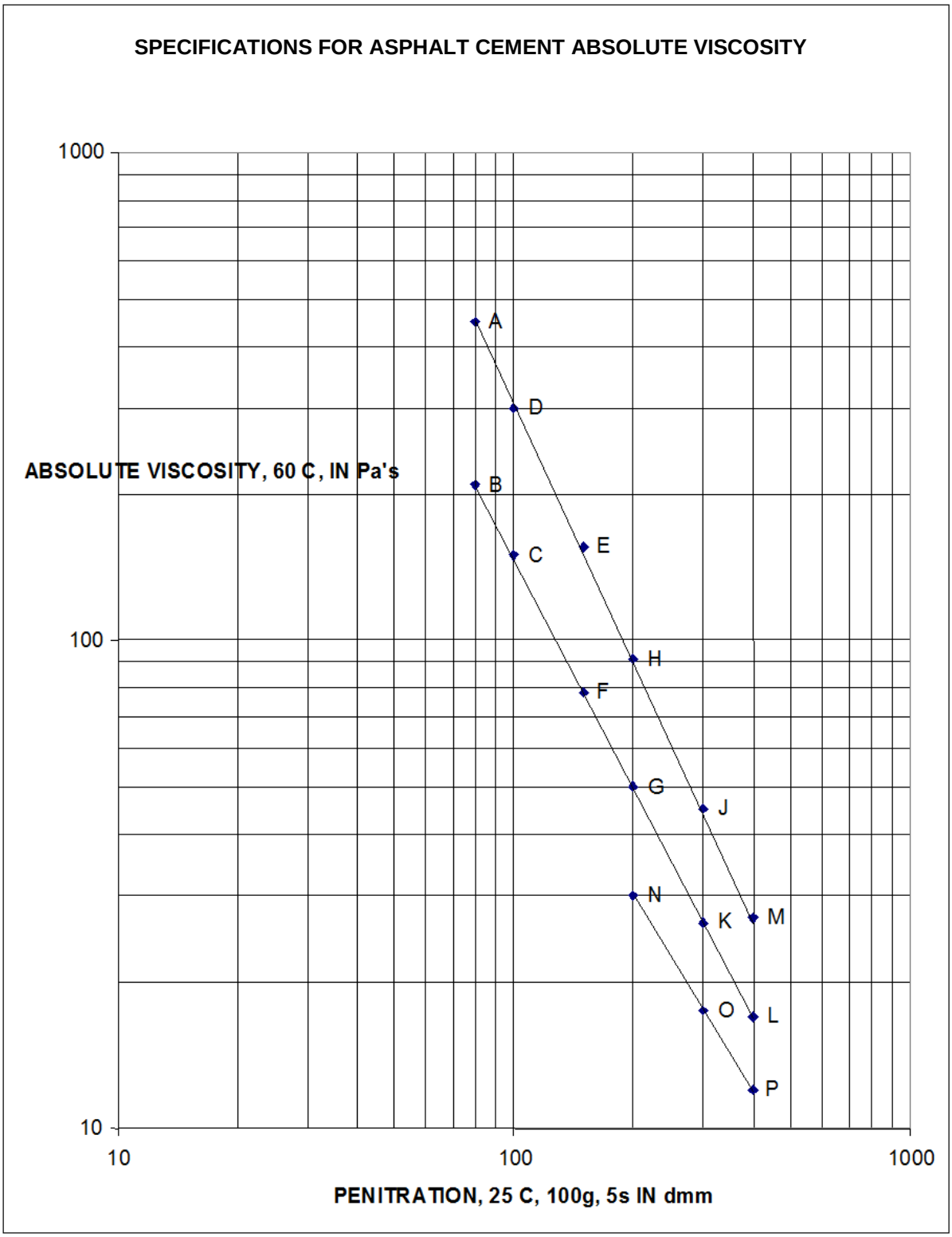
3.1.3.3 MATERIALS

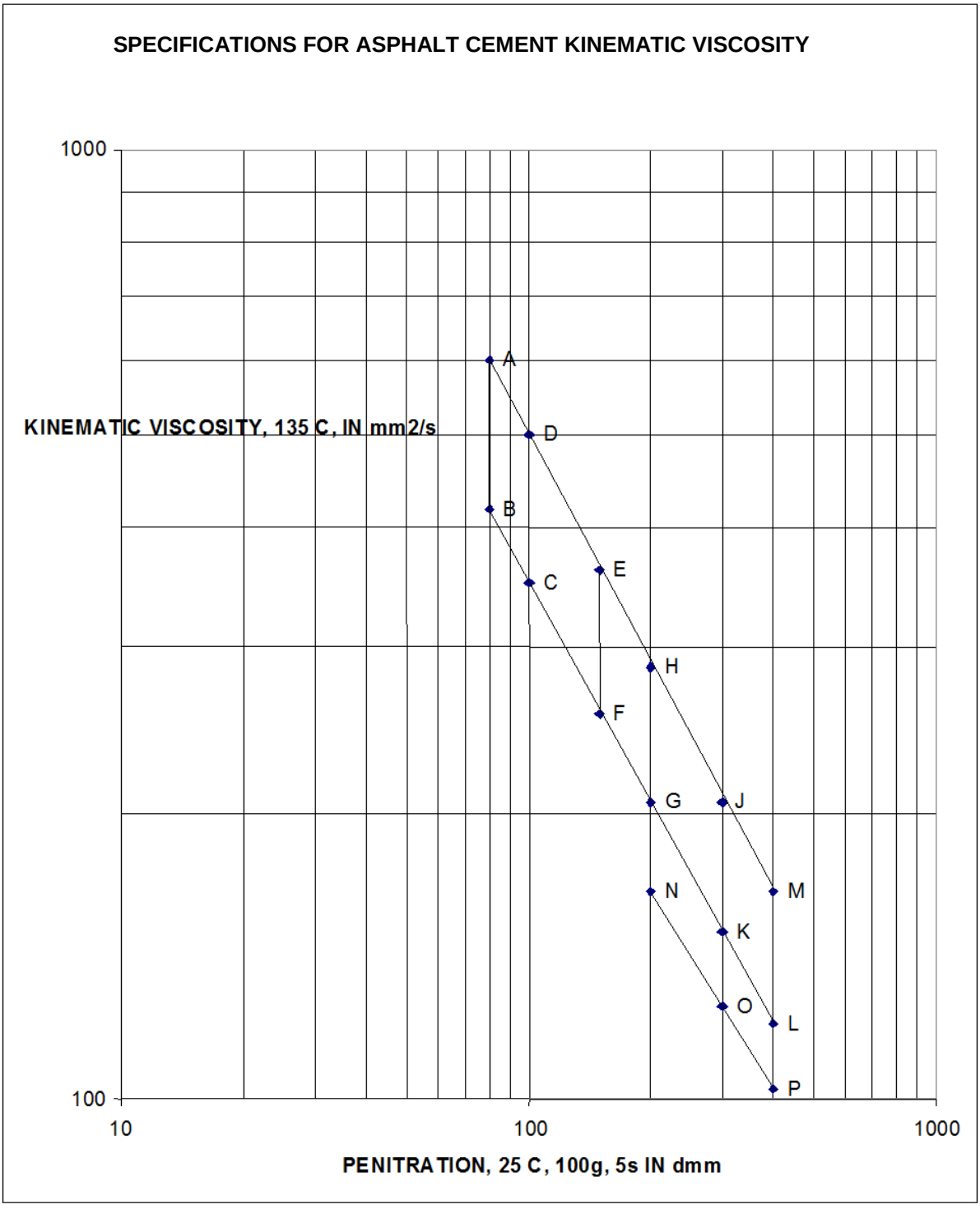
a) Asphalt cement: premium grade 80-100 (A) or 150-200 (A).

Specifications for Premium Grade Asphalt Cements

TEST CHARACTERISTICS	A.S.T.M. TEST METHOD	PREMIUM GRADES OF ASPHALT CEMENTS					
		80-100 (A)			150-200 (A)		
Absolute Viscosity, 60°C, Pa – s	D2171	The viscosity and penetration values must fall within the area bounded by A-B-C-D-A plotted as straight lines on a full logarithmic plot (log-log), with the coordinates of the points as follows:			The viscosity and penetration values must fall within the area bounded by E-F-G-H-E plotted as straight lines on a full logarithmic plot (log-log), with the coordinates of the points as follows:		
Penetration, 25°C, 100g, 5s, dmm	D5	Pt.	Abs. Visc.	Pen.	Pt.	Abs. Visc.	Pen.
		A	450	80	E	155	150
		B	208	80	F	70	150
		C	150	100	G	50	200
		D	300	100	H	92	200
Kinematic Viscosity, 135°C, sq. mm/s	D2170	The viscosity and penetration values must fall within the area bounded by A-B-C-D-A plotted as straight lines on a full logarithmic plot (log-log), with the coordinates of the points as follows:			The viscosity and penetration values must fall within the area bounded by E-F-G-H-E plotted as straight lines on a full logarithmic plot (log-log), with the coordinates of the points as follows:		
Penetration, 25°C, 100g, 5s, dmm	D5	Pt.	Kin. Visc.	Pen.	Pt.	Kin. Visc.	Pen.
		A	600	80	E	360	150
		B	417	80	F	225	150
		C	350	100	G	205	200
		D	500	100	H	285	200
Flash Point, Cleveland Open Cup, °C minimum	D92	235			205		
Solubility in Trichloroethylene, % minimum	D2042	99.5			99.5		
Tests on Residue from Thin Film Oven Test: Ratio of Absolute Viscosity of Residue from Thin-Film Oven Test to Original Absolute Viscosity, maximum:	D1754 D2171	4.0			4.0		
Ductility, 25°C, cm, maximum	D113	100			100		
Ductility, 15.6°C, cm, minimum		-			-		

General Requirement:
The asphalt shall be prepared by the refining of petroleum. It shall be uniform in character and shall not be heated to 175°C. The temperature at delivery to the site shall be between 135°C and 175°C.


SPECIFICATIONS FOR ASPHALT CEMENT ABSOLUTE VISCOSITY
ABSOLUTE VISCOSITY, 60 C, IN Pa's
1000
100
10
10
100
1000
PENITRATION, 25 C, 100g, 5s IN dmm
A
D
B
E
C
H
F
G
J
N
K
M
O
L
P


SPECIFICATIONS FOR ASPHALT CEMENT KINEMATIC VISCOSITY
1000
100
KINEMATIC VISCOSITY, 135 C, IN mm2/s
10
100
1000
PENITRATION, 25 C, 100g, 5s IN dmm
A
B
C
D
E
F
G
H
J
K
L
M
N
O
P

b) Aggregates

(i) Coarse aggregate is aggregate retained on 5.0 mm sieve and fine aggregate is aggregate passing the 5.0 mm sieve.
(ii) Do not use aggregates having known polishing characteristics in mixes for surface courses.
(iii) Gradation of aggregates blended to job mix formula to be within the following limits when tested to ASTM C117 and ASTM C136 (AASHTO T27 and T11) and giving smooth curve without sharp breaks when plotted on semi-log grading chart:

Aggregate Properties

Mix Designation Class Application Sieve Size	1 10.0 10mm HT	1 10.0 10mm LT	1 20.0 20mm B
	%Passing by Mass		
25 000	100	100	100
20 000	100	100	97 – 100
16 000	100	100	83 – 97
12 500	100	100	70 – 92
10 000	100	100	61 – 84
8 000	70 – 94	80 – 94	52 – 77
6 300	45 – 85	65 – 85	44 – 70
5 000	32 – 75	50 – 75	38 – 65
2 500	23 – 55	35 – 55	26 – 52
1 250	16 – 45	25 – 45	18 – 41
630	11 – 36	20 – 36	13 – 31
315	8 – 26	14 – 26	9 – 22
160	5 – 15	7 – 15	6 – 14
80	3 - 8	4 – 8	3 – 7

(iv) Los Angeles Abrasion to ASTM C131 (AASHTO T96) maximum % loss by mass, coarse aggregate: 30
(v) Crushed fragments, minimum % by mass with minimum of two freshly fractured faces, coarse aggregate: 85% for 10mm-LT; 90% for 10mm-HT and 20mm-B mm base course

c) Mineral Filler

(i) Finely ground particles of limestone, hydrated lime, Portland Cement or other approved non-plastic mineral matter, thoroughly dry and free from lumps.
(ii) Add mineral filler when necessary to meet job mix aggregate gradation or as directed to improve mix properties.
(iii) Mineral filler to be dry and free flowing when added to the aggregate.
(iv) Plasticity index of mineral filler to be zero.

3.1.3.4 MIX DESIGN

a) Job mix design to be completed by an approved materials testing agency and submitted for approval to the Engineer at least two weeks prior to commencing paving operations.
b) 10mm – High Traffic (10mm – HT) to be used for paving residential collector and selected arterial roadways.
c) 10mm – Low Traffic (10mm – LT) to be used for paving local residential roadways and alleys.
d) 20mm – Base (20mm – B) to be used for major arterials, industrial/commercial roadways and collector roadways.
e) Design of mix by a qualified laboratory shall be to the requirements below:

Mix Type	10mm HT	10mm LT	20mm B
Number of Gyrations N_{design} $N_{maximum}$	 100 160	 75 115	 100 160
Density at $N_{maximum}$ (%Gmm)	98.0 Max	98.0 Max	98.0 Max
Bailey CA-CUW	60 to 105 Max	60 to 85 Max	60 to 85 Max
Air voids in total mix, %	4.0 +/- 0.4%	3.0 +/- 0.4%	3.5 +/- 0.4%
VMA	13 Min	14 Min	12 Min
Voids filled, %	70 – 80	73 – 85	65 – 75
Tensile Strength Ration % (AASHTO T283)	80 Min	80 Min	80 Min
Minimum Film Thickness, mm	7.5 Min	7.5 Min	6.5 Min
APA (mm, 52 ^{o} C, 8000 cycles)	5.0 Max	7.0 Max	5.0 Max

f) Submit the following with the mix design:

(i) Temperature of asphalt during mixing in the plant.
(ii) Temperature of asphalt immediately prior to compaction.

g) Do not change mix design without prior approval of the Engineer. Should a change in material source be proposed a new mix design must be approved by the Engineer.

3.1.3.5 PLANT AND MIXING REQUIREMENTS

a) Batch and continuous mixing plants

(i) To ASTM D995.
(ii) Heat asphalt cement and aggregate to mixing temperature which will normally correspond to climatic viscosity of asphalt cement (ASTM 02170) in range of 150 to 300 centostokes or 175°C whichever is less. Do not heat asphalt cement above this temperature.
(iii) Before mixing, dry aggregates to a moisture content not greater than 0.5% by mass or to a lesser moisture content if required to meet mix design requirements.
(iv) Make available current asphalt cement viscosity data at plant.
(v) Feed aggregates from individual stockpiles through separate bins to cold elevator feeders.
(vi) Feed cold aggregates to plant in proportions that will ensure continuous operations.
(vii) Immediately after drying, screen aggregates into hot storage bins in sizes to permit recombining into gradation meeting job-mix requirements.
(viii) Store hot screened aggregates in a manner to minimize segregation and temperature loss.
(ix) Maintain temperature of materials within ± 5°C of specified mix temperature during mixing.
(x) Mixing time:

- In batch plants, continue wet mixing as long as necessary to obtain a thoroughly blended mix but not less than 30 s or more than 75 s.
- In continuous mixing plants not less than 45 s.

b) Dryer drum mixing plant:

(i) Feed aggregates to burner end of dryer drum by means of a multi-bin cold feed unit and blend to meet job-mix requirements by adjustments of variable speed feed belts and gates on each bin.
(ii) Meter total flow of aggregate by an electronic weigh belt system with an indicator that can be monitored by plant operator and which is interlocked with asphalt pump so that proportions of aggregate and asphalt entering mixer remain constant.
(iii) Provide for easy calibration of weighing systems for aggregates without having material enter mixer.
(iv) Make provision for conveniently sampling the full flow of materials from the cold feed.

(v) Provide screens or other suitable devices to reject oversize particles or lumps of aggregate from cold feed prior to entering drum.
(vi) Provide a system interlock which will stop all feed components if either asphalt or aggregate from any bin stops flowing.
(vii) Accomplish heating and mixing of asphalt mix in an approved parallel flow dryer-mixer in which aggregate and asphalt enter drum at burner end and travel parallel to flame and exhaust gas stream. Control heating to prevent fracture of aggregate or excessive oxidation of asphalt. Equip system with automatic burner controls and provide for continuous temperature sensing of asphalt mixture at discharge, with a printing recorder that can be monitored by plant operator. Submit printed record of mix temperatures at end of each week.
(viii) Mixing period and temperature to produce a uniform mixture in which particles are thoroughly coated, and moisture content of material as it leaves mixer to be less than 2%.

c) Temporary storage of hot mix

(i) Provide mixture storage of sufficient capacity to permit continuous operation and designed to prevent segregation.
(ii) Do not store asphalt mix in storage bins in excess of 3 H.

d) While producing asphalt mix for this project, do not produce mix for other users unless separate storage and pumping facilities are provided for materials supplied for this project.
e) Mixing tolerances:

(i) Permissible variation in aggregate gradation from job mix (percent of total mass):

5.00 mm sieve and larger	±5.0
1.25 mm sieve	±4.0
0.63 mm sieve	±3.0
0.315 mm sieve	±3.0
0.160 mm sieve	±2.0
0.08 mm sieve	±1.0

(ii) Permissible variation of asphalt cement from job mix, ±0.4%.
(iii) Permissible variation of mix temperature at discharge from plant, 5 °C.

3.1.3.6 EQUIPMENT

a) Pavers: mechanical self-powered pavers with automatic screed controls, vibratory screed equipped with vibratory extensions and augers capable of spreading mix within specified tolerances, true to line, grade and crown indicated without segregation and tearing.
b) Rollers: sufficient number of self-propelled rollers equipped with wetting and scraping devices to prevent adhesion of mix to drums or tires (petroleum derivatives not permitted for cleaning) of type and weight required to obtain specified density of compacted mix. Pneumatic-tired rollers are to be equipped with wind skirts.
c) Haul trucks: of adequate size, speed and condition to ensure orderly and continuous operation and as follows:

(i) Boxes with tight metal bottoms.
(ii) Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.
(iii) In cool weather or for long hauls, insulate entire contact area of each truck box.

d) Hand tools:

(i) Lutes or rakes with covered teeth during spreading and finishing operations.

(ii) Tamping irons having mass not less than 12 kg and a bearing area not exceeding 310 cm^5 for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by Engineer, may be used instead of tamping irons.
(iii) Straight edges, 3.0 m in length, to test finished surface.

3.1.3.7 PREPARATION

a) Written notice of intention to begin paving operations to be given to Engineer 24 h in advance.
b) When paving over existing asphalt surface, clean pavement surface. When levelling course is not required, patch and correct depressions and other irregularities to approval of Engineer before beginning paving operations.
c) Apply prime coat or tack coat.
d) Prior to laying mix, clean surfaces of loose and foreign material.
e) Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.

3.1.3.8 TRANSPORTATION OF MIX

a) Transport mix to job site in vehicles cleaned of foreign material.
b) Paint or spray truck beds with light oil, limewater, soap or detergent solution, at least once a day or as required. Elevate truck bed and thoroughly drain. No excess solution or use of gasoline, kerosene, or similar product will be permitted.
c) Schedule delivery of material for placing in daylight, unless Engineer approves artificial light.
d) Deliver material to paver at a uniform rate and in an amount within capacity of paving and compacting equipment.
e) Deliver loads continuously in covered vehicles and immediately spread and compact. Deliver and place mixes at a temperature within range directed, but not less than 135°C.

3.1.3.9 PLACING

a) Place asphaltic concrete to thicknesses, grades and lines indicated on drawings or directed by Engineer.
b) Placing conditions:

(i) No paving is permitted when rain or snow is imminent, or when the surface to be paved is wet, icy, snow-covered or frozen, unless waived by the Engineer.
(ii) No paving is permitted when air temperature and wind speed conditions are below the applicable mat curve, unless waived by the Engineer.
(iii) Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.

c) Place asphalt concrete in compacted lifts of thickness approved by Engineer.
d) Spread and strike off mixture with self-propelled mechanical finisher.

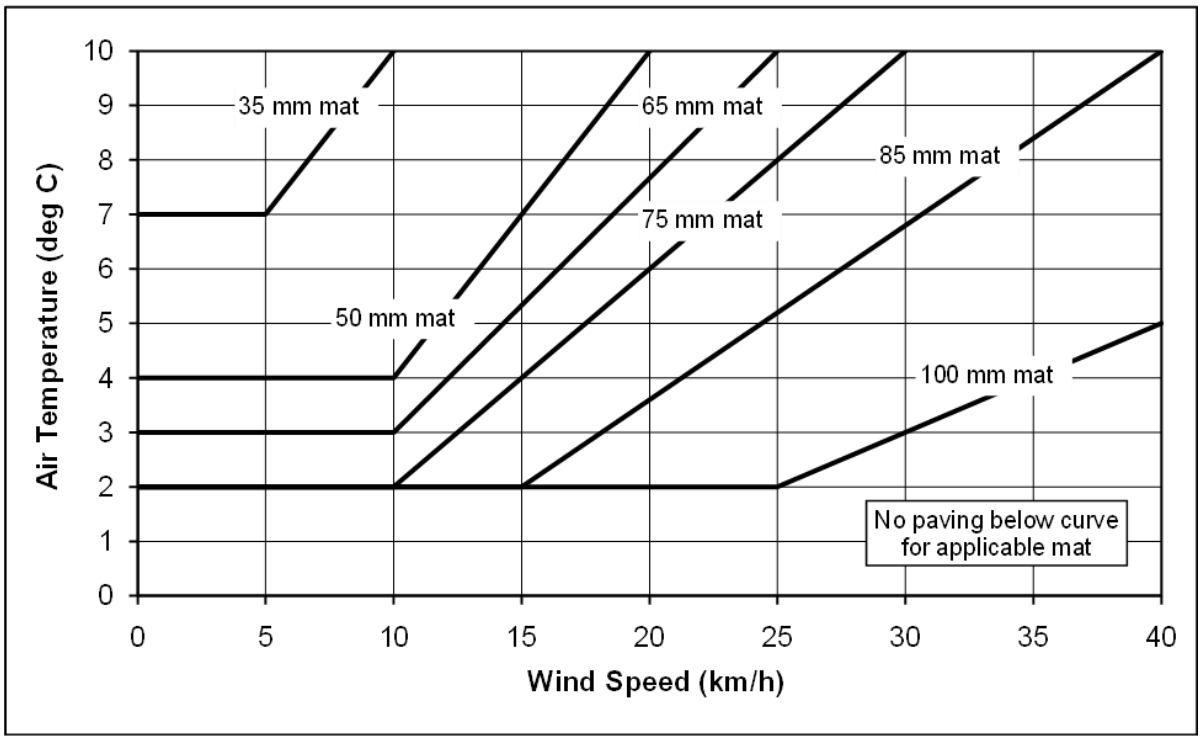
(i) Construct longitudinal joints and edges true to line markings. Lines for paver to follow parallel to centreline of proposed pavement. Position and operate paver to follow established line closely.
(ii) When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by first paver. Work pavers as close together as possible and in no case permit them to be more than 30m apart.
(iii) If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.
(iv) Correct irregularities in alignment left by paver by trimming directly behind machine.

(v) Correct irregularities in surface of pavement course directly behind paver. Remove by shovel or lute excess material forming high spots. Fill and smooth indented areas with hot mix. Do not broadcast material over such areas.
(vi) Do not throw surplus material on freshly screeded surfaces.

e) When hand spreading is used:

(i) Wood or steel forms, approved and rigidly supported to assure correct grade and cross section, may be used. Use measuring blocks and intermediate strips to aid in obtaining required cross section.
(ii) Distribute material uniformly. Do not broadcast material.
(iii) During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes. Reject material that has formed into lumps and does not break down readily.
(iv) Following placing and before rolling, check surface with templates and straightedges and correct irregularities.
(v) Provide heating equipment to keep hand tools free from asphalt. Avoid high temperatures which may burn material. Do not use tools at a greater temperature than temperature of mix being placed.

Air Temperature and Wind Limitations on Paving



3.1.3.10 COMPACTING

a) All asphalt mix shall be thoroughly compacted, and after final rolling the finished surface of the mix shall be free of segregation, waves, hairline cracks and other obvious defects.
b) General:

(i) Provide at least two rollers one of which must be pneumatic-tired type, and as many additional rollers as necessary to achieve specified pavement density within the available compaction time and compatible with the rate of hot-mix placement.

(ii) Start rolling operations as soon as placed mixture can bear weight of roller without undue displacement of material or cracking of surface.
(iii) Operate roller slowly initially to avoid displacement of material. For subsequent, rolling do not exceed 5 km/h for steel-wheeled rollers and 8km/h for pneumatic-tired rollers.
(iv) Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.
(v) Complete final rolling before the mat temperature reaches 80ºC.
(vi) Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.
(vii) Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.
(viii) When paving in echelon, leave unrolled 50 to 75 mm of edge which second paver is following and roll when joint between lanes is rolled.

3.1.3.11 JOINTS

a) General:

(i) Trim to vertical face to provide true surface and cross section against which new pavement may be laid. Remove loose particles.
(ii) Paint joint face with thin coat of hot asphalt cement prior to placing of fresh mixture.
(iii) Overlap previously laid strip with spreader by 100 mm.
(iv) Remove surplus material from surface of previously laid strip. Do not dispose on surface of freshly laid strip.

b) Transverse Joints:

(i) Construct and thoroughly compact transverse joints to provide a smooth riding surface.
(ii) Stagger joint locations minimum 2 m.
(iii) Offset transverse joint in succeeding lifts by at least 600 mm.

c) Longitudinal Joints:

(i) Plan mats so that the surface longitudinal joint will be offset by not more than 150 mm from the centre of an indicated marking line between travel lanes. If permitted by the Engineer, the joint may be located at the centre of travel lane.
(ii) Plan width of spread to provide for a minimum 150 mm offset of longitudinal joints in successive lifts.
(iii) Create a longitudinal joint while the edge temperature of the first of two adjacent mats is above 80ºC. This may be accomplished by multiple pavers in staggered formation, or by limiting paver advance.
(iv) Allow a 25 mm to 50 mm overlap between mats.
(v) Do not roll a 150 mm wide strip along the edge of first mat until the adjoining mat is placed. Roll the joined mat immediately to insure bonding while the joint temperature is above 80ºC.
(vi) For surface lifts on freeways, arterial roadways, industrial/commercial roadways and collector roadways carefully roll off the edge of a mat if a minimum joint temperature of 80ºC cannot be maintained prior to the placement of the adjacent mat. Trim off the rolled asphalt to a width of 150 mm resulting in a clean vertical face to the full depth of the mat. Paint the exposed face with tack coat prior to placing the adjacent mat.
(vii) Should this longitudinal joint treatment not be performed where required, the area of asphalt pavement will be assessed a pay factor of 95%. This pay factor will be applied to the price of the total quantity of asphalt placed in the mat area.
(viii) A longitudinal joint shall be thoroughly compacted and shall meet surface tolerances.

d) Construct feather joints so that thinner portion of joint contains fine graded material obtained by changed mix design or by raking out coarse aggregate in mix. Place and compact joint so that joint is smooth and without visible breaks in grade.

3.1.3.12 FINISH TOLERANCES

a) Finished asphalt surface to be within ±5mm of design elevation but not uniformly high or low.
b) Finished asphalt surface not to have irregularities exceeding 5 mm when checked with a 3.0 m straight edge placed in any direction.
c) The finished surface shall have a tightly knit texture free of visible signs of poor workmanship including, but not limited to, segregation, areas exhibiting excess or insufficient asphalt, improper matching of longitudinal and transverse joints, roller marks, cracking or tearing.

3.1.3.13 ASPHALT CONCRETE THICKNESS TOLERANCES

a) All asphaltic concrete pavement to be of thickness indicated on drawings.
b) If the average core thickness is deficient that area of asphalt pavement will be assessed a pay factor applied to the price of the quantity of hot-mix in that mat area placed.

Asphalt Thickness Pay Factors

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

c) Asphalt pavement with excess thickness may be accepted with no claim for extra payment, if surface, grade tolerances and texture are met.

3.1.3.14 ASPHALT DENSITY TOLERANCES

a) Each mat of hot-mix asphalt placed shall be compacted to the following minimum density (% of Maximum Theoretical Density (MTD))) for the type of paving, or as indicated in the contract.

Minimum Density	Type of Paving
94%	All paving roadways.
93%	Paving for laneways.
93%	Rehabilitation overlays.
93%	Asphalt trails.

b) If the average core density is below the specified density the area represented by the mat in question may be accepted subject to a pay factor to be applied to the price of the quantity of hot-mix asphalt in that mat area.

Asphalt Density Pay Factors

Percentage of MTD 94% MTD Required	Pay Factor (%)	Percentage of MTD 93% MTD Required	Pay Factor (%)
94.0	100.0	93.0	100.0
93.9	99.9	92.9	98.4
93.8	99.8	92.8	96.8
93.7	99.6	92.7	95.2
93.6	99.4	92.6	93.9
93.5	99.1	92.5	92.0
93.4	98.7	92.4	90.4
93.3	98.3	92.3	88.8
93.2	97.8	92.2	87.3
93.1	97.2	92.1	85.7
93.0	96.5	92.0	84.1
92.9	95.8	91.9	82.5
92.8	95.0	91.8	80.9
92.7	94.2	91.7	79.3
92.6	93.3	91.6	77.7
92.5	92.3	Under 91.5	Grind and Resurface
92.4	91.1		
92.3	89.8		
92.2	88.5		
92.1	87.1		
92.0	85.5		
91.9	83.8		
91.8	82.0		
91.7	80.0		
91.6	77.7		
Under 91.5	Grind and Resurface		

Actual Density = % of Marshall Density
Pay Factor = % of contract price

3.1.4 Liquid Asphalt Coats

Asphalt Prime Coat – The supply and application of liquid asphalt to seal the surface of granular base courses or soil cement in accordance with these specifications.

Asphalt Tack Coat – The supply and application of liquid asphalt coat to provide a bond between an existing asphaltic concrete or Portland cement concrete surface and the underlying asphalt surface in accordance with these specifications.

3.1.4.1 SAMPLES

a) If requested, submit to Engineer one 4-litre container of asphalt material proposed for use in the work, at least two weeks prior to commencing operations.

3.1.4.2 MATERIALS

a) Liquid or emulsified asphalt materials as indicated below and conforming to the related properties.

	Liquid Asphalt Type & Grade	Application Rate litres/m^2	Concentration
Prime Coat	MC-30/70	1.5+/-0.5	100%
Tack Coat	SS-1 MC-30/70	0.5+/-0.2 0.3+/-0.1	50% 100%

b) Dilute SS-1 emulsified asphalt with an equal amount of water.

3.1.4.3 EQUIPMENT

a) Provide distributor with such designed, equipped, maintained and operated asphalt material that even at heat it may be applied uniformly on variable widths of surface up to 4.6 m wide.
b) Distributor to have following characteristics:

(i) Capable of distributing asphalt material in a uniform spray with atomization at the rate specified and temperature required.
(ii) Equipped with a tachometer registering metre per second visibly located for truck driver to maintain constant speed required for application at specified rate.
(iii) Pump equipped with a tachometer registering litres per minute passing through nozzles and readily visible to operator. Pump to operate by a separate power unit independent of truck power unit.
(iv) Equipped with an easily read, accurate device which registers temperature of liquid in reservoir.
(v) Equipped with accurate volume measuring devices or a calibrated tank.

3.1.4.4 PREPARATION

a) Prepare surface to be coated to the applicable section. Have the surface approved by the Engineer before applying coating.
b) Protect adjoining curb, gutter, walk, slabs, barrier, poles and other surfaces not intended for coating from overspray or spills. Remove any overspray or spills.

3.1.4.5 APPLICATION

a) Asphalt prime coat: apply prime coat while the granular base course or soil cement surface is still moist. Do not apply when rain is forecast. Do not allow traffic on prime coat within 6 hours of application or until the prime coat has cured.

b) Asphalt tack coat: apply tack coat to an area to be paved in the next 24 hours. Do not apply tack coat unless the surface is dry and free of dust and other materials that could reduce the bond. Do not allow traffic on tack coat within two hours of application or until the tack coat has cured.
c) Prevent overlap at junction spreads.
d) Correct areas not sufficiently covered.
e) Where traffic is to be maintained, it shall be controlled at all times as directed by the Engineer.

3.1.4.6 USE OF SAND BLOTTER

a) If prime coat material fails to penetrate within a reasonable time, spread and blotter material in amounts required to absorb any excess asphalt material.
b) Sweep up and remove excess blotter material.

Specifications for Medium Curing Asphalts

ASPHALT GRADE REQUIREMENTS	ASTM TEST	MC-30		MC-70	
		Min	**Max**	**Min**	**Max**
Flash Point, Open Tag, degrees C	D1310	38	-	-	-
Kinematic Viscosity at 60 C, mm^2/s	D2170	30	60	70	140
Distillation Test: % by volume of total distillate to 360 C	D402				
190 C		-	-	10	-
225 C		-	25	50	-
260 C		40	70	70	-
315 C		75	93	85	-
Residue from distillation to 360°C Volume % by difference		50		55	
Tests on Residue from Distillation: Penetration at 25°C, 100 g, 5 s, dmm	D5	120	250	80	120
Ductility at 25°C, cm	D113	100	-	100	-
Solubility in Trichloroethylene, % by mass	D2042	99.5	-	99.5	-
Water, % by mass or volume	D95	-	0.2	-	0.2
Delivery Temperature, C		35	55	55	75

Note: If the ductility at 25°C is < 100 cm, the material will be acceptable if the ductility at 15°C is >100 cm.

General Requirements: The asphalt shall not foam when heated to the application temperature range. The asphalt shall be produced by the refining of petroleum and shall be uniform in character.

Specifications for Anionic Emulsified Asphalts

ASPHALT GRADE REQUIREMENTS	ASTM TEST	SS-1	
		Min	**Max**
Viscosity at 25°C, SF s	D244	20	60
Residue by Distillation, % by mass	D244	55	-
Settlement in 5 days, % difference by mass	D244	-	5
Storage Stability Test 24 hour, % by mass	D244	-	1
Retained on No. 1000 sieve, % by mass	D244	-	0.10
Cement Mixing Test, % by mass	D244	-	2.0
Tests on Residue from Distillation: Penetration at 25°C, 100 g, 5 s, dmm	D5	100	200
Ductility at 25°C and 5 cm/minute, cm	D113	60	-
Solubility in Trichloroethylene, % by mass	D2042	97.5	-
Delivery Temperature, C		40	70

Notes: The upper limit on % residue is governed by the consistency limits. The test for settlement may be waived when the emulsified asphalt is used in less than 5 days time. The 24-hour storage test may be used in place of the 5-day settlement test. However, in case of dispute, the 5-day storage settlement test shall govern. CAN/CGSB-8.2-M Sieves, woven wire, metric shall be used for the sieve test.

General Requirements: All tests shall be performed within 15 days of the date of delivery. The asphalt shall be uniform in character and shall have a refined petroleum base.

3.1.5 Cement Stabilized Subgrade

Supply and spreading Portland cement subgrade soil. Mix in existing soil, cement and water, compacting and finishing to specified grade and cross section.

3.1.5.1 MATERIAL

a) Portland cement: to CSA A5 Type 10 (normal).

3.1.5.2 EQUIPMENT REQUIREMENTS

a) Equipment capable of breaking down, pulverizing soil, and combining soil and cement into a homogeneous mixture to a depth of 300 mm.
b) Equipment capable of distributing cement uniformly at a specified rate.
c) Equipment capable of attaining a minimum density of 100% of Standard Proctor Density to a depth of 300 mm.

3.1.5.3 TEST AREA

a) If ordered by the Engineer, a test area determined by the Engineer will be constructed.

3.1.5.4 PROCEDURE

a) Application:

(i) Spread cement on the soil at a rate specified by the Engineer.

b) Mixing:

(i) Mix the soil and cement to a depth as specified until homogenous and free of lumps.
(ii) If required, add water and mix until mixture is at optimum moisture content.

c) Compaction:

(i) Compaction cement stabilized soil to a minimum density of 100% Standard Proctor Density.

d) Joints:

(i) When working in an area adjacent to an area already completed, the new work shall overlap the existing by 300 mm with no additional cost to the Owner.

e) Finishing Tolerances:

(i) 6 mm maximum variation above design elevation.
(ii) 25 mm maximum variation below design elevation.

3.1.5.5 QUALITY ASSURANCE

a) Required density is a maximum of 100% of the maximum density for each 150 mm lift of stabilized subgrade. Maximum density is defined as the dry unit mass of a soil sample at optimum moisture content as determined according to ASTM D698 Method A.
b) Testing frequency will be a minimum of one field density test for each 1000 m^2 of compacted subgrade lift according to ASTM D 2167 or ASTM D 2922.
c) For proof rolling, use a single axle dual wheeled truck loaded to a minimum 9100 kg on the rear axle. Tires to be inflated to a minimum 275 kPa.
d) Engineer may authorize use of other acceptable proof rolling equipment.
e) Where proof rolling reveals areas of defective subgrade, repair to the requirements of this section at no cost to the Owner.

3.1.6 General Concrete

3.1.6.1 MATERIALS

a) Cement: to CAN3-A5, Surface Concrete: Normal (Type 10), Subsurface Concrete: Sulfate Resistant (Type 50).
b) Aggregates: to CAN3-A23.1. Fine and coarse aggregate shall each have no more than 1.0% ironstone and similar materials which are known to cause surface defects, such as pitting and popouts, as determined by ASTM C295, Petrographic Examination of Aggregates for Concrete. No aggregate from any one supplier or source shall be used unless a copy of test results thereof, performed by an independent testing laboratory approved by the Engineer, is first submitted to the Engineer at least 10 days before the intended use.
c) Form stripping agent: colourless mineral oil, free of kerosene, with viscosity between 70 and 110 s Saybolt Universal 15 to 24 mm^2/s at 40°C, flashpoint minimum 150°C, open cup.
d) Pan forms: removable steel as indicated.
e) Tubular column forms: round, spirally wound laminated fiber forms, internally treated with release material.

f) Form ties: removable or snap-off metal ties, fixed or adjustable length, free of devices that will leave hole larger than 25 mm diameter and 10 mm deep in concrete surface.
g) Joint filler: to ASTM D1751, D3408, D3406 (AASHTO M213).
h) Admixtures:

(i) Air-entraining admixture to CAN3-A266.1.
(ii) Chemical admixtures to CAN3-A266.2 and CAN3- A266.4. Engineer to approve accelerating or set retarding admixtures during cold and hot weather placing.

3.1.6.2 CONCRETE MIXES

a) Mix design to be completed by an approved materials testing agency and submitted for approval to the Engineer two weeks prior to concrete being placed.
b) Except where indicated or specified otherwise, provide concrete mix:

(i) Compressive strength at 28 d, 30 MPa minimum.
(ii) Class of exposure A, maximum water cement ratio of 0.45.
(iii) Fine aggregate to CAN3-A23.1.
(iv) Coarse aggregate to CAN3-A23.1, Table 3, Group 1, 28-5 nominal size.
(v) Entrained air 6% ± 1%.
(vi) Slump at point of discharge, 25 to 100 mm.
(vii) Maximum flyash content is 10% by mass of cement. No fly-ash permitted after September 1.
(viii) Where 7 day strength is less than 65% of specified 28 d strength, provide additional curing and make changes to mix proportions to ensure specified 28 d strength is attained.

3.1.6.3 GENERAL

a) Do concrete work to CAN3-A23.1 unless otherwise directed by Engineer.
b) Ensure that reinforcement and inserts are not disturbed during concrete placement.
c) In locations where new concrete is joined to existing work, drill holes in existing concrete. Place steel dowels and pack solidly with non-shrink grout to positively position and anchor dowels.

3.1.6.4 HOT WEATHER CONCRETE

a) Hot weather concrete: air temperature at or above 25°C.
b) Conform to the requirements of CAN3-A23.1 for Hot Weather Protection.
c) Concrete temperature not to exceed 30°C.
d) Retardant admixtures: to CAN3-A266.2, CAN3-A266.4 and approval of Engineer.

3.1.6.5 COLD WEATHER CONCRETE

a) Cold weather concrete: air temperature at or below 5°C.
b) Conform to the requirements of CAN3-A23.1 for Cold Weather Protection.
c) Concrete not to be placed on frozen subgrade or subbase.
d) Metal forms to be heated if directed by Engineer.
e) Concrete delivered to have a temperature between 15°C and 32°C.
f) After September 30 all concrete placed to attain specified 28 d strength in 7 d.
g) Maintain air temperature of 18°C for 3 d by use of insulation or hoarding and heating around concrete.
h) Accelerating admixture: to CAN3-A266.2, CAN3-A266.4 and approval of Engineer.

3.1.6.6 INSERTS

a) Set sleeves, ties, anchor bolts, pipe hangers and other inserts, openings and sleeves, specified in other sections. Sleeves, and openings greater than 100 mm square not indicated must be approved by Engineer.
b) Place bolts and sleeves to setting details and secure in non- shrink grout.

3.1.6.7 DEFECTIVE CONCRETE

a) Concrete is defective when:

   (i) Failing to meet any requirement of this specification.
   (ii) Concrete contains excessive honeycombing or embedded debris.
   (iii) Average of 3 consecutive 28 day strength tests for that class of concrete is less than the specified strength or one individual strength test is more than 3.5 MPa below the specified strength.

b) For concrete deficient in strength the Engineer may, at his sole discretion, accept any portion of or all of the deficient concrete with the following price reductions:

Amount Under Specified Strength	Unit Price Reduction
Specified Strength or Greater	No reduction or 0%
0.01 MPa to 1.0 MPa	4%
1.01 MPa to 2.0 MPa	9%
2.01 MPa to 3.0 MPa	14%
3.01 MPa to 4.0 MPa	20%
4.01 MPa to 5.0 MPa	26%
5.01 MPa to 6.0 MPa	33%
More than 6.0 MPa	100% Reduction

c) The application of an adjusted unit price does not relieve the contractor of the contract maintenance requirements.

3.1.6.8 REPAIR

a) Repair defective areas while concrete is still plastic, otherwise wait until curing is completed.
b) Where directed, remove defective work and replace with new concrete.
c) Where directed, grind off high surface irregularities.

3.1.7 Concrete Curbs, Curbs and Gutters, Sidewalks, Medians, Driveways and Swales

This section specifies requirements for constructing Portland cement concrete curbs, curbs and gutters, sidewalks, medians and driveways.

3.1.7.1 MATERIAL

a) Joint filler: to ASTM D1751 (AASHTO M213) 20 mm preformed, non-extruding, resilient, bituminous type or approved alternates.
b) Curing compound to ASTM C309 with fugitive dye or plastic film to ASTM C171. Curing compound not to be applied where frost is expected within 14 days.
c) Sealing solution: White pigmented sealer or other sealant approved by the Engineer.
d) Form release agent: non-staining mineral type.

3.1.7.2 GRADE PREPARATION

a) Subgrade compacted to a density of 98% Standard Proctor.
b) Concrete slab medians: not applicable.

3.1.7.3 GRANULAR BASE

a) Sidewalks, medians: 150 mm granular base compacted to a density of 100% of Standard Proctor.
b) Concrete driveways and swales: 150 mm granular base compacted to a density of 100% of Standard Proctor.
c) Concrete slab median: not applicable.

3.1.7.4 TIE TO EXISTING CONCRETE

a) Remove existing concrete back to an existing joint or sawcut a straight edge to tie to.
b) In curb and gutter sections, drill two 10 mm diameter holes a minimum of 150 mm into the existing section at each end. One hole to be located at the midpoint of the gutter pan and the second hole in the midpoint of the curb section. When connecting sidewalk or slabs to curbs drill 10 mm diameter holes 100 mm deep at a spacing of 600 mm maximum.
c) For flatwork, drill 10 mm diameter holes 150 mm deep at a spacing of 600 mm maximum or a minimum of three holes per connection whichever is greater.
d) Butter drilled holes with concrete mortar.
e) Drive home 450 mm long 10 m rebar into each hole. Bars to extend at least 300 mm into new poured section.

3.1.7.5 FORMING

a) Form vertical surfaces to full depth using forming material that will not deform under loading by plastic concrete.
b) Securely position forms to required lines and grades.
c) Coat forms with non-staining mineral type forms release agent.
d) Obtain approval of forms before placing concrete.

3.1.7.6 REINFORCING STEEL

a) Place steel to details indicated.
b) Make laps of 500 mm where continuous reinforcement is required.
c) Make laps of 300 mm width, where required for wire mesh.

3.1.7.7 CONCRETE

a) Finish exposed surfaces to a smooth uniform finish, free of open texturing and exposed aggregate. Do not work more mortar to surface than required. Do not use neat cement as a drier to facilitate finishing.
b) Broom finish surface to provide non-skid texture.
c) Round edges, including edges of joints, with 5 mm radius edging tool.
d) Finish surfaces to within 6 mm in 3 m from line, level or grade as measured with a straight edge placed on surface.
e) Cure concrete to CAN3-A23.1 Section 21.1
f) Seal all concrete as follows:
g) Apply with spray method only, one coat of evenly applied white pigmented sealer.
h) Ensure concrete surfaces are dry, free of dirt or dust, and at least one week old before applying coating.
i) Apply according to manufacturer’s specification.
j) Protect adjacent surfaces from spray.

3.1.7.8 EXPANSION AND CONTRACTION JOINTS

a) For all flatwork (sidewalks, medians and driveways) install contraction joints a minimum of 1/4 of the depth of slab and 6 mm wide at intervals of 1.5 m.
b) For all flatwork (sidewalks, medians, and driveways) wider than 2.0 m a longitudinal contraction joint shall be included by either sawcutting or finishing. The contraction joint shall be a minimum of 1/4 of the depth of slab located at the midpoint of the slab or at a maximum 2-metre spacing. If the contraction joint is to be a sawcut, it shall be completed within 24 hours of concrete placement.
c) For curb and gutter install contraction joints a minimum of 40 mm deep and 6 mm wide at intervals of 3.0 m. On 500 mm gutter sections, the back section of the gutter is to be deep cut with a trowel at each contraction joint.
d) When sidewalk is adjacent to curb, make joints coincide.
e) Install isolation joints in concrete around manholes, poles, hydrants etc. and along length of concrete adjacent to concrete curb, building, or permanent structure.
f) Install construction joints at the end of all reinforced sections.

3.1.7.9 BACKFILL

a) Allow concrete to cure for 7 days prior to backfilling.
b) Backfill to designated elevations with suitable material, compact to 95% of Standard Proctor and shape to required contours as indicated or directed by the Engineer.
c) Backfill within 500 mm of concrete is incidental to work done under this section.

3.1.7.10 REJECTION OF CONCRETE

a) Concrete work shall be subject to rejection at the Engineer's discretion for any of the following reasons:

(i) Misalignment of vertical or horizontal grade
(ii) Gutters or swales which pond water
(iii) Cracks in locations other than at joints
(iv) Flaking or spalling of the surface
(v) Vertical displacements between adjoining sections or other forms of settlement
(vi) Surfaces which are marked or damaged
(vii) Failure to meet strength requirements
(viii) Variance from design section as specified on the drawings
(ix) Improper ties to existing concrete.
(x) Non-conformance to any requirement of the specifications or drawings.

3.1.8 Street Signing

This section specifies requirements for supply and installation of street and traffic control signs.

3.1.8.1 SHOP DRAWINGS

a) Supply proofs of all signs for review prior to manufacture of signs.
b) Provide layout plan for review prior to installation.

3.1.8.2 SIGN MATERIAL

a) Aluminium – 0.081 gauge sign grade.

3.1.8.3 BACKGROUND MATERIAL

a) Stop, yield, keep right and overhead lane control signs will be 3M diamond grade cubed (DG3) Scotchlite sheeting and appropriate 3M ink.

3.1.8.4 MESSAGE MATERIAL

a) All other signs to be 3M High Intensity Prismatic (HIP) Scotchlite sheeting and appropriate 3M ink.

3.1.8.5 BRACKETS AND ATTACHMENTS

a) Brackets to be K-9 raw material - 6063 aluminium.
b) H-clips to be extruded aluminum.
c) Bolts to be 9.5 mm aluminum complete with nuts.
d) Bandit Valustrap and Valuclips or equivalent.

3.1.8.6 POSTS AND BASES

a) Post for RB-25 and Hazard Marker to be 47.6 mm diameter extra strong pipe to ASTM A53. Length 2.5 m. Circular sign base 387 mm diameter cast iron to fit 47.6 mm diameter post.
b) Standard post to be Unistrut Telespar single post type complete with appropriate connection hardware. Post to be 50 mm square 12 gauge. Post to be 4.0 m long for street name and advance street name signs. All others to be 3.5 m or 4.0 m long, as required to meet the clearance and embedding requirements.
c) Armtech (or equivalent) 2-piece channel post (CSA G164) for signs up to 75 cm x 75 cm installed in landscaped boulevards.
d) All posts and bases to be galvanized.

3.1.8.7 STANDARDS

a) All signing to be in accordance with the RTAC "Uniform Traffic Control Devices of Canada" and the Alberta Transportation "Urban Guide and Information Sign Manual".

3.1.8.8 STREET NAME SIGNS

a) ALR-1 signs to be 22.5 cm high extruded aluminium.
b) Message is white on a black background and the blade style shall match current Town decorative style.
c) Letter height 150 mm. Message is printed on both sides of sign.
d) Use Ave. for Avenue and St. for Street.
e) Mount 3.0 m above ground surface.
f) Punch two 10 mm x 16 mm slotted holes, top and bottom of the left hand side of the sign where sign is to be mounted on street light standard.
g) Mount sign to end bracket with 2 bolts.
h) Mount on street light poles if located within 10 m of intersection otherwise on standard pole.
i) Centre mount signs on Telespar posts.

3.1.8.9 ADVANCE STREET NAME SIGNS

a) ALR-3 signs to be minimum 300 mm x 600 mm.
b) Message is white on black background with a 15 mm white border.
c) Letter height – 200 mm.
d) Use abbreviations.
e) Mount 3.0 m above ground surface.
f) Mount on light pole if located within 10 m of location indicated in drawings otherwise on standard pole.

3.1.8.10 REGULATORY AND WARNING SIGNS

a) Colours, message and sign dimensions as per Uniform Traffic Control Devices manual, unless otherwise specified on the drawings.
b) Mount bottom of signs at 2.0 m above ground surface and a minimum of 0.5 m clear of the face of curb.
c) Mount on street light pole if located within 10 m of location indicated on drawings otherwise on standard poles. Standard poles to be embedded 1 m.
d) Mount RB-25 and Hazard Marker on standard 2.5 m round pole complete with pole base on slab-on islands.

3.1.8.11 REJECTION

a) Signs bearing non-uniform letters or numerals, crooked borders, chipping or flattening of materials or other unworkmanlike defects will be rejected.
b) All sharp edges and debris to be removed.

3.1.9 Painted Pavement Markings

This section specifies requirements for painted pavement markings.

3.1.9.1 MATERIALS

a) Paint:

   (i) To CGSB 1-GP-74M, alkyd traffic paint.
   (ii) To CGSB 1-GP-149M, alkyd reflectorized traffic paint.
   (iii) Colour: to CGSB 1-GP-12.1C, yellow 505-308 white 513-301.

b) Thinner: as specified by paint manufacturer.

3.1.9.2 EQUIPMENT REQUIREMENTS

a) Paint applicator to be an approved pressure type distributor capable of applying paint in single and dashed lines and that will ensure uniform application and having a positive shut off.
b) Adequate warning signs and traffic channelization devices to minimize tracking by traffic.

3.1.9.3 CONDITION OF SURFACES

a) Pavement surface to be free from surface water, frost, ice, dust, oil, grease and other foreign materials.

3.1.9.4 APPLICATION

a) Pavement markings to be laid out by Contractor and layout approved by Engineer prior to application of paint.
b) Unless otherwise approved by Engineer apply paint only when air temperature is above 10°C and no rain is forecast.
c) Apply paint to pavement surface with an approved applicator to a dry thickness of 305µm (12 mils).
d) Do not thin paint unless approved by the Engineer.
e) Symbols and letters to conform to dimensions indicated.
f) Paint lines must be of uniform colour and density with sharp edges.
g) Thoroughly clean distributor tank before refilling with paint of different colour.

3.1.9.5 TOLERANCE

a) Paint markings to be within ± 12 mm of dimensions specified.

3.1.9.6 PROTECTION OF COMPLETED WORK

a) Protect pavement markings until dry.

3.1.10 Plastic Pavement Markings

This work shall consist of the supply and installation of MMA spray plastic, cold plastic or hot thermoplastic markings as required by the drawings or as directed by the Engineer. Markings shall include yellow and white lane and dividing lines, white crosswalk bars and stop bars, white turn arrows and yellow and white hazard and delineation markings.

3.1.10.1 MATERIALS

a) MMA spray plastic shall conform to the following specification:

Tests	Minimum Requirements	Maximum Requirements	Test Method A.S.T.M.
Abrasion Resistance *(maximum loss/grams)	-	0.45g	D4060
Reflectance			
White -	75%	-	E1347
Yellow -	45%	-	
Retroreflectance (with proper bead application)	200 millicandelas per square metre per lux		
Specific Gravity @ 25° C (77°F)	1.8	-	D792
Hardness	A-2 Shore 70		D2240
Water Absorption		0.5%	D570
Chemical resistance to	No signs of degradation after 7 days immersion		
anti-freeze			
brake fluid			
motor oil			
diesel fuel, gasoline			
calcium chloride			
sodium chloride			
transmission fluid			
Adhesion ** (to Portland Cement)	200 psi		
Skid Resistance (Field Base)	45 units		E303

*Abrasion resistance, maximum weight loss when subjected to 200 revolutions on Taber Abrader at 25°C using H-22 Calibrade wheels weighted to 500 grams with sample kept continuously wet with distilled water. Prepare test sample with representative material placed on 100mm square plate, 2±0.1mm thickness.

**Adhesion to asphalt is dependent on the tensile failure strength of the substrate. This compound shall be resistant to the effect of ultra-violet light.

b) Cold Plastic Markings: two-component, cold-extruded and cold-curing, having a specific gravity of 1.9 minimum at 25° C, and conforming to paragraph 2.1.4 below.
c) Hot Thermoplastic Marking: hot-extruded, having a specific gravity of 2.0 minimum at 25° C, having a softening point of 90° C minimum according to ASTM E28, and conforming to paragraph 2.1.4 below.
d) Both cold and hot plastic markings shall conform to the following:

(i) Water Absorption: 0.5% maximum by mass retained water after 24-hour immersion, according to ASTM D570 Procedure A.
(ii) Impact Resistance: minimum 1.13 J at 25° C when material is cast into bar 25 mm^2 cross-section by 75 mm long, with 25 mm extended above vice jaws in a cantilever beam (Izod type) tester using the 2.82 J scale, according to ASTM D256 Method C.
(iii) Abrasion Resistance: Maximum weight loss of 0.60 g when subjected to 200 revolutions on Taber abrader at 25° C using H-22 Calibrade wheels weighted to 500 g with sample kept continuously wet with distilled water. Prepare test sample with representative material placed on 100 mm square plate, 3±0.1 mm thick.
(iv) Chemical Resistance: Test sample of 50 mm square, no degradation after exposure to:
24 hour immersion in 5% NaCl.
24 hour immersion in 5% CaCl.
1 hour spot test with mineral oil.
(v) No deterioration when in direct contact with asphalt cement in asphalt materials, or with sodium chloride, calcium chloride or other de-icing chemicals.
(vi) Non-toxic and not harmful to persons or property when in hardened state.
(vii) No discoloration from sunlight ultraviolet exposure and no bond failure for warranted life of material.
(viii) Pre-marking Paint: As approved by the Engineer.
(ix) Groove Filler: LRS 424 or approved equal.

3.1.10.2 MIX FORMULATION

a) White Colour: conforming to U.S. Federal Standard 595B Colour Number 37925, 70% minimum when measured with the Colour Guide Reflectometer 0,45° daylight luminous directional reflectance, with a green filter.
b) Yellow Colour: conforming to U.S. Federal Standard 595B Colour Number 33538, 40% minimum when measured with the Colour Guide Reflectometer 0,45° daylight luminous directional reflectance, with a green filter.
c) No formulation change unless approved by the Engineer. Any significant change will be subject to field trials.

3.1.10.3 EQUIPMENT

a) Grooving Machine, Applicators: subject to the Engineer’s approval.

3.1.10.4 SITE PREPARATION

a) The contractor shall provide flagmen, barricades, and signing.
b) Sweep or airblow pavement surface clean and dry.
c) Remove conflicting markings.
d) Do not apply plastic marking until premarkings have passed inspection by the Engineer.

3.1.10.5 MMA SPRAY PLASTIC APPLICATION

a) Mix components and apply MMA plastic markings according to manufacturer’s surface application procedures, to a minimum thickness of 0.5 mm.
b) Apply plastic markings in accordance with manufacturer’s instructions and procedures.
c) Apply glass beads to surface of extruded material before it has set, at a rate of 140 to 250 g/m^2.
d) Do not permit traffic over applied markings until they have adequately hardened.

3.1.10.6 COLD PLASTIC APPLICATION

a) Mix components and apply cold plastic marking according to manufacturer’s surface application procedure, to a thickness of 2.0 mm minimum and 3.0 mm maximum.

b) Apply plastic markings in accordance with manufacturer's instructions and procedures.
c) Apply glass beads to surface of extruded material before it has set, at a rate of 140 to 250 g/m^2.
d) Do not permit traffic over applied markings until they have adequately hardened.

3.1.10.7 HOT THERMOPLASTIC APPLICATION

a) Cut groove into pavement surface to designated width and depth. Remove grindings and haul to a designated location. Sweep or airblast groove clean and dry.
b) Heat material and apply according to manufacturer's hot extrusion process.
c) Apply plastic markings in accordance with manufacturer's instructions and procedures.
d) Fill groove with hot molten material. Do not overfill more than 3.0 mm above pavement surface.
e) Apply glass beads to surface of extruded material while it is still molten at a rate of 140 to 250 g/m^2.
f) Trim surplus material to give clean straight edges.
g) Do not permit traffic over applied markings until they have adequately hardened.

3.1.10.8 PROTECTION AND CLEANUP

a) Protect surrounding areas and structures from disfiguration and damage. Repair any damage as directed by the Engineer.
b) On completion of work and prior to opening to traffic, clean up and leave site free of debris and waste matter.

3.1.10.9 THICKNESS TOLERANCE

a) MMA Spray Marking

   (i) Measurement: The Engineer may measure suspect markings with a thickness gauge instrument. The average of 5 measurements will represent 300 m of marking, or one job site, whichever is less.
   (ii) Thickness Deficiencies: Where a significant number of deficiencies occur in the work, involving average thicknesses less than 0.5 mm, the Engineer may order removal and replacement or application of additional material.

b) Cold Plastic Marking

   (i) Measurement: The Engineer may measure suspect markings with a surface micrometer. The average of 5 measurements will represent 300 m of marking, or one job site, whichever is less.
   (ii) Thickness Deficiencies: Where a significant number of deficiencies occur in the work, involving average thicknesses greater than 3.0 mm or less than 1.8 mm, the Engineer may order removal and replacement or application of additional material.
   (iii) If surface dishing deeper than 0.5 mm occurs, the Engineer may order removal and replacement. Variations in asphalt surface profile may be taken into consideration.

c) Thermoplastic Marking

   (i) Measurement: The Engineer may core suspect markings. The average thickness of 3 cores will represent 300 m of marking, or one job site, whichever is less.
   (ii) Overfill Thickness: That portion of marking above pavement surface will receive no additional payment. If overfill exceeds 3.0 mm, the Engineer may order removal and replacement of marking.
   (iii) Groove Thickness Deficiencies: Where a significant number of deficiencies occur, involving average groove thicknesses less than 70% of that specified, the Engineer may order removal and replacement.

(iv) If surface dishing deeper than 0.5 mm occurs, the Engineer may order removal and replacement. Variations in asphalt surface profile may be taken into consideration.

3.1.10.10 WIDTH TOLERANCE

a) MMA Spray Marking

(i) The Engineer may determine the width of suspect markings by the average of 5 measurements representing 300 m of marking, or one job site, whichever is less.

b) Cold Plastic Marking

(i) The Engineer may determine the width of suspect markings by the average of 5 measurements representing 300 m of marking, or one job site, whichever is less.

c) Hot Thermoplastic Marking

(i) A quality assurance laboratory may determine the groove width of suspect markings by the average measurements of 3 cores representing 300 m of marking, or one job site, whichever is less.

d) Width Deficiencies

(i) Where a significant number of deficiencies occur greater than 10 mm in average widths of cold plastic, or in average groove widths of hot thermoplastic, the Engineer may order removal and replacement.

3.1.10.11 WARRANTY

a) The Contractor shall provide written confirmation that the materials as installed shall be guaranteed to remain intact within the following limits for a period of five years, while being subjected to traffic and normal summer and winter roadway maintenance procedures:

(i) The first (1st) year from the date stated in the Construction Completion Certificate, all lines shall be 100% intact.
(ii) The second (2nd) year from the date stated in the Construction Completion Certificate, each line shall be 95% intact.
(iii) The third (3rd) year from the date stated in the Construction Completion Certificate, each line shall be 90% intact.
(iv) The fourth (4th) year from the date stated in the Construction Completion Certificate, each line shall be 85% intact.
(v) The fifth (5th) year from the date stated in the Construction Completion Certificate, each line shall be 80% intact.

b) Defective material or improper installation that result in the materials requiring replacement shall be replaced by the Contractor at no cost to the Owner.

3.1.11 Testing

3.1.11.1 TESTING AND INSPECTION

a) The Developer shall employ a CSA approved material testing firm to complete the tests as outlined. One copy of all test results shall be submitted to the Town for their review.

Test Frequency

Specification	Type of Test	Minimum Test Frequency	Remark
Trenching, Backfilling Trenching, Backfilling & Compaction for Electrical Installation	**Density Test:**		
	Trench longer than 15 m	2 tests per 600 mm of depth for every 100 m of trench length	Testing will vary with location of project and consequences of trench settlement.
	trench shorter than 15 m	3 tests per trench	
Roadway Excavation, Backfill & Compaction	**Grading/Fill Compaction:**		
	Subgrade Preparation:	1 density test per 2000 sq.m of compacted lift	
	Proof Rolling:	Entire project	
Aggregate: General Granular Sub-base Granular Base	Source Sampling:	1 sieve analysis per 500 tonnes (250 m;) of asphalt aggregate for crushing control	Required 2 weeks prior to commencing work
	Compaction:	1 sieve analysis per 2500 (1250 m;) tonnes of base and subbase aggregate	
	Proof Rolling	Entire project	
Stabilization: Lime	Source Sampling:		
	Test Area:	400 sq.m to establish and demonstrate work methods and timing	Required 2 weeks prior to commencing work
	Proof Rolling:	At completion of curing period	
Soil Cement	Source Sampling (aggregate):		
	Mix Design:	1 sieve analysis per 2500 tonnes (1250 m;)	Required 2 weeks prior to commencing work Required 2 weeks prior to commencing work
	Thickness Test:	1 core sample per 1000 sq.m of soil cement in place	Areas suspected to have inadequate thickness
	Compaction Test:	1 density test per 1000 sq.m of soil cement in place	
	Strength Test:	1 7-day compressive strength test per 1000 tonne of soil cement	
Topsoil	Topsoil Analysis:		
	On-site Sources	1 analysis report for each topsoil source	Required 4 weeks prior to commencing work
	Contractor Supplied	Contractor to supply 1 litre sample of each topsoil type for testing	
Asphaltic Concrete Paving	Mix Design:		
	Density/Thickness Test:	3 cores per 600 tonnes of asphalt pavement (5000 m3 for a 50 mm lift)	Required 2 weeks prior to commencing work
	Mix Proportions:	1 Marshall core per 6000 tonnes of mix, with a minimum of 1 test from each full day's production	
Watermain	Hydrostatic/Leakage Test: Bacteria/Chlorine Test:	Test section not to exceed 365 m in length	Provide Engineer at least 24 hours' notice
Storm Sewer Sanitary Sewer	Television and Photographic Inspections:	Upon completion of storm sewer installation, after backfilling	
Forcemains	Hydrostatic/Leakage Test:	Test section not to exceed 365 m in length	Provide Engineer at least 24 hours' notice
Concrete Curbs & Gutter, Walks, Medians, Driveways & Swales General Concrete Slip Formed Concrete	Mix Design: Slump Test:	1 per 20 cu.m for each class of concrete poured, min. 1 per day	Required 2 weeks prior to commencing work Every truck until consistency is established Every truck until consistency is established
General Concrete	Air Content Test:	1 per day	
Slip Formed Concrete	Strength Test:	1 per 20 cu.m for each class of concrete poured, min. 1 per day	

3.2 Trenching, Backfilling and Compaction

3.2.1 General

This section specifies requirements for excavating trenches, backfilling and compacting for installation of pipelines, sewers, conduits and appurtenances.

3.2.1.1 DEFINITIONS

a) Solid Rock:

(i) Material excavated from solid masses of igneous, sedimentary or metamorphic rock, which, prior to its removal, was integral with its parent mass.
(ii) Boulders or rock fragments having individual volume in excess of 0.5 m^3.

b) Muck:

(i) Mixtures of soils and organic matter not suitable for foundation materials regardless of moisture content.

c) Common Material:

(i) Deposits other than solid rock and muck.

d) Imported Granular Backfill:

(i) Material, as specified and approved by the Engineer, imported to replace excavated material as backfill.

e) Bedding Material:

(i) Materials, as specified and approved by the Engineer, used in "pipe zone".

f) Pipe Zone:

(i) Area of trench including and surrounding pipe as indicated on drawings.

g) Topsoil:

(i) Material capable of supporting good agricultural growth and suitable for use in top dressing, landscaping and seeding.

h) Untraveled Areas:

(i) Areas where vehicular or foot traffic do not regularly occur or are not anticipated at the completion of construction.

i) Travelled Areas:

(i) Areas where vehicular or foot traffic may be anticipated, including roads, lanes, parking areas, driveways, pedestrian areas and road shoulders. Shoulders beside paved roads are areas accessible to vehicular traffic within 3 m from the edge of pavement. Road shoulders beside gravel roads are accessible to vehicular traffic within 3 m from the normally travelled roadway.

3.2.1.2 PROTECTION

a) Existing Buried Utilities

(i) Size, depth and location of existing utilities shown on drawings are for guidance only; completeness and accuracy are not guaranteed.
(ii) Prior to commencing any excavation work, notify appropriate utility authorities (Alberta One-Call), establish location and state of use of buried services. Clearly mark such locations to prevent disturbance during work.
(iii) Maintain and protect from damage, water, sewer, and gas, electric or other utilities encountered.
(iv) Obtain direction of owner of utility and Engineer before moving or otherwise disturbing utility.

b) Existing Surface Features:

(i) Protect existing buildings, trees and other plants, lawns, fencing, service poles, wires or paving located within right-of-way or adjoining properties from damage while work is in progress. Repair to Engineer's satisfaction any damage which may occur.
(ii) Where excavation necessitates root or branch cutting, do so only under direct control of the Engineer.

c) Shoring and Bracing:

(i) Whenever shoring, sheeting, timbering and bracing of excavations is required, engage services of a professional engineer to design and assume responsibility for adequacy of shoring and bracing. Professional engineer is to be registered in province or territory in which work is to be carried out.
(ii) When requested by the Engineer, submit for review drawings and calculations signed and stamped by the professional engineer responsible for their preparation.
(iii) Close sheeting, when required, to be designed and constructed to prevent adjacent soil or water from entering excavation.

d) Access:

(i) Maintain unobstructed access to fire and police appurtenances, telephone, electric, water, sewer, gas or other public utilities and private properties.

e) Flooding:

(i) Protect open excavation against flooding and damage from surface water runoff.

3.2.2 Materials

3.2.2.1 IMPORTED GRANULAR BACKFILL

a) Clean, hard, durable uncoated particles, free from clay lumps, cementation, organic and other objectionable material meeting the following gradation limits:

Sieve Size	P/P		Sieve Size	P/P
25 mm	100%		63 mm	100%
20.5 mm	60 – 86%		20 mm	45 – 80%
5 mm	36 – 75%		5 mm	25 – 50%
2.0 mm	26 – 60%		0.075 mm	10% max
0.4 mm	12 – 43%			
0.16 mm	6 – 20%			
0.063 mm	2 – 10%			

3.2.2.2 NATIVE BACKFILL

a) Approved material selected from trench excavation or other source, unfrozen and free from cinders, ashes, sods, refuse or other deleterious materials and with the natural water content within 5% of the optimum value for the Proctor compaction specified, based on the native soil, which is being used for backfill.

3.2.3 Installation

3.2.3.1 SITE PREPARATION

a) Remove trees, shrubs, vegetation, fences and other obstructions, ice and snow, from surfaces to be excavated within limits indicated.
b) Strip top soil from within limits of excavation and stockpile as directed, for re-spreading after backfilling.

3.2.3.2 DEWATERING

a) Keep excavations dry while work is in progress.
b) Dispose of water in a manner not detrimental to public health, environment, public and private property, or any portion of work completed or under construction.

3.2.3.3 EXCAVATION

a) Excavate to lines, grades, elevations and dimensions indicated on Drawings. Ground profiles are approximate only. The Engineer will set out precise line and grade. Allow the Engineer one working day advance notice to set out line and grade.
b) Cut pavement or sidewalk neatly along limits of proposed excavation.
c) Where edge of existing pavement is damaged because of trench excavation in shoulder, a minimum 450 mm width to be cut neatly and continuously and reinstated.
d) Notify Engineer when soil at proposed elevation of trench bottom appears unsuitable for foundation of installation.
e) Remove unsuitable material from trench bottom to extent and depth directed by Engineer.
f) Notify Engineer if new construction conflicts with discovered obstruction.
g) Allow Engineer sufficient time to consider alternative alignment to avoid conflict with obstruction and modify alignment as directed by Engineer.
h) Unless otherwise authorized by Engineer, do not excavate more than 30 m of trench in advance of installation operations and do not leave more than 15 m open at end of day's operation.
i) Stockpile suitable excavated materials required for trench backfill in approved location. Sidecasting may not be approved.
j) Dispose of surplus and unsuitable material at the designated waste site. If no site is designated dispose of material at a site located by the Contractor at his expense and approved by the Engineer.
k) Do not obstruct flow of surface drainage or natural watercourses.
l) Obtain Engineer's approval for method of excavation.
m) Rock shall be excavated to a level 150 mm below the barrel of the pipe.

3.2.3.4 TRENCH BOTTOM PREPARATION

a) Where required due to removal of unsuitable material or unauthorized over-excavation, bring bottom of excavation to design grade with approved material.
b) Compact trench bottom to a density at least equal to density of adjacent surrounding soil.

3.2.3.5 PRE-INSTALLATION INSPECTION

a) Excavations require inspection and approval prior to commencement of installation operations.

3.2.3.6 BACKFILLING

a) Do not proceed with trench backfilling operations until Engineer has inspected and approved installations.
b) Use approved native or imported granular backfill material as indicated or directed.
c) Backfilling around installations:

   (i) Place bedding and surround material as specified.
   (ii) Do not backfill around or over cast-in-place concrete within 24 hours after placing.
   (iii) Place layers simultaneously on both sides of installed work to equalize loading.
   (iv) Place material by hand under, around and over installations until 600 mm of cover is provided. Dumping material directly on installations will not be permitted.

d) Do not place backfill in freezing weather without written permission of Engineer.
e) Shoring, sheeting and bracing:

   (i) Unless otherwise indicated, or directed by Engineer, remove sheeting and shoring from trench during backfilling operations.
   (ii) Do not remove bracing until backfilling has reached level of bracing.
   (iii) Pull sheeting in 150 mm increments until clear of installations, simultaneously placing and compacting backfill to fill voids left by pulled sheeting.
   (iv) Pull sheeting thereafter in increments that will ensure backfill is maintained at an elevation at least 450 mm above toe of sheeting.
   (v) When sheeting is to remain in place, cut off tops at elevations indicated or directed.

f) Place backfill material in uniform layers not exceeding 150 mm in compacted thickness up to subgrade elevation or top of trench. Compact each layer before placing succeeding layer to the required density, as defined below:

Required Compaction	Backfill Zone
Under existing or proposed road, alley, walk, streetlight or similar structure and within a distance from such structure equal to trench depth:	
100% of one-mould or 98.0% of standard proctor	From designated subgrade elevation or existing ground level, whichever is lower, to 1.5 m below
97.0% of one-mould or 95.0% of standard proctor	More than 1.5 m below
Adjacent to existing or proposed road, alley, walk, streetlight or similar structure and within a distance from the improvement equal to trench depth:	
92.0% of standard proctor	Through full depth of trench
Outside defined areas:	
90.0% of one-mould	Through full depth of trench

g) Compact imported granular backfill material to a minimum density of 98% Standard Proctor. Imported granular backfill to be used in travelled areas.

h) Compact using approved mechanical tamping devices, or by hand tamping to achieve specified compaction.

3.2.3.7 TEST FREQUENCY

a) Trench greater than 15 m in length: A minimum of two density tests per 600 mm of trench depth per 100 m of trench length. The tests shall be representative of the entire length of trench backfill, including around catch basins, manholes, valves and service connections. The Engineer or a qualified geotechnical representative may require additional testing as deemed necessary.
b) Trench 15 m or less in length: A minimum of 3 density tests evenly spaced through the depth and length of the trench or as directed by the Engineer.
c) If a density test result is less than the required density, that test result is discarded and 3 retests shall be performed on the area represented by the failed test. The average of the 3 retests shall represent the density of that area. If this average is less than the required density, the area shall be reworked to the full depth of the lift, and the soil moisture altered as necessary and re-compacted to the required density. If the area is not retested but is reworked and re-compacted, the area shall be tested at the normal testing frequencies.

3.2.3.8 RESTORATION

a) Replace topsoil as directed by the Engineer.
b) Restore travelled areas to the pavement or concrete structure shown on the contract drawings.
c) Clean and reinstate areas affected by work as directed.

3.3 Water

a) This section specifies requirements for supplying and installing pressure watermain pipe and appurtenances.

3.3.1 General

3.3.1.1 SCHEDULING OF WORK

a) Schedule work to minimize interruptions to existing services.
b) Submit schedule of expected interruptions for approval by Engineer to adhere to interruption schedule as approved by the Engineer.
c) Notify Engineer a minimum of 24 hours in advance of any interruption in service.
d) Do not interrupt water service for more than 3 hours and confine this period between 10:00 and 16:00 hours local time unless otherwise authorized.
e) Notify fire department of any planned or accidental interruption of water supply to hydrants.

3.3.2 Materials

3.3.2.1 PIPE AND FITTINGS

a) All polyvinyl chloride pressure pipe and 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. Clean reworked material generated from the manufacturer’s own pipe production may be used. PVC water pipe shall be coloured blue and shall utilize integral bell gasket joints. Pipe to be delivered in 6 m nominal lengths.
b) PVC Class Pipe and Fittings: To AWWA C900, pressure class 150 (DR18), for 100 mm through 300 mm diameter. To AWWA C905, pressure rating 165 (DR25) for greater than 300 mm diameter.
c) PVC Series Pipe is to be designed for a pressure rating of 1620 kPa (235psi) and shall be designated DR18 with cast iron outside diameters. The pipe shall be hydrostatic proof tested at 2760 kPa (400psi). Fittings to AWWA C907, CSA B137.3, and designed for a pressure of 1620 kPa.

d) PVC moulded fittings to CSA B137.2 Class 150.
e) All PE/HDPE pipe shall conform to AWWA C906 and shall have a dimension ratio (DR) of 11, unless otherwise specified.
f) Fittings shall be attached using only heat fusion welding or suitable mechanical connections.
g) Cast iron fittings from 75 mm to 1200 mm in diameter shall conform to the following specifications: ASTM A48, Class 30B and AWWA C 110/A21.10. Fittings shall be supplied with bell and spigot joints complete with rubber gaskets, to conform to the following specifications: AWWA C 111/A21.11. Cast iron fittings shall be encased in polyethylene in accordance with AWWA C 105.
h) Cast Ductile Iron Couplings: to be Robar couplings or approved equal, complete with stainless steel nuts and bolts, compatible with outside diameters of pipes to be coupled in locations approved by the Engineer. All couplings to be wrapped with densotape after installation.
i) All sub surface bolted connections in contact with the soil shall be made using stainless steel nuts and bolts and shall be wrapped in densotape (i.e., hydrants, valves, dresser couplings, etc.). Bolts and nuts shall be of ANSI type 304 stainless steel.
j) Thrust blocking shall be concrete having a minimum compressive strength of 20mPa at 28 days. Concrete shall be made using Type 50 sulphate resisting cement.

3.3.2.2 VALVES AND VALVE BOXES

a) Gate valves: to AWWA C509, standard iron body, resilient seated, bronze mounted wedge valves with non-rising stems, and screw type valve casing, suitable for 1035 kPa with suitable connection joints.
b) Valves to open counter clockwise.
c) Cast iron valve boxes: bituminous coated three piece sliding type adjustable over a minimum of 450 mm complete with valve operating extension rod, 25 x 25 mm cross section, of such length that when set on valve operating 50 mm nut top of rod will not be more than 150mm below cover complete with a stone catcher flange. Base to be large round type with minimum diameter of 300 mm. Top of box to be marked "WATER".

3.3.2.3 SERVICE CONNECTIONS

a) Copper tubing to AWWA C800, Type K, ASTM B88.
b) PEXa AWWA C 904, ASTM F876, CSA B137.5, NSF 14, NSF 61 and PPI TR-4.
c) PEX-AL-PEX, ASTM-F1281 and CAN/CSA-B137.10.
d) Copper pipe joints: to be of compression type suitable for 1035 kPa working pressure.
e) Service Connections:

   (i) Bronze saddle or stainless steel Type 304 saddle.
   (ii) Type 304 stainless steel strap and nuts.
   (iii) Single strap saddle for services 25 mm and less.
   (iv) Double strap saddle for services greater than 25 mm.

f) Brass corporation stops: red brass to ASTM B62 compression type having threads to AWWA C800.
g) Brass inverted key type curb stops: red brass to ASTM B62 compression type. Curb stops to have adjustable bituminous coated cast iron service box with stem to suit depth of bury. Top of cast iron box marked "WATER".

3.3.2.4 HYDRANTS

a) Hydrants shall be of the same type and make as presently used by the Town.
b) Contractor shall confirm type, make and outlet requirements with Engineer.
c) Hydrants: Conform to AWWA 502 and/or AWWA 503; designed for working pressure of 1035 kPa with two 65 mm threaded hose outlets, 100 mm pumper outlet, 150 mm riser barrel, 125 mm bottom valve and 150 mm connection for main. Hydrants to open counter clockwise, threads to local standard. Depth of bury as indicated on the drawings.
d) Provide key operated gate valve located 1 m from hydrant.

e) Hydrants shall be painted to conform with the current hydrant painting scheme of the Town.
f) If hydrants are installed in a high groundwater table area, where hydrants are unable to drain unassisted, then the drain holes shall be plugged.

3.3.2.5 PIPE BEDDING MATERIALS

a) Granular material:

(i) Gradation to be within specified limits when tested to ASTM C136 (AASHTO T11 and T27) and giving a smooth curve without sharp breaks when plotted on a semi log grading chart.
(ii) Bedding Sand:

– Natural sand or crushed rock screenings to following grading requirements:

Sieve Size	Percent Passing
10.0 mm	100
5.0 mm	50 - 100
2.0 mm	30 - 90
0.40 mm	10 - 50
0.08 mm	0 - 10

(iii) Bedding Stone: crushed stone or crushed gravel to following grading requirements:

Sieve Size	Percent Passing
20.0 mm	100
16.0 mm	75 - 100
12.5 mm	65 - 90
5.0 mm	35 - 55
2.0 mm	0

3.3.2.6 PIPE DISINFECTION

a) Sodium hypochlorite, calcium hypochlorite or liquid chlorine to AWWA B300 or AWWA B301 to disinfect watermains.

3.3.2.7 CATHODIC PROTECTION

a) Provide cathodic protection for steel, cast iron and ductile iron materials as required by municipal standards.

3.3.3 Installation

3.3.3.1 PREPARATION

a) Notify all consumers in writing at least 24 hours prior to any anticipated interruptions in their water service. Where possible, schedule interruptions to occur in non-peak hours. If interruption is to last longer than 8 hours, provide temporary water service to each house via the use of surface hoses connected to outside taps of each house.
b) Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.

3.3.3.2 TRENCHING AND BACKFILL

a) Trench depth to provide minimum cover over pipe as indicated.
b) Trench alignment and depth require Engineer's approval prior to placing bedding material or pipe.

c) Do not backfill trenches until installed work has been checked and accepted by the Engineer.

3.3.3.3 GRANULAR BEDDING

a) Place granular bedding materials to details indicated or directed.
b) Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. Do not use blocks when bedding pipe.
c) Shape transverse depressions in bedding as required to make joints.
d) Compact full width of bed to a minimum density of 95% Standard Proctor.
e) Place crushed stone instead of sand bedding material when directed.
f) Fill any excavation below level of bottom of specified bedding with crushed stone and compact.

3.3.3.4 PIPE INSTALLATION

a) Lay and join PVC pipes to AWWA Manual of Practice M23 and manufacturer's standard instructions and specifications. Lay and join PE/HDPE pipes to AWWA M55 and in accordance with Plastics Pipe Institute Handbook of Polyethylene Pipe.
b) Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
c) Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not in true alignment or grade or pipe which shows undue settlement after installation.
d) Face socket ends of pipe in direction of laying. For mains on a grade of 2% or greater, face socket ends up grade.
e) Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
f) Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
g) Position and join pipes with approved equipment. Do not use excavating equipment to force pipe sections together.
h) Cut pipes as required for specials, fittings or closure pieces, in a neat manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe.
i) Align pipes carefully before jointing.
j) Apply approved joint lubricant to male (spigot) end only as per manufacturer's recommendations. Any taste or odour problems, which may occur due to the over-application of lubricant will be the Contractor’s responsibility to resolve. Action required may include high velocity flushing, pigging of lines or total removal and replacement depending upon the severity of the problem.
k) Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
l) Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, and replaced before jointing is attempted again.
m) Complete each joint before laying next length of pipe.
n) Minimize deflection after joint has been made.
o) Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
p) Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by the Engineer.
q) When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
r) Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
s) Do not lay pipe on frozen bedding.
t) Protect hydrants, valves and appurtenances from freezing.

u) Upon completion of pipe laying and after the Engineer has inspected work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated or directed.
v) Hand place granular material in uniform layers not exceeding 150 mm thick to minimum 300 mm over top of pipe. Dumping of material directly on top of pipe is not permitted.
w) Place layers uniformly and simultaneously on each side of pipe to prevent lateral displacement of pipe.
x) Compact each layer to a minimum density of 95% Standard Proctor.

3.3.3.5 VALVE INSTALLATION

a) Install valves to manufacturer's recommendations at locations indicated.
b) Support valves located in valve boxes or valve chambers by means of either concrete or treated wood blocks, located between valve and solid ground. Valves shall not be supported by pipe.

3.3.3.6 SERVICE CONNECTIONS

a) Building water service to terminate at property line opposite point of connection to main. Install coupling necessary for connection to building plumbing. If plumbing is already installed, make connection, otherwise cap or seal end of pipe and place temporary marker to locate pipe end.
b) Do not install service connections until satisfactory completion of hydrostatic and leakage tests of water main.
c) Construct service connections at right angles to watermain unless otherwise directed. Locate curb stops 300 mm inside right of way.
d) Tappings on PVC pipe to be PVC valve tees.
e) Tappings for PE pipe shall be PE tapping tees or multi saddle tees.
f) Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.
g) Tap main at 2:00 o'clock or 10:00 o'clock position only; not closer to a joint nor closer to adjacent service connections than recommended by manufacturer, or 1 m, whichever is greater.
h) Leave corporation stop valves fully open.
i) In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position. Service to be "snaked" in trench.
j) Install rigid stainless steel liners in small diameter plastic pipes with compression fittings.
k) Install curb stop with corporation box on services 50 mm or less in diameter. Equip larger services with a gate valve and cast iron box. Set box plumb over stop and adjust top flush with final grade elevation. Leave curb stop valves fully closed.
l) Place temporary location marker at ends of plugged or capped unconnected water lines. Each marker to consist of a 50 x 100 mm stake extending from pipe end at pipe level to 1 metre above grade. Paint exposed portion of stake red with designation "WATER SERVICE LINE" in black.

3.3.3.7 HYDRANTS

a) Install hydrants at locations indicated or directed.
b) Install hydrants in accordance with AWWA Manual of Practice M 17.
c) Install 150 mm gate valve and cast iron valve box on hydrant service leads as indicated.
d) Set hydrants plumb, with hose outlets parallel with edge of pavement or curb line, with pumper connection facing roadway and with body flange set at elevation of 50 mm above final grade.
e) Place concrete thrust blocks as indicated and specified ensuring that drain holes are unobstructed.
f) To provide proper draining for each hydrant, excavate a pit measuring not less than 1 x 1 x 0.5 m deep and backfill with coarse gravel or crushed stone to a level 150 mm above drain holes.
g) Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.

3.3.3.8 THRUST BLOCKS

a) Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated on the drawings or as directed by Engineer.
b) Keep joints and couplings free of concrete.
c) Do not backfill over concrete within 24h after placing.

3.3.3.9 HYDROSTATIC AND LEAKAGE TESTING

a) Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
b) Notify Engineer at least 24h in advance of all proposed tests. Perform tests in presence of Engineer.
c) Where any section of system is provided with concrete thrust blocks, do not conduct tests until at least 7 days after placing concrete or 3 days if high early strength concrete is used.
d) Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by the Engineer.
e) Before testing, bed and cover pipe in accordance with paragraph 3.4 to prevent movement or snaking of pipe line when test pressure is applied.
f) Test procedure for PVC Pipe is as follows:

(i) Open valves.
(ii) Expel air from main by slowly filling main with potable water. Install corporation stops at high points in main where no air vacuum release valves are installed. Remove stops after satisfactory completion of test and seal holes with plugs.
(iii) Apply hydrostatic test pressure of 1035 kPa or 1.5 times the normal operating pressure based on elevation of lowest point in main and corrected to elevation of test gauge, for a period of two hours.
(iv) Define leakage as amount of water supplied in order to maintain test pressure for 2 hours.
(v) Do not exceed allowable leakage as defined in AWWA C600 82 using the following formula (See Section 3.8 for Water Pressure and Leakage Test Calculations form):

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

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

g) Test procedure for HDPE pipe is as follows:

(i) Pressure pipe section to 1.5 times pressure class. Vent and bleed-off trapped air as needed.
(ii) Initial Expansion: Maintain 1.5 times pressure class for 4 hours. Add water as needed (not measured).
(iii) Begin Test: Reduce 10psi (70 kPa) below 1.5 times pressure class. Monitor pressure for 1 hour.
(iv) The pipe is acceptable if the pressure drop over 1 hour is 5% or less.

h) Locate and repair defects if leakage is greater than amount specified.
i) Repeat test until leakage is within specified allowance for full length of watermain.

3.3.3.10 FLUSHING AND DISINFECTING

a) The Engineer shall witness flushing and disinfecting operations. Notify the Engineer at least 4 days in advance of proposed date when disinfecting operations will commence.

b) Flush watermains through available outlets with a sufficient flow to produce a velocity of 0.8 mls, within pipe for 10 min, or until foreign materials have been removed and flushed water is clear.
c) Flushing flows shall be as follows:

Pipe Size (mm)	Flow (L/s) Minimum
150 and below	13
200	26
250	38
300	57
450	100

d) Provide connections and pumps as required.
e) Open and close valves, hydrants and service connections to ensure thorough flushing.
f) When flushing has been completed to satisfaction of the Engineer, introduce a strong solution of chlorine into watermain and ensure that it is distributed throughout entire system.
g) Disinfect watermains to AWWA C651.
h) A standard disinfection procedure consists of:

(i) Preventing contaminating materials from entering the watermain during storage, construction, or repair.
(ii) Removing, by flushing and other means, those materials that may have entered the watermain.
(iii) Chlorinating any residual contamination that may remain, and flushing the chlorinated water from the main.
(iv) Determining the bacteriological quality by laboratory test after disinfection

i) Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.
j) After adequate chlorine residual not less than 50 ppm has been obtained, leave system charged with chlorine solution for 24h. Further samples shall be taken to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.
k) Upon acceptance of disinfection by the Engineer, flush the entire system with distribution water until all chlorinated water has been expelled.

3.3.3.11 BACTERIOLOGICAL TESTS

a) Refer to AWWA C651, Section 7.1 with additional requirements for the minimum acceptable bacterial level as follows:

(i) A sample must show the absence of coliform organisms; and
(ii) The total bacteria count shall not be greater than 300 organisms per millilitre.

b) If 1 to 10 coliform organisms are detected in the initial sampling, then the site should be resampled. If the presence of coliforms is confirmed, the disinfection and bacteriological sampling procedures shall be repeated.
c) If there are 10 or more coliform organisms and/or the total bacteria count is greater than 300, the disinfection and bacteriological sampling procedure shall be repeated.

It shall be the responsibility of the Contractor to ensure water from newly constructed watermains will not be used for drinking or other domestic purposes until the mains have been disinfected, samples have been taken and certified by an approved laboratory as being free from bacterial contamination and approval is obtained from the Local Board of Health and the Engineer.

3.4 Sanitary Sewers

3.4.1 General

This section specifies requirements for supplying and installing gravity sanitary sewer pipe and service connections.

3.4.1.1 SCHEDULING OF WORK

a) Schedule work to minimize interruptions to existing services.
b) Maintain existing sewage flows during construction.
c) Submit schedule of expected interruptions for approval and adhere to approved schedule.

3.4.2 Materials

3.4.2.1 CONCRETE PIPE

a) Reinforced circular concrete pipe: CAN/CSA-A257.2 and designed for flexible rubber gasket joints.
b) Rubber gaskets to be confined "O" ring and shall meet the specification of ASTM C443.

3.4.2.2 PLASTIC PIPE

a) Type PSM Poly (Vinyl Chloride) to CSA-B182.2.
b) Standard Dimensional Ratio (SDR) 35, unless indicated otherwise on the drawings.
c) Separate gasket and integral bell system.
d) All joints to meet the requirements of Specification for Joints for Drain and Sewer Plastic Pipes using Flexible Elastromeric Seals (ASTM D3212).
e) Nominal lengths: 6 m.

3.4.2.3 SERVICE CONNECTIONS

a) Plastic pipe to CSA B182.1-M with push on joints.
b) Plastic service saddles and tees.
c) All clamps and/or metal fasteners to be stainless steel.

3.4.2.4 CEMENT MORTAR

a) Portland cement: to CAN 3- 5-M Sulfate resistant (Type 50).
b) Mix mortar one part by volume of cement to two parts of clean, sharp sand mixed dry. Add only sufficient water after mixing to give optimum consistency for placement. Do not use additives.

3.4.2.5 PIPE BEDDING MATERIALS

a) Granular materials, general.

    (i) Gradation shall be within specified limits when tested to ASTM C136 and ASTM C117 (AASHTO T11 and T27) and giving a smooth curve without sharp breaks when plotted on a semi log grading chart.

b) Bedding Sand:
c) Natural sand or crushed rock screenings to following grading requirements:

Sieve Size	Percent Passing
10.0 mm	100
5.0 mm	50 - 100
2.0 mm	30 - 90
0.40 mm	10 - 50
0.08 mm	0 - 10

d) Bedding Stone: crushed stone or crushed gravel to following grading requirements:

Sieve Size	Percent Passing
20.0 mm	100
16.0 mm	75 - 100
12.5 mm	65 - 90
5.0 mm	35 - 55
2.0 mm	0

e) Concrete required for cradles, encasement, supports; 20 mPa sulfate resistant (Type 50) concrete.

3.4.2.6 INSULATION

a) If required in locations as shown on the drawings, the pipe shall be field insulated with extruded polystyrene board, Type HI 60 or approved equal as detailed.

3.4.3 Installation

3.4.3.1 PREPARATION

a) Clean pipes and fittings of debris and water before installation. Inspect materials for defects before installing. Remove defective materials from site.

3.4.3.2 TRENCHING AND BACKFILL

a) Trench line and depth require approval prior to placing bedding material and pipe.
b) Do not backfill trenches until pipe grade and alignment have been checked and accepted.

3.4.3.3 GRANULAR BEDDING

a) Place granular bedding materials in accordance with details indicated or directed.
b) Shape bed true to grade and to provide continuous, uniform bearing surface for barrel of pipe. Do not use blocks when bedding pipe.
c) Shape transverse depressions as required to receive bell if bell and spigot pipe is used.
d) Compact full width of bed to at least 95% Standard Proctor Density.
e) Use bedding stone in lieu of sand bedding material when directed. Use filter cloth to separate sand and bedding stone.
f) Fill excavation below bottom of specified bedding adjacent to manholes or structures with bedding material.

3.4.3.4 PIPES

a) Lay and join pipes in accordance with manufacturer's recommendations.
b) Handle pipe with approved equipment. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends.
c) Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

d) Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
e) Do not exceed maximum joint deflection recommended by pipe manufacturer.
f) Do not allow water to flow through pipe during construction, except as may be permitted by the Engineer.
g) Whenever work is suspended, install a removable water tight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
h) Position and join pipes by approved methods. Do not use excavating equipment to force pipe sections together.
i) Pipe Jointing:

(i) Install gaskets in accordance with manufacturer's recommendations.
(ii) Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
(iii) Align pipes carefully before joining.
(iv) Maintain pipe joints free from mud, silt, gravel and other foreign material.
(v) Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.
(vi) Complete each joint before laying next length of pipe.
(vii) Minimize joint deflection after joint has been made to avoid joint damage.
(viii) At rigid structures, install pipe joints not more than 1.2 m from side of structure.
(ix) Apply sufficient pressure in making joints to ensure joint is complete as outlined in manufacturer's recommendations.

j) Block pipes as directed when any stoppage of work occurs to prevent creep during downtime.
k) Plug lifting holes with approved prefabricated plugs set in non shrink grout.
l) Cut pipes as required for special inserts, fittings or closure pieces neatly, as recommended by pipe manufacturer without damaging pipe or its coating, leaving a smooth end at right angles to axis of pipe.
m) Make watertight connections to manholes. Use non shrink grout when suitable gaskets are not available.
n) Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes. Joint of saddle to pipe shall be structurally sound and watertight.
o) Upon completion of pipe laying and after the Engineer has inspected pipe joints, place specified granular material to dimensions indicated or directed.
p) Backfill remainder of trench.

3.4.3.5 SERVICE CONNECTIONS

a) Install pipe to CSA B182.11 and manufacturer's standard instructions and specifications.
b) Service connections to main sewer to be Engineer approved saddles or tees. Do not use break in and mortar patch type joints.
c) Service connection pipe shall not extend into interior of main sewer.
d) Make up required horizontal and vertical bends from 45° bends or less, separated by a straight section of pipe with a minimum length of four pipe diameters. Use long sweep bends where applicable.
e) Plug service laterals with watertight caps or plugs as approved.
f) Place location marker at ends of plugged or capped unconnected sewer lines. Each marker shall consist of a 50 x 100 mm stake extending from pipe end at pipe level to 1.0 m above grade. Paint exposed portion of stake red with designation SAN SWR LINE in black.

3.4.3.6 FIELD TESTING

a) Repair or replace pipe, pipe joint or bedding found defective.

b) When directed by the Engineer, draw a tapered wooden plug with a diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction. Use a plug 95% of inside diameter in PVC pipe test.
c) Remove foreign material from sewers and related appurtenances by flushing with water.
d) Perform infiltration and exfiltration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.
e) Do infiltration and exfiltration testing as directed. Perform tests in the presence of Engineer. Notify the Engineer 24 hours in advance of proposed tests.
f) Perform tests on each section of sewer between successive manholes, including service connections.
g) Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.
h) Exfiltration test:

    (i) Fill test section with water in such a manner as to allow displacement of air in line. Maintain under nominal head for 24 hours to ensure absorption in pipe wall is complete before test measurements are commenced.
    (ii) Immediately prior to test period, add water to pipeline until there is a head of 1 m over interior crown of pipe measured at highest point of test section or water in manhole is 1 m above static groundwater level, whichever is greater.
    (iii) Duration of exfiltration test shall be two hours.
    (iv) Water loss at the end of test period shall not exceed maximum allowable exfiltration over any section of pipe between manholes.

i) Infiltration test:

    (i) Conduct infiltration test in lieu of exfiltration test where static groundwater level is 750 mm or more above top of pipe measured at highest point in line to be used.
    (ii) Do not interpolate a head greater than 750 mm to obtain an increase in allowable infiltration rate.
    (iii) Install a watertight plug at upstream end of pipeline test section.
    (iv) Discontinue pumping operations for at least 3 days before test measurements are to commence and during this time, keep at least one third of pipe invert perimeter thoroughly wet.
    (v) Prevent damage to pipe and bedding material due to flotation and erosion.
    (vi) Place a 90° V notch weir, or other measuring device approved by the Engineer in invert of sewer at each manhole.
    (vii) Measure rate of flow over a minimum of 1 hour, with recorded flows for each 5-minute interval.

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

Nominal Pipe Diameter in mm	PVC Pipe	Concrete Pipe
100	2.08	8.33
125	2.60	10.42
150	3.13	12.50
200	4.17	16.67
250	5.21	20.83
300	6.25	25.00
350	7.29	29.17
400	8.33	33.33
450	9.38	37.50
500	10.42	41.67
550	11.46	45.83
600	12.50	50.00
700	14.58	58.33
800	16.67	66.67
900	18.75	75.00
1000	20.83	83.33
1100	22.92	91.67
1200	25.00	100.00

Values shown in columns 2 and 3 are in litres per hour per 100 metres of pipe. These limits are based upon the following:

- 20 L per day per mm diameter per 1 km concrete pipe
- 5 L per day per mm diameter per 1 km PVC pipe

k) Repair and retest sewer line as required, until test results are within limits specified.
l) Repair visible leaks regardless of test results.
m) Television and photographic inspections shall be performed prior to CCC and FAC:

(i) Perform a high definition camera survey of the installed sewers.
(ii) Provide a video copy of the survey to the Engineer conforming to the following:

– USB format.
– Running audio commentary of each pipe run.
– Written report and still photos of problem areas.

n) Repair any problem areas revealed by camera survey.

3.5 Stormwater Sewers

3.5.1 General

This section specifies the requirements for supplying and installing storm sewer pipe.

3.5.1.1 SCHEDULING OF WORK

a) Schedule work to minimize interruptions to existing services.
b) Maintain existing flow during construction.
c) Submit schedule of expected interruptions to the Engineer for approval and adhere to approved schedule.

3.5.2 Materials

3.5.2.1 CONCRETE PIPE

a) Sulfate resistant (Type 50) pipe.
b) Non-reinforced circular concrete pipe and fittings: to CAN/CSA – A257.1 (M92 (Class 3) and designed for flexible rubber gasket joints to CAN/CASA – A257.3 (M92).
c) Reinforced circular concrete pipe and fittings: to CAN/CSA-A 257.2 and designed for flexible rubber gasket joints to CAN/CSA-A 257.3 (M92).
d) Lifting holes:

(i) Pipe 900 mm and less in diameter; no lift holes.
(ii) Pipe greater than 900 mm in diameter; lift holes not to exceed two in a piece of pipe.
(iii) Provide prefabricated plugs to effectively seal lift holes after installation of pipe.

3.5.2.2 PLASTIC PIPE

a) Type PSM Poly (Vinyl Chloride) to ASTM D3034 and CSA B182.2.

(i) Standard Dimensional Ratio (SDR) 35, unless indicated otherwise on the drawings.
(ii) Separate gasket and integral bell system.
(iii) All joints to meet the requirements of Specification for Joints for Drain and Sewer Plastic Pipes using Flexible Elastromeric Seals (ASTM 03212).
(iv) Nominal lengths, 4 or 6 m.

b) PVC Profile Wall

(i) Extruded seamless pipe conforming to ASTM D1784 and CSA B182.4.
(ii) Separate gasket and integral bell system
(iii) All joints to meet the requirements of Specification for Joints for Drain and Sewer Plastic Pipes using Flexible Elastromeric Seals (ASTM 03212).
(iv) Approved Pipe: Ultra-Rib manufactured by IPEX.
(v) Transition Fitting: required to connect to manholes shall be considered incidental to supply and installation of profile wall PVC pipe.

3.5.2.3 PIPE BEDDING MATERIALS

a) Granular material:

(i) Gradation to within specified limits when tested to ASTM C136 and ASTM C117 and giving smooth curve without sharp breaks when plotted on semi log grading chart.

b) Bedding Sand:

(i) Natural sand or crushed rock screenings to following grading requirements:

CAN/C6SB-8.2-M	Percent Passing
10.0 mm	100
2.5 mm	80 min
0.63 mm	60 max
0.34 mm	30 max
0.15 mm	20 max
0.073 mm	15 max

(ii) Liquid Limit: ASTM D423 Maximum 25.

(iii) Plasticity Index: ASTM D424 Maximum 6.

c) Coarse Granular:

Sieve Size	Percent Passing
25 mm	100
20 mm	95 - 100
10 mm	60 – 80
5 mm	40 – 60
2.5 mm	28 – 48
0.63 mm	13 – 29
0.34 mm	9 – 21
0.15 mm	6 – 15
0.075	4 - 10

d) Washed Rock:

Sieve Size	Percent Passing
25.00 mm	100
5.00 mm	10 max
0.08 mm	2 max

3.5.2.4 CEMENT MORTAR

a) Concrete required for cradles, encasement, supports; 20 MPa Sulfate resistant (Type 50).
b) Portland cement: to CAN3 A5 M Sulfate resistant (Type 50).
c) Mortar to consist of one part Portland cement to two parts clean, sharp sand mixed with minimum amount of water to obtain optimum consistency for use intended. Do not use additives.

3.5.2.5 GASKETS

a) Rubber gaskets for joints as recommended by pipe manufacturer and to CSA A257.3 (ASTM C443). Gaskets for concrete sewer pipe shall be rubber, double finned gaskets conforming to ASTM Designation C443. "Tylox CR" gaskets have prior approval.

3.5.3 Installation

3.5.3.1 PREPARATION

a) Clean pipes and fittings of debris and water before installation. Carefully inspect materials for defects before installing. Remove defective materials from site.

3.5.3.2 TRENCHING AND BACKFILLING

a) Trench line and depth require approval prior to placing bedding material and pipe.

3.5.3.3 CONCRETE BEDDING AND ENCASEMENT

a) Place concrete to details indicated or directed.
b) Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.
c) Do not backfill over concrete within 24 hours after placing.

3.5.3.4 GRANULAR BEDDING

a) Place granular bedding materials to details indicated or directed.
b) Shape bed true to grade and to provide continuous, uniform bearing surface for barrel of pipe. Do not use blocks when bedding pipe.
c) Shape transverse depressions as required to receive bell if bell and spigot pipe is used.
d) Compact full width of bed to a minimum density of 95% Standard Proctor.
e) Use washed rock in lieu of sand bedding material when directed.
f) Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with bedding material or common backfill as directed.

3.5.3.5 SOIL BEDDING

a) Where granular bedding material is not indicated, shape trench bottom so that pipe is fully supported over lower quarter of pipe circumference on undisturbed subgrade.
b) Where trench bottom is rock and no bedding is indicated, lay pipe on a 150 mm cushion of granular material or approved bedding.

3.5.3.6 PIPES

a) Lay and join pipe in accordance with manufacturer's recommendations.
b) Handle pipe by approved methods. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
c) Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
d) Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
e) Do not exceed maximum joint deflection recommended by pipe manufacturer.
f) Do not allow water to flow through pipes during construction except as may be permitted by the Engineer.
g) Whenever work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
h) Position and join pipes by approved methods. Do not use excavating equipment to force pipe sections together.
i) Pipe Jointing:

    (i) Install gaskets as recommended by the manufacturer.
    (ii) Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
    (iii) Align pipes carefully before joining.
    (iv) Maintain pipe joints free from mud, silt, gravel and other foreign material.
    (v) Avoid displacing gasket or contaminating with dirt or other foreign material. Remove disturbed or dirty gaskets; clean, lubricate and replace before joining is attempted.
    (vi) Complete each joint before laying next length of pipe.
    (vii) Minimize joint deflection after joint has been made to avoid joint damage.
    (viii) Apply sufficient pressure in making joints to ensure joint is complete as outlined in manufacturer's recommendations.

j) When any stoppage of work occurs, block pipes as directed to prevent "creep" during downtime.
k) Plug lifting holes with approved prefabricated plugs set in non shrink grout.
l) Cut pipes as required for special inserts, fittings or closure pieces neatly, as recommended by pipe manufacturer without damaging pipe or its coating, leaving a smooth end at right angles to axis of pipe.
m) Make watertight connections to manholes and catch basins. Use non shrink grout when suitable gaskets are not available.
n) Television and photographic inspections:

    (i) Perform a high definition camera survey of the installed sewers prior to CCC and FAC.

(ii) Provide a video copy of the survey to the Engineer conforming to the following:

- USB format
- Running audio commentary of each pipe run.
- Written report and still photos of problem areas.

o) Repair any problem areas revealed by camera survey.
p) Perform leakage tests on each section of sewer between successive manholes, including service connections per the Town's construction specifications requirements.
q) Repair and retest sewer line as required, as directed by the Engineer until test results are acceptable.

3.6 Corrugated Steel Pipe Culverts

3.6.1 General

This section specifies the requirements for supplying and installing corrugated steel pipe culverts.

3.6.2 Materials

3.6.2.1 CORRUGATED STEEL PIPE

a) Corrugated steel pipe: to CSPI-501 Metric (Interim) Structural Plate Pipe, and CSA G401.
b) Couplers: H330 or H500 Hugger Band or equal c/w O-ring gaskets for storm sewer installations Standard Annular Corrugated Coupler for culvert installations.
c) Prefabricated end sections as indicated.

3.6.3 Installation

3.6.3.1 TRENCHING AND BACKFILL

a) Trench line and depth require Engineer's approval prior to placing bedding material or pipe.
b) Do not backfill until pipe grade and alignment checked and accepted by the Engineer.

3.6.3.2 BEDDING

a) Excavation for the culvert base shall be to a depth of not less than 0.3 m below the culvert invert elevation, as established by the Engineer, and shall be of sufficient width to permit assembly of the pipe and the operation of compaction equipment on either side of the pipe. All soft, yielding, or unsuitable material at this level shall be removed to a depth as directed by the Engineer and replaced with granular or other acceptable material to provide a firm foundation of uniform density throughout the entire length of the pipe. The Contractor shall compact the exposed surface to a uniform density. The Contractor shall then construct and thoroughly compact the culvert bed to the established elevation using granular or other material acceptable to the Engineer. The width of the culvert bed shall be the culvert diameter +0.45m.
b) Where gravel bedding or backfill is used, impervious, compacted clay cut-offs shall be constructed at both ends of the culvert MSD 35.

3.6.3.3 LAYING CORRUGATED STEEL PIPE CULVERTS

a) Commence pipe placing at downstream end.
b) Lay pipe with outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.
c) Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.

d) Place pipe surround material in maximum 150 mm lifts and compact to minimum density of 95% Standard Proctor. Material adjacent to "haunches" of pipe to be compacted using a hand tamper or a small diameter mechanical tamper approved by the Engineer.
e) Do not allow water to flow through pipes during construction except as permitted by the Engineer.

3.6.3.4 JOINTS: CORRUGATED STEEL CULVERTS

a) Corrugated steel pipe:

(i) Match corrugations or indentations of coupler with pipe sections before tightening.
(ii) Tap couplers firmly as they are being tightened, to take up slack and ensure a snug fit.
(iii) Insert and tighten bolts.

b) Structural plate:

(i) Erect in final position by connecting plates with bolts at longitudinal and circumferential seams.
(ii) Drift pins may be used to facilitate matching of holes.
(iii) Place plates in sequence recommended by manufacturer with joints staggered so that not more than three plates come together at any one point.
(iv) Draw bolts up tight, without overstress, before beginning backfill.
(v) Repair spots where damage has occurred to spelter coating by applying two coats of approved asphalt paint or two coats of zinc rich epoxy paint.

3.6.3.5 PROTECTION

(i) Do not allow construction or other traffic over pipe until protective fill is placed.

3.7 Manholes and Catchbasins

3.7.1 General

This section specifies the requirements for the supply and installation of manholes, catch basins and sewer appurtenances.

3.7.1.1 MATERIALS

a) Concrete:

(i) Cement: to CAN3 A5, Sulfate resistant (Type 50).
(ii) Concrete mix design to produce minimum compressive strength of 25 MPa at 28 days and containing 25 mm maximum size coarse aggregate, with water/cement ratio to CAN3 A23.1, table 7 for class A exposure and 150 mm slump at time and point of deposit. Air entrainment to CAN3 A23.1, table 8 for class A exposure.

b) Precast manhole sections: to ASTM C478, circular. Top sections eccentric cone or flat slab top type with opening offset for vertical ladder installation. Monolithic bases to be approved by the Engineer.
c) Precast catch basin sections: to ASTM C139, ASTM C478.
d) Sanitary manhole sections shall have confined "O" ring joints and rubber gaskets meeting requirements of CSA A257.3 and ASTM C443.
e) Storm manholes and catch basin sections shall be made watertight utilizing cement mortar or approved sealant.
f) Manhole and catch basin pipe connection joints to be made watertight using cement mortar as shown on the detailed drawings.
g) Mortar:

(i) Aggregate: to CSA A82.56.
(ii) Cement: to CAN3 A8, Sulfate resistant (Type 50).

h) Manhole ladder rungs: 20 mm diameter galvanized preformed steel rungs (drop step type).
i) Adjusting rings: to ASTM C478. Maximum of three rings on any manhole or catch basin.
j) Concrete brick: to CSA A165.2. Maximum of 200 mm of brick on any manhole or catch basin.
k) Frames, gratings, covers to plan dimensions and following requirements:

(i) Metal gratings and covers to bear evenly on frames. A frame with grating or cover to constitute one unit. Assemble and mark unit components before shipment.
(ii) Gray iron castings to ASTM A48 strength class 30B.
(iii) Castings to be sand blasted or cleaned and ground to eliminate surface imperfections.

l) Safety Platforms shall consist of 2-piece removable aluminum grates supported on aluminum frames designed to fit in the standard manhole joint.

3.7.2 Installation

3.7.2.1 EXCAVATION AND BACKFILL

a) Obtain approval by the Engineer before installing manholes or catch basins.

3.7.2.2 MANHOLE AND CATCHBASIN INSTALLATION

a) Construct units to details indicated, plumb and true to alignment and grade.
b) Complete units as pipe laying progresses. Maximum of three units behind point of pipe laying will be allowed.
c) Pump excavation free of standing water and remove soft and foreign material before placing concrete base.
d) Cast bottom slabs directly on undisturbed ground or when permitted by Engineer, set precast concrete base on a minimum of 30 – 100 mm granular material, compacted to a minimum density of 95% Standard Proctor.
e) For Precast Units:

(i) For Storm Manholes and Catch Basins: Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base. Make each successive joint watertight with approved cement mortar or approved rubber gaskets. Clean surplus mortar from interior surface of unit as work progresses.
(ii) For Sanitary Manholes: Set bottom section and each successive section using "O" ring joints and rubber gaskets to produce a watertight joint.
(iii) Plug lifting holes with concrete plugs set in cement mortar or mastic compound.
(iv) All manholes over 7 metres in depth shall have an aluminum safety platform installed at their midpoint.

f) For all sewers:

(i) Place stub outlets and bulkheads at elevations and in positions indicated.
(ii) Bench to provide a smooth U shaped channel. Side height of channel to be 0.75 times full diameter of sewer. Slope adjacent floor at 10 to 1. Curve channels smoothly. Slope invert to establish sewer grade.

g) Installing units in existing systems:

(i) Where a new unit is to be installed in an existing run of pipe, ensure full support of existing pipe during installation, and carefully remove that portion of existing pipe to dimensions required and install new unit as specified.
(ii) Make joints watertight between new unit and existing pipe.
(iii) Where deemed expedient to maintain service around existing pipes and when systems constructed under this project are ready to be put in operation, complete installation with appropriate break outs, removals, redirection of flows, blocking unused pipes or other necessary work.

h) Set frame and cover to required elevation using 2 – 4 concrete rings to a maximum of 350mm. Make joints smooth and watertight by parging with cement mortar.
i) Recess catch basin frame and cover 10 mm below gutter elevation and 10 mm behind the face of curb.
j) Recess manhole frame and cover 5 mm below finished surface elevation.
k) Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

3.8 Municipal Open Space Specifications

3.8.1 Topsoil

a) All topsoil must be free of any stones larger than 30mm in diameter, debris, quack grass, restricted noxious weeds, any other plants and inorganic matter.
b) The Applicant shall be responsible for all appropriate soil testing. Test results must be provided to the Town for approval prior to installation, including a map that verifies the location of the topsoil source. Should that pile be exhausted and a new stockpile source is required, new testing must be provided for Town approval. Tests shall include, at minimum, results for the following:

(i) particle size;
(ii) composition (sand, silt clay);
(iii) percentage dry organic matter (OM);
(iv) pH;
(v) P, K, Mg, Z, calcium, nitrogen; and
(vi) percentage salts by conductivity.

Any chemical deficiencies indicated by the soil analysis report shall be rectified by the application of the appropriate fertilizers and additives as per recommendation supplied by the test results. Topsoil shall consist of fertile natural loam containing a maximum of 10% organic matter by dry weight, 60% sand by dry weight and 40% clay by dry weight. Topsoil shall have a hydrogen ion concentration ranging from pH 6.0 to pH 7.5, shall contain no toxic materials and shall be capable of sustaining vigorous plant growth.

If organic material is required to meet the organic matter specification for topsoil listed above, peat moss or commercial screened compost shall be added in the field and mixed with cultivation equipment. The peat moss shall meet the following specifications:

(vii) shall be free of toxic material, live plants, live roots and seeds;
(viii) shall be delivered in a pulverized condition; and
(ix) the source shall be approved prior to mixing with the topsoil.

Topsoil shall be spread over the entire area to be seeded or sodded and shall be applied to a compressed depth of no less than 150 mm for sod areas, and 150mm for seeded areas. Prior to topsoil installation, the subgrade must be inspected by the Applicant and documentation provided to the Town at time of CCC certifying that subgrade conditions were uniform, and that adequate minimum topsoil depths were installed.

Areas for planting beds shall be excavated and filled with topsoil to a depth of 600 mm below finished grade and topsoil shall be applied to a minimum compressed thickness of 100 mm above finished grade.

3.8.2 Seeding

a) Areas to be seeded (in lieu of sodding) to be approved by the Town. Approval with be granted on the basis of:

   (i) intensity of use of the area to be covered;
   (ii) quality of topsoil growing medium;
   (iii) time of year that seed will be applied;
   (iv) sun exposure of the area, as well as gradient – steeper gradients will not be approved for seed application, in most instances; and
   (v) size of the area to be covered.

b) Generally, seeding will not be considered acceptable for patchwork in an existing, established turfed area, i.e. if a developer, utility company or any third party disturbs an established turfed area, sodding, not seeding, will be considered the only acceptable remedial treatment. Seeding may be accepted in low traffic areas and for large quantities but only with the approval of the Town.
c) Grass seed shall be certified Canada #1 Grade Seed, meeting the requirements of the Seed Act of Canada. The seed is to be delivered in the original containers giving the following information:

   (i) analysis of seed mixture;
   (ii) percentage of pure seed production;
   (iii) year of seed production;
   (iv) net weight;
   (v) date when bagged and location;
   (vi) name of supplier; and
   (vii) maintenance procedures and normal mowing height.

d) The Applicant shall provide proof upon request of Certification of Compliance with the Canadian Wheat Board Act (Seeds Act). Sample seed container tags that include the seed composition is required for verification at time of CCC.
e) Guidelines for composition of Seed Mixture are as follows:

   (i) Parks / Boulevards – 55% red fescue, 20% Kentucky bluegrass, 15% annual rye, 10% Canada blue grass;
   (ii) Roadsides – 55% red fescue, 30% Kentucky bluegrass, 15% annual rye; and
   (iii) Naturalization – to be proposed on a site by site basis, depending on intended conditions, and accepted by the Town.

f) Commercially available seed blends are to be approved prior to installation. Seed must be capable of producing a minimum germination rate of 75% in a germination test.
g) A cover crop of annual rye grass to help with establishment may be used at the Applicant's discretion. Should this approach be used, the Town must be notified at time of CCC inspection.
h) All areas to be seeded shall be given a layer of topsoil as specified in these standards. Before seeding, the topsoil surface shall be brought to a firm, even but fine graded condition, without local depressions or elevations by dragging, raking, rolling or other suitable means. The degree of firmness shall be such that footprints in the prepared surface shall penetrate not less than 6 mm and not more than 12mm.
i) All pebbles, stones, roots and debris shall be removed from the finished soil surfaces.
j) The seed shall be evenly applied at a rate of not less than 4.5kg per 100 square metres. Proposed seed rates must be noted on detailed drawings. Seeding shall not be carried out in wind velocities, which may cause the seed to be blown (above 8 km per hour). After the application of the seed, the seed shall be incorporated into the soil with wire rakes or some other suitable means. After the

seeded area has been raked, the seeded area is to be rolled with a light turf roller. After seeding, the Applicant shall give the seeded area a light watering with a fine spray to a depth of not less than 25 mm to avoid washing.

k) The seeded area shall be appropriately maintained by the Applicant, i.e. watering, rolling, fertilizing, until the time of final inspection and acceptance by the Town. Appropriate maintenance shall be determined by weather conditions, soil conditions, time of year and growing condition of the seed. A two-year maintenance schedule is to be submitted to the Town for approval at the time of the CCC Inspection.

l) At the time of final inspection and acceptance by the Town, the grass shall:

(i) be mowed to a minimum height of 50 mm;
(ii) cover 100 % of the seeded area;
(iii) be completely weed free;
(iv) be completely free of thin bare and dead spots; and
(v) be in an overall healthy growing condition, satisfactory to the Town.

m) The Applicant shall be responsible for providing and maintaining adequate barricades and signs to warn traffic entering the seeded area, until the time of adequate germination to handle traffic and FAC. In areas of high traffic, temporary fencing may be required at the discretion of the Town.

3.8.3 Hydroseeding

a) Hydroseeding will be acceptable on steep slopes, in hard to reach areas and for large areas to be seeded. Areas to be hydro seeded must be approved by the Town. All areas to be hydroseeded shall be given a layer of topsoil as specified in these standards. Before seeding, the topsoil surface shall be brought to a firm, even but fine graded condition without local depressions or elevations by dragging, raking, rolling or other suitable means. The degree of firmness shall be such that footprints, in the prepared surface shall penetrate not less than 6 mm and not more than 12 mm.

b) All pebbles, stones, roots and debris shall be removed from the finished soil surface. Water used for hydraulic and wood cellulose fibre mulching shall be free of any impurities that would inhibit germination or otherwise adversely affect the growth. The material used for mulching shall be specially prepared wood cellulose fibre or an equal substitute. It shall contain no growth or germination inhibiting factors and shall form, after application, a blotter like ground cover that will allow absorption and percolation of water.

c) The tackifier shall be an approved non-asphalt product, water dilutible with no detrimental effects on germination or existing plants. Seed shall be applied evenly at a rate of not less than 4.5kg per 100 square metres. Seed type as specified in Section 9.2 - Seeding. A suitable fertilizer shall be applied at a rate of 11kg per 100 square metres, or as otherwise required resulting from soil test data. Grass seed and fertilizer shall be thoroughly mixed and uniformly distributed by means of an approved hydraulic seeder over the area to be hydroseeded.

d) The work shall be done only in good weather and on ground free of frost, snow and ice or standing water. The hydro-seeded area shall be appropriately maintained by the Applicant, such as watering, fertilizing and cutting, etc. until the time of FAC.

e) Appropriate maintenance to be determined by weather conditions, soil conditions, time of year and growing condition of the seed. A two year maintenance schedule is to be submitted to the Town for approval, at the time of the CCC Inspection. CCC approval will not be granted until a maintenance schedule is provided by the Applicant and accepted by the Town.

f) At the time of final inspection the grass shall:

(i) be mowed to a minimum height of 50 mm;
(ii) cover 100 % of the seeded area;
(iii) be well established;
(iv) be completely free of weeds, thin, bare and dead spots; and
(v) be in an overall healthy growing condition satisfactory to the Town.

3.8.4 Sodding

a) Sodding shall be done in all areas of intensive use (such as high pedestrian traffic) and for all patchwork and remedial work in areas of established turf. All areas to be sodded shall be given a layer of topsoil at a minimum depth of 150mm after light compaction.
b) Sod to be installed for general use shall consist of No. 1 Nursery Sod consisting of a uniform mixture in the following proportions:

(i) Kentucky Blue Grass Blend - 75% by weight; and
(ii) Creeping Red Fescue - 25% by weight.

c) The sod shall be:

(i) a minimum of eighteen (18) months old;
(ii) free of noxious weeds and debris;
(iii) 25 mm - 30 mm in thickness;
(iv) cut in strips of uniform width;
(v) sufficiently moist so that no burning of the edges has occurred; and
(vi) have a vigorous healthy growth.

d) Sod shall be laid evenly and in staggered rows, as per Section 10.10 – Drawing 109 – Sod Installation. Sod shall be laid at right angles to all slopes. On slopes sod to be secured with pegs. Pegs shall not protrude above the surface of the sod. The Applicant shall be responsible for providing and maintaining adequate barricades and signs to warn traffic entering freshly sodded areas, until the time that the surface can withstand traffic without any damages.
e) The Applicant shall be responsible for appropriately maintaining the sodded areas, i.e. watering, rolling, fertilizing and mowing till the time of final inspection and acceptance. Appropriate maintenance to be determined by weather conditions, soil conditions, time of year and growing conditions of the sod. A two year maintenance schedule is to be submitted to the Town for approval at the time of the CCC Inspection.
f) At the time of inspection and acceptance by the Town, the sod shall be:

(i) mowed to a minimum height of 50 mm;
(ii) well established over 100 % of the sodded area;
(iii) without any ruts, depressions or areas of settlement;
(iv) completely free of weeds, thin, bare and dead spots; and
(v) in an overall healthy condition satisfactory to the Town. No more than 30% of blade height shall be removed to achieve minimum height.

3.8.5 Plant Material

a) All plant material shall meet the following standards:

(i) be specimen quality, healthy, and vigorous;
(ii) structure shall be sound and well branched, densely foliated when in leaf, free of pests or disease;
(iii) root systems shall be well developed, strong and fibrous;
(iv) have straight stems, well and characteristically branched for the species;
(v) conform to the Horticultural Standards for nursery stock of the Alberta Nursery Trades Association;
(vi) trees with multiple leaders unless specified, with damaged or crooked leaders, bark abrasions or unhealed pruning cuts shall be rejected;
(vii) plants grown in containers shall be of appropriate size for the container and free of circling roots on the interior and exterior of the root ball; and
(viii) must be sourced from Northern Alberta or a similar growing zone within Alberta.

b) Refer to Standard Drawing Details for more information related to tree and shrub planting. All trees and shrubs at the time of planting shall conform to the following standards in addition to information on standard details:

(i) caliper trees planted in poorly drained soil such as heavy clay can be planted with the root flare up to 50mm above the adjacent soil level;
(ii) installation of topsoil and planting mix shall not proceed until all utility work in the area is complete;
(iii) subsoil shall not be used as backfill for tree planting and is to be removed from site;
(iv) do not excavate or reuse materials from paving subgrade, utility installation, etc.;
(v) plants shall be placed on tampered or unexcavated pads at finished grade at the same depth to the ground as from which they were dug. Proper planting requires the root flare to be at or slightly above the finished grade;
(vi) remove plastic, paper, or fiber from containerized plant material and remove material, and do not bury;
(vii) roots shall be cut with a sharp knife and the soil medium loosened so as the root mat is away from the rootball. Plant, cover with soil, and water immediately;
(viii) remove all tags, labels, etc. from plants;
(ix) plants shall not be pruned at planting. Prune only for removal of damaged branches, double leaders, watersprouts, suckers, or interfering branches; and
(x) poor quality trees requiring staking from compromised rootballs or inadequate structure require approval form the Town for acceptance.

c) Permitted tree sizes shall be as follows:

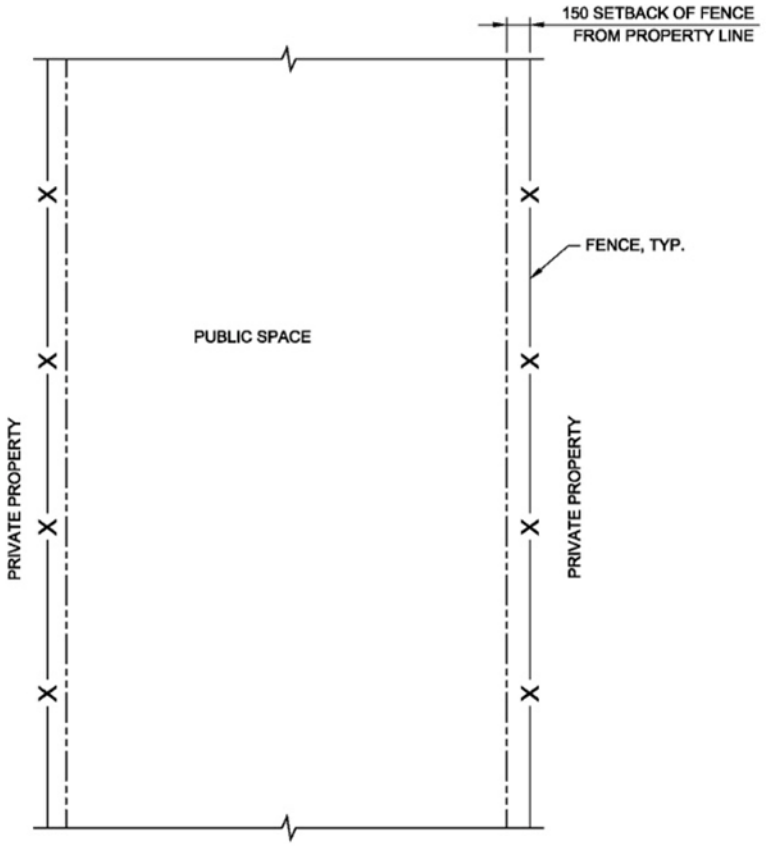
Deciduous Trees	
Height	*Minimum Caliper*
1.8 - 2.4 m	25 mm
2.4 - 3.0 m	37 mm
3.0 - 3.6 m	50 mm
3.6 - 4.6 m	87 mm
4.6 - 5.5 m	100 mm
Coniferous Trees	
Height	*Minimum Caliper*
700 - 900 mm	400 -525 mm
900 - 1.2 m	500 - 650 mm
1.2 - 1.5 m	675 - 800 mm
1.5 - 1.8 m	825 - 950 mm
1.8 - 2.1 m	975 mm - 1 m
2.1 - 2.4 m	1.1 m - 1.3 m
2.4 - 3.0 m	1.35 - 1.5 m

3.8.6 Uniform Fencing

3.8.6.1 Required Fence Types

Uniform fencing shall be constructed as approved by the Town, and be a 1800mm ht. wood screen (refer to Section 10.8 – Drawing 107 – Wood Screen Fence) or 1500mm ht. chain link (refer to Section 10.6 – Drawing 105 – Chain Link Fence) fence. Should the Town require sound attenuation fencing, heights of either 1800mm or 2400mm in height will be prescribed. Refer to Section 10.9 – Drawing 108 – Sound Attenuation Fence for more information related to sound attenuation fencing.

3.8.6.2 Fence Placement



FENCE LOCATION

a) Fencing must not be placed on public property in any situation, without specific written consent from the Town in addition to approval of detailed drawings. As seen in the diagram above, all fence components above grade must be minimum 150mm inside private property, while concrete piles may approach the property line. No portion of the concrete piles can be within the public realm.
For uniform wood screen fencing, the proposed colour of stain shall be approved by the Town.
Middle stringers must be installed on the private property side of the uniform wood screen fence. All fencing must be placed no less than 150mm inside private property.

b) Uniform fencing shall be constructed adjacent to and at the following locations:

(i) arterial roadways – minimum 1800mm ht. uniform wood fencing, or either 1800mm or 2400mm ht. sound attenuation fencing to the discretion of the Town;
(ii) MRs and school sites – minimum 1500mm ht. uniform chain link fencing;
(iii) walkways and PULs – minimum 1800mm ht. uniform wood screen fencing;
(iv) Town owned lands - e.g. Firehall sites, etc. – minimum 1500mm ht. uniform chain link fencing;
(v) multiple family sites – minimum 1500mm ht. uniform chain link fencing;
(vi) neighbourhood commercial sites – minimum 1500mm ht. uniform chain link fencing;
(vii) institutional sites – minimum 1800mm ht. uniform wood screen fencing; and
(viii) other areas as required by the Town – as defined in development agreements.

c) Wooden fencing shall be installed where residential property adjoins the above mentioned facilities. the Town may approve chainlink fencing where facilities such as playgrounds, parks or school sites are adjacent to arterial roadways. The Town will not mow 1m from any fence back of lot to ensure no damage is done to properties.

3.8.6.3 Fence Gates

a) Chainlink fencing and gates shall be constructed as approved by the Town. Fencing and gates must be no less than 1500mm ht. and all components be black powder coated. Gates must include provision for a lock to be installed on latches (by private property owners). Gates on wood screen fence segments will not be permitted.
b) Pedestrian gates may be installed on all residential lots that back onto MR / school sites, onto multiways, and on onto SWMFs where trails are developed along back of lot only. Gates shall be located at the mid-point of each lot and shall be constructed to open inwards onto the private property. Gates will not be permitted along any other fenceline unless approved in writing by the Town, in addition to approval on detailed drawings. In no instance will approval for gates leading into ER, walkways / PUL be granted by the Town.

3.8.7 Mulch and Mulch Beds

3.8.7.1 Materials

a) All mulch shall be as specified on approved drawings. Stockpile of mulch materials must be protected from contamination by dust, airborne herbicides, pesticides, fertilizers and other substances. All organic mulch must be free of diseases, moulds, fungi and insect infestations. The following characteristics must be applied to mulch material:

    (i) either coniferous or deciduous shredded mulch, consisting of any of maple, poplar, birch, ash, or any coniferous wood containing mark, wood and needles;
    (ii) free of non-organic material, wood preservatives and diseased wood;
    (iii) shredded particles ranging between 50 and 100mm in length; and
    (iv) containing no more than 5% by dry weight of soil, sawdust or other debris.

3.8.7.2 Installation

a) Plants must be watered before any mulch is installed. Mulch must be installed no closer than 100mm away from tree trunks and bases of shrubs. All mulch must be installed and maintained to a depth of no less than 100mm after settlement.

3.8.7.3 Landscape Bed Edger and Fabric

a) Landscape bed edger and fabric will not be permitted for any plant beds on public property.

3.8.8 Landscape Maintenance

3.8.8.1 Maintenance Periods

A summary of maintenance periods for landscape features – the time period between CCC and eligibility for FAC - is as follows:

a) turf (seeded or sodded grass) – 2 years;
b) plant material (trees, shrubs, groundcovers, etc.) – 2 years;
c) furniture and signage – no maintenance period, accepted by the Town at time of CCC;
d) fencing – no maintenance period, accepted by the Town at time of CCC;
e) entrance feature landscaping – 2 years; and
f) entrance features – not applicable, not developed on public land.

Warranty periods shall be effective the date of the inspection that showed all deficiencies have been rectified and shall not expire until the Town has issued a Final Acceptance Certificate.

3.8.8.2 Turf

Maintenance shall include, but be limited to watering, weeding, restoring any areas of settlement, topdressing and overseeing, fertilizing, application of any pesticides and herbicides or other materials as necessary to keep grass growing vigorously and in a viable condition for use during the maintenance period and until FAC. All turf must be mowed on a regular basis during growing seasons to maintain gras blade lengths to suit intended uses.

3.8.8.3 Plant Materials

a) Maintenance

(i) Maintenance of all plant material prior to final acceptance shall include:

- maintenance periods shall begin immediately after successful CCC inspection and continue until final acceptance;
- maintenance shall consist of pruning, watering, weeding, mulching, restoring planting saucers, adjusting staking and guy wires and any required integrated pest management tasks;
- irrigate as required to maintain healthy and vigorous plant growth; and
- rootballs shall be watered during the first four months after planting to maintain adequate water within the rootball.

b) Condition at FAC

(i) At the time of inspection and FAC, the plant material shall:

- conform to the standards for plant material contained in the MOSS and exceed any specified sizes after pruning;
- be planted as per the standard details as shown in Section 10 – Standard Drawing Details;
- include a base of mulch that shall be shredded bark or processed wood chips of uniform grade, free of foreign matter. Mulch shall not be placed within 50mm of the trunks of trees or shrubs; and
- exhibit two years of healthy growth to the satisfaction of the Town.

(ii) Any tree replaced in the second year of the maintenance period must be recorded by the Applicant using appropriately coded tree stakes and through written documentation and maps. These trees will require an additional year of maintenance prior to FAC of those particular trees.

3.8.8.4 Tree Staking

Tree stakes must be installed for all trees at the time of planting, with guy wires in place until which time the tree is structurally rooted to the satisfaction of the Applicant. Tree stakes must be painted at the top with the following colour codes. Once years listed on this chart end, colours revolve in the same order:

2023	2024	2025	2026	2027	2028	2029
Green	Blue	White	Yellow	Green	Blue	White

3.8.8.5 Tree Pruning

a) As a rule, growth is maximized if pruning is done just before the period of rapid growth in the spring. Prune during proper times in accordance with the following guidelines:

(i) shade trees – October 15 to April 15;
(ii) birch and maple – June 15 to July 15;
(iii) fruit trees – March 15 to April 15;
(iv) evergreens – April 15 to May 15; and
(v) elm trees – In accordance with provincial legislation.

b) Immediately upon planting of trees and shrubs, any dead, broken or interfering branches shall be pruned together with any diseased branches. The Town will not accept any plant material with diseases.
c) All pruning must be done or supervised by a fully certified ISA arborist. A maximum of 20% may be pruned from any plant at one time. All tools must be clean and sharp at all times. Small buts shall be close to the branch collar and parallel to the adjoining branch or trunk. For large limbs, flush cuts shall be avoided and cuts made at the collar shall have the lower part slanting slightly away from the trunk to leave a smaller wound.

3.8.8.6 Furniture and Signage

There is no maintenance period for any pedestrian furniture or signage. The Town will assume responsibility of all furniture and waste removal upon satisfactory CCC inspection of all furniture. The Town will also be responsible for changing SWMF Danger Thin Ice and No Swimming signage immediately upon installation.

3.8.8.7 Fencing

There is no maintenance period for any fencing. Upon CCC acceptance of all fencing in a stage of development by the Town, the applicant assumes no responsibility for the fence and all fencing becomes the possession and responsibility of the private homeowner. The Town will assume no responsibility for any modifications or damage done to any fence by private homeowners, and it is the Applicant's responsibility to protect all fencing from any damages or modifications prior to CCC acceptance by the Town.

3.8.8.8 Entrance Feature Landscaping

a) Maintenance of all entrance feature landscaping prior to FAC shall include:

(i) maintenance shall begin immediately after successful CCC inspection and continue until FAC;
(ii) ensure that plant material does not interfere with sightlines from the street to read any written text on the signage;
(iii) pruning, watering, weeding, mulching, restoring planting saucers, and any required integrated pest management tasks;
(iv) irrigate as required to maintain healthy and vigorous plant growth; and
(v) rootballs shall be watered during the first four months after planting to maintain adequate water within the rootball.

b) At the time of inspection and up until successful FAC, the plant material shall:

(i) conform to the standards for plant material contained in these standards;
(ii) be planted as per the standard tree detail herein;
(iii) include a base of mulch that shall be shredded bark or processed wood chips of uniform grade, free of foreign matter. Mulch shall not be placed within 50mm of the trunks of trees or shrubs; and
(iv) exhibit two years of healthy growth to the satisfaction of the Town.

c) Any tree replaced in the second year of the maintenance period must be recorded by the Applicant using appropriately coded tree stakes and through written documentation and maps. These trees will require an additional year of maintenance prior to FAC of those particular trees.

4.0 STANDARD DETAILS

4.1 Roadways

Detail	Drawing Number
9.0m Local Roadway	4.01
8.5m Cul-De-Sac (17m ROW)	4.02
8.5m Cul-De-Sac (18m ROW)	4.03
11.0m Minor Collector	4.04
12.0m Major Collector	4.05
16.0m Undivided Arterial	4.06
20.5m Divided Arterial	4.07
Residential Laneway	4.08
Rolled Curb & 250mm Gutter	4.09
Straight Face 150mm Curb & 250mm Gutter	4.10
Straight Face 190mm Curb & 500mm Gutter	4.11
Rolled Monolithic Curb & 250mm Gutter	4.12
Straight Face Monolithic Curb and Gutter	4.13
Separate Sidewalk	4.14
Curb Ramp	4.15
Commercial Crossing - Monowalk	4.16

4.2 Utilities

Detail	Drawing Number
Types of Trench Bedding	4.17
Hydrant Connection	4.18
Thrust Block Details	4.19
Blow-off Valve	4.20
1200mm Manhole	4.22
1200mm Perched Manhole	4.23
External Drop Manhole	4.25
Internal Drop Manhole	4.26
900mm Catchbasin	4.28
1200mm Catchbasin Manhole	4.29
Sanitary Service Connection	4.32
Water Service Connection	4.33
Sump Pump Connection	4.34

5.0 LANDSCAPE STANDARD DETAILS

Detail	Drawing Number
No Swimming / Thin Ice Signs	10.1 Drawing 100
Shrub Planting	10.2 Drawing 101
Shrub Planting on a Slope	10.3 Drawing 102
Tree Planting	10.4 Drawing 103
Typical Tree Planting on a Slope	10.5 Drawing 104
Chain Link Fence	10.6 Drawing 105
Chain Link Gate	10.7 Drawing 106
Wood Screen Fence	10.8 Drawing 107
Sound Attenuation Fence	10.9 Drawing 108
Sod Installation	10.10 Drawing 109
Paving Stone Installation	10.11 Drawing 110
Structural Soils	10.12 Drawing 111
Knock-Down Bollard	10.13 Drawing 112
Seating Node	10.14 Drawing 113
Playground Edger with Wood Fibre	10.15 Drawing 114
Playground Edger with Sand	10.16 Drawing 115
Step Down Wood Screen Fence	10.17 Drawing 116
2.5m Asphalt Trail	10.18 Drawing 117
3.0m Asphalt Trail	10.19 Drawing 118
Gravel Trail	10.20 Drawing 119