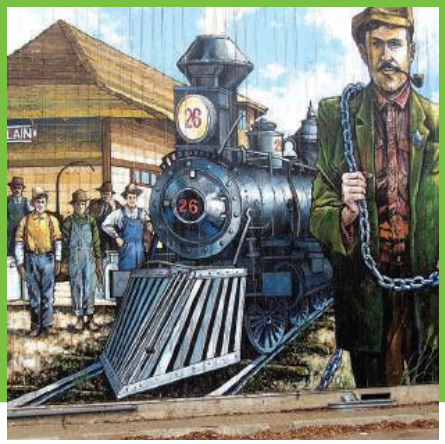
2025 Design and Construction Standards



TOWN OF STONY PLAIN

2025

SUMMARY OF REVISIONS

Version	Section	Revision
2025	ALL	Changed document name to "Design and Construction Standards" throughout
2025	ALL	Changed reference from "approval by Manager" to "approval by Town" to align with definitions
2025	ALL	Changed Alberta 1Call to Utility Safety Partners throughout
2025	ALL	Changed reference from "WNA" to NHA throughout
2025	ALL	Updated references to Alberta Transportation and Economic Corridors
2025	ALL	Changed reference from Alberta Capital Region Wastewater Commission to ARROW Utilities
2025	ALL	Updated references to City of Edmonton Standards to utilize correct names where applicable.
2025	ALL	Relocated Section 12 (testing / commissioning requirements) to relevant specific document sections.
2025	1.2.2	Added new section addressing application of standards to private development
2025	1.4	Revised definitions for Alberta Environment, Engineer, Manager of Engineering/Operations, and Town. Added definition for As-Built Drawings, Town Representative, and Utility Right of Way (URW)
2025	1.5	Updated reference document names
2025	2.1	Added utility bylaw to list of relevant bylaws.
2025	2.2	Added new section on submission and approval processes, incorporating LDI and subdivision processes.
2025	2.2.1	Provided links to Town website for LDI and submissions
2025	2.2.4	Updated drawing submission requirements to align with Town practice.
2025	2.2.4	Added references to relevant document sections for design calculations and additional information which may be requested by the Town.
2025	2.2.6	Added reference to Town fee and charges bylaw and website and clarified expectations around fees (including when additional fees may be charged).
2025	2.2.8	Added more guidance on red-line submissions
2025	2.2.9	Updated design deviation process, including introduction of new design deviation form
2025	2.2.11	Added clarification on where Canada Post mailboxes should be shown.
2025	2.3.1	Added authenticating and validation requirements per APEGA
2025	2.3.2	Added restrictions on boundary valve operation, reinforcing requirement for operation by Town staff only
2025	2.3.3	Added section dealing with road name approvals and when / what names should be shown on drawings.
2025	2.3.5	Added drawing requirements for Legal Plan and Land Use Plan
2025	2.3.5	Refined drawing requirements for lot grading plans and storm/sanitary/watermain plans
2025	2.3.5	Updated design calculation requirements to include storm systems, hydraulic calcs, and lift stations
2025	2.3.6	Added information on where to find existing / previous geotechnical investigations
2025	2.3.6	Revised content requirements for geotechnical reports.
2025	2.4.5	Revised requirements surrounding construction commencement to include high level schedule.
2025	2.4.11.4	Added maximum number of lots and hydrants which can be impacted by disruptions / shut downs
2025	2.4.12	Added content on commissioning for water infrastructure.
2025	2.4.14 / 2.4.15	Consolidated content of 2.4.15 into 2.4.14.
2025	2.5	Revised and reorganized CCC and FAC section to better align with chronological processes. Added CCC and FAC requirement subsections.
2025	2.5.1	Updated requirements for when record drawings must be submitted.
2025	2.5.2	Moved seasonal conditions under CCC and FAC section requirements and updated to clarify when CCC and FAC inspections will be carried out.
2025	2.5.3	Updated record drawing requirements.
2025	2.5.3	Added reference to Town fee and charges bylaw and website.
2025	2.5.5	Expanded list of separate CCC's available.
2025	2.6	Added earthwork permitting requirements and clarification that it may be issued before CCC. Added link to Town permit webpage.
2025	Section 3	Renamed section to "Checklists and Forms"
2025	Section 3	Added disinfection form

Version	Section	Revision
2025	Section 3	Added leakage test form
2025	Section 3	Added design deviation form
2025	Section 3	Added landscaping elements to Pre-Inspection Checklist
2025	Section 3	Revised service form to include pipe material checkboxes.
2025	Section 3	Added separate Town review and approval sign off lines to FAC form and rehomed from Section 2.
2025	Section 3	Added separate Town review and approval sign off lines to CCC form and rehomed from Section 2.
2025	4.3.6	Added new section to consolidate design guidance on curb and gutter.
2025	4.3.7	Updated design speeds, truck volume percentages, and corresponding SSD and K values. Updated / added notes for clarification. Updated ESAL requirements. Added 50 km/h posted undivided arterial.
2025	4.4	Added guidance on not allowing 20mm-B to remain open to elements where staged paving is utilized.
2025	4.4	Added ESAL requirements for roadways. Revised minimum pavement structures, including addition of middle lift where applicable. Revised minimum cement content to 10 kg, with requirement for confirmation as part of geotechnical investigation and pavement design.
2025	4.4	Added minimum pavement structures for alleys, temporary roadways, and accesses.
2025	4.4	Regrouped tables into Urban and Rural roadway sub tables
2025	4.5.1	Added requirement for manholes to be located outside of vehicle wheel paths wherever feasible
2025	4.5.3	Added requirement for contractor to clear snow prior to CCC and road opening to public
2025	4.5.6	Added reference to City of Edmonton standards for pavement restoration
2025	4.6	Added "minimum" to all standard proctor densities.
2025	4.6.2	Added allowance for use of geotextiles where deemed necessary based on geotechnical recommendations. Preference is that the appropriate road structure be constructed first, with geotextiles used as a last resort to bridge unsuitable materials.
2025	4.6.2	Added lift thickness requirements for backfill in rehab and new construction.
2025	4.6.2	Revised rural minimum proctor density to 97% (from 95%)
2025	4.6.2	Added granular 3-63 passing percentages
2025	4.6.2	Added granular sub base course properties.
2025	4.6.4	Added product information for crack sealant.
2025	4.6.4	Added requirement for echelon paving for new construction to reduce cold joints.
2025	4.7.4	Added requirement for grind and resurface when thickness deficiency exceeds 19%
2025	4.6.4 / 4.7.6	Added weather limitations (air + temperature) directly into document from Edmonton Volume 2 standards
2025	4.7.7	Added new section on paving weather conditions
2025	4.7.8	Added new section on re-coring of asphalt
2025	4.6.5	Added FDR section with reference to City of Edmonton standards
2025	4.8.1	Added new Signage section and guidance on street blades and sign installation
2025	4.8.2	Added new Pavement Markings section and guidance on pedestrian crossing signage and pavement markings
2025	4.8.3	Added new Signals section and reference to signalized intersection control requirements
2025	4.9.2	Added list of luminaires and davits acceptable to the Town
2025	4.10	Added guidance on noise and vibration abatement requirements.
2025	4.11	Added clarification on commercial / industrial lane widths
2025	4.12	Added new section addressing emergency access requirements
2025	4.13	Added fire truck weight specifications
2025	4.18	Added in guidance on off-street trails and new table with trail design criteria.
2025	4.20	Added new section on traffic calming and roundabouts
2025	4.21	Relocated Section 12.2.
2025	4.21	Revised subgrade prep and granular base course density targets
2025	4.22.5	Updated list of asphalt deficiencies
2025	4.22.6	Updated list of asphalt repairs
2025	5.2.3	Revised and added details on infiltration reduction measures, including the use of gasketed (NF 80/90) manhole covers in low spots.

Version	Section	Revision
2025	5.6	Revised minimum pipe grades for large pipes, added requirements for curved sewers, and upstream legs of sanitary systems.
2025	5.6	Added table for upstream minimum pipe grades.
2025	5.9	Refined requirements around single bends for CCTV and flushing
2025	5.12 / 5.19.3	Added requirement for manholes to be placed outside of wheel paths where feasible
2025	5.13	Clarified that cross lot servicing is not permitted
2025	5.15	Cross referenced section 6.19 for abandonment of mains
2025	5.16	Added requirement for submission of photos as part of service connection records.
2025	5.19.2	Removed steel sanitary sewer force main.
2025	5.19.3	Revised manhole sealing requirements
2025	5.19.3	Added manhole types
2025	5.19.4	Updated bedding material gradations
2025	5.20	Relocated Section 12.3.
2025	5.20.2	Added allowable leakage for concrete pipe
2025	5.20.4	Added minimum resolution and file type requirements for CCTV
2025	6.1	Added guidance on infill development storm discharge
2025	6.3	Clarified that overall drainage system must provide continuous overland path to SWMF
2025	6.3	Updated component definitions for major and minor systems.
2025	6.4	Reduced watershed size for rational formula to avoid under sizing of pipe systems. (From 65 ha to 30 ha)
2025	6.5	Added reference to current Land Use Bylaw to runoff coefficients table.
2025	6.7	Added requirement for URW registration where cross lot drainage is approved. Refined reference to pre-grading (instead of rough grading).
2025	6.7	Added requirement for side-yard drainage swales aligning with Land Use Bylaw.
2025	6.8 / 6.9	Revised direction around roof drainage discharge.
2025	6.10	Added requirement for manholes / grit separator where private storm systems connect to municipal infrastructures.
2025	6.11.3	Added requirement for designer to confirm catchbasin capacity.
2025	6.13	Clarified that cross lot servicing is not permitted
2025	6.13	Added minimum depth of cover for service connecting at property line
2025	6.14	Revised catch basin lead diameter.
2025	6.15.2	Expanded table to add minimum grades for larger sewers.
2025	6.16	Refined requirements around single bends for CCTV and flushing
2025	6.17 / 6.24	Added requirement for manholes to be placed outside of wheel paths where feasible
2025	6.20	Added new section on pipe abandonment.
2025	6.21	Refined requirements for catchbasin placement
2025	6.21	Added list of acceptable frame and covers
2025	6.23.1	Clarified that ultra rib material is not acceptable
2025	6.23.1	Updated pipe material list
2025	6.24.1	Updated SWMF design guidance, including requirements around geotechnical reports and determination of need for liners, and storm events to be used for design. Added guidance on oil/grit separators at entrances to SWMF in industrial areas, clarified requirements around orifice plates, and submission of O&M manuals for pond appurtenances. Added requirements around SCADA for larger outfalls.
2025	6.24.2	Added clarification around acceptable uses of dry ponds and requirements for downstream treatment facilities.
2025	6.24.3	Added requirement for certification report on pond liner materials and installation.
2025	6.24.4	Added clarification around regulatory guidance of constructed wetlands.
2025	6.25	Added new section dealing with cross-lot drainage swales.
2025	6.26	Added new section on LID, referencing City of Edmonton/EPCOR design standards
2025	6.28	Relocated Section 12.4.
2025	6.28	Added requirements for SWMF leakage testing

Version	Section	Revision
2025	6.28.1 / 6.28.2	Added video testing and deflection testing requirements same as for sanitary sewers (instead of cross-referencing sections).
2025	7.4	Updated minimum pipe diameters
2025	7.6	Added requirement for tracer wire installation when water is not located under carriageway in ROW.
2025	7.8	Added clarification that valves shall be located outside of curb returns on roadways (in addition to existing 30m setback requirement for arterials)
2025	7.9	Added new section on Hot Taping
2025	7.10	Revised wording of hydrant location text for clarity
2025	7.11	Clarified that cross lot servicing is not permitted
2025	7.14	Updated requirements for abandonment of water mains and service connections
2025	7.15	Updated allowable materials, including revisions to anodes and resistivity testing requirements
2025	7.15.6	Added hydrant port threads specifications
2025	7.15.6	Clarified requirement for breakaway flanges and couplers to be aligned
2025	7.15.6	Clarified when drains on hydrants need to be plugged relative to water table
2025	7.15.7	Clarified that crown surface adapters are not permitted. Switch to threaded Type B valve boxes.
2025	7.15.8	Clarified location and type of curb stops
2025	7.16	Relocated Section 12.5.
2025	7.16.1	Added commissioning requirements which clarify need for filling and flushing strategies to be submitted with the design drawings.
2025	7.16.1.2	Added that valves can only be operated by Town staff
2025	7.16.5	Added text around acceptable injection points
2025	7.16.5	Added requirements for dechlorination
2025	7.16.6	Revised wording for clarity. Added time specifications for sampling post-disinfection.
2025	7.17	Relocated Section 12.6.
2025	8.3.1	Added minimum depth requirements for utility crossings across the road carriageway and utility installations under roadways in the direction of travel.
2025	10.4	Added clarifications on height and placement of temporary fencing for tree protection.
2025	10.7	Added requirements for organic material content in topsoil and reference to soil cell to COE standards.
2025	10.8	Added time of year restrictions for seeding and associated delayed CCC.
2025	10.7.1	Revamped section addressing topsoil placement to include additional details.
2025	10.10	Added time of year restrictions for sodding and associated delayed CCC.
2025	10.11	Revised seeded area cover for naturalized areas to 80% as 100% coverage can take many years to achieve when seeding.
2025	10.12	Added setbacks to cc's and storm and sanitary services
2025	10.12	Added Ohio Buckeye and Brandon Elm to table. Added note that American Elm is recommended for use in parks and open spaces due to large canopy.
2025	10.12	Added Hawthorn and American Elm
2025	10.13	Added section addressing Dutch Elm Disease and response measures (referencing Provincial and City of Edmonton processes)
2025	10.16	Revised requirements for fencing, including adding more detail on wood, chain-link, and abatement fencing.
2025	10.17	Added alternative payment in lieu of additional tree warranty for replacement trees.
2025	11.1	Added requirement that playgrounds not be located in low spots to prevent flooding.
2025	11.4	Added new section addressing park lighting requirements.
2025	11.9	Added new section on natural sliding hills.
2025	12.1	Moved to start of new sections 4.21, 5.20, 6.28, 7.15, and 7.16.
2025	12.2	Moved to new section 4.21.
2025	12.3	Moved to new section 5.20.
2025	12.4	Moved to new section 6.28.
2025	12.5	Moved to new section 7.15.
2025	12.6	Moved to new section 7.16.

Table of Contents

1. INTRODUCTION TO STANDARDS

1.1. Forward

The following "Town of Stony Plain - Design and Construction Standards" have been prepared to provide information and define minimum acceptable standards to Developers and other interested parties requiring knowledge of the principles governing the development of land in the Town. These standards encourage good engineering and construction practices. Any deviation from these standards requires a written request to the Manager of Engineering for acceptance prior to implementation.

This manual is available on the Town's website and will be updated on an as-required basis. Revised documents will be uploaded on the Town's website. Users of the Design and Construction Standards are urged to refer to the Town's website periodically to ensure they have the latest edition.

If any standards set forth in this document contradict other applicable industry standards, the more stringent standards shall apply. Where these standards refer to bylaws, policies, acts, regulations, or standards, this shall mean the most recent edition or amendments of the referenced document.

1.2. Scope

These standards and procedures apply to the preparation and submission of engineering drawings for Local Improvements in both Rural and Urban Residential, Commercial, and Industrial developments and include:

- Water distribution systems, fire protection systems, and lot service connections;
- Sanitary sewage systems and lot service connections;
- Storm collection systems and related appurtenances, lot grading, and lot service connections;
- Facilities including sewage lift stations and stormwater management facilities;
- Roadways, sidewalks, curb and gutter, and lane improvements;
- Shallow (franchise) utilities (i.e. gas, power, lighting, telephone, and cable); and
- Landscape requirements, including hard and soft elements and walkway systems.

1.2.1. Redevelopment

These standards also apply to the redevelopment of Residential and Industrial / Commercial lands.

1.2.2. Private Development

All new on-site development shall follow the standards laid out within this document wherever feasible and applicable. All engineering related drawings and designs must be authenticated.

The Town's responsibility for maintaining services and utilities ends at the property line. Individual property owners are responsible for maintaining, operating and locating servicing and utilities on private property.

1.3. Relationship: Town and Developer

The Town provides Municipal Services (snow clearing and garbage collection) to all new developments upon construction completion acceptance. Upon final acceptance by the Town, all Local Improvements, and the responsibilities thereof, are taken over by the Town. For that reason, the Town is charged with the responsibility of ensuring that all Local Improvements provided in developing lands meet minimum acceptable standards, so that the Local Improvements can be properly operated and maintained for the benefit of the end users of the new development.

Town involvement, periodic inspections, and acceptance are therefore required in all aspects of servicing and land development.

1.4. Definitions

In this manual the following words shall have the meaning hereinafter assigned to them:

Term	Definition
Alberta Environment	The provincial ministry responsible for environmental policy and sustainable resource development. Known as Alberta Environment and Protected Areas . This general term is intended to encompass any future changes in department naming.
Applicant	See definition for "Developer".
Area Structure Plan (ASP)	An ASP provides the framework for developing and servicing new areas of the Town. An ASP must include the sequence of development proposed for the area, proposed land uses, proposed population density, the general location of major transportation routes and public utilities, and all other matters considered necessary by Council. Refer to the Town's website for more information pertaining to ASPs.
As-Built Drawings	Marked up construction drawings provided by the Consultant showing true elevation and location information of all constructed features and changes to the original drawings, indicated in red.
Commercial	A lot used for the buying and selling of commodities and services.
Construction Completion Certificate (CCC)	A certificate issued by the Engineer and executed by the Town confirming that the 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 can commence.
Contractor	Any person, persons, or corporation which shall undertake installation of municipal infrastructure and services on behalf of either the Developer or the Town.
Developer	A person, persons, or corporation which has applied to subdivide and/or develop, or to service an existing parcel of land, whether as the owner or an agent for the owner of the land.
Developer's Consultant	An Engineer, Landscape Architect, or Alberta Land Surveyor hired by the Developer to assist with the design and oversee construction of the proposed development.
Developer's Representative	An Engineer, Landscape Architect, or Alberta Land Surveyor hired by the Developer to act on the Developer's behalf.
Drainage Parkway	A wide-bottomed ditch used to convey large volumes of stormwater, under controlled conditions, through or past a subdivision.
Easement	An agreement, usually registered on the certificate of title to the property, that gives the Town the right to use a landowner's property in some way (such as to access a utility). Easements can also partially restrict a landowner's use of the affected portions of land.
Engineer	The Professional Engineer, in good standing with the Association of Professional Engineers and Geoscientists of Alberta (APEGA), responsible for the design drawings and design specifications of public infrastructure, the supervision of the work, the certification that the materials and installation are in accordance with these Design and Construction Standards, recording and reporting of as-constructed information, and performing those duties with the standard of care prescribed by APEGA.

Term	Definition
Environmental Reserve (ER)	Land owned by the Town to be preserved in its natural state as an Environmental Reserve, such as a swamp, gully, ravine, natural drainage course, flood plain, or shoreline, as defined in Section 664(1) of the Municipal Government Act.
Final Acceptance Certificate (FAC)	A certificate issued by the Developer's Consultant and accepted by the Town confirming that the work is complete and acceptable to the Town, that all deficiencies and Maintenance work have been resolved to the satisfaction of the Town, and that the Warranty Period for the work has expired.
Geographic Information System (GIS)	A system for collecting, managing, analyzing, and presenting geographic data that organize layers of information into maps to analyze spatial locations.
High Density Residential	Land that has, or is planned to have at least one building containing three or more dwelling units which may have a common entrance from street level, but does not include row housing.
Hydraulic Network Analysis (HNA)	A report, prepared by the Developer's Consultant, which demonstrates that the proposed water system is capable of meeting these Design and Construction Standards based on system pressures, flow velocities, headlosses, and flow rates and does not negatively impact adjacent areas or infrastructure.
Industrial	Land used in the manufacturing, processing, assembling, cleaning, repairing, servicing, testing, storage, warehousing, distribution or trans-shipment of materials, finished goods, products, or equipment, which does not include artisan shops but may include an accessory use like storage, display, sale, and technical or administrative support areas where there are impacts to adjacent lots.
Landscape Architect	A qualified landscape designer, in good standing with the Alberta Association of Landscape Architects (AALA), that is responsible for the design, layout, and supervision of installation of landscape and related work, recording as-built information, certifying the material and installation is in accordance with the standards, design drawings, and design specifications, and performing those duties with the standard of care prescribed by AALA.
Local Improvement	An off-site piece of infrastructure, feature, or upgrade required to support a proposed subdivision or development, which is the responsibility of the developer and includes, but is not limited to, deep utilities, shallow utilities, roadways, lanes, street lighting, and landscaping.
Low Density Residential	Land that has, or is planned to have at least one single or semi-detached dwellings.
Maintenance	All upkeep, repair, or replacement of Local Improvements during the Warranty Period, at the Town's discretion.
Manager of Engineering	An individual appointed by the Town that has delegated authority to represent the Town in any engineering or related functions, or their delegated designate.
Manager of Operations	An individual appointed by the Town that has delegated authority to represent the Town in any public works operations or related functions, or their delegated designate.
Master Plan	A document that outlines existing and future trends for the Town, such as utility (Water, Sanitary, Stormwater) and transportation Master Plans that describe the status of existing systems and any required upgrades to these systems to plan for and support future expansion areas.
Medium Density Residential	Land that has, or is planned to have at least one building with three or more dwelling units, such as row housing, three-plexes, or four-plexes.
Multi-Dwelling Residential	Land that has, or is planned to have at least one building with three or more dwelling units (row housing, three-plexes, four-plexes), or walk-up apartments, and includes Medium Density Residential and High Density Residential lands.
Municipal Reserve (MR)	Land owned by the Town for the development of parks, recreation, schools, and buffers between different land uses pursuant to Section 666 and Section 671 of the Municipal Government Act.
Municipal Service	A service provided by the Town upon construction completion acceptance, such as snow clearing or garbage collection.

Term	Definition
Open Space	Any parcel of land or body of water that is dedicated and reserved for public use, including Municipal and Environmental Reserves.
Prime Contractor	A company that, through a written, contractual agreement with the Owner (the Developer or the Town as the case may be), is responsible for coordinating activities conducted on a worksite, ensuring Occupational Health and Safety legislation is followed, and without written assignment of Prime Contractor, the person with the highest degree of control over a worksite is deemed the Prime Contractor.
Public Utility	An off-site piece of infrastructure, feature, or upgrade that is owned and maintained by the Town, including the water distribution system, sanitary collection system, stormwater collection management system, roadways, and Open Spaces.
Public Utility Lot (PUL)	Land required to be given under Division 8 of the Municipal Government Act for roads and/or Public Utilities.
Record Drawings	A revised set of drawings submitted by the Developer to the Town upon completion of construction that reflect all changes made to the specifications and drawings during construction and include updated dimensions, lengths, elevations, geometry, etc. of the work.
Rural	An area within the Town with Rural Services.
Rural Services	A level of service that entails individually owned and operated water and sewage systems.
Tangible Capital Assets (TCA)	An economic resource managed by the Town, including, but not limited to, roads, buildings, equipment, land, utilities, and stormwater management facilities.
Town	The municipal corporation of the Town of Stony Plain, Town Engineer, business unit, department, or designate, as the context applies.
Town Representative	A person designated by the Manager of Engineer or Manager of Operations to act on behalf of the Town, including Town employees, Contractors, and Engineers.
Traffic Impact Assessment (TIA)	A report, prepared by the Developer's Consultant, which investigates the impact a proposed development may have on traffic operations and recommends any mitigation measures that may be required as a result of the proposed development.
Urban	An area within the Town with Urban Service.
Urban Services	A level of service that includes a municipally owned water distribution system, sanitary collection system, and stormwater collection and management system.
Utility Right of Way (URW)	An area of land owned by another where there is interest in the land by the Town or utility company for development of access, utility infrastructure and/or surface drainage. Similar to an easement, a URW entitles its holder to a specific purpose.
Warranty Period	A minimum two-year period of time commencing with the execution of a Construction Completion Certificate and ending with the execution of a Final Acceptance Certificate.

1.5. Reference Materials

Throughout the Design and Construction Standards, references may be made to other standards and regulations including, but not limited to the following. Where these standards refer to bylaws, policies, acts, regulations, or standards, this shall mean the most recent edition or amendments of the referenced document.

- Alberta Environment and Protected Areas Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems:
  - Standards for Municipal Waterworks
  - Guidelines for Municipal Waterworks
  - Wastewater Systems Standards for Performance and Design
  - Wastewater Systems Guidelines for Design, Operating and Monitoring
  - Stormwater Management Guidelines
- Safety Codes Council: Alberta Private Sewage Systems – Standard of Practice
- Transportation Association of Canada (TAC):

  - Geometric Design Guide for Canadian Roads
  - Manual of Uniform Traffic Control Devices for Canada
  - Canadian Roundabout Design Guide
  - Canadian Guide to Traffic Calming
- Alberta Transportation and Economic Corridors: Highway Geometric Design Guide
- City of Edmonton:
  - Erosion and Sedimentation Control Guidelines
  - Erosion and Sedimentation Control Field Manual
  - Complete Streets Design and Construction Standards, Volume 2
  - EPCOR Drainage Standards, Volume 3
  - EPCOR Waster Standards, Volume 4
  - Landscape Standards, Volume 5
- Occupational Health and Safety (OHS) Legislation, including the OHS Act, OHS Regulation, and OHS Code

1.6. Freedom of Information and Protection of Privacy Act

The Freedom of Information and Protection of Privacy Act is in effect for the Town 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 the Town may be subject to the access and privacy provisions of the Act.

Developers 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 and financial labour relations, and scientific and technical information.

While the Town 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 Developer or their 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 the Town's custody and control.

2. PROCEDURES FOR DEVELOPMENT

2.1. General

In addition to these Design and Construction Standards, the Town has a number of other documents that Developers and/or their agents should be fully aware of in advance of undertaking the design of a specific subdivision or project. Developers and/or their agents will be required to read and follow all applicable bylaws. Examples include:

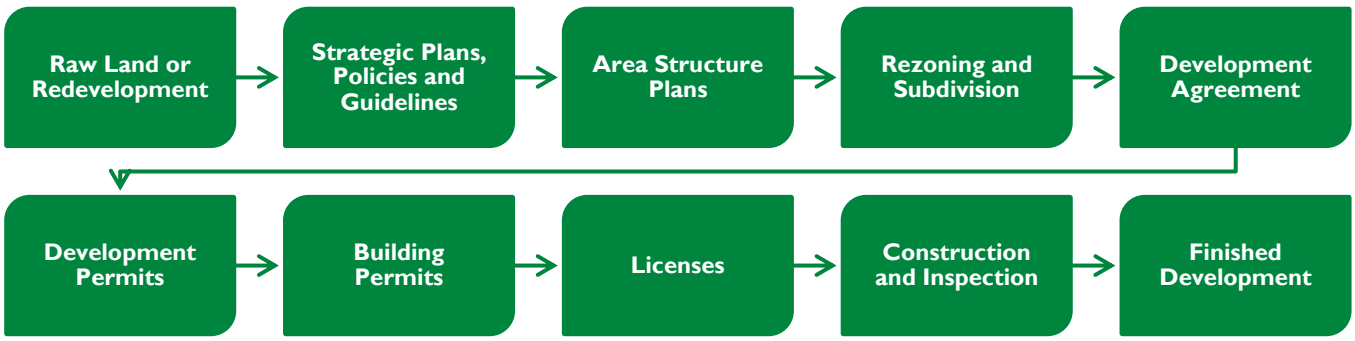
- **Municipal Development Plan** – describes general policies and guidelines with respect to land development within the town
- **Area Structure Plans** – provide the framework for developing and servicing new areas of the town (Approved Area Structure Plans are available on the Town's website)
- **Land Use Bylaw** – describes permitted and discretionary uses for each land use district and defines numerous design parameters
- **Utility Bylaw** – describes requirements for water, sanitary and stormwater servicing
- **Master Plans** – provide topic specific policies and guidelines, examples include the water, sanitary, stormwater, transportation, and trails master plans
- **Old Town Community Plan** – provides a cohesive vision, policy framework, and implementation plan to guide future development and redevelopment of the Old Town Community Plan area (encompassing Main Street, Old Town, and Highway 779)

Communication is key and the Town encourages early preliminary meetings with Planning and Infrastructure staff to discuss land development proposals and options.

2.2. Submission and Approval

The latest submissions procedures and fees are available on the Town website at:
https://www.stonyplain.com/en/work/land-development.aspx

The Town's land development process generally follows the flowchart below.



2.2.1. Land Development Inquiry (LDI)

The Developer is strongly recommended to submit a land development inquiry to Planning and Infrastructure for the purpose of discussing the project. Inquiries can be submitted via the Town website at:
https://forms.stonyplain.com/Planning/Land-Development-Inquiry

The information provided as part of the inquiry shall serve as the basis of the project between the Developer and the Town and may avoid expenditure by the Developer and/or their agents of time, effort, and money on concepts and plans that are unacceptable to the Town.

At a minimum, this information shall describe the proposed development, how it relates to applicable existing planning documentation (such as the Land Use Bylaw and relevant Area Structure Plan), and applicable servicing and infrastructure requirements.

2.2.2. Subdivision

A subdivision application is required when:

- Adjusting a lot line or creating multiple lots from one existing lot;
- Legally separating space in an existing building; or
- Subdividing one or more lots into a bare land condominium or strata subdivision.

The Town endorses all subdivisions approved by the Subdivision Authority. To finalize a subdivision and create new lots or units, the following are required:

- Provide a complete subdivision endorsement package to the Town;
- Meet all conditions of approval;
- Obtain Town approval; and
- Register the subdivision plan at Alberta Land Titles.

More information on the Town's subdivision process, including the subdivision application form can be found on the Town website at:

https://www.stonyplain.com/en/work/zoning-and-subdivision.aspx

2.2.3. Servicing Reports

The Developer may be required to provide conceptual plans of the road network, site servicing layouts, and landscape improvements as part of the various planning application stages (LDIs, planning bylaws, subdivisions, etc.). The plans are to be accompanied with preliminary calculations supporting the means by which the development will be serviced including all proposed rights-of-way, Easements, and PULs.

Conceptual engineering plans are to include a conceptual servicing layout (water, sanitary, storm) with preliminary pipe sizing indicated, are to indicate the volume of stormwater to be stored and the method of storage and are to include a preliminary road network with road classifications identified.

Conceptual landscape plans are to provide an overview of the development indicating community themes, reserve areas, open play areas, pedestrian linkage, and facilities including spray parks, playgrounds, gazebos, rest areas, and other park amenities.

The conceptual design package is to be accompanied by a preliminary geotechnical investigation, prepared by a qualified geotechnical Engineer, highlighting any design constraints which may need to be considered during detailed design.

2.2.4. Detailed Engineering Drawings, Specifications, and Landscape Plans

Upon acceptance of the conceptual engineering and landscape plans, the Developer shall submit the following to the Manager of Engineering for review:

- CAD files (submissions in ESRI are preferred; however, AutoCAD submissions are also acceptable);
- One (1) digital (PDF) set of specifications;
- One (1) digital (PDF) set of design drawings; and
- Geotechnical report(s)

All submissions shall be sealed by a qualified Engineer as per Section 2.3.1.

The review by the Town is for the sole purpose of ascertaining conformance to the Design and Construction Standards, the Municipal Development Plan, Land Use Bylaw, and other municipal plans, standards, and guidelines. Acceptance of the submission does not relieve the Developer of their responsibility for errors or omissions or of their responsibility of meeting all requirements of the Design and Construction Standards and other Federal and Provincial rules and regulations.

Other information may be required to be submitted during the approval process, including:

- Design calculations, including:
  - ESC (as per Section 2.4.10);
  - Sanitary tables (as per Section 5.2 and 5.3);
  - Storm tables (as per Section 6.4, 6.5, and 6.6);
  - Catchbasins (as per Section 6.11); and,
  - Swales (as per Section 6.11 and 6.24);
- Copy(ies) of any environmental approval(s);
- Turning movements (if applicable);
- Waste collection layouts (if applicable);
- Traffic Impact Analysis; and
- Hydraulic Network Analysis.

Following the Town's review of the submitted drawings and documents, review comments will be forwarded to the Developer's Consultant. Prior to resubmission of any drawings and documents, the Developer's Consultant is to prepare a response letter outlining the comments received from the Town and how each comment has been addressed. The Developer's Consultant shall submit the response letter to the Town in support of the revised drawings and documents.

Final engineering drawings, diagrams, and reports must be sealed by a qualified Engineer. Landscape plans are to be submitted with the engineering drawings; final landscape plans are to be signed by a qualified Landscape Architect.

2.2.5. Acceptance by the Town

The Town shall inform the Developer, within 20 working days after receipt of the detailed design submission, whether the Developer's submission has been accepted. Should the Town not approve a part of the Developer's plans or proposals, they will be returned to the Developer for revision to the satisfaction of the Town. The 20-working day approval period will begin again on the receipt of any resubmission.

2.2.6. Review Costs

The Developer will be responsible for any review and inspection costs deemed appropriate by the Town as set out in the Fees and Charges Bylaw. Current costs for applications and reviews can be found on the Town's website at:
https://www.stonyplain.com/en/work/fees.aspx

Fees for major engineering drawing review and construction completion certificate and final acceptance certificate inspections include underground, surface and landscaping with one initial inspection and follow up inspection per construction completion certificate and final acceptance certificate.

Fees for minor engineering drawing review and construction completion certificate and final acceptance certificate inspections includes one inspection per construction completion certificate and final acceptance certificate as required.

Additional construction completion certificate and final acceptance certificate inspections will incur additional costs.

Furthermore, additional costs may be incurred for the following:

- For each submission over and above the third submission when a Developer files more than three submission due to revisions by the Developer or the Developer's failure to revise the drawings as requested by the Town;
- When specialized consulting expertise is required by the Town to review development proposals, concept plans, and drawings;
- When additional staffing is required to review developments;
- For the review of complex resubmissions and deviations from the Design and Construction Standards;
- When excessive errors and omissions are encountered;
- When insufficient information is provided; and/or
- When improper procedures are followed.

The cost of review may take several forms, including:

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

The Town will review submissions made by the Developer and inform them of the anticipated review costs, as identified in the Fees and Charges Bylaw. At the Engineering Manager's discretion, the Developer shall reimburse the Town prior to review of resubmissions.

2.2.7. Development Agreement

The general guidelines for the preparation of Development Agreements are as follows:

- A Development Agreement can be prepared after the second submission of engineering drawings have been submitted to the Town, or substantially complete to only require minor changes at the discretion of the Town;
- The Developer must enter into a Development Agreement with the Town prior to commencing construction in accordance with a set of approved engineering drawings;
- The Town will engage their Solicitor to prepare a draft Development Agreement (any costs associated with the preparation of this agreement will be incurred by the Developer);

- A Development Agreement will specify the required security that a Developer must pay to the Town prior to commencing work; and,
- Once the elements of the draft agreement are finalized, a final agreement will be prepared for signatures by the Developer, and the Town's CEO (Mayor) and CAO (Town Manager). The Town will give the necessary consent to allow the Developer to commence construction of Local Improvements as identified in the approved engineering drawings.

2.2.8. Red-line Submissions

Whenever it is necessary to make changes to design drawings after they have been approved, the Developer will submit two prints and one (1) digital copy of each original drawing affected showing the proposed changes in red, accompanied by a letter outlining the reasons for the required changes.

The changes must be documented by a revision in the drawing(s) issue number. All changes to Construction Drawings must be clearly marked by placing a triangular flag containing the revision number adjacent to the area where the change is occurring and clouding all affected areas.

The Town will inform the Developer within 10 working days after receipt if the proposed changes meet with the approval of the Manager of Engineering. One (1) 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.

2.2.9. Design and Construction Standards Deviation Process

The Developer's Consultant shall identify and provide justification for any deviations or nonconformances from the Design and Construction Standards as part of the submission of the detailed design drawings. Otherwise, the submittal of detailed design drawings will be assumed to be in accordance with the Design and Construction Standards.

The Developer shall only install materials which have been approved in these Design and Construction Standards, or as otherwise approved in writing by the Town. The Contractor shall identify any non-approved materials and seek acceptance through the Standard Deviation Process.

No departure from these Standards shall be permitted except with written authorization of the Manager of Engineering. The Manager of Engineering has the ultimate authority with regards to setting minimum standards and not accepting deviations from the Design and Construction Standards.

Note that under no circumstances will a deviation from the Design and Construction Standards be considered by the Town without the submission of detailed documentation demonstrating the justification for the deviation and the added benefit to the Town. The proposal shall include sufficient detail regarding the proposed method or material to be used in the Design, including justification with respect to the impact on infrastructure quality, safety and environmental considerations, functionality, operation and maintenance requirements, and life cycle costs. The Manager of Engineering may request additional information as required to make an informed decision regarding the proposed design. The proposed deviation must be prepared, signed, and sealed by a professional engineer, landscape architect, architect, or other industry professional, as applicable to the design.

A deviation shall only be valid for the Development or Subdivision under consideration.
At the Manager of Engineering's discretion, costs incurred by the Town for review of submissions and resubmissions are the responsibility of the Developer (refer to Section 2.2.5 Review Costs).

2.2.10. Environmental Approvals

The Developer's Consultant shall submit the detailed plans and specifications to applicable Provincial and/or Federal regulatory body(ies) for approval. A copy of the submission, together with the approval(s), shall be supplied to the Town. The applicable environmental approvals are required prior to execution of the development agreement.

Examples of acts requiring approval may include, but are not limited to:

- *Fisheries Act* (R.S.C. 1985, c. F-14);
- *Canadian Navigable Waters Act* (R.S.C. 1985, c. N-22);
- *Environmental Protection and Enhancement Act* (R.S.A. 2000, c. E-12);
- *Water Act* (R.S.A. 2000, c. W-3);
- *Historical Resources Act* (R.S.A. 2000, c. H-9); and
- *Public Lands Act* (R.S.A. 2000, c. P-40).

Obtaining environmental approval in no way removes the responsibility of the Developer to comply with the Design and Construction Standards and to receive the Town's acceptance of the detailed plans and specifications.

2.2.11. Canada Post - Community Mailboxes

When required for subdivision, the Developer's Consultant shall submit the tentative plan of subdivision that has received conditional approval by the Town's Subdivision Authority to the local Canada Post Delivery Planning office to establish the location, size, and details of community mailboxes. For further information and requirements, consult Canada Post's "Delivery Planning Standards Manual for Builders and Developers." Upon approval of location and details by Canada Post, community mailboxes are to be shown on all applicable approved engineering drawings.

2.2.12. Approval by Other Agencies

The Developer shall submit documentary evidence to the Manager of Engineering that permission has been received from appropriate authorities for crossing of pipelines, railways, highways, or other facilities, if such crossings are intended. These supporting documents shall be submitted in conjunction with submission of the detailed drawings and specifications or soon thereafter - but in any event, prior to construction.

2.3. Preparation of Detailed Engineering and Landscape Drawings

2.3.1. Engineering Design

The Developer shall retain an Engineer and Landscape Architect who will be responsible for the design and preparation of drawings and specifications for all services as required. All services will be designed in accordance with the Design and Construction Standards.

All engineering designs shall be authenticated and validated in accordance with the most recent APEGA processes and procedures. All landscape designs shall be stamped and sealed by a landscape architect registered with the ALAA or CLAA.

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

2.3.2. Responsibility for Existing Structures and Utilities

The presence and location of underground utilities indicated on the plans which have been determined from existing records are not guaranteed and shall be investigated and verified in the field by the Developer's Consultant. The Town takes no financial responsibility for errors or omissions represented on record information. The Developer shall contact the Town and Utility Safety Partners for utility locates prior to proceeding with any ground disturbance.

The Developer will be held responsible for any damage to, and for Maintenance and protection of, existing structures and utilities during construction. Existing utilities are to be protected from damage or unauthorized use by means of boundary valves for watermains and plugs for sanitary and storm sewers.

2.3.3. Road Names

The Developer shall obtain approval from the Town of road names prior to acceptance of the engineering drawings and shall include road names on the final drawing submittals. Placeholder names are permitted for initial submissions.

2.3.4. Format for Engineering and Landscape Drawings

All engineering and landscape drawings that are submitted to the Town for approval should follow the basic format described in Table 2-1.

Additionally, drawing techniques that are significant to the drawings are:

- Care is taken to ensure a balanced distribution of detail throughout the drawing;
- Letters and figures are clearly legible, well spaced, and properly formed and proportioned;
- Lines are uniform in weight and density;
- New and existing features are readily distinguishable;
- Dimensioning of drawings should be such that it will not be misinterpreted. Dimensions should be given from an iron pin, lot line, chainage station, centreline, curb line, or other approved reference that can be readily established. All dimensions shall be in SI (System International) units;
- Drawing numbers shall be assigned by the Town; and
- Project names shall match or align with relevant subdivision and development permit names and stages.

Table 2-1
Drawing Requirements

General Requirements	
Plan Size	ANSI-D 22" x 34"
Material	Originals shall be printed on bond paper
Orientation	Continuous chainage shall be used whenever possible. Generally, drawings shall be orientated such that north arrows point to the top or left-hand side of a page and lettering should be read from the bottom-to-top or left-to-right.
Elevations	Elevations shall be relative to the Geodetic datum. Benchmark numbers, locations, and elevations used shall be shown on the design drawings.
Layout	Allow a minimum of 75 mm binding edge along the left side; nothing shall be drawn in this area. The plan portion of a drawing shall not extend into the profile section and vice versa.
Digital Format	Submissions in ESRI are preferred; however, AutoCAD submissions are also acceptable. NAD 83 10TM survey format shall be used.
Lettering Size	All lettering must be 2.5 mm or larger in height and 0.18 mm or thicker in line thickness.
Title Block Requirements	
Title blocks shall contain the following information:	
• Town of Stony Plain logo	
• Project name or name of development (name shall be approved by the Town and align with relevant subdivision or development permit names)	
• Description of drawing	
• Legal description	
• Name of consultant	
• Consultant's Permit to Practice stamp	
• Engineer's or Landscape Architect's stamp, as applicable	
• Draftsperson and designer identification	
• List of checks and approvals	
• List of revisions	
• Legend (if not on a separate plan)	
• Scale(s)	
• Date	
• Drawing number (to be assigned by the Town)	
Scale Requirement – Urban	
Overall Plans	1:1000
Plan / Profiles	Horizontal: 1:500 Vertical: 1:50
Cross-sections	Horizontal: 1:100 Vertical: 1:50
Overall System Network Analysis	1:2000
Landscape Plans	1:200
Details	1:100
Scale Requirement - Rural	
Regional Overview	1:5000
Overall Plans	1:2000
Plan / Profiles	Horizontal: 1:1000 Vertical: 1:100
Cross-sections	Horizontal: 1:100 Vertical: 1:50
Overall System Network Analysis	1:5000
Landscape Plans	1:200
Details	1:100

2.3.5. Drawing Requirements Checklist

The following checklist has been provided to help Developer's Consultant's ensure detailed design drawings include the required information.

Cover Sheets

- ☐ Town of Stony Plain logo
- ☐ Project name or name of development
- ☐ Stage of development
- ☐ Drawing issue (i.e., Issued for Review, Issued for Tender, Issued for Construction, Issued for Record, etc.)
- ☐ Name of the Developer
- ☐ Date
- ☐ Name of the engineering firm
- ☐ Name of the landscape firm

Key Plan, Index Plan, and List of Drawings

The key plan, index plan, and list of drawings may be contained on one drawing or on separate drawings, depending on the size of the project and on individual preference.

- ☐ Legal information is shown
- ☐ The portion of a street relating to a particular plan/profile sheet is indicated
- ☐ A complete list of drawings is included (may be included on a separate drawing, such as the Cover Sheet)
- ☐ A key plan showing the development as it relates to the surrounding lands is included (may be included on a separate drawing, such as the Cover Sheet)
- ☐ Street names are labelled
- ☐ A Phase / Stage Boundary is shown

Legal Plan

A legal plan may be required as a separate drawing, depending on the size of the project and on individual preference.

- ☐ Full extents of the parent parcel
- ☐ Legal information is shown
- ☐ Adjacent street names are labelled
- ☐ Phase / Stage Boundary are shown

Land Use Plan

A land use plan may be required as a separate drawing, depending on the size of the project and on individual preference.

- ☐ Full extents of the parent parcel
- ☐ Land use districts are shown for the parent parcel and adjacent properties
- ☐ Adjacent street names are labelled
- ☐ Phase / Stage Boundary are shown

Overall Plans

The following overall plans are to be included:

Topography and Land Use Plan

- ☐ Existing contours at 1 m intervals (maximum) or 0.5 m (preferred) are shown
- ☐ Proposed land use is identified
- ☐ Existing features (i.e. buildings, trees, temporary access roads, etc.) are identified
- ☐ Street names, lot, and block numbers are labelled
- ☐ Easements and rights-of-way, including widths and alignments, are labelled

Erosion and Sedimentation Control (ESC) Plan

- ☐ Existing contours at 1 m intervals (maximum) or 0.5 m (preferred). Must be sufficient for distinguishing runoff patterns before disturbance.
- ☐ Existing vegetation, such as grassy areas or vegetative buffers, that may reduce erosion or off-site sedimentation.
- ☐ Limits of clearing and grading.
- ☐ Critical areas within or near the project area, such as streams, lakes, wetlands, highly erodible soils, public streets, and residences.
- ☐ Locations and types of ESC measures, with dimensions.
- ☐ A legend, if necessary.
- ☐ Details of ESC structures and measures, showing dimensions, materials, and other important details

Road and Sidewalk Plans

- ☐ Road and sidewalk widths and alignments
- ☐ Cross-section design by road classification
- ☐ Road structure design elements and details
- ☐ Catch basins and drainage swales
- ☐ Pertinent topographical features (i.e. ditches)
- ☐ Limits of disturbance
- ☐ Rights-of-way and Easements
- ☐ Existing roadways, street names, and lot and block numbers
- ☐ Proposed street names, and lot and block numbers
- ☐ Proposed traffic markings and signage information

Lot Grading Plan

- ☐ Design elevations at lot corners and finished floor elevation (FFE)
- ☐ Detailed grading information for zero lot line development
- ☐ Design elevation of swales at property lines and high points
- ☐ Elevations of the major system hydraulic grade line for a 100-year storm event, plus a minimum of 0.3 m freeboard.
- ☐ Drainage arrows to indicate direction of proposed surface drainage flow
- ☐ Contours of original ground
- ☐ Sewer inverts at property line

- ☐ Uniform fencing requirements
- ☐ Important surface features (i.e. light standards, hydrants, pedestals, transformers)
- ☐ Individual lot types and detailed drawings
- ☐ Drainage Easements and swales
- ☐ Driveway locations, if known
- ☐ Street names and lot and block numbers

Storm, Sanitary, and Watermain Plans

- ☐ Sizes, alignment, depths, spacing, dimensions from property lines, and direction of flow (sanitary, storm, and foundation drain sewers only) of all underground municipal improvements
- ☐ Location, size, and type of green infrastructure (bioswales, rain gardens, soil cells)
- ☐ Local drainage areas which contribute to storm sewers
- ☐ Sanitary sewer areas
- ☐ Manholes
- ☐ Catch basins and leads
- ☐ Manhole cover types, including associated detail number
- ☐ Minor (1:5) and Major (1:100 HWL) delineations on storm plans
- ☐ Hydrants, valves, and other appurtenances
- ☐ Services and service details
- ☐ Foundation drain sewer
- ☐ Street names and lot and block numbers
- ☐ Easements, rights-of-way, and PULs

Shallow Utilities Plan

- ☐ Alignments and all pertinent information (i.e., pedestals, transformers, etc.) for all shallow (franchise) utilities (gas, power, telephone, cable)
- ☐ Easements, rights-of-way, and PULs
- ☐ Driveway locations, if known
- ☐ Street lights
- ☐ Services
- ☐ Street names and lot and block numbers
- ☐ Community mailbox locations, if known
- ☐ Other surface features such as valves, manholes, hydrants, curbs, etc., to identify conflicts

Signage and Pavement Markings Plan

- ☐ Traffic signs (types and locations)
- ☐ Street name sign locations
- ☐ Information sign locations
- ☐ Details of sign installation
- ☐ Pavement markings
- ☐ Street names and lot and block numbers

Plan / Profile Drawings

Generally, all underground and surface improvements are to be shown on the same drawings. Although some of the following information may not necessarily be required for construction drawings, the following information will be required for Record Drawings.

General Information

Plan

- ☐ Positioned at the top of the drawing
- ☐ Chainages to correlate with profile section
- ☐ Legal subdivision information
- ☐ References to cross-sections
- ☐ Street and walkway names and numbers
- ☐ Centreline chainages of roadways
- ☐ Accuracy of grade information to two decimal places

Profile

- ☐ Positioned at the bottom of the drawing
- ☐ Chainages to correlate with plan section
- ☐ Existing ground profile
- ☐ Centreline chainages of roadways
- ☐ Grade information to two decimal places

Roadway Information

Plan

- ☐ Horizontal alignments of roadway(s), curb and gutter, sidewalks, and lane(s)
- ☐ Dimensions of roadway(s), sidewalks, and lane(s)
- ☐ Cross-section design by roadway classification
- ☐ Chainages of the PI, BC, and EC of horizontal curves, together with delta angles, radius, tangent length, and arc lengths for each curve
- ☐ Pavement elevations at intersection
- ☐ Curb elevations for each basin and the BC and EC of corner radii
- ☐ Road structure design elements

Profile

- ☐ Vertical alignment (roadway crown or lip of gutter) of roadway(s)
- ☐ Grades of sidewalks, swales, lanes, etc.
- ☐ Vertical curve information:
- ☐ Chainage to BVC, EVC, and PVI
- ☐ Elevations of BVC, EVC, and PVI
- ☐ Lengths of curves
- ☐ Elevations and chainages at sags and crests of curves
- ☐ External value, e
- ☐ K-value of crest and sag curves
- ☐ Curb and centreline grades

Watermain Information

Plan

- ☐ Alignment of watermain(s)
- ☐ Location of hydrants, valves, and other appurtenances tied to property line
- ☐ Dimension offsets of watermain to property line
- ☐ Indicate details of connection to existing watermains
- ☐ Degrees of bends, if other than 90°
- ☐ Label size of watermains, valves, and appurtenances

Profile

- ☐ Label size, pipe material, and class of pipe for watermains, and class of bedding
- ☐ Label location of hydrants; show and label valves and fittings
- ☐ Show required depth of bury and top of pipe elevations at all grade changes, valves, and fittings
- ☐ Indicate requirements for backfill compaction
- ☐ Indicate areas requiring insulation, if applicable

Sanitary and Storm Sewer Information

Plan

- ☐ Alignment of sanitary sewer(s) and storm sewer(s)
- ☐ Location of sewers, manholes, clean outs, and other appurtenances tied to property line
- ☐ Location of catch basins based on road chainages
- ☐ Show leads between catch basins and manholes
- ☐ Manholes shall be numbered (sanitary with the prefix “SA”; storm with the prefix “ST”)
- ☐ Catch basins shall be numbered
- ☐ Indicate details of connection to existing manholes
- ☐ Label size of sewers, manholes (if larger than 1200 mm in diameter), and appurtenances

Profile

- ☐ Indicate length and slope (in percent) between manholes
- ☐ Label size, pipe material, and class of pipe for sewers, and class of bedding
- ☐ Rim elevation and diameter of manholes
- ☐ Invert elevations at all inlet(s) and outlet(s) of manholes
- ☐ Indicate requirements for backfill compaction
- ☐ Indicate minimum cover requirements
- ☐ Indicate areas requiring insulation, if applicable

Service Connection Information

Plan

- ☐ Show location of all services, with references to property lot corner
- ☐ Indicate the invert at property line for each service

Shallow Utility Information

Plan

- ☐ Show location of gas, power, telephone, and cable infrastructure

Special Requirements for Design Drawings

The design drawings shall be supplemented with the following information, when applicable.

- ☐ Details of special protection for pipe sections which are exposed to high velocities or which require corrosion protection or insulation
- ☐ Drawings required for obtaining permits for crossing oil, gas, power transmission lines, railroads, or highways
- ☐ Details of placement in areas of fill
- ☐ Details pertaining to trenchless installations
- ☐ Thrust block details

Requirements for Design Calculations

Design calculations for the sanitary and storm sewer systems shall be included in the drawing package and shall include the following information:

- ☐ Design flow calculations for minor and major systems
- ☐ Detailed hydraulic calculations
- ☐ Description of any required lift stations and force mains
- ☐ All manholes and sewer sizes
- ☐ Length of sewer sections, between manholes, in metres
- ☐ Grade of sewer sections, between manholes, in percent
- ☐ Total area of tributary sewers for each sewer section, between manholes, in hectares or square metres
- ☐ Tributary area in hectares and runoff coefficient (C value) for each storm sewer section, between manholes; tributary areas to be cross-referenced to any summary tables
- ☐ Estimated peak loading based on tributary area and infiltration in litres per second
- ☐ Part-full velocity in metres per second
- ☐ Pipe capacity in litres per second
- ☐ Invert elevations at manholes and catch basins

Where the size of a development warrants, or is required by the Manager of Engineering, a Hydraulic Network Analysis shall be carried out by the Developer's Consultant (refer to Section 1.8.6), ensuring all relevant information is submitted with the design documents.

Requirements for Landscape Plans

Landscape plans are to integrate with detailed engineering drawings and should include:

- ☐ Existing and proposed contours at 0.5 m intervals within the site and extending 3 m beyond, as well as all other grading details
- ☐ Site boundaries
- ☐ Temporary site access(es), laydown area(s), parking
- ☐ Stockpile location(s)
- ☐ Existing and proposed utility information
- ☐ Existing vegetation and/or other natural features to remain
- ☐ Existing trees to be relocated

- ☐ Proposed plant material illustrated at the mature spread or diameter, as noted in the Alberta Horticulture Guide (shown in plan view, as well as in a table with the following indicated: quantity of individual species, botanical name and common name, size of material – height and calliper, method of transport – balled and burlap, container stock, bare root, etc., Canadian Plant Hardiness Zone)
- ☐ Plant schedules, including overall quantities
- ☐ Areas to be sodded or seeded, with seed mix specified
- ☐ Details of hard and soft landscape installation
- ☐ Type and depth of mulch for shrub beds and tree wells
- ☐ Location of proposed site furnishings and related construction
- ☐ Areas of concrete, asphalt, or special paving
- ☐ Irrigation systems, where applicable
- ☐ Fencing locations and construction details
- ☐ Locations of bollard
- ☐ s along PULs, walkways, or trails
- ☐ Lighting details (including street lights and park lighting, where applicable)
- ☐ Trail locations, details, signage, and proposed drainage
- ☐ Adjacent land use information
- ☐ Total measurements (square metres) of shrubs beds, islands, buffers, PULs, Municipal Reserves, Environmental Reserves, and parks
- ☐ Total measurements (square metres) of sodded and seeded areas
- ☐ Any other details that relate to the landscape design

The above items shall be presented on the following plans, as required:

- ☐ Existing Site Conditions
- ☐ Site Preparation/Clearing
- ☐ Erosion and Sedimentation Control Plan
- ☐ Layout Plan
- ☐ Grading Plan
- ☐ Planting Plan
- ☐ Construction Details and Specifications

These plans are to be submitted with the engineering drawings for each phase; refer to Section 10 Landscaping and Fencing for additional information.

2.3.6. Requirements for Geotechnical Investigations

Available recent and historical geotechnical investigations may be requested from the Town via the Land Development Inquiry Process as outlined in Section 2.2.1.

Geotechnical reports, signed and sealed by a Geotechnical Engineer, are required at two stages:

- Conceptual plan stage; and
- Detailed design stage.

Geotechnical investigations shall be undertaken by a qualified engineering firm and specifically prepared for the development / project according to the respective scope and magnitude. As a minimum, geotechnical investigations and reports shall include the following characteristics and content:

- Geology review;
- Site description;
- Field investigation, including water table measurements;
- Laboratory testing;
- Evaluation of soil conditions, and groundwater with respect to land development, including:
  - Grading;
  - Underground utilities;
  - Roads and other surface utilities;
  - House foundations;
  - Preliminary building foundations (where applicable);
  - Storm management facilities;
  - Soluble soil sulphate issues;
  - Soil bearing capacity;
  - Ground water issues; and
  - Slope stability (where applicable)
  - Soil resistivity analysis (where applicable)
- Conclusions and recommendations on the above; and
- Appendices, including test hole logs and a site plan with test hole locations and elevations.

2.3.7. Requirements for Hydraulic Network Analyses

2.3.7.1. General Requirements

A Hydraulic Network Analysis (HNA) may be required to support proposed land use bylaws, area structure plans, subdivision applications, and detailed engineering drawings.

A HNA report should include the following elements:

- **Introduction** – describe the proposed development and include a figure illustrating the project area.
- **Topography** – describe the topography, notable features; include a map of the topography.
- **Proposed Staging** – describe the proposed construction staging and estimated timelines.
- **Existing Water Network** – describe the existing water network.
- **Boundary Conditions** – summarize the boundary conditions used in the analysis. Boundary conditions are to be requested from the Town.
- **Districting**– include a land use district map with the required fire flows indicated.
- **Demands** – state the assumptions used to estimate the demands for each scenario and summarize the demands in a table; include a figure with the demand nodes and consumption boundaries.
- **Proposed Pipe Network** – describe the proposed pipe network and include a map of the proposed pipe network with model facility names and pipe sizes.

- **Design Criteria** – describe the modelling software used for the design, state the assumptions used in the design (pipe material, Hazen-Williams C-factor, etc.), state the requirements in the area (fire flows, velocities, pressures, head losses).
- **Results** – describe the simulations that were run and compare the results to required values, explain why specific nodes were chosen for analysis, identify any deficiencies and necessary corrections.
- **Appendices** – show appropriate tables for the model simulations.

A HNA report must be prepared by the Developer's Consultant and submitted to the Town for acceptance at each stage of the planning process. The HNA report must include all relevant text, tables, and figures outlined above, must be in conformance with the current Water Master Plan, and the report must be signed and sealed by the Developer's Consultant.

2.3.7.2. Area Structure Plan HNA

The scope of an Area Structure Plan (ASP) HNA includes the entire ASP area and the HNA report must be submitted concurrently with the submission of the ASP to the Town. The purpose of an ASP HNA is to:

- Guide all future development in the area;
- Identify major watermains in the area;
- Consider the development of the looped distribution system as stages are constructed;
- Recognize areas of extreme or deficient pressures and high fire flows; and
- Identify requirements to service adjacent areas.

The Developer's Consultant must clearly state design assumptions required to create the model in the HNA report and shall ensure that all pipes are sized to meet velocity criteria during peak flows. The analysis must include the following simulations:

- Peak Hour Demand (PHD); and
- Peak Day plus Fire Flow.

Main feeds within a neighbourhood section of the ASP, mains servicing areas of extreme elevation, and mains required to satisfy the above simulations must be included in the ASP HNA.

2.3.7.3. Subdivision HNA

The scope of a Subdivision HNA includes the proposed stage of development. The purpose of a Subdivision HNA is to ensure that a proposed stage of development will meet all servicing and fire flow requirements throughout all development phases. If the proposed stage is not the first stage of development, it shall consider the water distribution system(s) of the previous stage(s).

The Developer's Consultant must clearly state design assumptions required to create the model in the HNA report and shall ensure that all pipes are sized to meet velocity criteria during peak flows. The analysis must include the following simulations:

- Peak Hour Demand (PHD); and
- Peak Day plus Fire Flow.

The Developer's Consultant must include all pipes to service the proposed stage of development and ensure that looping is provided such that no more than 30 dwelling units are isolated in the event of a watermain break, or watermain shut-off for Maintenance purposes.

2.3.8. Requirements for Traffic Impact Assessments

Refer to the "Transportation Impact Assessment Guidelines" prepared for the City of St. Albert for a description of the requirements for Traffic Impact Assessments submitted to the Town. This document is available for download from https://stalbert.ca/.
At a minimum, TIAs shall include the following sections:

- Traffic Analysis;
- Traffic Demand Analysis Steps;
- Capacity Analysis;
- Traffic Signal Warrant Analysis and Traffic Signal Design;
- Intersection and Roadway Illumination Warrant Analysis;
- Proposed Geometry of Study Intersections and Roadways Sections;
- Safety Analysis; and
- Other Issues.

2.3.9. Requirements for Facility / Mechanical Plant Pre-design Reports

A pre-design report must be prepared by the Developer's Consultant and submitted to the Town for acceptance prior to undertaking the detailed design of new facilities / mechanical plants. The pre-design report must include all relevant text, tables, and figures outlined below and the pre-design report must be signed and sealed by the Developer's Consultant.

A pre-design report for a new facility / mechanical plant should include the following elements:

- **Introduction** – describe the proposed development and include a figure illustrating the project area. Include a description of land ownership and identify if land acquisition is required for the proposed development.
- **Topography** – describe the topography, notable features; include a map of the topography.
- **Existing Infrastructure** – describe the existing infrastructure adjacent to the proposed development.
- **Boundary Conditions** – summarize the boundary conditions used in the analysis. Boundary conditions are to be requested from the Town.
- **Description of Proposed Facility / Mechanical Plant** – describe the proposed facility / mechanical plant, including, at minimum, a control philosophy and process flow schematic, and site-specific considerations which will impact the design of the facility / mechanical plant.
- **Design Criteria** – describe modelling software to be used for the design (if applicable), and state any assumptions to be used in the design.
- **Environmental Considerations** – describe any environmental permits or approvals that may be required for the proposed development.

2.3.10. Reference Standards

All references to specifications, standards, or methods of technical associations are to refer to the latest adopted revision, including all amendments, in effect on the date of submission of bids, except where a date or issue is specifically noted.

2.4. General Construction Requirements

All work for construction of Local Improvements carried out by the Developer shall be in accordance with all Federal, Provincial, and Local Statutes, acts, bylaws, and regulations and shall meet the following general requirements.

2.4.1. Occupational Health and Safety

The Developer, Developer's Representative, Developer's Consultant, and Contractor shall comply with current Occupational Health and Safety Legislation.

2.4.2. Project Supervision

The Developer's Consultant shall be responsible for the layout, field surveys, inspection, and approval of materials and the supervision of all Local Improvement installations, which are the responsibility of the Developer. The Developer's Consultant shall be **on-site periodically** to ensure adequate supervision during the installation of services to certify that all Local Improvements are in conformance with the Design and Construction Standards, accepted drawings, and specifications. The Developer will be held responsible to the Town for Contractor nonconformance, construction errors, and/or omissions.

In addition to supervision carried out by the Developer's Consultant, the Town may periodically inspect the work and assist in coordinating the Local Improvements with any related municipal work. The Town will bring the use of any unacceptable materials or practices to the attention of the Developer's Consultant. If remedial action is not taken to the satisfaction of the Town, a Stop Work Order will be issued and all work will cease. The unacceptable work will be corrected and/or replaced with direction given from the Developer's Consultant to the Contractor.

2.4.3. Right-of-Way Documents

When Easement or right-of-way documents are deemed necessary, they shall be prepared by a registered Alberta Land Surveyor at the Developer's expense. Easements or rights-of-way shall be of sufficient size to allow access for Maintenance purposes. It is the sole responsibility of the Developer's Consultant to prepare and submit such documents to the satisfaction of the Manager of Engineering.

2.4.4. Design Acceptance

Upon receipt and acceptance of certified drawings and specifications, and on the Satisfactory Execution of Development Agreement and payment of security deposit(s), the Developer may proceed to install the Local Improvements.

A copy of all accepted drawings and specifications shall be maintained at the construction site during the installation of Local Improvements.

2.4.5. Construction Commencement Notice

The Developer shall give the Town at least two weeks notice prior to commencing construction to allow for time to arrange for inspection staff. To facilitate inspections, the Developer shall provide a schedule with construction milestones and anticipated inspection dates at the time of Construction Commencement Notice.

Prior to commencement of any construction activities, the Developer shall organize a pre-construction start up meeting, with Town representatives invited to attend as outlined in Section 2.4.13.

2.4.6. Stockpile Locations

The location of all stockpiles shall be subject to acceptance by the Town through the engineering drawing review. The Town's acceptance of a stockpile location does not alleviate the Developer's responsibility to ensure safety, dust control, and weed control. Stockpile locations are to be temporarily fenced. Silt fencing placed around the perimeter of the stockpile is required for stockpiles adjacent to a stormwater management facility, ditch, or road.

2.4.7. Dust Control

The Developer shall be solely responsible for controlling dust nuisance resulting from the installation of Local Improvements, both within the right-of-way and elsewhere, be it with calcium chloride, water, or by other means available and acceptable to the Town.

2.4.8. Street and Sidewalk Cleaning

During the construction and Warranty Period and until issuance of the Final Acceptance Certificate, the Developer shall be solely responsible for the removal and disposal of mud and debris from streets and sidewalks within the project boundary and outside the project boundary when mud tracking from the development occurs. Any mud / debris entering the public right-of-way shall be removed and disposed of immediately; there will be zero tolerance for mud tracking onto public roadways. All applicable bylaws pertaining to this work must be followed.

2.4.9. Barricades, Temporary Fencing, and Safety Provisions

The Developer is responsible to protect persons from injury and to avoid property damage. The Developer shall place and maintain adequate barricades, construction signs, warning lights, and temporary fencing at all times until the work is safe for traffic or pedestrian use.

2.4.10. Erosion and Sedimentation Control (ESC)

The Developer shall have ESC measures in place to prevent erosion and the transport of sediment from the development. The Developer's Consultant shall consult the following City of Edmonton documents:

- Erosion and Sedimentation Control Guidelines; and
- Erosion and Sedimentation Control Field Manual.

The ESC plan and strategy shall be implemented prior to development and shall be maintained throughout construction and the Warranty Period, until issuance of the Final Acceptance Certificate. Additionally, an ESC report may be required, at the discretion of the Manager of Engineering. The requirement for an ESC report will be considered on a case-by-case basis.

The Developer shall comply with the Federal, and Provincial acts, regulations, codes of practice, standards, and guidelines that are applicable to development activities that result or could result in erosion, sedimentation, or other adverse impacts to the environment. The Developer shall be held solely accountable to Alberta Environment for noncompliance.

Refer to Section 3 for a Sample ESC Inspection / Maintenance Report. The ESC Inspection / Maintenance Report shall be kept up to date at all times during construction and shall be made available for the Town's review upon request.

2.4.11. Traffic and Utilities Controls

2.4.11.1. Approvals

Prior to any work being done within the municipal right-of-way, the Developer must obtain approval(s) from the Manager of Engineering at least five (5) working days prior to work commencing.

For work being performed on or adjacent to public roadways, the Manager of Engineering may require the Developer to provide a plan to accommodate traffic flow in a safe and effective manner. This plan will include but is not limited to temporary construction signage, barricades, warning lights, and detours. The plan must be provided to the Town at least five (5) business days prior to work commencing.

2.4.11.2. Traffic Disruption

Excavations for pipe laying operations shall be conducted to cause the least interruption to traffic. The Developer shall provide and maintain safe and suitable temporary bridges at street and driveway crossings where traffic must cross open trenches. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, and other utility controls shall be unobstructed and accessible during the construction period.

2.4.11.3. Flagpersons

At locations of traffic disruption, suitably trained and certified flagpersons, able to handle traffic safely and effectively, are required to minimize traffic disruption to the public.

2.4.11.4. Utility Disruption

Adequate provision must be made for the flow of sewers, drains, and water courses encountered during construction. Valves and other controls on the existing utility system shall be operated only by the Town.

Disruptions and shutdowns shall impact no more than 2 hydrants and no more than 30 single-family residential units.

2.4.11.5. Adjacent Property Owner Notification

All property owners affected by the construction of Local Improvements shall be notified by the Developer in consultation with the Town before any service interruptions or paving operations and shall be advised of the probable time when service will be restored. Notices will be required to inform residents of service interruptions or paving operations; these notices are required to be distributed to residents 72 hours prior to any service interruptions or paving operations.

2.4.11.6. Detours

Prior to any road closure, the Developer must submit, at the Developer's expense, a detour plan for acceptance by the Town. Public safety is of the utmost importance and an acceptable detour plan must include provisions outlining safe vehicular passage and pedestrian movement.

If the proposed road closure is within an 800 m radius of a Provincial highway, Alberta Transportation and Economic Corridors must be notified, and Alberta Transportation and Economic Corridors approval of the detour plan must be obtained and provided to the Town in support of the detour plan.

The Town's acceptance of the detour plan does not relieve the Developer of their responsibility for maintaining the provisions outlined on the detour plan during construction. The Town's acceptance of a proposed detour plan in no way implies that Alberta Transportation and Economic Corridors will approve the proposed detour plan.

The Developer shall be solely responsible for supplying, placing, and maintaining detour signage at all times for the duration of construction.

Emergency access must be maintained at all times. It is solely the Developer's responsibility to contact emergency services (Fire Department, RCMP, and Alberta Health Services) within a reasonable timeframe of the planned road closure and to satisfy in full any additional requirements emergency services may have. Prior to the road closure, written confirmation that emergency services have accepted the proposed detour plan is required to be submitted to the Town.

2.4.11.7. Signage

The Developer must, at their expense, provide, erect, and maintain all signs, barricades, flares, etc. to the satisfaction of the Town.

Road closures / detours must be advertised to the public via two (2) electronic message boards at least 72 hours prior to the road closure and commencement of the detour. Any required changes to the date(s) of the road closure / detour indicated on the electronic message board will require a new full 72-hour notification period prior to the road closure and commencement of the detour.

Any damage to or lost signage shall be repaired or replaced immediately, at the Developer's expense.

All signage shall be placed in accordance with the Urban Traffic Control Devices Manual. All signage shall be inspected and maintained on a regular basis for legibility and/or damage. All signage shall be mounted on fixtures appropriate for the intended use. Measures shall be taken to ensure that the signage remains erect during inclement weather.

2.4.11.8. Staged Construction

To permit movement of traffic across streets where new pavement is being constructed, the Town may require that the Developer construct intersections one-half at a time. This will allow traffic to cross the road through a gap in the pavement until traffic is allowed to cross on the new pavement at which time the gap in the pavement can be filled in.

2.4.12. Boundary Controls and Water Commissioning

A boundary valve is to be placed at the tie-in to the existing water distribution system. The valve is to remain closed until commissioning has been completed. Water mains must be commissioned as soon as reasonably possible after completion of construction as per Section 6.28. The exception is when the boundary valve is cracked open to fill the new main for testing and chlorination purposes.

Filling and Flushing Plans are required for each project, to be submitted to the Town for acceptance prior to undertaking watermain testing. Copies of all bacteriological tests performed are to be forwarded to the Town.

Plugs are to be placed at the downstream end of new pipes at the tie-in manholes to the existing sanitary and storm sewer systems. The plugs are to remain in place until a CCC is issued on the sanitary and storm sewer systems.

Boundary valves are to be operated by Town staff only. The Town must be given at least 72 hours notice prior to cracking boundary valves to fill new watermains for testing and chlorination purposes. Only one boundary valve shall be opened at one time to prevent backflows. Boundary valves are to remain closed until new water lines are accepted, except for the following construction activities:

- Filling water mains for wet-tapping of services;

- Hydrostatic testing; and,
- Disinfection and subsequent flushing.

Use of Town water for purposes outside of normal development (i.e., use of hydrants for dust control or SWMF leak testing using potable water) will require metering.

2.4.13. Progress Meetings

Prior to commencement of any construction activities, the Developer's Consultant shall administer a pre-construction meeting with representatives of the Town, Contractor and subcontractor(s) in attendance. Subsequent progress meetings are to be held at a frequency to suit the timelines of the project, preferably weekly. The frequency of progress meetings is to be determined between the Town and Developer.

Town representatives shall be invited to the pre-construction meeting and all subsequent progress meetings. The Town shall be included in the meeting minutes distribution list.

2.4.14. Stop Work Order

The Town will issue a Stop Work Order to the Contractor due to nonconformance. Non-conformance includes:

- Unsafe work practices;
- Risk of imminent danger;
- Lack of traffic control;
- Construction not in accordance with accepted drawings, specifications, and Design and Construction Standards;
- Non-conforming and non-approved materials;
- Damage to existing facilities; and/or
- No consulting supervision.

Should a Stop Work Order be issued, the Developer shall immediately cease operation, rectify the nonconformance and obtain the Town's written approval prior to proceeding. Any and all materials installed without Town consent shall immediately be removed and replaced with Town Representatives present before other work can commence.

2.4.15. Survey Monument Control

The Developer shall be responsible to maintain and, if necessary, replace such monuments as may be destroyed, damaged or removed by the operation of the Developer in carrying out the construction and installation of Local Improvements.

2.5. CCC and FAC

2.5.1. CCC and FAC Inspections

Five (5) working days prior to any construction completion inspection or final acceptance inspection, the Developer's Consultant shall conduct a pre-inspection. Any deficiencies noted at the pre-inspection are to be documented and the list of deficiencies is to be submitted to the Town at least 72 hours prior to the construction completion or final acceptance inspection. Any deficiencies noted at the pre-inspection are to be rectified and the Developer's Consultant shall complete a Pre-Inspection Checklist that confirms that there are no outstanding deficiencies and certifies the readiness for the construction completion or final acceptance inspection. All catch basin sumps shall be cleaned (hydro vacuumed) prior to any inspections.

The Developer's Consultant shall take the lead role in the construction completion and final acceptance inspections. The Contractor shall have personnel on site to operate any installed infrastructure (valves, curb cocks, etc.) as part of the inspections. The Town Representative will observe the inspection and only provide comments whenever necessary. The Developer's Consultant is responsible to confirm that the project has been constructed in general conformance to the accepted drawings and specifications and Design and Construction Standards.

2.5.2. Seasonal Conditions

At the discretion of the Manager of Engineering, and weather permitting, inspection can occur between May 1st and October 15th, provide snow cover, temperature, and other considerations do not prevent the ability to perform a thorough inspection. The Manager of Engineering may allow inspections outside of these dates at their discretion. Inspections occurring after October 15th may require an additional warranty due to operational constraints of the infrastructure.

Should seasonal conditions not permit the CCC or FAC inspection, execution of the CCC or FAC by the Town will be delayed until appropriate conditions exist. The Town is not responsible for notifying the Developer when inclement weather will delay the CCC or FAC inspection. Examples of inclement weather which will delay inspections until appropriate conditions exist include: snow, ice, and freezing conditions.

2.5.3. CCC and FAC Inspection Costs

The Developer will be responsible for any inspection costs deemed appropriate by the Town as set out in the Fees and Charges Bylaw. Current costs for inspections can be found on the Town's website at:

https://www.stonyplain.com/en/work/fees.aspx

Costs may include, but are not limited to:

- Consulting expertise required by the Town for specialized inspection needs; or
- When excessive deficiencies are present and re-inspections are required.

Inspection costs may take several forms, including:

- A lump sum fee charged to the Developer; or
- An invoiced cost by specialized consultant, plus mark-up for handling and administration.

2.5.4. CCC Requirements

Upon completion of construction of the Local Improvements, and in one (1) complete submission, the Developer shall submit the following documentation. The Town's acceptance of the supporting documentation is required prior to issuance of a Construction Completion Certificate.

- CCC application
- Deficiency free inspection report
- Lot service records, including photos;
- Compaction test results;
- Pressure and leakage testing results;
- Chlorine residual test results;
- Bacteriological test results;
- Closed-circuit television (CCTV) inspection report for sanitary and storm sewers;
- Infiltration or exfiltration test results for sanitary and storm sewers;
- Concrete and asphalt mix designs;
- Density test results;
- Deflection test results;
- Concrete strength test results;
- Materials testing results;
- Asphalt core results;
- Operation and Maintenance manuals (for mechanical systems and control structures);
- Piping, instrumentation, and single line electrical diagrams (where applicable); and
- An accurate as-constructed bill of materials for the Town's TCA database. Please contact the Town to obtain a copy of the TCA excel table which is to be completed and submitted to the Town at the time of construction completion.

Incomplete or "piecemealed" submissions will be returned to the Developer.

2.5.5. Construction Completion Certificates (CCC)

Upon satisfactory completion of the project, a satisfactory construction completion inspection, and after all deficiencies have been corrected and submissions received, the Town shall execute the Construction Completion Certificate submitted by the Developer or Developer's Consultant, notifying:

- Acceptance of the work by the Town; and
- The commencement date of the Warranty Period.

A copy of the Construction Completion Certificate is included in Section 3 for issuance by the Developer and the Developer's Consultant.

Separate Construction Completion inspections and commencement of Warranty Periods shall be issued for the following:

- Underground utilities;

- Shallow utilities;
- Separate sidewalks and trails;
- Surface works; and
- Landscaping.

Additional Construction Completion inspections and commencement of Warranty Periods for specific Local Improvements may be issued at the discretion of the Manager of Engineering.

2.5.6. Warranty Period

The construction cut-off date for underground and surface improvements, with the exception of landscape improvements, shall be as directed by the Town, but generally shall be no later than October 15, subject to the conditions as outlined in Section 2.6.1.

The Developer shall be responsible for any defect, fault, or deficiency in the completed work during a minimum two (2) year Warranty Period and shall remedy it at their own expense.

Upon commencement of the Warranty Period, the Town will assume responsibility for snow removal and garbage pickup on paved streets within the occupied subdivision. The Developer shall remain responsible for all other Maintenance and repair items including third party damages, Maintenance of street signs, flushing of sewer lines, thawing and flushing of watermains, and Maintenance of the landscaping up until the issuance of the Final Acceptance Certificate.

Third party damage occurring during the Warranty Period will be reviewed by the Town on a case-by-case basis; upon review and consideration by the Town, the Developer may be held responsible for the third party damage.

2.5.7. General Requirements for Record Drawings

The Developer shall submit to the Town Record Drawings and other related information giving detailed measurements of the Local Improvements constructed. The submission of Record Drawings and all other data for record purposes is a condition of the execution of Final Acceptance Certificates by the Manager of Engineering.

Record drawings must be submitted and accepted by the Town prior applying for FAC, and must include any changes that occurred during the Warranty and Maintenance period. Record Drawings must only be completed and certified once all outstanding deficiencies have been completed and at a time when any future maintenance work shall not alter information contained within the Record Drawings.

The Developer shall submit to the Town one (1) authenticated electronic copy (PDF), and one (1) electronic copy (.shp or .dwg) stamped "For Record". The date, Prime Contractor, and subcontractors shall be indicated on Record Drawings. The Town will accept digital submissions in the Town's most current version of ArcGIS or AutoCAD, in NAD 83 10TM format.

The Developer's Consultant shall certify that all work has been completed in accordance with the plans and specifications, the Design and Construction Standards, and that all work and deficiencies have been completed.

2.5.7.1. Record Drawing Requirements for Surface Improvements

All data shown on the construction drawings shall be updated to as-constructed information, in red, including:

- Elevations of catch basins, manhole covers, and curb returns on the plan / profile drawings, as well as any grade changes which exceed the design grade by more than 0.1% (or 25 mm);

- Location of curb cocks, including those installed as part of any underground improvements, as well as any existing curb cocks;
- Curve radii, distances from back of walk to property line, and sidewalk widths on the plan / profile drawings;
- Type of curb, whether rolled face or straight face, on an overall plan;
- Elevations at either the roadway crown or lip of gutter; and
- Lot corner elevations, swales centreline elevations at beginning and end as well as at property line crossings and any changes in alignment of the swale.

If the cross-section design has changed in width or structure, then this shall be indicated on the typical section plan.

2.5.7.2. Record Drawing Requirements for Underground Improvements

All data shown on the construction drawings shall be updated to as-constructed information, in red, including:

- Location of drainage facilities; for example, manholes, catch basins, and the end of pipe stubs;
- Identification of pipe bedding and backfill materials;
- Size of manholes, inverts of all pipes entering / exiting manholes;
- Horizontal alignments, sizes, and grades of sanitary and storm sewers;
- Horizontal alignments and sizes of watermains;
- Locations of valves, hydrants, curb stops, and horizontal and vertical bends;
- Location of services from property line;
- Elevations of pond / wetland bottom, normal water level, high water level, and freeboard;
- Water table elevations and other geotechnical considerations;
- Area at pond / wetland bottom, normal water level, high water level, and freeboard;
- Notation indicating the elevation of the lowest allowable building opening for lots abutting the stormwater management facility;
- Measurements to locate submerged inlets, outlets, and sediment traps referenced to identifiable permanent features which are not submerged at normal water level; and
- Location, material, diameter, inverts, and slope of culverts.

Where the water table is located above the fire hydrant drain, the hydrant drain ports may require plugging. Hydrants with plugged drain ports must be clearly identified on the Record Drawings.

As part of the post-construction submission package, the Developer shall submit certification by an accredited materials testing firm or manufacturer confirming that all materials conform to the Design and Construction Standards or the special letter of approval.

2.5.8. FAC Requirements

The Town's acceptance of the supporting documentation is required prior to issuance of a Final Acceptance Certificate.

- FAC application;
- Deficiency free inspection report;

- Accepted Record Drawings as per Section 2.5.7;
- Closed-circuit television (CCTV) inspection report for sanitary and storm sewers;
- Asphalt density test results;
- Asphalt thickness test results;
- Concrete repair strength test results;
- Materials testing results; and,
- Computer models of all utilities.

2.5.9. Final Acceptance Certificate (FAC)

Prior to the expiration of the Warranty Period, the Developer shall request, in writing, a final inspection and, within sixty (60) working days of receipt of such request, the Town will carry out an inspection.

Final Acceptance certificates shall be issued for underground improvements, surface improvements, and landscaping, upon correction of all deficiencies. Additional certificates for specific improvements may be approved under a separate Final Acceptance Certificate at the discretion of the Manager of Engineering. A copy of the certificate is included in Section 3 for execution by the Developer and the Developer's Consultant. The Warranty Period shall remain in effect until the Final Acceptance Certificate is issued by the Town.

Should seasonal conditions not permit the inspection, execution of the Final Acceptance Certificate by the Town will be delayed until appropriate conditions for inspection exist

2.6. Development and Building Permits

With the exception of Earthworks Permits, no development or building permit shall be issued until water service is operational for fire protection and all-weather roads are constructed for emergency access.

Generally, both the underground and surface CCCs are required prior to issuing of development or building permits. Building Occupancy shall not be allowed until both the underground and surface CCCs are issued.

Requirements for Earthwork Permits can be found on the Town's website at:
https://www.stonyplain.com/en/work/applications-licences-and-permits.aspx

3. CHECKLISTS & FORMS

The following checklists and forms, referenced throughout the Design and Construction Standards, are provided in this section for completion by the Developer's Consultant.

- Construction Completion Certificate (CCC) Form;
- Final Acceptance Certificate (FAC) Form;
- Sample ESC Inspection / Maintenance Checklist;
- Engineering Pre-Inspection Checklist;
- Landscape Pre-Inspection Checklist;
- Fence Pre-Inspection Checklist;
- Disinfection Form;
- Leakage Test Form;
- Design Deviation Form; and
- Service Report Form.

CONSTRUCTION COMPLETION CERTIFICATE

The following certificate shall be prepared and executed by the Developer and Developer's Consultant for submission to the Town of Stony Plain.

Date: _____

Brief Project Description:

_____

_____

_____

Developer:		Developer's Consultant:	
Name:	_____	Name:	_____
Address:	_____	Address:	_____
	_____		_____
	_____		_____
Phone:	_____	Phone:	_____
Fax:	_____	Fax:	_____
Email:	_____	Email:	_____

The CCC inspection was performed on _____ and all noted deficiencies have been rectified.

I, _____ of _____
(Consultant's Name) (Consultant's Firm)

hereby certify that the contract for the above described project has been completed in general conformance with the Contract Documents and the Town of Stony Plain's Design and Construction Standards.

Engineer's Seal

Company Permit Stamp

Town of Stony Plain

Based on the above certification, the Town of Stony Plain accepts that the project is complete and that the warranty period as it affects the Town will commence on _____

Reviewed By:	_____	Approved By:	_____
Date:	_____	Date:	_____
Signature	_____	Signature	_____

FINAL ACCEPTANCE CERTIFICATE

The following certificate shall be prepared and executed by the Developer and Developer's Consultant for submission to the Town of Stony Plain.

Date: _____

Brief Project Description:

_____

_____

_____

Developer:		Developer's Consultant:	
Name:	_____	Name:	_____
Address:	_____	Address:	_____
	_____		_____
	_____		_____
Phone:	_____	Phone:	_____
Fax:	_____	Fax:	_____
Email:	_____	Email:	_____

The FAC inspection was performed on _____ and all noted deficiencies have been rectified.

I, _____ of _____
(Consultant's Name) (Consultant's Firm)

hereby certify that the contract for the above described project has been completed in general conformance with the Contract Documents and the Town of Stony Plain's Design and Construction Standards and that all deficiencies have been rectified to the Town's satisfaction.

Engineer's Seal

Company Permit Stamp

Town of Stony Plain

Based on the above certification, the Town of Stony Plain accepts that the warranty period has expired effective _____ and that the Town assumes responsibility for the development as it concerns the Town

Reviewed By:	_____	Approved By:	_____
Date:	_____	Date:	_____
Signature	_____	Signature	_____

SAMPLE ESC INSPECTION / MAINTENANCE REPORT

Project Name	**File No.** **Contract No.**
Inspection Date: Time:	Date of Last Inspection:
Inspected By:	Date:
Current Weather:	Weather Forecast:
mm of rain in last week:	mm of rain in last 24 hrs:
Stage of Construction:	
Contractor(s) on Site:	
Construction Activities on Site:	
Heavy Equipment on Site:	

INSPECTION CHECKLIST	YES / NO	COMMENTS	ACTION REQUIRED
Has stripping and grading been phased where possible?			
Have stripped areas / exposed soils / steep slopes been protected and stabilized?			
Have waterways and drainage ways been protected and stabilized?			
Are perimeter controls in place and functioning adequately?			
Are off-site / downstream properties / waterways protected?			
Are construction entrances stabilized to minimize tracking of soil and mud off-site?			
Are Sedimentation Control BMPs in place and functioning adequately?			
Are Transport Control BMPs in place and functioning adequately?			
Are Erosion Control BMPs in place and functioning adequately?			

Note:
BMP: Best Management Practice.

ENGINEERING PRE-INSPECTION CHECKLIST

SANITARY SEWER

		COMMENTS
Manholes		
Channel	☐	
Base	☐	
Joints	☐	
Cover	☐	
Grade Rings	☐	
Clean	☐	
Main Line		
Compaction Tests	☐	
CCTV Repot	☐	
CCTV Review	☐	
Exfiltration / Infiltration Test	☐	
Mandrel Test	☐	

STORM SEWER

		COMMENTS
Manholes		
Channel	☐	
Base	☐	
Joints	☐	
Cover	☐	
Grade Rings	☐	
Clean	☐	
Main Line		
Compaction Tests	☐	
CCTV Repot	☐	
CCTV Review	☐	
Exfiltration / Infiltration Test	☐	
Mandrel Test	☐	
Catch Basins		
Sump	☐	
Base	☐	
Joints	☐	
Grate	☐	
Location	☐	
Clean	☐	
SWMFs		
Flared Ends (Inlet)	☐	
Flared Ends (Outlet)	☐	
Trash Rack	☐	
Rip Rap (Class, Size)	☐	
Topsoil	☐	
Seeding	☐	
Control Structure	☐	
General Clean-up	☐	

WATERMAINS

		COMMENTS
Compaction Tests	☐	
Hydrant Operation	☐	
Valve Operation	☐	
Pressure / Leakage Test	☐	
Chlorine Residual Test	☐	
Bacteriological Test	☐	

SERVICES

		COMMENTS
Compaction Tests	☐	
CC Operation	☐	
Sanitary	☐	
Storm	☐	
Water	☐	
Marker Stakes	☐	
Service Reports	☐	

CONCRETE

Curb and Gutter	☐	
Sidewalk	☐	
Expansion Joints	☐	
Concrete Test	☐	
Mix Design	☐	
CC Stamps	☐	
Backfill	☐	
Clean	☐	
	☐	

ASPHALT

Asphalt Surface Uniformity	☐	
Subgrade Compaction Tests	☐	
GBC Compaction Tests	☐	
Proofrolls	☐	
Asphalt Core Results	☐	
Mix Design	☐	
Thickness	☐	
Density	☐	
Clean	☐	

SITE GRADING

Ditches	☐	
Culverts	☐	
Swales	☐	
Clean	☐	
Lots Rough-Graded to	☐	
Ensure Positive Drainage	☐	

LANDSCAPING

Plant Vitality	☐	
Topsoil & Mulch	☐	
Health, Pest, Diseases	☐	
Seeded & Seed Germinated	☐	
Sodded & Pieces Knitted	☐	
Weed Control	☐	
ESC	☐	
Fencing	☐	
Dry	☐	
Clean	☐	

I, _____ (Consultant's Name) of _____ (Consultant's Firm) Certify that _____ (Project Name) has been preinspected and is ready for a _____ (CCC / FAC) inspection of the _____ (Storm / Sanitary / Water / Surface / Landscape) works.

Signature: _____ Date: _____

LANDSCAPE PRE-INSPECTION REPORT

Project Name	**File No.** **Contract No.**
Inspection Date: Time:	Date of Last Inspection:
Inspected By:	Date:
Current Weather:	Maintenance Logs:
Stage of Construction:	
Contractor(s) on Site:	

INSPECTION CHECKLIST	YES / NO	COMMENTS	ACTION REQUIRED
Has planting been completed? Are the counts correct?			
Are trees staked and tied?			
Are trees straight / aligned / and at the proper planting height?			
Are the trees healthy and watered in the last 48 hours?			
Are tree soil / mulch rings in place?			
Has seeding / sodding been completed? Has it been maintained recently? Have sod pieces knit together?			
Are there any bare/ damaged sections of turf which need to be replaced/ overseeded?			
Has the site been weeded / sprayed?			
Have all site amenities been installed as per plan			
Are there any damages to site amenities which require touch-up or replacement?			
Have construction debris / stockpiles been removed from site?			

FENCE PRE-INSPECTION REPORT

Project Name	**File No.** **Contract No.**
Inspection Date: Time:	Date of Last Inspection:
Inspected By:	Date:
Current Weather:	
Stage of Construction:	
Contractor(s) on Site:	

INSPECTION CHECKLIST	YES / NO	COMMENTS	ACTION REQUIRED
Has all fencing been completed as per plans?			
Has the fence alignment/ offset been verified?			
Are all posts straight and firmly set in the ground?			
Are all panels securely fastened to posts?			
Are there any damages which require touch-up or replacement?			
Are all gates installed as per plans?			
Do all gates swing into lots without impediment & latch properly?			
Is the bottom of the fence a minimum of 75 mm above final grade? (Not applicable to Noise Fence)			
Have construction debris/ stockpiles been removed from site?			

DISINFECTION FORM

The following form shall be prepared by the Developer's Representative for submission to the Town of Stony Plain.

CHLORINATION

Date: _____

Project: _____ Drawing No.: _____

Location: _____ From: _____ To: _____

Pipe Size: _____ Length of Test Section: _____

Pipe Type: _____

Location No. 1 Flush and Chlorinating Corp.: _____

Location No. 2 Flush and Chlorinating Corp.: _____

Rate of Discharge: _____ L/min. Rate of chlorine feed: _____ kg/day

Flow through time: _____ hrs – mins. _____ Residual at finish: _____ mg/L

FINAL FLUSHING

Date: _____

Time started: _____ Chlorine residual _____ mg/L

Time finished: _____ Chlorine residual _____ mg/L

SAMPLES FOR RESIDUAL CHLORINE TEST

Sample No.	Sample Location	Discharge Rate (L/min.)	Time Taken	Date Taken	Chlorine Residual

_____ _____

Operator's Name Operator's Signature

_____

Company Name Address Phone No.

SAMPLES FOR BACTERIOLOGICAL TEST

Sample No.	Sample Location	Time Taken	Date Taken	Total Chloroforms	HPC

_____

Testing Laboratory

_____ _____

Date Testing Submitted Date Testing Completed

Consulting Firm:_____

Developer's Representative's Signature:_____

LEAKAGE TEST FORM

The following form shall be prepared by the Developer's Representative for submission to the Town of Stony Plain.

Date: _____

Project: _____ Drawing No.: _____

Location: _____ From: _____ To: _____

Pipe Size: _____ Length of Test Section: _____

Pipe Type: _____ of Joints: _____

Allowable Leakage per Hour (L) _____ (for test pressure of: kPa)

Actual Leakage per Hour (L) _____ (for test pressure of: kPa)

Pump Start Time	Meter Reading	Pump Stop Time	Meter Reading	Total Loss (L)

High Pressure Water Meter Used (Brand name, model, and serial number)

_____

Date Meter Tested and Calibrated: _____

Date Complete: _____ Operators Signature: _____

Company: _____ Company's Address: _____

Phone No.: _____

Developer's Representative's Signature: _____

PROPOSED DESIGN DEVIATION FORM

Project Information

Project Name:	
Project Limits:	

Design Deviation Information

Location:	*Where will the design deviation apply (e.g., side of road; intersection; intersection quadrant; neighbourhood, etc.)? Include a site plan as an attachment.*
Context:	*What is the context (e.g. adjacent land use and orientations, road classification, design and posted speed, anticipated volumes, components that do not meet the standards)?*
Deviation Requested:	*Describe the deviation you are requesting and identify the standards document (most recent published version/volume), specific text, drawings, and/or section you are requesting deviation from? Indicate the design element or combination of elements which the design deviation is proposed for (e.g. curb radius; lane width; offset; etc.), the proposed value, and the range of values in the current standards.*
Rationale:	*What is the rationale for the design deviation? Include any supporting documents as applicable (calculations and/or modeling results; supporting drawings, swept path analyses, previous documents, amendments, or approvals) that provide further justification for the requested deviation.* *What alternatives (if any) were considered in the decision? What is the benefit of and what are the impacts avoided with the identified solution(s) over other alternatives considered?* *What are the potential risks associated with this deviation and what is being done to mitigate them (e.g., signage, vehicle restrictions, etc.)? What additional mitigation measures are being included to offset potential impacts of the deviation, including any related to the service life of infrastructure, operation and maintenance requirements, and overall performance?* *What additional supporting documents, data, or technical resources were used in making the decision (e.g., research papers, best management practices, other municipal/provincial/federal guidelines, etc.)?*

Submitted By

Name:		Title	
Date:		Company	
Engineer Stamp (Authentication)		Permit to Practice (Validator)	

Acceptance / Rejection (Town Use Only)

Decision:	☐ Accepted	☐ Rejected
Name:		
Title		
Date:		

TOWN OF STONY PLAIN

SERVICE REPORT

Street _____

Lot_____ **Civic No.** _____

Development Permit No: _____

PUBLIC

	Water	Sanitary	Storm
Length:			
Material:	☐ PVC IPEX BLUE BRUTE ☐ PVC IPEX CENTURION ☐ PVC Next AQUALOC 150 ☐ PVC AQUALOCK 100 ☐ _____ (other approved with form)	☐ PVC D3034 SDR35 ☐ STEEL CAN3-Z245.1 ☐ _____ (other approved with form)	☐ CONC CAN/CSA A257.2 ☐ CONC ASTM C76/ C76M ☐ PVC ASTM D3034 DR35 ☐ PP CSA B182.2 DR35 ☐ CSP (CULVERT ONLY) ☐ _____ (other approved with form)
Diameter:			
Colour:			
Depth @ Main (m):			
Depth @ PL (m)L			
T.O.P. Elev. @ Main:			
T.O.P. Elev. @ PL:			
Main Diameter:			
Curb Stop to PL (m):			
PL to Stub (m):			

PRIVATE

	Water	Sanitary	Storm
Length:			
Material:	☐ Type K Copper ☐ PEXa ☐ PVC DR18 ☐ _____ (other approved with form)	☐ PVC DR28 CSA B182.2 (150mm) ☐ PVC DR35 CSA182.2 (≥200mm) ☐ _____ (other approved with form)	☐ PVC ASTM D3034 DR35 ☐ PP CSA B182.2 DR35 ☐ _____ (other approved with form)
Diameter:			
Colour:			
Depth @ Bldg (m):			

Contractor _____

Inspected By _____

Date _____

Contractor: _____

Inspected By: _____

Date: _____

Record Drawing #: _____

Insulation? ☐ Yes ☐ No

Anode? ☐ Yes ☐ No

RURAL DEVELOPMENTS

Driveway Culvert? ☐ Yes ☐ No

Precast Headwalls? ☐ Yes ☐ No

Driveway Culvert Diameter: _____

Material: _____

Insulation ☐ Yes ☐ No

Sump Pump Connected to Foundation Drain? ☐ Yes ☐ No

Sanitary Service Type? ☐ Gravity ☐ Pressure

Private Pump Station Info Lift: _____

Distance: _____

Additional Notes & Comments:

Additional Notes & Comments:

ATTACH PHOTOS (PRE AND POST BACKILL) TO SUBMISSION

SEE REVERSE FOR SKETCH

TOWN OF STONY PLAIN

SERVICE REPORT

Street _____

Lot_____ **Civic No.** _____

PRIVATE

PUBLIC

4. ROADWAY SYSTEMS

4.1. General

This section covers the general design and construction of roads, lanes, curbs, gutters, sidewalks, boulevards, and accessories to be built or rebuilt in the Town. Pedestrian trails and bike paths are covered in Section 10. Standard Details relating to roadway design and construction are provided in Section 4.22 Roadway Systems.

Specific construction requirements, construction materials, and procedures are not included.

4.2. Traffic and Transportation

This section covers the transportation and traffic engineering aspects of roadway and walkway design in the Town. These standards are the minimum requirements for roadway and walkway facilities. Changes in the design values may be considered, provided that the changes are justified and added benefits are provided by the Developer's Consultant to the Manager of Engineering's satisfaction.

All designs shall conform to the relevant Area Structure Plan, the Transportation Master Plan, and shall ensure the safe and efficient movement of traffic and pedestrians. Sufficient access points to Rural and Urban collectors shall be provided to the satisfaction of the Town.

Roadway capacity and safety can be affected by the following factors:

- **Roadway Geometrics** - Road right-of-way, road width, lane width, storage turn bay lengths and geometrics, grade and curvature, intersection configuration, etc.
- **Traffic Characteristics** - Traffic volume, speed, traffic composition, traffic fluctuations, saturation flow, etc.
- **Road "Frictions"** - Traffic control measures, parking conditions, access locations and numbers, driver sight distance, street furniture, etc.

4.3. Road Classification and Geometric Standards

The classification and designation of roads and walkways shall be undertaken during the subdivision planning stages. It shall commence with the Area Structure Plan, to ensure road, walkway, utility, and right-of-way requirements can be coordinated, established, and approved in the design stages of subdivision development.

4.3.1. General

- Roads are classified based on a functional hierarchy. The road classifications are local, collector, and arterial for Urban areas; and collector and local for Rural areas.
- The design standards for Urban and Rural roads shall be in accordance with the geometric design standards outlined in "Geometric Design Guide for Canadian Roads" published by TAC. Alberta Transportation and Economic Corridors' Highway Geometric Design Guide may also be applicable.
- Typical cross-sections are included with the Standard Details (Section 4.22).
- Table 4-1 provides a summary of the road classifications and geometric guidelines.

4.3.2. Arterial Roads

Arterial roads generally serve as line-haul facilities carrying traffic between activity centres; i.e., connecting with collectors, other arterials, or freeways, but not local streets. Unless specified otherwise, arterial roads shall be undivided and will carry more than 12,000 vehicles per day. On-street parking is not permitted on arterial roads.

4.3.3. Collector Roads

Collector roads provide local access to frontage developments and collect traffic from several local streets or from an Industrial area, and channel it towards the arterial system. A collector street can connect with local streets, other collectors, or with arterial roadways; however, their location should minimize the potential for use as a short-cut between arterial roadways. Parallel parking may be allowed on these streets.

4.3.4. Local Road

Local roads are intended solely to provide access to individual properties. The level of traffic on a local road is not generally a problem; however, the volume can be controlled if the maximum length is set at 600 m and traffic calming considerations are incorporated into the design. Local roads should only be permitted to connect with other local roads or with collector roads. All sites should provide sufficient on-site parking to meet demands. School buses may be permitted.

4.3.5. Angled Parking

Angled parking is generally not permitted; however, angled parking for roads may be acceptable to the Town upon submittal of appropriate design parameters.

4.3.6. Curb and Gutter

All urban roads within the Town shall have curb and gutter. Minimum grade along all linear curb and gutter is to be 0.6%. Minimum grade along all curved curb and gutter, including curb returns and cul-de-sacs, is to be 0.8%.

All arterial and Collector roads shall have straight face curb and gutter. Industrial local roads shall have straight face curb and gutter with driveway cuts.

For residential local roads, straight face curb and gutter shall be provided along side lots, flanking lots, backing lots or where rear lanes access is provided. Rolled face curb and gutter may be used elsewhere on residential local roads.

4.3.7. Geometric Design Criteria

Table 4-1 on the following page provides the minimum design criteria which shall be used to design streets in the Town.

Table 4-1
Road Classification and Geometric Guidelines

Classification	Arterial			Urban					Rural			
	Divided	Undivided		Collector			Local		Collector		Local	
				Residential		Ind./ Comm.[2]	Residential	Ind./ Comm.[2]	Residential	Industrial[2]	Residential	Industrial[2]
				Major	Minor							
TAC Designation	UAD	UAD		UCU	UCU	UCU	ULU		RCU		RLU	
Parking	No			Permitted					No			
Service	Through Traffic			Through Traffic & Access		Access Only			Through Traffic & Access		Access Only	
Average Daily Volume	12,000-30,000	5,000-12,000		2,500 – 5,000	1,000 – 2,500	1,000 – 5,000	Up to 1,000		1,000 – 5,000		Up to 1,000	
Truck Traffic	5%	5-10%		<1%	<1%	10%	0%	10%	5%	10%	1%	10%
No. of Housing Units	-			Over 250	100 – 250	-	< 100	-	-		< 100	-
Flow Characteristic	Uninterrupted except traffic / pedestrian signals			Interrupted Flow								
ESALS[3]	To be determined based on anticipated volumes·			6.0×10^5	2.5×10^5	3.0×10^6	1.0×10^5	1.0×10^6	6.0×10^5	1.0×10^6	1.0×10^5	6.0×10^5
Design Speed (km/hr)	70	70	60	50			50		80		60	
Posted Speed (km/hr)	600	60	50	50					70		50	
Road Width (m) [1]	21.5	16.0		12.5	11.5	14.0	9.5	12.0	8.0	9.0	7.0	8.0
Travel Lanes (m)	4 @ 3.7	4 @ 3.7		2 @ 3.6	2 @ 3.1	2 @ 3.7	N/A					
Parking Lanes (parallel)	N/A	N/A		2 @ 2.4		2 @ 3.0	N/A	Optional	N/A			
Curb and Gutter (mm)	650			400	Straight Face with Driveway Cut		600	400	N/A			
Curb Type	Straight Face						See Section 4.3.6	See Section 4.3.6	N/A			
Radii (m) for Cul-de-Sac	Restricted			14.5 to FOC [7]			12.5 to FOC [7] (See Note 4)		14.0 to EOP [9]			
Radii (m) for Curb Return	Channel[11]	15		9	9	12	9	12	12	15	9	12
Sidewalk	Separate, 1 or 2 sides			Sep. / Mono, both sides			Sep. / Mono, 1 or 2 sides		Optional			
Sidewalk / Trail Width (m)	3.0 ACP [8]			1.8 Conc. or 3.0 ACP [8]	1.8 Conc.				3.0 ACP [8]		N/A	
Right-of-Way Width (m)	52	28[10]		24	20	24	18	22	30			
Max. / Min Gradient (%) [5]	3 / 0.6	5 / 0.6		6 / 0.6		8 / 0.6		6 / 0.6	8 – 10 / 0.6		10 – 13 / 0.6	
Min. Stop Sight Distance (m)	105	105	85	65			65		130		85	
K, Crest (m)	17	17	11	7			7		26		11	
K, Sag (m)	12	12	9	6		6	6	6	30		18	
Max. Superelevation (m/m)	0.06	0.06	0.06	0.02		0.04	Crowned		0.08			

Notes:

1. Road width dimension is face of curb to face of curb.
2. Industrial applies to light industrial. For heavy industrial, provide suitable design.
3. ESALS represent the 20-year design ESALS.
4. Parking restrictions shall be applied on all residential cul-de-sacs from 7:30 am to 4:30 pm on the scheduled garbage collection day in the subject area.
5. See Section 4.3.6 for minimum gutter grades.
6. Major collectors connect to arterial roads and minor collectors connect to major collectors. Local roads connect to local roads and minor collectors.
7. FOC = face of curb.
8. ACP = asphalt concrete pavement.
9. EOP = edge of pavement.
10. Right-of-way width maximum for undivided arterials will be increased to accommodate noise impact assessments and topographic requirements based on the 4 Lane Urban Divided arterial roadway cross-section.
11. Channelized right turns shall follow City of Edmonton High Entry Angle Standard

4.4. Pavement Structures

Table 4-2 summarizes the minimum pavement structure requirements. A geotechnical investigation and independent pavement design are required for all developments and shall be based on a 20-year design life for in-situ conditions and projected traffic volume. Additional pavement structure strengths and/or materials may be required in areas with poor subgrade materials, for areas with trucked water and sanitary service, and for heavy Industrial applications pending the results of the geotechnical investigation. In no cases will the pavement structure be less than that noted in Table 4-2. Where road use is mixed (i.e. Commercial and residential), the pavement structure shall meet the higher load criteria.

Roadways in all Urban subdivision developments shall be surfaced with asphaltic concrete pavement (hot mix asphalt).

Gravel surfacing may be accepted, through a requested deviation to the Design and Construction Standards, in remote Rural locations only.

Irrespective of the accepted roadway surface finish, good roadway industry construction practices and techniques shall be employed. Furthermore, roadway base and subbase construction shall be undertaken with the view that an asphaltic concrete pavement surface will ultimately be the final finished surface.

In the case of a final lift being provided in the second year or later, the first lift shall be designed to withstand the expected loads due to construction activity. In all instances, where staged paving is proposed, any 20mm-B asphalt lifts should not be left open to the elements without a 10mm-LT or 10mm-HT lift due to its porous nature.

Table 4-2A
Urban Minimum Pavement Structure Requirements

Classification	Arterial Divided / Undivided	Collector			Local		Alley		Temporary Road	Commercial Access
		Residential		Ind./ Comm.[2]	Residential	Ind./ Comm.[2]	Residential	Commercial		
		Major	Minor							
ESALs	5×10^6	6×10^5	2.5×10^5	3×10^6	1×10^6	1×10^6				
Asphalt Concrete Pavement (mm)	190	140	110	200	100	160	75	125	100	125
Top / Final Lift [1] (mm)	50–10mm-HT	40–10mm-HT	40–10mm-LT	50–10mm-HT	35–10mm-LT	50–10mm-HT	35–10mm-LT	50–10mm-LT	35–10mm-LT	50–10mm-LT
Middle Lift (mm)	50–10mm-HT	40–10mm-HT		50–10mm-HT		40–10mm-HT				
Bottom Lift [2] (mm)	90–20mm-B	60–20mm-B	70–10mm-LT	100–20mm-B	65–10mm-LT	70–20mm-B	40–10mm-LT	75–20mm-B	65–10mm-LT	75–20mm-B
Granular Base Course (GBC)[3] (mm)	300	300	300	300	250	300	225	325	250	300
Granular Subbase Course (GSC)[4] (mm)	200	-								
Cement – Stabilized Subgrade [5] (mm)	200						-			
Subgrade Clay Modulus (MPa)	30						-			

Table 4-2B
Rural Minimum Pavement Structure Requirements

Classification	Collector		Local	
	Residential	Industrial [2]	Residential	Industrial [2]
ESAL	6×10^5	1×10^6	1×10^5	6×10^5
Asphalt Concrete Pavement (mm)	140	160	100	140
Top / Final Lift [1] (mm)	40–10mm-HT	50–10mm-HT	35–10mm-LT	40–10mm- HT
Middle Lift (mm)	40–10mm-HT	40–10mm-HT		40–10mm-HT
Bottom Lift [2] (mm)	60–20mm-B	70–10mm-HT	65–10mm-HT	60–20mm-B
Granular Base Course (GBC)[3] (mm)	300	300	250	300
Granular Subbase Course (GSC)[4] (mm)	-			
Cement – Stabilized Subgrade [5] (mm)	200			
Subgrade Clay Modulus (MPa)	30			

Notes:

1. Maximum Aggregate Size = 10 mm
2. Maximum Aggregate Size = 20 mm
3. Maximum Aggregate Size = 20 mm
4. Maximum Aggregate Size = 75 mm
5. Cement Modification = 10 kg/m (to be confirmed as part of geotechnical investigation and pavement design)

4.5. Road Construction Requirements

4.5.1. General

Roadway construction shall be in accordance with the detailed design drawings and specifications accepted through the engineering drawing review (Section 1.7.3). The work shall be carried out in an efficient manner with acceptable equipment and capable personnel. The Town Representative shall have access to the site at all times and shall promptly be provided with all test results and information necessary to assess the Contractor's performance. The Town must be notified prior to and have the option to be present at any proof rolls (pre- and post-cement-stabilization), large concrete pours, backfilling operations, or paving operations.

4.5.2. Manholes

Storm, sanitary, and other utility manholes covers shall be located outside of the vehicle wheel paths wherever feasible. Manhole structures should be located outside of wheel paths wherever feasible.

4.5.3. Temporary Roads and Accesses

Plans for temporary roads, accesses, and detours shall be approved by the Town. All-weather type construction will be required, and the Developer is responsible for all Maintenance of temporary roads, accesses, and detours.

All signage, channelization, detours, closures, etc., shall be in accordance with the Manual of Uniform Traffic Control Devices for Canada as published by TAC.

4.5.4. Snow Removal

The Developer shall be responsible for clearing snow prior to issuance of a Construction Completion Certificate and opening of the road to the public.

The Town shall be responsible for snow removal once the first lift of asphalt has been installed and a Construction Completion Certificate has been executed.

4.5.5. Maintenance of Existing Facilities

The Developer is responsible to ensure that existing services, such as sewer mains, watermains, roadways, and landscaped areas, are not disturbed or become inoperable as a result of actions by the Developer, their agents, or Contractors. Existing services shall not be exposed to loadings beyond their design capacities. Existing services shall continuously be maintained and cleaned by the Developer where their actions are cause for additional Maintenance. The existence and location of underground utilities indicated on the plans that have been determined from the Town's records are not guaranteed.

4.5.6. Staged Construction

Staged construction shall be to the satisfaction of the Town. The Developer shall meet with the Town, prior to the submission of the detailed engineering drawings, to confirm the approach for staged construction.

The Developer is responsible for all Maintenance of partially completed works which have been opened for use. All partially completed works shall be properly restored prior to commencing with the next stage of construction.

4.5.7. Pavement Restoration

Pavement restoration shall conform to the City of Edmonton's Complete Streets Design and Construction Standards (Volume 2) – latest edition, Section 3.2.

4.6. Materials

4.6.1. General

Materials used in roadway construction shall be from sources approved by the Town Representative. Manufactured goods shall meet the standard manufacturer's specifications and the approved roadway specifications. Under no circumstances shall defective, rejected, or substandard materials be used in the construction of roadways.

4.6.2. Subgrade, Fill Materials, and Granular Road Base

Subgrades under the roadway structure shall be constructed of suitable soils, free from organic and frost susceptible materials. Subgrade preparation shall typically include scarification to a minimum depth of 200 mm, windrowing material to the side, compaction of exposed surface to a minimum 97% Standard Proctor Density (at optimum moisture content), replacement of windrowed material to line/grade, cement stabilization, and compacted to a minimum 100% Standard Proctor Density (at optimum moisture content).

The use of geotextiles may be accepted by the Town, where deemed necessary based on the recommendations of the geotechnical report. The use of in-situ clay materials may be considered for use as backfill to reduce differential movements.

Trench backfill under roadways shall be as follows:

- **Class I** – use of imported granular backfill
- **Class II** – use of native backfill
- **Class III** – under landscaped areas within the road right-of-way

Trench backfill for rehabilitation projects under existing roadways shall be approved granular material, compacted to a minimum 100% of Standard Proctor Density. Backfill shall be placed and compacted in lifts of no more than 150mm under existing roads, and no more than 300mm under new roads.

Fill areas under the subgrade shall be compacted to a minimum of 97% Standard Proctor Density in Urban applications and a minimum 97% Standard Proctor Density in Rural applications. All materials shall be compacted in layers such that a uniform compaction is obtained.

Granular road base materials shall be compacted to a minimum 100% Standard Proctor Density. Refer to Table 4-2 for Minimum Pavement Structure Requirements.

Granular base course materials (3-20) shall adhere to the following gradation:

Metric Sieve µm	Percent %
20 000	100
16 000	84 - 95
12 500	60 - 90
10 000	50 - 84
5 000	37 - 62
2 000	26 - 50
1 250	19 - 43
630	14 - 34
400	11 - 28
315	10 - 25
160	6 - 18
80	2 - 10

Granular subbase materials shall adhere to the following gradations:

Metric Sieve µm	3-63 Percent %	3-80 Percent %
80 000		100
63 000	100	
25 000	55 - 75	46 - 85
20 000	50 - 70	40 - 81
16 000	44 - 65	32 - 76
12 500	38 - 60	30 - 70
6 300	23 - 47	
5 000	20 - 45	25 - 50
2 000	14 - 38	19 - 42
1 250	12 - 34	15 - 38
630	10 - 28	10 - 32
400	8 - 24	7 - 27
315	7 - 22	6 - 24
160	4 - 17	3 - 18
80	0 - 10	0 - 10

Granular base course and granular subbase course materials shall have the following properties:

Property	Granular Base Course (3-20_	Granular Subbase Course
+5000 µm with ≥ 2 fractured faces (% mass)	60 min.	30 min.
Plasticity Index < 400 µm	6 max.	6 max.
Liquid Limit	25 max.	25 max.
LA abrasion wear (% mass)	50 max.	40 max.
Soundness loss (% mass)		
Lightweight Pieces (% mass)	2 max.	2 max.

4.6.3. Concrete

Concrete for roadways (including sidewalks, walkways, and structures) shall be Class C, shall conform to the City of Edmonton's Complete Streets Design and Construction Standards (Volume 2) latest edition, and shall have the following properties:

Minimum 28-day compressive strength	30 MPa
Slump (mm)	60 ± 20
Entrained air limits (% by volume)	> 5.5
Maximum aggregate size (mm)	20
Maximum water to cementing materials ratio (by mass)	0.45
Minimum Portland cement content (kg/m^3) – Spring and Fall mixes	335
Minimum Portland cement content (kg/m^3) – Summer mixes	302
Cement Type	GU

Place hot and cold weather concrete to CSA-A23.1; for cold weather concrete:

- Protection shall be provided when there is a probability of the air temperature falling below 5°C within 24 hours of placing, as forecast by the nearest meteorological office.
- During cold weather, as defined above, adequate protection of the concrete shall be provided that will maintain the concrete temperature at a minimum of 10°C for the duration of the required curing period.
- Protection shall be provided by means of heated enclosures, coverings, insulation, or a suitable combination of these methods.
- To avoid cracking of the concrete due to a sudden temperature change near the end of the curing period, the protection shall not be completely removed until the concrete has cooled to a temperature in accordance with CSA A23.1.

4.6.4. Asphalt

- Hot-mix asphalt concrete shall conform to the City of Edmonton's Complete Streets Design and Construction Standards (Volume 2) latest edition.
- Production, placement, compaction, and quality assurance of the hot-mix mix should be pursuant to the requirements of TB-1 "Hot Mix Asphalt Materials, Mixture Design and Construction" as prepared by the National Centre for Asphalt Technology (NCAT) and published by the National Asphalt Pavement Association (NAPA), for guidance in good practices of handling materials and hot-mix production.
- Paving should be completed using echelon formations to reduce cold joints for all new construction. Where echelon paving is not possible, 100m should be used as a maximum pull length.
- Refer to the latest edition of the "Construction of Hot Mix Asphalt Pavements", Asphalt Institute Manual Series No. 22 (MS-22), for guidance in good paving practice.
- Refer to Table 4-2 for minimum pavement structure requirements and acceptable asphalt concrete types.
- Crack sealant shall be Crafco Roadsaver 552, or an approved equivalent.

4.6.5. Full Depth Reclamation (FDR)

- Full depth reclamation shall conform to the City of Edmonton's Complete Streets Design and Construction Standards (Volume 2) latest edition, Section 6.8.

4.7. Construction Standards

4.7.1. General

Construction standards used for roadways shall generally be as accepted in the construction industry and as specifically set out in the construction specifications, procedures and methods set out by the Asphalt Institute, and the Portland Cement Association.

4.7.2. Competent Labour

The Developer shall at all times employ skilled and competent labour for all construction operations. The Town shall retain the right to require the removal of incompetent labour.

4.7.3. Equipment

The construction equipment shall be maintained in proper operating conditions. The Town maintains the right to order the removal or repair of improperly maintained equipment.

Equipment shall be used in accordance with the manufacturer's recommendations and within the rated capacities specified.

4.7.4. Asphalt Thickness Pay Factors

If average core thickness is deficient, the affected area of asphalt pavement will be assessed a pay factor according to Table 4-3, which will be applied to the price of the quantity of asphalt in that mat area.

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

Table 4-3
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
> 19.0	Grind and Resurface

4.7.5. Asphalt Density Pay Factors

Each mat of asphalt placed shall be compacted to the minimum density (Percent of Maximum Theoretical Density (MTD)) for the type of paving, as indicated in Table 4-4.

Table 4-4
Asphalt Density Requirements

Minimum Density	Type of Paving
94%	All stages for staged paving for arterials, Industrial / Commercial roadways, residential collector roadways, and residential local roadways, including FAC Overlays
94%	Paving on full depth reclamation where 10mm-HT is used
93%	Lane paving
93%	Paving on full depth reclamation where 10mm-LT is used
93%	Rehabilitation overlay (mill and overlay locations)
93%	Asphalt walkway

If the average core density is less than specified, the affected area of mat may be accepted, subject to a pay factor according to Table 4-5 which will be applied to the price of the quantity of asphalt in that mat area.

Table 4-5
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	≤ 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		
≤ 91.5	Grind and Resurface		

4.7.6. Asphalt Content

If the asphalt content varies from approved design, the affected area of mat may be accepted, subject to a pay factor according to Table 4-6 which will be applied to the price of the quantity of asphalt in that mat area.

Table 4-6
Asphalt Content Pay Factors

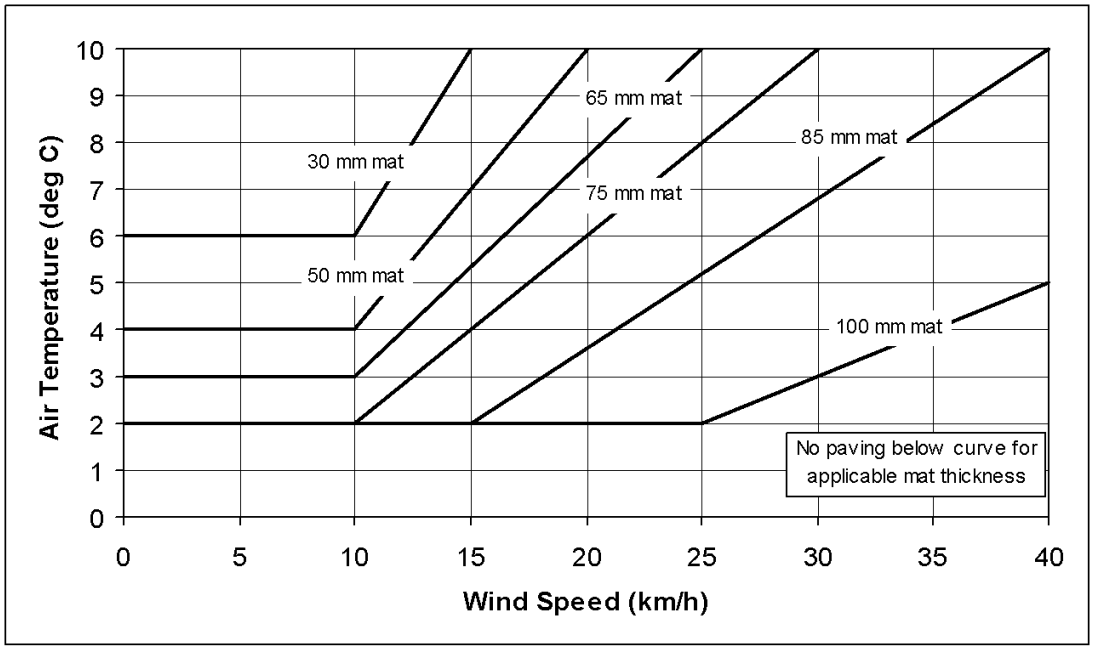
Asphalt Cement Content (%)	Pay Factor (%)
± 0.00 – 0.30	100.0
± 0.31 – 0.35	94.0
± 0.36 – 0.40	90.0
± 0.41 – 0.45	86.0
± 0.46 – 0.50	78.0
± > 0.51	Grind and Resurface

4.7.7. Weather Limitations

No paving is permitted when rain or snow is imminent, or when the surface or base to be paved is wet, icy, snow covered or frozen.

No paving is permitted when the air temperature and wind speed conditions are below the applicable mat curve in Figure 4-1.

Figure 4-1
Air Temperature and Wind Limitations on Paving
(Adopted from City of Edmonton)



4.7.8. Re-Coring

In the event of deficient asphalt cement content or thickness test results, the Contractor will be allowed to re-core within 10 metres on either side of the original test location. All core holes shall be filled with hot-mix asphalt, by the Contractor, to the satisfaction of the Town Representative.

Where the re-coring results fall within the penalty ranges of Table 4-3, Table 4-4, or Table 4-5, no additional re-coring will be allowed.

Where re-coring results fall within the "grind and resurface", additional cores shall be taken at equal distances on either side of the original core until locations identify asphalt within specification. The spacing will be at the discretion of the Contractor. Once the area to be removed and replaced is identified, the area inclusive of the last core used to delineate the deficient area shall be removed and replaced to the satisfaction of the Town Representative.

4.8. Traffic Control Devices, Street Signs, and Pavement Markings

Traffic control devices, street signs, and pavement markings shall be installed by the Developer and shall be in accordance with the "Manual of Uniform Traffic Control Devices for Canada," issued by TAC.

Traffic control devices, street signs, and pavement markings are the primary means of regulating, warning, and guiding all traffic. These devices, signs, and markings should fulfill a need, command attention, convey a clear and simple meaning, command respect, and give adequate time for proper response.

4.8.1. Signage

Highly reflective engineer-grade street name signs and traffic control high density signs shall be mounted on 50 mm Telespar posts. Anchors shall be 52.5 mm x 900 mm and shall be driven into the ground, leaving 0.3 m to 0.6 m exposed above ground surface. The Telespar post shall be inserted approximately 150 mm to 200 mm into the anchor. Telespar plates are to be used for concrete mounts; breakaways are not permitted. The bottom of signs shall be 2 m from the ground surface.

For streets with speed limits of up to 50 km/hr, street name blades shall be 150 mm, double-sided, white on green, with the Town logo (62.5 mm wide x 50 mm tall) displayed. For streets with speed limits of 60 km/hr or more, street name blades shall be 225 mm, double-sided, white on green, with the Town logo (100 mm wide x 87.5 mm tall) displayed. Street blade configurations are shown in Drawing 4-840.

Street signs shall be installed by the Developer as per the accepted Traffic Control Devices and Street Signs plan. Typical sign installation locations and methods are shown in Drawing 4-810 and 4-811.

A Red Brite-Side Reflective Sign Post Panel shall be installed on all stop signs, with the panel oriented to face oncoming traffic. Yellow Red Brite-Side Reflective Sign Post Panels shall be installed on both sides of the posts for all yellow signs (for example, school zone and pedestrian crossing signs).

All pedestrian signage shall be fluorescent yellow.

4.8.2. Pavement Markings

Pavement markings, including lane markings, stop lines, and pedestrian crossings, shall be provided by the Developer at their own expense. All transverse markings, crosswalks, and stop bars, as well as all pavement markings for collector and arterial roads shall be thermoplastic, placed on the top course asphaltic concrete surface at the time of construction. Permanent

cold pour applications are not permitted. All other pavement markings for local roads shall be water-based paint placed on the top course asphaltic concrete surface at the time of construction.

Mid block crosswalks and crosswalks where yield control or no traffic control is present are to be zebra painted. All other crosswalks are to be parallel line painted.

Placement of signage for pedestrian crossings shall follow the latest version of the TAC Pedestrian Crossing Control Guide and MUTCD.

4.8.3. Signals

Traffic control signals and pedestrian crossing signals shall be provided by the Developer at their own expense at all traffic and pedestrian points on arterial roads and as otherwise warranted. All stop lines shall be perpendicular to the curb line. All signalized intersections shall be equipped with an Opticom™ Priority Control System to ensure fire trucks have priority during an emergency. The Opticom™ GPS system intersection equipment shall consist of a compact, weather-resistant RF-energy-emitting Opticom™ Model 3100 GPS Radio Unit containing a GPS receiver with antenna and a 2.4 GHz spread spectrum transceiver with antenna.

Rectangular Rapid Flashing Beacons (RRFBs) may be required at pedestrian crossings where no signal control is present, including at intersection and midblock.

4.9. Roadway Illumination

4.9.1. General Street Lighting Requirements

Street lighting shall be arranged for and coordinated by the Developer. Streetlight cables shall be installed underground with an acceptable type of steel post streetlights, complete with LED fixtures.

Street lighting shall be installed in all new subdivisions. The Developer shall install all streetlight infrastructure at the time of development at the Developer's cost and as per Fortis requirements.

Street lighting design shall be in accordance with TAC Guide for the Design of Roadway Lighting, Illuminating Engineering Society (IES) standards, and in accordance with Fortis requirements.

No capital costs are to be amortized; the Developer is to pay all capital contribution.

4.9.2. Urban

The street lighting layout and location of the buried lines shall be as shown on the Standard Details (Section 4.22) and accepted by the Town.

Urban street light davits and luminaires shall be one of the following styles available through Fortis:

- Cobra Head luminaire on galvanized steel single or double head davit poles
- Galleon luminaire on black painted poles
- Traditionaire luminaire on black painted poles

Streetlights shall be placed at locations not interfering with proposed driveways or water and sewer services and in general shall be located in line with the extension of common property lines between two lots.

4.9.3. Rural

The minimum requirements for Rural street lighting shall be:

- At all access points to arterial roads, secondary highways, and primary highways.
- At all high density country residential subdivisions in accordance with TAC Rural standard and Illuminating Engineering Society (IES) standards.
- At internal park areas that do not abut onto a lighted street.
- At common areas such as mailbox pull-outs, Commercial areas, trail crossings, school grounds, and Industrial areas.

4.10. Sound and Vibration Abatement

A noise impact assessment, signed and sealed by a professional engineer, must be provided for developments where a major arterial roadway, highway, and/or railway line runs through or adjacent to a proposed residential development.

The assessment must list the current noise levels, estimate future noise levels, and identify and implement sound abatement measures required to achieve a maximum noise level of 65 dBA Leq over a 24-hour period.

Vibration assessments, signed and sealed by a professional engineer, may be requested by the Town where residential development abuts a railway line. Where required, vibration assessments shall conform to Canadian Transportation Agency (CTA) standards.

Berms or elevated contoured embankments and/or sound barrier fencing shall be used for sound abatement along arterial roadways, highways, and/or railways as required by the regulatory authorities and the Town. Fencing shall meet the requirements outlined in Section 10.15.6.

The subdivision side of the embankment shall include gentle slopes of no more than 4H:1V. Rights-of-way may require widening to accommodate sound abatement berms / embankments.

4.11. Lanes

In general, the following design standards should be followed:

- Minimum 6.0 m right-of-way.
- Residential lanes must be paved for a minimum width of 4.0 m, with centreline swale and 2% cross fall. Commercial / Industrial lanes must be paved for the full width.
- Where lane traffic is expected to be high, such as for certain Commercial / Industrial developments, a 6.0m paved surface width and wider right-of-way may be required, at the Town's discretion.
- Road structure shall match the road structure of the adjoining roadway(s).
- Dead-end lanes must be terminated with a means to turn around.
- Maximum length of a lane between streets shall not exceed 350 m. Lane layouts should not encourage possible short-cutting between streets.
- Maximum length of drainage in lanes shall be 150 m to any one catch basin.
- Maximum lane grade shall be 6.0%.
- Minimum lane grade shall be 0.9%.

- All lane grades are to be at property line and are to tie to the back of walk / gutter elevation of the intersecting street.
- It may be necessary to remove sidewalk crossings and replace with depressed crossings.
- Property line elevations are to be a minimum of 100 mm above design lane grade for drainage purposes.

Lanes shall be provided for residential lots fronting directly onto collector streets.

4.12. Emergency Accesses

Secondary emergency accesses shall be provided whenever the length of a cul-de-sac exceeds 120 m (as measured from the centre of the cul-de-sac to the centre of the intersection), or whenever the bottle neck length of any portion of roadway exceeds 120 m (as measured from the centre of one intersection to the centre of the second intersection). The secondary emergency access may take the form of an emergency access connection via an off-street path.

The off-street path shall be centred on the right of way, with a straight alignment requiring minimal turning manoeuvres. Any off-street paths used for emergency access must have sufficient load-bearing capacity to support the Town's Fire Turck as outlined in Section 4.13.

No bollards or wooden posts shall be permitted at entrances to walkways. This requirement is to ensure that emergency services can access the walkway in an emergency.

4.13. Fire Truck Specifications

Table 4-6 outlines the specifications for the Town of Stony Plain's fire trucks. The Town of Stony Plain may require new cul-de-sacs be designed to accommodate the turning movements of a fire truck; the Developer shall consult with the Town when planning a new cul-de-sac. All turnarounds, temporary or permanent, shall be designed to accommodate the turning movements of a fire truck.

Table 4-6
Fire Truck Specifications

Parameter	Definition	Value
Inside Cramp Angle	Maximum turning angle of the front inside tire	40°
Axle Track	King-pin to king-pin distance of the front axle	2.18 m
Wheel Offset	Offset from the centreline of the wheel to the king-pin	135 mm
Tread Width	Width of the tire tread	432 mm
Chassis Overhang	Distance of the centreline of the front axle to the front edge of the cab. This does not include the bumper depth.	1.77 m
Additional Bumper Depth	Depth that the bumper assembly adds to the front overhang	0.56 m
Front Overhang		2.9 m
Wheelbase	Distance between the centrelines of the vehicle's front and rear axles	6.7 m
Inside Turning Radius	Radius of the smallest circles around which the vehicle can turn	7.6 m
Curb to Curb Turning Radius	Radius of the smallest circle inside of which the vehicle's tires can turn. This measurement assumes a curb height of 225 mm.	12.5 m
Wall to Wall Turning Radius	Radius of the smallest circle inside of which the entire vehicle can turn. This measurement takes into account any front overhang due to chassis, bumper extensions, and/or aerial devices.	14.3 m
Weight	The weight of the fire truck that must be borne by any emergency access routes.	36,900 kg

4.14. Service Roads

Service roads may be acceptable to the Town for highway Commercial access. Design of service roads shall satisfy all requirements of Alberta Transportation and Economic Corridors and shall be subject to approval by the Alberta Transportation and Economic Corridors and acceptance by the Town.

4.15. Dead-End Roads

Other than for an interim solution, dead-end roads shall not be allowed in Industrial subdivisions.

In residential subdivisions, all dead-end roads shall be provided with a cul-de-sac or turnaround consistent with the requirements outlined in the Standard Details (Section 4.22) and TAC requirements. "Hammerhead" turnarounds are not permitted. The maximum length of dead-end roads that service residential lots, without provision of a secondary access, shall be 120 m.

4.16. Urban Approaches and Driveways

Urban approaches and driveways shall be in accordance with the geometric standards of the TAC Geometric Design Guide for Canadian Roads and as modified herein as well as the requirements of the Town's Land Use Bylaw.

4.16.1. Private Driveways

All driveways shall be constructed to provide a minimum 1.5 m clearance from any structure such as hydrants, light standards, service pedestals, transformers, manual air release valves, blow off valves, manholes, and catch basins. Driveways on corner lots shall be located to provide a minimum of 8.0 m clearance from the lot property line adjacent to the intersection. When the locations of driveways are known, the driveways shall be clearly shown on the design drawings and the driveway aprons shall be installed at the time of sidewalk construction.

4.16.2. Commercial / Industrial Driveways

The edge of a driveway shall be a minimum horizontal distance of 10 m from the end of the curb return of an intersection and shall be designed to accommodate the types of vehicles the business / industry will generate.

4.16.3. Driveway Widths

Driveway widths shall be as follows:

- Residential: Minimum 3.2 m
- Commercial: Minimum 7.5 m to maximum 12.5 m
- Industrial: Minimum 7.5 m to maximum 12.5 m
- Apartment: Minimum 7.5 m to maximum 12.5 m
- Residential Laneways: Minimum 4.0 m
- Commercial / Industrial Laneways: Minimum 6.0 m

4.17. Rural Approaches and Driveways

Rural road approaches and driveways shall be in accordance with the geometric standards of the TAC Geometric Design Guide for Canadian Roads and as modified herein as well as the requirements of the Town's Land Use Bylaw.

- Refer to section 4.16.3 for requirements for driveway widths.

- All driveways shall be constructed to the same structure as the adjoining roadway with the same surfacing extending to the property line.
- Where trucked water and sanitary service is required, internal private driveways / accesses shall be designed to accommodate the expected wheel loads and, at a minimum, shall be paved.
- All residential subdivision developments shall require the Developer to construct one driveway to each lot.
- Driveways to Industrial / Commercial lots are not required to be constructed by the Developer unless the locations are known. The Lot Owner / Developer will be responsible for constructing such driveways to the standards outlined herein.
- Culverts shall be installed as per Section 6.22. All culverts installed to facilitate roadway drainage in road right of way shall be subject to CCC and FAC prior to being entered into Town inventory.

4.18. Sidewalks and Trails

4.18.1. Urban Sidewalks

Concrete sidewalks measuring 1.8 m in width will be required in the following instances:

- On one or both sides of collector and local roads, except where replaced by trails;
- Where there is a possibility of a requirement to provide continuity of sidewalks to future development; and
- Where linkage is required to maintain continuity of the pedestrian network.

Refer to Standard Details (Section 4.22) for typical layouts and dimensions.

Curb ramps shall be provided on sidewalks at all roadway intersections and at all pedestrian crossings in accordance with the Standard Details (Section 4.22). Curb ramps shall be aligned with one another, with the tooled grooves matching up congruently to facilitate those persons with disabilities to cross the intersection safely.

4.18.2. Multi-Use Trails

Trails shall be constructed in accordance with the Standard Details (Section 4.22) and the requirements in Table 4-7.

Trails are required on both sides of arterial roads and may replace sidewalks on collector or local roads where needed to conform to the Trails Master Plan, relevant Area Structure Plans, and the Active Transportation Strategy or for trail continuity.

Off-street trails shall be constructed in parks, utility corridors, stormwater management facilities, and natural areas as directed by the Manager of Engineering. Gravel trails may be permitted by the Town in natural areas of environmental concern where minimizing environmental impacts and / or impermeable surfaces are of highest priority.

Table 4-7
Multi-Use Trail Design Criteria

	Asphalt Trails	Gravel / Interpretive Trails
Surface Treatment	LT Asphalt	Surfacing Gravel
Granular Base	150mm 3-20 GBC	150mm 3-20 GBC
Grade:		
Desirable	0.5% to 5.0%	
Maximum Sustained	12.5% for 3.00m max length	
Maximum Steep	8.3% for 61.00m max length	
Minimum Vertical Clearance:	3.00m	
Minimum Surface Width	3.00m	2.40m
Minimum Cleared Width	5.00m	4.40m
Desired Cross Slope	0.50% to 2.00%	2.00% to 5.00%
Minimum Horizontal Radius	10.00m	5.00m

4.19. Community Mailboxes

The Developer shall accommodate community mailbox locations when community mailbox locations are required. The criteria and requirements below must be followed when locating community mailboxes:

- Along flankage (side yard) of corner lots, between the front and rear property lines.
- Provide additional 0.5 m x 5.0 m Easement if encroaching on private property.
- Next to an Open Space or playground.
- On the predominantly homecoming side of the street.
- Adjacent to the sidewalk.
- Not along arterial roads.
- Not closer than 10 m from a fire hydrant.
- Not above a utility.
- The location shall not impede pedestrian and vehicle sight distances.

Additional requirements for Rural applications include:

- Road widening; and/or;
- Right-of-way widening, where necessary.

Mailboxes shall be placed on a concrete pad of a thickness matching the adjacent sidewalk; bricks / paving stones are not permitted.

4.20. Traffic Calming and Roundabouts

Consideration of traffic calming methods and roundabouts should be incorporated into the design of new local and collector roadways in residential and commercial developments.

Traffic calming or improved pedestrian crossings (curb bulb outs, raised crosswalks, etc.) should be considered at known and anticipated major pedestrian and active modes crossing points, such as midblock crossings, pathway crossings, and crossings at or adjacent to parks and school spaces.

Additional traffic calming along residential collector intersections may also be required at the discretion of the Town as outlined in TAC's Canadian Guide to Traffic Calming, such as vertical deflections, lateral deflections, constrictions, entrance features, or other means to alter driver behaviours and improve conditions for residents and vulnerable users.

Curb bulb outs should typically be 2.0 m to 2.5 m in width, measured from face of curb to street prior to the bulb to the face of curb o the bulb, and at least 6.0m long. A minimum radius of 4.5m is required to allow for street sweeping and snow removal equipment to navigate the inside curves of the curb bulb. At intersections, the corner curb radius will depend on the roadway classification and design vehicle.

Roundabouts for new developments shall be designed in accordance with the latest edition of the Transportation Association of Canada Canadian Roundabout Design Guide.

4.21. Roadway Materials Testing

It shall be the responsibility of the Developer and/or Developer's Representative to ensure that the Contractor adheres to the minimum testing requirements outlined in this section.

The Developer shall submit all test data performed by the accredited testing company to the Town as per the requirements outlined in Section 2. Failure to receive test results will be considered sufficient cause for not accepting such work.

The requirements for roadway materials testing are outlined in Table 12-1.

The Town must be notified prior to and have the option to be present at any proof rolls (pre- and post-cement-stabilization), large concrete pours, backfilling operations, or paving operations.

Table 4-8
Specifications for Roadway Materials Testing

Location of Testing	Required Compaction	Frequency of Testing
Site Grading	100% of SPMDD under roadways at ±2% of OMC 97% of SPMDD under sidewalks at ±2% of OMC 95% of SPMDD in landscaped areas at ±2% of OMC	1 test every 1,000 m^2 per lift, or minimum 3 tests for small areas
Sand Bedding	Minimum of 95% of SPMDD	1 test every 100 m per lift, or minimum 3 tests for small areas
Trench Backfill	Minimum of 97% of SPMDD at ±2% of OMC Minimum of 100% of one-mould maximum dry density Maximum moisture content: PL + (PI/3) to a maximum of 5% above the PL	1 test every 100 m per every 2nd lift, or minimum 3 tests for small areas
Subgrade Preparation	Minimum of 100% of SPMDD at ±2% of OMC under pavement structures, concrete curbs, concrete gutters, concrete monolithic sidewalks, Commercial and lane crossings, and asphalt walkways. Minimum of 97% of SPMDD at ±2% of OMC under concrete separate sidewalks, curb ramps, slabs, and shared use trails made of concrete pavers, brick pavers, or granular materials.	1 test every 1,000 m^2 for roads 1 test every 100 m for sidewalks or curb / gutter Minimum 3 tests for small areas
Granular Base Course	Minimum of 100% of SPMDD under roads, curb, and gutters, Commercial and lane crossings, concrete monolithic sidewalks, curb ramps, and shared use trails. Minimum of 97% of SPMDD under asphalt or concrete separate sidewalks, and median or island strips.	1 test every 1,000 m^2 for roads 1 test every 300 m^2 for sidewalks Minimum 3 tests for small areas
Asphalt Pavement	HT mix for collector and arterial roadways LT hot-mix for local roads, and trails 94% of MTD for roadways 93% of MTD for lanes, and trails	1 Mix Analysis every 1,000 tonnes (min. 1/day) Asphalt content and MTD every 500 tonnes 1 core every 1,000 m^2
Concrete	Compressive strength: 30 MPa Air: > 5.5% Slump: 60 mm ± 20 mm Max. Aggregate Size: 20 mm	1 test every 50 m^3 (min. 1/day)

Notes:

1. SPMDD: Standard Proctor Maximum Dry Density
2. OMC: Optimum Moisture Content
3. MTD: Maximum Theoretical Density
4. PL: Plastic Limit
5. PI: Plastic Index
6. The above ±2% moisture content is for clay materials.
7. Moisture content for high plastic clay requires recommendation by a Geotechnical Engineer.

The Developer shall engage a qualified materials testing firm to take representative samples of all materials to be incorporated into the pavement structure, to prepare mix designs for acceptance by the Town, and to carry out quality control testing during construction.

4.22. Roadways CCC / FAC and Deficiency Repair Requirements

4.22.1. Inspection Requirements

For CCC and FAC inspections, the following requirements shall be met:

- The surface improvement being inspected is to be clean and free of debris.
- The Developer's Consultant / Contractor has inspected the site and verified that all improvements are in satisfactory condition.
- All roads and gutters to be water flushed immediately prior to FAC inspection. Flushing prior to CCC shall be required at the Town Representative's discretion.
- Noncompliance with any of the above is sufficient reason to cancel the inspection.
- Deficient areas to be marked with spray paint and cross-referenced to the numbers used on the written deficiency list and index map.

4.22.2. General Repair Requirements

- All Maintenance and repair work is to be carried out in accordance with the Design and Construction Standards, except as herein noted.
- Contractor / Developer's Consultant is to provide verbal notice to the Town 1 week prior to commencement of repair.
- Provide written notice to occupants of affected and/or adjoining properties 48 hours prior to commencement of repair work.
- All concrete works, curb, gutter, paved roads, boulevards, landscaped areas, private walks, and driveways shall be cleaned of any repair debris within 24 hours of completion.
- Materials, placement, and testing must conform to the requirements of the Design and Construction Standards and/or as required by the Town.
- All coordination and costs of barricading and material testing shall be the responsibility of the Developer.

4.22.3. Concrete Deficiencies

Concrete shall be replaced if one or more of the following exist:

- If a crack is greater than 2 mm in width in curb and gutter or any crack in sidewalk.
- Cracks with chipped or spalled edges.
- Any longitudinal crack.
- Random or multiple cracks of any size or more than one crack between any two contraction joints.
- Loss of surface mortar and/or aggregate.
- Sidewalk with less than 10 mm/m of crossfall (slope toward curb unless specifically noted otherwise).
- Sidewalk with more than 40 mm/m of crossfall (slope toward curb unless specifically noted otherwise).
- Vertical differential displacements greater than 5 mm.
- Joint separation greater than 10 mm.
- Settlements greater than 10 mm over a 3 m length or that cause retention of water.

- Settlements causing retention of water in front of driveways or curb ramps.
- Concrete that has been disfigured by extraneous means.
- Notable ponding is observed. Ponding shall be limited to within the gutter; notable ponding includes ponding extending beyond the lip of gutter.

The use of route and seal will only be permitted at the Town's discretion.

4.22.4. Concrete Repair Requirements

- Concrete sections to be removed at a contraction, expansion, or surface joint. If warranted, a 1.5 m minimum length of curb and gutter section may be replaced.
- Where curb and gutter or sidewalk deficiencies exist, the entire mono curb, gutter, and sidewalk shall be replaced.
- Existing private walkways and driveways must be adjusted to match repaired concrete sidewalks. The Town may require the replacement of existing private walkways and/or driveways to provide a satisfactory tie-in.
- Where there is less than 8 m of concrete sidewalk, monolithic sidewalk or curb and gutter between repairs, the remaining concrete must be replaced.
- When replacing separate sidewalks, positive drainage from the front of sidewalk to the curb must be maintained throughout the boulevard.

4.22.5. Asphalt Deficiencies

Asphalt shall be replaced if one or more of the following exist:

- The roadway is not built in accordance with the approved Engineering Drawings or Design and Construction Standards.
- Asphalt that has open joints causing unacceptable ride quality
- Alligator cracking
- Longitudinal cracking
- Cracking that is detrimental to the road structure or causes unacceptable riding quality
- Rutting
- Potholes
- Ponding
- Aggregate loss / ravelling / segregation
- Manholes and valves are to be adjusted to final asphalt grade (+0 mm, -6 mm).
- Asphalt adjacent to curb and gutter must be less than 10 mm above the lip of gutter except in the case of structural overlay or rehabilitation of roads where no new curb and gutter has been placed.
- Localized areas of settlement which cause water ponding.
- A repair is required if the asphalt surface has a coarse and open texture resulting from, for example, clay tracking, segregations, or petroleum spillage.

4.22.6. Asphalt Repair Requirements

- Asphalt repairs are to be rectangular or square and a minimum of 1.2m wide. Grind existing asphalt adjacent to gutter lines and at butt joints to allow for a minimum of 50 mm of asphalt overlay. Grinding shall extend to the full width of the lane from lip of gutter or lane line. Grind seams shall not be allowed in the wheel path.
- Place a levelling course on all subsidence greater than 50 mm.
- Edges of existing asphalt to be ground or cut vertically (minimum 50 mm). No feathering of patches is allowed.
- To repair asphalt surface failure, cut out failed road structure and replace. If the cut area is less than a full lane width, grinding is required for the full width of the lane.
- Localized areas of settlement which cause ponding shall be repaired by grinding from the centre of the roadway to the lip of gutter.
- Manholes and valves are to be adjusted to final asphalt grade (+0 mm, -6 mm) prior to paving.
- Cracks and joints between 2 mm and 15 mm wide are to be routed and sealed.

5. SANITARY SEWER SYSTEMS

5.1. General

These standards cover the design and construction of sanitary sewer mains and appurtenances to be built or rebuilt in the Town. Standard Details relating to sanitary sewer system construction are provided in section 5.19.

These standards provide the minimum design criteria, general construction requirements, and construction materials for consulting Engineers to use in their preparation of specifications and drawings. These standards may be exceeded if warranted by the design consultant. Good engineering practices and designs must prevail on all projects.

5.2. Design Flow

Sanitary sewer systems shall be designed on the population density basis of either the ultimate subdivision design population in the Area Structure Plan or Land Use Bylaw or as follows; whichever is greater:

- Low Density: 40 people / ha
- Medium Density: 80 people / ha
- High Density or mixed use: 200 people / ha

Commercial and Industrial design flows will be based on the gross developed area or the specific application; refer to section 5.2.2.

The sewer main capacity shall be designed to convey the peak hourly sewage contribution plus infiltration, without the use of holding tanks, and based on the following:

5.2.1. Domestic Contribution

1. Minimum average contribution of 300 litres per capita per day.
2. Peak hourly flow for each contributing area calculated at an average flow multiplied by a peaking factor:
   $Q_{PDW} = (G \times P \times PF) / 86{,}400$

   Where:
   - Q_{PDW} = Peak dry weather flow (L/s)
   - G = Average daily per capita contribution, 300 L/c/d
   - P = Design population
   - PF = Peaking factor, calculated using Harmon's Formula
     $= 1 + (14 / (4 + P_{pf}^{0.5}))$
     Where: P_{pf} = design population, in thousands

   The maximum peaking factor shall be 3.8.

5.2.2. Non-Residential Contribution

1. For high level planning purposes, when the specific type(s) of Commercial / Industrial / institutional uses are unknown, the following equivalent populations (ep) can be used:
   1. Commercial / Institutional 37 ep / ha
   2. Industrial 30 ep / ha
2. For design purposes, when the specific Industrial, Commercial, and Institutional uses are known, Table 5-1 may be used unless the development has higher or specialized flow generation.

Table 5-1
Commercial, Institutional, and Industrial Sanitary Flow Generation Factors Based on Land Use

Type of Establishment	Average Flow Generation (L/day/m^2 of Floor Area)
Office Buildings	8
Restaurants	20
Bars and Lounges	12
Hotels and Motels	14
Neighbourhood Stores	8
Department Stores	8
Shopping Centres	4
Laundries and Dry Cleaning	41
Banks and Financial Buildings	12
Medical Buildings and Clinics	12
Warehouses	4
Meat and Food Processing Plants	115
Car Washes	77
Service Stations	8
Auto Dealers, Repair and Service	6
Supermarket	8
Trade Businesses - Plumbers, Exterminators, etc.	8
Mobile Home Dealer, Lumber Co., Drive-In Movies, Flea Market	7
Places of Assembly - Churches, Schools, Libraries, Theatres	24
Factories - Manufacturing raw products into finished products	33
Hospitals	1700 L/bed/day

3. The peak flow, Q_{PDW}, in litres per second, for each contributing area shall be calculated based on the average flow, Q_{AVG}, in litres per second, multiplied by a peaking factor:

   Q_{AVG} = (average flow generation from Table 5-1) x (floor area) / 86,400

   $Q_{PDW} = Q_{AVG} \times PF$

   The peaking factor shall be calculated as described in section 5.2.1, by converting Q_{AVG} to an equivalent population: ep = Q_{AVG} (L/s) * 86,400 (s/d) / G (L/c/d)

5.2.3. Infiltration

1. Roof leaders and weeping tiles shall not be connected to the sanitary sewer system. In existing areas where roof leaders and weeping tiles are connected to the sanitary system, an allowance for roof leader / weeping tile contribution of 0.6 litres per second per gross hectare shall be provided.
2. The sanitary sewer and manhole system shall be watertight; however, an infiltration allowance of 0.28 litres per second per gross hectare shall be used.
3. Any existing manholes located in sags (low areas subject to inundation during major rainfall events) are subject to an additional allowance of 0.4 litres per second per manhole. Every effort is to be made to ensure new manholes are not located in sags or else inflow / infiltration reduction features shall be installed.
4. Sealed manhole covers shall be used in low spots where water ponding may be expected and in potentially odorous locations where sewer off-gassing is not ideal.

5.3. Pipe Flow Formula

5.3.1. Gravity Sewers

Required full flow sewer capacity = (estimated peak wet weather flow rate) / 0.86

Manning's formula shall be used to calculate pipe capacity:

$$Q = (AR^{(2/3)}s^{0.5}) / n$$

Where: Q = Pipe capacity (m^3/s)
A = Cross-sectional area of pipe (m^2)
R = Hydraulic radius (area / wetted perimeter) (m)
s = Slope of hydraulic grade line (m/m)
n = Roughness coefficient = 0.013 for smooth-walled pipe (for example, PVC)
= 0.015 for older pipe (for assessment purposes)

5.3.2. Sewage Force Mains

Use Hazen-Williams formula:

$$Q = CD^{2.63}s^{0.54} * 278.5$$

Where: Q = Rate of flow (L/s)
D = Internal pipe diameter (m)
s = Slope of hydraulic grade line (m/m)
C = Roughness coefficient = 120 for all mains

5.4. Velocity

Pipes shall be designed such that the velocity falls within ranges identified below.

Type of Sewer	Minimum Velocity	Maximum Velocity
Gravity	0.60 m/s	3.00 m/s
Force Main	0.76 m/s	1.50 m/s

5.5. Minimum Pipe Diameter for Gravity Sewers

5.5.1. Mains

- Detached Dwelling Residential Areas: 200 mm diameter
- Multi-dwelling Residential Areas: 250 mm diameter
- Non-Residential Areas: 250 mm diameter

5.5.2. Services

- Detached Dwelling Dwellings: 150 mm diameter
- Multi-unit Dwellings: 150 mm diameter*
- Non-Residential Buildings: 150 mm diameter*

Note:
* Multi-unit dwelling and non-residential services shall be sized based on the anticipated peak wet weather flow for the development; however, in no case shall the services for these types of developments be less than 150 mm in diameter.

5.6. Minimum Pipe Grade

Minimum pipe grades for sewers along a straight alignment are indicated in Table 5-2; however, steeper grades are preferred.

Table 5-2A
Minimum Pipe Grades

Nominal Pipe Diameter (mm)	Minimum Grade [1] Straight Run (%)	Minimum Grade [1] Curved Sewer (%)
200	0.40	0.40
250	0.28	0.31
300	0.22	0.25
375	0.15	0.18
450	0.12	0.15
525	0.10	0.13
600 and greater	0.10	0.10

Note:
[1.] Pipe grades shall be increased for the most upstream leg of any 200mm sanitary sewer where the peak dry weather flow (DWF) is less than 1.5 as follows:

Table 5-2B
Minimum Pipe Grades For Upstream Leg of 200mm Sanitary Sewer

Peak DWF (L/s)	Minimum Slope (%)
< 0.10	1.70
0.10 – 0.25	1.50
0.25 – 0.40	1.00
0.40 – 0.60	0.83
0.60 – 0.80	0.67
0.80 – 1.00	0.57
1.00 – 1.25	0.50
1.25 – 1.50	0.45
> 1.50	0.40

5.7. Minimum Depth of Cover

Sanitary sewers require a minimum cover of 3 m from finished surface to pipe crown and shall be of sufficient depth to satisfy the following criteria:

- Permit all buildings to drain by gravity to the sewer main;
- Prevent freezing;
- Clear other underground utilities; and
- Prevent damage from surface loading.

When it is not feasible to provide 3 m cover from finished surface to pipe crown, the sewer shall be insulated as per Standard Detail 7-900.

5.8. Manhole Spacing

1. Manholes shall be provided at the end of each line and at all changes in pipe sizes, grades, or alignment.
2. The maximum allowable distances between manholes for sewers along a straight alignment shall be as follows:
   - Sewers smaller than 600 mm: 120 m maximum spacing; and
   - Sewers 600 mm and larger: 150 m maximum spacing.
3. The maximum allowable distances between manholes for sewers along a curved alignment shall be as follows:
   - Sewers smaller than 600 mm: 90 m maximum spacing; and
   - Sewers 600 mm and larger: 120 m maximum spacing.

5.9. Curved Sewers

1. Maximum joint deflection shall be as recommended by the pipe manufacturer. The Town requires a letter from the pipe manufacturer indicating the maximum joint deflection for proposed curved sewers; the letter from the pipe manufacturer is to be submitted as part of the detailed engineering design package.
2. Curved sewers shall be aligned parallel to the road centreline.

5.10. Hydraulic Losses Across Manholes

1. Generally, for increasing pipe diameters, the crown of the downstream pipe shall match crown of the upstream pipe; however, in no case will the upstream 0.8 depth point be below the downstream 0.8 depth point.
2. The minimum drop in invert elevations across manholes shall be as follows:
   - Straight runs and deflections up to 45° 30 mm
   - Deflections between 45° and 90° 60 mm

   Deflections greater than 90° shall be accommodated using two or more manholes.
3. An internal drop pipe shall be installed when the drop between inverts exceeds 1.0 m. The manhole shaft shall be sized to attain a clear entry access width of at least 0.6 m; refer to Standard Detail 5-200.

5.11. Sewer Location

1. Sanitary sewer mains shall be located within the municipal road right-of-way as per the typical cross-sections in accordance with the Standard Details (Section 5.19 No. 4-100 through 4-102).
2. A minimum width of 6 m is required for PULs with up to two utilities; additional width may be required for PULs with more than two utilities.
3. Sanitary services shall be installed in a common trench with the water service. Services shall be located under landscape areas, as close to the centre of the property as possible.
4. Sanitary sewer mains shall maintain the following clearances from watermains, storm sewers, and power / telephone / cable infrastructure:
   - Minimum 3.0 m horizontal clearance unless sewer depth requires increased spacing; and
   - Minimum 0.5 m vertical clearance above or below at crossings; however, sanitary sewer mains shall cross under watermains wherever possible.

5.12. Manhole Details

1. Manholes shall be designed in accordance with the Standard Details (Section 5.19 No. 5-100 and 5-101).
2. Manhole covers within the road carriageway shall be placed outside of vehicle wheel paths wherever feasible. Manhole structures should be located outside of wheel paths wherever feasible.
3. To abandon a manhole, plug all pipes with non-shrink grout, remove and dispose the manhole to 1.0 m below ground and fill remainder with fillcrete.

5.13. Service Connections

1. Refer to Standard Details (Section 5.19 No. 5-500, 5-501, and 5-502) and Standard Details (7.15 No. 7-302).
2. Sanitary sewer services for Commercial, Industrial, multi-dwelling residential, or institutional areas, unless otherwise approved by the Town, shall only be made after the service requirements have been determined and a permit, approving the installation, is issued by the Town.
3. Sanitary sewer services shall be designed as a single connection from the main to the property line. Cross lot servicing is not permitted.
4. Sanitary sewer services shall terminate at the property line or 1 m past the shallow utility Easement.
5. All sanitary sewer services shall be designed for gravity flow with a minimum grade of 2.0% and require a minimum of 2.75 m of cover at property line, from finished surface to pipe crown.
6. Single bends shall be restricted to no greater than 22.5 degrees to provide access for CCTV camera and flushing work, especially at the service connections.
7. Sanitary sewer services which are 150 mm in diameter shall be PVC DR28 building service pipe conforming to CSA specification B182.2, latest revision thereof. Sanitary sewer services 200 mm in diameter and larger shall be PVC DR35 conforming to CSA specification B182.2, latest revision thereof.
8. Single detached residential sanitary service connections shall be via the use of in-line tees. Manholes for sanitary sewer connections to the main are required for all multi-dwelling residential, Commercial, Industrial, or institutional lots.
9. Pipe saddles shall be used to connect sanitary sewer services to mains only in instances where retrofit work is undertaken.
10. Risers shall be employed where the service connection at the main is 4.0 m or deeper.
11. An inspection / sampling chamber or manhole, located at 0.5 m inside the road right-of-way, is required for all Industrial and Commercial sanitary sewer service connections. Inspection / sampling chambers and manholes shall meet the requirements of the ARROW Utilities, in particular Bylaw No. 8 Quality of Wastewater. Refer to Standard Details (Section 5.19 No. 5-501 and 5-502). Sampling chambers (Standard Detail 5.19 No. 5-501) shall only be permitted for Commercial / Industrial lots which have been pre-serviced with sanitary and water services installed in a common trench. All other Commercial / Industrial lots require a sanitary service with a sampling manhole (Standard Detail 5-502).
12. The end of sanitary sewer services shall be adequately capped or plugged to prevent the entry of earth, water, or other deleterious material into the pipe. Furthermore, the end of the pipe shall be marked by a vertical, nominal size 2" x 4" timber set at the service invert and extending 1 m above the ground surface. The top 300 mm of the exposed portion of this marker shall be painted green. These marker stakes are required prior to issuance of a Construction Completion Certificate for the development.

13. Roof leaders and building foundation drains shall not be connected to the sanitary sewer system; refer to Section 6 of these Design and Construction Standards.

14. Grease and sediment traps shall be provided at all food processing establishments, shopping centres, service stations, car washes, hotels/motels, manufacturing, equipment servicing and cleaning facilities, institutions (churches, schools, etc.) and any other facility that is anticipated to discharge sediment and/or grease. Grease and sediment traps shall meet the requirements of the ARROW Utilities, in particular Bylaw No. 8 Quality of Wastewater.

5.14. Service Abandoning

Sanitary services are to be abandoned by installing a plug in the sanitary service at the connection to the main.

5.15. Main Abandoning

Sanitary sewer mains are to be abandoned as per Section 6.20 for storm sewer pipe abandonment.

5.16. Service Connection Records

The Developer's Consultant shall provide detailed service reports for all installed services. Service reports shall provide information related to pipe diameter, invert elevations at the property line, location of services relative to property line(s), manholes or watermain valves, and lot number. Photos of installed service connections prior to and after backfilling shall also be included. A sample service report is provided in Section 3.

5.17. Special Conditions

Special design requirements such as pipe foundations, special bedding, anchors, etc., may be required for certain soil conditions. All special designs are subject to acceptance by the Town.

5.18. Low Pressure Sewer System

5.18.1. General

These standards cover the design and construction of low pressure sewer force mains and appurtenances to be built or rebuilt in the Town.

These standards provide the minimum design criteria and general construction requirements for consulting Engineers to use in their preparation of specifications and drawings. These standards may be exceeded if warranted by the design consultant. Good engineering practices and designs must prevail on all projects.

5.18.2. Requirements

Low pressure sewer systems for new subdivisions are only permitted with prior approval by the Manager of Engineering, provided that the system conforms to the Sanitary Master Plan. The Developer shall consult with the Manager of Engineering prior to designing a low pressure sewer system for a new subdivision.

5.18.3. Design Flow

The system shall be designed based on the probable maximum number of pumps operating simultaneously, which is a function of the total number of pumps connected to the system, per Table 5-3. The design flow can then be determined as the product of the maximum number of pumps in operation simultaneously, and the capacity of the average pump within the system.

The design of a low pressure sewer system is to be based on all pumps having the same specifications. Environment One Grinder Pumps, with a flow rate of 0.7 L/s (11 USGPM) at 28 m (92 ft) of total dynamic head (TDH), are to be used in low pressure sewer systems in the Town of Stony Plain. The Developer's Consultant is responsible for ensuring the specified pump is suitable for the proposed development. If the specified pump is not suitable for the proposed development, the Developer's Consultant shall submit a request for deviation to the Manager of Engineering; the request for deviation must provide evidence that the proposed pump alternative is suitable for the proposed development and will not overwhelm the Town's sanitary sewer system.

Table 5-3
Low Pressure Sewer System Design Flow

Total Number of Pumps Connected to System	Maximum Pumps Operating Simultaneously
1	1
2 – 3	2
4 – 9	3
10 – 18	4
19 – 30	5
31 – 50	6
51 – 80	7
81 – 113	8
114 – 146	9
147 – 179	10
180 – 212	11
213 – 245	12
246 – 278	13
279 – 311	14
312 – 344	15

Assume zero inflow and infiltration for a closed system.

5.18.4. Minimum Force Main Pipe Diameter

- Single Dwelling Service Connection: 38 mm diameter
- Force Mains in Residential Areas: 100 mm

  (50 mm and 75 mm diameter mains may be allowed at upstream ends of systems, as required to meet the minimum velocity specified in Section 5.4.)
- Force Mains in Non-Residential Areas: As required to maintain minimum velocity specified in Section 5.4

5.18.5. Isolation Valves

Isolation valves, at a maximum spacing of 300 m, are recommended along the pipeline as a means to isolate a section for servicing, repair, or regular Maintenance. The valves should be installed at intersections to allow each branch to be isolated.

Valves are to plug valves or ball valves, equipped with a gear actuator and non-rising stem to be operable from ground level.

5.18.6. Flush Points

Flush points are recommended at the end of every branch, at intermediate points along long stretches of pipe, and at low points.

5.18.7. Combination Air / Vacuum Valves

Combination air / vacuum valves are required at the sewer high points or wherever needed to release entrapped air during normal operation of a vacuum when the pump stops or the sewer is drained.

5.18.8. Low Pressure Sewer Service Connections

A curb stop, labelled "SEWER", and service box located 0.3 m inside the road right-of-way is required on all low pressure sewer service connections. A check valve is also required, located on private property.

5.18.9. Gravity / Low Pressure Standards

All other standard gravity sewer requirements listed in Section 5 also apply to low pressure sewer systems.

5.19. Materials and Specifications

Pipe materials shall be selected using a rational design method, with the following information as a guide. The Developer's Consultant is responsible to ensure that the selected pipe material and class is suitable for the proposed application (site conditions, depth of installation, etc.).

Alternative pipe materials will be evaluated through a deviation request submitted by the Developer's Consultant. Developer's Consultant shall provide a justification for the request for deviation. Alternative pipe materials shall not be installed without receiving written authorization from the Town.

5.19.1. Gravity Sewers

Table 5-4
Acceptable Pipe Materials for Gravity Sewers

Material	Specification
Polyvinyl Chloride (PVC)	ASTM D3034, SDR 35 (CSA B182.2)
Casing Pipe (Steel)	CAN3-Z245.1, Grade 241*

Note:

* or higher as required by crossing owner.

5.19.2. Force Mains

Table 5-5
Acceptable Pipe Materials for Sewer Force Mains

Material	Specification
Polyethylene (PE)	AWWA C906, DR11 or approved

5.19.3. Manholes

1. Precast manhole sections and grade rings shall conform to CAN/CSA A257.4 and shall be manufactured using sulphate-resistant Type 50 cement.
2. Manhole sections shall be precast reinforced concrete sections conforming to ASTM C478 and CSA A257.4. All precast units shall be marked with manufacturer's identification, date of casting, type of cement, and CSA standard.
3. Manhole steps shall be standard safety type, aluminium forged of 6061-T6 alloy having a minimum tensile strength of 260 MPa.
4. All manhole sections shall have flexible watertight joints using flexible joint sealant. All preformed flexible joint sealants shall meet ASTM C990 (Section 6.2.1), Butyl rubber sealants and contain 50% minimum Butyl rubber (hydrocarbon blends), % by weight. Manhole joints shall meet requirements of CSA A257.3.
5. Manholes shall be fitted with the appropriate cast-iron frame and cover conforming to Class 35B ASTM A48 as shown on the Standard Details (Section 5.19). All castings shall be true to form and dimension, and shall be free from faults, sponginess, cracks, blowholes, or other defects affecting their strength. Covers shall be cast with a single vent hole and shall be stamped with the Town of Stony Plain logo, as shown on Standard Detail 5-300.
6. Pre-benched manhole bases shall be used wherever possible with pre-cored connection holes and watertight Duraseal or G-Loc joints or approved equal.
7. Tee-riser manholes shall conform to CSA 257.2 / ASTM C76 for the pipe component and CSA A257.4 / ASTM C76 for the manhole riser component.
8. Perched manholes may be required when adding a manhole along an existing sanitary sewer.
9. Manhole covers shall be located outside of vehicle wheel paths wherever feasible. Manhole structures should be located outside of wheel paths wherever feasible.
10. The following is a list of accepted manhole frames and covers. Other manhole assemblies may be used upon approval by the Town.
    - F-39 – manhole in boulevard
    - F-80 – manhole in road
11. Sealed manhole covers shall be used in low spots where water ponding may be expected and in potentially odorous locations where sewer off-gassing is not ideal.

5.19.4. Pipe Bedding Materials

1. Granular material for bedding of pipes in sound dry soils shall be Class B sand (refer to Standard Detail 5-600) conforming to Table 5-6:

Table 5-6
Class B Sand Bedding Material Gradation

Standard Sieve Size (µm)	% Passing
10 000	100
5 000	70 - 100
160	5 - 20
80	0 - 12

2. Washed rock wrapped in filter cloth shall be used in areas with high water table. Washed rock shall consist of washed, crushed, or screened stone or gravel consisting of hard and durable particles meeting the gradation limits specified in Table 5-7 and shall be free from sand, clay, cementitious, organic, and other deleterious material.

Table 5-7
Washed Rock Bedding Material Gradation

Standard Sieve Size (µm)	% Passing
25 000	100
5 000	10 (max.)
80	2 (max.)

5.19.5. Trench Section

For trenching and bedding details, refer to the Standard Details (Section 5.19 No. 5-600, 5-601, and 5-700).

5.19.6. Corrosion Protection

All concrete used in a sanitary sewer system shall be made with sulphate-resistant cement.

A specialist's evaluation of cathodic protection requirements shall be supplied to the Town, both digital and print, for all steel applications.

5.19.7. Private Sewage Systems (Rural Areas Only)

1. All installations of private sewage systems shall be in accordance with the Safety Codes Council: Alberta Private Sewage System – Standard of Practice.
2. In general, private sewage systems are required for Rural residential and Industrial / Commercial developments without reasonable access to a common sewage collection and disposal system.
3. The owner of a private sewage system shall ensure the system:
   - Is maintained;
   - Is operated within the design parameters of the system; and
   - Effectively treats and disposes of the sewage and effluent.
4. The use of sanitary holding tanks is preferred over the use of septic fields.
5. The Developer's Consultant is responsible for selecting a sanitary holding tank(s) of the appropriate size for the proposed development. An access road to the tank is required and shall be designed to accommodate sewage collection truck wheel loads. Refer to Section 4.

5.20. Sanitary Sewer Testing

It shall be the responsibility of the Developer and/or Developer's Representative to ensure that the Contractor adheres to the minimum testing requirements outlined in this section.

The Developer shall submit all test data performed by the accredited testing company to the Town as per the requirements outlined in Section 2. Failure to receive test results will be considered sufficient cause for not accepting such work.

Testing of installed pipes shall depend on the elevation of existing groundwater. At minimum, video testing shall be undertaken as outlined in 12.3.4, with the following additional tests also required at the Town's discretion:

5.20.1. Infiltration Test

1. This test shall be performed where the existing groundwater level is at least 1.0 m above the pipe crown in the upstream manhole.
2. Install a watertight plug at the upstream end of the pipeline test section.
3. Discontinue dewatering operations for at least 3 days before test measurements are to commence and, during this time, keep thoroughly wet at least one third of the pipe invert perimeter.
4. Prevent damage to pipe and bedding material due to floatation and erosion.
5. Place a 90° V-notch weir, or other measuring device acceptable to the Manager of Engineering, in invert of sewer at each manhole.
6. Measure rate of flow over a minimum of 1 hour, with recorded flows for each 5 min interval.
7. Allowable leakage: 4.6 L/day/ mm diameter/km of length for PVC pipe.
8. Repair and retest the sanitary sewers as required until the test results are within the specified limit.
9. Repair visible leaks regardless of test results.

5.20.2. Exfiltration Test

1. The test section shall be filled with water, allowing displacement of air in the line, and shall stand for 24 hours.
2. Prior to the test, add enough water to ensure a head of 1 m over the pipe crown in the upstream manhole. Pressures in excess of 7.6 m water head at the lowest point are not recommended.
3. The test duration shall be 2 hours.
4. The water level shall be measured at the beginning and end of the test in order to calculate the exfiltration.
5. Allowable leakage: 4.6 L/day/mm diameter/km of length for PVC pipe and 60 L/day/mm diameter/km of length for Concrete pipe.
6. Repair and retest the sanitary sewers as required until the test results are within the specified limit.
7. Repair visible leaks regardless of test results.

5.20.3. Deflection Testing

1. Where CCTV inspections show evidence of excessive or non-symmetrical deflection, formal deflection tests shall be conducted.
2. A mandrel shall be pulled through the pipe in such a manner so as to ensure that excessive force is not used to advance the device through any deflected portion of the pipe.
3. Deflection testing shall be performed in conjunction with a CCTV inspection. The mandrel shall be located in front of, and in clear view of, the television camera. An appropriate distance is typically from 1.5 to 2.5 pipe diameters in front of the television camera.
4. The mandrel shall be cylindrical in shape, constructed with 9 evenly spaced arms.
5. Mandrels larger than 450 mm in diameter shall be constructed of special breakdown devices to facilitate entry through access manholes.

6. The barrel section of the mandrel shall have a contact length of at least 75% of the base inside diameter of the pipe.
7. The outside diameter of the mandrel shall not be less than 95% of the inside diameter of the sewer.
8. The mandrel material shall be steel.
9. Deflection testing must be conducted within 30 days of pipe installation.
10. If the mandrel is unable to pass through the pipe, the Contractor is to measure the exact inside diameter of the pipe with a deflectometer. If the pipe deflections are found to exceed 5%, the pipe is to be replaced.

5.20.4. Video Inspection Test

CCTV inspections of the sanitary sewer system shall be carried out by the Developer at the end of construction and at the end of the Warranty Period. One digital copy in colour format (mp4 using H.264 compression), and of acceptable clarity, quality (with a minimum resolution of 640 x 480 pixels and a data rate of 6000 kbps), and colour, along with inspection reports and summaries of the CCTV inspection, shall be supplied to the Town prior to issuing the Construction Completion Certificate and Final Acceptance Certificate.

The CCTV report shall also include the location of all service connections together with a statement of opinion as to whether the service connections are leaking.

Any deficiencies found during this test shall be promptly remedied by the Developer at their expense. Repair all defects which will impair the structural integrity or the performance of the sewer system including, but not limited to improper joints, cracked, sheared, or excessively deflected pipe, sags and rises which pond water in excess of twice the allowable deviation from grade, protruding service connections, and visible infiltration or exfiltration. Prior to undertaking any repairs, a meeting with the Town is required to review the proposed construction method.

Allowable deviation from grade: The invert of the pipe shall not deviate from the design grade by more than 6 mm plus 20 mm per metre of diameter and should not be consistently high or low.

5.20.5. Testing of Force Mains

Force mains shall be tested as described for watermains.

6. STORM DRAINAGE SYSTEMS

6.1. General

These standards cover the requirements for storm drainage systems and shall be dependent on the type of development, the drainage area, and the length of surface drainage runs. Standard Details relating to the storm drainage system construction are provided in Section 6.25.

These standards also address Drainage Parkways. Open ditches along streets and lanes within Urban developments are not permissible unless they are a part of the properly designed Drainage Parkway system approved by the Town.

Offsite flows into the Town's storm system from infill development or redevelopment of existing parcels must match pre-development conditions unless otherwise approved by the Town.

6.2. Stormwater Management Plan

Stormwater runoff generated from within the subdivision shall be routed through a stormwater management facility as required to regulate the rate of outflow prior to discharge, unless otherwise approved by the Town.

Stormwater management facilities shall be designed in accordance with the "Stormwater Management Guidelines" prepared by Alberta Environment and in accordance with good engineering practice. Evaporation ponds are not permitted and will not be accepted by the Town.

A phased construction approach to match the expected development sequence may be acceptable to the Town, provided the requirements of this guideline are met. Temporary ponds and structures, without the required facilities and design components per this guideline, are not acceptable.

Prior to submission of any detailed design, a stormwater management plan shall be prepared by the Developer and submitted to the Town for acceptance. The stormwater management plan shall be consistent with the standards outlined herein and shall:

1. Identify the impact of the proposed development on the watershed.
2. Identify and quantify the amount of upstream drainage entering the proposed development lands, including all points of entry.
3. Identify all existing flow channels, drainage patterns or routes, and containment areas.
4. Identify the point(s) of discharge from the lands, as well as the type and calculated capacity of the receiving drainage facility(ies), whether natural, man-made, or a combination of both.
5. Provide details of required stormwater retention / detention facilities.
6. Provide details of water quality enhancement facilities.
7. Identify all licensing requirements and/or approvals as may be required by Provincial or Federal environmental acts.

6.3. Minor and Major Systems

Each drainage system shall consist of the following components:

1. **Minor System**: underground pipe system, manholes and junctions, open channels, and water courses which convey flows of a 5-year return frequency, without surcharging.
2. **Major System:** surface flood paths, roadways, trap lows, swales, storage facilities, escape routes, Drainage Parkways, and water courses which convey flows of a 100-year return frequency. The major system shall include culverts crossing roadways. The overall major drainage system must be designed to provide continuous overland flow routes with minimum depths of ponding in roadway sags and to provide overflow routes at all SWMF. Ponding shall not extend onto private property.

6.4. Design Flows

Design flows shall be computed using one or more of the following methods:

6.4.1. Rational Formula

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

Where: Q = Design flow (m^3/s)
A = Drainage area (ha)
I = Rainfall intensity (mm/hr)
C = Runoff coefficient

The rational formula is applicable for minor system storm sewer main design for watersheds (less than 30 ha) which discharge into detention facilities or other outlets approved by the Town.

6.4.2. Hydrograph Methods

Computer modelling shall be used for stormwater drainage design for:

- Urban residential and Commercial / Industrial development areas greater than 30 ha in size.
- High Density Rural Residential and Commercial / Industrial development areas greater than 30 ha in size.
- Low Density Rural Residential development areas greater than 30 ha in size.
- Any development requiring storage or detention facilities.
- Alternatively, computer modelling may be used for areas smaller than those outlined above.

Contact the Town prior to design to confirm the type of modelling software to be used in the design.

6.5. Coefficient of Runoff

The coefficients of runoff for storm events with return periods of up to 10-years shall be taken from Table 6-1.

Table 6-1
Runoff Coefficients for 5-Year and 10-Year Event Return Periods

Description (and Zone)	Runoff Coefficient		
	Minimum	Average	Maximum
Pavement (Asphalt or Concrete)	0.70	0.83	0.95
Roofs	0.70	0.83	0.95
Business			
Downtown (C3)	0.70	0.83	0.95
Neighbourhood (C1, C2)	0.50	0.60	0.70
Industrial			
Light (M1)	0.50	0.65	0.80
Heavy	0.60	0.75	0.90
Residential			
Low Density Residential (R1, R2, R3, R4, R5)	0.40	0.50	0.60
Medium Density Residential (R7)	0.60	0.68	0.75
High Density Residential (R8)	0.50	0.60	0.70
Rural	0.25	0.33	0.40
Parks / Cemeteries	0.10	0.18	0.25
Playgrounds	0.20	0.28	0.35
Railroad Yards	0.20	0.28	0.35
Unimproved	0.10	0.20	0.30

Notes:

- Values within the range specified depend on the soil type if the watershed is significantly unpaved (sand is minimum, clay is maximum) and on the nature of the development.
- For storms with return periods of more than 10 years, increase the specified values as follows, up to a maximum coefficient of 0.95:
    - 25-Year: Add 10%
    - 50-Year: Add 20%
    - 100-Year: Add 25%

6.6. Rate of Precipitation

The most up-to-date Intensity-Duration-Frequency (IDF) curves published by EPCOR Drainage shall be used for design purposes. The 5-year IDF curve shall be used for the design of minor systems; the 100-year IDF curve shall be used for the design of major systems.

The inlet time shall be as per Table 6-2.

Table 6-2
Design Inlet Time

Catchment Area	Imperviousness (%)		
	30	50	>70
8 ha or less	8 mins	8 mins	5 mins
Between 8 ha and 40 ha	9.2 mins	9.2 mins	6 mins
40 ha or greater	10.4 mins	10.4 mins	7.25 mins

6.7. Final Site and Lot Grading

The following criteria shall be used:

1. Each lot shall be graded to drain to the municipal storm drainage system. Cross-lot drainage is not permitted. Where cross lot drainage is approved by the Town, a URW shall be registered on all impacted titles to protect the drainage conveyance with drainage swales constructed as per Section 6.25.
2. Areas around buildings shall be graded away from the foundations to prevent flooding. Refer to Standard Detail 6-300 for typical grading requirements.
3. Lots lower than adjacent roadways shall be avoided where possible.
4. To provide basic positive drainage until a lot is developed, the lot(s) shall be pre- graded, allowing for earth balancing of future basement excavation and landscaping. Rough grading shall ensure positive drainage is maintained in the interim; the Developer shall be responsible to remove and properly dispose of standing water on lots. Rough grading of lots to ensure positive drainage is required prior to requesting a CCC inspection.
5. The Developer shall be responsible for clean-up after rough grading operations; the area around the lot being graded shall be left in a developable condition.
6. Building foundations shall be above the major system hydraulic grade line for a 100-year storm event, plus a minimum of 0.3 m freeboard. This requirement may not apply to replacement of structures / developments within existing flood plains. In these areas, suitable precautions, such as mounting electrical panels above the 1:100-year hydraulic grade line, shall be taken.
7. Internal side-yard drainage swales are required for locations where common property drainage swales cannot be constructed due to inadequate foundation grading on an adjacent property (i.e., for infill developments) and within the 1.5 m wide easements found between the homes of zero lot line properties. They must provide a minimum unobstructed width of 1.5 m within the developing property, a minimum depth of 15 cm and a minimum 1.5% slope to direct surface runoff towards a Town right-of-way.

6.8. Foundation Drains

Foundation drain sewers are required in all areas without a storm sewer and shall discharge to the nearest downstream storm sewer. The system shall be dedicated to the collection of foundation drain flows produced from basement sump pump discharge only.

A sump pump, in the basement with a pressure discharge connection to a foundation drain service riser pipe on the outside of the building foundation, and a foundation drain service connection pipe from the riser connection at the house to the property line are required (refer to Standard Detail 6-400). The pressure discharge connection to the gravity foundation drain service riser pipe shall be provided with a cleanout and an overflow discharge to a concrete splash pad. Installation and Maintenance of these on-lot components are the responsibility of the homeowner.

The remainder of the system components are located within road right-of-way or a PUL and consist of:

1. Foundation drain service from the property line to the storm sewer, or
2. Where there is no storm sewer in the street, a foundation drain sewer shall be installed to permit connection of foundation drain services to the nearest downstream storm sewer. Manholes shall be provided for the foundation drain sewer at a maximum spacing of 120 m.
3. Discharge to surface will not be allowed unless approved by the Town and will be assessed on case-by-case basis.

The following criteria shall be used:

1. Under no circumstances shall a foundation drain service be discharged to the sanitary system.
2. The depth of the foundation drain service shall be 2.0 m from the finished grade to the crown of the service at the property line. In areas where it is not feasible to provide a minimum depth of cover of 2.0 m, evaluate alternative solutions with the Manager of Engineering.
3. The depth of the foundation drain sewer shall be adequate to receive the drainage from the foundation drain service such that the service can be connected to the sewer above its mid diameter, within 45 degrees of the pipe crown. A minimum of 2.0 m of cover, measured from the finished grade to the crown of the sewer, must be provided. In areas where it is not practical to provide a minimum depth of cover of 2.0 m, evaluate alternative solutions with the Manager of Engineering.
4. Size the foundation drain sump pump discharge collection system to provide the capacity in free flow based on all connected sump pumps operating simultaneously.
5. The minimum size and grade of the foundation drain sewer shall be 200 mm and 0.40%, respectively. The respective minimum size and grade of the foundation drain service shall be 100 mm and 1.0%, respectively.
6. Single bends shall be restricted to no greater than 22.5 degrees to provide access for CCTV camera and flushing work, especially at the service connections.

6.9. Roof Drainage

1. Roof drainage from single detached and semi-detached dwellings shall be discharged to the ground and dispersed via splash pads at the downspouts. The point of discharge shall be a minimum of 1.0 m away from the building (including downspout extensions) to ensure positive drainage. Discharge should be directed to grassed or pervious areas to help reduce the volume of runoff.
2. Collection of roof leader runoff water can be incorporated into the residential lot storm service line only where requested by the Town. Sewer piping shall be designed to carry the expected runoff from 1:5 year 4hr storm in non-surcharged pipe flow. Service pipes to lots must be sized based on the expected flows. Design calculations for the typical lot must be shown on the drawings along with roof size, runoff model information, design flow and pipe velocity flow and full flow.
3. Roof drainage from multi-dwelling residential, Commercial, and Industrial areas may discharge to the storm sewer where the new and existing systems are designed to accommodate the direct discharge and only if acceptable to the Town.

6.10. Private Storm Systems Connections

Where private on-site stormwater collections systems exist, such as for commercial, industrial, institutional, or multi-unit residential properties, storm sewer service connections for the connection of onsite storm drainage systems and/or roof drains are to be provided. When required service locations are known, storm service connections should be installed concurrently with the general area servicing. Otherwise, installation of connections may be deferred until the specific property development is proposed.

Oil and grit separator manholes are to be installed where required at lots where oil and sediment is generated to protect the Town's infrastructure from excess sediment loads. Maintenance of these oil and grit separators shall be the responsibility of the property owner.

6.11. Flow Capacities

6.11.1. Storm Sewers and Open Channels

Manning's formula shall be used to calculate pipe capacity:

$$Q = (AR^{(2/3)}s^{0.5}) / n$$

Where: Q = Pipe capacity (m^3/s)
A = Cross-sectional area of pipe (m^2)
R = Hydraulic radius (area / wetted perimeter) (m)
s = Slope of hydraulic grade line (m/m)
n = Roughness coefficient = 0.013 for smooth-walled pipe (for example, PVC, concrete)
= 0.024 for corrugated steel pipe (unpaved)
= 0.020 for corrugated steel pipe (invert paved)
= 0.033 for gravel lined channels
= 0.020 for concrete or asphalt lined channels
= 0.05 for natural streams and grassed channels

6.11.2. Culverts

Use the inlet control and outlet control methods referred to in:

1. The Handbook of Steel Drainage and Highway Construction Products, by the Corrugated Steel Pipe Institute
2. The Handbook of Concrete Culvert Pipe Hydraulics, by the Portland Cement Association
3. Design Guidelines for Bridge Size Culverts, by Alberta Transportation and Economic Corridors

6.11.3. Catchbasin Inlets

The designer is responsible for determination of the appropriate design capacity factors for all proposed catchbasin inlets and swales. Information on capacity and capture efficiency of existing CBs can be found in the EPCOR Drainage Volume 3 Design Guidelines, Appendix A.

6.12. Pipe Location

1. Storm sewer mains shall be located within the municipal road right-of-way as per the typical cross-sections in accordance with the Standard Details (Section 4.22 No. 4-100 through 4-103).
2. A minimum width of 6 m is required for PULs with up to two utilities; additional width may be required for PULs with more than two utilities.
3. Service connections should be located adjacent to sanitary service connections at property line and shall be as shown on Standard Detail 7-302. Cross lot servicing is not permitted.
5. Services shall be located under landscape areas, as close to the centre of the property as possible.
6. Storm sewer mains shall maintain the following clearances from watermains, sanitary sewers, and power / telephone / cable infrastructure:
    - Minimum 3.0 m horizontal clearance unless sewer depth requires increased spacing; and
    - Minimum 0.5 m vertical clearance above or below at crossings.

6.13. Minimum Depth of Cover

The minimum depth of cover shall be as follows:

- Storm sewers in roads: Minimum 2.4 m to pipe crown
- Culverts across roads: Greater of half the culvert diameter or 500 mm (to pipe crown)
- Catch basin leads at the catch basin: Minimum 1.8 m to pipe crown
- Landscaped areas: Minimum 2.1 m to pipe crown
- Service connection at property line: Minimum 2.0 m to pipe crown

When it is not feasible to provide the required depth of cover from finished surface to pipe crown, the sewer shall be insulated as per Standard Detail 7-900.

6.14. Minimum Pipe Diameter

1. Storm Sewers: 300 mm
2. Culverts crossing roads: 500 mm
3. Catch Basin Leads: 250 mm
4. Foundation Drain Sewers: 200 mm
5. Foundation Drain Services: 100 mm

6.15. Minimum Velocity and Grade

6.15.1. Minimum Velocity

All storm sewers shall be designed with velocities ranging from 0.90 m/s to 1.0 m/s where feasible, based on Manning's formula, when flowing at the design (part-full) flow. Velocities below 0.60 m/s will not be allowed. Special design considerations are required when velocities exceed 3.0 m/s.

6.15.2. Minimum Grade

Minimum pipe grades for sewers along a straight alignment are indicated in Table 6-3; however, steeper grades are preferred.

Table 6-3
Minimum Grade for Storm Sewers Along a Straight Alignment

Pipe Size (mm)	Minimum Grade (%)
200	0.40[1]
250	0.28 [1]
300	0.22
375	0.15
450	0.12
525	0.10
600 and larger	0.10

Note:

[1.] Foundation drain sewers only.

6.16. Curved Sewers

1. Minimum grades of sewers along a curved alignment shall be 0.30% greater than the minimum grades outlined in Table 6-3 for pipes under 600mm diameter.
2. Maximum joint deflections shall be as recommended by the pipe manufacturer. The Town requires a letter from the pipe manufacturer indicating the maximum joint deflection for proposed curved sewers; the letter from the pipe manufacturer is to be submitted as part of the detailed engineering design package.
3. Curved sewers shall be aligned parallel to the road centreline.

6.17. Manhole Spacing

1. Manholes shall be provided at the end of each line and at all changes in pipe sizes, grades, or alignment.
2. The maximum allowable distances between manholes for sewers along a straight alignment shall be as follows:
    - Sewers smaller than 900 mm: 120 m maximum spacing; and
    - Sewers 900 mm and larger: 150 m maximum spacing.
3. The maximum allowable distances between manholes for sewers along a curved alignment shall be as follows:
    - Sewers smaller than 1200 mm: 90 m maximum spacing; and
    - Sewers 1200 mm and larger: 120 m maximum spacing.
4. Manhole covers within the road carriageway shall be placed outside of vehicle wheel paths wherever feasible. Manhole structures should be located outside of wheel paths wherever feasible.

6.18. Hydraulic Losses Across Manholes

1. Generally, for increasing pipe diameters, the crown of the downstream pipe shall match crown of the upstream pipe; however, in no case will the upstream 0.8 depth point be below the downstream 0.8 depth point.
2. A smooth transition shall be provided between the inverts of incoming sewers and the outlet sewer and extreme changes in elevation at manholes should be avoided wherever possible.
3. The minimum drop in invert elevations across manholes shall be as follows:
    - Straight runs and deflections up to 45° 30 mm
    - Deflections between 45° and 90° 60 mm
    - Deflections greater than 90° shall be accommodated using two or more manholes.
4. Where drops greater than 1.0 m cannot be avoided, a specially designed drop manhole will be required to address the hydraulic requirements of the change in elevation. The following shall be considered in the design of the drop manhole:
    - The pipe shall be sized so that it does not surcharge.
    - A smooth vertical curve shall be formed between the inlet pipe and the drop shaft with no breaks in grade, projections, or edges.
    - The drop shaft diameter shall be equal to or greater in size than that of the largest inlet pipe. For multiple connections, a larger drop shaft shall be supplied.
    - Air vents shall be provided.
    - The cover shall be able to withstand pressures from air discharge and surcharging.
    - The outlet shall provide a hydraulic jump basin to dissipate energy, to convert the flow to subcritical velocity and to allow for air release.
5. Baffled vertical drop shafts are generally not permitted due to potential Maintenance and access problems. Vortex type drop shafts are preferred. Proposals to use vortex type drop shafts must be supported by the appropriate design calculations and submitted to the Town for acceptance.

6.19. Manhole Abandonment

1. To abandon a manhole, plug all pipes with non-shrink grout, remove and dispose of manhole to 1.0 m below ground and fill remainder with fillcrete.

6.20. Pipe Abandonment

1. To abandon existing sewers, after receiving Town approval in writing, plug one end and completely filling the sewer with cement-stabilized flowable fill and then sealing. Confirm all active sewer services have been disconnected from sewer being abandoned and have been reconnected to new sewer before filling the sewer.
2. Plug each end of the sewer section identified on the drawings for abandonment, as follows:
    - For concrete pipe 375 mm to 675 mm diameter, place sandbags or other firm backing 300 mm inside the abandoned sewer and seal with concrete. Break out section of the pipe invert in front of the sandbags to allow concrete to key into the pipe to prevent shifting.
    - For PVC pipe 375 mm to 675 mm diameter, place sandbags or other firm backing 300 mm inside the abandoned sewer and seal using manufactured compression type plug.
    - The method for plugging each end of sewer pipes larger than 675 mm shall be detailed on the drawings or specified elsewhere.
3. A disturbed soil caveat must be registered on title for those lots where a water main is installed, abandoned in place, or removed from within the lot or adjacent walkway, lane, or public utility lot.

6.21. Catch Basins

1. Catch basins shall be of sufficient number and have sufficient inlet capacities and adequate catch basin leads to receive and convey the calculated stormwater flow.
2. Catch basins shall be provided to intercept surface runoff and shall be spaced a maximum of every 120 m. The maximum flow distance to the first catch basin shall be 150 m.
3. Catch basins shall be located and sized such that no ponding shall occur during the 1:5 year, or less frequent, rainfall event.
4. Provide sufficient catch basins such that the flow depth in gutters does not exceed the top of curb during the 1:5 year rainfall event.
5. At sag locations and depressions, locate catch basins with sufficient inlet capacity such that ponding does not exceed 150 mm for a major event.
6. All catch basin bodies shall be of precast concrete sections conforming to the most recent ASTM specifications and constructed to provide a 500 mm sump to trap rocks and gravel.
7. All catch basin sections shall have flexible watertight joints sealed with rubber gaskets conforming to ASTM C443.
8. Precast catch basins shall have pre-cored connection holes and watertight Duraseal or G-Loc joints or approved equal.
9. Catch basin leads shall be installed to provide a minimum depth of cover of 1.8 m, measured from finished grade to pipe crown, unless otherwise accepted. The minimum slope of the catch basin leads shall be 2%.
10. Catch basin leads shall generally discharge directly into stormwater manholes. Catch basins may be connected in series, provided that the downstream catch basin is a catch basin manhole which discharges into a stormwater manhole.

11. The maximum length of a catch basin lead shall be 30 m. Where catch basin leads in excess of 30 m in length are required, a catch basin manhole must be installed to intercept surface runoff.

12. To abandon a catch basin, follow the procedure for the abandonment of manholes as outlined in section 6.18.

13. Catch basin grade rings and the catch basin frame shall be installed within 50 mm of plumb with catch basin shaft. A clear distance of 810 mm must be provided within the catch basin.

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

    - F-39 – manhole in road or boulevard
    - F-51 with side inlet – straight face curb and gutter
    - DK-7 – roll face curb and gutter
    - K-7 – roll face curb and gutter
    - F-38 – v-gutter or swale

6.22. Culverts and Rural Drainage

The minimum allowable ditch grade shall be 0.6%. Ditch grades in excess of 2.0% shall be protected against erosion through rock ditch checks, silt fences, Enviroberm fences, and/or erosion control blankets.

The minimum ditch bottom width shall be 1.5 m, sloping away from the roadway at a minimum of 5.0%.

Culvert size requirements shall be determined through the stormwater drainage analysis; however, the minimum size of culverts shall be as follows:

- Roadway cross culvert: 500 mm
- Residential driveway culvert: 400 mm
- Industrial driveway culvert: 500 mm

Culverts shall be new galvanized CSP (corrugated steel pipe) with a minimum wall thickness of 1.6 mm, or as required by the loading criteria, and a profile of 68 mm x 13 mm. All culverts shall be installed in accordance with the manufacturer's recommendations and shall be installed complete with bevelled end sections, on both the inlet and outlet ends, with the invert extended to the toe of the side slope. Culvert bedding and backfilling shall be installed as per EPCOR Volume 3-06: Construction Specifications and Standard Drawings for CSP culverts.

Culverts shall be installed to provide a minimum depth of cover of 500 mm or one-half (½) the culvert diameter, whichever is greater, as measured from finished grade to the top of the culvert.

Riprap shall be placed around the inlet and outlet of all culverts; refer to Standard Detail 6-900. Alberta Transportation and Economic Corridors Class 1M riprap shall be used and shall meet the requirements outlined in Table 6-4. Typical riprap installation is illustrated on Standard Detail 6-900.

Table 6-4
Class 1M Riprap Requirements

Criteria	Value
Nominal Mass	7 kg
Nominal Diameter	175 mm
None greater than	40 kg 300 mm
20% to 50%	10 kg 200 mm
50% to 80%	7 kg 175 mm
100% greater than	3 kg 125 mm

Geotextile filter fabric shall be a non-woven fabric with the following properties:

- Grab Strength: 650 N
- Elongation (Failure): 50%
- Puncture Strength: 275 N
- Burst Strength: 2.1 MPa
- Trapezoidal Tear: 250 N
- Minimum Fabric Lap: 300 mm

All culverts installed to facilitate roadway drainage in road right of way shall be subject to CCC and FAC prior to being entered into Town inventory.

6.23. Pipe, Manhole, and Bedding Materials and Specifications

6.23.1. Pipe

Pipe materials shall be selected using a rational design method, with the following information as a guide. The Developer's Consultant is responsible to ensure that the selected pipe material and class is suitable for the proposed application (site conditions, depth of installation, etc.).

Alternative pipe materials will be evaluated through a deviation request submitted by the Developer's Consultant. Developer's Consultant shall provide a justification for the request for deviation. Alternative pipe materials shall not be installed without receiving written authorization from the Town. Ultra-Rib and similar pipes will not be accepted by the Town.

Table 6-5
Acceptable Pipe Materials

Material	Specifications
Reinforced Concrete	CAN/CSA A257.2, ASTM C76/ C76M
PVC	ASTM D3034, CSA B182.2, Class DR35
Corrugated Steel Pipe (culverts only)	CSA-G401, stiffness AASHO-M-36

6.23.2. Manholes

1. Precast manhole sections and grade rings shall conform to CAN/CSA A257.4 and shall be manufactured using sulphate-resistant Type 50 cement in accordance with the Standard Details (Section 6.25 No.5-100 and 5-101).
2. Manhole sections shall be precast reinforced concrete sections conforming to ASTM C478 and CSA A257.4. All precast units shall be marked with manufacturer's identification, date of casting, type of cement, and CSA standard.
3. Manhole steps shall be standard safety type, aluminium forged of 6061-T6 alloy having a minimum tensile strength of 260 MPa.
4. All manhole sections shall have flexible watertight joints sealed with rubber gaskets conforming to ASTM C443 and grouted inside and outside with non-shrink grout. Grout shall be per EPCOR Volume 3-06: Construction Specifications and Standard Drawings.
5. Manholes shall be fitted with the appropriate cast-iron frame and cover conforming to Class 35B ASTM A48 as shown on the Standard Details (Section 6.25). All castings shall be true to form and dimension, and shall be free from faults, sponginess, cracks, blowholes, or other defects affecting their strength. Covers shall be cast with a single vent hole and shall be stamped with the Town of Stony Plain logo, as shown on Standard Detail 5-300.
6. Pre-benched manhole bases shall be used wherever possible with pre-cored connection holes and watertight Duraseal or G-Loc joints or approved equal.
7. Tee-riser manholes shall conform to CSA 257.2 / ASTM C76 for the pipe component and CSA A257.4 / ASTM C76 for the manhole riser component.
8. Perched manholes are required when adding a manhole along an existing sanitary sewer.
9. Manhole covers shall be located outside of vehicle wheel paths wherever feasible. Manhole structures should be located outside of wheel paths wherever feasible.

6.23.3. Bedding Material

Bedding material shall be in accordance with section 5.19.4.

6.23.4. Outfall Structures

1. A hydraulic analysis is required for outfalls to ensure that exit velocities will not negatively impact natural watercourses. Final velocities into a natural drainage course shall not exceed 1.5 m/s.
2. Appropriate erosion control measures, including energy dissipators, are to be provided downstream of the outfall.
3. All storm sewer outfalls shall be constructed with lockable grates to allow Maintenance but prevent entrance of unauthorized personnel. Where required, guardrails, and/or fences shall be installed to provide fall protection.
4. Outfall structures shall be designed with consideration of aesthetics as they are generally located within parks, ravines, and on riverbanks. Concrete surface treatment is recommended. Refer to Standard Detail 6-500

6.24. Major Systems

Stormwater management facilities shall be designed to meet Alberta Environment guidelines and the following:

6.24.1. General Stormwater Management Facility Requirements

1. Stormwater management facilities shall be sized such that there will be storage for the equivalent of 120mm of water over the total catchment area draining to the facility, based on the July 1937 storm event utilized by EPCOR Drainage (refer to EPCOR Drainage Design Standards Volume 3-01 and 3-02), plus adequate freeboard to contain the maximum historical event or 0.3m which ever is greater.

2. The performance of each storage facility design is to be verified by computer simulation of its response, considering the outflow rate as limited by control elements or downstream conditions, to the most critical of any of the design rainfall events from the following listing:

   - 1:100 year, 24 h synthetic design event based on the Huff distribution;
   - The July 14 - 15, 1937 storm event;
   - The July 10 - 11, 1978 storm event;
   - The July 2 - 3, 2004 storm event; and
   - The July 12, 2012 storm event;

   Refer to EPCOR Drainage Design Standards Section 2.0 - Vol. 3-02: Stormwater Management and Design Manual for rainfall data references.

3. Stormwater management facilities shall control the release rate to the pre-development flow rate; refer to the Stormwater Master Plan, available on the Town's website. Acceptable structures can include manholes or vaults with adjustable weir or sluice gate configuration with automatic or passive controls, and consideration for confined space entry and rescue.

4. All outflow piping shall be sized for a flow twice that of the maximum designed control flow.

5. An oil and grit separator manhole shall be required at the entrance to Town storm facilities in industrial areas and at outfalls to watercourses where no other upstream storm water management and treatment facilities (such as engineered storm ponds) exist. Oil and grit separators must be accessible by maintenance vehicles, including vacuum trucks.

6. Water release shall be controlled via an orifice or other approved means and shall include provisions for increasing the release rate in an emergency. When used, orifice plates shall be designed to be easily removeable without the need to enter the control structure, or a secondary high-level orifice or weir for overflow shall be provided at the high water level elevation.

7. An emergency overland drainage swale shall be provided from the downstream end of the pond to the receiving pond or stream with capacity to transport storm runoff should a downstream malfunction occur.

8. Wet ponds and constructed wetlands require warning signs, posted along the perimeter of the PUL, to prohibit activities that may present a danger to public health and safety or interfere with the operation of the facility.

9. Stormwater management facilities require an outlet control structure. The Developer's Consultant shall submit a design for all outlet control structures, detailing:
   - Size and configuration of concrete chamber;
   - Types of hatches (must be lockable);
   - How the structure will be accessed for Maintenance (all-weather access suitable for a hydro-vac truck is required);
   - Locations of safety railings around the hatches;
   - Provision for kickplates at the base of railings; and
   - Locations and models of davit bases (if required – Developer's Consultant to discuss this requirement with the Town);
   - Locations and models of water level control gates (if required); and
   - Location and size of orifice and provisions for increasing the release rate for rapid drawdown.

10. Outlet control structures shall include monitoring instrumentation where the combined development outfall capacity is equivalent to or greater than a 500mm pipe size. Instrumentation and monitoring shall be designed in accordance with Volume 3-03 of the EPCOR Drainage Design and Construction Standards, and shall align with the Town's reference SCADA standard, which can be requested from the Town Engineer.

11. The Developer's Consultant shall submit all relevant operations and maintenance manuals for stormwater management facility appurtenances, including control structures, pond level sensor, and lift stations.

12. A geotechnical report must be undertaken by a qualified geotechnical consultant that addresses issues related to the design of all stormwater ponds (wet ponds and wetland, and dry ponds if requested). The report must identify subdrainage design, liner requirements and special design conditions such as slope stability

13. Identify whether any embankments need to be classified as a dam under the Water Act and include a dam safety assessment if needed.

14. A hydrogeological assessment may be required at the Town's discretion, depending on the depth and location.

6.24.2. Design of Dry Ponds

1. Dry ponds are not considered a treatment facility for water quality improvement and shall not be accepted unless a wet pond is provided downstream of the dry pond. Further, dry ponds shall only be used when topological or planning constraints exist which limit the use of wet ponds or constructed wetlands. In all cases, the use of dry ponds shall be approved by the Engineering Manager.

2. Dry ponds shall be located in a PUL which covers up to the 5-year water level.

3. Side slopes shall not be steeper than 5H:1V within public property and shall not be steeper than 7H:1V within private property.

4. The pond bottom shall be graded to provide positive drainage to the outlet at a minimum slope of 2%.

5. All surfaces, including the bottom, shall be topsoiled and seeded with approved materials, except for the low flow channel which can be either aquatic type plants or a rip-rapped channel.

6. The maximum storage depth shall be 3 m, as measured from the invert of the outlet pipe.

7. Provide a landscaped or rip-rapped channel to accommodate the 1:5-year event and low flow condition.

8. Dry ponds shall be designed as an amenity to the development with Open Space for passive play with flood resistant recreational amenities and/or sports fields and links to pedestrian walkways for use by the public.

6.24.3. Design of Wet Ponds

1. Wet ponds shall have a minimum surface area at normal water level (NWL) of 2 ha. If a wet pond is not to become a publicly owned and maintained facility, a surface area of less than 2 ha may be permitted, upon approval of the Town and Alberta Environment.

2. The active storage depth shall be as required to provide storage for a 1:100-year storm event.

3. An impervious pond bottom shall be constructed of material with a permeability coefficient in the order of 1×10^{-6} cm/s. A report shall be submitted to the Town signed by an Engineer certifying the materials which were used and their correct installation.

4. A minimum pond depth of 2 m, from pond bottom to NWL, shall be required; however, a 3 m depth is preferred.

5. Dead bay areas are not permitted.

6. All inlet and outlet pipes shall be submerged a minimum of 1 m below NWL and shall be posted at the surface. Inlet and outlet pipe inverts shall be a minimum of 100 mm above the pond bottom.

7. The freeboard elevation shall be set such that it is below adjacent house basement footings.

8. The side slopes of the pond shall, generally, not be steeper than 7H:1V from free board elevation to 1 m below NWL; however, when space limitations exist, side slopes of 5H:1V may be permitted. Side slopes of 3H:1V are permitted from pond bottom to 1 m below NWL.
9. The normal water elevation shall be such that the collection system shall not surcharge to an elevation greater than the lowest catch basin invert in the collection system during a 1:5-year storm.
10. The shoreline treatment of the pond shall consist of a band of granular material, from 0.3 m above to 0.3 m below NWL, on top of woven polypropylene geotextile fabric. The granular material shall be chemically sterilized, shall be 75 mm minimum size, and shall be installed in a 250 mm thick layer. An evaluation of wave action shall be made and, if necessary, additional bank protection shall be provided. The designer is encouraged to propose alternate edge treatments that exceed this minimum standard. The final selection of edge treatment is subject to the approval of the Manager of Engineering.
11. A buffer strip shall be provided between NWL and the 1:25-year flood level. The difference between the NWL and the 1:25-year flood level shall be limited to 1 m vertical rise.

6.24.4. Design of Constructed Wetlands

1. Constructed wetlands shall be designed in accordance with the most recent version Alberta Guide to Wetland Construction in Stormwater Management Facilities (Alberta Environment and Parks).
2. The size of a constructed wetland should be approximately 5% of the watershed area that it will be servicing.
3. Approximately 25% of the surface area at NWL should consist of deep pools (at inlets(s) and the outlet) which are 2.4 m to 3.0 m deep to allow for settleable solids removal.
4. Average permanent wetland water depth shall be 0.3 m with 1 m deep zones for flow redistribution and for fish and submerged or floating aquatic vegetation habitat.
5. Water depths shall be 0.1 m to 0.6 m deep, with an average permanent water depth of 0.3m. Fluctuation in excess of 1 m above NWL should be infrequent to avoid killing vegetation.
6. A length to width ratio of 3:1 is preferred; however, if space limitations exist, the length to width ratio can be as low as 1:1, provided that additional considerations are made to maximize the travel time through the wetland for treatment and to prevent short-circuiting.
7. The deep zone shall be sloped at 1.0% from inlet to outlet and the shallow marshy areas are to have a smooth bottom to promote sheet flow through the system.
8. Design with the landscape, not against it; take advantage of natural topography and drainage patterns.
9. Incorporate as much "edge" as possible and design in conjunction with a buffer and the surrounding land and aquatic systems.
10. Design to protect the wetland from any potential high flows and sediment loads.
11. Design for self-sustainability and to minimize Maintenance; however, an all-weather Maintenance access is required to all deep pool areas for sediment removal.

6.24.5. Recreation

1. Recreational use of wet and dry ponds will be regulated by the Town. Recreational uses are not permitted for constructed wetlands.
2. Suitable recreational facilities such as bicycle trails, benches, trees, etc. shall be provided for stormwater management facilities.

3. Primary recreational activities will not be allowed upon wet ponds. The ponds will be posted, prohibiting primary recreational activities, i.e. all water-based activities where there is body contact with the water, such as swimming and wading.

6.24.6. Erosion

1. Construction of new developments shall be undertaken in a manner such that erosion of the site and sediment discharge via runoff to the receiving stream are minimized. The Developer's Consultant shall be required to submit a formal erosion and sedimentation control plan to the Town.
2. Adequate erosion protection will be required for all natural and man-made water courses within the new development.
3. Outfalls of storm sewers shall be designed to control local erosion to the conveyance channel or receiving stream and shall not change the hydraulic characteristics of the receiving stream.

6.24.7. Maintenance

1. The Developer shall be responsible for any defects of the works and lands associated with the stormwater management facility, including adjacent park lands, for the duration of the Warranty Period.
2. The Developer shall assume full responsibility with respect to the operation and Maintenance of the stormwater management facilities in all aspects relating to flows, water volumes, surface debris, aeration, hydrological cycle, hydraulic performance, utility devices such as outlet structures, vegetation control, insect control, and on-shore facilities until issuance of a Final Acceptance Certificate (FAC).
3. The Developer will be responsible for siltation and debris problems which are caused due to poor erosion control for the development. Should siltation and debris problems occur in the stormwater management facilities that are the result of stormwater draining lands beyond the Developer's control, the Town shall assume responsibility for any necessary remedial actions.
4. The monitoring and Maintenance of water quality to eliminate any nuisance factors and to protect against health hazards shall be the responsibility of the Developer during the Warranty Period.

6.24.8. Pond Boundary Control and Use

1. All stormwater management facilities and shoreline areas must be sufficient to accommodate the 1:100-year design event and will be retained within a PUL.
2. Land above the 1:100-year design flood level within lots that back onto a stormwater management facility, when no overflow is provided, shall be protected by a restrictive covenant registered against the title of the property. The restrictive covenant shall indicate that the land is subject to flooding and that the owner will not construct any permanent structures susceptible to flood damage.
3. If the provision of public access to the shoreline is being considered, fencing of a uniform type shall be constructed by the Developer along the 100-year event elevation to separate public from private lands.
4. Noxious Industrial land uses are considered unacceptable adjacent to or upstream of stormwater management facilities.
5. Minimum lot dimensions and rear yard depths, as measured from the property line, shall conform to the requirements of the Town of Stony Plain Land Use Bylaw and relevant Area Structure Plan.

6.24.9. Site Acquisition and Financing of Construction

1. The acquisition of all stormwater management facility sites shall occur as part of the subdivision approval process, at no cost to the Town. The site of the stormwater management facility must be provided to the Town as a PUL. Easements will need to be established during the construction and warranty period for the Town to access the stormwater management facility.
2. All design and construction of stormwater management facilities, interconnecting pipe systems, and outfalls shall be completed to the Town's acceptance and shall be paid for by the Developer and such works shall be closely coordinated with the grading and earthworks balance of the remainder of the subdivision.
3. When a new development is within the drainage basin of an existing system, designed and constructed by others, the Town will endeavour to collect off-site levies or development charges from the Developer of the new development which is benefitting from the existing system.

6.24.10. Legal Liability and Safety

1. Given that primary water contact (i.e. swimming and wading) will be forbidden, supervision will not be provided.
2. Proper and adequate signage to alert people to the potential hazards (No Swimming – Deep Water, subject to flooding, etc.) shall be provided by the Developer; refer to Standard Detail 6-950.
3. Fencing of municipal park areas shall be determined during the detailed design stage in consultation with the Town and shall be provided by the Developer.
4. Lighting, in accordance with Fortis requirements, shall be provided by the Developer at the interface between the stormwater management facility and the adjacent land. Additional lighting requirements are to be determined at the detailed design stage in consultation with the Town.

6.25. Drainage Swales

Internal side-yard drainage swales are required for locations where a common property drainage swales cannot be constructed due to inadequate foundation grading on an adjacent property and within the 1.5 m wide easements found between the homes of zero lot line properties. They must provide a minimum unobstructed width of 1.5 m within the developing property, a minimum depth of 15 cm and a minimum 1.5% slope to direct surface runoff towards a Town right-of-way.

Cross lot drainage swales for residential developments shall be constructed of concrete as per Standard Detail 4-900. Grassed swales will not be accepted. Where cross lot drainage is approved by the Town, a URW shall be registered on all impacted titles to protect the drainage conveyance with drainage swales. Swale capacity calculations are required for any cross lot drainage swales as per Section 6.11.

6.26. Low Impact Development (LID)

Where approved by the Town, Low Impact Development shall be designed and constructed in accordance with the latest EPCOR Drainage Low Impact Design Guidelines and standards.

6.27. Drainage Parkways and Erosion Control

6.27.1. Drainage Parkways

Drainage Parkways, if acceptable to the Town, may be used to convey large volumes of stormwater under controlled conditions through or past the subdivision. The Drainage Parkway shall be designed in accordance with the "Stormwater Management Guidelines", as published by Alberta Environment, and good engineering practice.

The minimum Drainage Parkway cross-section shall be as follows:

- 3.0 m wide bottom, sloped to drain to a low flow trickle channel to be installed in the bottom;
- Maximum side slopes of 5H:1V;
- Terraced side slopes when depth exceeds 3 m or for amenities such as trails or treed terraces;
- 3.0 m wide sloped terrace;
- 1.5 m clearance between top of excavation and property lines.
- The area above the 1:25-year flood elevation shall be landscaped for recreational uses, complete with trails, benches, trees, etc.

6.27.2. Erosion Control

All storm drainage systems, including pipe outlets and other drainage channel outlets or overflows, shall be designed to control erosion that may result from piped or overland stormwater flows and discharge into the storm drainage system.

Requirement for development of ESC measures is outlined in Section 2.4.10.

6.28. Storm Sewer Testing

It shall be the responsibility of the Developer and/or Developer's Representative to ensure that the Contractor adheres to the minimum testing requirements outlined in this section.

The Developer shall submit all test data performed by the accredited testing company to the Town as per the requirements outlined in Section 2. Failure to receive test results will be considered sufficient cause for not accepting such work.

Testing of installed pipe shall consist of the following:

1. CCTV inspections of the entire storm sewer system, including catch basin leads, as per Section 6.28.2.
2. Deflection testing as per Section 6.28.1 (for PVC storm sewers and catch basin leads).
3. All testing and repair of deficiencies found during the testing shall be rectified by the Developer at their own expense. Prior to undertaking any repairs, a meeting with the Town is required to review the proposed construction method.

6.28.1. Deflection Testing

1. Where CCTV inspections show evidence of excessive or non-symmetrical deflection, formal deflection tests shall be conducted.
2. A mandrel shall be pulled through the pipe in such a manner so as to ensure that excessive force is not used to advance the device through any deflected portion of the pipe.

3. Deflection testing shall be performed in conjunction with a CCTV inspection. The mandrel shall be located in front of, and in clear view of, the television camera. An appropriate distance is typically from 1.5 to 2.5 pipe diameters in front of the television camera.
4. The mandrel shall be cylindrical in shape, constructed with 9 evenly spaced arms.
5. Mandrels larger than 450 mm in diameter shall be constructed of special breakdown devices to facilitate entry through access manholes.
6. The barrel section of the mandrel shall have a contact length of at least 75% of the base inside diameter of the pipe.
7. The outside diameter of the mandrel shall not be less than 95% of the inside diameter of the sewer.
8. The mandrel material shall be steel.
9. Deflection testing must be conducted within 30 days of pipe installation.
10. If the mandrel is unable to pass through the pipe, the Contractor is to measure the exact inside diameter of the pipe with a deflectometer. If the pipe deflections are found to exceed 5%, the pipe is to be replaced.

6.28.2. Video Inspection Test

CCTV inspections of the sanitary sewer system shall be carried out by the Developer at the end of construction and at the end of the Warranty Period. One digital copy in colour format (mp4 using H.264 compression), and of acceptable clarity, quality (with a minimum resolution of 640 x 480 pixels and a data rate of 6000 kbps), and colour, along with inspection reports and summaries of the CCTV inspection, shall be supplied to the Town prior to issuing the Construction Completion Certificate and Final Acceptance Certificate.

The CCTV report shall also include the location of all service connections together with a statement of opinion as to whether the service connections are leaking.

Any deficiencies found during this test shall be promptly remedied by the Developer at their expense. Repair all defects which will impair the structural integrity or the performance of the sewer system including, but not limited to improper joints, cracked, sheared, or excessively deflected pipe, sags and rises which pond water in excess of twice the allowable deviation from grade, protruding service connections, and visible infiltration or exfiltration. Prior to undertaking any repairs, a meeting with the Town is required to review the proposed construction method.

Allowable deviation from grade: The invert of the pipe shall not deviate from the design grade by more than 6 mm plus 20 mm per metre of diameter and should not be consistently high or low.

7. WATER DISTRIBUTION SYSTEMS

7.1. General

This section covers the design and construction of watermains and appurtenances to be built or rebuilt in the Town. Details related to construction of water distribution systems are provided in the Standard Details (Section 7.15).

This section provides the minimum acceptable standard for general construction requirements, construction materials, and construction procedures. These standards may be exceeded wherever appropriate; good engineering practices and designs must prevail on all projects.

7.2. Design Flow

1. The water distribution system shall be designed in accordance with the design manual of the American Water Works Association (AWWA) as part of the overall municipal distribution system. The system shall be capable of delivering the peak day demand plus fire flow, or the peak hour flow, whichever is greater. Velocities shall not exceed 1.5 m/s during normal operation or 3.0 m/s during a fire event.

2. The rate of water demand is based on residential population, or an "equivalent population" (ep) for non-residential land uses. The water demand shall be based on the ultimate subdivision design population in the Area Structure Plan or, if the ultimate subdivision design population is unknown, based on the following:
    - Low Density Residential 40 people / ha
    - Medium Density Residential 80 people / ha
    - High Density Residential 200 people / ha
    - Commercial / Institutional 37 ep / ha
    - Industrial 30 ep / ha

3. The minimum per capita water demands for the Town are as follows:
    - Average Daily Demand (ADD): 300 litres/capita/day (L/c/d)
    - Peak Daily Demand (PDD): 2.0 times ADD
    - Peak Hour Demand (PHD): 3.0 times ADD

4. Fire flows shall be in accordance with the Fire Underwriters Survey; typical requirements are provided in Table 7-1.

Table 7-1
Fire Flow Requirements based on Land Use

Land Use / Description of Development	Fire Flows
Low Density Residential	
Wood frame construction	
Two stories or less	
100 m^2 to 150 m^2	5,000 L/min. (83 L/s)
150 m^2 to 275 m^2	6,000 L/min. (100 L/s)
Medium Density Residential	
Wood frame construction with a fire separation	
4 units, up to 100 m^2 each	8,000 L/min. (133 L/s)
Walk-up Apartments	
Ordinary construction	
Up to 3,200 m^2 (with a 10 m to 20 m separation)	12,000 L/min. (200 L/s)
Schools	
Non-combustible construction	
Up to 3,300 m^2	10,000 L/min. (167 L/s)
Up to 4,000 m^2	11,000 L/min. (183 L/s)
Up to 12,000 m^2	19,000 L/min. (317 L/s)
Institutional, Churches	
Ordinary construction (15% exposure)	
Up to 850 m^2	6,000 L/min. (100 L/s)
Commercial	
Non-combustible construction (50% exposure)	
Up to 2,900 m^2	11,000 L/min. (183 L/s)
Up to 4,200 m^2	14,000 L/min. (233 L/s)
Light Industry	
Non-combustible construction	
Up to 2,900 m^2 (25% exposure)	9,000 L/min. (150 L/s)
Up to 2,900 m^2 (50% exposure)	11,000 L/min. (183 L/s)
If the Town designates that a rural residential area will receive fire protection, then examples of fire flow requirements are:	
Low Density Rural Residential	
2 stories or less	
Over 30 m separation	2,000 L/min. (33 L/s)
High Density Rural Residential	
2 stories or less	
10.1 m to 30 m separation	3,000 L/min. (50 L/s)

The Developer's Consultant shall confirm the required flows for these and other types of construction with the latest edition of Fire Underwriters Survey, "Water Supply for Public Fire Protection."

In instances where automatic sprinkler systems are to be installed in residences, the distribution and/or storage systems must consider the additional demand resulting from these fixtures.

7.2.1. Fire Department Requirements - Buildings

1. All buildings with internal fire suppression systems require a twin 5" Stortz Fire Department Connection (FDC) accessible to the Fire Department.

2. FDC signage must be kept visible at all times.

3. The Developer's Consultant shall contact the Town to confirm requirements for the model of lock box to be used, to ensure it is compatible with the Fire Department's requirements.

7.3. Design Computations

1. Use Hazen-Williams formula:

$$Q = CD^{2.63}s^{0.54} * 278.5$$

Where: Q = Rate of flow (L/s)
D = Internal pipe diameter (m)
s = Slope of hydraulic grade line (m/m)
C = Roughness coefficient, as per Table 7-2

Table 7-2
Hazen-Williams Roughness Coefficient for Watermains

Pipe Material	Roughness Coefficient, C
PVC	130
Asbestos Cement (AC) [1]	110
Cast Iron [1]	100
Steel [1]	120
Ductile Iron [1]	120

Note:
[1] These materials are not accepted pipe materials. Roughness coefficients have been provided for the assessment of the existing system only.

2.

Minimum pressure at peak demand:	280 kPa
Minimum pressure with automatic sprinklers	350 kPa
Maximum allowable pressure:	550 kPa
Minimum fire pressure at main (demand hydrant):	150 kPa
Minimum zone pressure during a fire event:	280 kPa

3. Network analysis shall be by the Hardy-Cross method or a suitable computer program.

7.4. Minimum Main Pipe Diameter

Minimum pipe diameter shall be 200mm.

Main sizes shall be confirmed by a Hydraulic Network Analysis (HNA) and may be increased, as considered necessary by the Town, to accommodate future development.

7.5. Dead Ends

Blow offs, as per Standard Detail 7-201, shall only be used for temporary dead-ends (i.e., in the interim until subsequent stage(s) of a subdivision develop(s)).

All permanent dead end watermains shall be plugged and tapped with a flush point shown in Drawing 7-960 or 7-961.

Except in cul-de-sacs of less than 120 m length, all watermains shall be looped.

7.6. Location

1. Watermains shall be located within the municipal road right-of-way as per the typical cross-sections in accordance with the Standard Details 4-100 through 4-102.
2. A minimum width of 6 m is required for PULs with up to two utilities; additional width may be required for PULs with more than two utilities.
3. Services shall be located under landscape areas, as close to the centre of the property as possible.
4. Watermains shall maintain the following clearances from other infrastructure:
    - Minimum 3.0 m horizontal clearance from sanitary / storm sewers, unless sewer depth requires increased spacing;
    - Minimum 2.0 m horizontal clearance from power / telephone / cable infrastructure (including services);
    - Minimum 0.5 m vertical clearance above or below utilities at crossings;
    - Minimum 3.5 m horizontal clearance from trees;
    - Minimum 1.5 m horizontal clearance between watermains and catch basins; and
    - Minimum 3.0 m horizontal clearance between water services and catch basins.
5. Tracer wire shall be installed on all water mains and service connections in road right of way not located under the roadway carriageway. Tracer wire on water mains under the carriageway is not required, but may be installed if required for efficient tracer wire system operations.

7.7. Minimum Depth of Cover

1. Minimum depth of cover shall be 3.0 m from finished grade to pipe crown and shall be sufficient to:
    - Prevent freezing; and
    - Clear other underground utilities.

When it is not feasible to provide 3.0 m depth of cover from finished surface to pipe crown, the watermain shall be insulated as per Standard Detail 7-900.

7.8. Valving

In general, valves shall be located as follows:

1. At intersections, at the beginning of the curb return approaching the intersection on the intersecting street:
    - 4 valves at cross intersections; and
    - 3 valves at tee intersections.
2. Valves shall be located a minimum of 30 m from arterial intersections
3. Valves shall be located at the beginning of the curb return approaching the intersection for all other roadway intersections.
4. Valves shall be provided at both ends of PULs / walkways / Easements, located 0.5 m from the property line, inside municipal right-of-way.
5. Not more than 2 hydrants shall be isolated during a watermain break or shutdown for Maintenance purposes.

6. A maximum of 4 valves shall be closed to isolate any one section of watermain.
7. No more than 30 lots shall be cut-off from the water supply during a watermain break or shutdown for Maintenance purposes.
8. Valves shall not be strapped directly to the tees or crosses.

7.9. Hot Tapping

Hot-tapped connections shall follow the valving notes outlined in Section 7.8.

In addition, hot-tap shall be located a minimum of 1.5 m from joints. Hot tap coupons must be retained and returned to the Town, labelled with the address of the hot tap.

7.10. Hydrant Location

Fire hydrants shall generally be located at street intersections and shall be spaced as follows:

Table 7-3
Maximum Allowable Hydrant Spacing

Land Use	Maximum Spacing
Low Density Residential	150m
All Others (Medium/High Density Residential, Commercial, Industrial)	90m

1. No dwelling shall be located more than 100m from the nearest hydrant.
2. For cul-de-sacs less than 90 m in length, hydrants shall be placed along the intersecting street, at or near the intersection with the cul-de-sac.
3. In accordance with "Water Supply for Public Fire Protection", published by Fire Underwriters Survey.
4. Refer to Standard Details (No. 4-100 to 4-103) for locations of hydrants within the road cross-section in addition to the following requirements:
    - In no case shall a valve be located in a sidewalk;
    - Hydrants require 3.0 m separation from franchise utilities (pedestals, transformers, street lights, etc.);
    - Hydrants shall be located at curb returns; and
    - A 1.5 m clear distance is required around all hydrants.

7.11. Service Connections

Refer to Standard Details (No. 7-300 to 7-304) for service connection installation details.

1. A water service for a single detached residence shall have a minimum diameter of 25 mm. Water services for multi-unit dwellings and non-residential uses shall be sized by the Developer's Consultant based on the calculated water demand.
2. Water, sanitary, and storm services shall have the following minimum horizontal separation from each other:
    - 50 mm diameter or smaller: 0.3 m (installed in a common service trench)
    - 100 mm diameter or greater: 3.0 m

3. Water services shall have a minimum depth of cover of 2.8 m at the property line, measured from finished grade to pipe crown. Services shall terminate at the property line or 1.0 m past the shallow utility Easement.
4. The minimum distance between corporation (main) stops shall be 600 mm.
5. Curb stops shall be located within road right of way 100mm from the property line;
6. Cross lot servicing is not permitted.

7.12. Thrust Blocking

Concrete thrust blocking shall be provided at bends, tees, wyes, reducers, plugs, caps, hydrants, valves, dead ends, and transition couplings, as per the Standard Details.

7.13. Chamber Drainage

Chambers or manholes containing valves, blow-offs, meters, or other appurtenances shall not be connected directly to a storm or sanitary sewer by gravity, nor shall blow-offs or air release valves be connected to any sewer. Such chambers or manholes shall be drained either to the surface, by gravity, where they are not subjected to flooding by surface water, to absorption pits underground where they are above the groundwater table or shall be pumped to a storm or sanitary sewer. Chambers shall be insulated to prevent freezing where necessary.

7.14. Abandonment

If an existing service connection is to be abandoned, the main stop shall be closed, the service pipe shall be cut at the goose neck and removed, and a cap shall be installed on the main stop.

When an existing watermain is to be abandoned and:

- It is less than 675mm in diameter and does not conflict with a new watermain's horizontal alignment, it can be abandoned in-place if it is capped or sealed at each end, to prevent it from allowing soil or water migration;
- It conflicts with a new watermain's horizontal alignment, or if the diameter is larger than 675 mm, the proposed abandonment method must be approved by the Engineer. Removal or grouting of the existing main may be required.

A disturbed soil caveat must be registered on title for those lots where a water main is installed, abandoned in place, or removed from within the lot or adjacent walkway, lane, or public utility lot.

7.15. Approved Materials and Specifications

7.15.1. Pipe

1. Table 7-4 lists specifications for acceptable watermain pipe materials.

Table 7-4
Acceptable Pipe Materials for Watermains

Material	Specification	Manufacturer	Model / Type
Polyvinyl Chloride (PVC)	AWWA C900, DR18	IPEX	Blue Brute
Polyvinyl Chloride (PVC)	AWWA C900, DR25	IPEX	Centurion
Polyvinyl Chloride (PVC)	AWWA C900, DR18	Next Polymers	AQUALOC (Class 150)
Polyvinyl Chloride (PVC)	AWWA C900, DR25	Next Polymers	AQUALOC (Class 100)

7.15.2. Fittings and Hardware

1. Table 7-5 identifies acceptable materials for fittings and hardware.

Table 7-5
Acceptable Materials for Fittings and Hardware

Type of Fitting / Hardware	Specifications
Cast Iron Fittings	AWWA C110, 1.03 MPa working pressure, wrapped with Denso paste and tape
PVC Fittings	CSA B137.2 (Class 150); AWWA C907 CSA B137.3 (Class 150); AWWA C905
Flanged Joints	Class 150, ASME B16.5, flat-faced
Bolts and Nuts	Stainless Steel, Type 304, wrapped with Denso paste and tape

7.15.3. Cathodic Protection

1. Cathodic protection for buried non-steel metallic fittings, valves, and hydrants:
    - All buried non-steel metallic fittings and valves shall be cathodically protected with 7.7 kg magnesium anodes;
    - All hydrants shall be cathodically protected with 7.7 kg magnesium anodes;
    - Magnesium anodes shall confirm to ASTM B843-07;
    - Zinc anodes shall conform to ASTM B418; and
    - Refer to Standard Details (Section 7.15 No. 7-500 and 7-501) for typical anode installation.

2. Cathodic protection for water services:
    - All copper services 50 mm diameter and smaller shall have a 7.7 kg magnesium anode attached to the copper service pipe;
    - The anode wire shall be clamped to the copper service within 1.0 m of the curb stop, within the road right-of-way;
    - An all-brass clamp shall be used; and
    - Refer to Standard Detail 7-501 for typical anode installation.

3. Cathodic protection for buried steel pipe and fittings (retrofit work only):
    - All steel pipe and fittings require cathodic protection with at least two 7.7 kg (17 lb) sacrificial high-potential magnesium anodes at the point of connection;
    - A soil resistivity analysis shall be conducted along length of the pipeline to calculate the weight and spacing of anodes;
    - A cathodic protection report shall be provided to the Town in conjunction with the detailed design; and
    - Cathodic protection design shall be undertaken by a corrosion specialist.

4. Anode Requirements:
    - To calculate the type, weight and spacing of the anodes for metal pipes and fittings, a soil resistivity analysis shall be conducted along the length of the pipe. A report on soil resistivity's and the weight and spacing of anodes is to be provided to the Engineer along with the first submission of Engineering Drawings.
    - Zinc anodes shall be Type II in accordance with ASTM B418;
    - Magnesium anodes shall confirm to ASTM B843-07;
    - Anodes shall have a minimum efficiency ration of 40% as measured by ASTM G97;

- The anode container shall consist of a water permeable cardboard tube or bag;
- The anode shall be centered in the tube and backfilled with material sufficient to over all parts of the anode to a minimum thickness of 25 mm;
- The backfill material shall possess a maximum resistivity of 50 ohm-cm when wet and as measured by the soil box method in ASTM G57; and
- The water used for wetting the backfill should be distilled or demineralised and no more than 15% - 20% water by weight should be added.

7.15.4. Bedding

Bedding material for pipes shall conform to the Standard Details (Section 7.15 No. 7-600 and 7-601) and the gradation identified in section 5.19.4.

7.15.5. Trench Section

Refer to Standard Detail 7-700 for trenching and backfilling requirements.

7.15.6. Fire Hydrants

1. Table 7-6 identifies approved materials for fire hydrants.

Table 7-6
Acceptable Materials for Fire Hydrants

Manufacturer	Model / Type	Specification
Canada Valve	Century	AWWA C502

2. Hydrants are to be complete with a breakaway flange and a 300 mm spool piece. Refer to Standard Detail 7-200. The breakaway ground flange and internal breakaway stem coupling must be aligned.
3. The minimum hydrant connection size shall be a 150 mm hub end.
4. The minimum cover over hydrant leads shall be 3.0 m, as measured from finished grade to the pipe crown.
5. Drain outlets shall be provided and the Developer's Consultant shall confirm the level of the groundwater table to determine whether to plug drain ports. Where the water table is above the hydrant drain, the hydrant drain port may require plugging. All hydrants with drain ports plugged shall be identified on the Record Drawings.
6. Hydrants shall have two 63.5 mm hose connections and one 114 mm pumper connection as presently used in the Town. Threads shall conform Table 7-7.

Table 7-7
Hydrant Connection Thread Requirements

Requirement	Pumper	Nozzles
Nominal Size	114.3mm (4 ½")	63.5mm (2 ½")
Thread Designation	4.5 NH	AMA

7. The use of Storz hydrant connections is not permitted.

8. Hydrant main spindles shall turn to the left (counter-clockwise) to open.
9. A gate valve shall be provided on each connection between a hydrant and watermain.
10. Hydrants shall be enamel painted to CAN/CGSB-1.59. Town hydrants are to be red in colour with aluminium colour tops and caps. Private hydrants are to be painted yellow in colour.
11. All bolts and nuts shall be stainless steel, type 304, and wrapped with Denso paste and tape.
12. Hydrants shall be cathodically protected; refer to Standard Detail 7-500.

7.15.7. Gate Valves

Gate valves shall be in accordance with AWWA C509 and the following:

1. Gate valves shall have an epoxy-coated iron body, bronze mounted, and are to be cathodically protected in accordance with the Standard Details (Section 7.15).
2. Valves shall be resilient seat gates with non-rising stem, to open by turning in a counter-clockwise direction.
3. Valve ends shall be provided to fit the pipe. Where flanged valves are used, they must be accompanied by flexible couplings.
4. The position of the valve in line shall be vertical.
5. Stem seals shall be O-ring.
6. Valve boxes with operating stem and 50 mm square operating nut are required on all valves. All valve boxes shall be threaded Norwood Type B.
7. All gate valves larger than 350 mm shall have a bypass built into the body of the valve.
8. Crown surface adapters are not permitted.

7.15.8. Service Connections

1. Water Service Pipe:
    - Approved materials for water services and associated appurtenances are listed in Tables 7-7 through 7-13;
    - Services shall be Type K copper or crosslinked polyethylene (PEXa) tubing for services 50 mm and smaller; services 100 mm and greater are to be PVC DR18;
    - Couplings shall be Standard Brass, compression type; and
    - Minimum pipe size:
        - Non-sprinklered dwelling: 25 mm
        - Sprinklered dwelling: 38 mm
        - Multi-dwelling residential / Commercial / Industrial / Institutional: Sized appropriately

2. Water Service Fittings:
    - Curb stop shall be copper to copper invert and key stop and drain;
    - All curb stops are to be non-self draining unless specifically approved by the Town;
    - Curb stops shall be located within road right of way 0.1m from the property line; and,
    - All fittings shall be able to withstand a test pressure of 1,035 kPa.

3. Rural Residential Service Pipe Sizing:
   - Rural residential dwellings may require larger service connections due to additional demands such as irrigation systems or a higher number of fixtures. Each system should be sized according to the expected demand and the distance from the main.

Table 7-8
Acceptable Materials for Service Saddles

Manufacturer	Model / Type
Robar	2606

Table 7-9
Acceptable Materials for Corporation (Main) Stops

Manufacturer	Model / Type	Comments
Cambridge Brass	E17073	Compression End
Cambridge Brass	E17076	Compression End
Mueller	H-15008	Compression End

Table 7-10
Acceptable Materials for Water Service Unions

Manufacturer	Model / Type	Comments
Cambridge Brass	E17084	Compression Ends
Cambridge Brass	E17087	Compression Ends
Cambridge Brass	E17088	Compression Ends
Mueller	H-15403	Compression Ends

Table 7-11
Acceptable Materials for Curb Stops

Manufacturer	Model / Type	Comments
Cambridge Brass	E17403	Compression Ends
Cambridge Brass	E17030	Compression Ends
Cambridge Brass	E17040	Compression Ends
Mueller	H-15209	Compression Ends

Table 7-12
Acceptable Materials for PVC Services

Manufacturer	Model / Type	Specifications
IPEX	Blue Brute	AWWA C900, DR18

Table 7-13
Acceptable Pipe Materials for Copper Services

Manufacturer	Model / Type
Wolverine	Type K
Cerro	Type K
Halstead	Type K

Table 7-13
Acceptable Pipe Materials for Polyethylene Services

Manufacturer	Model / Type	Specifications
Rehau	Municipex	Crosslinked Polyethylene (PEXa) CSA B137.5, NSF 61, NSF 14, AWWA C901

7.16. Watermain Testing

It shall be the responsibility of the Developer and/or Developer's Representative to ensure that the Contractor adheres to the minimum testing requirements outlined in this section.

The Developer shall submit all test data performed by the accredited testing company to the Town as per the requirements outlined in Section 2. Failure to receive test results will be considered sufficient cause for not accepting such work.

7.16.1. Filling and Flushing Strategies

7.16.1.1. Submissions

1. A filling strategy is required for all projects. The purpose of a filling strategy is to create an agreed upon plan for the staging and direction of fill for a new watermain.
2. A flushing strategy is required for all projects. The purpose of a flushing strategy is to create an agreed upon plan for the staging and direction and rate of flow of water for flushing a watermain prior to commissioning.
3. A commissioning plan is required for all projects. The purpose of the commissioning plan is to allow water mains to be placed into service soon as reasonably possible after completion of construction and testing.
4. Sampling and pressure test locations need to be identified.
5. Filling and flushing strategies must be signed and sealed by an Engineer.
6. Copies of the filling and flushing strategies shall be available on site during testing, and the Contractor must agree to follow the strategies prior to commencing any filling of flushing work.

7.16.1.2. Requirements for Filling and Flushing Strategies

1. All source water must come from a clean, potable source.
2. There must be only one source valve for each stage of fill.
3. Valves shall only be operated by the Town.
4. Valves should be planned such that unidirectional flows are achieved. The water should not loop back on itself.

7.16.1.3. Specific Requirements for Filling Strategies

1. The filling strategy must consist of a drawing indicating the following:
    - Air release locations;
    - High points on watermains;
    - Water source for each fill;
    - Staging of fill:
        - Current fill highlighted;
        - Completed fill highlighted;
    - All valve positions for each stage; and
    - Clear legend symbology.
2. Air release locations should be at or near the high point of the watermain.
3. A copy of the accepted filling strategy must be on-site during filling activities.

7.16.1.4. Specific Requirements for Flushing Strategies

1. Flushing runs must be less than 450 m in length. The ideal flushing run length is 200 m.
2. Watermains less than or equal to 300 mm in diameter should have a flush velocity of 1.5 m/s.
3. Watermains greater than 300 mm in diameter should have a flush velocity of 0.9 m/s.
4. Water must be exchanged a minimum of 5 times to achieve a completed flush. Water quality sampling reports must confirm a completed flush.
5. During a flush, the source water should flow from larger pipe to smaller pipe, whenever possible.
6. The flushing strategy should include:
    - A written flushing procedure;
    - A spreadsheet indicating:
        - Order of flushing segments;
        - Water supply (source valve);
        - Discharge location;
        - All valve positions for each flushing segment;
        - Pipe details for each flushing segment;
        - Required discharge volume (to achieve 5 times the volume of the flushing segment);
        - Ideal flow velocity for the size of the watermain;
        - Ideal flow rate to achieve the velocity;
        - Type and size of ports to discharge the water;
        - Number of ports;
        - Estimated flow rate; and
        - Required flush time.
    - A drawing indicating the following:
        - Water supply (source);
        - Current flush;
        - Completed flush;
        - Opened valve;
        - Closed valve;
        - Discharge location; and
        - Clear legend symbology.
    - Each flushing segment should have its own drawing.
7. Use Table 7-14 to find the number of ports required to achieve the requisite velocity.

Table 7-14
Number of Ports Required to Achieve Velocity for Flushing

Pipe Diameter (mm)	Required Flow (L/s) for 0.9 m/s Velocity	Hydrant Nozzles Required [1,2]		Required Flow (L/s) for 1.5 m/s Velocity	Hydrant Nozzles Required [1,2]	
		63.5 mm	114 mm		63.5 mm	114 mm
200	N/A	N/A	N/A	47.1	1	N/A
250	N/A	N/A	N/A	73.6	2	1
300	N/A	N/A	N/A	106.0	2	1
350	86.6	2	1	N/A	N/A	N/A
400	113.1	2	1	N/A	N/A	N/A
450	143.1	2	1	N/A	N/A	N/A

Notes:

1. Assuming a residual pressure of 280 kPa.
2. With a 280 kPa residual pressure, a hydrant flowing to atmosphere will discharge 63 L/s from a 63.5 mm nozzle and 158 L/s from a 114 mm steamer (Source: After AWWA C651-14).

7.16.1.5. Placing Water Mains into Service

A commissioning plan is a required submission when requesting the construction start up meeting.

Water mains must be commissioned as soon as reasonably possible after completion of construction and testing.

The commissioning plan shall include the following:

- Sequence of boundary valve operation;
- Dechlorination of water discharges;
- Interim flushing plan to prevent water stagnation; and,
- Any other activities necessary to ensure satisfactory commissioning of the water main.

Notify the Town at least 24 hours in advance of putting a newly constructed water main into service.

7.16.2. Pressure and Leakage Test

1. Refer to AWWA C605 and AWWA M23 for information on pressure and leakage testing for PVC watermains.
2. Install all water services, air relief services, and blow offs.
3. Partially or completely backfill the excavation before testing.
4. Wait for concrete thrust blocks to cure: minimum of 3 days in the case of high early strength concrete or a minimum of 7 days in the case of normal concrete.
5. Ensure that main stops are open and curb stops are closed.
6. Inform the Town of the date, time, and location of the pressure and leakage tests at least 72 hours prior to the test time. Failure to notify the Town may result in tests being unacceptable.
7. Open all main valves in the test section.
8. Open all hydrant control valves in the test section and be sure hydrants are closed. All hydrants shall be inspected prior to pressure testing to ensure that they are properly installed and that nipples are threaded or locked in place.
9. Inform other construction crews or Contractors and check that no valves are being operated during the test.
10. Test duration shall be 2 hours.

11. Maximum length of distribution watermain test sections shall be 450 m.

12. Ensure air is expelled from the section of watermain by exhausting trapped air at high points and dead ends. Air content can be minimized through the following procedure:

    - Lay the pipeline to grade when possible;
    - Bleed air from the pipe slowly; and
    - Fill the watermain at a velocity of less than 0.6 m/s.

13. Test pressure will be 150% of the working pressure, or 1,036 kPa, whichever is greater, at the point of test but not less than 125% of normal working pressure at the highest elevation on the test section.

14. Raise the watermain pressure to the appropriate test pressure using either a hand or motor-powered pump located at a hydrant or approved blow off. The hydrant valve will be completely opened and the flow rate will be controlled by the valve at the pump.

15. Mark the gauge and the level of water in the storage barrel at the beginning of the test. Take care in these marks since they are the basis for calculating water loss.

16. Maintain the test pressure within ± 20 kPa of the specified test pressure for the duration of the test.

17. Pump the test section back to the test pressure at the end of the first 30 min. If the allowable leakage is exceeded, air may be trapped. Remove trapped air and repeat the test.

18. During the test, walk along the test section and check for signs of leakage or distress at all exposed appurtenances or fittings.

19. No allowance can be made for services or in-line valves. Watermain renewal projects may be exempt under some circumstances.

20. Allowable leakage shall be calculated based on the following formula:

$$Q_m = LDP^{0.5} / 795{,}000$$

Where: Q_m = quantity of make-up water (L/hr)
L = length of pipe section being tested (m)
D = nominal diameter of pipe (mm)
P = average test pressure (kPa)

No installation will be accepted if the quantity of make-up water is greater than that determined by the above formula. Record the leakage test results on the Leakage Test Form provided in Section 3.

21. For testing HDPE sanitary force mains, adjust the procedure for PVC watermains as follows:

    - Hydrostatic test pressure shall be 1.5 times the pressure class;
    - Maintain 1.5 times the pressure class for 4 hours and add water as needed. Do not measure this volume. Hydrostatic pressure expands pipe;
    - Begin Test: Reduce pressure to 10 psi (70 kPa) below 1.5 times pressure class. Monitor pressure for 1 hour; and
    - The pipe is acceptable if the pressure drop over 1 hour does not exceed 5%.

7.16.3. Flushing

1. Upon completion of pressure and leakage testing, watermains shall be thoroughly flushed to remove all foreign matter.

2. Water systems which will not provide watermain flushing velocities of at least 3.0 m/sec shall be flushed using foam pigs prior to disinfecting.

7.16.4. Disinfection

1. Provide at least 72 hours notice to the Town prior to disinfection. Perform disinfection in the presence of Town staff.
2. Complete flushing operations before beginning disinfection. Disinfection may be done with hydrostatic leakage testing.
3. New valves and hydrants are to be open to ensure they are disinfected.
4. Disinfect watermains and water services.
5. Disinfect using continuous-feed method with liquid chlorine, solution-feed chlorinator, and booster pump in accordance with AWWA C651. Introduce chlorine solution for disinfection at appurtenance used for initial flushing of test section. Chosen appurtenance should be a main stop, service connection, or bleeder, do not use Fire Hydrants for chlorine feed.
6. Chlorine feed and discharge rates to be in accordance with Table 12-3. Discharge rate to be accepted by the Town. Ensure free chlorine residual of initial chlorine solution is between 25 mg/L and 75 mg/L. Chlorine gas will not be permitted for chlorination.
7. Open new hydrants and valves on the section of watermain being tested. Supply water for chlorinator from hydrant on an active system or water tank. Use pump to inject chlorine solution into pipe if using water tank.
8. Continue feeding chlorinate solution for the length of time indicated in Table 12-3 for pipe size, length, and discharge rate.
9. Isolate the watermain or water service containing chlorine solution and maintain for 24 hours.
10. Determine the chlorine residual after 24-hour retention time using the “drop dilution” method or the method indicated in AWWA C651 in the presence of the Town. Acceptable minimum free chlorine residual after 24 hours is 10 mg/L.
11. Ensure chlorine residual in hydrants used for introducing the chlorine solution does not exceed 75 mg/L at the conclusion of chlorination.
12. Perform final flushing of pipe with potable water using the appurtenance used for initial flushing once actual chlorine residual is acceptable. Continue flushing until chlorine residual is less than 2 mg/L. Test chlorine residual in the presence of the Town. The Developer’s Representative shall complete the Disinfection Report provided in Section 3.
13. Discharge chlorine solution flushed from the pipe to the nearest sanitary sewer. Ensure the flushing rate of chlorine does not exceed the allowable rate approved by the Manager of Engineering. If de-chlorination is required it should follow AWWA C655 for detailed information on standard industry practices.
14. Disinfect watermains less than 5.5 m long and watermain repairs by swabbing or spraying with a maximum 5% solution of chlorine or a 1% hypochlorite solution either before or after installation.

Table 7-15
Disinfection Feed Rate

Nominal Size of Pipe (mm)					150	200	250	300	350	400	450
Litres of Water per 100 m of Pipe					1,827	3,248	5,075	7,308	9,948	12,993	16,444
				10 mg/L	0.018	0.032	0.051	0.073	0.099	0.130	0.164
				25 mg/L	0.046	0.081	0.127	0.182	0.249	0.325	0.411
				50 mg/L	0.091	0.162	0.254	0.365	0.499	0.650	0.822
				75 mg/L	0.137	0.243	0.381	0.548	0.746	0.974	1.233
Discharge Rate (L/min.)	mg / L				Approximate Flow Through Time for 100 m of Pipe (Hours – Minutes)						
	10	25	50	75							
	Feed Rate (kg/day)				150	200	250	300	350	400	450
100	1.4	3.6	7.2	10.8	0-18	0-32	0-51	1-13	1-39	2-09	2-44
150	2.2	5.4	10.8	16.2	0-12	0-21	0-33	0-49	1-06	1-29	1-50
200	2.9	7.2	14.4	21.6	0-09	0-16	0-25	0-37	0-50	1-05	1-22
250	3.6	9.0	18.0	27.0	0-07	0-13	0-20	0-29	0-40	0-52	1-06
300	4.3	10.8	21.6	32.4	0-06	0-11	0-17	0-24	0-35	0-43	0-55
350	5.0	12.6	25.2	37.8	0-05	0-09	0-15	0-21	0-28	0-37	0-47
400	5.8	14.4	28.8	43.2	0-05	0-08	0-13	0-18	0-25	0-32	0-41
450	6.5	16.2	32.4	48.6	0-04	0-07	0-11	0-16	0-22	0-29	0-36

7.16.5. Bacteriological Samples

1. Bacteriological testing shall be carried out by the Developer's Representative and the results shall be acceptable to the local Health Authority and the Town.
2. The first sample shall be taken after a minimum of 16 hours following disinfection and flushing of the pipe network.
3. 2 sets of samples shall be taken at least 15minutes apart, A set of samples includes, one sample from every 370 m of pipe and one from the end of the main section of pipe being tested. One sample shall be taken, from the end of each branch of pipe connected to the main section (where branches are more than 3 m long). Samples shall be taken from the discharge pipe used for leakage testing after adequate flushing time to replace water in the discharge pipe.
4. The Developer's Representative shall submit the samples to an accredited laboratory as soon as possible after obtaining. Samples that cannot be submitted within 1 hour after collection shall be stored in an iced cooler at 4 degrees Celsius during transport to the laboratory. Samples shall be submitted for processing no more than 24 hours after obtaining.
5. Disinfection shall be acceptable when bacteriological test results from both samples show total Coliform results are < 1 colony forming unit (cfu) per 100 ml, Heterotrophic Plate Count (HPC) does not exceed 500 cfu per ml and total chlorine residual does not exceed 2 mg/L after flushing.
6. The Developer's Representative shall enter the bacteriological test results, on the Disinfection Report provided in Section 3, once received from the laboratory.
7. If either sample fails bacteriological testing, repeat flushing and the Developer's Representative shall take 2 new samples for testing. If either of the second set of samples taken fail bacteriological testing, repeat disinfection and flushing and the Developer's Representative shall take 2 new samples for testing. Repeat this procedure until acceptable results are obtained.

7.16.6. Test Results

1. All testing results shall be documented and submitted to the Town for acceptance prior to commissioning the system and the issuance of a Construction Completion Certificate.

7.17. Reservoir Testing

It shall be the responsibility of the Developer and/or Developer's Representative to ensure that the Contractor adheres to the minimum testing requirements outlined in this section.

The Developer shall submit all test data performed by the accredited testing company to the Town as per the requirements outlined in Section 2. Failure to receive test results will be considered sufficient cause for not accepting such work.

7.17.1. Water Tightness

1. Prior to testing, all visible cracks shall be sealed in an approved manner.
2. All water tightness tests shall be conducted before placing backfill material. Tests shall be conducted as follows:
    1. Fill reservoir to overflow level;
    2. Allow water to stand for 72 hours to saturate the concrete;
    3. Top-up the water in the tanks to the original level at the end of the 72-hour saturation period, measure the water elevation, and begin the leakage test;
    4. Measure the drop in liquid elevation over the next 48 hours to determine the liquid volume loss for comparison with allowance leakage. Evaporative losses shall be measured or calculated and deducted from the measured loss to determine net leakage of the tanks;
    5. There shall be no persistently damp areas on the exterior walls or visible leakage at any point on the structure; and
    6. The maximum allowable leakage over the duration of this test, after allowance for evaporation losses, is limited to 0.05% of the total liquid volume.

If any test shows leakage, or if leaks or persistently damp areas are visible, the structure shall be emptied, carefully examined, and all defects repaired, and the test repeated until a satisfactory test has been achieved.

The water used for testing shall be clean and to an approved standard and shall be supplied at the Developer's cost.

7.17.2. Disinfection

Prior to disinfection, the structure shall be thoroughly cleaned of all dirt and loose material.

All equipment in contact with potable water shall be disinfected. Chlorine used in disinfection shall be either hypochlorite solution or liquid chlorine conforming to AWWA B300 and B301.

Combine hydrostatic testing with disinfection. Disinfection shall be in accordance with ANSI/AWWA C653.

Disinfect again those areas within the structure which have been repaired or otherwise contaminated subsequent to initial disinfection.

No disinfection shall be carried out until all measures to protect the reservoir against intrusion by insects, animals or unauthorized personnel have been satisfactorily completed.

8. FRANCHISE UTILITIES

8.1. General

All work necessary for the installation of gas, power, street lighting, and telecommunications shall be the responsibility of the Developer and the installation of these utilities will be a condition of development. In addition to the financial responsibilities, the Developer must initiate and coordinate the design, approval, and construction of these services. The actual design and construction of each utility is normally handled by the respective utility company.

Four-party trenching (one common trench for telephone, cable, gas, and electric) located within a 3.5 m Easement on property is the accepted trench configuration.

The following provides some of the basic procedures and requirements for the installation of franchise utilities.

8.2. Design Standards

8.2.1. Design and Approval

To coordinate design of gas, power, street lighting, and telecommunication systems, it is necessary to first classify and designate cross-sections for each street (and walkway) within a subdivision area, in relation to Standard Details (Section 4.22).

Upon approval of a tentative subdivision plan, the Developer's Consultant shall circulate to each utility company copies of the approved subdivision plan, complete street classifications, and utility alignments, and any other information the utility companies may require. The utility companies shall indicate on this plan their basic design, complete with all rights-of-way, Easements, and PUL requirements, and return it to the Developer's Consultant. After checking for and eliminating potential conflicts, the Developer's Consultant shall prepare a servicing plan showing all franchise utilities on a site plan. This site plan will also show the Local Improvements.

This plan shall then be circulated to, and approved by, the respective utility companies. The plan will then be included with the other engineering drawings submitted by the Developer's Consultant to the Town for acceptance.

8.2.2. Location of Utilities

For all Urban applications, power shall be underground. For isolated Rural applications where the installation of buried power may not be practical, aboveground power may be acceptable to the Town.

All distribution cables for primary and secondary power, telecommunications, and streetlight feeders, may be installed in one common 300 mm wide trench at the required alignment.
Streetlights shall be placed at locations not interfering with proposed driveways and shall be located in line with the extensions of common property lines between two lots.

The face of the posts, poles, pedestals, and transformers shall be at least 1 m clear of the face of the curb.

8.2.3. Separation from Other Utilities

The franchise utilities shall be separated from the deeper municipal utilities (i.e., water, sanitary sewer, and storm sewer) by not less than 3.0 m laterally.

A separation of 1.0 m from other franchise utilities is also required; common (four-party) trench installations excepted.

8.3. Installation

8.3.1. Road Crossings

Adequate ducts shall be installed under roadways prior to their construction to accommodate the installation of power and telecommunications.

Where the road crossings are installed after the construction of road improvements, they shall be installed via an appropriate trenchless method to avoid disruption of the surface improvements.

All roadway crossings must maintain a minimum depth of 1.2m below finished top of the roadway. Where utilities run within the carriageway parallel to the direction of travel, a minimum depth of 1.8m must be provided.

8.3.2. Site Preparation

The Developer shall pre-grade all boulevards, lanes, and/or Easements, where franchise utilities are to be installed, in accordance with the franchise utilities' standards.

8.3.3. Survey

The Developer shall be responsible for laying out all work, lines, and levels as required to proceed with the entire installation and for the preservation of all such stakes and marks during construction.

8.3.4. Compaction of Trenches

All trenches located on municipal property or within municipal Easements are to be compacted to the following standards:

- 95% Standard Proctor Density for trenches in boulevards and landscaped areas.
- 97% Standard Proctor Density for trenches under roadways, with the top 300 mm of subgrade material compacted to 100% Standard Proctor Density.
- Restore granular base course to a thickness matching that of the existing roadway, compacted to 100% Standard Proctor Density.
- Restore asphaltic concrete pavement to a thickness matching that of the existing roadway, compacted to 94% Maximum Theoretical Density.

8.3.5. Rights-of-Way, Easements, and Public Utility Lots

The Developer shall provide, to the satisfaction of the utility companies, rights-of-way, Easements, or PULs to accommodate the utility servicing, registered in the name of the Town.

Easements shall be registered at the time of subdivision registration; if subdivision is not involved, they shall be registered on each lot prior to the sale of any lot in the development area.

9. MECHANICAL PLANTS

9.1. General

This section covers the design and construction of mechanical plants to be built or rebuilt in the Town.

General construction requirements, construction materials, and procedures are not alluded to in this section and are left to the Developer's Consultant to present to the Town for acceptance.

All mechanical plants shall be in accordance with the Alberta Environment, Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems, and all other relevant standards and codes (i.e. electrical, building, etc.). Where a roof structure cost exceeds $50,000, ARCA certification is required.

Underground power shall be installed to all mechanical plants; overhead power will not be permitted.

9.2. Water Booster Pumping Stations

9.2.1. Hydraulic Design Parameters

The need for a pumping facility shall be determined during preliminary discussions between the Developer and the Town. Pumping facilities shall only be considered as a last resort if there are no other suitable alternatives.

The design flows and pressures shall be based on parameters and computation methods outlined in Section 7 - Water Distribution Systems. The design period for sizing pump stations shall be a minimum of 25 years.

9.2.2. Sump and Intake Design

Sumps and intakes shall be designed in accordance with the current edition of the Hydraulics Institute Standards.

Minimum submergence shall not be less than the pump manufacturer's recommendations.

Net positive suction head (NPSH) required at the operation point and at the best efficiency point shall be at least 7 kPa less than the NPSH available.

Open sumps shall have an overflow and a drain point. Provision shall be made to allow over-pumping or bypassing the pump station.

9.2.3. Pump and Driver Selection

Service pumps shall be vertical turbine or horizontal split case centrifugal pumps. Fire pumps shall be FM/UL approved, unless otherwise approved in writing by the Town. Pump shafts and line shafts shall be stainless steel.

Pumps shall have their maximum efficiency within the normal operating range. Maximum pump speed shall be 1800 RPM. Slower speed pumps are preferred where available. Spare parts as recommended by the pump manufacturer shall be provided.

Pumps shall be variable speed or soft start. Service pumps shall be driven by open drip proof, NEMA Design B, CSA-approved electric motors. The Developer's Consultant shall contact the Town to confirm the requirements for any proposed fire pumps.

Service pumps shall be sized such that the station can meet the peak hour demand with the largest pumping unit out of service. Fire pumps shall be sized for the fire flows indicated in Section 7. Jockey pumps can be used to meet average day demands.

In-line booster pumps may be canned vertical turbines or horizontal split case pumps. Vertical turbine pumps with flanged suction connections may be considered for in-line booster pumps, provided the inlet arrangement complies with the pump manufacturer's recommendations.

Horizontal split case pumps and vertical turbine pumps with flanged suction connections shall be tested to a hydraulic pressure of twice the maximum operating pressure or 1.5 times the shutoff head, whichever is greater.

Intermittent type pumping systems including pumps, bladder type pressure tanks may be used when the average flow is less than 0.25 L/s.

9.2.4. Dry Well / Pump Room Layout

The layout shall be such that all equipment and valves are easily accessible. There shall be a minimum horizontal clearance around pumps and motors of 1 m and a vertical clearance of at least 3 m. Additional clearance may be required by the Town for critical or large pieces of equipment. Special attention shall be given to the ease of removal of pumps, motors, and valves for Maintenance and repair.

If the initial capacity of the proposed pumps is to be less than the 25-year design capacity, the station shall be designed so that the capacity can be easily increased, when required, without significant changes to the existing structural, architectural, mechanical, electrical, or instrumentation systems.

9.2.5. Valves and Fittings

Magnetic type meters shall be installed on all discharge headers.

Check valves shall be installed in each pump discharge line between the pump and the discharge isolating valve. They shall be the tilting disc type with dashpot-controlled closing or globe style silent checks. All pump discharge check valves shall have an external arm to allow for position monitoring with a proximity style limit switch.

Isolating valves shall be installed on each pump suction and pump discharge line. They shall be AWWA Standard C504 short body flanged butterfly valves. In booster stations, isolating valves must be provided 10 diameters upstream.

Motorized or hydraulic pump control valves shall be installed to reduce water hammer during pump start and stop. The pump discharge isolating valve may be motorized to function as a pump control valve.

Air release valves shall be installed on the discharge header. Air and vacuum valves shall be installed between the pump discharge and the check valve on wet well vertical turbine pumps which do not have a separate pump control valve discharging back to the wet well.

Pipes and valves shall be adequately supported, tied down by commercially available supports or concrete pillow blocks, spaced in accordance with the manufacturer's design data and restrained against thrust where necessary.

A flexible coupling shall be installed on each pump discharge line to enable easy removal of the pump and check valve. The isolating valve shall allow the facility to continue to operate during removals.

Pipe material up to and including 150 mm diameter shall be PVC to AWWA C900 or stainless steel, type 304, Schedule 80 to ASME B31.3 A53 Standard Wall. Pipe material greater than 150 mm diameter to 620 mm diameter shall be ASTM A53, Grade B, standard wall steel. Pipes greater than 150 mm shall be epoxy lined to AWWA Standard C210.

Pipework may be painted and colour coded to WHMIS Standards and the Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems.

9.2.6. Auxiliary Systems

Air

Where compressed air is used in a pumping station, the air system shall be complete with dual air compressors (one duty, one standby), receiver, dryer, controls, and all necessary appurtenances to supply dry air for all air-operated equipment. Each compressor shall be capable of continuously supplying air at a rate of at least twice the maximum anticipated consumption.

Water

Potable water for station service may be drawn from the pump discharge line or other suitable supply point having adequate pressure. Where necessary, a pressure reducing valve capable of maintaining the station service water between 350 kPa and 700 kPa shall be provided. The line supplying water for non-domestic uses such as cooling, gland sealing, hose bibbs, etc., shall be provided with an approved reduced pressure backflow preventer. Water for domestic use shall be drawn from a point upstream of the backflow preventer. At least one hose bibb shall be provided in the wet well area, in the dry well area, and on the exterior of the station.

Dry Well Drainage

Where practical, dry wells shall be drained by gravity to a sanitary sewer. If gravity drainage is impractical, dry wells shall be provided with a sump and two sump pumps (one duty, one standby). Pump capacity shall be at least 100 L/min. Liquid discharged by the sump pumps shall be considered contaminated and shall be discharged only to a sanitary sewer or other approved wastewater disposal system.

The floor of the dry well shall drain towards the sump with a minimum slope of 1.0%.

Lifting Equipment

Lifting equipment (bridge cranes, monorails, etc.) with capacity of 1.5 times the heaviest anticipated load, with allowance for impact, shall be provided. Where a monorail is used to convey heavy equipment, the rail shall extend a minimum distance of 2 m outside the building wall through a double doorway. A neoprene seal shall be installed around the monorail where it extends through the doorway.

Electrical Equipment

The pump station's electrical system shall be designed by a qualified electrical Engineer.

The Developer shall ascertain from the electric utility the nature of the available power supply and make all necessary arrangements for connection.

Wherever practical, there shall be two independent power supply feeders to the station, with provision for automatic switch over to the second feeder in the event of a failure of the first. If the Town determines that continuous operation of the station is essential (i.e. that failure would result in serious consequences), then an automatic standby power generation system shall be installed in the station. This system shall have sufficient capacity to allow the station to operate at the maximum anticipated flow rate.

Location of electrical switchgear and similar equipment shall be such that it is not subject to immersion in the event of dry well flooding.

Adequate lighting to meet the code requirements for the specific area shall be provided throughout the entire structure to ensure the safe operation and Maintenance of the complete facilities.

Conduit shall be required for all low voltage wiring (security systems, telephones, etc.).

Instrumentation and Control
All pumping stations shall have instrumentation and control systems which will allow the station to run unattended and are fully integrated and compatible with the Town's existing Supervisory Control and Data Acquisition (SCADA) System.

The nature of the instrumentation and control systems will vary depending on the size, type, and function of the station and shall be decided during discussions between the Developer and the Town. At a minimum, the following is required:

- Station discharge flow (meter to be magnetic type) - in critical applications a float back-up switch may also be required;
- Wet well level indicator / controller (sensor to be ultrasonic type);
- Station discharge pressure indicator / alarm;
- Dry well flooding alarm;
- Intruder alarm for all entrance points;
- Pump failure alarm;
- Pump on/off indicator;
- Main power failure alarm;
- All alarms to be locally indicated separately; and
- Low temperature alarm.

All the above shall be telemetered by means of digital or analog signals to a remote location determined by the Town. The telemetry system shall have a battery uninterruptible power supply to allow the system to operate for at least 4 hours after a power failure.
All instruments and sensors to be installed in a wet well or limited access area shall be, wherever possible, accessible and removable without entering the wet well or limited access area. All instruments which have local indication or which require access for programming should be installed at eye level. All instruments and electrical or control panels which require occasional access must be readily accessible.

9.2.7. Heating, Ventilation, and Air Conditioning

Heating and ventilation systems that use natural gas as a main fuel source shall be provided for all pumping stations. Air conditioning will be required only in unusual circumstances.

Ventilation systems shall conform to all existing local and/or provincial codes. Forced ventilation shall be provided for all rooms, compartments, pits, and other enclosures below ground floor and for all areas where an unsafe atmosphere may develop or where excessive heat build-up may occur.

In areas where excess moisture could cause safety hazards or damage to equipment, a suitable dehumidification system shall be provided.

Heating facilities shall have sufficient capacity to prevent freezing temperatures in any part of the station during the coldest anticipated weather conditions.

9.2.8. Prefabricated Pumping Stations

The use of prefabricated pumping stations is not acceptable.

9.3. Reservoirs

9.3.1. Hydraulic Design Parameters

Reservoirs are provided in a water supply system to satisfy the following criteria:

1. To balance hourly or daily peak demand variations.
2. To provide storage of water to meet fire flow demand.
3. To maintain supply in the event of a source failure.

The storage volume required to balance peak daily flow variations shall be determined from analysis of the daily demand variations.

The storage volume to meet fire flow demands shall be assessed in accordance with the recommendations contained in "Water Supply for Public Fire Protection" published by the Fire Underwriters Survey.

The storage volume required to maintain supply in the event of a source failure shall be determined from considerations of the reliability of sources and the consequences of supply failure. Generally, a storage volume of the peak day demand plus fire demand is considered acceptable but each case should be individually determined.

Demand
The total system demand shall be determined as outlined in Section 7 of these Design and Construction Standards. Future demands shall be determined from consideration of past trends and known planned developments.

Design Period
The design period for reservoir sizing shall be a minimum of 25 years.

Optimum Location
The optimum location for a reservoir is between the supply source and the distribution system to ensure that all stored water is in a fresh condition. In addition, locating reservoirs as close as possible to the centre of demand, to minimize the size of distribution mains, is recommended.

Connection to Distribution System
The outlet main from the reservoir should be sized to pass the peak hourly flow or peak day flow plus fire flow, whichever is greater.

9.3.2. Operating Philosophy

Pumped Feed
The pumps shall be sized to meet the peak day flow plus fire flow or the peak hourly flow, whichever is greater, and the pump station shall be designed in accordance with Sections 7 and 9.

Stagnation
The design of reservoirs shall be such that stagnation caused by the retention of water for long periods is minimal.

The reservoir inlet shall be located at the opposite end as the outlet to ensure adequate turnover. In addition, the use of baffles or barrier walls are to be utilized to ensure water circulation.

Fill Control
All reservoirs shall be equipped with an electrically operated solenoid control valve located on the inlet main. The valve shall be designed to close when the reservoir level is 150 mm below overflow level.

Where it is required to maintain a minimum upstream pressure within the fill line, a mechanism shall be added to the valve to achieve this.

All fill control valves shall be sized in accordance with the manufacturer's recommendations.

Isolation
All inlet and outlet mains shall be fitted with valves to permit isolation of the reservoir. The reservoir shall be divided into two or more sections and the pump wet well into two sections to permit cleaning of one section while maintaining service to the distribution system, unless otherwise approved by the Manager of Engineering.

9.3.3. Reservoir Types

The following are acceptable reservoir types:

1. Buried reinforced concrete;
2. Circular prestressed concrete; and
3. Prefabricated steel.

The optimum form should be determined for each application, taking into account serviceability, Maintenance, and economic considerations.

Other types may be considered, on a case-by-case basis, if they can be used to advantage.

9.3.4. Structural Considerations

Foundations, Geotechnical Evaluation
A detailed geotechnical evaluation shall be carried out at each proposed reservoir location by suitably qualified and experienced geotechnical consultants. The reservoir foundations and yard piping shall be designed and constructed in accordance with their recommendations.

Structural Design
Structural design shall be in accordance with CSA CAN3-A23-1, CSA CAN 3-A23-2, and CSA CAN 3-A23-3. Reference may also be made to BS 337 "The Structural Use of Concrete for Retaining Aqueous Liquids," published by the British Standards Institution.

Underdrainage
A 150 mm weeping tile drain shall be provided around the entire perimeter of the reservoir at a minimum depth of 500 mm below reservoir floor level. The effluent from the drain shall be disposed by gravity or pumping to prevent surcharging of a weeping tile drain.

All exposed above-grade surfaces shall have insulation equivalent to at least RSI-7 steel clad to protect the insulation and include electrical heat tracing cables. Below-grade surfaces with less than 0.6 m of earth cover shall have insulation equivalent to at least RSI = 3.5.

Construction Joints
All construction joints located beneath overflow level shall be cast with integral extruded ribbed PVC waterstops of approved size and manufacture. Waterstops shall be continuous with pre-welded corners and intersecting pieces.

Environmental Impact
The environmental impact of the reservoir at the proposed location shall be carefully considered and a consultation with all relevant authorities and affected parties will be conducted to achieve an acceptable appearance to all structures. The site shall be landscaped as required by the Town.

9.3.5. Other Considerations

Drawdown / Drainage of Reservoir
Provision shall be made to permit the drawdown or drainage of the reservoir with discharge to a suitable surface drain or stream. The reservoir floor shall have a minimum slope of 1:400 to the sump.

Overflow
The reservoir shall be provided with an emergency gravity overflow system designed to pass the maximum possible reservoir inflow rate. The overflow system shall be protected against ingress by insects, birds, or small animals.

The overflow system shall discharge into a suitable surface drain, stream, or soakaway capable of accepting the discharge flow at all times. The Developer’s Consultant shall confirm if Provincial or Federal environmental acts require dechlorination prior to discharging water from a reservoir.

Venting
Each reservoir cell shall be provided with air vents sized at a rate equivalent to one 100 mm diameter vent per 1,000 m^3 of reservoir capacity.

All vents shall be fitted with insect screens.

Instrumentation
All reservoirs shall be provided with an ultrasonic type level indicator / controller. In critical applications, a float backup may also be required.

The discharge pipe and the fill line shall be provided with a magnetic type flow meter to balance consumption flows.

The requirement for further instrumentation, alarms, and control systems shall be discussed with the Town at the design stage and required equipment shall be installed and shall be fully integrated and compatible with the Town's SCADA system.

Where pumps are provided to draw directly from the reservoir, low level shutdown controls shall be provided.

Where a reservoir is required to provide fire storage in addition to normal balancing storage, controls shall be provided to prevent depletion of the fire storage by normal system demands.

All instruments and sensors to be installed in a wet well or limited access area shall be, wherever possible, accessible and removable without entering the wet well or limited access area. All instruments which have local indication or which require access for programming should be installed at eye level. All instruments and electrical or control panels which require occasional access must be readily accessible.

Cathodic Protection
Cathodic protection shall be provided, complete with above ground test stations.

Testing
For reservoir testing, refer to Section 12 of these Design and Construction Standards.

9.4. Sanitary Sewage Lift Stations

9.4.1. Hydraulic Design Parameters

The design flow shall be based on the parameters and computation methods described in Section 5 of these Design and Construction Standards.

The design period for sizing pumping facilities shall be a minimum of 25 years. Growth projections shall be determined during discussions between the Developer and the Town.

9.4.2. Influent Structures

Sumps and wet wells shall be designed in accordance with the Hydraulic Institute and the recommendations of the pump manufacturer.

Sizing shall be determined after due consideration of all relevant factors, including flow, number of pumps, pump capacity, and collection system storage capacity. In general, the usable pit volume should be at least equal to twice the maximum volume (in L/min.) to be pumped. In addition, the pit shall be sized to limit the number of starts per hour per pump to between 4 and 6.

Sumps and wet wells shall be designed to minimize dead areas where debris may accumulate.

The floor shall have a minimum slope of 1:1 in the direction of the suction inlets. Suction inlets shall be of the bell-mouth (flared) type to minimize vortexing and accumulation of solid material.

Ancillary mechanical equipment such as screens, comminutors, and grit removal devices should be avoided, unless special circumstances make the use of such equipment unavoidable.

Provision shall be made for over-pumping or bypassing the pumping station.

9.4.3. Pump and Driver Selection

Pumps shall be of the centrifugal, non-clog type and shall have been designed specifically for use with wastewater. Both submersible and dry-pit types may be acceptable, depending on circumstances.

Pumps shall have their maximum efficiency within the normal operating range. Maximum speed shall be 1800 rpm, with lower speeds preferred where possible. Pumps shall be constant speed, unless operational, Maintenance, or economic advantages would result from the use of variable speed drives.

Pumps shall be sized so that the station is able to handle the maximum anticipated flow with the largest pump out of service.

The number of pumps to be installed in the station will depend on the station capacity and range of flow. In stations with a maximum flow of less than 4,000 m^3/d, two pumps shall be installed, provided the capacity of each is capable of meeting the maximum inflow rate. For larger stations, the number of units should be selected so that the range of inflow can be met without starting and stopping pumps too frequently and without requiring excessive wet well storage capacity.

Pumps will normally be driven by constant-speed, drip proof, squirrel cage motors, although special circumstances may require alternative equipment. Motors shall be sized to handle the maximum load anticipated under adverse conditions.

9.4.4. Dry Well / Pump Room Layout

The layout shall be such that all equipment and valves are easily accessible. There shall be a minimum horizontal clearance of 1 m and a vertical clearance of at least 3 m around pumps and drives. Additional clearance may be required by the Town for critical or large pieces of equipment. Special attention shall be given to the case of removal of pumps, motors, and valves for Maintenance and repair. Catwalks / ladders shall be provided for Maintenance or repair of pump shafts.

Provision shall be made to allow the capacity of the station to be increased in the future to its ultimate design capacity by the installation of additional pumping units or substitution of larger units, without the need for substantial changes to the structural, architectural, mechanical, electrical, or instrumentation systems.

The elevation of the pump room shall be such that the pumps are under a positive suction head at the lowest wet well level anticipated.

9.4.5. Piping, Valves, and Fittings

Check valves used for sewage discharge pumps in dry well locations shall allow for an external arm to be mounted in conjunction with a proximity switch to monitor the check valve's position (open or closed). When arms and proximity switches are not used on check valves in a wet well application, a flow meter that is approved for submerged applications shall be provided.

Piping shall be sized so as to give average velocities of between 0.76 m/s and 1.5 m/s in suction piping and between 1.0 m/s and 2.5 m/s in discharge piping. Future increases to capacity shall be taken into account when sizing piping.

Each pump shall have its own suction line from the wet well. Where suction lines pass through concrete walls, a wall casting with flanges on both sides of the wall and a waterstop cast into the wall shall be provided. Suction lines shall be kept as short as possible and shall incorporate an isolating valve, a non-metallic flexible coupling, and an eccentric reducer. Valve design shall be such that the interior is free of obstructions which could accumulate debris and prevent tight shutoff. Gate, knife, diaphragm, and eccentric plug valves are acceptable.

Pipe material shall be steel, AWWA C-200, standard wall thickness. The exterior surface of the pipes and fittings shall be coated in the wet well with coal tar epoxy, and in the dry well with polyethylene or epoxy type coating.

Discharge lines shall be designed to withstand the maximum pump discharge pressure, plus anticipated surge pressure. Each pump discharge line shall incorporate a concentric increaser, a restrained-type non-metallic flexible coupling, a check valve, and an isolating plug valve.

The isolating valve shall be located downstream of the check valve. The check valve shall be of the tilting disc type. Adequate supports and hangers shall be provided for all piping. Air relief valves shall be installed at all high points in the piping and drain valves at all low points. All pump discharge check valves must have an external arm to allow for position monitoring with proximity style limit switches that are located above flood level of the wet well or in the dry well.

9.4.6. Auxiliary Systems

Air

The air system shall be complete with dual air compressors (one duty, one standby), receiver, dryer, controls, and all necessary appurtenances to supply dry air for all air-operated equipment. Each compressor shall be capable of continuously supplying air at a rate of at least twice the maximum anticipated consumption.

Water

A potable water supply line from the Town's distribution system shall be provided, where practical. Line size shall be determined by anticipated maximum demand and length of run, but shall in no case be less than 50 mm. The water service shall be installed inside the building, as per Alberta Environment standards and guidelines. At least one hose bibb shall be provided in the wet well area, the dry well area, and on the building exterior. The wet well hose bib shall be 50 mm in diameter or greater. The dry well and external hose bibs shall be 25 mm in diameter or greater. The pump system and main distribution header shall be 50 mm or greater.

Where provision of a piped water supply is impractical because of distance or other considerations, a potable water holding tank of at least 4,500 L (1,000 gallons) capacity and corresponding distribution system shall be provided.

Dry Well Drainage

Dry wells shall be provided with a sump and two sump pumps (one duty, one standby). Pumps shall be non-clog type and operate at a speed no greater than 1,800 rpm. Discharge shall be to the wet well at an elevation above the high liquid level. Pump capacity shall be at least 100 L/min. The floor of the dry well shall drain towards the sump with a minimum slope of 1.0%.

Lifting Equipment

Lifting equipment (bridge cranes, monorails, etc.) with capacity of 1.5 times the heaviest anticipated load, with allowance for impact, shall be provided. Where a monorail is used to convey heavy equipment, the rail shall extend a minimum distance of 2 m outside the building wall through a double doorway. A neoprene seal shall be installed around the monorail where it extends through the doorway.

9.4.7. Electrical Equipment

The pumping station's electrical system shall be designed by a qualified electrical Engineer.

Three-phase power shall be provided wherever possible and each phase shall be monitored using a 3-phase monitor back through the main control centre.

The Developer shall ascertain from the electric utility the nature of the available power supply and make all necessary arrangements for connection.

Wherever practical, there shall be two independent power supply feeders to the station, with provision for automatic switch-over to the second feeder in the event of a failure of the first. If it has been determined by the Town that continuous operation of the station is essential (i.e. that failure would result in serious consequences), then an automatic standby power generation system shall be installed in the station. This system shall have sufficient capacity to allow the station to operate at the maximum anticipated flow rate.

All electrical equipment shall match the class and division of the area in which it is installed.

Location of electrical switchgear and similar equipment shall be such that it is not subject to immersion in the event of dry well flooding.

A minimum of two receptacles shall be provided on the wet and dry sides of the station.

Adequate lighting shall be provided throughout the entire structure to ensure the safe operation and Maintenance of the complete facility. Metal Halide lighting (250W) shall be installed for both wet and dry wells. High-pressure sodium and incandescent lighting are not acceptable in the wells. LED lighting, complete with photocells, shall be installed for all outdoor lighting.

Conduit shall be required for all low voltage wiring (security systems, telephone, etc.).

9.4.8. Instrumentation and Control

All pumping stations shall have instrumentation and control systems which will allow the station to run unattended and are fully integrated and compatible with the Town's existing SCADA system.

The nature of the instrumentation and control systems will vary depending on the size, type, and function of the station and shall be decided during discussions between the Developer and the Town. At a minimum, the following are required:

- Station discharge flow (meter to be magnetic type);
- Wet well level indicator / controller (sensor to be ultrasonic type);
- Station discharge pressure indicator;
- Dry well flooding alarm;
- Intruder alarm for all entrance points;
- Pump failure alarm;
- Pump on/off indicator;
- Main power failure alarm;
- Wet well high- and low-level alarm switches to provide backup to the wet well level indicator / controller;
- Sump alarm;
- Fire alarm; and
- Low temperature alarm.

All alarms are to be locally indicated. All the above shall be telemetered by means of digital or analog signals to a remote location determined by the Manager of Engineering. The telemetry system shall have a battery-powered backup supply to allow the system to operate for at least 4 hours after a power failure.

All instruments and sensors to be installed in a wet well or limited access area shall be, wherever possible, accessible and removable without entering the wet well or limited access area. All instruments which have local indication, or which require access for programming should be installed at eye level. All instruments and electrical or control panels which require occasional access must be readily accessible.

9.4.9. Heating, Ventilation, and Air Conditioning

Heating and ventilation using natural gas shall be provided for all pumping stations. Air conditioning will be required only in unusual circumstances.

Ventilation systems shall conform to the requirements of Alberta Environment standards and guidelines.

Wet well ventilation shall be continuous and capable of providing at least 6 complete air changes per hour when occupied; when unoccupied, a minimum 30 air changes per hour are required. Air shall be forced into the wet well rather than exhausted from it.

Dry well ventilation shall be continuous and capable of providing at least 6 complete air changes per hour.

Ventilation shall have sufficient capacity to provide 21°C discharge air and be equipped with a modulating burner complete with stainless steel exchanger. A low discharge temperature shut down and no airflow alarm shall be provided in the system. Main heating units may consist of natural gas heaters using aluminized heat exchangers.

Odour control facilities may be required where there is the likelihood of septic sewage and the station is located in a sensitive area. The need for odour control facilities shall be assessed on an individual basis.

9.4.10. Prefabricated Pumping Stations

The use of prefabricated pump stations without separate wet well and dry well chambers is not acceptable.

9.4.11. Submersible Pumps

The use of submersible pumps, in either the submerged or dry well mode, may be acceptable. If submerged pumps are used, proximity switches shall be provided above overflow levels. Wet wells shall have a galvanized grating located 1.5 m below the effluent outlet to allow access to valves and checks for repairs. Grating shall have removable sections to allow for the removal and servicing of pumps. Full details of the proposed pumps and station layout shall be submitted to the Town for acceptance.

9.5. Other Requirements

9.5.1. Aesthetics

The Town shall be consulted regarding aesthetic requirements for the site. If the site is visible to the public, special architectural treatments, signage, landscaping, etc. are required.

Mechanical plants shall be of masonry and metal construction. All mechanical plants shall be equipped with double metal door structures complete with panic hardware for Maintenance and removal of large equipment.

9.5.2. Personal Considerations

The work shall be designed and constructed in full accordance with all relevant Municipal, Provincial, and Federal safety standards.

Separate access shall be provided to dry wells and wet wells, using stairs wherever possible. Temporary ladders for access are not acceptable and fixed ladders shall be the minimum supplied.

In larger mechanical plants, the Manager of Engineering may require office(s), telephone, washroom, storage areas/rooms, and workshop facilities.

9.5.3. Security

Station design shall be such that the potential for vandalism is minimized. A chain link security fence, complete with locking double gate and barbed wire, shall perimeter the site. Adequate outside lighting shall be installed with light sensitive switches.

All external doors and access hatches shall be provided with security locks to a standard approved by the Manager of Engineering. Wherever possible, locate access hatches within the associated building structure. Intruder alarms for all entrance points shall relay to the Town's SCADA System.

9.5.4. Access

An access road of minimum width 5.5 m shall be provided at all stations. The minimum standards shall be 50 mm asphalt surface, 250 mm granular base course, and 300 mm pitrun gravel base on 200 mm of cement-stabilized subgrade; however, the access road structure is to be confirmed by the Geotechnical Engineer as part of the geotechnical investigation. A more substantial road and parking structure may be required where the facility is subject to heavy wheel loads, pending the results of the geotechnical investigation. Asphalt stabilized base course (cold mix) or gravel surfacing will not be accepted.

Adequate provision shall be made at the site to enable vehicles to park, turn, and leave the site in a forward direction. A full perimeter road is not required but vehicle access must be available to all points.

9.5.5. Operations and Maintenance Manuals

Three (3) complete bound sets and one (1) electronic (PDF) copy of the manufacturer's operation and maintenance manuals shall be provided to the Town. In addition, a manual completely describing the design and operational philosophy of the station shall be provided (Process Functional Specification) including PLC ladder logic printouts and copies of PLC controller programs provided on a disc or memory stick.

9.5.6. Equipment

The Town uses specific manufacturers of equipment and accessories common throughout their systems. Therefore, specific standard equipment (make and model) may be requested by the Town and shall be supplied by the Developer. Coordinate with the Town for specific requirements.

9.5.7. Lubrication and Spare Parts

Sufficient lubricants for all equipment shall be provided for all testing and trial runs, in sufficient additional quantity for 12 months of operation by the Town. Identify lubricants furnished by brand, grade, and item of equipment for which it is intended. Operate, drain, and flush out bearings and refill with a new change of oil before completion. Type of lubricants shall be as recommended by the manufacturer and in consultation with the Town's Operation personnel.

Provide all spare parts as deemed necessary by the manufacturer and the Town for 12 months of operation. Identify spare parts furnished by brand, grade, and item of equipment for which it is intended. In addition, provide all special tools required for servicing and maintaining the equipment.

9.5.8. Commissioning and Operator Training

General

The Contractor shall provide, commission, train operating personnel, and turnover a complete operating facility. Generally, commissioning will follow these steps:

- Test all individual items and ensure they are ready for operation;
- Commission the entire system; and
- Turnover the facility to the Town.

The procedures outlined in this section are general, and more detailed requirements may be needed depending on the type and complexity of the system.

Preparation

- Establish a written, detailed procedure and schedule and submit it to the Town for review.
- Arrange for any specialty testing and certification personnel.
- Provide all instruments required to test, adjust, and balance operation.
- Inspect all equipment to ensure the installations are complete, secure, and that the manufacturer's instructions have been complied with for lubrication, cooling fluids, and other requirements.

Personnel

- Provide competent, experienced, and if necessary, factory-trained personnel to supervise the installation, inspection, testing, and commissioning of equipment.
- The Town will provide a list of operating personnel requiring training and will coordinate their attendance.

Testing Systems

- Each individual item of equipment shall be tested by itself and in combination with related items to ensure that the item or subsystem is ready for operation. Provide test results.
- Test, adjust, check, and lubricate each individual item of equipment and ensure SCADA systems are fully operational.

Commissioning

- Commissioning shall generally include the Developer's personnel operating the complete system for a 2-week period, without failure, and the Town's personnel operating for the following 2-week period, without failure, under the Developer's supervision. These operating times will fluctuate depending on the complexity of the facility and any failures will restart the test period(s).

- Operation of existing facilities shall be performed by the Town.
- During the commissioning period, the Developer shall demonstrate that the operation of the entire facility, as well as individual components, is correct and in accordance with the manufacturer's performance criteria.
- All equipment shall be demonstrated in all expected conditions of operation including variation in flow, pressure, speed, and control.
- All alarm conditions, including malfunctions, safety devices, interlocks, and annunciations shall be demonstrated.
- During the Developer's period of operation, the Town's operators shall observe the operation and receive instruction.
- During the following period, the Developer shall observe the Town's personnel operating the equipment and provide any necessary guidance.

Turnover

Upon completion of training, satisfactory testing results, operations, and repair of any deficiencies, the Town will assume complete responsibility for operation of the facility.

10. LANDSCAPING, SITE FURNISHINGS, AND FENCING

10.1. General

This section identifies minimum landscape requirements for capital projects, new development, and Restoration of post-construction disturbance, including:

- Design of public landscapes and recreation amenities;
- Preparation of submissions to the Town;
- Implementation of landscape construction; and
- Procedures to obtain acceptance from the Town.

10.2. Reference Documents

The following documents are a source of additional information and are referenced within this document:

- Canadian Nursery Stock Standard Ninth Edition, Canadian Nursery Landscape Association (CNLA);
- Landscape Alberta Nursery Trades Association (LANTA); and
- Weed Control Act.

10.3. Supplementary Definitions

The following words shall have the meaning hereinafter assigned to them:

Term	Definition
Restoration	A type of habitat restoration; the process of fully re-establishing a target level of ecosystem function and biodiversity to a degraded habitat, as defined by the reference habitat. This includes species composition and vegetation community structure.
Naturalization	A type of habitat restoration; the deliberate reintroduction of species that are native to a given area or are well adapted to the climate circumstance; activities that are intended to improve and enhance the natural environment. The biodiversity and ecosystem function of a naturalized ecosystem is lower compared to a reference habitat but higher compared to a reclaimed ecosystem
Reclamation	A type of habitat restoration; that aims to stabilize disturbed lands to an ecologically productive use. A reclaimed ecosystem has less biodiversity and ecosystem function compared to a reference habitat, and the least compared to other types of habitat restoration
Low Impact Development (LID)	A land development and stormwater management approach that works with nature to manage stormwater as close to the source as possible. LID focuses on maintaining and restoring the natural hydrological processes of a site.

10.4. Plant Material Protection

1. 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 Manager of Engineering.
2. 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.
3. 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.

4. Temporary fencing will be required around all plant material to be preserved. Fencing shall be placed outside of the root zone for those plant materials that will be retained as identified by a certified arborist. Temporary fencing shall be a minimum of 1.2m in height.
5. Existing grades around plant material are to be retained. If existing grades around plant material to remain are altered, either raised or lowered, the Developer will be responsible for constructing remedial measures, to compensate for the grade changes.
6. If the grade or elevation of surrounding land is altered in a manner that will adversely affect retained plant material, the Developer will be responsible for all remedial work. Plant material must not suffer from any grade changes. The Developer will also be responsible for replacing all plant material that has died or suffered due to construction disturbance or grade changes.
7. If grades are to be lowered, two remedial techniques will be acceptable to the Town:
   - Tree mounds; and
   - Retaining walls.

   The Contractor will be responsible for supplying water to plant material where the grades have been lowered, for the first growing season, to compensate for the lowered water table.
8. If grades are to be raised around plant material to be preserved, the Contractor will be responsible for constructing tree wells to the satisfaction of the Town.

10.5. Site Clearing

1. The Developer shall locate all underground utilities and protect all survey control monuments prior to construction.
2. Plant material shall not be removed from the project site without written permission from the Town Representative.
3. In areas where clearing is required and has been approved, all trees and shrubs shall be completely removed from the site.
4. In areas to be cleared, roots and stumps shall be removed to a minimum depth of 0.6 m below rough grade.
5. Where stumps are to be removed, the entangled roots of the stumps shall be left in the ground.
6. Burning of debris on-site is not permitted.
7. The Developer shall ensure positive drainage is maintained throughout all stages of site clearing and rough grading.

10.6. Rough Grading

1. Rough grading shall be carried out without damage to the root and branch systems of existing plant material to be retained.
2. All sites requiring topsoil shall be rough graded to within 150 mm of final grade.
3. At the toes of slopes and banks, grades shall be smoothly rounded to a minimum slope of 8H:1V. All slopes, banks and disturbed areas, as a result of the development, are to be feathered to meet with existing grades.
4. The maximum allowable slope for berms shall be 4H:1V, unless otherwise acceptable to the Town. Slopes of 3H:1V may be acceptable in areas of minimal pedestrian traffic and for the side slopes of drainage swales. Slopes of 3H:1V must be approved by the Town.
5. All fill material required for rough grading shall be free of sticks, stones, and debris greater than 7 cm and any other material which may be subject to rot or corrosion.

10.7. Topsoil

1. Topsoil shall be free of stones larger than 25 mm in diameter, debris, quack grass, restricted noxious weeds, any other plants and inorganic matter.
2. Topsoil for vegetative purposes shall be tested for N, P, K, Mg, soluble salt content, and pH value. The Developer shall be responsible for all appropriate soil testing.
3. Any chemical deficiencies indicated by the soil analysis report shall be rectified by the application of the appropriate fertilizers and additives.
4. Topsoil shall consist of fertile natural loam containing a maximum of 10% organic matter by dry weight, maximum 40% sand, maximum 30% clay, and minimum 30% silt by dry weight.
5. 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.
6. Organic material required to meet the organic matter specification above shall be as follows:

1 Peat Moss: Peat moss shall be added in the field and mixed with cultivation equipment. The peat moss shall meet the following specifications:

- Shall be free of toxic material, live plants, live roots and seeds;
- Shall be delivered in a pulverized condition; and
- The source shall be approved prior to mixing with the topsoil.

2 Compost: Compost may be added to increase the organic content of topsoil, as follows:

- Shall be commercially prepared and shall meet the Canadian Council of Ministers of the Environment (CCME) Guidelines for Compost Quality (2005)
- Be substantially free from coliform, pathogens, and chemical or organic contaminants that may be detrimental to plant, animal or human he
- Shall not exceed a 40:1 total C:N ratio. Compost with a total C:N ratio of 25;1 to 30:1 is recommended.
- Shall consist of well rotted residuals when found to be a component of compost are acceptable provided the total C:N ratio for the topsoil type (mixture) shall be a maximum of 25:1 to 30:1.
- Manure compost must meet the CCME (2005) guidelines before use as a amendment.
- High-lignin organic material may be used as a surface amendment to a topsoil mixture provided it consists of bark or other plant material with hard fibrous structure, shall have a particle size of 1mm to 15mm, and with no more than 10% under 2 mm. Sawdust is not permitted, and pH range shall be between 4.5 and 7.

10.7.1. Topsoil Placement

1. Do not place topsoil when topsoil or subgrade is frozen, very wet or very dry, or in a condition that would inhibiting proper grading, cultivation, or compaction, or in a condition that is detrimental to the work or topsoil integrity.
2. For topsoil depths greater than 300mm, place in lifts no greater than 150mm and compact with appropriate weighted landscape roller where applicable to release air pockets. Do not compact more heavily than is needed to support footprints. Mechanical compactors, including plate compactors, are not permitted.
3. Fine grade to eliminate rough or low areas and to ensure positive drainage.

4. Final topsoil grades for seeded areas shall be flush to finished grade at surface structures, ie manholes, sidewalks and curbs.
5. Final topsoil grades for sodding, the final grade of compacted topsoil shall be 25mm below finished grade of adjacent work such as walk, curb and manhole and 25mm below crown of adjacent turfed area.
6. Manually spread topsoil around trees and plants to prevent damage by grading and levelling equipment.
7. For environmentally sensitive areas, including wetlands, where existing soil conditions are sufficient to sustain additional plantings, the Consultant may request that plantings be installed in native, disturbed soil.
8. Seeded or Sodded Areas: Topsoil shall be spread over area to be seeded or sodded to a depth of 200mm depth.
9. Shrub Beds: 600mmm depth for planting beds shall be excavated and filled with topsoil to a depth of 600 mm below finished grade.

10.7.2. Soil Cells

Soil cells shall conform to the latest version of the City of Edmonton Volume 5: Landscape Design and Construction Standards.

10.8. Seeding

1. Areas to be seeded (in lieu of sodding) must be approved by the Town, granted on the basis of:
    - Intensity of use of the area to be covered;
    - Size of the area to be covered.

    Generally, seeding will not be considered acceptable for patchwork in an existing, established turfed areas; 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 with the approval of the Town.
2. 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:
    - Analysis of seed mixture;
    - Percentage of pure seed production;
    - Year of seed production;
    - Net weight;
    - Date when bagged and location; and
    - Name of supplier;

    The Developer shall provide proof upon request of Certification of Compliance with the Canadian Wheat Board Act (Seeds Act).

3. Composition of Seed Mixtures shall be:

Parks / Boulevards	Roadside	Naturalization	Wet Meadow
55% Red Fescue	55% Red Fescue	35% Awned Wheatgrass	30% Fowl Bluegrass
20% Kentucky Blue Grass	30% Kentucky Blue Grass	25% Slender Wheatgrass	20% Tufted Hair Grass
15% Annual Rye	15% Annual Rye	15% Western Wheatgrass	15% Giant Wild Rye
10% Canada Blue Grass		15% Rocky Mountain Fescue	10% Awned Wheatgrass
		5% Western Porcupine grass	10% Western Wheatgrass
		5% Junegrass	10% Sloughgrass
			5% Annual Ryegrass

Seed must be capable of producing a minimum germination rate of 75% in a germination test.

4. 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 12 mm.

   All pebbles, stones, roots and debris shall be removed from the finished soil surfaces

5. The seed shall be evenly applied at a rate of not less than 3.5 kg per 100 m^2.

6. Seeding shall not be carried out in wind velocities above 8 km/hr.

7. Avoid seeding in temperatures above 22 degrees Celsius.

8. Grass Seeding: Recommended season May 1 to September 15 to allow time for seed to establish

9. Fall seeding for spring germination may occur in areas that won't be disturbed by site activities which could damage germinating seeds.

10. 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.

11. After seeding, the Developer shall give the seeded area a light watering with a fine spray to an absorbed depth of not less than 25 mm.

12. The seeded area shall be appropriately maintained by the Developer; i.e., watering, rolling, fertilizing, until the time of final inspection and acceptance by the Town.

    Appropriate Maintenance to be determined by weather conditions, soil conditions, time of year and growing condition of the seed. A 2-year Maintenance schedule is to be submitted to the Town for approval at the time of the CCC inspection.

13. At the time of final inspection and acceptance by the Town, the grass shall:

    - Be mowed to a minimum height of 50 mm if area is to be maintained;
    - Cover 100% of the seeded area;
    - Be completely weed free;
    - Be completely free of thin bare and dead spots; and
    - Be in an overall healthy growing condition, satisfactory to the Town.

14. The Developer shall be responsible for providing and maintaining adequate barricades and signs to warn traffic entering the seeded area until the time of final inspection and acceptance by the Town.

10.9. Hydroseeding

1. Hydroseeding will be acceptable on steep slopes, in hard to reach areas, and for large areas to be seeded. Areas to be hydroseeded must be approved by the Town.

   All areas to be hydroseeded shall be given a layer of topsoil as specified in these standards. Before hydroseeding, 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.

2. All pebbles, stones, roots, and debris shall be removed from the finished soil surface.

3. Water used for hydraulic and wood cellulose fibre mulching shall be free of any impurities which would inhibit germination or otherwise adversely affect the growth.

4. 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 which will allow absorption and percolation of water.

5. The tackifier shall be an approved non-asphalt product, water dilatable with no detrimental effects on germination or existing plants.

6. Seed shall be applied evenly at a rate of not less than 3.5 kg per 100 m^2. Seed type as specified in section 10.8.

7. A suitable fertilizer shall be applied at a rate of 11 kg per 100 m^2.

8. Grass seed and fertilizer shall be thoroughly mixed and uniformly distributed by means of an approved hydraulic seeder over the area to be hydroseeded.

9. The work shall be done only in good weather and on ground free of frost, snow, ice, and standing water.

10. The hydroseeded area shall be appropriately maintained by the Developer; i.e., watering, fertilizing, cutting, etc., until the time of final inspection and acceptance by the Town.

    Appropriate Maintenance to be determined by weather conditions, soil conditions, time of year, and growing condition of the seed. A 2 year Maintenance schedule is to be submitted to the Town for approval, at the time of the CCC inspection.

11. At the time of final inspection, the grass shall:
    - Be mowed to a minimum height of 50 mm if area is to be maintained;
    - Cover 100% of the seeded area;
    - Be well established;
    - Be completely free of weeds, thin, bare and dead spots; and
    - Be in an overall healthy growing condition satisfactory to the Town.

10.10. Sodding

1. Sodding shall be done in all areas of intensive use and for all patchwork and remedial work in areas of established turf.

2. All areas to be sodded shall be given a layer of topsoil as specified in section 10.7.

3. Sod Laying Recommended season is May 1 to September 30. All sod laid after September 30 will not receive CCC until June 30 of the following year to give time for knitting of sod pieces.

4. Sod to be installed for general use shall consist of No. 1 Nursery Sod consisting of a uniform mixture in the following proportions:
    - Kentucky Blue Grass Blend: 75% by weight
    - Creeping Red Fescue: 25% by weight

   The sod shall be:
    - A minimum of 18 months old;
    - Free of noxious weeds and debris;
    - 25 mm - 30 mm in thickness;
    - Cut in strips of uniform width;
    - Sufficiently moist so that no burning of the edges has occurred; and
    - Have a vigorous healthy growth.
5. Sod shall be laid evenly and in staggered rows.
6. Sod shall be laid at right angles to all slopes. Secure sod to all steep slopes with pegs. Pegs shall not protrude above the surface of the sod.
7. The Developer shall be responsible for providing and maintaining adequate barricades and signs to warn traffic entering sodded areas, until the time of final inspection and acceptance by the Town.
8. The Developer shall be responsible for appropriately maintaining the sodded areas; i.e., watering, rolling, fertilizing, and mowing until the time of final inspection and acceptance by the Town.

   Appropriate Maintenance to be determined by weather conditions, soil conditions, time of year, and growing conditions of the sod. A 2-year Maintenance schedule is to be submitted to the Town for approval at the time of the CCC inspection.
9. At the time of inspection and acceptance by the Town, the sod shall be:
    - Mowed to a minimum of 50 mm and maximum of 75 mm height;
    - Well established over 100% of the sodded area;
    - Knit between sod pieces, with seams grown together;
    - Completely free of weeds, thin, bare, and dead spots; and
    - In an overall healthy condition satisfactory to the Town. No more than 30% of blade height shall be removed to achieve minimum height.

10.11. Naturalization

1. The Town prefers a more naturalized approach to landscaping. Major roadways, utility corridors, non-programmable or low-use park spaces, and stormwater management facilities are to be naturalized unless otherwise agreed upon.
2. Developer's Consultant to select native trees and seed to reduce the need for ongoing Maintenance. The tree sizes are to be specified on plans and can be reduced to 40 mm caliper (deciduous), 2.0 m height (coniferous).
3. Mowing of naturalized seed mixtures to be completed only to establish plant health and must maintain a minimum height of 100 mm to 150 mm. Once seed is established, no additional mowing is to be completed.
4. Seed shall be applied evenly at a rate of not less than 3.5 kg per 100 m^2. Seed type and installation process as specified in section 10.8.
5. At the time of final inspection, the grass shall:
    - Be grown to full natural height;
    - Cover 80 % of the seeded area;

- Be well established;
- Be completely free of weeds, thin, bare and dead spots; and
- Be in an overall healthy growing condition satisfactory to the Town.

10.12. Plant Material

1. All plant material shall be of first grade quality, free from insects, disease, and physical injury, shall have a strong fibrous root system and must be structurally sound. All plant material shall have straight stems, well and characteristically branched for the species. All plant material shall conform to the Horticultural Standards for nursery stock of the Landscape Alberta Nursery Trades Association.

2. Plant material to be confined to tree planting only. Shrubs beds are only permitted at entry features or as agreed upon with the Town. All shrubs to be laid out as to not overlap and setback a minimum 500 mm from the edge of the bed to the mature spread of the plant material.

3. The following list identifies minimum tree quantities required for base level land development (based on the total area of the site):

    - District Parks: 45 trees/ ha
    - Pocket Parks: 70 trees/ ha
    - School Park Sites: 55 trees/ ha
    - Greenways: 200 trees/ ha
    - Stormwater Management Facilities: 70 trees/ ha (above normal water level)

4. Where possible, trees shall be setback a minimum distance, measured from the centre of the tree, from above and below ground utilities and property lines, as identified in Table 10-1.

Table 10-1
Tree Setbacks from Utilities and Property Lines

Utility / Property Line	Distance
Light Standards / Power Hardware	3.5 m
Fire Hydrants	3.5 m
Stop / Yield Signs	3.5 m
Other Signs	2.0 m
Private Property on Walkway Right-of-Way	1.0 m
Private Property on Open Parkland	3.0 m
Private Property on Boulevards	1.0 m
Crosswalks	3.5 m
Shallow Underground Utilities (Power / Gas / Communication)	1.0 m
Gas or Oil Right-of-Way	Contact Utility
Sanitary & Storm Sewers	2.0 m
Sanitary & Storm Sewer Manholes	2.0 m
Watermains	2.5 m
Curb Cocks & Water Service to Coniferous Trees	1.8m
Curb Cocks & Water Service to Deciduous Trees	3.5m
Storm & Sanitary Services	1.8m
* Ensure trees do not create sightline obstructions for vehicles approaching intersections / crosswalks.	
Note: Distance from overhead power utilities shall be as per the requirements established by the Utility Authority.	

5. At the time of planting, all deciduous / coniferous trees shall conform to Table 10-2:

Table 10-2
Tree Size Requirements

Deciduous Trees			
Height	**Caliper**	**Staking/ Ties**	**Rootball Diameter**
2.4 – 3.0 m	40 mm	1 stake w/ tie	600 mm
3.0 – 3.5 m	50 mm	2 stakes w/ ties	700 mm
3.5 – 4.5 m	75 mm	2 stakes w/ ties	850 mm
4.5 – 5.5 m	100 mm	2 stakes w/ ties	1050 mm
Coniferous Trees			
Height	**Spread**	**Staking/ Ties**	**Rootball Diameter**
1.8 – 2.0 m	975 mm – 1.0 m	2 stakes w/ ties	850 mm
2.0 – 2.5 m	1.0 m – 1.3 m	2 stakes w/ ties	850 mm
2.5 – 3.5 m	1.3 m – 1.5 m	3 guy wires w/ anchors	1220 mm

6. The following tables list all approved trees and shrubs within the Town. Alternate trees or shrubs may be approved following submission of a request for deviation to the Manager of Engineering, depending on quantity and location.

Table 10-3
Approved Tree Species – Streets and Boulevards

Botanical Name	Common Name
Deciduous	
Acer x freemanii - cultivars	Autumn Blaze / Sienna Glen Maple
Acer rubrum – cultivars	Northwood / Autumn Spire / Red Rocket Maple
Aesculus glabra 'Ohio Buckeye'	Ohio Buckeye
Fraxinus mandshurica 'Mancana'	Manchurian Ash
Fraxinus nigra 'Fallgold'	Fall Gold Black Ash
Fraxinus pennsylvanica - cultivars	Prairie Spire / Patmore Green Ash
Malus ssp. – cultivars	Gladiator / Pink Spire / Spring Snow / Thunderchild
Quercus macrocarpa	Bur Oak
Syringa reticulata – cultivars	Boulevard / Ivory Silk Japanese Tree Lilac
Tilia Americana – cultivars	Redmond / True North / American Sentry Linden
Tilia cordata 'Greenspire'	Greenspire Littleleaf Linden
Tilia x flavescens 'Dropmore'	Dropmore Linden
Ulmus americana[1]	American Elm
Ulmus americana 'Brandon'	Brandon Elm
Coniferous	
Picea abies	Norway Spruce
Picea glauca	White Spruce
Picea pungens	Colorado Green Spruce
Pinus cembra	Swiss Stone Pine
Pinus sylvestris	Scots Pine
Pinus uncinata	Swiss Mountain Pine

Note: American Elm are recommended for use in parks and open spaces due to wide spread and canopy.

Table 10-4
Approved Tree and Shrub Species – Municipal Reserves, Parks, and General Landscapes

Botanical Name	Common Name
Deciduous	
Acer negundo - cultivars	Manitoba Maple (male hybrids only)
Aesculus glabra	Ohio Buckeye
Crataegus x mordenensis 'Hawthorn'	Hawthorn
Celtis occidentalis	Hackberry
Elaeagnus angustifolia	Russian Olive
Hippophae rhamnoides	Sea Buckthorn
Juglans cinerea	Butternut
Malus ssp.	Crabapples
Prunus cerasus - cultivars	Evans / North Star / Carmine Jewel Cherry
Prunus maackii	Amur Cherry
Prunus nigra 'Princess Kay'	Princess Kay Plum
Pyrus ussuriensis 'Golden Spice'	Golden Spice Pear
Salix alba 'Sericea'	Silver Willow
Salix alba var. vitellina	Golden Willow
Salix pentandra	Laurel Leaf Willow
Sorbus ssp.	Mountain Ash species and cultivars
Syringa ssp.	Lilac species and cultivars
Ulmus americana	American Elm
Coniferous	
Abies lasiocarpa	Subalpine Fir
Abies sibirica	Siberian Fir
Larix sibirica	Siberian Larch
Picea abies 'Cupressina'	Columnar Norway Spruce
Pinus aristata	Bristlecone Pine
Pinus contorta var. latifolia	Rocky Mountain Lodgepole Pine
Pinus ponderosa	Ponderosa Pine
Shrubs	
Abies balsamea 'Nana'	Dwarf Balsam Fir
Acer ginnala	Amur Maple
Acer tataricum	Tatarian Maple
Amelanchier alnifolia	Saskatoon Berry
Alnus hirsuta 'Harbin'	Prairie Horizon Manchurian Alder
Aronia melanocarpa	Black Chokeberry
Chamaecyparis pisifera 'Filifera'	Japanese False Cypress
Forsythia ovata 'Northern Gold'	Northern Gold Forsythia
Hydrangea arborescens 'Annabelle'	Annabelle Hydrangea
Juniperus ssp.	Juniper species and cultivars
Lonicera tatarica	Tatarian Honeysuckle
Microbiota decussata	Russian Cypress
Philadelphus 'Blizzard'	Blizzard Mock-orange
Philadelphus x virginalis 'Minnesota Snowflake'	Minnesota Snowflake Mock-orange
Picea pungens 'Globosa'	Dwarf Globe Blue Spruce
Prunus x nigrella 'Muckle'	Muckle Plum
Prunus tomentosa	Nanking Cherry
Prunus triloba 'Multiplex'	Double Flowering Plum
Rosa ssp.	All landscape and shrub roses
Shepherdia argentea	Silver Buffaloberry
Syringa	Lilac species and cultivars
Taxus cuspidata 'Densiformis'	Dense Spreading Yew

Botanical Name	Common Name
Thuja ssp.	Upright Cedar species and cultivars
Weigela florida	Oldfashioned Weigela
Perennials	
Anemone sylvestris	Snowdrop Windflower
Aruncus dioicus	Goatsbeard
Astilbe ssp.	False Goat's Beard
Bergenia cordifolia	Bergenia
Delphinium grandiflorum	Siberian Larkspur
Echinacea purpurea	Purple Coneflower
Hemerocallis ssp.	Daylilies
Iris x germanica	Bearded Iris
Leucanthemum maximum	Chrysanthemum
Leucanthemum x superbum	Shasta Daisy
Monarda didyma	Scarlet Beebalm
Paeonia ssp.	Peonies
Phlox paniculata	Tall / Garden Phlox
Rudbeckia fulgida	Orange Coneflower
Rudbeckia hirta	Black-eyed Susan
Hylotelephium spectabile	Stonecrop
Grasses	
Calamagrostis x acutiflora	Feather Reed Grass
Elymus glaucous	Blue Wild Rye
Festuca ovina glauca	Blue Fescue
Helictotrichon sempervirens	Blue Oat Grass
Molina caerulea	Purple Moor Grass
Panicum virgatum	Switchgrass
Phalaris arundinacea	Ribbon Grass

Table 10-5
Approved Tree and Shrub Species – Naturalized Areas

Botanical Name	Common Name
Abies lasiocarpa	Subalpine Fir
Alnus alnobetula ssp. crispa	Green Alder
Alnus incana ssp. tenuifolia	Mountain Alder
Amelanchier alnifolia	Saskatoon Berry
Arctostaphylos uva-ursi	Kinnikinnick
Betula papyrifera	Paper Birch
Cornus stolonifera	Red Osier Dogwood
Corylus cornuta	Beaked Hazelnut
Elaeagnus commutata	Wolf-willow
Eupatorium maculatum	Spotted Joe Pye Weed
Juniperus communis	Common Juniper
Larix laricina	Tamarack
Picea glauca	White Spruce
Pinus banksiana	Jack Pine
Pinus contorta var. latifolia	Rocky Mountain Lodgepole Pine
Populus balsamifera	Balsam Poplar
Populus tremuloides	Trembling Aspen
Prunus besseyi	Western Sandcherry
Prunus virginiana	Western Chokecherry
Ribes americanum	Wild Black Currant
Ribes oxyacanthoides	Canadian Gooseberry
Rosa acicularis	Prickly Rose
Rosa woodsii	Wood's Wild Rose
Rubus idaeus	Red Raspberry
Salix discolor	Pussy Willow
Salix exigua	Sandbar Willow
Sambucus racemosa	Red-berried Elder
Shepherdia argentea	Silver Buffaloberry
Shepherdia canadensis	Russet Buffaloberry
Viburnum trilobum	Highbush Cranberry

Table 10-6
Approved Tree and Shrub Species – Stormwater Management Facilities

Botanical Name	Common Name
Above Normal Water Level	
Larix laricina	Tamarack
Picea glauca	White Spruce
Populus balsamifera	Balsam Poplar
Populus tremuloides	Trembling Aspen
Populus x jackii 'Northwest'	Northwest Poplar
Quercus macrocarpa	Bur Oak
Ulmus americana	White Elm
Salix alba var. vitellina	Golden Willow
Salix pentandra	Laurel Leaf Willow
Alnus incana	Grey Alder
Aronia melanocarpa	Black Chokeberry
Cornus stolonifera	Red Osier Dogwood
Fraxinus nigra	Black Ash
Salix amygdaloides	Peach Leaf Willow
Salix discolor	Pussy Willow
Salix exigua	Sandbar Willow
Spiraea alba	Meadowsweet
Viburnum trilobum	Highbush Cranberry
Submergent and Aquatics	
Alisma plantago-aquatica	Common Water-plantain
Carex ssp.	Sedges
Nuphar variegata	Yellow Pond-lily
Potamogeton zosteriformis	Flat-stem Pondweed
Sagittaria ssp.	Arrowhead
Scirpus ssp.	Bulrushes
Sparganium ssp.	Bur-reeds
Typha latifolia	Broadleaf Cattail

7. At the time of inspection and final acceptance by the Town, the plant material shall:

    - Conform to the standards for plant material listed above;
    - Be planted and staked for CCC;
    - Have stakes removed and be stable at FAC; and
    - Exhibit 2 years of healthy growth to the satisfaction of the Town.

10.13. Dutch Elm Disease

1. The presence of Dutch Elm Disease has been confirmed in the Edmonton Metropolitan Region. To prevent the spread of Dutch Elm Disease, the Alberta Government's Dutch Elm Disease Prevention and Control Measures shall be followed.

2. Elm wood should be burned immediately or disposed of at appropriate waste management facilities. Elm wood should not be place in waste collection bins or stacked, piled or otherwise saved.

3. Should diseased trees be identified, the City of Edmonton Dutch Elm Disease Integrated Pest Management Action Plan shall be followed.

10.14. Mulches

1. All mulch to be bark or coniferous / deciduous wood chip mulch with a size range of 50 mm to 100 mm and be free of non-organic material, wood preservatives, and diseased wood. Contains no more than 5% total volume of soil, sawdust, and peat moss.
2. The following mulches are prohibited for use unless otherwise approved by the Town: rock, gravel, riprap, shale, peat moss, manures, paper products, plastics, rubbers, and lumber containing chemicals or preservatives.

10.15. Site Furniture

1. The following list of the site furniture is to be used as a standard for all development within the Town unless otherwise approved. All furniture to be surface mounted unless stated otherwise.

   Picnic Table: Victor Stanley CM 56 or CM 4. Acceptable colours are: maple, silver, or titanium.

   Bench: Victor Stanley CM-50 bench c/w silver powder-coated steel and recycled plastic boards in maple finish

   Waste Receptacle: Victor Stanley RTH-24. Acceptable colours are: maple, silver, or titanium.
2. Alternate furniture will require a request for deviation, submitted to the Manager of Engineering, indicating supplier information, model number, colour and finish, and installation method prior to consideration.
3. Install all site furniture as per manufacturer's specifications. Table and bench legs to be installed in concrete with table top / bench slats being installed once concrete surfaces have been completed. Waste Receptacle to be surface-mounted once concrete surfaces have been completed.
4. All site furniture to be installed plumb and level and be aligned as per the landscape layout plans. Exposed mounting hardware to be painted to match site furniture colour following installation.
5. All site furniture shall be inspected prior to installation to ensure the furniture is free of all defects; site furniture with defects will be rejected and shall be replaced immediately.

10.16. Uniform Fencing

1. All fencing to be constructed 150 mm inside private property with the posts on the interior of the fence alignment.
2. Uniform wood fencing shall be constructed as approved by the Town. Colour of stain shall be indicated on the landscape plans and approved by the Town.
3. Wood fence shall be:
   - 1.8m in height
   - Have a gap not exceeding 50mm between finished graded and the bottom of the lower stringer.
4. Uniform fencing shall be constructed adjacent to and at the following locations:
   - Arterial roadways;
   - Parks and playfields;
   - Public walkways and PULs;
   - School sites;
   - Collector flanking and backing lots;
   - Town-owned lands; e.g., Fire Hall sites, etc.;
   - Medium and high density residential sites;
   - Neighbourhood Commercial sites;
   - Institutional sites; and

- Other areas as required by the Town.

Wooden fencing shall be installed where residential property adjoins the above-mentioned facilities. The Town may approve chain link fencing where facilities such as playgrounds, parks or school sites are adjacent to arterial roadways.

5. Chain link fencing and gates shall be constructed as approved by the Town. Finish and colour shall be indicated on the landscape plans and approved by the Town.
6. If a noise abatement fence is required', the fence shall be wood, a minimum of 1.8m in height with a fence density of 20kg per square meter. There shall be no gaps between finished grade and bottom rail.
7. Private development fencing adjacent to parks, playfields and school sites must be a minimum 1.2m.
8. Private development fencing adjacent to formal sports fields (or future sports fields) shall be a minimum 1.8m in height to protect against stray balls.
9. Pedestrian gates may be installed on all residential lots which back onto a public park or in special purpose areas such as valley lots. Gates shall be located approximately at the mid-point of each lot and shall be constructed to open inwards onto private property.
10. Wood rail fencing may be approved by the Town for selected park or walkway areas.
11. Fencing must achieve CCC. Fencing on private property does not require a FAC.

10.17. Warranty Period

1. The Developer shall be responsible for, and at their own expense to remedy, any defect, fault, or deficiency in the completed works during the 2-year Warranty Period.
2. Landscape Maintenance shall be conducted throughout the Warranty Period and shall include all measures necessary to establish and maintain plant material in an acceptable, vigorous, and healthy growing condition. The Maintenance activities are to include, but not be limited to:
   - Watering during establishment period and weekly throughout the Warranty Period;
   - Weeding monthly;
   - Mowing at regular intervals to maintain a maximum of 75 mm height;
   - Pruning any broken, damaged, diseased branches; and
   - Structural Pruning prior to FAC by ISA Certified Arborist.
3. Monthly Maintenance logs are to be kept throughout the Warranty Period and submitted for review and approval prior to FAC including all Maintenance items listed above.
4. Any required pesticide / herbicide applications are to be completed by a certified company or individual with prior Town approval of the location, mixture, and date of proposed application a minimum of 5 working days prior.
5. All weeds are to be controlled at CCC and throughout the Warranty Period, with full eradication at the time of FAC. All noxious weeds are to be removed and disposed of prior to flowerings wherever possible to reduce the rate to seed spread.
6. At the time of FAC site review, a maximum mortality / disturbance rate for that year's plant material is 25% of the overall plant count.
7. Any tree which is replaced during the Warranty Period will require an additional 2 years of Warranty; the additional 2 years of Warranty will commence on the date the tree is replaced. Security on the replaced trees will be held accordingly for the duration of the additional 2 years of Warranty, until the FAC is issued.

8. As an alternative to Item 7, the developer may make payment in lieu of the additional 2 years of Warranty on a tree replaced during the Warranty Period, upon approval of the Town. The payment will include the cost of the supply and installation of that tree and the cost of maintenance for the 2 years of Warranty.

9. Third party damage occurring during the Warranty Period will be reviewed by the Town on a case-by-case basis; upon review and consideration by the Town, the Developer may be held responsible for the third party damage.

11. PLAYGROUNDS

11.1. Preface

1. This section addresses the planning, design and construction of children's playgrounds. This standard shall apply to all new playgrounds and those undergoing redevelopment.
2. The owner/operator supports a "designed" approach to development of play and natural learning spaces under its jurisdiction.
3. Establish a comprehensive "program", from which to establish the design. As part of this process, input is to be sought from children, students, caregivers, and associated staff.
4. Utilize a "universal design" approach in the preparation of a site master plan which in turn complies with all applicable codes and regulations and provides for a diverse range of settings and play opportunities.
5. Playgrounds shall not be located in the low point of a park or open space to prevent flooding during rainfall events.

11.2. Intent

1. The intent of this section is to state the Town's interpretation of the Canadian Standards Association CAN/CSA Z614 Children's Playgrounds and Equipment and to outline supplemental standards. The standard identifies requirements intended to meet design objectives in a manner that promotes positive play experiences in a safe environment which has been designed considering the Town's environment.
2. CAN/CSA Z614 Children's Playgrounds and Equipment (CSA) has been adopted as a minimum standard; the Town has clarified and enhanced the CSA standards in several specific areas to reflect past experience.
3. In the event that the CSA technical committee on Children's Playgrounds and Equipment releases an updated version of CAN/CSA Z614, the updated version shall take precedence and replace the existing standard on the date of release. Playground designs that have not received final approval shall be evaluated and modified to comply with the new standard.
4. Deviations to the standard may be reviewed upon submission of documentation in support of the requested change by the Developer's Consultant. This information should provide examples of the proposed deviation that can be either field inspected or reviewed through literature. The Developer's Consultant is responsible to provide the documentation.

11.3. Definitions

Term	Definition
Annex H	A supplemental document approved for CSA Z614 titled "Children's Play and Equipment that are Accessible to Persons with Disabilities". The document outlines minimum requirements for playground accessibility. It is written in mandatory language for where it is required as a policy.
Canadian Standards Association (CSA)	A non-profit governing body of independent, autonomous organizations that work towards the further development and improvement of voluntary standardization in the national interest. CAN/CSA Z614 Children's Play and Equipment is the standard developed by the Technical Committee on Children's Playgrounds and Equipment. Any references to CAN/CSA Z614 shall mean the most recent version of the document.
Professional Judgment	Refers to the ability of an individual with current knowledge, skill, experience, or a combination of these characteristics, in the field of Playgrounds / Playground equipment design, use, or operations, which enables the person to form an opinion or make a decision, or both, concerning a matter within that area of expertise.

Term	Definition
Review Committee	The Town's Project Manager, Landscape Architect, and the Playground Supervisor for the project.
Measurement	Where both metric and imperial measurements are provided in a standard, the metric measurement shall be used.

11.4. Lighting

Streetlights shall be provided for each internal park area that does not abut onto a lit street. A streetlight shall be located at the point where each walkway opens out onto the park area.

11.5. Equipment

11.5.1. Bridges

1. Bottoms rungs of metal rail and chain bridges shall not be installed higher than 304.8 mm above the surface.

11.5.2. Chain

1. Chain extending into concrete piles shall be a minimum of grade 40 steel and no less than 6.35 mm (1/4 inch) diameter. If the chain extends into pour-in-place it requires a sleeve and pivot mechanism.
2. To eliminate lacerations caused from peeling plastic and to allow inspection to determine the degree of wear, all metal chains shall be free from plastic or rubber coating.

11.5.3. Climbing Walls

1. Grasping and standing points must be secured with at least two fasteners to prevent rotation.
2. Stand-alone climbing walls shall not exceed 2,743 mm in height. Stand-alone climbing walls with last climbable surface 1,829 mm and higher shall have a minimum 3,000 mm fall zone. Stand-alone climbing walls with the last climbable surface lower than 1,829 mm in height shall have a minimum 1,829 mm fall zone.
3. Climbing walls shall only be linked or functionally linked with one another or with composite structure platforms. All other play elements surrounding a climbing wall within the composite structure shall require a minimum fall zone of 1,829 mm.
4. Climbing walls that are functionally linked with one another shall be positioned no closer than 254 mm and no farther than 305 mm apart. Climbing walls positioned at distances greater than 305 mm from one another are not considered functionally linked and shall comply with standards specified in clause 11.4.3.2 for stand-alone climbing walls.
5. Climbing walls that are functionally linked with composite structure platforms shall be positioned no closer than 254 mm and no farther than 305 mm apart.
6. The highest horizontal or stepping surface on climbing walls that are linked or functionally linked to composite structure platforms shall not exceed 305 mm above the platform it serves to access for tot structures and 457 mm above the platform it serves to access for senior structures.
7. The maximum height permitted for a composite structure platform that is linked or functionally linked to a climbing wall shall not exceed 1,829 mm.
8. No rock-climbing wall shall be positioned in a manner to function as a sole means to link or access platforms (bridging).

9. Standards described for climbing walls in clauses 11.4.3.1 through 11.4.3.6 shall also apply to climbers.
    - Exception to 11.4.3.2: For rung ladders, flexible components, and arch climbers, the stepping surface used for final access shall not be above the designated play surface it serves (CSA-Z614 Transition from Access to Platform).
10. To prevent injuries from striking lower internal components during a fall, multi-dimensional (spatial geometric) stand-alone and attached climbers shall not incorporate lower, inner horizontal elements that are constructed of metal rungs or chains. (Examples: jungle gyms and castle towers).
11. "Fire Towers", "Mine Shaft" climbers, and similarly designed climbers that are constructed of metal rungs or chains and do not incorporate multi-dimensional internal components shall have a minimum internal fall zone of 1,800 mm.
12. "Chimney" climbers and similarly designed climbers that are constructed of rope or cable shall be exempted from the minimum internal fall zone restriction specified in 11.4.3.2 above.
13. Multi-dimensional climbers incorporating internal rope or cable elements shall be reviewed on an individual basis prior to granting approval.

11.5.4. Natural Form Play Structures

1. Natural form play structures require the same fall zone protection and height restrictions as conventional Playground equipment.

11.5.5. Overhead Equipment

1. All overhead equipment rungs shall be free from plastic or rubber coating.

11.5.6. Platforms

1. The maximum senior deck height shall not exceed 2,438 mm; see 11.4.6.2 for exception.
2. A deck higher than 2,438 mm shall be permitted if:
    - All barricade panels shall be continuous from floor to roof.
    - The deck shall have a roof (roof shall comply with section 11.4.7).
3. The maximum tot deck height shall not exceed 1,219 mm.
4. Spaces between adjacent platforms shall be closed off to prevent crawl through motion and entrapment. Protective infill panels (kick plates) shall be required between all upper and lower decks; refer to CSA-Z614 for specifications. Functionally linked platforms (including step pods) shall have a distance no less than 305 mm and no greater than 356 mm apart.

11.5.7. Roofs - Design Guidelines

1. Roof designs should not have easily accessible hand holds or gripping points on the roof and no accessible ornamental features on top of the roof (flags, chimneys, banners, etc.).
2. Roof designs shall have no adjacent components / features located in close proximity to roofs that promote access to the roof.
3. Roofs shall overhang the outside of the support posts to make them harder to climb.

4. Roofs shall have a minimum 30° slope.
5. Four 3D enlargement views of all roofs are required along with measurements of the distance between the top of barrier railing and the bottom portion of the roof.

11.5.8. Roofs - Unintended Use and Access to Roof

1. Equipment design shall not encourage roof access. Hazardous use is promoted when the upper surfaces of roofs become directly or indirectly accessible by the relative positioning of:
   - Barrier panels;
   - Climbers having rungs positioned higher than the adjoining deck; or
   - Any climbable component higher than the platform.
2. All efforts shall be made to identify and eliminate hazards during the design review process. The Review Committee shall use Professional Judgment to determine hazardous equipment relationships during design review. If the hazard becomes evident after the installation, the Review Committee shall use Professional Judgment to determine whether equipment relationships are hazardous. Identified hazards shall require modification, replacement, or removal.

11.5.9. Rotating Equipment

1. The Town has modified CSA standards for rotating equipment (see CSA definition "Rotating equipment"). Town standards apply to the full range of angled rotation between horizontal and vertical axis rotational equipment.
2. Vertical, semi-vertical (angled axis) rotational equipment intended for standing or sitting shall be considered on a trial basis.
3. Stand-alone vertical, semi-vertical (angled axis) rotational equipment intended for standing or sitting shall not be permitted unless the structural support is the axis (ex: spinner cups).
4. Upper body rotational equipment intended for grasping, having a diameter greater than 610 mm, shall require a minimum fall zone of 1.8 m and a no-encroachment zone.
5. Rotating equipment with a diameter of 1,219 mm or greater shall be installed over a rubber protective surface that extends a minimum distance of 1.2 m beyond the edge of the apparatus.
6. Multi-overhead event upper body rotational grasping wheels less than 610 mm are exempt from the Town modifications listed above.
7. Rotating equipment axis must have a surfacing line indicated to meet CSA standard of 350 mm.

11.5.10. Sand and Water Tables

1. Sand and water tables shall not be constructed of fiberglass material.
2. Sand and water tables must have grounding tabs, stainless steel studs, or holes for grounding wires.
3. Sand and water tables grounding wires must be enclosed in conduit and be installed at a minimum depth of 51 mm (2 inches) below subbase.
4. Sand and water tables must drain freely.

11.5.11. Slides

1. The maximum acceptable height for all starting platforms shall not exceed 2,438 mm; see 11.4.11.2 for exception.
2. A deck higher than 2,438 mm up to a maximum of 2,743 mm shall be permitted if all of the following conditions are met:
   - The deck shall have a roof which complies with this standard;
   - All barricade panels shall be continuous from floor to roof (including slide entrance);and
   - No opening shall exist between top of slide sidewall and deck vertical support. The sitting section shall have guardrails, handholds, and a means of forcing the user to sit down (sit-down bar, hood, guardrail, etc.).
3. All slides shall be metal. To minimize solar heating of the sliding surface, slides shall be positioned with chutes facing between northwest and east locations.
4. All slides shall be designed and installed to eliminate all entanglements; see Playspace Equipment Standard, Testing Methods section.
5. A no-encroachment zone shall be provided in front of the lower exit protective surfacing zone of a slide regardless of the vertical height.
6. Slide exit points shall be installed over a rubber protective surface that extends a minimum distance of 1.2 m beyond the edge of the apparatus.

11.5.12. Swings

1. Senior swing belt seats and tot swing bucket seats shall not be located within the same bay.
2. Senior swing crossbar heights shall be between 2,438 mm and 3,048 mm above the protective surface.
3. Chain shall be a minimum of grade 40 steel, with corrosion-resistant coating and shall have a minimum gauge of 6.4 mm (1/4 inch). The working load limit shall be minimum 590 kg (1,300 lbs).
4. Installed senior swing seats under load shall be between 406 mm minimum and 508 mm maximum above the surface.
5. Tot bucket swing seats shall be between 610 mm and 762 mm above the protective surface. Tot swing crossbar heights shall be between 2,134 mm and 2,438 mm above protective surface.
6. Concrete footings shall be a minimum of 610 mm deep (measured from the bottom of the hole to the top of the clay surface, with vertical or angled-drilled holes and 305 mm in diameter. An anchoring bar shall be inserted through the vertical support at a minimum 305 mm depth.
7. For swings that incorporate two single vertical posts as structural supports, the concrete footings shall be a minimum 762 mm deep and 610 mm in diameter. An anchoring bar shall be inserted through the vertical support at a minimum 305 mm depth.
8. Swing seats at rest shall be installed over a rubber protective surface that has a minimum radius of 0.6 m.

11.5.13. Telescopes

1. Telescopes shall not have the ability to retain liquid.

11.6. Other Hazard Controls

1. Above grade cross-structural bracing systems shall not be permitted in the Town. Footings cannot protrude above the subbase. If a subbase grade elevation change exists, the footing shall conform to grade.
2. Equipment attached to decking (chain ladders, slides, arch climbers, fire poles, etc.) shall be anchored in concrete. Pinning in clay is not acceptable. Ground bound ends shall be secured in concrete footings with a minimum depth of 610 mm and a minimum diameter of 152 mm. There shall be a minimum depth of 305 mm surfacing above the anchor.
3. Talk tube pipes and mounting clamps shall be buried below the top of the subgrade.
4. All mis-drilled holes on playground structures shall be filled with the appropriate material, such as a rivet or weld.
5. To prevent post-settlement of pour-in-place safety surfacing subbase, any mis-drilled piling hole shall be filled in with clay and compacted level to subgrade.
6. All threaded fasteners shall be secured with threadlocker or a type of locking nut.

11.7. Outdoor Fitness Equipment

1. Outdoor fitness sites must meet playground protective surfacing standards.

2. Outdoor fitness sites must include suitable drainage.

11.8. Prohibited Playground Equipment

1. Types of prohibited equipment:
    - Tube see-saws;
    - Spring toys with chain;
    - Mesh decks and mesh in-filled components;
    - Poly/plastic bubble panels;
    - Pressure-treated wood*;
    - Untreated wood*;
    - Sectional rubber safety tiles;
    - Poly/plastic slides;
    - Roller slides;
    - Playground carpet protective surfacing; and
    - Teeter-totters with automobile tires as shock-absorbing material.

*All untreated wood products for playground equipment (exception: Town crews performing day to day repairs or playground conservation may use untreated wood products to maintain existing wood playgrounds).

11.9. Natural Sliding Hills

Sliding hills shall be grassed mounds with a maximum height of 6 m and a minimum width at the top of 4 m. The maximum slope of the hill shall be 1:3 (vertical : horizontal) at the top of the hill, gradually flattening to 1:6 to flat through the runoff zone.

If any hill can be expected to be used for tobogganing, there should be no obstructions such as roads, plants, benches, fences, power boxes or play equipment present on the slope or at the foot of the hill (i.e. runoff zone) for a distance of 18 m.

Grassed mounds should be orientated to the north or east if possible.

Whenever possible, top soiling and seeding or sodding of hills and berms should be delayed until the spring following construction to allow for settlement of the soil.

11.10. Protective Surfaces

1. Regardless of the type of protective surfacing, all playground footprints shall have compliant weeping tile that allows sub-drainage from the footprint to an approved outflow system.
2. The following safety surfacing materials are approved for use:
    - Engineered wood fiber specification;
    - Poured-In-Place rubber safety surfacing specification;
    - No rubber colour changes within a single pod if possible;
    - Seamless application of rubber is strongly preferred;
    - Sand cannot be used as a protective surfacing;
    - No change of surfacing within fall zones; and
    - Other alternative materials may be considered and shall be subject to the new product approval process.
3. The minimum standard for depth of loose fill at installation shall be 356 mm. The minimum standard for depth of loose fill after settling shall be 305 mm.

11.11. Spray Decks

1. No climbable structures.
2. No features designed for exiting into pools of water (i.e. water slides)
3. A separate standards document will need to be established.

11.12. Testing Methods

1. See all testing methods in the current CAN/CSA-Z614.
2. Testing method for all playground safety surfacing shall refer to playground safety surfacing impact testing protocol. The playground shall remain closed until all testing protocol has been implemented and compliance achieved.

11.13. Annex H

7. The Town supports building barrier free playgrounds and providing support and increasing opportunities for people of all abilities to grow and learn together through outdoor play. The framework for this is provided in Annex H of the CSA-Z614 standards.
8. The scope of Annex H does not include the area surrounding or beyond the playground including, but not limited to, parking, washrooms, drinking fountains, and recreation facilities.
9. For more information about accessible design beyond the playground see CSA B651.

11.14. Test / Trial and Prohibited Equipment

1. New equipment can be installed and tested on a trial basis. See prohibited equipment list in section 11.7.

11.15. Equipment Layout Design Approval Process

1. The general process for approving equipment layout design plans shall be as follows:

- Site development plan to be confirmed and approved prior to finalization of equipment layout design. Fencing, lighting, walkways, washrooms, storage, emergency phone, trees, park furniture, trash units, etc. are amenity considerations for playspace facilities on a project-by-project basis, accounting for location, and surrounding and adjacent uses.
- Review Committee will review the proposed equipment layout.
- Supplier will be contacted about equipment and/or layout concerns identified by the Review Committee and given the opportunity to give feedback and/or suggest alternate equipment or layout.
- Final equipment approval by the Review Committee and project can proceed to the construction detail phase when all funding is in place.
- All design changes shall be solely communicated to the Town for approval, prior to implementation.
- Playground equipment shall be constructed and installed according to specifications as shown on the approved design plans, notes, and manufacturer's specifications. Equipment suppliers' plans shall include the following:
    - Project title / description;
    - Equipment layout plan revision # and date of revision;
    - Provide an itemized final list of equipment installed;
    - Listing / logo of each equipment supplier represented;
    - Statement of CSA compliance;
    - Specified protective surface zones around the equipment with no change of surfacing within entry;
    - Specified no-encroachment zones;
    - Heights of all decks / platforms, overhead apparatus, and swing crossbars;
    - Built-in scale;
    - 3D drawings from all 4 angles;
    - 3D drawings of all roofs in playground design;
    - Roof heights showing distances from all climbable structures and components;
    - Installation detail for roof design;
    - Table specifying number and type of ground level play components confirming accessible requirements according to Annex H;
    - Age-specific designation for applicable equipment;
    - PDF version of the AutoCAD drawing;
    - AutoCAD drawing (.dwg);
    - Drawing in metric, to scale;

- Drawing in 2D;
- All drawing layers turned on that are required for use by Town (i.e., play apparatus, fall zones, labels, pour-in-place layout, piles);
- Cross-references associated with the drawing;
- Blocks associated with the drawing;
- Equipment drawn in the playground pod;
- Equipment labeled;
- Pile layout for all equipment;
- Fall height chart;
- Universal Access chart specifying the number and type of ground level play components confirming accessible requirements according to Annex H;
- PDF highlighting the piles the installer would like staked by survey; and
- CSA conformance disclaimers.

11.16. Identification and Correction of Deficiencies

1. The inspectors are authorized to identify and prioritize deficiencies by applying the CSA standard, the Town's playground standard, and their Professional Judgment to identify hazardous conditions and maintenance concerns.
2. Deficiencies shall be documented by the Developer's Consultant. In determining or clarifying a deficiency and its severity, the inspectors are authorized to:
    - Assign class hazard criteria to prioritize correction deadlines;
    - Quote references from or provide an interpretation of CSA and the Town playgrounds standards manuals; and
    - Document deficiencies in cases where no written standard currently exists.
3. The Review Committee shall make every effort to identify and correct hazards and maintenance concerns on the plan prior to the installation. They shall use their Professional Judgment to determine deficiencies pertaining to equipment relationships that encourage hazardous use on plans and as-built composite structures.
4. All equipment deficiencies shall be corrected by the supplier and approved by the Review Committee.

11.17. Equipment Hazard Classification

The inspectors shall assign class hazard criteria* to indicate the nature and priority of repairs:

EQUIPMENT HAZARD CLASS	CRITERIA*	NATURE CORRECTION	CORRECTION TIMELINE (upon issuance of the inspection report)

CLASS 'A'	Any condition which has the potential to be life threatening or can cause severe, permanent injury.	Equipment shall be removed, modified, or replaced	The playground will not be opened until deficiencies are rectified.
CLASS 'B'	Any condition which has the potential to cause serious but non-disabling injury.	Equipment shall be removed, modified, or replaced	The playground will not be opened until deficiencies are rectified.
CLASS 'C' Equipment hazards and all construction-related deficiencies	Any condition which can cause slight injury or may not cause injury but does not meet current standards.	Equipment may be removed, modified, replaced, or be placed on a one-year trial and monitored, or require no action or follow-up	14 working days or as negotiated

*Hazard priority ranking classification adapted from The International Loss Control Institute. Currently published in The Consumer Product Safety Commission (CPSC) Playground Audit Guide.

11.18. Responsibilities of the Supplier / Contractor

1. The supplier shall provide a Canadian Playground Safety Institute (CPSI) certified installer for playground equipment. The certified installer shall be on site at all times during the installation of the playground equipment.
2. The playground site shall not be opened until all deficiencies are corrected and the CCC is issued. Only the Town's playground inspector shall collaborate with the Town to remove the security fencing, if appropriate for the stage of the site development.
3. The supplier is responsible to provide the Town with a fully stocked maintenance kit and a manufacturer's installation / maintenance manual upon the completion of each playground installation before the playground will be opened. These will include detailed specifications for each component.
4. The Developer's Consultant shall provide a timeline charter to the Town before construction begins.

11.19. Construction Specifications

The security fencing shall be 1,829 mm. Each panel shall be attached to adjacent panels with fastening brackets.

1. Clay footings are not allowed. Alternatives for large footings are concrete or soil cement.
2. No vegetation (other than grass) within 10 m of a playspace.

11.20. Warranty Replacement Work and Maximum Replacement Times

The supplier shall ensure that replacement parts are available within the Warranty Period within the following timelines:

TYPE OF EQUIPMENT	TIMELINES
Fasteners & Bolts	5 working days or as negotiated
Common Wear & Tear Components, Moving and Swivel Components	7 working days or as negotiated
Cables, Ropes, & Connectors	14 working days or as negotiated

Technical or Electronic Replacement Parts	7 working days or as negotiated
Manufactured Structural Components	Within 6 weeks or as negotiated

11.21. Protective Surfacing Installation and Specifications

11.21.1. Poured-In-Place Rubber Surfacing

11.21.1.1. Summary

1. Section incudes: poured-in-place resilient playground safety surfacing
2. Related work: playground equipment installation, subsurface preparation, storm drainage, security fencing, and similar work shall be provided by the general contractor or other assigned party.
3. At the time of sign-off to the surfacing contractor, the surfacing contractor accepts the like and kind of the base preparation as suitable to the base applied.

11.21.1.2. References

1. CAN/CSA-Z614 & ASTM F1292-04: Standard Specifications for Impact Attenuation of surface systems under and around playground equipment.
2. ASTM 2157: Running Track Standard.
3. ASTM D2859: Standard Test method for flammability of finished textile floor covering materials as per ASTM 2157.
4. ASTM 1951: Standard specification for determination of accessibility of surface system under and around Playground equipment.

11.21.1.3. Description of System

1. Product: poured-in-place protective safety surfacing or approved equal.
2. Description: A dual density, resilient impact attenuating safety surfacing system that is mixed, troweled, and compacted on site to form a resilient seamless surface. Surface system shall consist of an impact layer and a wear layer consisting of recycled tire crumb, chips, or thread, blended with a polyurethane binder throughout the entire depth of surfacing.
3. Materials: The surfacing contractor shall be responsible for all labor, materials, tools, equipment, and applicable taxes to perform work and services required for the installation of the protective surfacing.

    - **Impact Layer:** Binder to rubber ratio range (by weight) for impact layer shall be within 12-15% unless otherwise specified. Deviations to this specification may be considered but will require pre-approval by the Town. Impact layer shall be installed to thickness sufficient to the impact attenuation requirements as determined by the designated play surface or a location otherwise specified in CAN/CSA-Z614 and the protective surfacing beneath it (see CSA Elevated Platforms).
    - **Wear Course:** Shall be manufactured using a mixture of EPDM rubber granules and polyurethane binder mixed at a ratio range of 21-23% binder to rubber (by weight) unless otherwise specified. Deviations to this specification may be considered but will require pre-approval by the Town. Wear course shall be installed to a minimum thickness of 9 mm.
    - **Colours:** EPDM coloured crumb shall be used unless otherwise specified. Colour shall not be obtained by way of pigmented binder unless specified or pre-approval by the Town is obtained. Coloured rubber shall be colorfast and UV-resistant. Colours may be applied as one solid color, as a combination of variegated speckles, or as specified by design.

11.21.1.4. Quality Assurance

1. CAN/CSA-Z614 & ASTM F1292: Gmax less than 200; HIC less than 1,000 within 3 temperature laboratory tests (standard lab test temperature is -1°C). Field testing will be conducted within temp range of -5°C and +49°C in a clean condition.
2. The fall height around elevated platforms shall be measured from the protective surfacing to 724 mm above the elevated platform when intended for children 18 months to 5 years old and 950 mm above the elevated platform when intended for children 5 to 12 years old. The fall height of an elevated platform that is totally enclosed by protective barriers that meet the roof shall be the height of the elevated platform.
3. In the case of inclement weather, the subbase contractor shall be responsible for ensuring that reasonable steps have been taken to protect the subbase area from the undesirable weather elements. In cases where heavy rainfall or other threatening environmental conditions persist, compaction retesting may be required prior to the installation of the impact layer or wear course surfacing.
4. In keeping with the need for ambient temperatures required for installation, poured-in-place rubber surfacing shall not be installed when temperatures fall below 10°C. Deviations may be granted upon special request and approval by the Town, in which case necessary heating and hoarding may be required. Rubber surfacing installed outside the specified conditions must still comply with the specified Warranty conditions.

11.21.1.5. Submittals

1. Surfacing contractor shall supply a materials list of items proposed for the identified project.
2. Surfacing contractor shall supply manufacturers' specifications and other related test data needed to prove compliance with specified requirements.
3. Verification samples showing product color and texture will be provided prior to installation.
4. Surfacing contractor shall supply recommended Maintenance and repair procedures to the owner operator.
5. Surfacing contractor shall supply certificate of qualifications of surfacing installer.
6. Surfacing contractor shall supply MSDS & product data sheets for all component materials supplied.
7. Warranty documents shall be supplied in writing to all parties delineating specific terms and conditions for all applicable Warranty items.

11.21.1.6. Supply

1. Construction drawings with sufficient detail will be provided to the surfacing contractor as part of the scope of work tender package.
2. Subbase preparation and specific installation requirements shall be supplied to the surfacing contractor prior to installation by way of the tender package or as directed by the Landscape Architect.

11.21.1.7. Installation

1. Refer to subbase, drainage, and installation requirements as specified in defined scope of work detail supplied by project tender and Landscape Architect.
2. Areas and conditions within the defined scope of work shall be examined prior to commencement and officially signed-off by the general contractor, Landscape Architect, surfacing contractor, and Town as suitable to proceed.

3. Conditions detrimental to timely and proper completion of the work must be corrected prior to proceeding with installation. Installation shall not proceed until unsatisfactory conditions are corrected.

4. In areas where the surfacing contractor requires thicker protective surfacing (following subbase sign-off), the surfacing contractor shall be responsible for modifying the subbase accordingly.

11.21.1.8. Subbase Preparation

1. Compacted Aggregate:

   - 150 mm — 200 mm, minus 20-25 crushed gravel base spec, with < 5% fines, compacted to 95% or better standard proctor density.
   - Shall maintain a planarity of ± 6 mm over 3 m in any direction unless otherwise specified.
   - When protective surfacing is applied after equipment installation it is difficult to obtain the required compaction standard. Hand tamping may be required in areas difficult to access. In such cases, compaction around the existing post or support structure shall be tamped with a hand block in 50 mm lifts, adding moisture as each lift is applied.
   - 150 mm depth subgrade preparation beneath crushed gravel base spec; required compaction of 98% or better standard proctor density.

2. Concrete / Asphalt (as per section 4):

   - Concrete 120 mm minimum thickness; asphalt 75 mm minimum thickness
   - Slope as specified on drawings
   - Light broom finish
   - Asphalt must be at least two weeks old and washed down once prior to application of base mat material

3. Edges (refer to manufacturer's edge details):

   - Concrete retainer as specified on drawings
   - Sloping edge at 30% minimum
   - Keyway, 50 mm width, 100 mm depth

4. Protection:

   - Site shall be protected from unintended walking on installed surfacing until 100% cure is obtained, unless otherwise agreed to and a sign-off inspection has occurred with the surfacing contractor and Town. Cure time will vary depending on temperature and humidity. Generally, curing is achieved within 36-48 hours. Product will cure faster when outside temperature is warm and humid and much slower when cold and dry.

11.21.1.9. Warranty

1. **Materials & Workmanship** - protective surfacing supplier shall provide a minimum 2-year Warranty on materials and workmanship.

2. **Performance Criteria** - Protective surfacing installed must meet the performance criteria of less than 200 Gmax and less than 1,000 HIC when tested according to ASTM F1292. Test results performed on the installed protective surfacing using a Triax2000 instrument (conforming to the technical requirements of ASTM F1292) between 10 to

25 days after the installation will be required and must confirm the Gmax of less than 200 and HIC of less than 1,000.

3. An independent third party will conduct the Triax test. The Town will arrange for the on-site field test within 10 to 25 days after installation. At the discretion of the Town, additional follow up test(s) may be conducted prior to the issuing of the FAC. If a follow up test is applied, the performance criteria required shall comply with the current CAN/CSA-Z614 standard in effect at the time of installation.

11.21.2. Sand

Sand is not permitted as a permanent surface.

11.21.3. Engineered Wood Fibre (EWF)

11.21.3.1. Scope

10. Notwithstanding other mulch that may be supplied to the Town, engineered wood fibre (EWF) is very specific to playground safety surfacing. The following specification shall be adhered to for EWF when supplied to the Town for playground construction tenders.

11. The supply and delivery of EWF for playground safety surfacing and accessibility during a playground construction project must adhere to the following specifications.

11.21.3.2. General

1. EWF shall be uniform and natural in composition and conform to these specifications as well as any manufacturer specifications of the supplier.

2. EWF shall be free from vegetation or other extraneous material. The fibre should come mainly from deciduous trees and not contain such items as bark, twigs, or coniferous needles.

3. All EWF shall be clean, free from prohibited materials (peat moss, manure, raw compost, paper products, plastics, rubbers, gelatinous sprays, plywood or other lumbers containing chemical adhesives or wood preservatives) and must conform to the sieve analysis shown below.

4. EWF shall be of high quality, free from diseases, molds, fungi, and insect infestations. All organic fibre shall be free of inorganic materials (metal, glass, rock, and other foreign materials).

5. EWF shall contain no more than 2% of dust floating on a liquid of specific gravity.

6. The allowable moisture content shall be no more than 2%.

11.21.3.3. Selection

1. The source of the EWF must be submitted to and approved by the Town before the commencement of operations.

2. Substitutions during the construction season will not be allowed unless the new supplier meets the requirements and has filled out a new supplier application.

3. The contractor shall use reasonable care in the selection of material as to produce a uniform product, so that it will meet the following sieve analysis.

11.21.3.4. Sieve Analysis

1. When tested by means of laboratory sieves, the EWF shall meet the following gradation requirements and be uniformly graded between the limits:

	Minimum	Maximum	Total
3/4"	99%	100%	100%
3/8"	75%	100%	86%
No. 16	0	15	12

2. Samples for the EWP shall be provided. Samples shall be approximately 2 to 3 kg contained in plastic lined jute bags. The type of material bagged shall be clearly identified.

11.21.3.5. Delivery, Storage and Handling – EWF Delivered Directly to Site

1. When EWF is to be delivered from the mill, the average gradation of any three consecutive tests shall conform to the appropriate sieve analysis prior to shipping from the mill. This analysis must be provided to the Town early in the spring of each construction season before any release to site.
2. EWF may be inspected and tested at any time during the contract period as directed by the Town. If the material does not conform to these specifications then it may be rejected and delivery refused.
3. Non-compliant EWF already delivered to site shall be removed by the supplier at the supplier's expense within 24 hours.

11.21.3.6. Base Preparation for EWF Material

Preparing base for EWF products must be done in accordance with the manufacturer's specifications for their product.

11.21.3.7. Spreading, Topping and Tamping of Material

Contractor or supplier shall spread fibre evenly throughout the footprint in tamped lifts of 150 mm to an overall settled depth of 305 mm. To ensure the settled depth, the fibre shall be topped up to a minimum of 50 mm above the top of the curbing.

12. TESTING PROCEDURES

12.1. General

The contents of this section have been moved to Section4.21 Roadway Materials Testing, Section 5.20 Sanitary Sewer Testing, Section 6.28 Storm Sewer Testing, Section 7.16 Watermain Testing, and Section 7.17 Reservoir Testing.

12.2. Roadway Materials Testing

The contents of this section have been moved to Section 4.21 Roadway Materials Testing.

12.3. Sanitary Sewer Testing

The contents of this section have been moved to Section 5.20 Sanitary Sewer Testing.

12.4. Storm Sewer Testing

The contents of this section have been moved to Section 6.28 Storm Sewer Testing.

12.5. Watermain Testing

The contents of this section have been moved to Section 7.16 Watermain Testing.

12.6. Reservoir Testing

The contents of this section have been moved to Section 7.17 Reservoir Testing.