

CITY OF YELLOWKNIFE

Development & Design Standards



April 2022

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- B Design Specifications and Provisions
- C Design Drawings Specifications
- D Process Checklists and Applications



Acronyms, Abbreviations, Definitions

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

Applicant	synonymous with Developer and Landowner
Compliance	shall mean the actions by the development are consistent with these standards as determined by the City's Engineering Division, or Engineer acting in their behalf.
Construction Completion Certificate	shall mean a certificate issued by the City, confirming that the work is complete and operational, that all deficiencies have been resolved to the satisfaction of the City, and that the warranty period for the work has commenced. (Also see Section 2.8).
Consulting Engineer	shall mean the professional engineer retained by the Developer to be responsible for the design, layout and supervision of installation, recording of as-built information, certifying the installation is in accordance with the standards, design drawings and design specifications, and performing those duties in connection with the provision of municipal services as set out in these design standards. As an agent of the Developer, Consultant Engineer shall be synonymous with Developer, Owner, Consultant, and Agent.
Contractor	shall mean any person, persons or corporation which shall undertake the installation of municipal services on behalf of either the Developer or the City.
Department	shall mean the Department, or an individual, appointed by the City to represent the City in any functions related to their governing responsibility.
Developer	shall mean a person, persons or corporation which has applied to subdivide and/or develop, or to service an existing parcel of land, whether as the land owner or applicant.
Easement	shall mean an easement, interest or right held by the City for the purpose of providing utilities, access or drainage.
Final Acceptance Certificate	shall mean a certificate issued by the City, confirming that the work is complete and acceptable to the City, that all deficiencies and maintenance work has been resolved to the satisfaction of the City, and that the warranty period for the work has expired. (Also see Sections 2.2 & 15.3).
Green Initiatives or Environmental initiatives	refers to the planning of infrastructure utilizing methods that reduce environmental damages or re-contribute to environmental health through energy and carbon emissions reduction.



Landscape Consultant	shall mean the Landscape Architect retained by the Developer to be responsible for the design, layout and supervision of installation of landscape and related work, recording of as-built information, certifying the material and installation is in accordance with the standards, design drawings and design specifications, and performing those duties in connection with the provision of municipal services as set out in these design standards.
Leadership in Energy and Environmental Design for Neighbourhood Development (LEED-ND)	is a Canadian based rating system that integrates the principles of smart growth, urbanism and green building into a national system for neighborhood design.
Low Impact Development (LID)	refers to systems and practices that use or mimic natural processes that result in the infiltration, evapotranspiration or use of stormwater in order to protect water quality and associated aquatic habitat.
Maintenance	shall mean the Developers sole responsibility for any and all repairs and replacements of any improvements which may, in the opinion of the City, become necessary during the warranty period.
"Municipal" "City"	shall all refer to the City of Yellowknife.
Municipal Engineer	synonymous with "Engineering Services Division" or "Engineering"
"Open Space" or "Public Open Space"	shall mean any parcel of land or body of water which is set aside and reserved for public use including Municipal and Environmental Reserve.
"Parks and Recreation Division" or "Parks Division"	shall mean the Department, or an individual, appointed by the City to represent the City in any park or landscape related improvements.
"Public Utility Lot (PUL)"	shall mean land designated for a public utility.
Urban services	shall generally mean an area with a municipally owned sanitary collection system and water distribution system.
Warranty Period	shall mean a minimum three (3) year period of time commencing with the issuance of a Construction Completion Certificate and ending with the issuance of a Final Acceptance Certificate.



Document Transition Policy

The policies and requirements in this document, Development & Design Standards for Municipal Infrastructure, shall take effect exactly 90 days after the of the date of the amendment, noted as a footer on each page. For any current Subdivision or Development Agreements the requirements of those conditions of the Agreements shall apply. For any future phases, the requirements of this document shall apply unless superseded by a new Agreement.

This current version of the Development Standards is Version 1.0 amended herein on the _____ day of _____, 20____.

Changes to Version 1.0 from the previous document named V 1.0 include:

Document Version	Amendment Date	Effective Date
V 1.0	April 12, 2022	June 1, 2022



1.0 Introduction to Document

1.1 Foreword

The "City of Yellowknife – Development & Design 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 City of Yellowknife (City).

Figure 1.1 illustrates the City's overall growth demands, and how demands are met. Specific parties and their roles in addressing growth needs, approvals, construction and long-term operation by the City, are illustrated in the City's process flow charts found in **Appendix A – Development Process Flow Charts**.

These Standards will encourage good engineering and construction practices while providing Developers the flexibility to fairly explore and implement viable economic alternatives while providing an end product that is economical to operate and maintain by the City. Any deviation from these Standards will require a formal request complete with justification to the City and the City's approval prior to implementation. Standards deviation process for design details can be found in **Appendix A – Development Process Flow Charts – Construction Drawings Submission Procedure**.

These standards in no way relieve the designer from the responsibility to ensure that the system components are adequate to meet the use intended and the demands described herein. The City shall be entitled to rely on the work of the Developer and their Consultant with whom the ultimate design responsibility shall rest.

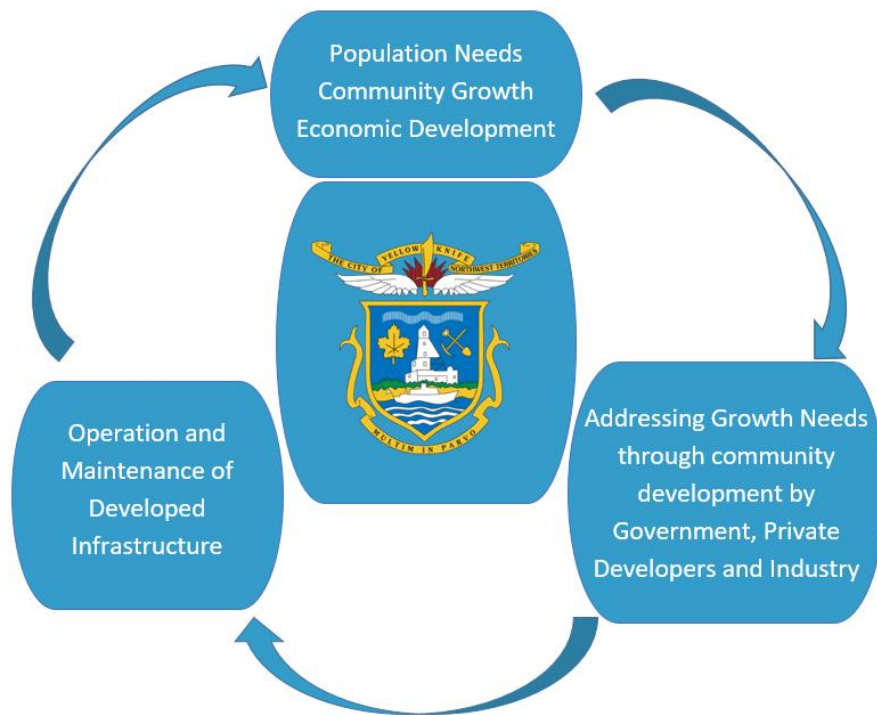
The standard drawings referred to in the various sections form an integral part of these design standards.

This manual will be updated on an as-required basis. Persons in receipt of, and using the "City of Yellowknife – Development & Design Standards for Municipal Infrastructure", are urged to contact the Engineering Division and ensure they have the latest revisions. Revised documents are available on the City of Yellowknife website or upon request from the Engineering Division.

It is the intent that these Standards will be a useful tool for all persons interested in the development of land, redevelopment of land, and installation of infrastructure in the City of Yellowknife.



Figure 1-1: Growth in Yellowknife



1.2 Scope of Development & Design Standards

These Standards and Procedures apply to the conceptual and preliminary design, detailed design and construction of the following services in both residential, commercial and industrial developments within the City:

- Preparation and submission of Design Briefs, Conceptual Development Plans, Area Structure Plans, Outline Plans, Preliminary and Detailed Engineering Drawings.
- Water distribution systems and lot servicing.
- The Sanitary and Storm sewage collection systems and related appurtenances, lot grading, and lot servicing.
- Design and construction of facilities including reservoirs, pump houses, sewage lift stations, and storm water management facilities.
- Municipal road right-of-way including the roadway lanes, sidewalks, curb and gutter, and roadway improvements.
- Private (franchised) utilities (i.e. power, lighting, telephone and cable T.V.).
- Landscaping requirements including hard and soft elements and walkway systems.

These Development Standards also apply to the undeveloped or the redevelopment of residential and industrial/commercial lands. Where a unique situation arises that requires deviation from these Standards, a written request must be submitted in advance, to the Planning & Development Department.



1.3 Relationship: City and Development

The City provides and maintains typical municipal infrastructure servicing to all new developments upon construction completion acceptance. Upon final acceptance by the City, all municipal improvements, and the responsibilities thereof, are assumed by the City. For that reason, the City is charged with the responsibility of ensuring that all municipal services provided in developing lands meet minimum acceptable standards, so that the municipal services can be properly operated and maintained for the benefit of the end users of the new development.

City involvement, inspection and approval is therefore required in all aspects of the servicing and development of land.

1.4 Access to Information and Protection of Privacy Act (ATIPP Act)

The Freedom of Information and Protection of Privacy Act is in effect for the City and it gives any person a right of access to the records in City 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 City 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, financial, labour relations, scientific and technical information.

While the City will endeavour to use the *Access to Information and Protection of Privacy Act (ATIPP 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 City's custody and control.



2.0 Procedures for Development

2.1 General

In addition to these Standards and Development Procedures, the City also maintains and enforces:

- City of Yellowknife Community Plan
- Master Transportation Plan
- All Master Plans
- Area Structure Plans
- Developers' Design Briefs
- Strategic Outline Plans
- Waterworks Master Plan
- Sanitary Sewer Master Plan
- Storm Drainage Master Plan
- Parks and Outdoor Recreational Master Plan
- City of Yellowknife Zoning By-Law

To expedite the processing of applications, Developers and/or their agents are encouraged to arrange preliminary meetings with the Planning & Development Staff, and to coordinate all submissions through the Planning & Development Department.

2.2 Procedures and Processes

An outline of the major steps and development procedures from subdivision approval to final acceptance are listed but not limited to the following:

- Approvals for Subdivision development is the responsibility of the Government of Northwest Territories
- Pre-application meeting (suggested) with Planning & Development Department to discuss intent and processes.
- Submit a development brief showing conformity to the City of Yellowknife Community Plan, Land Use By Law, Master Transportation Plan, Waterworks Master Plan, Sanitary Sewer Master Plan, Storm Drainage Master Plan, Parks and Outdoor Recreational Master Plan, Area Structure Plan and/or Area Redevelopment Plan.
- Amendments to the City of Yellowknife Zoning By-Law and Area Structure Plan if necessary.
- Preparation and approval of the conceptual plans and supporting documents.
- Subdivision plan, development agreement and supporting documents.
- Development and finalization of easement and Municipal Reserve Agreements.
- Preparation of detailed Engineering Drawings and Specifications and Landscape Plans and Specifications.



- Approval of Engineering and Landscape drawings and specifications from The City of Yellowknife.
- Apply and obtain Permits to Construct
- Negotiation and finalization of a Development Agreement.
- Preparation and registration of the Legal Plan of Subdivision.
- Execution of Site Servicing Agreement.
- Financial Security Arrangements.
- Tender and award by Developer.
- Complete construction activities in accordance with these Standards and the approved plans and specifications.
- Submission of As-built Drawings and related data.
- Inspection by City and issuance of Construction Completion Certificate(s).
- 2 year maintenance period(s).
- Final overlays, correction of deficiencies.
- Inspection, Final Acceptance Certificate and takeover by the City.
- Release of Financial Security.

The overall development approval process is illustrated on the flowcharts found in **Appendix A – Development Process Flowcharts**.

2.3 Submission and Approval

2.3.1 Development Brief

The Developer is required to submit a development brief to the Planning & Development Department for the purpose of discussing the project. Proposed development displayed in development brief is subject to conformity with the City's **Community Plan** and **Zoning By-law**.

The Developer is encouraged to consider Green Initiatives in the site layout and building design for energy efficiency including Low Impact Development and LEED-ND.

The development brief will be the basis for the preliminary discussion of the project between the Developer and the City, and may avoid the expenditure by the Developer and their Agents of time, effort and money on concepts and plans that are unacceptable to the City. The Development Brief is to include, but not be limited to, the following:

- Site conditions and topography including man-made and natural constraints to development;
- Existing land uses and building conditions;
- Future land uses, lot sizes and density;
- Proposed population and housing types if applicable;
- Adequacy of schools, parks, open spaces and community services to accommodate the proposed residential development;
- Provision for redevelopment charges if required;



- Transportation requirements including upgrades to roadways and noise attenuation;
- Requirements for upgrading water, sanitary, and storm water servicing infrastructure including proposals for financing these upgrades;
- Architectural controls if required;
- Indication of how issues and opportunities raised during the community consultation process are to be addressed if encountered; and
- Other requirements deemed appropriate by the Approving Authority.

2.3.2 Conceptual Plans and Supporting Documents

After the conclusion of the preliminary discussion and Preliminary Design, the Developer shall prepare a Design Brief for submission to the Planning & Development Department, which includes conceptual plans of the roadway network, site servicing layouts and landscape improvements. The plans will be accompanied with detailed calculations supporting the means by which the development will be serviced including all proposed right-of-way, easements and utility lots.

Conceptual Landscape Plans are to provide an overview of the development indicating community themes, reserve areas, open play areas, pedestrian linkage, and facilities including play grounds, gazebos, rest areas, and other park amenities.

2.3.3 Detailed Engineering Drawings and Specifications and Landscape Plans

Upon acceptance of the conceptual engineering and landscape plans the Developer shall submit for approval to the Planning & Development Department, a digital copy of design drawings and specifications, sewer, storm and water distribution network diagrams and geotechnical report sealed by a Consulting Engineer registered in the Northwest Territories. Submission of documents must be completed through **CityView** in digital format only.

The review by the City is for the sole purpose of ascertaining conformance to the Engineering Servicing Standards, the City of Yellowknife Community Plan and the City of Yellowknife Zoning By-Law. Approval 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 Servicing Standards and other Federal and Territorial Rules and Regulations.

Engineering drawings, diagrams and reports must be sealed by a Professional Engineer registered in the Northwest Territories. Landscape plans are to be submitted with the Engineering Drawings and be signed by the Landscape Consultant, who is a member in good standing of the NWT Association of Architects.



Other information required to be submitted in the approval process includes but is not limited to:

- Design calculations
- Traffic Impact Analysis (TIA)
- Grading Plans
- Sanitary Sewer Design
- Storm Sewer Design c/w Stormwater Management Report
- Water Network Design and Analysis
- Construction drawings and contract documents
- Geotechnical Reports
- Environmental Assessment Reports

Information required to be submitted following City's review and approval of detailed design:

- Approved Franchised Utility Design;
- Estimates for Oversized and Cost Shared Infrastructure;
- Copy of approval from NWT Environmental Protection; and
- Signed tender documents, specifications, and construction schedules.

2.3.4 Design Approval by the City

The Planning & Development Department shall inform the Developer whether or not the Developer's submission has been approved. Should the City not approve of any part of the Developer's plans or proposals, they will be returned to the Developer for revision to the satisfaction of the City.

2.3.5 Review Costs

The Developer will be responsible for any review costs deemed appropriate by the City. Costs include, but are not limited to:

- Specialized consulting expertise required by the City to review development proposals, concept plans and drawings.
- Additional staffing required to review developments.
- Review of complex re-submissions and deviations from the Standards.
- Where excessive errors and omissions are encountered.
- Where insufficient information is provided.
- Where improper procedures are followed.

The cost of review may take several forms including:

- Lump sum fee charged to the Developer.
- Invoiced cost by specialized consultant plus mark-up for handling and administration.



Each and every submittal by the Developer will be reviewed by the City and the Developer will be informed of the anticipated review costs prior to beginning of formal review period. The Developer shall reimburse the City prior to review of re-submissions.

2.3.6 Development Agreement

The Planning & Development Department has general guidelines for the preparation of Development Agreements. The Developer will coordinate with the Planning & Development Department for requirements and the preparation and execution of the document.

2.3.7 Right-of-Ways and Easements

The Municipal Land Management Department has general guidelines for the preparation of Right-of-Way Agreements and Crossing Agreements. The Developer will coordinate with the Planning & Development Department for the requirements and the preparation and execution of the documents.

2.3.8 Bare Land Condominiums

The requirements for lot grading, deep services, roads intended for municipal transit routes, drainage easements and landscape improvements within municipal reserves will comply with the requirements of these Servicing Standards.

2.3.9 Design Revisions after Approval

Whenever it is necessary, for any reason to make any changes to the design drawings after they have been approved, digital copies of the original drawings affected shall be submitted with the proposed changes shown in red, accompanied by a letter outlining the reasons for the required changes. The Planning & Development Department will inform the Developer within 7 days after receipt if the proposed changes meet with the approval of the City. One copy of the requested change will be signed and returned, accompanied by a letter authorizing the changes to be made on the original approved detailed design drawings. No changes are to be made to any original approved drawings without following this procedure.

2.3.10 Standards Deviation Process

The Developer shall identify and provide justification for any deviations or non-conformances from these Services Standards in the submission. Otherwise, the submittal of detailed design drawings will be assumed to be in accordance with the Standards.

The City has the ultimate authority with regards to the setting of minimum standards and not accepting deviations from these Standards. However, should a Developer strongly disagree with a deviation from the standard not being accepted by the City, he may appeal the decision. The overall process is illustrated on flowchart in **Appendix A – Development Process Flow Charts**.



Note that under no circumstances will a deviation from these Standards be considered by the City without the submission of detailed documentation demonstrating the justification for the deviation and the added benefit to the City.

The costs incurred by the City for review of submissions, and resubmissions are the responsibility of the Developer (see Section 2.3.5 Review Costs).

2.3.11 Acts, By-Laws and Standards

Any reference to Acts, By-Laws and Standards shall be to the most recent edition of these documents.

2.4 Approval by Other Agencies

The Developer shall submit documentary evidence to the Planning & Development Department that permission has been received from appropriate authorities where crossing pipelines, highways, or other facilities will occur. Evidence is to be provided with submission of detailed plans and specifications construction cannot commence until this evidence has been submitted and accepted by the City Engineering Division.

Agencies that may require involvement during the planning and design process include:

Table 2-1: Agencies, Approvals, and Notifications

Plan / Permit / Study / Notification	Proponent/Agency
Development Permit	City of Yellowknife
Building Permit	City of Yellowknife
Subdivision Approval	GNWT Department of Lands
Land Acquisition (Lease or Sale of Land)	City of Yellowknife
Demolition Permit	City of Yellowknife
Highway Access Permit	GNWT Department of Infrastructure
Water Licence	Mackenzie Valley Land & Water Board
(water, wastewater, landfill uses)	Mackenzie Valley Land & Water Board
Land Use Permit	Mackenzie Valley Land & Water Board
Fisheries Authorization	Department of Fisheries and Oceans
Navigable Waters Authorization	Transport Canada
Authorization for Development in Vicinity of Airport	N.A.V. Canada
Environmental Permits	Environment and Natural Resources
Emergency Services (closed roads, new roads)	Office of the Fire Marshall



2.4.1 Canada Post - Community Mailboxes

If applicable to the subdivision, the Developer will submit an overall subdivision layout plan (Area Structure Plan) to Canada Post, Delivery Planning & Development Department for establishing the location, size and details of community mailboxes. For further information and requirements consult the Canada Post “Postal Delivery Standards Manual, Planning for Postal Service” available from Canada Post. Upon approval of location and details by Canada Post, community mailboxes are to be shown on all applicable drawings and brochures.

Upon receipt of the mailbox location plan from Canada Post, the Consultant shall ensure that the community mailbox locations meet the following criteria, wherever possible:

- At the corner of the lots towards the side of houses, not along the front.
- Next to an open space or playground.
- On the predominately homecoming side of the street, so that people can pick up their mail on the way home without crossing the street.
- Not along City major thoroughfares.
- Not closer than 10 m from a fire hydrant or bus stop.
- Not on a utility easement or over a utility trench (deep or shallow).
- Not directly adjacent to streetlight standards, utility poles, traffic signs, or any raised utility box such as a transformer.
- The location of the boxes shall not impede the pedestrian and vehicular sight distances.
- The Consultant shall advise Canada Post of the acceptability of the locations, or suggest a revised location for consideration by Canada Post. Submit final locations to the City.

2.5 Development Permits

Unless otherwise agreed to by the City, no development permits shall be issued until the subdivision plan, complete with easements is registered and the Construction Completion Certificate has been issued for the underground utilities including franchise utilities.

2.6 Review Checklist

The City utilizes checklist forms to assist in the evaluation of a Developer’s submittal. Found in **Appendix D – Checklists and Application Documentation**

The form shall not be considered complete and it remains the Developers’ responsibility to ensure all aspects of the Engineering Servicing Standards and Development Procedures and other regulations are addressed accordingly.



3.0 Roadway Design Criteria

3.1 General

This section covers the design and construction of roads and roadway facilities to be built or improved in the City of Yellowknife.

General construction requirements, materials and procedures are included to guide engineers in the preparation of project specific specifications. Sound engineering practice must prevail on all projects.

The actual street pattern, street widths, including number of access locations, turning lanes, intersection signalization, shall be identified through a traffic study carried out by the Owner's Engineer or a sub-consultant experienced in traffic engineering if requested by the City. Owners are encouraged to contact City early in the process to determine whether a traffic study is required.

3.2 Road Right-of-way

Rights-of-way shall be of adequate width to accommodate the carriageway, sidewalks, boulevards, underground utilities, street lighting, etc. in an acceptable manner. Easements will be as required and approved by the City

Minimum rights-of-way requirements are as follows:

Table 3-1: Minimum Road right-of-way Dimensions

Type of Road	Width in Meters
Lane/Alley	6 m
Local Roads: <ul style="list-style-type: none"> • Residential • Commercial/Industrial 	20 m 20 m
Arterial Roads	30 m
Residential Cul-de-Sac Bulb (Radius)	17 m



3.3 Geometric Design

Roads shall be designed in accordance with the geometric design standards outlined in the latest edition of the Manual of Geometric Design Standards for Canadian Roads, Transportation Association of Canada and the Urban Supplement to the Geometric Design Guide for Canadian Roads, also by the Transportation Association of Canada. The following table was developed from the above mentioned standards:

Table 3-2: Geometric Requirements for Roadway Design

	Local Roads	Collector Residential	Arterial Minor	Arterial Major
TAC Classification	ULU	UCU	UAU	UAD
Estimated Daily Traffic	L1, 000	L8, 000	5,000-10,000	5,000-20,000
Min. Design Speed (km/hr) ¹	50	60	60	60
Min Crown (mm)	150	200	200	200
Min. Pavement Width (m)	11	13.0	2 @ 7.5	2 @ 7.5
Min Radius (m)	115	185	120	130
Superelevation ¹	No	Optional, 6% Max.	Yes, 6% Max.	Yes, 6% Max.
Min. Curve Lengths (m)	65	115	180	180
Max. Gradient	7%	6%	5%	5%
Min. Gradient²	0.5%	0.5%	0.5%	0.5%
Min. Intersection Spacing (m)	60	60	200	200
Min. Curb Return Radii (m)	10	10	10	15

Note:

¹ Varies with roadway design speed and superelevation

² - 1% preferred

A maximum grade of 8% is not to be exceeded for all driveways.

3.4 Right-of-Way Grading

The grading of the streets and lanes shall be compatible with the overall grading of the lots and public lands within the subdivision.

The area between back of curb or sidewalk and property line shall be graded to provide a uniform slope (3% maximum) from top of concrete to finished grade at the property line as established on the lot grading plan.

3.5 Lanes

Paved lanes shall have a minimum of 60 mm of asphalt with a minimum 6 meters wide driving surface. Paved lanes shall be crowned.



The structure for lanes shall be designed to provide capacity for a fully loaded twin axle garbage truck. The Developer is to consult the City's Engineering and Public Works Division before commencing preliminary design to determine if bike lanes are planned for a given area.

3.6 Sub-grade Construction

The sub-grade shall be excavated or filled to the required grade over the full width of the roadway. Where sub-grade fill is required it shall be placed in maximum lifts of 300 mm in depth. Each lift shall be compacted to a minimum of 95% of Standard Proctor Density.

Sub-base material (50 mm minus) is to be compacted to a minimum of 98% Standard Proctor Density. Base material (20 mm minus) minimum compaction is 100% Standard Proctor Density. Lifts for sub-base and base are not to exceed 150 mm.

Table 3-3: Minimum Sub-grade Depth Requirements

	Residential	Arterial	Industrial	Commercial
Crushed Gravel (mm)	300	450	450	300

3.7 Concrete Design

3.7.1 Concrete Mix Design

Concrete mixes shall be designed by a qualified testing laboratory engaged and paid for by the Developer. The mix design shall be submitted to the Consulting Engineer for approval a minimum of 7 days prior to delivery of any concrete to the site. As a minimum, and unless specified elsewhere, the properties of the concrete shall be:

- The specified compression strength at 28 days is 25 MPa. The strength level of 25 MPa shall be considered to be achieved if the averages of all sets of three consecutive strength tests equal or exceed the specified strength and no individual strength tests is more than 5 MPa below the specified strength;
- The concrete shall contain not less than 315 kg of Portland Cement per cubic meter of concrete produced;
- The maximum water to cementing materials ratio is 0.45;
- The total air content of the concrete shall be maintained between the limits of 5 - 8%;
- For hand placed concrete the slump shall be 60mm ± 20mm;
- For slip-formed concrete the slump shall be 30 ± 10mm;
- Concrete placed after September 30 shall attain the specified compressive strength in 7 days;
- The nominal maximum size of coarse aggregate is from 14 to 20 mm;
- Chemical admixtures to be used only when approved by the Consultant; and
- Use of calcium chloride shall not be permitted.



3.7.2 Tolerances for Concrete Structures

- All exposed concrete surfaces shall be checked by the Developer with a 3 m straightedge, and any water pockets or deviations in line or grade exceeding 6 mm shall be corrected immediately.
- Differences in elevation at any given point from the design grade shall not exceed ± 20 mm.
- Deviations in alignment at any given point from that specified shall not exceed ± 15 mm and the variation over 100 m intervals shall not be greater than 25 mm.

3.7.2.1 Sidewalk, Curb and Gutter Failures

Replacement of affected sections required when one or more of the following exist:

- Any crack greater than 3 mm in width, with no vertical displacement, or chipping or spalling edges;
- Any crack with vertical displacement, chipping or spalling edges;
- Any longitudinal crack greater than or equal to 1.5 mm in width;
- A displacement, at a joint of greater than or equal to 12 mm;
- A dished surface of sidewalk or gutter;
- A reverse cross fall, or cross fall greater than 8% or less than 0.7%;
- A random cracking of any size;
- Any feature considered detrimental to pedestrian safety or appearance of the sidewalk and/or curb and gutter; and
- A corner cut exists.

All breakout shall end at a contraction, expansion or surface joint. The edge of a surface mark shall be sawn to a depth of 50 mm minimum, while contraction joints may be neatly hand chiseled to produce a true straight joint. The contact edge shall be exposed to produce a good bond.

Joints which have expanded up to a maximum of 13 mm without vertical displacement shall be sealed by use of an approved flexible sealant.

3.8 Pavement Design

Paved roadways shall be designed in accordance with the Asphalt Institute method of pavement design using the maximum traffic loadings to be expected within the next 20 years. The design parameters such as traffic count, percentage of trucks, California Bearing Ratio (CBR) etc., are to be outlined to the City.

The Developer shall engage a soils testing firm to completed sub-grade testing and confirm adequacy of the pavement design. The Developer shall submit a Geotechnical Report including detailed road structure design calculations as part of the submission of engineering drawings.

The complete pavement shall have a tightly knit structure and be free from segregation, surface cracking and uneven joints.



3.8.1 Tolerances

3.8.1.1 Asphalt Thickness

A minimum compacted thickness of asphaltic concrete design shall be:

Table 3-4: Minimum Compacted Asphaltic Concrete Thickness

Type of Road	Thickness in Millimeters
Residential:	
Local & Minor Roads	60 mm
Arterials	100 mm (In two lifts)
Commercial/Industrial:	
Local & Minor Roads	60 mm
Arterials	100 mm (In two lifts)

A minimum compacted thickness of 60 mm of hot mix asphalt concrete shall be placed on all streets unless specified otherwise. Pavement structure shall be constructed to the minimum thickness specified in **Table 3-4**. Pavement deficient in thickness by 13 mm or more shall be removed and replaced at the Developer's expense. For pavement found deficient by more than 3 mm but less than 13 mm, it will be assessed a penalty payment based on a percentage of the pavement contract unit price calculated as the ratio of the square of the average thickness found to the square of the specified thickness for the affected areas. The percentage determined above will represent the percentage of paving completed and the difference from the total value of the work will be paid to the City by the Developer. No adjustments will be made for thickness greater than specified.

3.8.1.2 Density

The mixture shall be compacted immediately after spreading to a minimum density of not less than 97% of the 75 Blow Marshall Compaction test. Asphalt which fails to meet the density specified shall be removed and replaced at the Contractor's expense or an assessed payment reduction may be substituted, according to the following:

Table 3-5: Pavement Density Assessed Payments

% of 75 Blow Marshall Density	% Assessed Payment
97.0	0
96.0 - 96.9	5
95.0 - 95.9	20
94.5 - 94.9	60
Below 94.5	Replace



3.8.1.3 Asphalt Cement Content

Project average asphalt cement content deviating from design value shall result in the following value adjustment.

Table 3-6: Asphalt Cement Content Deviation

Deviation	% Value Payment
0.1-0.2	70
0.2-0.3	50
Greater than 0.3	No Payment

3.8.1.4 Base Course Construction

The base course shall not be less than the equivalent to that given in **Table 3-4** or an alternative design as approved by the City to meet sub-grade and traffic requirements.

3.9 Curb and Gutter

Curb and gutter shall be constructed on the roadway as follows:

- **Residential Streets** - Rolled face curb and gutter on both sides
- **Collector Streets** – Rolled face curb and gutter on both sides
- **Arterial Streets** - Barrier face curb and gutter on both sides.
- **Industrial Roads and Lanes** - No curb and gutter.

3.10 Cul-de-Sac

Cul-de-sacs must be treated as a special road and meet the following requirements:

- The **maximum length** is to be 120 m to the centre of the bulb. In special instances the City may adjust this standard.
- The **minimum radius** in bulb is 13.0 m to curb face.

3.11 Sidewalks

Residential Sidewalks are primarily built with a concrete mix design stamped by an engineer. See **Appendix B – Design Specifications and Provisions** for details. In certain settings the City may request an asphalt multi-use pathway. This requires a stamped asphalt mix design to be submitted to the City, further details can be found in **Appendix B– Design Specifications and Provisions**.



Sidewalks are required according to the following:

- **Residential Streets** – Concrete sidewalk on both sides of the roadway.
- **Arterial Streets** – Concrete sidewalk on one side of the road in downtown core, multi-use pathway (3.0m width) outside of the downtown core
- **Industrial Roads and Lanes** – No sidewalk required.
- **Cul-De-Sacs** – Sidewalk around full length of cul-de-sac
- **Commercial** – Concrete sidewalk on both sides of the roadway.

3.11.1 Requirements

All sidewalks designed for installation within the City’s right-of-way shall be:

- Constructed adjacent to school sites and commercial sites and on both sides of the roadway if so required by the City Engineer.
- Constructed on all other lands that, in the opinion of the City, generate significant pedestrian traffic.
- Stamped with the year of installation and the name of concrete contractor at roadway intersections.
- Constructed with para ramps at the locations of pedestrian crossings.

3.11.1.1 Subgrade Construction

Backfill is to be provided by the developer to bring sidewalk to the required grade and cross section of the sidewalk. Material and compaction requirements are in accordance with roads, as outlined in **Section 3.6** of these Standards and **Appendix B – Design Specifications and Provisions**.

3.11.2 Dimensions

Sidewalks and curbs shall be depressed at street intersections to permit easy passage of carriages and wheelchairs.

Table 3-7: Sidewalk Design Dimensions

Parameter	Residential	Arterial	Commercial/Public Institutions
Width (m)	1.5	1.5	1.8
Construction Joint Intervals (m)	1.5	1.5	1.5
Thickness (mm)	120	120	120
Thickness at Crossings (mm)	150	150	180
Steel Rebar Reinforcement at Crossings	No	No	Yes



3.11.2.1 Longitudinal Grades

Grades shall be provided by the Developer's Engineer.

Sidewalk cross-slope down to the curb shall be consistent within 2 to 4% minimum-maximum limits.

3.11.3 Multi-Use Path

Minimum width 3.0 m asphalt multi-use pathways may be requested in lieu of concrete sidewalk. The granular base is to be 150 mm minimum wider than the asphalt on each side. Multi-use pathways shall follow side-walk standards for all driveways.

3.12 Traffic Signs and Signalized Crosswalks

The actual intersection signalization, shall be identified through a traffic study carried out by the Developer's Engineer or a sub-consultant experienced in traffic engineering if requested by the City. Developers are encouraged to contact City early in the process to determine whether a traffic study is required.

3.12.1 Traffic Signs

Standard traffic signs and traffic control devices shall be installed by the Developer and shall be in accordance with the Manual of Uniform Traffic Control Devices of the Transportation Association of Canada.

3.12.2 Street Signs

Reflectorized street signs, of the type and colour satisfactory to the City and mounted on 50 millimeter diameter metal posts shall be installed by the Developer as per City requirements.

3.13 Street Lighting

3.13.1 Installation

Local Power Utility guidelines for the design and installation of street lighting shall govern street light installation complete with fixture as per the Local Power Utility Standard. It shall be the Consultants responsibility to coordinate with the utility companies to establish the location of their existing and proposed services.



3.13.2 Costs

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

The City will pay rental charges to the utility company providing street lighting, for the operation of street lights thus installed after the Final Acceptance Certificate is issued.

3.13.3 Location

Street lights shall be placed at locations not interfering with proposed driveways and in general shall be located in line with the extension of common property lines between two lots.

The face of the posts shall be at least 1.5 m clear of the face of the curb or 0.3 m of the back of the sidewalk or as approved by the City and the Local Power utility.

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

Street lights with underground wiring shall be provided for all public walkways which are not in street right-of-way and which in addition are not located immediately adjacent to private dwelling units or public housing.

3.14 Bike Lanes

The City encourages bikeways, walking trails, and multi-use pathways in all new Developments. Bike lanes may be requested on collector and arterial roads, at City discretion, and at the Developer's expense. Walking trails and multi-use pathways may be required at various locations, at the Developer's expense



4.0 Water Distribution

4.1 General

This section covers the design and construction of watermains and their accessories to be built in the City of Yellowknife.

4.2 Design Flow

The waterworks system shall be designed as part of the overall City distribution system. The design manual of the American Water Works Association (AWWA) shall be the guide for this design with allowances made for Yellowknife specific flow distribution, freeze protection, and minimum/maximum required system pressures. The system shall be capable of delivering the maximum day demand plus fire flow or the peak hour flow, whichever is greater.

Velocities at peak hour demand shall not exceed 1.5 meters per second. Velocities at maximum day plus fire flow shall not exceed 3.0 meters per second.

4.3 Water Demand

The rate of water demand shall be determined by the land use density basis of either the ultimate subdivision design population, or if population is unknown:

- 50 persons per gross developable hectare; or
- 3.5 persons per residential dwelling, whichever is greater.

The minimum per capita water demands for the City, except where historical data indicates otherwise, are as follows:

Table 4-1: Minimum per Capita Water Demands

Demand	Rate of Water (Litres/capita/day)
Average Daily	450
Maximum Daily	900
Peak Hour	1350

Commercial and industrial areas shall be designed on the basis of equivalent population.

Table 4-2: Population Equivalency for Non-Residential Areas

Area	Design Population (Equivalent People/Hectare)
Commercial	37
Industrial	30



4.4 Fire Flows

Fire flows shall be in accordance with the recommended standards of the Insurance Bureau of Canada. Generally these are:

Table 4-3: Design Fire Flows by Building Type

Type of Building	Required Fire Flow (litres/second)
Single Family Residential	76
Multi-Family Residential	90
Walk-Up Apartments	115
Institutional	90
Commercial	265
Light Industry	225
Building on Trucked Service	See section 4.16

4.5 Design Computations

The Hazen-Williams formula for flow in waterpipes shall be used:

$$Q = CD^{2.63}S^{0.54} \bullet (278.48)$$

Where

- Q = Rate of flow in L/s
- D = Internal pipe diameter in m
- S = Slope of hydraulic grade line in m/m
- C = Roughness coefficient is 125 for all mains

4.6 Design Parameters

The following pressures shall be designed for:

Minimum pressure at peak hour demand	= 280 kPa (40 psi)
Maximum allowable pressure	= 875 kPa (125 psi)
Minimum system pressure during a fire	= 140 kPa (20 psi)

4.7 Hydraulic Network Analysis

The following shall be required for Hydraulic Network Analysis:

- Network analysis shall be performed by utilizing the Hardy-Cross Method or a suitable alternative computer program acceptable to the City.
- Ensure the minor pressure losses through valves and fittings are accounted for.



- The City may require the Consultant to analyze the development’s watermain network on the City’s overall computerized network model. The analysis shall determine the effect that the development’s watermain network may have on the City’s overall watermain network supply and circulation flows.
- The City may require configuration and/or size alterations to the developments’ watermain networks based on the results of this section.
- For City records, a report outlining the results of the network analysis shall be submitted with the engineering drawings.

4.8 Minimum Pipe Diameter

The following diameters shall be used for:

Table 4-4: Required Pipe Diameters

Type of Pipe	Minimum Diameter (mm)
Distribution Mains	150 (6")
Return Mains	100 (4")
Fire Hydrant Connection	150 (6")

Main sizes may be increased as considered necessary by the City to accommodate future development.

4.9 Watermain Circulation

It is the responsibility of the Developer and their consultant to fully understand the City water system (inquire with City Engineering Division for description of system in area of development)

To reduce the risk of frozen watermains, the City’s watermain system continually circulates from a pumphouse (or recirculation building), through the distribution system and back to a pumphouse. The circulation is created by a combination of water demand and a continuous flow in mains that returns to a pumphouse.

The Consultant shall, where mains are to become the property of the City, utilize the City’s circulating water system as part of the development’s watermain freeze protection. The watermains shall loop from a City main, through the development and back to a City main. No “dead end” watermains are permitted. For large or remote developments, the City may require recirculation buildings to provide circulation if the City’s overall system is adversely affected.

To design the circulation through the development, the Consultant must consider such factors as, but not limited to, the following:

- Periods of minimum demand;
- Heat loss from watermains, services and related appurtenances;



- Potential flow reversals during water demand fluctuations;
- Water temperature (parameters subject to City approval);
- Low water usage during the early stages of the development's construction; and
- A hydraulic network analysis (see **Section 4.7**).

Circulation pumps in maintenance holes, water bleeders, aqua-flows, or heat trace shall not be used to facilitate circulation (or freeze protection) in the development's watermain.

Partially open valves or orifice plates shall not be used to create watermain circulation. All main valves shall be in a fully open or fully closed position.

During staged construction of the development, and subject to approval and conditions as set out by the City, the Developer may use temporary circulation pumps or water bleeders.

The Consultant shall provide a heat loss analysis of the developments circulating watermain network. Ensure all contributing heat losses, such as services, are included.

Increasing the thermal insulation of the watermain system to achieve adequate circulation flows is not acceptable.

4.10 Water Main Grades

The watermains shall be graded to prevent the formation of air pockets in the main. Air pockets may cause an "air lock" of the main creating a stop or restriction of the circulation flow; therefore, the following is required:

- Watermains shall be continuously graded to low points at hydrant vaults or water maintenance holes. Here the air can collect and be released by vent valves or hydrants and in the event a section of the watermain is shut down during cold weather conditions, the main can be drained of all water.
- For looped watermains that positively grade to a high point in a cul-de-sac, the last full length (6 m) of each pipe shall be installed at 0.0%. A minimum of three water services (6 pipes) shall be tapped along the flat section of main. The three services shall be installed at the one or eleven o'clock position of the pipe (not vertical). The intent is to remove the air through the service pipes when the services are actively supplying water to an occupied building.
- During the development's construction, the services mentioned above may be inactive until such time as the lot is developed. To temporarily clear air from the high point in the main, one or more of the services shall be extended to the surface at the property line where a bleed valve and circulation pump shall be installed. Approval and conditions, as set out by the City, shall apply.



- Subject to City approval, air may be removed by grading the watermain to a high point located at a water service 100 mm dia. or greater. The water service must positively grade to the meter in an occupied building. This situation is not preferred and acceptance is subject to the size difference between the main and the service.
- Return mains shall be continuously graded to hydrant vaults or water maintenance holes where the air can collect and be released by vent valves.

4.11 Watermain Alignments and Depths

Minimum horizontal separation of watermains from sanitary or storm sewers shall be in accordance with governing authorities. Consideration must also be given to allow for the future excavations of an adjacent sanitary or storm main without undermining the watermains or related appurtenances.

A minimum depth of cover to top of main shall be 1.5 m.

Minimum vertical clearance between top of sewer and bottom of watermain at crossings shall be 450 mm. In no case shall watermains pass under a sanitary sewer.

The preferred location for watermains is under the paved roadway surface a minimum of 1.5 m from any curb or sidewalk.

The minimum centerline to centerline horizontal separation between two parallel watermains shall be as follows:

- 0.6 m for 100 and 150 mm dia.;
- 0.8 m for 200 and 250 mm dia.; and
- 1.0 m for 300 mm dia. and greater.

Where applicable and practical, locate watermains in areas of bedrock or competent soil. Avoid placing mains and, especially, bends or fittings in areas of poor ground conditions such as permafrost.

4.12 Watermain Valve Locations

Where two or more main valves are installed in close proximity (i.e. hydrants, crosses, and tees) they shall be installed in an insulated hydrant vault or water maintenance hole (See **Appendix B – Design Specifications and Provisions**). For operational and maintenance purposes, the City prefers to locate all watermain valves in hydrant vaults and water maintenance holes. Subject to City approval, a buried main valve with valve box may be allowed, where practical. However, the Consultant shall strategically locate hydrant vaults and water maintenance holes so that the direct bury of main valves is not necessary.



Valves shall be located as follows:

- Not more than 200 m apart;
- Not more than 1 hydrant isolated due to minimum number of valve closures;
- Maximum of 3 valves need to be closed to isolate any one section; and
- A maximum of 20 lots would be cut off from the water supply if a section of watermain is isolated.

Valves are not required to isolate or by-pass a looped watermain into a cul-de-sac or dead end street if the requirements of **Section 4.13** are met.

Service lines 100 mm and larger shall have an isolation valve with valve box brought to the surface. The valve shall be located close to the main to prevent the service stub and valve from freezing if the valve is shut off. An exposed service stub length of 50 mm shall be provided between the bell faces of the service valve and the watermain fitting so that the stub can be connected.

Where applicable and practical, locate valves in areas of bedrock. Avoid areas of poor ground conditions such as permafrost.

4.13 Hydrant Location & Installation

A plan showing all proposed hydrant locations shall be submitted to the City for approval. Fire hydrants shall generally be located at street intersections or on extensions of property lines and placed as follows:

- In insulated hydrant vaults (see **Appendix B – Design Specifications and Provisions**). Direct bury or in-line hydrants are not allowed;
- At 1.0 m from the curb return at a street intersection or on extensions of property lines;
- Not more than 150 m apart in residential area, not more than 90 m apart in multi-family, commercial and institutional areas, and not more than 90 m from any dwelling;
- In accordance with “Water Supply for Public Fire Protection - A Guide to Recommended Practice” (published by Public Fire Protection Survey Services);
- 2.0 m back from curb or 1.0 m from property line;
- The top of the hydrant flange shall be 200 mm to 300 mm above the final grade elevation; and
- If hydrant coverage permits, locate at the mouth of a cul-de-sac instead of the end.

4.14 Hydrant Vaults

The hydrant vault shall contain the hydrant and watermain valve and shall be constructed as shown in **Appendix C - Drawings and Details**.



Where applicable and practical, locate hydrant vaults in areas of bedrock. The geotechnical investigation and test probe holes shall be used to locate bedrock for a design vault location in regions of overburden. If bedrock is not found prior to final design, the Consultant shall monitor trench excavations during construction in an attempt to place the vault on exposed bedrock or to avoid placement in poor ground conditions. If necessary, the City will consider allowing slight deviations from the requirements in **Appendix B – Design Specifications and Provisions** to facilitate vault placement on bedrock.

4.15 Trucked Water Services

All trucked water service systems shall comply with National Building Code of Canada, National Plumbing Code of Canada, CAN/CSA Standards, manufacturer specifications and all municipal by-laws (particularly the City of Yellowknife Water and Sewer By-law). In the event of a contradiction between the information in these standards and a Municipal By-Law, the By-law shall govern.

Un-impeded access, including the removal of mud, ice, snow, pets, vehicles, and yard material, to the water fill point shall be maintained. All buried tanks shall be anchored to concrete pads or pinned to bedrock to prevent movement or floating to the surface. Buried and partially buried water and sewage holding tanks are not permitted to be installed within the footprint of the building. Cylindrical tanks installed horizontally that require soil or granular material to provide structural stability may be located within the footprint of a building. Existing buried holding tanks are permitted to be abandoned and left in place in the same location provided they are filled up with concrete, gravel or earth in a manner that is deemed to be adequate to maintain ground stability and prevent cave in.

The water holding tank shall be a minimum of 500 Imperial gallons or 2,250 litres in size for new development and a minimum of 200 Imperial gallons or 900 litres for upgraded dwellings, or other size subject to approval by the City Engineer. Trucked service building facilities installations servicing more than four (4) bathrooms or having a capacity of more than 3,000 imperial gallons (13,638 litres) shall be certified by a Professional Engineer.

No trucked service building facilities shall be enclosed, covered and backfilled until the work has been inspected and approved by the S.A.O. All installation, maintenance, repair and disconnection of trucked service building facilities shall be subject to the inspection and approval of the S.A.O.

All water holding tanks shall be provided with adequate freeze protection consisting of one of the following:

- Installation of tank within a heated portion of a building or within a heated accessory building, for which the main lines are required to be insulated and heat traced or insulated to a higher value to prevent freezing; or
- Installation of tank within an unheated space in a building or accessory building, tanks shall be double walled, insulated to minimum R15 value and heat traced, or insulated to a higher value to prevent freezing; or



- Installation of tank outside the footprint of the building, tanks shall be, double walled, insulated to minimum R15 value and heat traced, or insulated to a higher value to prevent freezing.

Structural support of the water holding tank shall be sufficient to support one and one-half times the weight of a full water tank.

4.16 Water Boosting Pump Stations

4.16.1 Hydraulic Design Parameters

The Developer shall provide an analysis of the City's water system to determine if additional pumping facilities are required.

The design flows and pressures shall be based on parameters and computation methods outlined in **Section 4.5 & 4.6 in Development Standards**. The design period for sizing pump stations shall be 25 years minimum.

4.16.2 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.

4.16.3 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 City. 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.

Pumps shall be variable speed or soft start. Service pumps shall be driven by open drip proof, NEMA Design B, CSA approved electric motors with 1.15 service factors in rush current with the power utilities. Fire pumps shall be driven by diesel engines or standby diesel generators with an exterior fuel tank and interior day tank.



Service pumps shall be sized so 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 given in **Section 4.4** in **Development Standards**. Jockey pumps can be utilized to meet average day demands.

In-line booster pumps may be canned vertical turbine or horizontal split case pumps. Vertical turbine pumps with threaded 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 threaded 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.

When the average flow is less than 0.25 L/s intermittent type pumping systems are required, such as pumps or bladder type pressure tanks.

4.17 Reservoirs

4.17.1 Hydraulic Design Parameters

Reservoirs are provided in a water supply system to satisfy the following criteria:

- To balance hourly or daily peak demand variations.
- To provide storage of water to meet fire flow demand.
- 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 - A Guide to Recommended Practice" published by the Insurance Bureau of Canada.

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 maximum day demand plus fire demand is considered acceptable but each case should be individually determined.

4.17.2 Design Period

The design period for reservoir sizing shall be a minimum of 25 years.



5.0 Sanitary Sewer System

5.1 General

This section covers the design and construction of sanitary sewer mains and accessories to be built in the City of Yellowknife.

5.2 Design Criteria

5.2.1 Population Density

The sanitary sewage system shall be designed on the population density basis of either the ultimate subdivision design population or if population is unknown:

- 50 persons per gross developable hectare; or
- 3.5 persons per residential unit, whichever is greater.

Commercial and industrial areas shall be designed on the basis of equivalent population.

Table 5-1: Equivalent Population for non-Residential Areas

Area Classification	Equivalent Population (People/Hectare)
Commercial	37
Industrial	30

The sewer main capacity shall be designed to convey the peak hourly sewage contribution plus an allowance for infiltration. Design data shall be submitted to the City for review and approval. Design population shall be reviewed for conformance with active version of **Community Plan**.

5.2.2 Domestic Contribution

Minimum average contribution of 450 litres per capita per day or based on historical data. Peak hourly flow for each contributing area calculated at an average flow multiplied by a peaking factor calculated as follows:

$$\text{Peak factor} = 1 + \frac{14}{(4 + P^{0.5})} \quad (\text{Harmon formula})$$

Where: $P = \text{the population in thousands.}$

5.2.3 Commercial and Industrial Contribution

A Minimum average contribution of 450 litres per capita per day on the basis of equivalent population is to be used for commercial and industrial areas. Peak hourly flow for each contributing area calculated at average flow is to be multiplied by a minimum peaking factor of 3.0



5.2.4 Infiltration

The developer shall submit the Consultant’s design data to the City for its records. Infiltration design criteria is as follows:

- Roof leaders shall not be connected to the sanitary sewer system.
- The sanitary sewer and maintenance hole system shall be water tight. An infiltration allowance of 11,200 litres per gross hectare per day shall be used.
- Weeping tiles and similar appurtenances will not be permitted to discharge into sanitary sewers. Weeping tiles may be connected to sumps with pumped discharge directly to ground surface (splash pads will be required). Other alternatives may be submitted to the City for review. Only alternatives authorized in writing by the City are acceptable.
- Any maintenance holes 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 maintenance hole.

5.3 Pipe Flow Calculations

5.3.1 Gravity Sewer

For gravity sewers, the following formulas shall be used:

Manning’s formula:

$$Q = \frac{AR^{0.66}S^{0.5}}{n}$$

Where:

Q = Design flow in m³/s

A = Cross sectional area in m²

R = Hydraulic radius (area/wetted perimeter) in m

S = Slope of hydraulic grade line in m/m

n = Roughness coefficient is 0.013 for all pipe

Sanitary sewers are to be designed to carry the design flow at a flow depth of 80% of the sewer diameter. This results in a flow rate of approximately 86% of the sewers’ full flow capacity. Therefore, the required flow capacity for sizing the sewer may be computed using the following relationship:

$$\text{Required full flow sewer capacity} = \frac{\text{estimated total design peak flow rate}}{0.86}$$

5.3.2 For Sewage Force Mains

Hazen-William’s formula:

$$Q = CD^{2.63}S^{0.54} \times (278.48)$$

Where:

Q = Rate of flow in L/s

D = Internal pipe diameter in m

S = Slope of hydraulic grade line in m/m

C = Friction coefficient is 125 for all pipe



5.3.3 Velocity

The following criteria shall be used:

Minimum Velocity:

Gravity sewers: V = 0.76 m/s

Force mains: V = 0.76 m/s

Maximum Velocity:

All sewers: V = 3.0 m/s

5.3.4 Grade

Sanitary sewer grade design shall be as follows:

- Sanitary sewers shall be designed for gravity flow unless approved otherwise by the City.
- The minimum grade of the sanitary sewer from any high maintenance hole (or dead end Maintenance hole) to the next downstream maintenance hole shall not be less than 2.0%.
- Where practical, in areas at risk to thaw settlement caused by the degradation of ice rich permafrost, the sanitary sewer main grade shall be a minimum of 2.0%. The main size shall not be reduced to take advantage of the increased grade through these areas. The intent is to extend the operational life of the main by allowing grade redundancy to be lost if settlement occurs.

5.3.5 Minimum Pipe Diameter

The following criteria shall apply:

Collector sewers: D = 200 mm

Service connections: D = 100 mm

5.4 Sewer Main Alignments and Depths

Minimum horizontal separation of sanitary mains from watermains or storm sewers shall be in accordance with governing authorities. Consideration must also be given to allow for the future excavations of a sanitary main without undermining adjacent storm sewers, watermains or related appurtenances.

Minimum vertical clearance between top of sewer and bottom of watermain at crossings shall be 450 mm. In no case shall watermains pass under a sanitary sewer.

The preferred location for sewer mains is under the paved roadway surface a minimum of 2.0 m from any curb or sidewalk.



Where applicable and practical, locate sanitary mains in areas of bedrock or competent soil. Avoid placing mains in areas of poor ground conditions such as permafrost.

Sewer main cover shall be consistent with service line requirements. Any sewers with less than 2.0 m of cover from invert to finished grade may require insulation as per **Sections 3.8** and **4.1** in **Appendix B** and/or an extended warranty period at the discretion of the City.

Sewer mains are to be extended 1.5 m past the last house service lead with the exception of cul-de-sacs. In cul-de-sacs, extend the main to a location that allows the end sanitary services as straight a route as possible past the sanitary maintenance hole into the main. The intent is to minimize the amount of bends in the sanitary service.

5.5 Sanitary Sewer Maintenance Hole

Pipes at maintenance holes shall be as per the following:

- Max length of 100m between any size of sewer.
- The crown of an inlet pipe shall be at the same elevation or higher than the crown of the outlet pipe.
- The invert slope across maintenance holes from inlet to outlet shall not be less than the greater of the slopes of the downstream or upstream sewers.
- Inverts in maintenance holes, where sewage flow changes directions, will have a minimum of 50 mm fall across the maintenance hole.
- Invert elevations of inlet and outlet sewers shall not differ by more than 600 mm.
- Incoming sewage mains shall not intersect out-going sewage mains at an angle greater than 90°.
- Bench bottom of maintenance hole to provide a U-shaped channel. Side height of channel to be 0.75 times the full diameter of sewer. Slope adjacent floor at 1 to 10. Curve channels smoothly. Slope the invert to establish sewer grade. Mortar parge coat is not allowed.
- Where sewer pipes pass straight through a maintenance hole, the top 1/3 of the pipe shall be removed and benching poured flush with the cut edge of the pipe. Slope benching adjacent to pipe at 1 to 10.
- Pipes entering maintenance holes shall have two (2) joints one (1) meter apart adjacent to the maintenance hole.
- Where pipe enters precast maintenance hole section, break a clean and neat hole not greater than 100 mm plus the outside diameter of the pipe.

Maintenance holes shall be provided at the end of each line, at junctions, at all changes in sewer size, at all changes in direction and grade, and at distances not exceeding 120 meters on straight runs of the sewer.



Maintenance hole ladder rungs shall be installed securely in the maintenance hole barrel and spaced at 400 mm maximum. First step 500 mm maximum below frame and last step 300 mm maximum above base. No rungs shall be installed in the joints of the maintenance hole barrels or the adjustment rings. Ensure horizontal rung alignment is plumb from top to bottom.

Maintenance hole bases shall be poured in-place. Set bottom section of precast unit in wet concrete or pour wet concrete around set in place bottom precast unit.

Where applicable and practical, locate maintenance holes in areas of bedrock. The geotechnical investigation and test probe holes shall be used to locate bedrock for a design maintenance hole location in regions of overburden. If bedrock is not found prior to final design, the Consultant shall monitor trench excavations during construction in an attempt to place the maintenance hole on exposed bedrock or to avoid placement in poor ground conditions. If necessary, the City will consider allowing slight deviations from the requirements of **Appendix B – Design Specifications and Provisions** to facilitate maintenance hole placement on bedrock.

Do not allow surface drainage to enter the maintenance hole through the maintenance hole cover. Do not locate the maintenance hole entrance in a gutter, swale, low-point, or drainage course.

The maintenance hole structure shall be watertight. Plug lifting holes with mortar or mastic compound.

Maintenance holes shall be bedded as per **Appendix B – Design Specifications and Provisions** with Class B bedding. Bedding compaction densities shall be as per **Appendix B– Design Specifications and Provisions** with the exception of 100% under the base of the maintenance hole. Bedding shall surround the maintenance hole for a distance of 1.0 m and up to the under surface of roadway structures or to a depth of 150 mm below final grade in areas to be landscaped.

Individual sanitary services shall not connect to a sewer maintenance hole. An exception shall be large diameter services (150 mm dia. and larger) with multiple units using the same service line.

Where possible, provide adequate spacing between the maintenance hole and adjacent buried utilities to reduce undermining if future maintenance hole maintenance excavations occur.

Set frame and adjustment rings onto maintenance hole with cement mortar.

Wrap each maintenance hole, on outside of insulation where present, from the top of the lowest pipe to the top of the cone with two layers of tar paper and, on the outside of the tar paper, place two layers of 6 mm polyethylene sheet secured with fibreglass tape.



5.6 Trucked Sanitary Services

All trucked water service systems shall comply with National Building Code of Canada, National Plumbing Code of Canada, CAN/CSA Standards, manufacturer specifications and all municipal by-laws (particularly the City of Yellowknife Water and Sewer By-law). In the event of a contradiction between the information in these standards and a Municipal By-Law, the By-law shall govern.

Unimpeded access, including the removal of mud, ice, snow, pets, vehicles, and yard material, to the water fill point shall be maintained. All buried tanks shall be anchored to concrete pads or pinned to bedrock to prevent movement or floating to the surface. Buried and partially buried water and sewage holding tanks are not permitted to be installed within the footprint of the building. Cylindrical tanks installed horizontally that require soil or granular material to provide structural stability may be located within the footprint of a building. Existing buried holding tanks are permitted to be abandoned and left in place in the same location provided they are filled up with concrete, gravel or earth in a manner that is deemed to be adequate to maintain ground stability and prevent cave in.

The Developer or occupant shall maintain an access free of mud, ice, snow, pets, vehicles or other obstructions to the sewage pump-out service point.

The volume of the sewage holding tank shall be twice the volume of the water holding tank or a minimum of 4,550 litres (1,000 imperial gallons), or other size subject to approval by the City Engineer.”

Structural support of the sewage holding tank shall be sufficient to support one and one-half times the weight of a full sewage holding tank.

All sewage holding tanks shall be provided with adequate freeze protection consisting of one of the following:

- Installation of tank within a heated portion of a building or within a heated accessory building, for which the main lines are required to be insulated and heat traced or insulated to a higher value prevent freezing; or
- Installation of a tank within an unheated space,, tanks shall be double walled, insulated to minimum R15 value and heat traced, or insulated to a higher value to prevent freezing; or
- Installation of a tank, outside the footprint of the building, tank must be double walled, insulated to minimum R15 value and heat traced, or insulated to a higher value to prevent freezing.”

5.7 Sanitary Sewage Lift Stations

5.7.1 Hydraulic Design Parameters

The need for pumping facilities shall be determined during preliminary discussions between the Developer and the City.



The design flow shall be based on the parameters and computation methods described earlier in this section.

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 City. The design basis is as follows:

Table 5-2: Sewage Lift Station Standards

OPTION	Flow (L/S)	Equiv. Pop.	Type of Sewage Lift Station
1	0-50	1,400 – 3,400	Lift Station to include an insulated wet well with two submersible pumps, 100% Standby pump capacity. Package lift station acceptable. Heated building to be provided over wet well. EI&C panels to be installed in adjacent heated structure. Fence to be provided around entire pump station and EI&C Panel.
2	50-100	3,400 – 6,900	Lift Station to include two (2) wet wells with two to three submersible pumps in total. 100% Standby pump capacity. (Number of pumps dependent on the hydraulics.) Backup generator and EI&C panels to be housed inside heated building. Building complete with appropriate lighting, heating and ventilation. Fence to be provided around entire lift station wet well and building.
3	100-200	6,900 +	Lift station to include a two (2) wet wells and one (1) dry well with three dry pit pumps. 50% Standby pump capacity. Pumps to be placed in the dry well with building over top of the dry well and wet wells. The wet well and dry well buildings to be separated entirely with two separate access doors. Dry well to be accessible with stairs. Backup generator and EI&C panels to be housed inside building. Building complete with mono-rail, appropriate lighting, heating and ventilation. Fence to be provided around entire pump station wet well and building

Piping shall be sized so as to give average velocities of between 0.76 and 1.5 m/s in suction piping and between 1.0 and 2.5 m/s in discharge piping. Future capacity increases shall be taken into account when sizing piping.

5.7.2 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 must be self-priming and include a method for removing air from the system when the liquid level is below the pump suction level.



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 m³/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.

5.7.3 Backup Power Design Considerations

A backup generator is to be provided at every lift station, designed and stamped by an Engineer of Record. Generator design considerations must include:

- Consideration of required electrical loading based on lift Station Panel schedule;
- Considerations of generator sizing to include equipment operations requirements such as lead/lag pumps from discussions with an operator;
- Spare generator load capacity consistent with the required amounts (typically 30%);
- An automatic transfer switch sized for the generator in use;
- A backup power generator can be within the dry side (no sewer gases) of a lift station building;
- When the generator is in a standalone enclosure, the building envelope must be a heated, weatherproof, sound attenuated to 55 dBA, skin-tight non-walk-in enclosure for the generator c/w receptacle and light; and
- Double-wall sub-base fuel tank to be sized for minimum 24 hours of fuel supply at 100% load.

As-Built Drawings are to be provided to the City as a part of submission for substantial completion consistent with drawing standards from **Section 13.0**.



6.0 Storm Drainage

6.1 General

This section covers the design and construction of storm drainage works to be built in the City of Yellowknife.

The requirements for storm drainage systems shall be dependent on the type of development and the drainage area.

Open ditches along streets and lanes within the development shall not be permitted unless such ditches are designed as part of a drainage parkway system.

Where a piped system is designed, provision shall be made for overland flows in cases of extreme run-off conditions or malfunction of the piped system. Flooding of developed property during extreme run-off conditions is unacceptable.

Where applicable, the Developer shall apply and obtain all permits required by the Government of the Northwest Territories (GNWT) or Federal governing authorities with regards to storm water discharges into water courses or surface waters.

6.2 Minor and Major Systems

A drainage system for a development area shall consist of the following components:

- The Minor System; pipes, open channels and water courses that convey flows of a 5-year return frequency; and
- The Major System; surface flow routes, roadways, parkways and water courses which convey flows of a 100-year return frequency.

6.2.1 Rate of Precipitation

The rate of precipitation shall be obtained from the rainfall curves included with this document.

The 5-year frequency curve shall be used for all minor systems. The 100-year frequency curve shall be developed and used for major systems.

The maximum inlet time shall be 15 minutes.



6.3 Design Flows

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

6.3.1 Rational Formula

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

Where:
Q = Design flow in cu m/sec
A = Drainage area in ha
I = Rainfall intensity in mm/hr
R = Runoff coefficient

The rational formula is applicable for the minor system storm sewer main design for small watersheds (approximately 65 hectares or less) which discharge into detention facilities or other outlets approved by the City Engineer.

6.3.2 Hydrograph Methods

Hydrograph methods are to be utilized in the design of large areas and for any drainage system including detention facilities. Methods of calculation shall be submitted to the City for their approval.

The developer shall submit the Consultants design data to the City for its records.

6.3.3 Coefficient of Run-off

The coefficients of run-off for storm flow calculations shall be:

Table 6-1: Storm Drainage Run-off Coefficients

Runoff Areas	Coefficients
Undeveloped area	0.1
Residential area	0.4
Light commercial	0.6
Heavy commercial	0.8
Light industrial area	0.6



6.3.4 Flow Capacities

Formula for Storm Sewers, Pipes and Open Channels

Using Manning's formula:
$$Q = \frac{AR^{0.667}S^{0.5}}{n}$$

Where:

- Q = Design flow in m^3/s
- A = Cross sectional area in m^2
- R = Hydraulic radius in m
- S = Slope of hydraulic grade line in m/m
- n = Roughness coefficient:

- 0.013 for, clay and concrete pipe
- 0.020 for gravel lined channels
- 0.013 for concrete or asphalt lined channels
- 0.050 for natural streams and grassed channels
- For corrugated steel pipe, use n values as published by the pipe supplier for specific pipe sizes.

6.3.5 Culverts

Use the inlet control and outlet control methods referred to in current editions of:

- Handbook of Steel Drainage and Highway Construction Products, by American Iron and Steel Institute; and
- Handbook of Concrete Culvert Pipe Hydraulics, by Portland Cement Association.

6.3.6 Flow Velocity

In a piped system, the minimum flow velocity in pipes flowing full or half full shall be 0.90 m/s.

To provide adequate flow velocities in catch basin leads, the grade on the lead shall be 1% or greater.

6.4 Grades

Storm sewers shall be designed for gravity flow unless approved otherwise by the City.

Where practical, in areas at risk to thaw settlement caused by the degradation of ice rich permafrost, the storm sewer main grade shall be a minimum of 1.0%. The main size shall not be reduced to take advantage of the increased grade through these areas. The intent is to extend the operational life of the main by allowing grade redundancy to be lost if settlement occurs.



6.5 Minimum Pipe Diameters

Minimum pipe sizes for piped systems shall be:

Table 6-2: Minimum Pipe Sizes

System	Minimum Diameter (mm)
Mains	300
Catch Basin Leads	250
Culvert Road Crossings	450
Culvert Driveway Crossing	300

6.6 Storm Main Alignments and Depths

Minimum horizontal separation of storm mains from watermains or sanitary sewers shall be 2.0 m. If necessary, consideration must also be given to increase this separation to allow for the future excavation of a sanitary main or watermain without undermining the storm main or storm maintenance holes.

The preferred location for storm main is under the paved roadway surface a minimum of 2.0 m from any curb or sidewalk.

Alignment

- The centreline of mains 900 mm or less shall not deviate from the design line by more than 150 mm during construction; and
- Pipes greater than 900 mm shall not deviate from the design line by more than 50 mm for every 300 mm of pipe diameter during construction.

Grades

- Invert elevations of storm sewer mains shall not deviate from design elevations by an amount greater than to 6 mm plus 20 mm per meter of diameter of storm sewer pipe.

Joints

- Deflections at joints shall not exceed those recommended by the manufacturers.

The minimum depth of cover is governed by the ability to drain the catch basin lead into the storm maintenance hole and by the minimum cover requirements stated by the manufacturer. Typically, the storm main is located above the water and sewer mains.

Where applicable and practical, locate the storm mains in areas of bedrock or competent soil. Avoid placing mains in areas of poor ground conditions such as permafrost.



6.7 Storm Sewer Maintenance holes

Maintenance holes shall be provided on storm sewer mains at junctions, at changes in direction, to accommodate catch basin leads and at distances not exceeding 120 meters on straight runs of storm sewer main.

Maintenance hole materials for pipes 600 mm and less shall be as described in **Appendix B – Design Specifications and Provisions**. Maintenance holes for pipes larger than 600 mm shall be cast-in-place.

6.7.1 Pipes at Maintenance holes

The crown of an inlet pipe (or catch basin lead) shall be at an equal elevation or higher than the crown of the outlet pipe.

The invert slope across maintenance holes from inlet to outlet shall not be less than the greater of the slopes of the downstream or upstream storm sewers.

Inverts in maintenance holes, where storm sewer flow changes directions, will have a minimum of 50 mm fall across the maintenance hole.

Invert elevations of inlet and outlet storm sewers shall not differ by more than 600 mm.

Incoming storm sewer mains shall not intersect out-going storm sewer mains at an angle greater than 90°.

6.8 Catch Basins

Catch basins shall be of sufficient number with adequate inlet capacity to receive and convey the calculated storm water flows of a 5-year return frequency.

Where a piped system is provided, catch basins shall be placed to limit the length of surface storm water runs on streets to 150 m. Where roadways convey minimum run-off, calculations may be submitted for approval indicating potential catch basin reductions.

Gratings for flow inlet to catch basins shall be of a flat top style and (where curb and gutter is provided), set into the gutter.

Catch basin barrel size shall be a minimum of 900 mm diameter. The minimum sump depth shall be 600 mm.



6.9 Internal Site Drainage and Lot Grading

Individual sites and lots shall be designed and graded such that:

- Minimum lot grades shall be 2.0% (rear yard to curb). Each lot shall drain from back to front where possible. Exceptions to the rule must be approved by the City;
- Where lanes exist, drainage can be split or all drainage can be front to back where topography governs;
- Areas adjacent to buildings shall have a minimum 5% grade for the first 3 meters draining away from the building;
- In special circumstances swales at the back of lots may be allowed;
- Lots lower than adjacent roadways should be avoided where possible;
- To provide basic positive drainage until a lot is developed, the lots shall be rough graded, allowing for earth balancing of future basement excavation and landscaping; and
- Building finished grade should be above the Major System hydraulic grade line for a 100-year storm event plus a minimum of 0.3 m freeboard.

All above stipulations 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 level shall be taken.

6.9.1 Foundation Drains

Foundation drains shall be pumped and discharged to the surface away from building. Unless approved by the City, foundation drains shall not discharge to existing storm sewer systems and under no circumstances shall they be discharged to the sanitary system.

6.9.2 Roof Drainage

Roof drainage and downspouts shall not be connected to the piped storm sewer system.



7.0 Site Services

7.1.1 General

This section covers the design and construction of services and associated appurtenances to be built in the City of Yellowknife. See **Appendix C - Drawings and Details** for details on connections and installations.

7.1.2 Requirements and Sizing of Services

All Services

- When rock is present, service trenches shall be blasted six (6) meters into each property and backfilled with granular material. See **Appendix C Drawings and Details** for service trenching details.
- Multi-family, commercial and industrial service designs shall be submitted to the City for approval.
- Where single 100 mm or larger gate valves are used to isolate large water services from the main, the valve shall be installed immediately adjacent to the main to prevent freezing of the valve.

7.1.3 Location

Service may be brought in a common trench to the lot corner. This will allow for two lots to be serviced in the same trench. If this alignment is used a 100 mm sanitary service must be provided to each lot and capped. Separate water services to the watermains must be provided for each lot (**See drawing details in Appendix C**).

Where individual services are brought to each lot, they shall be installed 1.5 m downstream from the lot centerline. Other orientations require approval of the City.



8.0 Parking

8.1 Parking Design Standards

- a. Parking Access
- Other than tandem parking spaces, all areas used for required parking spaces shall have driveway access to a street or lane that is direct and unobstructed, excluding moveable barriers or similar security features such as a gate.
- b. Drive Aisle Width and Parking Angles
- Parking areas shall be developed in accordance with the following minimum area standards:

Table 8-1: Drive Aisle Width and Parking Angles

A: Parking Angle	B: Width of Space	C: Length of Space Perpendicular to Maneuvering Aisle	D: Width of Space Parallel to Maneuvering Aisle	E: Width of Maneuvering Aisle
0°	2.7 m	2.7 m	7.0 m	3.6 m
45°	2.6 m	5.2 m	3.7 m	3.6 m
60°	2.6 m	5.6 m	3.0 m	5.5 m
90°	2.6 m	5.5 m	2.6 m	7.0 m
0°	2.7 m	2.7 m	7.0 m	3.6 m

- c. Landscaping for Parking
- Where a parking area consists of ten (10) or more parking spaces, the area shall include a landscaping in accordance with an approved landscape plan or site plan.
 - Curbs, rails, and/or fences shall be provided to protect adjacent rails, fences, walls, boulevards, sidewalks, landscaped areas or buildings on the site or adjacent sites.



- d. Lighting of Off-Street Parking
 - Off-street parking area shall be illuminated with light sources situated in such a way that does not to direct light onto streets, lanes, or adjacent properties.
 - Light sources shall be kept in good repair and in good working order at all times and be illuminated to a level that provides safety and security.

- e. Buffering
 - The use of barriers such as a fence or landscaping to create a visual screen to prevent lighting and vehicle headlights from shining directly into a dwelling unit must minimize effects that cause a nuisance.
 - Full cut-off outdoor light sources designed to direct light to the ground and not up into the sky are recommended to minimize contribution to light pollution and reduce glare.

- f. Location of Accessible Parking Spaces
 - Accessible parking spaces must be assigned to the parking spaces located closest to a main pedestrian access to a building and are encouraged to be at the same level as the pedestrian entrance to the building.

- g. Vehicle Access
 - Parking areas require access from a city roadway by means of one or more unobstructed access point.
 - The maximum number of access points shall be not more than two access points for the first 60m of lot frontage plus one access point for each additional 30m of lot frontage thereafter.

8.1.1 Parking Space Dimensions

- a. A parking space is subject to the following:
 - Type “A” accessible parking space for all zones unless otherwise noted must have a:
 - Minimum length of 5.6 meters;
 - Minimum width of 4.0 meters; and
 - Minimum vertical clearance of 2.3 meters;
 - Type “B” parking space for all zones unless otherwise noted must have a:
 - Minimum length of 5.6 meters;
 - Minimum width of 2.6 meters; and
 - Minimum vertical clearance of 2.0 meters.
 - The minimum width of a parking space must be increased by 0.3 meters for each side of the parking space that is obstructed by any part of a fixed object such as a wall, column, bollard, fence, pipe or structural element that would interfere with the opening of a vehicle door.



- b. Vertical Clearance of a Parking Space
 - The vertical clearance minimum requirement of a parking space extends over the entire area of the parking space excluding curb stops.
- c. Parking Space Divider Lines to be Clearly Marked
 - All parking spaces in a parking area or parking structure are required to be clearly identified and marked with permanent striping extending the full length of the spaces excluding residential uses that have 5 dwelling units or less.
- d. Surface and Drainage of Parking Area and Driveway
 - Adequate provision for site drainage must be incorporated into plans for hard-surfacing.
 - Hard-surfacing must be completed within one year of occupancy of the development unless there is an engineering reason for a delay.
 - Driveways shall be setback at least 0.5m from a side property line to ensure drainage patterns are maintained.
 - All parking areas and driveways shall be hard surfaced in accordance with the City of Yellowknife's Development Standards
- e. Traffic Flow within a Parking Area
 - The flow of traffic in maneuvering aisles shall be one-way with the exception of parking laid out at ninety (90) degrees in which case traffic flow may be two-way.
 - All curb crossings, entrances and exits shall be subject to the prior approval of the Development Officer and in accordance with the City of Yellowknife's Development Standards.
 - The design of the parking area and the flow of the traffic within the parking area shall embody the site planning principles of Section 7.1.
 - The Development Officer may require the applicant enter into a development agreement which includes:
 - implementation of all mitigation measures recommended in a Traffic Impact Analysis which includes a functional parking study to the satisfaction of the City; and
 - implementation of all mitigation measures recommended in a noise and vibration study to the satisfaction of the City.
 - Nothing in this subsection shall apply to prevent the use of a right-of-way as a means of obtaining access to a parking area, provided the said right-of-way has been specifically established for such purpose.



9.0 Landscaping

9.1 General

All Landscaping work must first consider the requirements from the **Yellowknife Zoning By-law**. Developers are to first review Landscaping requirements in the By-law for general requirements before consulting the following standards.

Landscaping shall be the final grading of the areas to comply with the Lot Grading plan; the placing and spreading of topsoil the cultivation of the areas, planting it to grass and treeing; all in accordance with the landscaping plans. These areas often include buffer strips, drainage parkways reserves and public utility

The developer is responsible to maintain the landscaped areas during the warranty period. This shall include, but is not limited to:

- Grass cutting;
- Shrubs;
- Watering of trees and grass;
- Fertilizing;
- Weed control; and
- Debris removal.

9.2 Site Planning

The following Principles shall be applied in the review of Development Permit and Subdivision Application to encourage a high standard and quality of development:

- Natural landscape features are encouraged to be retained on site. If the landscape is altered, it shall be replaced, excluding building footprint and required parking areas.
- Applicants are encouraged to incorporate natural terrain, topographic features and views into the design of buildings.
- Vehicular access/egress points to public roadways, as well as interior driveways, parking lots and circulation areas, must comply with accepted transportation standards.
- Proposed developments are encouraged to provide pedestrian access points to public roadways, public transit and any adjoining trails and open space areas.

Electrical, telephone and cable lines shall be underground where possible.

Outdoor lighting sufficient only to provide for safety, security, display or attraction for any development shall not project to adjacent properties or interfere with the effectiveness of any traffic control device.



Exposed storage areas, exposed machinery installations, outdoor pellet silo/hopper, service areas, truck loading areas, utility buildings and structures shall be subject to such setbacks or screening methods as are required to prevent negative impacts on adjacent properties and the environment.

All open and enclosed spaces shall be designed to facilitate building evacuation and maximize accessibility by fire, police or other emergency personnel and equipment.

Any proposed development, subdivision, or lease of any site on, adjacent, or near a water-body shall be designed and constructed so as to prevent any discharge or drainage of any contaminant, excrement, refuse, toxic or deleterious substance (As defined in Environmental Protection Act, R.S.N.W.T. 1988. C.E-7 as amended and requirements of the Fisheries Act) into the water-body.

9.3 Landscaping Drainage Requirements

Boulevards and Buffer Strips shall be graded to drain over the curbs into the street gutters. Reserves shall be graded to drain over the adjacent curbs into the street gutters or into catch basins within the reserve, or into adjacent drainage courses.

Proposed development must incorporate proper site surface drainage so that the removal of surface waters will not adversely affect adjacent properties or the public storm drainage system. Storm water shall be removed off site in a manner acceptable to the Development Officer. Paved areas design includes collection of surface water at intervals so that it will not obstruct the flow of vehicular or pedestrian traffic and will not create standing water in the paved areas or walkways. Approved site surface drainage shall be maintained for the life of the development.

9.4 Seeding

Designated areas within the subdivision area shall be pre-graded, filled to final grade to provide a minimum of 100 mm of topsoil, and seeded with a variety of grasses approved by the City. See Approved Species List

9.5 Sound Abatement

Berms or elevated contoured embankments may be utilized for sound abatement along arterial roads, if required by the City. The subdivision side of the embankments shall be with gentle slopes; minimum of 4:1.

9.6 Fencing

Fencing is to conform to the requirements outlines in the *City of Yellowknife Zoning By-law*, including any amendments at the time of design.



9.7 Approved Species

Native trees within the subdivision are to be preserved to the maximum extent possible.

Planted trees shall be a mixture of bush type shrubs (minimum height of 1 m) and trees (minimum height of 2 m). The trees and shrubs shall be a mixture of local evergreens, deciduous and trees and shrubs compatible with the local growing conditions.

Planted vegetation shall be capable of healthy growth in Yellowknife, grown from a northern stock, and with certification that the plants are grown north of 54 degrees latitude. The Development Officer may also require compliance of planted vegetation with the Canadian Standards for Nursery Stock;

See **Appendix B – Specifications and Provisions** with regards to the approved planting species.

Planting conditions are as important as the species, and the developer is encouraged to seek a professional opinion on the ability of the species to meet the warranty requirements.

9.8 Acceptance

The following requirements for the City's acceptance of landscaping must be met:

- Construction Completion, all plant materials live and healthy, and installed properly.
- Expiration of two (2) year warranty period:
 - All plant materials live and healthy.



10.0 Accessibility

10.1 General

All Development and Design in The City of Yellowknife should take accessibility into consideration in the aim of barrier-free infrastructure for purposes of public use. Buildings are to meet the accessibility standards outlined in the National Building Code of Canada. Consideration should be made to CSA B651 *Accessible Design for the Built Environment and Good Building Practice for Northern Facilities* to incorporate accessibility in all development wherever possible.

Some Considerations to be included in Accessible Development:

- Tactile Walking Surface Indicators (TWSI) on changing surfaces (ex. Intersections or top of stairs)
- Power door operators
- Barrier-free access ramps at buildings
- Required Clearances and widths on doorways and entrances
- Designated Accessible Parking Spots
- Sloped curbs at intersections
- Handrails where required
- Signs – indicating the accessible areas, high contrast and large lettering
- Appropriate Lighting
- Accessible washrooms
- Surface materials should meet traction characteristics for wheel chairs, walkers, canes and crutch tips.

Where the NBC and CSA Standard B-651 address the same issues, when practical, the more stringent recommendations should govern. For items listed in NBC 3.8.3.1, CSA B651 shall be applied, where possible.

10.2 Intersections

Accessible Pedestrian Intersection Elements shall be provided at all intersections in urban areas or with a concentration of commercial or residential activity.

For Intersection Design, consult the most recent version of CSA B561 Accessible Design for the Built Environment.

The layout of travel lanes, curb ramps, crosswalks, bicycle lanes, and transit stops all constitute part of the geometric roadway design. Ensure that approaching drivers, cyclists, or pedestrians have a clear view of one another.



The desired vehicle and pedestrian actions can be facilitated by discouraging undesirable movements, providing safe refuges, offering signage for cyclists, and pedestrians, defining appropriate vehicular lanes, encouraging safe speeds, helping to separate points of conflict, or facilitating the movement of high-priority traffic flows.

For safety at pedestrian crossings, the corners should be free of obstructions, maintain adequate sight lines between drivers and pedestrians, design corner radii to ensure vehicles do not drive over the pedestrian area, ensure that crosswalks clearly indicate where crossings should occur, limit exposure to conflicting traffic, and provide refuges where necessary.

Narrowing a roadway by constructing a bulb- or a bump-out at intersections reduces pedestrian risk by creating a shorter crossing distance. It also provides a safe waiting area for pedestrians, where they can see and be seen before crossing. This bulb or bump should extend along the curb for at least 2000 mm and include a curb ramp.

10.3 Trails

The City maintains different types of trails in several areas of the City providing active transportation modes away from motor vehicles allowing residents to experience natural settings. Trails are not required to be completely level throughout to be considered accessible for people with limited mobility or mobility aids. In Design of Trails consider:

- All users have different abilities which are accommodated to the greatest extent possible for different types of trails
- Universal design does not mean making every trail available for use by every possible user (e.g., hiking trails can only be for hikers, not cyclists)
- Universal design strives to minimize, to the greatest extent possible, the proportion of potential users who cannot access the trail.

10.4 Building Accessibility

The City of Yellowknife aims to address issues of barrier-free accessibility in buildings for persons with physical, sensory, developmental, and mobility challenges. The aim is to provide inclusive spaces, designed for equitable use among people with diverse abilities.

10.4.1 Design Requirements

Refer to Section 3.8 of the National Building Code (NBC), which provides the minimum requirements for Barrier-Free Design. As all projects are unique, some may require minimal renovations to achieve the projects and the NBC barrier free requirements, while in other cases, extensive renovations may be necessary. These circumstances should be identified early in the pre-design/programming phase, so as to be appropriately defined in the scope of work.



10.4.2 Building Access

Access to buildings shall consider the following:

- Building Entrance Accessibility:
 - Consider method of accessing the building entrance from the street, parking areas and walkways.
- Building Entrance:
 - Consider thresholds, powered door operators, location of controls, guard rails and required number of barrier-free entrances.
- Consider appropriateness of location, dignity and prominence of barrier-free devices.
- Consider barrier-free parking, complete with curb cuts/ramps, exterior lighting, and signage.

10.4.3 Accessibility of Path of Travel within Main Level

Accessibility of paths of travel within main level shall consider the following:

- Access to Facilities:
 - Consider width of corridors and exits, differing elevations of floor levels, flooring requirements, door width and door location requirements, door hardware requirements.

10.5 Interior Building Accessibility Recommendations

10.5.1 Personal Facilities

For Hygienic Facilities determine if existing washrooms can be modified or if it is more feasible to introduce new separate washrooms to meet barrier-free requirements. Then, consider required sizes of facilities, building plumbing fixture requirements, washroom accessories and mounting heights.

For Personal Use Facilities consider requirements for drinking fountains and service counters. Consider the value added function of a universal barrier free washroom that can serve as baby change room, and a trans-gender washroom.

10.5.2 Accessibility to Other Levels

Accessibility to other levels shall consider the following:

- Stairwells:
 - Consider stair width, landing sizes, stair surfaces and nosings, handrails and guardrails, and lighting.
- Elevators:
 - Consider size, travel distances and speed, suitability of various types, location, accessibility and design of controls.



- Areas of refuge:
 - Consider where and to what extent the areas of refuge are required. Often these are provided within stairwells, but not always. Coordinate the Barrier Free fire escape planning with the local fire chief or authority having jurisdiction.
- Chair Lifts:
 - Determine if chair lifts can be used to provide access to other levels while ensuring the required exit width is not minimized when chair lift is in operation.
- Platform Lifts:
 - Consider the travel distance limits and location. Generally, platform lifts are only acceptable for use within one floor level.
- Enclosed Platform Lifts:
 - Consider use restrictions, travel distance limits, requirements for shaft and machine room, and location.
- Consider the requirements for each accessible floor to provide at least the same level of barrier-free accessibility provided on the first barrier-free level.

10.5.3 Building Security

The following shall be considered for building security:

- User Actuated Systems:
 - Consider mounting heights of actuation devices and requirements for audible and visual signals to indicate when door lock is released.
- Remote Actuated Systems:
 - Consider mounting heights of call devices and requirements for audible and visual signals to indicate when door lock is released.



11.0 Power, Cable Television and Telephone Services

11.1 Installation

The buried power, cable television and telephone services to be installed shall be arranged and coordinated by the Developer with the respective utility companies.

11.2 Costs

Any cost for these services charged by the respective utility companies, shall be paid by the Developer.

11.3 Right-of-way

The Developer shall provide either registered rights-of-way or registered easements in the name of the City for the purpose of accommodating the utility services. Rights-of-way shall be of sufficient width and satisfactory to the utility companies.

Easements shall be registered on each individual lot prior to the sale of any lot in the development area.



12.0 Geotechnical Studies & Reporting

12.1 General

The Developer shall engage the services of a qualified Geotechnical Consultant registered with the Association of Professional Engineers and Geoscientists of the Northwest Territories. The Report shall evaluate the soil characteristics and existing groundwater conditions (where applicable) on which the local improvements are to be constructed.

12.2 Report Requirements

The Report shall be based on test holes drilled at an appropriate spacing and depth to adequately define the conditions throughout the areas of the development containing buried utilities, indicated lot services and roadway structures.

The Geotechnical Report is not intended to provide lot specific geotechnical information to individual residential, commercial or industrial lot Developers. Those Developers are expected to conduct their own geotechnical investigations to provide information, recommendations, and requirements for their development.

A subdivision Developer typically installs lot services from the main to 1.0 m past the lot property line; however, the Geotechnical Report must include the general geotechnical conditions for the lot services from the main to the building foundation. The development on an individual lot may not be known at the time of the geotechnical investigation, therefore, for report purposes, a typical service installation on lot property can be assumed by the Developer. The intent is to reduce claims under the Service Connection Failure Assistance Bylaw under which the City is responsible for lot service repair from the main to the building foundation.

Geotechnical Reports are to be completed in accordance with CAN/BNQ 2501-500 *Geotechnical Site Investigations for Building Foundation in Permafrost Zones*.

12.3 Report Content

The investigation section of the Report shall include at least the following:

- Test hole location plan and soil logs for each test hole
- Soil moisture content at appropriate intervals throughout each test hole;
- Bearing capacity tests for the road subgrade soils;
- Sieve analysis of each predominant soil type;



- Measurement of the groundwater table and analysis of its influence with respect to the design of roadways, utility trenches, and foundations. (The City shall be informed when cold seasonal conditions prohibit the gathering of groundwater data);
- Analysis for active soils that may corrode buried utilities;
- Identification and reasonable delineation of permafrost areas;
- Moisture (ice) content of the permafrost. In addition, the City may require temperature-monitoring devices in ice rich permafrost areas; and,
- Comments on the limits the permafrost conditions may have on various types of building foundations;
- Groundwater contour maps with seasonal adjustments shown (if applicable);
- Any additional investigations deemed necessary for the design and construction of the local improvements.
- Recommendations:
 - On the suitability of the site for the proposed local improvements;
 - For the lowest floor elevations as determined by the groundwater conditions;
 - On the installation of buried utilities and roadway structures in areas of permafrost;
 - To protect ice rich permafrost areas from thaw degradation;
 - On minimizing the impact thaw settlement may have on local improvements in ice rich permafrost;
 - On minimizing road surface undulations caused by the frost heave of high moisture or frost susceptible soils outside the limits of granular filled trench excavations. (Recommendations may include, but are not limited to, the complete removal of the frost susceptible soil, protection of the soil from freezing or the sloping of the trench excavation to spread the undulation over an appropriate distance); and
 - On the suitability of using, as backfill, the native granular material that may exist on the development site.

The Developer may decide to drill probe holes to determine bedrock depths for contract purposes. The Developer shall include the depth to bedrock information in a separate report to the City. The Developer is not required to provide any other Geotechnical information from the probe holes unless it significantly differs from the test holes results.



12.4 Conditions Not Requiring a Geotechnical Report

Report is not required in the following situations:

- A development that is predominantly exposed bedrock with areas of overburden less than 1.5 m in depth.
 - A Test pit program may still be required to establish the depth of bedrock.
 - The Consultant shall investigate the depth of the overburden and provide this information to the City for review.
 - The Consultant shall ensure all unacceptable overburden is removed below roadway structures and utility trenches.
 - At any time during the development, the City or Consultant may instruct the Developer to engage the services of a Geotechnical Consultant to investigate and provide recommendations if unacceptable soil conditions or depths are discovered during construction.
- A local improvement or redevelopment of a lot that involves the installation of a single service to a building.

The City may, however, require service designs that differ from those of the Development and Design Standards in areas known to have problem soil conditions.



13.0 Preparation of Detailed Engineering and Landscape Drawings

13.1 Requirements for Network Diagrams

The sanitary sewer and storm sewer network diagrams shall include the following information:

- All maintenance holes and size of sewer sections
- Length of sewer section in meters
- Grade of sewer sections
- Total length of tributary sewers in meters for each sewer section
- Tributary area in hectares, coefficient of run-off for each storm sewer section area (tributary areas to be cross-referenced to any summary tables)
- Estimated peak loading based on tributary area and infiltration in litres per second
- Manning velocity for full flow in litres per second
- Manning capacity in litres per second
- Manning design flow in litres per second
- Invert elevation of Maintenance holes and catch basins

Where the size of a development warrants, or is required by the Engineering Division, a water network analysis shall be carried out by the Developer and all relevant information shall be submitted with the design document.

13.2 Requirements for Landscape Plans

The following shall be considered for Landscape Plans:

- Landscape plans are to integrate with detailed engineering drawings
- Existing and proposed contours at 0.5 m intervals within the site and extending 3 meters beyond, as well as, all other grading detail
- Site boundaries
- Temporary site access, laydown areas, parking
- Stockpile locations
- All existing and proposed utility information
- Existing vegetation and/or other natural features to remain
- Existing trees to be relocated
- Proposed plant material illustrated at 2/3 the mature spread or diameter, as noted in the Alberta Horticulture Guide, current edition
- Plant schedules, including overall quantities
- Areas to be sodded and 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 bollards along PUL walks 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 meters) of shrubs beds, flowerbeds, islands, buffers, PUL's, MR's and parks)
- Total measurements (square meters) of sodded and seeded areas
- All other details that relate to the final landscape design

Present the above items in the following plans, as required:

- Existing Site Conditions
- Site Preparation / Clearing
- Layout Plan
- Grading Plan
- Planting Plan
- Construction Details and Specifications

These plans are to be submitted with the engineering drawings for each phase.

See **Section 9.0 – Landscaping**, for additional information.

13.2.1 Reference Standards

All references to specifications, standards, or methods of technical associations 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.



13.3 Abbreviations (To be used in drawings and tender documents)

13.3.1 Symbol or Abbreviation

If abbreviations are required, use the following:

Table 13-1: Technical Drawing Abbreviations

Abbreviation	Term	Abbreviation	Term
A			
A	ampere	AB	anchor bolt
Aban	Abandoned	ABS	acrylonite butadiene
AC	alternating current	ACP	Asphaltic Cement
AF	audio frequency	AFC	automatic frequency control
Al	aluminum	AM	amplitude modulation
AUX	auxiliary	Ave	avenue
AVG	average	AWG	American wire gauge
B			
B&B	Balled and Burlap	BBL	barrel
BC	begin horizontal curve	BLDG	building
BLVD	boulevard	BM	bench mark
BOC	Back of curb	BOW	Back of walk
BPD	Barrels per day	BRKR	Breaker
BSMT	basement	BVC	Begin vertical curve
BWV	Backwater valve	-	-
C			
C&G	curb and gutter	C	cord length
CAL	caliper	C/L	centreline
CCRED	concentric reducer	CB	catch basin
CDN	Canadian	Cd	Cadmium
CF	curb face	CDT	conduit
CI	cast iron	CHC	continuous high chair
CJ	construction joint	CIP	cast in place
cm	centimeter	CL	clearance
conc.	concrete	CMP	corrugated metal pipe
Cr	chrome	CR	Curb Return
CSK	countersink	CRES	crescent
cu	cubic	CTR	centre
CULV	culvert	Cu	copper
CW	cold water	CV	control valve



Abbreviation	Term	Abbreviation	Term
D			
DBL	double	d ^a	deflection angle
DI	ductile iron	DC	direct current
DIM	dimension	DIA	diameter
DR	dimension ratio	DL	deadload
DWV	drain waste vent (Plastics)	DWG	drawing
E			
e.g.	example	e	external (curve data)
ECB	erosion control blanket	EC	end of curve
EHV	extra high voltage	ECCRED	eccentric reducer
ELB	elbow	EJCTR	ejector
EMT	electrical metallic tubing	ELEV	elevation
EP	Epoxy (plastics)	EOP	Edge of Pavement
EQ	equal	EPDM	Ehtylene propylene dienemonomer
ESP	External static pressure	ER	Environmental Reserve
EVC	End vertical curve	-	-
F			
F/C	flanged by compression	FBM	board foot (foot, board,measure)
FDN	foundation	Fe	iron
FF	flat-face	FIB	found iron bar (survey)
FLTR	filter	FM	frequency modulation
FM/UL	Factory Mutual/Underwriters Laboratory	FOC	face of curb
FS	forged steel	FSD	flat side down
FSL	full surface level	FSU	flat side up
G			
GA	gauge	GALV	galvanized
GRD	electrical ground	-	-
H			
HF	high frequency	HDW	hardware
HORIZ	horizontal	HGR	hanger
HP	high pressure	hp	horsepower
HT	height	HSS	high strength steel
HW	hot water	HV	high voltage
Hz	hertz	HYD	hydrant
I			
ID	inside diameter	IB	iron bar
IP	iron pipe	INV	invert



Abbreviation	Term	Abbreviation	Term
L			
LIN	linear	LC	length of curve
LOG	LOG	LL	Live load
LR	LR	LP	LP
LVC	length of vertical curve	-	-
M			
MAX	Maximum	MH	Maintenance Hole
MIN	Minimum	Mono	Monolithic
MR	M	MTG	Mounting
N			
N	Newton	N/A	Not applicable
NIC	Not-in-contract	No.	number
NPT	National pipe thread	NTS	Not-to-scale
O			
OC	On centre	OD	Outside diameter
P			
pH	hydrogen-ion concentration	PE	polyethylene
PL	Property Line	PI	point-of-intersection
Pt	platinum	PRV	Pressure reducing valve
PUL	Public utility corridor	PT	Pressure treated
PVI	Point of vertical intersection	PVC	Polyvinyl chloride
R			
R/W	Right-of-way	R	radius
Rd	road	R/W	right-of-way
REINF	reinforce(d)	RED	reducer or reducing
reserve	RR railroad	REQ	required
RF	raised-face	REV	revision
RIM	rim elevation	RGE	range
Rolled	curb (mountable)	RO	rough opening
RW	Raw water	rpm	revolutions per minute
RWL	Rainwater leader	RWL	rainwater leader
S			
S4S	Smooth four sides	S/W	Sidewalk
SCH	schedule	SAN	sanitary (sewer)
SPD	Standard Proctor Density	SDR	standard dimension ratio
SPF	spruce, pine, fir	SPEC	specification
SR	short radius	sq	square
STA	station	St	street
STM	storm	STD	standard
SW	switch	-	-



Abbreviation	Term	Abbreviation	Term
T			
TAN	tangent	TDH	total differential head
TH	test hole	TLLD	total load
TOC	top of curb	TVS	tapping valve and sleeve
TWP	township	TYP	typical
U			
U/G	underground	UHF	ultra-high frequency
UR/W	utility right-of-way	US	American
UV	ultraviolet	-	-
V			
VC	vertical curve	V	Volt
VERT	vertical	VCT	vitriified clay tile
VHF	very high frequency	-	-
W			
W	watt	WCB	water curb box
WM	Watermain	WOG	water, oil and gas



13.3.2 Abbreviations of Governing Bodies

Table 13-2: Abbreviations of Governing Bodies

Abbreviation	Governing Body
A	
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AFBMA	Antifriction Bearing Manufacturers Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AISC	American Institute of Steel Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
API	American Petroleum Institute
ARCA	Alberta Roofing Contractors Association
ASCE	Air-Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWMAC	Architectural Woodworkers Manufacturers Association of Canada
AWPA	American Wood Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association
C	
CAN	Canadian National Standard
CBM	Certified Ballast Manufacturers
CBTIC	Clay Brick and Tile Institute of Canada
CEC	Canadian Electrical Code
CEMA	Canadian Electrical Manufacturers Association
CGA	Canadian Gas Association
CGRA	Canadian Good Roads Association
CGSB	Canadian General Standards Board
CISC	Canadian Institute of Steel Construction
CITC	Canadian Institute of Timber Construction
CLA	Canadian Lumbermen Association
CMAA	Crane Manufacturers Association of America
CMHC	Canada Mortgage and Housing Corporation
CPC	Canada Post Corporation
CPA	Canadian Painting Contractors Association
CPCI	Canadian Prestressed Concrete Institute
CRCA	Canadian Roofing Contractors Association
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Association
CSSBI	Canadian Sheet Steel Building Institute
CUA	Canadian Underwriters Association



Abbreviation	Governing Body
CWB	Canadian Welding Bureau
CWC	Canadian Wood Council
CSPI	Corrugated Steel Pipe Institute
E	
ECCE	Environment and Climate Change Canada
EI	Edison Electric Institute
EEMAC	Electrical and Electronic Manufacturers of Canada
F	
FFPC	Federal Fire Prevention Committee
FM	Factory Mutual Engineering Corporation
G	
GNWT	Government of the Northwest Territories
I	
IAO	Insurers' Advisory Organization
IBRM	Institute of Boiler and Radiator Manufacturers
IEC	International Electrotechnical Commission
IEE	Institution of Electrical Engineers (U.K.)
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IGMAC	Insulated Glass Manufacturers Association of Canada
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America
ISO	International Standardization Organization
L	
LEMA	Lighting Equipment Manufacturers Association
LTIC	Laminated Timber Institute of Canada
M	
MMA	Millwork Manufacturers Association
MVLWB	Mackenzie Valley Land and Water Board
N	
NAAMM	National Association of Architectural Metal Manufacturers
NBC	National Building Code of Canada
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESC	National Electric Safety Code
NFPA	National Fire Protection Association
NLGA	National Lumber Grade Authority
O	
OECI	Overhead Electrical Crane Institute
P	
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PMBC	Plywood Manufacturers Association of British Columbia



Abbreviation	Governing Body
R	
RCABC	Roofing Contractors Association of British Columbia
RLM	RLM Standards Institute
S	
SAE	Society of Automotive Engineers
SBI	Steel Boilers Institute
SJI	Steel Joist Institute
SSPC	Steel Structures Painting Council
T	
TAC	Transportation Association of Canada
TTMAC	Terrazzo, Tile and Marble Association of Canada
U	
ULC	Underwriters' Laboratories of Canada
USFG	United States Federal Government
W	
WCB	Workers' Compensation Board
WCLIB	West Coast Lumber Inspection Bureau

13.3.3 SI Units and Symbols

The following list of physical quantities, SI (System International) units and SI symbols are to be used in reports prepared for the City:

Table 13-3: Design Drawings SI Unit and Symbols

Physical Quantities	Units	Symbols
Length	kilometer	km
	meter	m
	centimeter	cm
	millimeter	mm
	micrometer	um
Area	square kilometer	km ²
	hectare	ha
	square meter	m ²
	square centimeter	cm ²
	square millimeter	mm ²
Volume	cubic meter	m ³
	hectare meter	ham
	cubic centimeter	cm ³
	cubic millimeter	mm ³
	litre	l
Mass	tonne	t
	kilogram	kg
	gram	g
	milligram	mg



Physical Quantities	Units	Symbols
Density (Mass Density)	tonne per cubic meter kilogram per cubic meter gram per cubic centimeter	t/m ³ kg/m ³ g/cm ³
Unit Weight (Weight Density)	kilonewton per cubic meter	kN/m ³
Force	meganewton kilonewton newton	MN kN N
Flow	megalitres per day meter per second litre per second	ML/d m/s L/s
Pressure	megapascal kilopascal	MPa kPa
Energy	kilojoule joule	kJ J
Power	kilowatt kilowatt-hour ampere-hour ampere volt kilovolt kilovolt ampere	kW kW.h A.h A V kV kVA
Temperature	degree Celsius	°C
Coefficient of volume compressibility or swelling	1/megapascal 1/kilopascal	MPa-1 kPa-1
Coefficient of Consolidation or Swelling	square meter per second square meter per year square centimeter per second	m ² /s m ² /yr cm ² /s
Noise	decibel	dB
Time	year day hour second	yr d h s
Illumination	lux	lx
Hydraulic conductivity (formerly coefficient of permeability)	meter per second centimeter per second	m/s cm/s
Concentration	milligram per litre (ppm) milligram per millilitre (ppb)	mg/L mg/mL



13.4 Pre-Construction Drawings

13.4.1 Engineering Design

The Developer shall retain an Engineering Consultant and Landscape Consultant who will be responsible for the design and preparation of drawings and specifications for all services (except lighting, telephone, T.V., gas and power) as required within the City. All services will be designed in accordance with these Development and Design.

The Design drawings shall show all existing and proposed services. It shall be the Consultants responsibility to coordinate with the utility companies to establish the location of their existing and proposed services.

13.4.2 Responsibility for Existing Structures and Utilities

The presence and location of underground utilities indicated on the plans that have been determined from existing records are not guaranteed. These shall be investigated and verified in the field by the Developer. 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 plugs. These devices are to be removed only after Construction Completion Certification and clean up.

13.4.3 Format for Engineering and Landscape Drawings

All engineering landscape drawings that are submitted to the City for approval should follow the basic format described herein.

Plan Size

ISO-A1 or 610 mm x 915 mm (22 x 34) plan size shall be used or as approved. If architectural – can use A0 size, however, reduce for submittal to ½ size, ¼ scale plans

Title Blocks:

Title blocks shall contain the information noted below:

- The City of Yellowknife Logo
- Project Name or Name of Development
- Description of Drawing
- Legal Description
- Name of the Consultant
- Consultants Permit Stamp
- Engineers Stamp
- Identification of Draftsperson and Designer
- List of Checks and Approvals



- List of Revisions
- Legend (if not on separate plan)
- Scales
- Dates
- Drawing Numbers
- Scales

Unless otherwise approved the scale of drawings shall be:

Table 13-4: Drawing Scale

Drawings	Scale
location plans	1:10,000
overall plans	1:1000
plan/profiles <ul style="list-style-type: none"> • horizontal • vertical 	1:500 1:50
cross sections <ul style="list-style-type: none"> • horizontal • vertical 	1:100 1:50
overall system network analysis	1:5000
landscape plans	1:200
details	1:100

Orientation

It is preferred that continuous chainage be used wherever possible. Generally, drawings shall be orientated such that north arrows point to the top or left hand side of a page. Lettering read from the bottom or right hand side of the sheet.

Elevations

Elevations shall be relative to the Geodetic datum. Bench mark numbers, location and elevations used shall be shown on design drawings.

Geodatic Datum

HORIZONTAL DATUM

PROJECTION: UNIVERSAL TRANSVERSE MERCATOR (UTM, ZONE 11, CM 117°00'00"W)

DATUM: NAD83(2010.0)

VERTICAL DATUM

ELEVATIONS ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD2013:CGG2013a)



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.

Layering Protocol

All drawings shall adhere to the City's layering protocol. A copy of which may be obtained from the Engineering Services Division.

Digital Formats

In general, digital copies shall be in the most current version of AutoCAD, unless approved otherwise.

Lettering Size

All lettering must be 2.5 mm or larger in height and 0.18 mm or thicker in line thickness.

Drawing Technique

Points of drawing technique that are significant to the preparation of drawings are as follows:

- Care in ensuring balanced distribution of detail throughout the drawing.
- Letters and figures shall be clearly legible, well-spaced, properly formed and proportioned.
- Lines shall be uniform in weight and density.
- New and existing features shall be readily distinguishable.
- Dimensioning of a drawing is extremely important and should be such that it will not be misinterpreted. Dimensions should be given from an iron pin, lot line, chainage station, a centreline, curb line or other approved reference that can be readily established. All dimensions shall be in SI (System International) units.

13.4.4 Required Drawings

13.4.4.1 Cover Sheets

Cover sheets should show the following information:

- The City of Yellowknife Logo
- Name of subdivision or project
- Stage of development
- Nature of drawings
- Name of the Developer
- Date
- Name of the engineering firm
- Name of landscape firm



Location Plan, Index Plan and List of Drawings

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

- The index plan shall be a copy of the legal plan indicating that portion of a street relating to a particular plan/profile sheet.
- A complete list of drawings.
- A location plan showing the development as it relates to the surrounding lands and its orientation shall be provided.
- Street names to be shown.
- Phase/Stage Boundary.

13.4.4.2 Overall Plans

Overall plans shall include but not be limited to the following information:

Topography and Land Use Plan

- Existing contours 1 m intervals (maximum)
- Proposed land use
- Existing features (i.e. Buildings, trees, temporary access roads etc.)
- Street names, lot and block numbers
- All easements and right-of-way's including widths and alignments

Road and Concrete Improvement 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 contract
- Right-of-way easements
- Adjacent roadways, existing/proposed, street names, lot, block numbers
- Traffic markings and signage information

Lot Grading Plan

- Design elevations at lot corners and at building
- Direction of surface drainage flow for design
- Contours of original ground
- Sewer inverts at property line
- Uniform fencing requirements
- Important surface features (i.e. Light standards, hydrants, pedestals and transformers)



- Individual lot types, detail drawings of same
- Drainage easements and swales
- Driveway locations
- Street names, lot and block numbers

Storm, Sanitary and Watermain Plans

- Sizes, alignment, depths, spacing, dimensions off the property lines and direction of flow of all underground municipal improvements
- Local drainage areas which contribute to storm sewers
- Sanitary sewer area
- Maintenance holes
- Catch basins and leads
- Hydrants, valves and other appurtenances
- Services
- Third pipe storm system
- Street names, lot and block numbers

Franchised Utilities Plan

- Alignments and all pertinent information (i.e. Pedestals, transformers, etc.) for all shallow utilities
- Gas
- Power
- Telephone
- Cable T. V.
- Easements and utility lots
- Driveways
- Street lights
- Lot services
- Street names, lot and block numbers
- Community mailbox locations if planned
- Other surface features such as valves, maintenance holes, hydrants, curbs, etc. to identify conflicts

Signing and Pavement Markings Plan

- Traffic signs and street name signs
- Information signs
- Bus routing and bus stop signs
- Details of sign types, installation, construction, etc.
- Pavement markings
- Street names, lot and block numbers



13.4.4.3 Detail Plan/Profile Drawings

Generally, all underground services and surface improvement profiles are shown on the same drawings. The plan portion of the drawing will be positioned at the top and the profile portion at the bottom. Information shown on plan profiles shall include, but not be limited to, the information on the following table and, although not necessarily shown on the construction drawings, this information will be required for the record drawings.

Table 13-5: Plan/Profile Drawings

The Drawing Shall Show in Plan	The Drawing Shall Show in Profile
General Information	
<ul style="list-style-type: none"> ● SCALE ● Urban 1:500 horizontal ● Rural 1:1000 horizontal ● Chainages and property line ties to correlate with profile section ● Legal subdivision information ● Cross-sectional references to detail drawings ● Street and walkway names and numbers ● True centreline chainages of roadways ● Accuracy of grade information to two decimal points 	<ul style="list-style-type: none"> ● SCALE ● Urban 1:50 vertical ● Rural 1:100 vertical ● Chainages and property line ties to correlate with plan section C legal subdivision information ● Existing ground profile ● Cross-sectional references to detail drawings ● True centreline chainages of roadways ● Grade information to two decimal points
Road Information	
<ul style="list-style-type: none"> ● Horizontal alignments of all roadways, curb and gutters, sidewalks and lane ● Dimensions of all roadways, sidewalks and lanes ● Cross-section design by road classification ● Chainages of the PI, BC and EC of horizontal curves, together with delta angles, radius, tangent length and arch lengths for each curve ● Pavement elevations at intersection ● Curb elevations for each basins and the BC & EC of corner radii ● Road structure design elements 	<ul style="list-style-type: none"> ● Vertical alignments (grades of the crownline or top of curb of all roadways) ● Grades of all sidewalk, swales, lanes, etc. ● Vertical curve information: <ul style="list-style-type: none"> ○ Chainage to BVC, EVC and PVI elevations of BVC, EVC & PVC ○ Lengths of curves ○ Elevations and chainages at sags and crests of curves ○ External value, e ○ K. crest, K. Sag ○ Curb and centre line gradient



The Drawing Shall Show in Plan	The Drawing Shall Show in Profile
Water Main Information	
<ul style="list-style-type: none"> • Tie the location of watermains, hydrants, C indicate size, type, pipe material, class of pipe valves and other appurtenances to property and class of bedding line • Show offsets of main to property line • Indicate details of connection to existing water mains • Degrees of bends if other than 90 degrees 	<ul style="list-style-type: none"> • Show hydrants, valves and fittings show required depth of bury and top of pipe elevations at all grade changes, valves and fittings backfill compaction • Show size of watermains and all valves and appurtenances
Sanitary and Storm Sewer Information	
<ul style="list-style-type: none"> • Alignments of all sewer profiles shall be drawn showing the length • Tie locations of sewers, maintenance holes, cleanouts and other appurtenances to property lines • Locate catch basins using road chainages and show leads between catch basin and the Maintenance hole • Maintenance holes shall be numbered (sanitary with the prefix "SAN", storm with the prefix "STM") 	<ul style="list-style-type: none"> • Sewer profiles shall be drawn showing the length and percent grades between maintenance holes size, type, class of pipe material and class of bedding rim elevations of all maintenance holes • Invert elevations at both inlet and outlet of maintenance holes • Maintenance holes shall be numbers (sanitary with the prefix "SAN" and storm with the prefix "STM") • Common trench installation shall be referenced to a cross-section showing separation, class of pipe, class of bedding and trench widths • Backfill compaction
Water and Sanitary Service Connections	
<ul style="list-style-type: none"> • The service connection provided to each lot shall be shown on the plan and the location referenced to the property lot corner • Invert Elevations of Sanitary Sewer Services, third pipe services, and water services. • Coordinate table showing geodetic locations of all lot services 	<ul style="list-style-type: none"> • Invert at property line to be shown where risers are used
Shallow Utilities	
<ul style="list-style-type: none"> • Plan sections shall show gas, power, telephone and cable alignments 	

13.4.5 Maintenance Hole, Hydrant Vault and Buried Main Valve Numbering

To provide consistency for the City utility numbering system, proposed maintenance holes, hydrant vaults and buried main valves shall be submitted on a sketch to the City for numbering designation. The City shall return the sketch to the Developer and the Developer shall incorporate the numbers into the engineering drawings.



13.4.6 Special Requirements for Design Drawings

The design drawings shall be supplemented with the following details:

- 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 the crossings of oil, gas, power transmission lines or railroads and highways;
- Details of placement on fill, tunnelling, or pipe jacking, if such special methods are envisaged; and
- Thrust block details.

13.5 Record Drawings (Post Construction)

Record drawings shall be prepared in accordance with the specifications set forth in this Servicing Standard and shall reflect the works and improvements actually constructed. Shall conform to previously stated drawing styles.

13.5.1 Submission of Drawings to the City

A complete electronic set of PDF record drawings of the same format as the engineering drawings.

- A computer graphic file of the record drawings on a USB drive in AutoCAD's DWG format version 13.
- Record drawings shall be submitted 90 days from the start of the warranty period. In no event will a Final Acceptance Certificate be issued prior to acceptance of record drawings by the City.
- A local improvement or re-development of a specific lot that involves the installation of a service to a building requires the submission of a record service drawing within 60 days of construction.

13.5.2 Information Requirements

13.5.2.1 General

The engineering drawings shall be revised to provide accurate record information of the as constructed local improvements.

Engineering Drawings are to be stamped by the engineer of record.

Additional information to be recorded on the drawings

- Underground local improvements;
- Bedrock profiles as encountered during construction;
- Depth of over-excavation beneath utilities; and
- Locations, elevations and descriptions of existing utilities.



Surface Local Improvements

- Depth and location of roadway sub-cut and granular fill replacement;
- Location and type of geotextile;
- Profile, location, thickness and type of road insulation;
- Revisions of grades and elevations if the difference from design is greater than 10 mm; and
- Areas of fill on lots.

Services (see Appendix C for Relevant Drawings)

- Type and size of service (may be indicated as a note on the drawing if all services are the same);
- Horizontal distance from the downstream sanitary maintenance hole to the sanitary service tap;
- Location of the sanitary service from the main to the building or property line;
- Horizontal position of any bends or fittings in the sanitary service measured from the main;
- Location of the water services and buried valves;
- A dimensioned location of the service from the property lines and, if applicable, at the building;
- Elevations of water services (100 mm dia. or greater) and sanitary services at the mains, valves, bends or fittings, grade changes, property lines and, if applicable, at the buildings;
- Bend and fitting types shall be labeled;
- Elevations of water services installed in a trench separate from the sanitary sewer;
- Insulated portions of the sanitary service; and
- A separate drawing for the service record is not required if the information can be indicated on the plan/profile drawing.

Single Service Installations

- The service record information as specified in above shall be shown.
- The service record drawing shall be sketched at an appropriate scale on an 8.5" x 11" sheet. The drawing shall show the plan profile of the service.
- Record drawings shall be certified by a Journeyman Plumber, or Professional Engineer for service pipes 65 mm dia. or less and by a Professional Engineer for service pipes greater than 65 mm dia. (These are requirements of the **City Water and Sewer By-Law No. 4663**).
- Location, elevations, and descriptions of the existing utilities shall be shown.
- The finished surface profile over the centre line of the service shall be shown.
- The City may, at its discretion, require a plan/profile sheet.
- A service installation from a main to a building may not have a geodetic elevation reference in the vicinity. In this case, the City may approve a reference elevation of 0.00 m located at the top of pipe (steel) of the sanitary main where the sanitary service is tapped.
- A service installation from a property line to a building shall use geodetic elevation references. The majority of these service installations occur in younger developments that have reference survey information and lot grading requirements.
- A photograph(s) showing the exposed service pipes prior to backfill. The photograph(s) shall also show the service alignment from the main or property line to the building



Geotechnical

- Soil types that differ significantly from the Geotechnical Report;
- Ice rich permafrost profiles exposed during construction; and
- As constructed recommendations of the Geotechnical Report.

Completion Date

- The month and year of the construction completion shall be shown on all engineering drawings.

13.6 Record Drawings and Other Documents

The Developer shall submit to the Planning & Development Department record drawings and other related information giving detailed measurements of the actual municipal services constructed. The submission of this data for record purposes is a condition of the issuance of Construction Completion Certificates by the City. Record Drawings will be required in two stages, and are required for occupancy permits (Digital submissions only, through **CityView**).

13.6.1 Interim Stage

On completion of the sanitary and storm sewer systems, the water distribution system and lot services the Developer shall submit to the Engineering Division an electronic copy of as-constructed drawings to the City's format.

The Consulting Engineer shall certify that all work had been completed in accordance with the plans and specifications, the Engineering Servicing Standards and that all work and deficiencies have been completed.

Together with the above the Developer shall submit the monthly progress reports, lot service records, compaction test results and successful pressure, leakage and chlorination tests.

Upon satisfactory acceptance of this data, the Developer may request a construction completion inspection for sewer and water.



13.6.2 Completed Stage

Within thirty (30) days of satisfactory completion of surface improvements and as a condition of the issuance of Construction Completion Certificate for surface improvements the Developer shall submit to the Engineering Division the following information:

- Certification by the Consulting Engineer that all work has been completed in accordance with the plans and specifications, the Engineering Servicing Standards and that all work and deficiencies have been completed.
- One digital copy of as constructed drawings sealed by a professional engineer registered in the Northwest Territories and complete with a "Certificate of Compliance". At this stage, the drawing shall be stamped "As-built Drawings for all Municipal Improvements".
- All previously not submitted certificates concerning materials inspection and testing, mix designs, deflection test, concrete strength tests, compaction tests, infiltration, exfiltration, light, video-inspection tests, as required by this document and by the City.
- Operation and Maintenance Manuals, spare parts and lubricants.
- Completed tender document as tendered by the successful contractor and a copy of the Final Progress Payment Certificate.

Upon acceptance of this data, the Developer may request a construction completion inspection and within thirty (30) days of such request, the City will carry out an inspection for issuance of the Construction Completion Certificate. Should seasonal conditions not permit the inspection, execution of the Construction Completion Certificate, by the City, will be delayed until appropriate conditions exist and/or conditional acceptance may be granted based on the Consulting Engineer's Certification.

13.6.3 Additional Information

Record drawings will be of the same format as the original construction drawings with all changes noted and the following information added:

- Design data is erased on original and replaced with record data.
- All hydrants, valves, curb stops, Maintenance holes and catch basins are to be dimensioned in two directions.



14.0 General Construction Requirements

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

14.1.1 Occupational Health and Safety

The Developer, Contractor, Consulting Engineer and Landscape Consultant, shall comply with the provisions of the Occupational Health and Safety Act, and amendments thereto and regulations thereunder or any successive legislation, and shall at all times ensure that all subcontractors at the worksite shall comply with the requirements of the said Act and regulations thereunder. The Contractor shall be the general representative and agent to the Developer for the purposes of insuring compliance with safety regulations for both itself and subcontractors.

The Contractor shall bring to the attention of subcontractors the provisions of the Occupational Health and Safety Act and regulations thereunder.

The City considers the Developer the Prime Contractor for the work site and is responsible for ensuring compliance with the Occupational Health and Safety Act by all employers and employees on the Work site.

The Contractor and the Consulting Engineer shall have either full certification in the NWT Labour approval “Certificate of Recognition” (C.O.R.) Program appropriate to their industry or a Temporary Letter of Certification (T.L.C.) issued by the NWT Construction Safety Association.

14.1.2 Project Supervision

The Consultant shall be responsible for the layout, field surveys, inspection and approval of materials and the supervision of installation of all improvements which are the responsibility of the Developer.

The Consultant or their authorized representative shall be onsite at all times during the installation of services to certify that all improvements are in conformance with the approved plans and specifications.

In addition to supervision carried out by the Consultant, the City will periodically inspect the work and assist in coordinating the works with any related Municipal works. The City will bring the use of any unacceptable materials or practices to the attention of the Consultant. If remedial action is not taken to the satisfaction of the City, a Stop Work Order will be issued and all work will cease. The unacceptable work will be corrected and/or replaced.



14.1.3 Right-of-Way Documents

Where easement or right-of-way documents are deemed necessary, they shall be prepared by a registered Land Surveyor at the Developer's expense. Easements or right-of-ways shall be of sufficient size to allow access for maintenance purposes.

14.1.4 Construction Approval

Upon receipt and approvals of certified drawings and specifications, the Developer on the satisfactory execution of the Development Agreements may proceed to install the municipal improvements.

A copy of all approved drawings and specifications shall be maintained at the construction site during the installation of services.

14.1.5 Inspection Notice

The Developer shall give the City Development Officer at least two weeks' notice prior to commencement of construction to allow for time to arrange for inspection staff, from the appropriate City Division.

14.1.6 Stockpile Locations

The location of all stockpiles shall be subject to the approval of the City.

14.1.7 Dust Control

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

14.1.8 Street and Sidewalk Cleaning

During the warranty period and until the issuance of 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 tracking of mud from the development occurs.

14.1.9 Barricades, Guards and Safety Provisions

To protect persons from injury and to avoid property damage, adequate barricades, construction signs, warning lights and guards shall be placed and maintained during the progress of the construction work and until it is safe for traffic or pedestrian use, all in conformance with WSCC and GNWT Regulations. Whenever required, watchmen shall be provided to prevent accidents.



In redevelopment areas or any locations where development is occurring are issued provide:

- Minimum of a perimeter fence (chain link) complete with warning signs
- If risk of falling items on pedestrians then provide overhead protection over walkways

14.1.10 Traffic and Utilities Controls

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

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 or other utility controls shall be unobstructed and accessible during the construction period. Adequate provision must be made for the flow of sewers, drains and water courses encountered during construction. No valve, switch or other control on existing utility system shall be operated for any purpose by the Developer. All property owners affected by such operations shall be notified by the Developer in consultation with the Engineering Division before the interruption of service and advised of the probable time when service will be restored.

Prior to any road closure, the Developer must submit and have approved, a detour plan to the Engineering Division in two weeks advance of implementation to allow time for review. Developer is to apply for and receive an orderly use of Highway Permit from the City before implementation of the detour.

The Developer shall be responsible for supplying, placing and maintaining detour signing for the duration of construction. Emergency access must be maintained at all times. The Developer must, at their expense, provide, erect and maintain all signs, barricades, flares, flag persons etc.

In order to permit movement of traffic across the streets where new pavements are being constructed, the Developer may be required by the City to construct some intersections one-half at a time. In this way, traffic can cross the road through a gap in the pavement until it is allowed to cross on the new pavement at which time, the gap in the pavement can be filled in.

14.1.11 Reporting

Submit regular progress reports to the Engineering, Planning and Development and Parks Departments in a format approved by the City. In addition, invite the City to regular site meetings and circulate meeting minutes.



Other information to be submitted as part of the Construction Completion Certificate (CCC) includes:

- Test results from:
 - Compaction
 - Strength
 - Exfiltration/infiltration
 - Pressure
 - Leakage
 - Chlorination and bacterial test results
 - T.V. monitoring analysis of underground sanitary sewer and storm sewers

14.1.12 Stop Work Order

The City may issue a “Stop Work Order” to the Contractor due to non-conformance. Non-conformance includes:

- Unsafe practices
- Imminent danger
- Lack of traffic control
- Failure to submit required testing certification
- Construction not in accordance with approved drawings and specifications
- Non-compliance with the development requirements
- Damage to existing facilities

Should a “Stop Work Order” be issued, the Developer shall immediately cease operation, rectify the non-conformance and obtain the City’s approval prior to proceeding.

14.1.13 Material

The Developer shall only install materials which have been approved either in these Standards, the Engineering Specifications, or otherwise approved in writing by the City.

The Developer shall submit certification by an accredited testing firm in which that firm verifies that all materials conform to this Guideline or the special letter of approval. Failure to submit the certification will be cause for halting the project and issuance of a “Stop Work Order”.

14.1.14 Survey Monument Control

The Developer shall be responsible as follows:

- To see that the survey control networks are extended (and recorded in accordance with the Canadian Survey Requirements) into the development area. The density and location of survey control monuments shall be mutually agreed upon through consultation with the Engineering Division (suggested spacing + 600 meters).



- 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 municipal improvement.

14.1.15 Work at Night

For work carried out between 11:00 PM and 7:00 AM, the developer is required to obtain a noise-bylaw exemption from the City in advance of commencing work.



15.0 Approvals

The following certificates are to be utilized by the Developer and Consultant:

15.1 Construction Compliance

Upon satisfactory completion of the project, Developer is required to submit letter from Consulting Engineer stating that the infrastructure installed is in compliance with stamped design drawings, City standards, specifications, and expectations.

15.2 Construction Completion Certificate (CCC)

Upon satisfactory completion of the project, construction completion inspection is satisfactory and after all the deficiencies have been corrected, the City shall execute the Construction Completion Certificate submitted by the Developer and Consulting Engineer, notifying:

- Acceptance of the portion of work by the City
- Commencement date of warranty

A copy of the Construction Completion Certificate is included in this section for execution by the Developer and the Consulting Engineer. The procedure is illustrated in **Appendix A**.

If provided for in the Development Agreement, separate Construction Completion Inspections and commencement of warranty periods shall be issued for the following:

- Underground utilities only
- Underground utilities and surface works
- Landscaping
- Facilities

15.2.1 Permitted Stages

The permitted stages of Construction Completion Certificate (CCC) are as follows:

CCC Full – Underground and Surface

This CCC is issued when Underground and Surface work has been completed, inspected and approved in accordance with the Project Specifications and Development Phasing.

- Warranty commence;
- Some minor deficiencies may exist. For example, a small crack in a sidewalk;
- LOC is reduced, typically to 10%;
- DP's can be issued; and
- Municipal Operations (such as snow clearing, garbage pickup and transit services) commence subject to the site being safe and uncluttered in the opinion of Public Works.



CCC – Partial –Underground and Surface

This CCC is issued when Underground and Surface work has been completed in a portion of the intended Project Phase with the intention of completing the remaining work, the following construction season.

- Subject to approval from Engineering;
- Warranty does not commence until remaining part has been completed and approved;
- No reduction in LOC;
- No Municipal Operations; and
- A Site Management Plan is required to address emergency, functionality and operational issues.

CCC – Conditional – Underground and Surface

This CCC is issued when significant portions of the work are incomplete, deficient or have not been inspected due to seasonal conditions.

- Same conditions as partial CCC noted above; and
- Entire phase is re-inspected when work is complete.

CCC – Underground Only

This CCC is issued on Completion of Deep Services.

- LOC for Underground component is reduced;
- Warranty commences;
- Some minor deficiencies may exist. For example, grouting of catch basins;
- In some cases, DP's can be issued subject to Engineering approval. Typically for Multi-Family, Commercial, Industrial, Institutional or Recreations buildings;
- No Municipal Operations; and
- A Site Management Plan is required to address emergency, functionality and operational issues.

15.3 Final Acceptance Certificate (FAC)

Prior to the expiration of the warranty period, the Developer shall request in writing a final inspection, and within thirty (30) days of receipt of such request, the City will carry out an inspection. Final Acceptance shall include underground services and surface work, and facilities, where applicable, and, upon correction of all deficiencies, shall be issued under one combined Final Acceptance Certificate encompassing all improvements. Landscape improvements will be approved under a separate Final Acceptance Certificate. A copy of the certificate is included in this section for execution by the Developer and the Consulting Engineer. The procedure is illustrated in the appended flow charts (**Appendix A**). The warranty shall remain in effect until the Final Acceptance Certificate is accepted by the City.

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



16.0 Warranty Period

The Developer shall be responsible for any defect, fault or deficiency in the completed work during a minimum twenty-four (24) month warranty period and shall remedy it at their own expense.

The Developer shall be responsible for any and all third party damages up until the issuance of the Final Acceptance Certificate.

Upon commencement of the warranty period, the City will assume responsibility for snow removal and garbage pickup on paved collector and arterial streets within the occupied development area.

The Developer shall be responsible for snow clearing and the collection of residential garbage on all local streets until:

- The local streets are consistently clear of construction materials and contractor activity such that the City can safely and efficiently provide municipal services within the subdivision; or
- As otherwise negotiated between the Developer and Public Works.

The Developer shall remain responsible for all other maintenance and repair items including third party damages, maintenance of street signs, flushing of sewer lines and thawing and flushing of water mains.



17.0 Reference Materials

Throughout the Standards, reference will be made to other standards and regulations. These include, but are not limited to:

Public Health Act – Government of the NWT

Public Sewerage Systems Regulations – Government of the NWT

Water Supply System Regulations – Government of the NWT

Occupational Health and Safety Policy – Government of the NWT

Transportation Association of Canada, Geometric Design Guide for Canadian Roads, including supplements

Transportation Association of Canada (TAC), Manual of Uniform Traffic Control Devices for Canada

Canadian Institute of Transportation Engineers (ITE)

Fire Smart: Protecting your Community from Wildfire

Freedom of Information and Protection of Privacy Act

Design and Development Standards

General Municipal Plan, Land Use Bylaw and other Municipal Plans, Fire Smart Guidelines and Engineering Master Plans

City of Yellowknife By-Laws

Postal Delivery Standards Manual, Planning for Postal Service

American Water Works Association (AWWA)

CSA Canadian Standards Association

Standards Council of Canada (SCC)

American Society for Testing and Materials (ASTM)

Canadian General Standards Board CGSB

Handbook of Steel Drainage and Highway Construction Products, by American Iron and Steel Institute

Handbook of Concrete Culvert Pipe Hydraulics, by Portland Cement Association

Canadian Construction Safety Code 1977 (7.1.2 Rock Excavation)

Water Supply for Public Fire Protection - A Guide to Recommended Practice" published by the Insurance Bureau of Canada. (6.3.1 Hydraulic Design Parameters)

Standards and Guidelines for Municipal Water Works, Wastewater and Storm Drainage Facilities (6.2.5 Valves and Fittings)



BS 337 "The Structural Use of Concrete for Retaining Aqueous Liquids," published by the British Standards Institution. (6.3.4)

WHMIS (6.2.5 Valves and Fittings)

Local Power Utility Standard.

Municipal Engineering Specifications

Shaw Pipe Protection "Insul-8" system, Urecon Ltd "U.I.P" system, or Thermal Pipe Systems Inc (3.1.8)

AWWA : C651 (3.1.13); 800 (3.1.14); C478 Concrete Material (4.1.1.1) Maintenance hole Materials; C-200-05 (6.4.5 Piping, Valves and Fittings); C52. (6.7.2 Disinfection – Water Reservoirs); C210-07 (6.2.5 Valves and Fittings)

ASTM C478 4.1.1.1) Maintenance hole Materials; A48 4.1.1.1) Maintenance hole Materials; D698 (7.1.4 Backfilling)

CAN/CSA-A23.1 AND CSA-A3000 (From **section 1.1.2 of Appendix B**) ALL BELOW FROM AB

CAN/CSA 30.18, 4.1.1.1) Maintenance hole Materials; CSA CAN3-A23.1, CSA CAN 3A23.2, and CSA CAN 3-A23.3 ; CSA G164 4.1.1.1) Maintenance hole Materials

CGSB 56 – CP – 4a 4.1.1.1) Maintenance hole Materials; CGSB Standard 1-GP-181M. (5.1.2 Pipe, Fitting and Coupler Materials)

All of 4.1.3 Pipe Fitting and Coupler Materials

Corrugated Steel Pipe Institute Specification No. 501 SCC G401-14 (5.1.2 Pipe, Fitting and Coupler Materials)

CAN 3-G401 (5.1.2 Pipe, Fitting and Coupler Materials) Standards Council of CANADA

Corrugated Steel Pipe Institute Specification CAN 3-G401 (5.1.2 Pipe, Fitting and Coupler Materials)

All of 4.1.3 Pipe Fitting and Coupler Materials

American Society for Testing and Materials (ASTM) <https://www.astm.org/>

American Water Works Association (AWWA) <https://www.awwa.org/Publications/Standards>

AWWA : C651 (3.1.13); 800 (3.1.14); C478 Concrete Material (4.1.1.1) Maintenance hole Materials; C-200-05 (6.4.5 Piping, Valves and Fittings); C52. (6.7.2 Disinfection – Water Reservoirs); C210-07 (6.2.5 Valves and Fittings)

ASTM C478 4.1.1.1) Maintenance hole Materials; A48 4.1.1.1) Maintenance hole Materials; D698 (7.1.4 Backfilling)



- BS 337 "The Structural Use of Concrete for Retaining Aqueous Liquids," published by the British Standards Institution. (6.3.4) <https://shop.bsigroup.com/ProductDetail/?pid=00000000010106992> (from 1976)
- CAN 3-G401 (5.1.2 Pipe, Fitting and Coupler Materials) Standards Council of CANADA
- CAN/CSA-A23.1 AND CSA-A3000 (From **section 1.1.2 of Appendix B**) ALL BELOW FROM AB
- CAN/CSA 30.18, 4.1.1.1) Maintenance hole Materials; CSA CAN3-A23.1, CSA CAN 3A23.2, and CSA CAN 3-A23.3 ; CSA G164 4.1.1.1) Maintenance hole Materials
<http://www.scc.ca/en/standardsdb/standards/28327>
- Canadian Construction Safety Code 1977 (7.1.2 Rock Excavation) <https://nrc-publications.canada.ca/eng/view/object/?id=bc1f625b-64d0-479e-b193-7f7b2020cd25>
- Canadian General Standards Board CGSB <https://www.tpsgc-pwgsc.gc.ca/ongc-cgsb/publications/catalogue/index-eng.html>
- Canadian Institute of Transportation Engineers (ITE) <https://www.cite7.org/>
- CGSB 56 – CP – 4a 4.1.1.1) Maintenance hole Materials; CGSB Standard 1-GP-181M. (5.1.2 Pipe, Fitting and Coupler Materials)
- City of Yellowknife By-Laws <https://www.yellowknife.ca/bylaws/Bylaw>
- City of Yellowknife, Utility Installation and Traffic Control Manual.
- Corrugated Steel Pipe Institute Specification CAN 3-G401 (5.1.2 Pipe, Fitting and Coupler Materials)
- Corrugated Steel Pipe Institute Specification No. 501 SCC G401-14 (5.1.2 Pipe, Fitting and Coupler Materials) <http://cspi.ca/>
- CSA Canadian Standards Association
https://store.csagroup.org/ccrz__ProductList?viewState=ListView&categoryId=a0K1I000002IWGqUA0

Engineering Servicing Standards

- Fire Smart Guidelines and Engineering Master Plans https://www.yellowknife.ca/en/living-here/resources/Fire_Division/Sylvia/FireSmarting-Homeowner-Checklist.pdf
- Fire Smart: Protecting your Community from Wildfire <https://firesmartcanada.ca/wp->
- Freedom of Information and Protection of Privacy Act
<https://www.justice.gov.nt.ca/en/files/legislation/access-to-information-and-protection-of-privacy/access-to-information-and-protection-of-privacy.a.pdf>
- General Municipal Plan, <http://www.yellowknife.ca/bylaws/Bylaw/Details/20bcec36-a6fd-472c-aa1a-e99f092d1c67>



Handbook of Concrete Culvert Pipe Hydraulics, by Portland Cement Association,
<https://www.worldcat.org/title/handbook-of-concrete-culvert-pipe-hydraulics/oclc/706570>.

Handbook of Steel Drainage and Highway Construction Products, by American Iron and Steel Institute;
https://www.ail.ca/wp-content/uploads/2017/07/CSPI_Handbook-of-Steel-Drainage-Highway-Construction-Products.pdf

Land Use Bylaw and other Municipal Plans,
<https://www.yellowknife.ca/bylaws/Bylaw/Details/e8eea1e6-ea75-48f1-ab31-ca0465401a21>

Local Power Utility Standard.

Municipal Engineering Specifications

Occupational Health and Safety Policy – Government of the NWT
<http://www.wscn.nt.ca/documents/occupational-health-and-safety-regulations-nwt>

Postal Delivery Standards Manual, Planning for Postal Service
https://www.canadapost.ca/cpo/mr/assets/pdf/business/standardsmanual_en.pdf

Public Health Act – Government of the NWT. <https://www.justice.gov.nt.ca/en/files>

Public Sewerage Systems Regulations – Government of the NWT. <https://www.justice.gov.nt.ca/en/files>

Shaw Pipe Protection “Insul-8” system, Urecon Ltd “U.I.P” system, or Thermal Pipe Systems Inc (3.1.8)

Standards Council of Canada (SCC) <https://www.scc.ca/en/standards>

Standards and Guidelines for Municipal Water Works, Wastewater and Storm Drainage Facilities (6.2.5 Valves and Fittings)

Transportation Association of Canada, Geometric Design Guide for Canadian Roads, including supplements. (<https://tac-atc.ca/sites/tac->

Transportation Association of Canada (TAC), Manual of Uniform Traffic Control Devices for Canada.
<https://www.tac-atc.ca/en/5th-edition-manual-uniform-traffic-control-devices-canada>

Water Supply for Public Fire Protection - A Guide to Recommended Practice" published by the Insurance Bureau of Canada. (6.3.1 Hydraulic Design Parameters) <http://www.scm-rms.ca/docs/Fire%20Underwriters%20Survey%20-%201999%20Water%20Supply%20for%20Public%20Fire%20Protection.pdf>

Water Supply System Regulations – Government of the NWT. <https://www.justice.gov.nt.ca/en/files>

WHMIS (6.2.5 Valves and Fittings) <http://whmis.org/>

