



TOWN OF PARADISE  
**ENGINEERING GUIDELINES**  
ADOPTED BY COUNCIL DECEMBER 17, 2019

FOR USE IN DEVELOPMENT WITHIN PARADISE

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Forward:

These guidelines shall be used in conjunction with the latest edition of the following publications:

1. Government of Newfoundland & Labrador Municipal Water, Sewer and Roads Master Construction Specifications (Municipal Master Specification).
2. Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (Metric Edition).
3. Transportation Association of Canada (TAC) Canadian Roundabout Design Guide
4. Transportation Association of Canada (TAC) Manual of Uniform Traffic Control Devices for Canada (Metric Edition).
5. The National Building Code of Canada (NBCC).
6. The National Plumbing Code of Canada (NPC).
7. The National Fire Code of Canada (NFC).
8. The National Farm Building Code of Canada (NFBC).
9. The Association of Newfoundland Land Surveyors (ANLS) Manual Of Practice.
10. Fire Underwriters Survey Water Supply for Public Fire Protection.
11. Department of Municipal Affairs and Environment (DMAE) Guidelines for the Design, Construction, and Operation of Water and Sewerage Works.
12. Town of Paradise Municipal Plan, Development Regulations and Policies.

In any case where standards in the above noted publications are less than those stated in the Town's Engineering Design Guidelines, The Town's Engineering Design Guidelines shall be used as the accepted standard.

This document is a guideline. The Municipal Plan & Development Regulations are adopted standards and in the case of a conflict, the Municipal Plan & Development Regulations shall prevail as the standard. In all cases the more stringent requirement is to be applied.

**It is the responsibility of the reader to ensure they are referencing the latest revision of this document. The Town will maintain the latest version on the Town of Paradise website, [www.paradise.ca](http://www.paradise.ca). Please check regularly for revisions.**

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## **1.0 GENERAL INFORMATION**

The Town of Paradise Engineering Design Guidelines are developed and maintained by the Infrastructure and Public Works (IPW) Department of the Town of Paradise. They are provided for the purpose of presenting standards, guidelines and instructions for the design and construction of developments within the Town of Paradise.

This document must be read in conjunction with the Municipal Master Specification and with the Town of Paradise Municipal Plan, Development Regulations and Policies and with all applicable Provincial Acts and Regulations.

### **1.1 Definitions**

- 1.1.1 Stage 1 Work - Stage 1 work consists of all work relating to the installation of water, sanitary, and storm sewer systems, construction of all street right-of-ways including base course asphalt, curb & gutter, temporary street lighting, and development of open space areas and accesses to these areas.
- 1.1.2 Stage 2 Work - Stage 2 work consists of all work relating to the construction of above ground work, including but not limited to, surface course asphalt, landscaping of areas other than open space areas, tree planting, privacy fencing, sidewalks, and walkways.
- 1.1.3 Developer - A person or company who has applied for and has been granted approval to subdivide or service an existing parcel of land
- 1.1.4 Construction Approval - Approval to the Developer to proceed with construction work as per the development agreement or as otherwise authorized by the Town.

### **1.2 General Requirements**

- 1.2.1 Developer is responsible to obtain all required permits from the Town's Planning and Development Department prior to beginning work.
- 1.2.2 Developer is responsible to obtain all required permits and approvals from Federal and Provincial Governing Bodies prior to beginning work, including, but not limited to, Fisheries and Oceans Canada, Service NL, and Department of Municipal Affairs and Environment – Water Resources Management Division.
- 1.2.3 Developer must have a full time inspector during construction operations to confirm all work is completed as per these Guidelines and the Municipal Master Specification. Proof of full time inspection must be provided to the Town. The Town reserves the right to refuse work if proof of full time inspection is not satisfactory.

### **1.3 Stage 1 Work**

- 1.3.1 Stage 1 Work will not be permitted to commence until construction approval has been issued, all financial requirements have been met and the Subdivision Agreement and the Subdivision Permit have been issued and executed.

#### **1.4 Acceptance of Stage 1 Work**

- 1.4.1 Stage 1 work will be accepted upon submission and approval by the Town of all required as-built information, as identified in Section 12 – As-Built Information.
- 1.4.2 The Developer is responsible for all work contained within the subdivision boundaries as per the Development Agreement until acceptance of Phase 2 and conveyances of streets, easements and open space to the Town.

#### **1.5 Stage 2 Work**

- 1.5.1 Stage 2 Work shall not commence until Stage 1 Work has been accepted by the Town. Base course asphalt and curb and gutter must be placed prior to the Town undertaking any snow clearing operations. All manholes must be ramped and approved by the Town. The Town will not accept responsibility for damage to, and maintenance of, any Stage 1 Work until all Stage 2 Work has been completed and accepted by the Town.
- 1.5.2 Surface course asphalt and concrete sidewalks shall not be placed without the approval of the Town. Approval will not be granted for surface course asphalt and sidewalk until 80% of the lots have been issued an occupancy permit or two years after the date of signing of the development agreement. Approval will not be granted for surface course asphalt until video inspection has been completed as per Section 11.3 Reports, and approved by the Town.

#### **1.6 Acceptance of Stage 2 Work**

- 1.6.1 Stage 2 work will be accepted upon submission and approval by the Town of all required as-built information, as identified in Section 12 – As-Built Information.

#### **1.7 Warranty Period**

- 1.7.1 The Developer shall, at his own expense, rectify and make good any defect or fault (to the satisfaction of the Town) however caused, appearing within a one year period from the date of acceptance of the Stage 2 Work.
- 1.7.2 Failure of the developer to comply shall give the Town the right to utilize any or all of the security to complete the outstanding work.
- 1.7.3 The security, less funds utilized by the Town to complete or rectify deficiencies, will be released at the end of the warranty period providing that all noted deficiencies have been corrected, all conditions of the development agreement have been met, the subdivision is 100% complete and all work has been accepted by the Town.



## **2.0 SURVEYING OR LAND SURVEYING**

### **2.1 Definitions**

- 2.1.1 Land Surveying is the art, science and technology of locating and determining by measurement the shape and size of any portion of the earth's surface and the representation of these surveys on maps and plans.
- 2.1.2 Provincial geographic referencing system is based on the North American Datum 1983 "NAD83" and the Modified Three Degree Transverse Mercator Projection for Newfoundland.
- 2.1.3 Provincial Control Monument means any marker established by the Province of Newfoundland and Labrador with precise positions for the reference of topographic mapping, land surveys, and engineering surveys for the Provincial Co-Ordinate Survey System.

### **2.2 Survey Plan**

- 2.2.1 A survey plan shall be submitted to the Town in electronic format, both PDF and CAD.
- 2.2.2 The survey plan shall be provided in accordance with the "Manual Of Practice" established by the Association of Newfoundland Land Surveyors (ANLS) and shall include at a minimum:
  - a) The name of the owner of all abutting lands;
  - b) The length and bearing of each line of any traverse which connects any point on the boundary of the subdivision with a Provincial Co-ordinate Monument;
  - c) Each street, walkway, and easement;
  - d) All infrastructure and utility easements;
  - e) Each lot and it's civic number;
  - f) The coordinates for all street intersections, deflections and endpoints.
  - g) The length, bearing, and internal angle of each line of the boundary of, and the area in square metres of:
    - i. The land being subdivided;
    - ii. Each street, walkway, right-of-way, and easement;
    - iii. Each lot; and
    - iv. The land, if any, which is reserved for park, playground, and public purposes.
  - h) The width of each street;
  - i) The geometry of connections between existing streets and streets of the subdivision;
  - j) The location of any existing structure which is to remain;
  - k) Every water course and its direction of flow, including stream banks and high water marks;
  - l) All ditches and swales;
  - m) All information necessary for the calculation and laying out of any curved line;
  - n) The date of compilation;

- o) The date of revision, if any;
- p) The name of the subdivision;
- q) All existing streets, roads, lanes, and intersections in the immediate area and their official names as designated by the Town;
- r) The location and extent of rock outcrops;
- s) The location and results of any test borings;
- t) At least two (2) centre line points of known chainage related to the Provincial Co-ordinate Survey System;
- u) The location and elevation of the Provincial Benchmark used; and
- v) The location of manholes. Manholes shall be assigned numbers by using the last four whole numbers of the easting with the suffix "S" for sanitary sewer manholes and "R" for storm sewer manholes; and
- w) The location of hydrants, valves, catch basins, culverts and other related infrastructure.

2.2.3 The survey plan shall be of a size within the following limits<sup>1</sup>:

- a) MAXIMUM – Size designation B1 (707 mm wide x 1000 mm long).
- b) MINIMUM – Size designation A1 (594 mm wide x 841 mm long).
- c) LEGAL SIZE - Size designation P4 (215 mm wide x 355 mm long).

2.2.4 A survey plan shall be to a scale of 1:500 or more precise if required.

2.2.5 A survey plan shall show a Key Plan to locate the subdivision as it relates to adjacent streets of the Town.

2.2.6 The radius, central angle, the length of arc, the point of curve, and the point of tangency shall be given for each curved line and clearly indicated on the survey plan.

2.2.7 A survey plan shall be certified by a Newfoundland Land Surveyor, registered for the current year.

### **2.3 Survey Details and Accuracy**

2.3.1 All surveys are to be completed using total station or GPS technology.

2.3.2 All boundary line dimensions to be shown to at least three (3) decimal places with all angles shown to the nearest five (5) seconds or better.

2.3.3 When an irregular natural feature (ie. water body, etc) forms or references a boundary, a straight line bearing and distance from one end of the boundary to the other end shall be shown.

2.3.4 Contours shall be shown to determine the proper elevations for all streets, roads, easements, and walkways in relation to the proposed lot layout.

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<sup>1</sup> Refer to National Standards of Canada, CAN 2-9.60 M and CAN 2-9.61 M for paper size.

- 2.3.5 For proposed streets, the existing vertical alignment conditions (contours) shall be obtained from actual field surveys.
- 2.3.6 All Vertical Control shall be related to the Province of Newfoundland Approved Datum.
- 2.3.7 Information shown on a survey plan shall be sufficiently detailed to permit any point on any surveyed line to be accurately located in the field.
- 2.3.8 The accuracy of closure shall be not more than 1 meter in 10,000 meters.

## **2.4 Street, Walkway and Lot Identification**

- 2.4.1 When the roadway and street (street line to street line), have been constructed and the subdivision or area involved is ready for acceptance, each public lot, easement, walkway, right-of-way, and street shall be identified by an iron pin or steel pipe driven into the ground at each corner, beginning of curve, and end of curve, unless these points fall upon solid rock. In such cases, an "X" shall be cut into the rock.

## **2.5 Survey Information**

- 2.5.1 Prior to Stage 1 work acceptance, a copy of all information, regarding permanent subdivision survey monuments, street lines, boundary lines, easements, and walkway locations will be presented to the Town.
- 2.5.2 Survey information shall be clear, concise, neat and accurate, properly labeled and signed by a Newfoundland Land Surveyor, registered for the current year.

## **2.6 Benchmarks**

- 2.6.1 Benchmark plans shall be submitted to the Town for all developments. See Typical Benchmark Plan in Appendix A.
- 2.6.2 The Developer shall supply brass plugs and wedges or other markers (spikes, concrete nails, etc) that are accepted by the Town to be used as benchmarks.
- 2.6.3 The Town shall assign numbers to the benchmarks.
- 2.6.4 The plugs with wedges shall be placed in the concrete curb flush with the concrete. Prior to setting, the plug hole will be filled with quick-set cement. Then, with the use of a mallet and a wooden block, the plug and wedge will be driven into the hole. All other markers to be installed in a similar fashion.
- 2.6.5 All benchmarks shall be intervisible and coordinated using the Modified Three Degree Transverse Mercator Projection. The traverse closure shall be a Minimum of 1:10,000. Crown land reference monuments and their coordinates shall be listed when running the traverse.
- 2.6.6 The maximum distance between benchmarks shall be 300 meters.
- 2.6.7 Benchmarks must be established from other Town benchmarks or Geodetic benchmarks and end at different Town benchmarks or Geodetic benchmarks that have acceptable elevation values. All lines beginning and ending in existing benchmarks with known elevations and all lines forming self-closing loops will be leveled one way. All benchmarks must be turning points and form part of

the leveling loop **OR** if GPS technology is being used the requirements of the ANLS Standards, Regulations and Manual of Practice must be met..

- 2.6.8 Benchmarks must be established by spirit levels, to third order standards with a minimum accuracy of 24 mm/k where k = the distance in kilometers between benchmarks measured along the leveling route. If the misclosure or discrepancy exceeds the allowable, the line shall be re-leveled **OR** if GPS technology is being used the requirements of the ANLS Standards, Regulations and Manual of Practice must be met.
- 2.6.9 The method used will be the three wire method (mean of the reading for the three wires). The difference of elevation is the mean of the two running where:

$$Mean = \frac{(F) - (B)}{2}$$

The Contractor/Surveyor will perform all necessary adjustments of the level loops.

- 2.6.10 The original field notes for the horizontal, vertical control and completed description sheets shall be submitted to the Town.
- 2.6.11 All notes shall be on loose leaf paper (100 mm x 165 mm) with the cover sheet showing the name of the firm, date, name of observer, and recorder.
- 2.6.12 The Town shall supply description sheets for the drafting of a reference plan for each benchmark.
- 2.6.13 The description sheet shall be prepared in a fashion that will produce clear and legible copies. A minimum of three ties shall be shown to reference the benchmark. The reference plan does not have to be to scale, however, all lettering and numbering must be completed using current AutoCAD software.
- 2.6.14 All benchmarks and benchmark information shall be shown on the subdivision plan according to the Town standards.
- 2.6.15 If the work does not meet the above criteria, the contractor/surveyor's work shall be returned for corrections.

## 3.0 DRAFTING

### 3.1 Preparation of Drawings

#### 3.1.1 CAD Drawings

3.1.1.1 All drawings must be prepared using a computer aided design and drafting program. No hand drafted plans or drawings will be accepted.

#### 3.1.2 Version of CAD

3.1.2.1 All drawings must be compatible with AutoCAD 2019.

#### 3.1.3 Size of Drawings

3.1.3.1 All drawings in any one development shall be the same size. The prime consultant shall coordinate the drawing size with any/all sub-consultants, i.e., surveyors, etc.

3.1.3.2 Drawings shall be "A1" (594 mm wide by 841 mm long) or ANSI D size.

#### 3.1.4 Scales

3.1.4.1 All CAD drawings shall be drawn full size and plotted at a reduced scale.

3.1.4.2 The plotting scale of the:

- a) Engineering Plan or Site Services Plan shall be:
  - i. Plan – 1:500.
  - ii. Profile – 1:500 Horizontal, 1:50 Vertical.
- b) Survey Plan/ Subdivision Plan shall be:
  - i. 1:500; or
  - ii. As approved by the Town.
- c) Site Drainage Plan shall be:
  - i. 1:500; or
  - ii. 1:1000; or
  - iii. As approved by the Town.
- d) Location Plan or Key Plan shall be 1:250 or better.
- e) Site Grading Plan shall be 1:500 or better.
- f) Detail plan and cross-sections shall be at a scale that will fully illustrate the subject matter.
- g) All drawings to include a scale bar.

#### 3.1.5 Grid Reference

3.1.5.1 Drawings shall be prepared using NAD83 with northings and eastings indicated. All drawings and surveys must be geo-referenced.

#### 3.1.6 North Arrow

3.1.6.1 A north arrow shall be placed in the upper right corner of each drawing.

### 3.1.7 Plan Orientation

3.1.7.1 Survey plans shall be drawn using the development's actual coordinates based upon NAD83. Title blocks, borders and plots shall be rotated such that the top of the sheet is approximately north and text can be read left to right and/or bottom to top.

### 3.1.8 Symbols and Line Types

3.1.8.1 All symbols and line types to be shown in a legend.

### 3.1.9 Lettering CAD

3.1.9.1 All lettering shall be computer generated.

### 3.1.10 Layering

3.1.10.1 Data on each drawing shall be layered according to standard engineering practice.

### 3.1.11 Reserved Area

3.1.11.1 An area at least 21.5 cm high shall be reserved above the title block for the key plan, notes, legend, engineer's stamp, revision data, etc.

### 3.1.12 Cover Sheet

3.1.12.1 A cover sheet shall be provided for each drawing set and shall contain the following information:

- a) Project Name;
- b) Key Plan;
- c) Name of Consulting Engineer and Sub-Consultants;
- d) Name of Developer;
- e) List of Drawing Names and Numbers;
- f) Date of Issue; and
- g) "As-Built" or "Record Drawing" when applicable.

### 3.1.13 Submission of Drawings

3.1.13.1 All drawings must be geo-referenced.

3.1.13.2 Design and construction drawings shall be submitted as follows:

- a) 2 each – white prints, full size;
- b) 1 each – white prints, 11 x 17 prints;
- c) PDFs; and
- d) CAD files (complete with plot styles and with an assigned coordinate system (CANQ-M1(NAD83 MTM Zone 1))).

3.1.13.3 Storm and sanitary drainage plans must be provided in both hard copy and CAD format.

3.1.13.4 As-built drawings to be submitted as per Section 11.0: As-Built Drawings.

## **3.2 General Conditions**

### **3.2.1 Street Names**

3.2.1.1 All streets shall be identified and printed within street lines. All names to be submitted to the Town for approval prior to incorporating. The Town will forward names to the St. John's Regional Fire Department for review and approval. Upon approval by the St. John's Regional Fire Department and Council, the developer will be advised of approved names.

### **3.2.2 Intersection Identification**

3.2.2.1 At intersecting streets or where streets continue onto other plans, the following note shall be shown:

3.2.2.2 "For Continuation, See Sheet no. \_\_\_\_\_"

3.2.2.3 Coordinates, northings, and eastings must be provided for each street intersection and beginning of the road.

### **3.2.3 Percent (%) Grade**

3.2.3.1 Percent (%) grades (slopes) shall be shown for all appropriate services to two (2) decimal places.

### **3.2.4 Accuracy of Measurements**

3.2.4.1 All distances shall be measured to the nearest millimetre.

### **3.2.5 Geodetic Datum**

3.2.5.1 Elevations shown on any plan shall be referred to the Provincial Geodetic Datum and the reference Bench Mark (BM) along with its location and description shall be shown in the area above the Title Block.

### **3.2.6 Irregular Boundary Line Measurements**

3.2.6.1 More or less distances shall not be accepted except along a water boundary or other irregular boundaries in which case a "tie line" between the adjoining boundary end points shall show the bearing and the distance.

### **3.2.7 Horizontal Curves**

3.2.7.1 Horizontal curves must be labelled and the following information provided for each:

- a) Deflection angle;
- b) Radius;
- c) Tangent Length; and
- d) Curve Length.
  - i. The beginning of curve (BC) and end of curve (EC) stationing must be indicated on the plans.
  - ii. Coordinates, northings, and eastings to three (3) decimal places must be provided for each point of intersection (PI).

### **3.2.8 Vertical Curves**

3.2.8.1 Vertical curves must be identified on profile drawings and the following information provided for each:

- a) Station and elevation of beginning of vertical curve (BVC) and end of vertical curve (EVC);
- b) Station and elevation of the vertical point of intersection (PI);
- c) Station and elevation of all high points and low points;
- d) Length of the vertical curve in metres; and
- e) K value.

### **3.2.9 Revisions To Plan**

3.2.9.1 If plans are revised, amended, or altered, the date and Draftsperson's initials shall be noted in the revision area of the Title Block with a description of the revision.

3.2.9.2 All corrections and changes shall be shown in permanent fashion, ie. with revision cloud.

### **3.2.10 Signing Of Plan**

3.2.10.1 All plans shall be stamped and signed by a professional engineer licensed to practice in the Province of Newfoundland and Labrador at the date of signing.

3.2.10.2 Permit to Practice stamps shall be signed/numbered by the Member in Responsible Charge as per PEGNL requirements.



## **4.0 EASEMENTS**

### **4.1 General**

- 4.1.1 Easement means an incorporeal right, distinct from ownership or the soil, vested in the Town and consisting of a use of another's land for any Public service or utility.
- 4.1.2 When sewers, surface drainage (ie. ditches, swales, etc.) or water system pipes are to be installed other than in a street or walkway, an easement shall be provided over such installations.
- 4.1.3 The owner of the easement land shall not construct any type of structure over such easement area.
- 4.1.4 An easement shall be provided to Canada Post for community mailboxes in a location approved by the Town.
- 4.1.5 Easements cannot be combined with non-Town owned utility easements without the written permission of the Town and the non-Town owned utility.

### **4.2 Design**

- 4.2.1 The width of any easement shall be based upon the type and number of services proposed to be installed.
- 4.2.2 The minimum width of an easement shall be as follows, unless otherwise approved by the Town:
  - a) 6 m wide for one (1) pipe;
  - b) 8 m wide for two (2) pipes;
  - c) 9 m wide for three (3) pipes; or
  - d) For greater than three (3) pipes, width at the Town's discretion.
- 4.2.3 The alignments for any easement shall be dependent upon the type of service to be installed.
- 4.2.4 If a road ROW does not accommodate all infrastructure required for the development, easements must be granted to the Town. Width to be at the Town's discretion.

### **4.3 Acceptance**

- 4.3.1 Acceptance of services within an easement shall be at the sole discretion of the Town of Paradise.
- 4.3.2 All easements shall be covered by legal agreement as approved by the Town's Solicitor.

### **4.4 Restoration**

- 4.4.1 When the Town carries out work within an easement, it shall be responsible for restoring the area as close as practical to its original condition or as otherwise stipulated in the Easement Agreement.
- 4.4.2 This procedure is subject to change without notice, and the onus lies with the user to ensure that he is in possession of the latest revision.

## **5.0 SITE GRADING**

### **5.1 Submissions**

- 5.1.1 Developer shall submit full size CAD drawings of proposed grading plan, as-built grading plan, and real property survey as per Figures 2, 3, and 4 in Appendix A and Section 3.0 Drafting.
- 5.1.2 Developer is to adhere to the current revision of the Town's Foundation Elevations & Lot Grading Policy for all work.
- 5.1.3 Grading plan shall be reviewed by the Town and approved prior to construction.
- 5.1.4 Finished grades must be submitted on an as-built grading plan. The finished grades must correspond to the approved grading plan. Any deviations must be submitted to the Town for review and approval.

### **5.2 Grading Plan**

- 5.2.1 Grading plans shall include, at a minimum, the following information (See lot grading figures in Appendix A):
  - a) Elevations at all lot corners, at top of curb or edge of pavement (where there is no curb);
  - b) Proposed finished ground elevations at a minimum of four (4) corners of the building and at all building exits for non-residential development;
  - c) Finished floor elevation;
  - d) Top of concrete elevation at all building corners;
  - e) Finished grades at the centreline of streets every 10 m;
  - f) Elevations at sides and centreline of ditches and swales every 10 m;
  - g) Existing grades along limits of proposed development;
  - h) Location of all drainage structures, collection points, watercourses, etc;
  - i) If a watercourse is located within or adjacent to the development, the 1:100 year floodplain must be identified;
  - j) Driveway locations;
  - k) Elevations at the top and toe of all slopes. Means of stabilization for slopes (maximum permitted slope is 2 horizontal to 1 vertical);
  - l) Drainage arrows indicating direction of surface runoff; and
  - m) Any other pertinent information related to site drainage or lot grading.
- 5.2.2 Where the proposed development could potentially divert runoff onto an adjacent property, additional grades may be required at the discretion of the Town.
- 5.2.3 Additional grades are required at locations where the finished grade at the lot boundary lines is higher than the elevation at the building to demonstrate that the minimum 2% grade away from the building is provided.
- 5.2.4 A minimum slope of 2% away from all buildings in all directions must be provided.

- 5.2.5 The finished floor elevation must be at least 1.0 m above the finished grade of the street at the centre of the lot. The top of concrete at the garage must be minimum 450 mm above the finished grade at the road.
- 5.2.6 Cross-sections illustrating typical house styles proposed for each lot must be provided on the grading plan. Refer to Appendix A for details.

### **5.3 Other Items**

- 5.3.1 All rear yards in serviced areas to be landscaped as per the Town's Landscaping in New Developments Policy.
- 5.3.2 Landscaping is to be completed from the property boundary to centreline of the ditch in areas not serviced by storm sewers as per the Town's Landscaping in New Developments Policy.
- 5.3.3 Where applicable, site grading must comply with requirements of the Town Fence and Retaining Wall Regulations. A copy of these regulations can be found on the Town website.

## 6.0 STORM DRAINAGE

### 6.1 Design Drainage Area

6.1.1 The drainage area shall be determined from contour plans and shall include any fringe area not provided for in adjacent storm drainage areas, as well as other areas which may become tributary by reason of regrading.

### 6.2 Drainage Plan

6.2.1 Plan of the drainage area shall show generally:

- a) Streets;
- b) Lots;
- c) Any body of water defined as per the Water Resources Act;
- d) Direction of flow for all water courses
- e) Proposed storm sewers with manholes numbered using the last four (4) digits of the easting with the suffix "R";
- f) Tributary areas to each manhole, size of the area in hectares, and the runoff coefficient clearly shown therein;
- g) Contour lines having an interval not exceeding one (1) metre;
- h) Proposed surface drainage (including side ditches in areas without storm sewers);
- i) Impervious areas affecting the drainage area (large drives, roofs, etc.);
- j) Any existing infrastructure affecting the storm drainage;
- k) Details of connections to existing infrastructure; and,
- l) Details of existing infrastructure within the catchment.

### 6.3 Runoff

6.3.1 Computations shall be based on the Rational Method formula for areas less than 10 hectares. For areas greater than 10 hectares, an approved computer model will be used along with the appropriate intensity-duration frequency curves for the St. John's area which have been adjusted for climate change.

$$Q = R.A.I.N.$$

Where: Q = maximum rate of runoff, in litres per second

R = Constant = 2.78

A = area tributary to the point of design, in hectares

I = average rainfall intensity, having duration equal to the time of concentration of drainage area, in millimetres per hour

N = runoff coefficient

6.3.2 Standard design forms using Microsoft Excel shall be used for all calculations for areas under 10 hectares (See Appendix B). Computations shall be submitted in hard copy on the standard design forms and in digital format on CD.

**6.4 Runoff Coefficient**

6.4.1 The value of the coefficient shall be obtained by correlating the ratio of impervious to pervious surfaces. The minimum coefficients for fully developed areas shall be as in Table 6-1.

**Table 6-1 - Runoff Coefficient by Land Use**

LAND USE	RETURN PERIOD	
	10 yrs	25 yrs
Single Family Residential*	0.30	0.50
Semi-Detached Residential	0.40	0.60
Row Housing Residential	0.60	0.75
Apartments	0.60	0.75
Paved Parking Areas	0.90	1.00
Light Industrial	0.50	0.80
Heavy Industrial	0.60	0.90
Light Commercial	0.50	0.70
Commercial Core	0.70	0.90
Parks & Undeveloped Areas	0.25	0.45
Heavily Developed Areas	0.80	0.95

\*This applies to a Standard Building Lot, as defined in the Development Regulations (450 m<sup>2</sup> area). Larger lot sizes may require a weighted coefficient.

6.4.2 Other uses will be determined in consultation with the Town.

**6.5 Rainfall Intensity**

6.5.1 The rainfall intensity for standard storm sewer design shall be based on a 1 in 10 year return period with a storm duration equal to the time of concentration.

6.5.2 Trunk storm sewers, drainage ditches, and minor culverts shall be designed for a 1 in 25 year storm with duration equal to the time of concentration

6.5.3 Bridges and other critical structures as determined by the Town shall be on a 1 in 100 year storm with duration equal to the time of concentration.

6.5.4 All design intensities must be obtained from the most up-to-date intensity-duration frequency curves available from Environment Canada for the St. John's area which have been adjusted for climate change.

## 6.6 Time of Concentration

6.6.1 The time of concentration is defined as the time for a drop of water to flow from the remotest point in the watershed to the outlet. The time of concentration shall be calculated using the following equation:

$$t_c = \left[ 2.1873 \frac{Ln}{\sqrt{S}} \right]^{0.467}$$

Where:

- $t_c$  = time of concentration (mins);
- L = maximum length of travel from the most remote part of the basin to the outlet (m);
- S = mean slope of the main drainage channel (m/m); and
- n = roughness coefficient, known as Manning's 'n', selected from Table 6-2.

**Table 6-2 – Roughness Coefficient (Manning's 'n') by Land Use**

Land Use	Return Period (years)	
	10	25
Single Family Residential*	0.060	0.055
Semi-Detached Residential	0.050	0.045
Row Housing Residential	0.040	0.035
Apartments	0.040	0.035
Paved Parking Areas	0.020	0.015
Light Industrial	0.040	0.035
Heavy Industrial	0.030	0.015
Light Commercial	0.045	0.040
Commercial Core	0.040	0.015
Parks & Undeveloped Areas	0.100	0.070
Heavily Developed Areas	0.020	0.015

\* This applies to a Standard Building Lot, as defined in the development regulations (450 m<sup>2</sup> area). Larger lot sizes may require a weighted Manning's 'n'.

## 6.7 Capacity of Pipe

6.7.1 Manning's Formula shall be used to determine capacity of the pipe:

Q = VA, with:

$$V = \frac{R^{2/3} S^{1/2}}{n}$$

- Where:
- A = cross-sectional area of the pipe (m<sup>2</sup>)
  - Q = pipe capacity (m<sup>3</sup>/s)
  - V = cross-sectional average velocity (m/s)
  - R = hydraulic radius, defined as the cross-sectional area of the pipe divided by the wetted perimeter (m)
  - n = Manning's roughness coefficient (as noted below)
  - S = slope of pipe (m/m)

6.7.2 The following roughness coefficient shall be used:

- a) Concrete Box Culverts 0.013
- b) PVC 0.013
- c) HDPE Corrugated Double Walled 0.013
- d) CSP Aluminized or Double Galvanized – Refer to Manufacturers Information and Specifications

## 6.8 Pipe Material

6.8.1 The Town requires the use of HDPE double wall corrugated pipe for sewer main diameters up to 900 mm. Larger diameter HDPE may be allowable if it is suitable for the traffic loads as per Manufacturer's Specifications and approved by the Town. For larger sewer mains and culverts, corrugated steel pipe or concrete can be used.

## 6.9 Minimum Size

6.9.1 The minimum pipe size shall be as follows:

- a) Street Sewers 300 mm
- b) Catch Basin Leads single 200 mm / double 300 mm
- c) Building Sewer 100 mm
- d) Roadside Culverts 450 mm

## 6.10 Velocity (for design flow)

6.10.1 Velocities shall be calculated using Manning's Formula (see Section 6.7.1 above for equation).

6.10.2 The minimum allowable velocity shall be 1 m/s.

6.10.3 The maximum allowable velocity shall be 4.5 m/s. Where velocities greater than 4.5 m/s are unavoidable, special provisions shall be made to protect against displacement by erosion and shock.

## **6.11 Change of Size**

6.11.1 No decrease of pipe size from a larger size upstream to a smaller pipe downstream shall be allowed regardless of the increase in grade.

## **6.12 Clearance**

6.12.1 A minimum of 300 mm clearance is required between outside barrels at all sewer pipe crossings.

6.12.2 A minimum of 450 mm in a vertical and horizontal direction is required between the sewer pipe and water pipe.

## **6.13 Location**

6.13.1 Storm sewers shall be located such that manholes are placed in the centre of driving lanes, wherever possible.

6.13.2 Manholes shall be located at every change of horizontal and vertical alignment, size, and material of the sewer.

## **6.14 Construction**

6.14.1 All pipe to be installed with adequate cover and bedding as per Manufacturer's specifications.

6.14.2 Any deviation from this must be fully designed and stamped by a professional engineer licensed to practice in Newfoundland and Labrador and approved by the Town.

## **6.15 Manholes**

6.15.1 Standard types of manholes and their details are shown in the Municipal Master Specification Standard Drawings.

6.15.2 All manhole chamber openings must be located on the upstream side of the manhole.

6.15.3 Manhole size (ie. depth and diameter) to be clearly indicated on the drawings.

6.15.4 Special manholes shall be fully designed, detailed and certified.

6.15.5 Maximum distances between manholes unless otherwise specified shall be 90 m for 750 mm pipe or smaller and 120 m for pipe greater than 750 mm.

6.15.6 If a drop manhole is required, it shall be designed such that it is an outside drop manhole. Drop manholes are to be designed as per the Municipal Master Specification.

6.15.7 Horseshoe manholes will not be permitted by the Town. A cast-in-place base with a pre-cast manhole as per the Municipal Master Specification may be allowed at the discretion of the Town.

6.15.8 Safety landings are to be installed in manholes deeper than 5 m. For manholes between 10 m and 15 m depth, two safety landings shall be installed. Refer to Municipal Master Specification Standard Drawing #04270E for details.



## **6.16 Special Structures**

6.16.1 Inlet and outfall structures including head walls, stilling chambers, etc. shall be fully designed and submitted in detail. In each case, topography shall be shown as well as the protective works necessary to counteract erosion of the site at the structure (ie. stabilization of material). Trash racks shall be provided on all inlet structures and outlet structures greater than 600 mm in diameter and shall be fully designed, detailed, certified and approved by the Town.

## **6.17 Outfalls**

6.17.1 All storm outfalls which empty into a ditch or water course must receive all required Federal and Provincial Government approvals from Fisheries and Oceans Canada (DFO) and the Provincial Department of Municipal Affairs and Environment (DMAE) – Water Resources Management Division (WRMD).

## **6.18 Catch Basins**

6.18.1 The lead shall have a minimum 2% grade and shall discharge directly to an existing or proposed manhole located within 30 m of the catch basin.

6.18.2 Recess catch basin shall not be used.

6.18.3 Catch basins shall be located and spaced in accordance with conditions of design and shall provide for expected maximum flow.

6.18.4 Standard location for catch basins at street intersections shall be immediately upstream of sidewalk or pedestrian crosswalks and between intersections at all low points.

6.18.5 Spacing shall not exceed 95 m for road grades up to 3%. On steeper roads, this spacing shall be reduced as follows:

a) Grades from 3% up to 6%: 65 m

b) Grades from 6% up to 10%: 50 m

6.18.6 Catch basins are to be depressed 30 mm with respect to the gutter grade.

6.18.7 Double catch basins are to be used at all low points.

6.18.8 All catch basins to be connected to storm manholes

## **6.19 Storm Building Services**

6.19.1 Separate and independent building services shall be provided for every single family house, each unit in a semi-detached and each apartment building, office building, factory or similar building. The location of the end cap will be clearly marked using a 50 x 100 timber marker extending 600 mm above finished curb grade. (See House Service Detail, Appendix A).

6.19.2 The Town will not permit a grey water connection to the storm service line.

6.19.3 The Town will not permit a storm connection to a sanitary sewer.

## 6.20 Side Ditches

6.20.1 See Section 9.6 Open Ditches.

## 6.21 Drainage Swales

6.21.1 Drainage Swales are not permitted unless approved by the Town.

## 6.22 Head Walls

6.22.1 Head walls shall be designed for inlet control with:

$$HW/D \leq 1.0$$

Where: HW = headwater depth (m)

D = diameter of pipe (m)

6.22.2 Handrails shall be installed on all head walls as per the Municipal Master Specification.

## 6.23 Stormwater Detention

6.23.1 Stormwater detention may be required at the discretion of the Town. Detention calculations are to be completed as directed by the Town.

## 6.24 Floodplain Determination

6.24.1 Floodplain determination for a 1:100 year return period may be required for developments near watercourses at the discretion of the Town. The floodplain delineation is to be completed as directed by the Town and in conjunction with the Town's Stormwater Management Plan.

Any development in a floodplain must be as per the DMAE – WRMD Policy for Flood Plain Management and permits must be obtained from DMAE - WRMD in advance of any work being undertaken.

6.24.2 When a development borders on a watercourse, all living space floor elevations of the structure shall be 0.6 m above the 100 year floodplain.

## 7.0 SANITARY SEWER

### 7.1 Design Drainage Area

7.1.1 The drainage area shall be determined from contour plans and shall include all other areas which may become tributary by reason of regrading, pumping or future development.

### 7.2 Drainage Plan

7.2.1 Plan of the design area shall be to a scale as indicated in Section 3.0 Drafting and shall show generally:

- a) streets;
- b) lots;
- c) the size and grade of the sanitary sewers with manholes numbered using the last four digits of the easting and the suffix "S"; and
- d) tributary areas to each manhole, size of the area in hectares and ultimate average population per hectare clearly shown therein.
- e) details of connections to existing infrastructure.
- f) details of existing infrastructure within the catchment.

### 7.3 Evaluation of Design Flows

7.3.1 Standard design forms using Microsoft Excel (Appendix B) shall be used for all calculations. A sample of same may be obtained from the Town.

7.3.2 The design of all sanitary sewers shall be based on the Peak Dry Weather Flow. A typical computation of Peak Dry Weather Flow is shown in Table 7-2 and Table 7-3 and some of its aspects explained in the following items.

7.3.3 The minimum rate of infiltration for which capacity shall be provided is 22 500 L/ha/d.

7.3.4 The design flows from developments of single family residence shall be based on an average population density of 80 people per hectare for RLD and RMD and 120 people per hectare for RHD.

7.3.5 Flow computations shall be based on Table 7-1 to Table 7-3 and shall be submitted using the standard design forms on a CD.

7.3.6 Average Sewer Flow: is predicted flow based on ninety (90%) percent of water consumption.

7.3.7 Peaking Factor: is the ratio of the peak rate of flow on the average rate of flow. It is based on the Harmon Formula:

$$M = 1 + \frac{14}{4 + p^{1/2}}$$

Where "p" is the tributary design population in thousands for residential areas. For other than residential, the design population "p" can be termed as an equivalent population and is computed

by dividing the unit non-residential sewage flow by the average unit residential sewage flow of 275 L/c/d or by using the values given.

**Table 7-1 - Average Sewage Flow by Land Use**

Land Use	Average Sewer Flows	Peaking Factor
<b>Residential</b>	275 L/c/d	$1 + \frac{14}{4 + p^{1/2}}$
<b>Commercial Core</b>	90 000 L/ha/d	$0.8 \left( 1 + \frac{14}{4 + p^{1/2}} \right)$
<b>Light Commerce</b>	28 000 L/ha/d	$0.8 \left( 1 + \frac{14}{4 + p^{1/2}} \right)$
<b>Universities</b>	34 000 L/ha/d	$0.8 \left( 1 + \frac{14}{4 + p^{1/2}} \right)$
<b>Hospitals</b>	168 500 L/ha/d	$0.8 \left( 1 + \frac{14}{4 + p^{1/2}} \right)$
<b>Heavy Industrial</b>	168 500 L/ha/d	$0.8 \left( 1 + \frac{14}{4 + p^{1/2}} \right)$
<b>Light Industrial</b>	39 000 L/ha/d	$0.8 \left( 1 + \frac{14}{4 + p^{1/2}} \right)$

**Table 7-2 - Sample Calculation for Peak Dry Weather Flow for Residential Development**

No.	Item	Amount	Units	Comments
1	Tributary area	10	hectares (ha)	
2	Average population density	80	persons/ha	For single family residential development = 80 persons/ha
3	Tributary design population, p	800	persons	Row 1 x Row 2
4	Average per capital sewage flow rate	275	L/person/day	For single family residential development = 275 L/person/day
5	Average sewage flow	2.55	L/s	(Row 3 x Row 4) / 86,400
6	Peak flow factor	3.86	-	As per Harmon Formula (see Section 7.3)
7	Peak sewage flow	9.84	L/s	Row 5 x Row 6
8	Infiltration allowance rate	22,500	L/ha/day	Minimum infiltration rate = 22,500 L/ha/day
9	Infiltration allowance	2.60	L/s	(Row 1 x Row 8) / 86,400
10	Average dry weather flow	5.15	L/s	Row 5 + Row 9
11	Peak dry weather flow (PDWF)	12.44	L/s	Row 7 + Row 9

**Table 7-3 - Sample Calculation for Peak Dry Weather Flow for Non-Residential Development**

No.	Item	Amount	Units	Comments
1	Tributary area	10	hectares (ha)	
2	Average sewage flow rate	28,000	L/ha/day	See Table 7-1 for sewage flow rates
3	Average sewage flow	280,000	L/day	Row 1 x Row 2
4	Average per capita sewage flow rate	275	L/person/day	For single family residential development = 275 L/person/day
5	Equivalent population, p	1018	persons	Row 3 / Row 4
6	Average sewage flow	3.24	L/s	Row 3 / 86,400
7	Peak flow factor	3.04		As per Harmon Formula (see Section 7.3)
8	Peak sewage flow	9.85	L/s	Row 6 x Row 7
9	Infiltration allowance rate	22,500	L/ha/day	Minimum infiltration rate = 22,500 L/ha/day
10	Infiltration allowance	2.60	L/s	(Row 1 x Row 9) / 86,400
11	Average dry weather flow	5.84	L/s	Row 6 + Row 10
12	Peak dry weather flow (PDWF)	12.45	L/s	Row 8 + Row 10

## 7.4 Capacity of Pipe

7.4.1 Manning's Formula shall be used to determine capacity of the pipe:

Q = VA, with:

$$V = \frac{R^{2/3} S^{1/2}}{n}$$

Where:

- A = cross-sectional area of the pipe (m<sup>2</sup>);
- Q = pipe capacity (m<sup>3</sup>/s);
- V = cross-sectional average velocity (m/s);
- R = hydraulic radius, defined as the cross-sectional area of the pipe divided by the wetted perimeter (m);
- n = Manning's roughness coefficient (as noted below); and
- S = slope of pipe (m/m).

7.4.2 The following roughness coefficient shall be used:

a) PVC pipe            0.013

## 7.5 Pipe Material

7.5.1 The Town requires the use of polyvinyl chloride (PVC) pipe for all sanitary sewers. The Town will consider the use of other materials on a case by case basis.

## 7.6 Minimum Size

7.6.1 The minimum pipe size shall be as follows:

a) Street Sewer        200 mm

b) Building Sewer    100 mm

## 7.7 Velocity (for design flow)

7.7.1 Velocities shall be calculated using Manning's Formula.

7.7.2 The minimum allowable velocity shall be 1 m/s

7.7.3 The maximum allowable velocity shall be 4.5 m/s. Where velocities greater than 4.5 m/s are unavoidable, special provisions shall be made to protect against displacement by erosion and shock.

## 7.8 Change of Size

7.8.1 No decrease in pipe size from a larger size upstream to a smaller size downstream shall be allowed regardless of the increase in grade.

## **7.9 Clearance**

- 7.9.1 A minimum of 300 mm clearance is required between outside pipe barrels at all sewer pipe crossings.
- 7.9.2 A minimum of 450 mm clearance in vertical and horizontal direction is required between the sewer pipe and water pipe.

## **7.10 Manhole Location**

- 7.10.1 Sanitary sewers shall be located such that manholes are placed in the center or driving lanes wherever possible.
- 7.10.2 Manholes shall be located at every change of grade, alignment, size or material of the sewers.
- 7.10.3 Manholes shall be spaced a maximum of 90 m apart for sewers smaller than 700 mm diameter and 120 m apart for sewers over 700 mm diameter.

## **7.11 Construction**

- 7.11.1 All pipe to be installed with adequate cover and bedding as per Manufacturer's specifications.
- 7.11.2 Any deviation from this must be fully designed and stamped by a professional engineer licensed to practice in Newfoundland and Labrador and approved by the Town.

## **7.12 Manhole Details**

- 7.12.1 All manhole chamber openings must be located on the upstream side of the manhole.
- 7.12.2 All pipes turning at a greater angle than 45° in a manhole require a 150 mm drop between pipe inlet and outlet.
- 7.12.3 Manhole size (ie. depth and diameter) to be clearly indicated on the drawings.
- 7.12.4 Special manholes shall be fully designed and detailed.
- 7.12.5 If a drop manhole is required, it shall be designed such that it is an outside drop manhole. Inside drop manholes will not be permitted by the Town. Drop manholes are to be designed as per the Municipal Master Specification.
- 7.12.6 Horseshoe manholes will not be permitted by the Town. A cast-in-place base with a pre-cast manhole as per the Municipal Master Specification may be allowed at the discretion of the Town.
- 7.12.7 Safety landings are to be installed in manholes deeper than 5 m. For manholes between 10m and 15 m depth, two safety landings shall be installed. Refer to the Municipal Master Specification Standard Drawing #04270E for details.

## **7.13 Sanitary Building Services**

- 7.13.1 Separate and independent building services shall be provided for every single family house, each unit in a semi-detached, each unit in row housing, and each apartment building, office building, factory or similar building. The end cap for the sanitary service shall be painted red. The location

of the end cap shall be captured using total station or GPS and will be clearly marked using a 50 x 100 timber marker extending 600 mm above finished curb grade.

#### **7.14 Force Mains**

7.14.1 Pipe for all sewage force mains shall be ductile iron class 50 or PVC pressure-rated pipe. Joint restraints shall be used as per Manufacturer's specifications. Flow velocity in the force main shall be between 1 and 3 m/s.

#### **7.15 Sewage Lift Stations**

7.15.1 The Town prefers the use of gravity sewage systems and lift stations should be avoided where possible.

7.15.2 Lift stations shall be readily accessible by maintenance vehicles during all weather conditions. The facility should be located off the traffic way of streets.

7.15.3 Security fencing and/or barriers may be required, at the Town's discretion.

7.15.4 All sewage lift station pumps and controls shall be new and manufactured by a CSA approved company. The pumps shall be designed based on hydraulic analysis considering all factors such as inflows, anticipated expansions, peaking factors, system hydraulic characteristics, etc. Special attention should be paid to pumping installations that must pump against high heads. The pumps should be chosen to ensure maximum efficiency and minimum friction losses. These shall include relays for supervision of alarm and trouble codes and be provided with a single telephone line installed in a 35 mm conduit.

7.15.5 Lift stations to be designed to be compatible with the Town's SCADA control system.

7.15.6 Lift stations shall have a generator connection. Lift stations deemed critical by the Town will require a diesel backup generator complete with autostart.

7.15.7 For lift stations which are not deemed critical the wet well shall have a minimum of 3 hours of storage.

7.15.8 Design parameters, design drawings, and shop drawings shall be submitted to the Town for review and approval.

#### **7.16 Unserviced Lots**

7.16.1 Approval for septic system design for unserviced lots will be through Service NL. Approval must be provided to Town before a permit will be issued.

7.16.2 Town requires a site plan to be submitted for review/approval. Site Plan should include location and size of septic field, well location and associated structures.



## 8.0 WATER SYSTEMS

### 8.1 General

#### 8.1.1 Definitions

##### 8.1.1.1 Water system

An assembly of pipes, fittings, control valves and appurtenances which convey water to water service pipes and hydrants.

##### 8.1.1.2 Water service pipe

A pipe that conveys water from a water system to the inner side of the wall through which the pipe enters the building.

### 8.2 Design Criteria and Location

#### 8.2.1 Dead Ends

8.2.1.1 Pipes will be looped wherever possible.

#### 8.2.2 Pipe Material

8.2.2.1 The Town requires the use of ductile iron, PVC or PE pipe for water mains (see additional requirements in Section 8.2.11 for PVC and PE). The Town will consider other materials on a case-by-case basis and in accordance with the Municipal Master Specification.

#### 8.2.3 Size of Water Pipe

8.2.3.1 All pipe is to be designed, but in all cases a minimum pipe size of 150 mm diameter mains will be used on cul-de-sacs. Minimum 200 mm diameter mains shall be used for all other mains.

8.2.3.2 The size of a main feeder pipe shall be a minimum of 300 mm.

#### 8.2.4 Depth of Cover

8.2.4.1 All water pipe shall have a minimum cover of 2000 mm above top of pipe in relation to the final finished street grade.

8.2.4.2 Reduced cover with insulation will only be permitted at the discretion of the Town.

8.2.4.3 For streets not paved prior to December 1 of any year, a sufficient depth of fill shall be placed to give a minimum cover of 1500 mm.

#### 8.2.5 Location of Water Pipes

8.2.5.1 All water pipes shall normally be laid on the quarter point of the street right of way and in a separate trench from the sanitary and storm sewers.

8.2.5.2 Where a water pipe is to be laid in a trench, other than in a street, the sub-divider shall grant to the Town by deed and plan, at his cost, title to the Easement. The easement shall be as required in Section 4.0: Easements, above, and its location shall be approved by the Town.

#### 8.2.6 Location of Valves

- 8.2.6.1 Valves at street intersections shall be located in the roadway at street line intersection. Measurements giving the location of all valves shall be shown on the “As Built” drawings. A minimum of two measurements shall be shown for each valve to a permanent structure and the northing and easting of the valve included.
- 8.2.6.2 Four (4) valves shall be required at each four-way street intersection. If there are more or less than four (4) streets meeting at any intersection, the appropriate number of valves shall be installed to allow complete isolation of the system. The minimum number of valves at any intersection shall be three.
- 8.2.6.3 On straight runs in a residential area, the maximum distance between valves shall be 180 m.
- 8.2.6.4 On dead end streets zoned for future development a valve shall be installed at the end of the water main.

### **8.2.7 Valve Chambers**

- 8.2.7.1 All valves 400 mm in diameter and larger shall be geared.
- 8.2.7.2 All valves of 400 mm and larger shall be installed in a chamber constructed of reinforced concrete or made from a 1500 mm diameter pre-fabricated concrete manhole.
- 8.2.7.3 Access frames and covers for these chambers shall be cast iron, providing a clear opening of 750 mm in diameter with two (2) countersunk lifting rings in the cover. The term “WATER” shall be imprinted on the cover. Access ladders shall be provided in the chamber.

### **8.2.8 Hydrants**

- 8.2.8.1 Hydrants are generally placed at the rear of the sidewalk, and spaced not more than 140 m apart. Hydrants shall be placed a minimum of 3 m from service lines, driveway locations and power and utility lines.
- 8.2.8.2 Hydrants shall be installed so that the top of the standpipe flange will be from 100 mm – 150 mm above the finished curb grade.
- 8.2.8.3 The branch pipe to the hydrant shall be 150 mm in diameter and shall include a 150 mm branch valve located 2.75 meters from the hydrant. Where the hydrant valve is less than 3.0 m from the water main the valve shall be restrained to the main with an approved mechanical restraint collar.
- 8.2.8.4 Hydrants shall be placed at all high points along a street.
- 8.2.8.5 Hydrant markers are required and shall be placed as per the Municipal Master Specification.
- 8.2.8.6 The Town will not approve the use of AVK type hydrants.
- 8.2.8.7 Hydrants are to be painted as follows:
  - 1. Red Barrell
  - 2. Caps as per Table 8-1.

**Table 8-1 – Color Coding of Hydrant Caps**

Hydrant Class	Usual Flow Capacity		Color
	At 20 psig (:140 kPa (gauge))*		
	gpm	(L/min)	
AA	1500	(5680)	Light Blue
A	1000 to 1499	(3785 to 5675)	Green
B	500 to 999	(1900 to 3780)	Orange
C	Less than 500	(Less than 1900)	Red

\* Capacities are to be rated by flow measurements of individual hydrants at a period of ordinary demand. See AWWA Standard for Dry-Barrel Fire Hydrants 1985 for additional details.

### 8.2.9 Pressure Reducing Valves (PRVs)

- 8.2.9.1 PRVs shall be required at the discretion of the Town.
- 8.2.9.2 PRVs must be heated and properly designed.
- 8.2.9.3 PRVs must coordinate with the Town’s Water Master Plan.

### 8.2.10 Building Services

8.2.10.1 Separate and independent building services shall be provided for every single family house, each unit in a semi-detached, each unit in row housing, and each apartment building, office building, factory or similar building. The minimum size pipe accepted for residential services shall be 25 mm in diameter, type k copper or Muncipex. The minimum size pipe accepted for commercial/industrial services shall be as per Section 11.0: Commercial, Industrial And Non-Residential Developments. The location of the end cap shall be captured using total station or GPS and will be clearly marked using a 50 x 100 timber marker extending 600 mm above finished curb grade. Refer to NBCC for different size requirements.

8.2.10.2 Water service lines installed beyond the last hydrant on dead end streets will remain inactive until such time as the water main is extended and additional fire hydrants are installed or the line is looped.

### 8.2.11 Additional Requirements

- 8.2.11.1 The Town will accept PVC or PE pipe only if the following conditions are met:
  - a) All materials specified must comply with Section 02713 Watermains of the Municipal Master Specifications.
  - b) All materials must be installed in accordance with the Manufacturer’s specifications.
  - c) The Developer must provide a survey plan indicating northings, eastings, and elevations for watermains and service lines at all bends, valves, tees, reducers, and joints. Information provided must be in real world coordinates and be provided on a survey plan stamped and signed by a licensed Newfoundland Land Surveyor. This information may be included on the property’s legal survey or subdivision plan. Note that the information is only required from the main line up to and including the curb stop for water service lines.

### **8.3 Design of Water Main System**

#### **8.3.1 General**

8.3.1.1 The design of water systems shall be based on the flow requirements needed to satisfy domestic, commercial, industrial, and fire flow demands.

#### **8.3.2 Flow Requirements**

8.3.2.1 Domestic, Commercial and Industrial flow requirements shall be based on the values given in Table 7-1.

8.3.2.2 Fire flow demand shall be calculated as per the Fire Underwriters Survey document *Water Supply for Public Fire Protection*.

### **8.4 Connections to Existing Water Systems**

#### **8.4.1 General**

8.4.1.1 All connections to existing infrastructure to be inspected by the Town and approved by the Design Engineer.

8.4.1.2 Existing valves, hydrants, PRVs and other Town-owned infrastructure to be operated only by Town Staff.

8.4.1.3 Hydrants are not to be used to reduce pressure during connection.

#### **8.4.2 Service Interruption**

8.4.2.1 A connection of the sub-divider's water system to any part of the existing water system must be carried out to cause the least interruption to existing service and each such connection must be approved by the Town. All costs associated with closure shall be borne by the Developer including public announcements.

#### **8.4.3 Scheduling of Connection**

8.4.3.1 The Town will assist in the scheduling of any such connection. The Developer will install the tapping sleeve and valve at the Developer's expense. The work must be completed under the supervision of the Town at the Developer's expense. Town requires notice at least 48 hours in advance.

8.4.3.2 Work to be completed in accordance with the Town's Road Cut Policy and Arterial and Collector Road Lane Closures Policy.

#### **8.4.4 Other Connections**

8.4.4.1 Whenever the existing water system is within reasonable distance from a proposed subdivision, and an interconnection is practical, the developer shall be required, at his cost, to install the necessary pipe and interconnect the water system in his subdivision to the existing water system.

#### **8.4.5 Prohibited Cross-Connections**

8.4.5.1 No pipe or water service pipe cross-connection will be made from the existing water system to a water system in a subdivision which is connected to some other source of supply.

#### **8.4.6 Tapping Sleeves and Mains**

- 8.4.6.1 Unless otherwise approved by the Town, tapping sleeves and valves shall be used for all ductile iron connections to existing water mains and shall be as per the requirements of the Municipal Master Specification.. The Developer will be responsible for determining the outside diameter of the existing water main.

#### **8.5 Sampling Stations**

- 8.5.1 Sampling stations may be required at locations as determined by the Town.

#### **8.6 Joint Restraints**

- 8.6.1 Joint restraints are to be used at all hydrants, tees, bends, valves, and elsewhere as directed by the Town.
- 8.6.2 Mechanical joint restraints shall be in compliance with the requirements in the Municipal Master Specification.

#### **8.7 Unserviced Lots**

- 8.7.1 Approval for drilled well for unserviced lots will be through Service NL. Approval must be provided to Town before a permit will be issued.
- 8.7.2 Town requires a site plan to be submitted for review/approval. Site Plan should include location of well.

## 9.0 STREETS

### 9.1 Street Classification

9.1.1 Streets shall be classified as shown in Table 9-1.

**Table 9-1 - Street Classification**

	<b>ARTERIAL</b>	<b>COLLECTOR</b>	<b>LOCAL</b>
<b>Traffic Service Function</b>	Traffic movement first consideration	Traffic movement and land access of equal importance	Traffic movement second consideration
<b>Land Access Function</b>	Land access second consideration		Land access first consideration
<b>Parking</b>	Please refer to the Town's Development Regulations		
<b>Bicycle Lanes</b>			
<b>Sidewalks</b>			
<b>Median</b>			
<b>Design Volume (A.D.T.)</b>	12,000-30,000	5000-12,000	Less than 1,000
<b>Characteristics of Traffic Flow</b>	Uninterrupted except at signals and crosswalks	Interrupted flow	Interrupted flow
<b>Vehicle Type</b>	All types but trucks may be omitted	All type with truck limitations	Passengers and service vehicles; large vehicles restricted
<b>Connects To</b>	Arterials, collectors, highways and some locals	Arterials, collectors, locals	Collectors, locals

**Table 9-2 - Characteristics of Street Classes (Residential Development)**

	ARTERIAL	COLLECTOR	LOCAL	LOCAL UNSERVICED
<b>Street grade maximum<sup>1</sup></b>	10%	10%	10%	10%
<b>Street grade minimum</b>	0.5%	0.5%	0.5%	0.5%
<b>Street right of way width</b>	Please refer to the Town's Development Regulations			
<b>Minimum Centreline Radius</b>	90 m	90 m	50 m	50 m
<b>Maximum super Elevation</b>	As Per TAC			
<b>Minimum stopping sight Distance and turning sight distance</b>	As Per TAC			
<b>Pavement widths</b>	Please refer to the Town's Development Regulations			
<b>Minimum "K" value vertical curve</b>				
<b>Crest</b>	7	7	7	7
<b>Sag</b>	11	11	11	11
<b>Minimum length of vertical curve</b>	L= length in meters should not be less than design speed in Kilometers per hour with exception of local intersections, if approved by the Town.			
<b>Vertical curve maximum (length for drainage)</b>	Crest: K=60 Sag: K=30			
<b>Minimum distance between intersections</b>	400 m	60 m	60 m	60 m
<b>Minimum face-of-curb radius at intersections</b>	15 m	9 m	8.0 m	8.0 m
<b>Sidewalks (sides)</b>	Please refer to the Town's Development Regulations			
<b>Shoulders minimum width</b>				
<b>Street lighting (minimum requirements)</b>	1.5 cd/m or 22 lx	1.0 cd/m or 15 lx	1.0 cd/m or 15 lx	1.0 cd/m or 15 lx

NOTES:

<sup>1</sup> Maximum road grade in industrial/commercial areas to be as per Section 10.0 Commercial, Industrial, and Non-Residential Developments.

## 9.2 Design Criteria

9.2.1 Streets shall be designed to provide the safest and smoothest traffic flow possible. The criteria in Table 7.2 consist of the minimum requirements for flat vertical alignments.

9.2.2 For specific situation not covered by this Section, the latest edition of the Transportation Association of Canada (TAC) Road Design Manual (Metric Edition) should be used as a guide.

### 9.3 Cul-de-Sacs

- 9.3.1 Use of cul-de-sacs will only be considered if no road connection is possible.
- 9.3.2 Cul-de-sacs shall have the following minimum requirements:
- Face of curb line, turning circle, radius of 15.25m.
  - Maximum exit grade of +/- 2% for 20 m from the intersection.
  - Low back curb and gutter to extend around the turning circle.
  - Transitional street line radius of 15.25 m into street line turning circle.
- 9.3.3 Maximum length shall be 200 m for permanent, serviced cul-de-sacs and 300 m for permanent, unserviced cul-de-sacs, to be measured from connecting street right of way or intersecting street to end of the turning circle.
- 9.3.4 Sidewalk shall extend all around bulb.
- 9.3.5 In cases where turning circles are temporary due to phasing of developments, all temporary turning circles shall be paved with 50 mm of asphalt and properly graded prior to end of paving season. Radius of the temporary turning circle shall be 15.25m.
- 9.3.6 Measures must be taken to address storm drainage around and adjacent to the temporary turning circle. Details must be provided to the Town for approval prior to implementation.

### 9.4 Intersections

- 9.4.1 Intersections shall be designed to account for the Level of Service (LOS) as determined by the Transportation Association of Canada (TAC) Guidelines.
- 9.4.2 Roundabouts shall conform to the standards and guidelines outlined in the Canadian Roundabout Design Guide, as published by TAC. All roundabout designs shall be carried out and/or reviewed by an engineer experienced in roundabout design.
- 9.4.3 All other intersections shall conform to the following:
- Have a vertical alignment within the intersection approach of not more than 4% grade for a minimum distance of 20 m from the roadway intersection curb line, though a 2% grade is preferred;
  - Have an intersecting angle within 10° of a right angle and this is to be maintained for 30 m from the intersection. Angles less than 80° / greater than 100° may be considered at the Town's discretion. (Minimum 75°);
  - Have a minimum center line distance between adjacent and/or opposite intersections.
- 9.4.4 When two (2) streets (or more) intersect, only one (1) street may have a curved horizontal alignment; all other streets at this intersection shall have a minimum tangent section of 30.5 m as measured from the point of street line intersection to the first point of horizontal curvature on each approached street line.

### 9.5 Bicycle Lanes / Boulevards

- 9.5.1 Bicycle lanes and boulevards shall be implemented as per the Development Regulations.



- 9.5.2 Bicycle lanes and boulevards shall be asphalt or concrete.
- 9.5.3 Bicycle lanes and boulevards shall be clearly marked with appropriate signage and/or pavement markings.
- 9.5.4 Bicycle lanes and boulevards shall have stop signs at all intersections.

## **9.6 Open Ditches**

- 9.6.1 Side ditches shall be constructed along both sides of streets that do not have piped storm drainage systems. In all cases the invert of the ditch shall be below sub grade of the street and the finished cross-section shall conform to the following dimensions:
  - a) Minimum Bottom Width 0.5 m but no less than the culvert diameter.
  - b) Minimum Finished Depth 1.0 m
  - c) Maximum Side Slope 2:1
- 9.6.2 All ditches shall be lined with minimum 200 mm – 300 mm angular rock laid on geo-textile material or as directed by the Town. Ditches with grades over 5% shall have rock sized for the anticipated velocities. Additional erosion control may be requested at the discretion of the Town.

## **9.7 Traffic Barriers**

- 9.7.1 Traffic, pedestrian and/or bicycle barriers shall be constructed in accordance with the requirements of the Transportation Association of Canada.
- 9.7.2 Roadside obstacles that may require the use of traffic barriers include bridges, headwalls, cut slopes, ditches, embankments, retaining walls, signs, traffic signal supports, utility poles, boulders, trees or bodies of water.
- 9.7.3 Traffic Barriers may take the form of roadside barriers, median barriers or crash cushions. Barriers will be installed on the basis of a warrant analysis using procedure outlined by TAC.
- 9.7.4 Roadside barriers should be placed as far from the travelled way as conditions permit, in order to provide greater recovery area for vehicles and to avoid impeding sight distance. Roadside barriers should not be placed further than 4.0 m from the edge of the travelled way.

## **9.8 Other General Requirements**

- 9.8.1 Traffic Impact Statements or Studies may be required for new developments at the discretion of the Town.
- 9.8.2 Tangent distances between reverse horizontal curves shall not be less than 50 m.
- 9.8.3 Horizontal alignment of streets shall be such that the center line and curb lines shall be symmetrical with their street lines.
- 9.8.4 Vertical alignments of streets shall be considered as symmetrical about the center line unless otherwise instructed by the Town.
- 9.8.5 All streets shall have a minimum 150 mm crowned roadway cross-section and in no case should the crowned roadway cross-section be less than 2%.

- 9.8.6 No driveway (ramp) shall be permitted to enter onto a proposed designated limited access highway, arterial or major street.
- 9.8.7 Asphalt driveways are required in areas where curb and gutter is present.
- 9.8.8 Curb and gutter is required in all areas serviced with storm sewers. All serviced subdivisions shall have piped storm drainage systems.
- 9.8.9 All streets shall use asphalt and granular thicknesses as per the Department Transportation and Works detail for RCU 80. Additional granulars and asphalt may be specified as determined by the Town.
- 9.8.10 Paraplegic Ramps shall be required at all intersections where there are sidewalks. Otherwise, low back curb is required.

### **9.9 Street Signs, Markings and Traffic Control Devices**

- 9.9.1 All street signs, markings and traffic control devices shall conform to the latest version of the TAC Manual entitled "Uniform Traffic Control Devices for Canada" (metric edition).

### **9.10 Road Cut Policy**

- 9.10.1 Any road cut shall abide by the Town's Road Cut Policy.

### **9.11 Traffic Calming Policy**

- 9.11.1 Any traffic calming must be as per the Town of Paradise Traffic Calming Policy.

## **10.0 COMMERCIAL, INDUSTRIAL, AND NON-RESIDENTIAL DEVELOPMENTS**

### **10.1 General**

- 10.1.1 Unless otherwise stated in this Section, all developments shall comply with residential standards in Sections 5 through 9 of this document.
- 10.1.2 Civil, architectural, mechanical, electrical, and structural drawings must be submitted for all developments and must be stamped and signed by a professional engineer licensed to practice in Newfoundland and Labrador and in good standing with PEGNL. The Permit to Practice shall be signed/numbered by the Member in Responsible Charge as per PEGNL requirements.
- 10.1.3 Maximum street grade for commercial/industrial developments is 6%.
- 10.1.4 For new developments, the ditch must be included in the road right-of-way. For existing development, an easement must be provided for the ditch along the property from boundary to top of slope.

### **10.2 Storm Drainage**

- 10.2.1 All commercial/industrial developments to implement on site storm collection systems, which incorporate all drainage from the site as well as any drainage from neighboring properties onto the site.
- 10.2.2 Stormwater detention may be required at the discretion of the Town. See Section 6.23 Stormwater Detention.
- 10.2.3 Drawing(s) showing storm drainage catchment areas along with calculation sheets (see Appendix B) shall be submitted and approved by the Town prior to construction.
- 10.2.4 Site development drawings must show all information on existing storm sewer systems in the area, including tie-in location, location of existing storm sewer main, size and pipe material, locations of manholes and catchbasins and all invert information. Locations and sizes of all existing culverts, ditches and drainage swales.

### **10.3 Sanitary Sewer**

- 10.3.1 Minimum size for sanitary service pipe for a Commercial or Industrial lot is 100 mm diameter. Minimum slope of sanitary service is 2%.
- 10.3.2 Drawing(s) showing sanitary drainage catchment areas along with calculation sheets (see Appendix B) shall be submitted and approved by the Town prior to construction.
- 10.3.3 Sanitary calculations are to be prepared and submitted to the Town as per Section 7.0 Sanitary Sewer. In the event that the proposed land use is not listed in Table 7-1, the developer is to consult the *Guidelines for the Design, Construction, and Operation of Sewerage and Water Works* published by the DMAE. Alternatively, sanitary calculations provided by the Mechanical Engineer based on occupancy loads may be accepted.
- 10.3.4 Site Development drawings must show all information on existing sanitary sewer systems, including tie-in location, location of existing sanitary sewer main, size and material of piping, locations of manholes and all invert information.

## **10.4 Water Systems**

- 10.4.1 Minimum size for water service pipe for a Commercial or Industrial lot is 50 mm diameter.
- 10.4.2 Developer shall demonstrate that each building lot has sufficient access to fire hydrants as per the NBCC's structural fire fighting requirements prior to submitting a design for water mains.
- 10.4.3 Water main design is to be as per Section 9.0 Water Systems.
- 10.4.4 Site Development plan must show all information on existing water systems, including tie-in location, locations of existing water main, valves and hydrants and all pipe sizes and materials.

## **10.5 Lot Development**

- 10.5.1 The width of the entrance shall be minimum 7.5 m. The turnout radius must be a minimum 8 m, and can be higher depending on the use of the lot.
- 10.5.2 The paved areas shall consist of a minimum of 50 mm asphalt, 75 mm Class 'A' material, and 150 mm Class 'B' material. The subgrade shall be fully compacted.
- 10.5.3 Lot shall be landscaped as per the Town's Landscaping in New Developments Policy. Maximum allowable sloping on site shall be 2H:1V.
- 10.5.4 Lot shall be graded with a minimum 2% slope away from the building in all directions, with positive drainage to on-site storm collection.
- 10.5.5 Curb shall extend to the limits of asphalt and/or the end of the building, whichever is longer.

## 11.0 AS- BUILT INFORMATION

### 11.1 General

11.1.1 As-built drawings must be stamped and signed by a professional engineer in good standing with PEGNL and signed and dated to indicate the as-built information. The Permit to Practice shall be signed/numbered by the Member in Responsible Charge as per PEGNL requirements.

11.1.2 All as-built drawings to be submitted in digital format, CAD and pdf.

11.1.3 The following information is required:

- a) Revisions to finished street centre-line elevations;
- b) Revisions to type of sidewalk and/or curb & gutter;
- c) Revisions to street cross-sections;
- d) Revisions to grading plan;
- e) Revisions to lengths, grades, inverts, and alignment for sanitary sewer, storm sewer, and watermains;
- f) The location of all hydrants, valves, manholes, catch basins, and other appurtenances c/w northings and eastings to three decimal places as well as reference to the front survey pins of the nearest building lot by means of two ties measured to the nearest 0.1 m.
- g) Location of benchmarks;
- h) All cover and invert elevations shall be noted for manholes and catch basins; and
- i) The month and year of completion of the construction shall be shown for each plan for Stage 1 and Stage 2 work.

11.1.4 The information listed in this Section shall be submitted to the Town after Stage 1 works and before issuing Building Permits.

11.1.5 The Town has the discretion to verify as-builts and to request changes.

### 11.2 Drawings

11.2.1 The Developer shall submit the following as-built drawings:

- a) 1 CD containing or USB drive:
  - Geo-referenced and bound drawing compatible with AutoCAD, complete with plot styles and an assigned coordinate system (CANQ-M1(NAD83 MTM Zone 1))
  - PDF drawings
  - Sanitary and storm drainage spreadsheets (Excel spreadsheet, to be updated with as-built information)
  - Sanitary and Storm Drainage Drawings (CAD and PDF formats)
  - Curb-stop and tie-in locations with northings and eastings shown on drawings and hard copy house service sheets.
  - Where sewage lift stations are part of the work an Operation and Maintenance manual.

### **11.3 Reports**

11.3.1 The Developer shall submit the following as-built reports (see Report Tables in Appendix C):

- a) Sanitary and Storm Sewer Inspections
  - Infiltration tests
  - Exfiltration tests
  - Manhole tests
  - Deflection tests
  - CCTV inspections
  - House service lateral information
  - Lift Station Commissioning Report
- b) Water main
  - Disinfection reports
  - Pressure test reports
  - Swabbing reports
- c) Streets
  - Asphalt Quality Control Tests
  - Class 'A' and Class 'B' Sieve Analysis
  - Compaction Tests (Class "A", Class "B" and asphalt)
  - Asphalt mix design
- d) Concrete Works
  - Compressive Strength Tests
  - Slump Tests
  - Air Entrainment Test
- e) Final Inspection
  - Manhole/Catch Basin/Valve Box Cleaned
  - Valves/Curb Stops Operational
  - Streets Cleaned
  - Signage and Traffic Markings in Place
- f) Written confirmation from engineer of record confirming:
  - All work has been completed as per the approved construction drawings and complies with the Town guidelines and the Municipal Master Specification.
  - Overall grading is in general conformance to the approved grading plan as per the Town's Grading Policy.

- g) Financial Report
  - Final Construction Costs (Detailed Breakdown)
  - Engineering Costs
  - Assessment Calculations

**APPENDIX A**  
Typical Figures

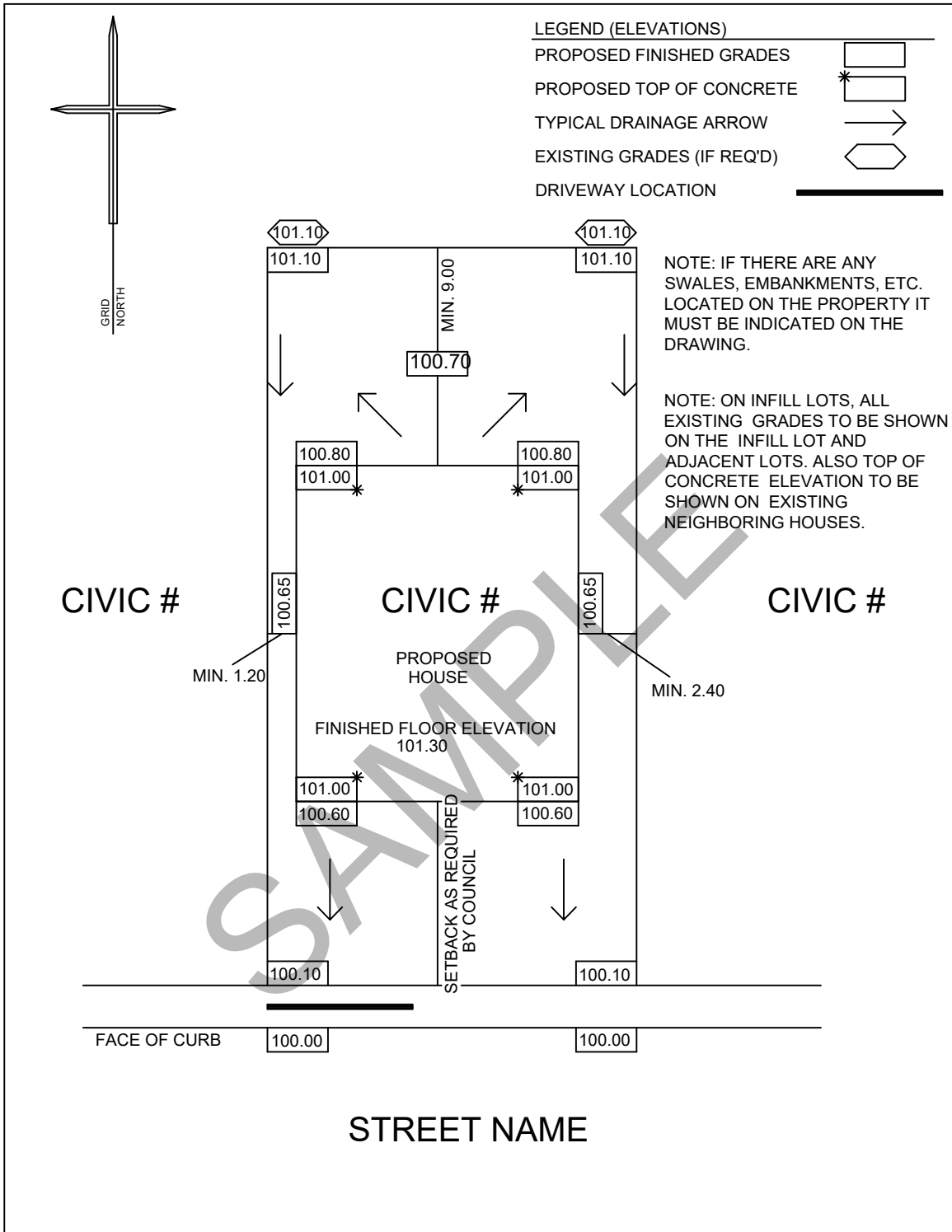
List of Figures:

- Figure 1 – Sample Benchmark Plan
- Figure 2 – Typical Proposed Lot Grading
- Figure 3 – Typical As-built Lot Grading
- Figure 4 – Typical Surveyors Real Property Report
- Figure 5 – House Service Laterals Location Plan



VERTICAL CONTROL SURVEY		B.M. N° 3	
<p><b>KEY PLAN</b> LAKESIDE SUBDIVISION STAGE 4</p>		<p><b>REFERENCES</b></p>	
VICINITY:    SOUTHWEST SIDE OF BLUE JAY PLACE		VERTICAL:	
INSPECTION DATE:			
TYPE: PLASTIC CAP    IN CURB		ELEVATION:            152.082	
<p>DESCRIPTION: PLASTIC CAP IN FRONT OF CIVIC NO. 40 BLUE JAY PLACE</p> <p style="text-align: center;"><u>          NAD 83 CO-ORDINATES          </u> N 5 265 500.983m E 313 328.464m</p>			
	SAMPLE BENCHMARK PLAN		
	PREPARED FOR		
	DATE:	PREPARED BY:	

FIGURE #1 - SAMPLE BENCHMARK PLAN




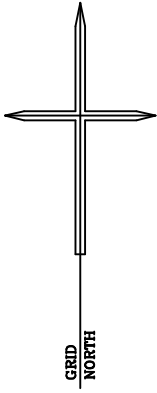
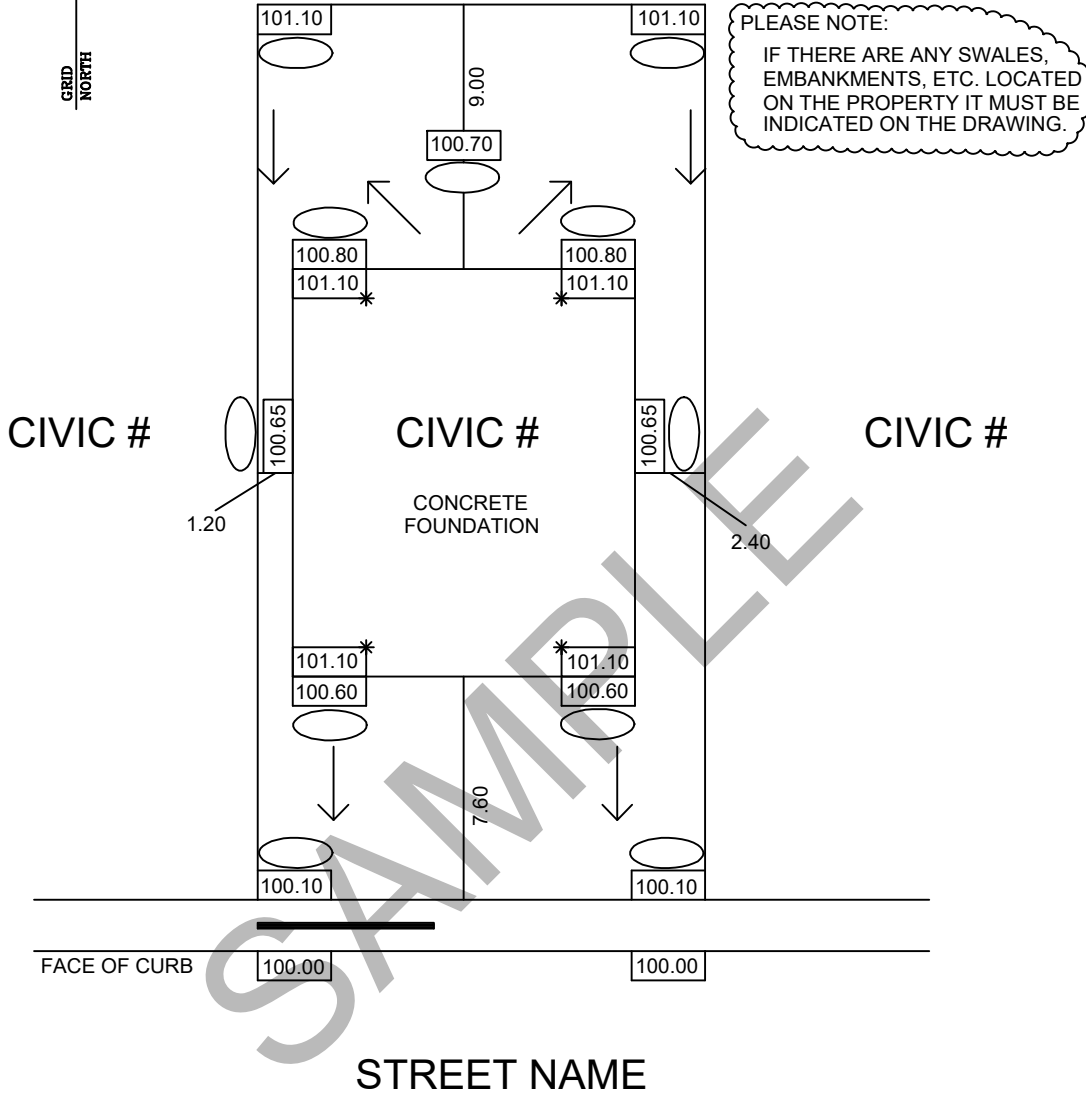
 <p>SCALE 1 : 200</p>	PROPOSED LOCATION & GRADING FOR CIVIC # , PARADISE, NL	
	PREPARED FOR	
	DATE:	PREPARED BY:

FIGURE #2 - TYPICAL PROPOSED LOT GRADING



PLEASE NOTE:  
 ELEVATIONS TO BE REFERENCED FROM PROVINCIAL MONUMENTS OR BENCHMARKS THAT HAVE BEEN ESTABLISHED IN THE SUBDIVISION FROM PROVINCIAL MONUMENTS. PLEASE PROVIDE THE INFORMATION ON THE MONUMENT OR BENCHMARK USED.

LEGEND (ELEVATIONS)	
PROPOSED FINISHED GRADES	[Empty box]
TOP OF CONCRETE	[Box with asterisk]
ASBUILT GRADES	[Empty oval]
DRIVEWAY LOCATION	[Thick line]



ASBUILT GRADING PLAN FOR  
 CIVIC #, PARADISE, NL

PREPARED FOR

SCALE 1 : 200

DATE:

PREPARED BY:

FIGURE #3 - TYPICAL AS-BUILT LOT GRADING

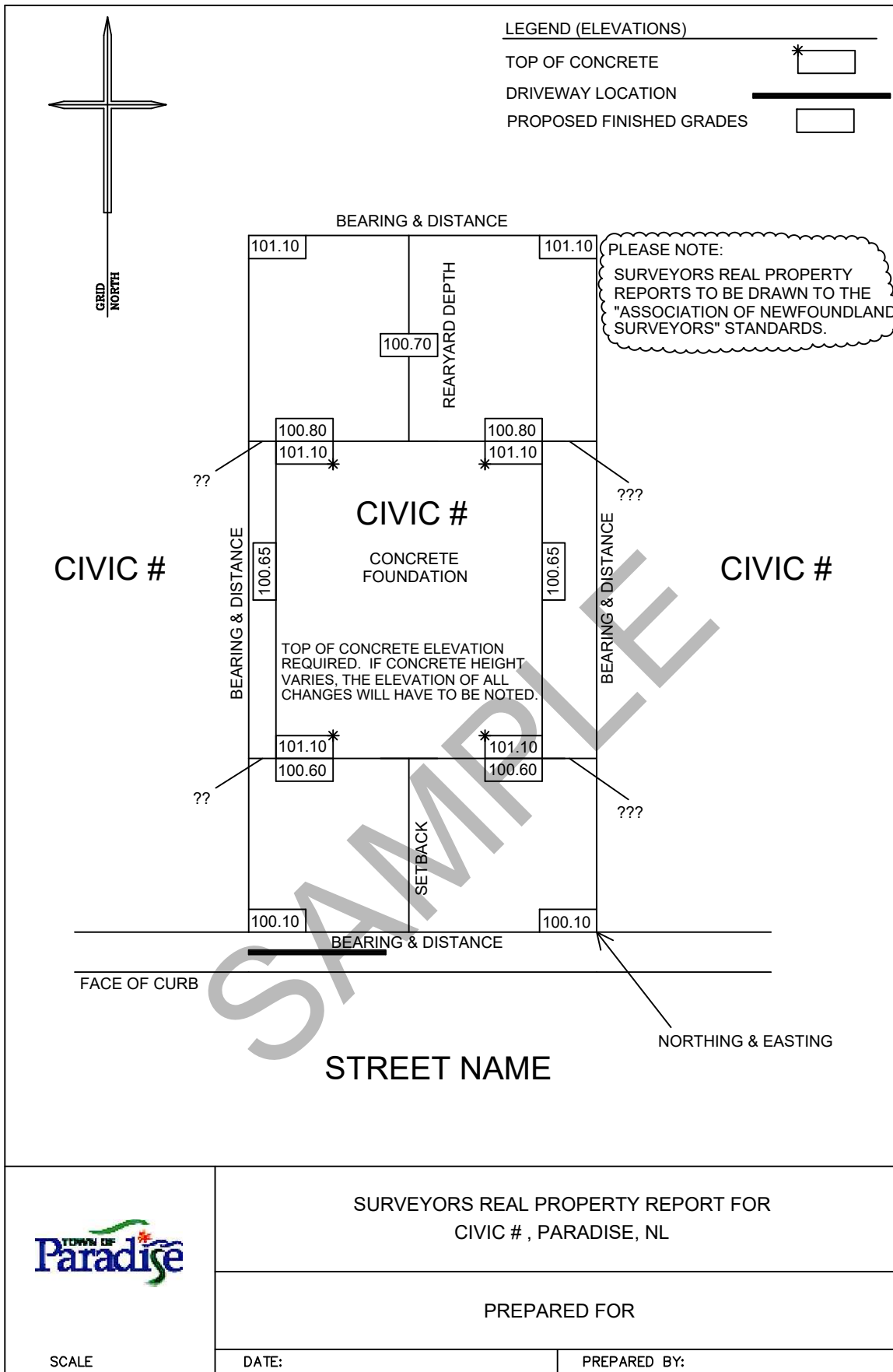


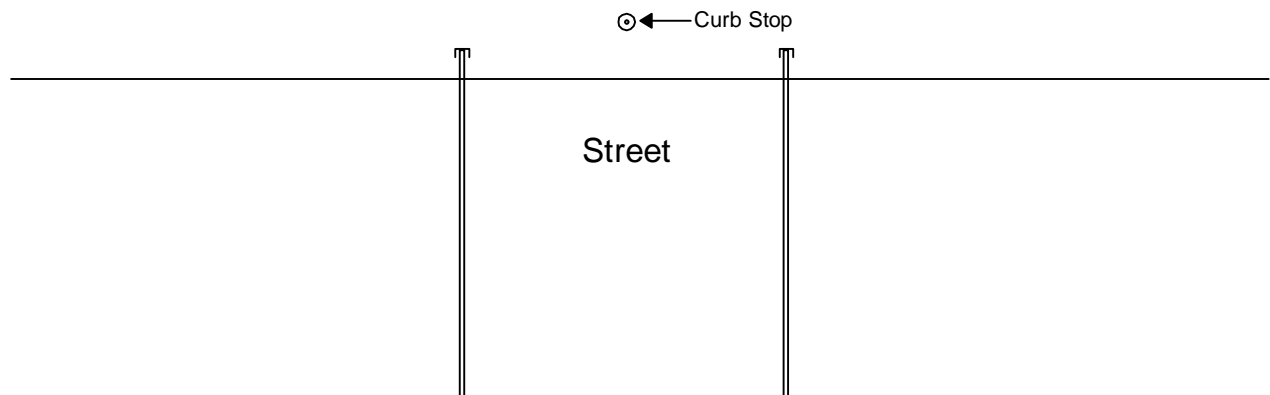
FIGURE #4 - TYPICAL SURVEYORS REAL PROPERTY REPORT



Front Elevation

Storm Sewer  
(Left Hand Side)

Sanitary Sewer  
(Right Hand Side)



Within the Town of Paradise all House Service Laterals shall be installed with the Storm Sewer Line on the Left and the Sanitary Sewer Line on the Right as shown above. Contractors will be held responsible for services installed incorrectly.

Note:  
Do not scale from drawing

House Service Laterals Location Plan

DWG 2010.09

**APPENDIX B**

Storm and Sanitary Calculation Sheets







**APPENDIX C**  
Standard Report Tables

List of Tables:

1. Sanitary Sewer Test Results
2. Manhole Test Results
3. Pipe Deflection Test Results
4. Watermain Disinfection Test Results
5. Watermain Hydrostatic Pressure Test Results
6. Watermain Swabbing Test Results
7. Asphaltic Concrete Pavement Test Results
8. Granular Material Test Results
9. Compaction Test Results
10. Final Inspection Report

**TOWN OF PARADISE**

**Table 1 - Sanitary Sewer Test Results**

Project Name: \_\_\_\_\_

Date: \_\_\_\_\_

Date	Section MH to MH	Location (Street)	Pipe Size (mm)	Length of Pipe (m)	Allowable Loss (L)	No. of Building Services	Length of Service Pipe (m)	Exfiltration Test			Infiltration Test			Comments
								Test Time (mins)	Measured Loss (L)	Pass/Fail	Test Time (min)	Measured Loss (L)	Pass/Fail	

Allowable Exfiltration: 0.000023L/min/mm, DIA/m  
 Allowable Infiltration: 0.00000767 L/min/mm, DIA/m

I hereby certify that all tests have been performed according to the Contract Specifications and this/these sections of pipe have passed the required test.

Contractor Representative: \_\_\_\_\_  
 Site Representative \_\_\_\_\_

Consulting Engineer: \_\_\_\_\_











## TOWN OF PARADISE

**Table 7 - Asphaltic Concrete Pavement Test Results**

Project Name: \_\_\_\_\_  
 Date: \_\_\_\_\_  
 Street: \_\_\_\_\_  
 Sample Location (Stn): \_\_\_\_\_

Date	Sieve Size (mm)	Base Course Required % Passing (by weight)	Base Course Actual % Passing (by weight)	Surface Course Required % Passing (by weight)	Surface Course Actual % Passing (by weight)	Comments
	19	100				
	12.5	80 - 100				
	4.76	35 - 75				
	2	20 - 60				
	0.425	10 - 35				
	0.07	0 - 8				

Other Parameters	Required Content Base Course	Actual Content Base Course	Required Content Surface Course	Actual Content Surface Course
Asphalt Content	5.0% - 7.0%		5.5% - 7.5%	
% Air Voids	3% - 5%		3% - 5%	

I hereby certify that all tests have been performed according to the Contract Specifications and this/these sections of pavement have passed the required test.

Contractor Representative: \_\_\_\_\_  
 Site Representative: \_\_\_\_\_  
 Consulting Engineer: \_\_\_\_\_



## TOWN OF PARADISE

**Table 8 - Granular Material Test Results**

Project Name: \_\_\_\_\_  
 Date: \_\_\_\_\_  
 Street: \_\_\_\_\_  
 Sample Location (Stn): \_\_\_\_\_

Date	Sieve Size (mm)	Class "A" Required % Passing	Class "A" Actual % Passing	Class "B" Required % Passing	Class "B" Actual % Passing	Comments
	50.8	-		75 - 100		
	19.0	100		-		
	15.9	-		45 - 80		
	9.51	55 - 80		-		
	4.76	35 - 60		25 - 55		
	1.20	17 - 35		12 - 35		
	0.30	7 - 20		7 - 20		
	0.075	3 - 6		3 - 6		

I hereby certify that all tests have been performed according to the Contract Specifications and this/these sections of granular material have passed the required test.

Contractor Representative: \_\_\_\_\_  
 Site Representative: \_\_\_\_\_  
 Consulting Engineer: \_\_\_\_\_



