9. CIVIL - TECHNICAL

9.1 REGULATIONS

9.1.1 CODES AND STANDARDS

1. National Building Code of Canada (NBCC)
2. National Plumbing Code of Canada
3. NFPA Standards
4. Building Accessibility Act and Regulations
5. AQQA Standards
6. Newfoundland and Labrador Department of Environment and Conservation Standards
7. Fisheries and Oceans Canada Standards
8. Other legislated codes, and standards, that will affect the design of the project

9.1.2 AUTHORITIES HAVING JURISDICTION

1. Office of the Fire Commissioner
2. Service NL
3. Department of Environment & Conservation
4. Workplace Health, Safety and Compensation Commission
5. Municipality

9.2 SITE INVESTIGATION

1. Visit the site and evaluate its characteristics.
2. Review and assemble existing conditions information on:
    a. stormwater surface runoff
    b. sanitary sewage collection system and wastewater treatment
    c. water supply and distribution system
    d. underground electrical
3. Review and assemble land use planning and development regulations pertaining to the site.
4. Assess location for vehicular entrance/exit to the site.

5. Solicit geotechnical Consultant services on behalf of the TW, and manage the execution of the geotechnical program.
6. Solicit site surveying Consultant services on behalf of TW, and manage the execution of the program.

9.3 CODES AND STANDARDS

1. Provide a listing of codes and standards applicable to the work in accordance with PEGNL "Guidelines for Municipal Engineering Services, Latest Edition".

9.4 SUBMISSIONS

1. Submissions are to follow Guidelines published by PEGNL, June 1996.

9.5 DESIGN FLOW

1. Domestic average design flow will be based on flows recommended in Department of Environment & Conservation's Guidelines, and take into consideration water efficiency measures to be deployed at the facility.
2. Make allowances for domestic peak flow of five times average design flow, for maximum daily flow of three times average design flow and for any special industrial type needs unless otherwise established by tests or reliable records.
3. Make allowance for internal water requirements for sprinkler or standpipe systems where appropriate. Consider supply to hydrants when sizing building connections and supply mains.
4. Desirable pressure for domestic purposes is 400 to 500kPa under average conditions.
5. Determine fire flows overall for building and site from the Fire Underwriters' Survey "Water Supply for Public Fire Protection, A Guide to Recommended Practice".
6. Mains and supply facilities are to be capable of simultaneously supplying the maximum daily domestic flow and the maximum fire flow requirement.
7. Limit maximum flow velocity in pipes to 1.5 m/s.

9.6 PIPES

1. Specify pipe materials in accordance with NL Master Specification Guide for Public Funded Buildings. Selection should consider local pressure, water quality, soil and climatic conditions.
2. Select pipe diameter based on hydraulic requirements. Do not oversize unless approval is given.
3. Ensure that pipe wall thickness calculations takes into consideration working pressure, laying conditions, earth pressure, traffic loads, etc.
4. Limit maximum flow velocity to 1.5 m/s.

9.7 VALVES

1. Provide one valve on each building connection at or near the tee off the main.
2. Provide one valve on each hydrant branch, located near the hydrant.
3. Provide sufficient valves on supply mains to enable a break to be isolated without interrupting the supply to more than approximately 250 m of main to avoid seriously affecting fire protection.
4. Direction of rotation and valve boxes is to be local standard.
5. Consider need for valve markers and special measures, e.g. pressure reducing valves, air release valves, electrical supervision, etc.

9.8 FIRE PROTECTION

1. Mains and supply facilities must be capable of supplying simultaneously the maximum daily domestic flow and the maximum fire flow requirement.
2. Minimum hydrant distance from any building to be 15 m and maximum length of hose to reach any part of a building to be 90 m. A hydrant is required within 45 m of the firefighting connection for the building. Ensure the drawings and specifications include any additional hydrants necessary.
3. Minimum size for pipe serving hydrants to be 150 mm diameter. Provide tie rods and thrust blocks at each hydrant plus one gate valve. Provide a satisfactory means of draining hydrants based on local practice.

4. Where a sprinkler system is used, consider need for separate supply line to the building to service sprinklers and standpipe system only. Check available flow and pressure to ensure that highest sprinkler heads are adequately served with minimum pressure and flow at the most remote sprinkler.

9.9 SANITARY & STORM SEWERS

9.9.1 GENERAL

1. Provide separate sanitary and storm sewers.
2. Determine required design capacity of the new sanitary and storm connections for TW's review.
3. Storm water or drain tiles shall not be connected to sanitary sewers.
4. Inform the Design Manager if it is not possible to dispose of sewage or storm water by gravity.
5. Exclude fuels and toxic chemicals from sewer systems.
6. Required capacity of the new sanitary and storm connections shall be determined as necessary for the design. Submit capacity requirement for TW's review.

9.9.2 DESIGN OF SANITARY SEWERS

1. Design sewers to be flowing 75% full when carrying maximum anticipated flow.
2. Base maximum flow in sanitary sewer mains on peak domestic flow, taking into consideration water efficiency measures.
3. Minimum velocity shall be 0.6 m/s at average flows and not less than 0.3 m/s at minimum flow. The latter requirement may be modified only if the maximum daily velocity exceeds 0.9 m/s and the sewer is self-cleansing. In general, the maximum velocity for sewers should be 3.0 m/s.
4. Building sanitary sewers shall be designed to accommodate peak domestic flows calculated on a fixture unit basis. Minimum size of sewer is 150 mm diameter. The preferred grade is 2%, with a minimum grade of 1%.

9.9.3 Design of Storm Sewer System

1. Drain all roofs and parking areas, roads, foundation drains, etc. to the storm sewer system.
2. Design for worst storm likely to be encountered in ten (10) years, based on local rainfall intensity records.
3. Design for minimum velocity of 0.6 m/s in sewers under average conditions.

9.9.4 Manholes and Catch Basins

1. Where the ground water level is above the sewer, special attention must be given to selection and waterproofing of manholes. Sanitary manhole covers should be of a tight-fitting type. The frames should be set in cement mortar and the tops placed slightly above grade whenever possible.
2. Manholes should be tested for water-tightness whenever conditions are wet.
3. Special attention must be paid to the structural strength of deep manholes,
4. For storm sewers, the water tightness of manholes is usually not critical. Generally, storm manhole tops will be of the perforated type, and may in fact double as catch basins or storm water inlets.
5. Safety landings are required when manholes exceed 5.0 meters in depth.
6. Manholes and inlet spacing in paved surfaces should not exceed 100 m.
7. In parking areas, catchbasin manholes should be used.

9.9.5 Sewage Forcemains

1. Design velocity shall not be less 0.8 m/s or greater than 1.5 m/s based on range of installed pumping capacity.
2. Provide uniform grade where possible.
3. Avoid dramatic changes in direction. Deflection of piping within allowable bending radius is preferred to accomplish changes in direction.
4. Consider automatic air relief valves at all high points.
5. Select pipe to withstand normal pressure and pressure surges.

9.9.6 SEWAGE LIFT STATIONS

1. Design sewage lift stations in accordance with Environment & Conservations' publication of "Guidelines for the Design, Construction & Operation of Water & Sewerage Systems", latest edition.
2. Use wet well design with duplex installation of submersible pumps.
3. Wet wells are to be equipped with high water level alarms.
4. Evaluate back up power supply source, or provision for overflow in the event of primary power supply failure.

9.9.7 BEDDING AND BACKFILLING

1. Where sewers pass under paved roads, drives and paved areas well compacted granular bedding and backfill shall be used for the full height.
2. Wide trapezoidal trenches are to be avoided where possible, and if used at all, the bottom section of the trench wall shall be vertical to a point 300 mm above the crown of the pipe and the trench shall be not more than OD +400 mm wide for pipes up to 825 mm diameter and OD+600 mm for pipes over 825 mm diameter.
3. Typical pipe bedding details on drawing are to show bedding and backfill and are to conform to the manufactures' recommendation for the loading and class of pipe selected.
4. If one or more services are located in the vicinity of a sewer pipe, detailed drawing and instruction shall be prepared showing how trenches are to be excavated and the various services bedded and supported during and after trench excavations.

9.9.8 INSPECTION AND TESTING

1. Specification shall call for inspection and testing of all sanitary and storm sewers before backfilling.
2. All sewers should be video inspected.
3. Deflection testing is required for sewers constructed of plastic pipe.

9.10 SITE GRADING AND SURFACE DRAINAGE

9.10.1 GENERAL REQUIREMENTS

1. To the greatest extent possible, design surface grades to preserve the natural character of the site while ensuring efficient treatment, retention and final disposal of surface water with minimal ground disturbance.
2. Site grading should produce a useable and easily maintainable ground surface not subject to flooding or erosion. Through initial rough grading and final site grading adhere to the following to the maximum extent possible:
    a. Preserve existing vegetation, and topsoil, particularly trees.
    b. Provide final road and site grades that ensure suitable pedestrian and vehicular access to buildings and permit adequate drainage of the site.
    c. Balance cut and fill as much as possible to localize the movement of earth. Ensure new grades merge smoothly with existing grades without causing low areas which pond water.
3. Establish building floor elevations so that ground floor of the building will not flood if storm sewer system becomes blocked.
4. Foundation drains are not to be connected to sanitary sewer system
5. Establish building floor elevations so that ground floor of the building will not flood if storm sewer system fails or becomes blocked.
6. Provide onsite storm water management to mitigate storm water discharge to the receiving environment. Achieve best storm water management practice respecting storm water treatment and retention.
7. Provide information on the impact of the proposed drainage system affecting the quantity and quality of runoff to receiving water bodies.
8. Provide positive drainage for the total site that is away from buildings with gradients of at least 2% (optimum 4%) for grass covered areas and 1% for hard surfaces.

9.10.2 SIDE SLOPES, DITCHES AND BACK SLOPES

1. Provide for a smooth transition at the top of cuts, toes of fills, bottom of ditches and other locations where the rate of slope is changing.

2. On slopes to be maintained and for long term slope stability of side slopes, use no less than 1 vertical to 3 horizontal to facilitate maintenance operations, especially grass cutting.
3. Design ditch cross section to have adequate hydraulic capacity and to keep water velocities below scour limits.
4. Ditches adjacent to pavements should be 150 mm deeper than pavement structure to avoid saturated foundations.
5. Ditches and swales are to be sodded or lined with crushed, clean rock, 100 mm minus.
6. Gradients for ditches:
    a. minimum 2%
    b. maximum 5%

9.10.3 Culverts

1. Slope culverts:
    a. minimum 0.5%
    b. maximum 6%
    c. maintain a flow of 1 to 3 m/s
2. Provide minimum cover of 400 mm from top of pipe to top of pavement or in accordance with the pipe manufacturer's recommendations.
3. Culvert should have an invert elevation at least 1.0 m below grade to avoid frost heave.
4. Culverts should be designed for a ten (10) year return period.

9.10.4 Drainage Appurtenances

1. Depth of catch basin leaders should be adequate to prevent freezing.
2. Minimum diameter of catch basin leaders and building connections is 200 mm and the minimum for storm sewers is 250 mm.
3. Maximum run to catch basins in surface drainage to be approximately 45 m. Aim at achieving a surface grade to catch basins of 1% to 2% with an absolute minimum of 0.4%.

9.11 Subsurface Drainage

1. Subsurface drainage systems will generally include foundation drains, under-slab drains, retaining wall drains, and general site sub-drains. Systems may typically include such

components as perforated and non-perforated pipe and fittings, graded fine and coarse aggregate filter material, geotextile fabrics, prefabricated drainage mats, and associated structures such as manholes, outfall structures, and sump pits.

2. Provide subsurface drainage systems as may be necessary to maintain site groundwater levels at least 400 mm (1000 mm preferred) below lowest floor slab or finished grade elevations, and to prevent hydrostatic pressure against basement walls or other earth retaining walls.
3. Provide filter medium surrounding and extending above pipe to highest groundwater elevation, or to floor slab sub-base elevation. Filter medium shall be fine aggregate, or coarse aggregate with surrounding geotextile fabric.
4. Perforated pipe 100 mm minimum diameter, shall be placed with perforations in the bottom half of the pipe. Minimum slope of perforated pipe shall be 0.2%.
5. Geotextile fabric is to be selected to suit soil characteristics for separation and filtration function. Equivalent or Effective Opening Size (EOS) will normally range between 150 um - 212 um.
6. Design for subsurface runoff as determined from geotechnical investigation, or using engineering judgment supplemented by recognized guidelines.
7. Typical cross-section of drainage trench containing perforated pipe should have a minimum trench width of 200 mm plus the pipe diameter with minimum of trench base of 100 mm below pipe.

9.12 PAVEMENTS - ROADS, PARKING LOTS AND SIDEWALKS

9.12.1 INTERSECTIONS

1. Ensure clear lines of sight at all intersections.
2. Avoid junctions near the crest of hills or where driver's vision is likely to be obstructed.
3. Design intersections to TAC standards.

9.12.2 ROADS DESIGN CRITERIA AND REQUIREMENTS

1. Design roads to incorporate the following parameters:
    a. minimum lane width 3.5 m

   b. minimum shoulder width 1.2 m
   c. minimum radius of horizontal curvature is 15 m inside edge for roads. Widen the inside lane by 0.6 m when minimum radius is used. For semi-trailers use compound curves for edge

2. Optimum horizontal road radii are 50 m. Radius used should accommodate critical vehicle.
3. Minimum turning radius for cul-de-sac edge of pavement: 14 m.
4. Minimum longitudinal gradient at centreline: 0.5% (absolute minimum is 0.35% if curbs provided).
5. Provide 2% cross slope.
6. Grades on hills not to exceed 5% where possible.
7. Shoulder slopes:
   a. gravel or crushed stone 5%
   b. earth or turf 6%
8. Where surface runoff water flows across more than one continuous lane (travelling or parking) use a minimum cross slope for the lane at the high point on the transverse profile.
9. T-shaped terminus used at dead-ends is to allow good driver visibility while backing. The wings of the terminus to be the vehicle length and 4 m minimum width.
10. Provide for the following minimum radii inside edge:
    a. at T-shaped terminus, 9.0 m
    b. at road intersection, 10.5 m
    c. at parking lots, 6.0 m
    d. at driveways, 4.5 m
11. Maximum grade within 30 m radius of intersection: 5%
12. Minimum grade for adequate drainage: 0.5%
13. Pavement structure: 50 mm asphaltic concrete over 100 mm granular base and 150 mm granular sub-base, except where site conditions require a different structure.

9.12.3 Parking Lots

1. Maximum gradient and cross slope 5%.
2. Minimum gradient and cross slope 0.5%.
3. Optimum gradient and cross slope:

   a. on paved areas 2%
   b. on gravel 3%
4. Locate entrances at least 60 m or as far as practical from street intersections. Left turn stacking should be checked.
5. Minimum setback for parking areas, 8.0 m from street right of ways and from buildings.
6. Provide turnaround at dead-ends by extending the aisle an extra 3.0 m.
7. Set parking spaces at 90^{o} where possible.
8. Parking stall dimensions: standard - 2.75 m wide, 6.0 m deep. Barrier Free - 3.6 m wide, 6.0 m deep.
9. Aisle width: 7.5 m.
10. Inside corners with parking areas to be rounded 1.5 m to facilitate turning in and out of parking spaces.
11. Where strip parking is to be provided, the access way may be widened and spaces designed as though the street were the access aisle. Provide an additional 1.0 m clearance from road edge to stall.
12. Pavement structure, same as roadways.
13. Provide low back curb unless otherwise directed.
14. Provide a large single parking lot where practical to facilitate ease of snow clearing and related maintenance. Large grassed landscaped islands to visually break up parking lot may be appropriate for major building complexes.
15. Provide grassed, snow dump area at each end of parking lot.

9.12.4 SIDEWALKS

1. Maximum gradient, 5% preferred
2. Maximum local cross slope, 5%.
3. Minimum gradient, 2%.
4. Barrier free ramps gradient, 5% preferred.
5. Minimum width:
   a. 1.5 m for walks accessed by wheelchairs and pedestrians
   b. 1.3 m for service entrances.

6. Avoid steps in walks but where unavoidable, provide at least three risers, and a handrail. Otherwise, follow natural grade up to 10% gradient.
7. Provide expansion joints and control joints as necessary

9.13 PLANTING DESIGN

9.13.1 GENERAL REQUIREMENTS

1. The planting design should reflect and preserve the natural character of the site.
2. All slopes should ensure drainage away from the building and towards natural drainage channels to minimize need for storm sewers.
3. Sodding should be used where the lawn must be established immediately or where grading results in steep slopes.
4. Materials, trees and shrubs, where required, should be selected for characteristics of sturdiness, low maintenance and tolerance to specific site condition. Generally, planting should be native and indigenous to site.
5. Plant material may be used to stabilize both existing and proposed grades.
6. Locate trees so that root spread and brand spread at maturity will not overlap underground utility/service lines.

9.13.2 TREES & SHRUBS

1. Select trees and shrubs sufficiently large to guarantee quick establishment and vigorous growth.
2. Avoid trees and shrubs within 1.5 m of curb.
3. Selection of trees and shrubs shall be in line with requirements of LEED® credits being pursued.

9.13.3 TOPSOIL, LAWNS AND PLANT MATERIALS

1. Sodding should be used where the lawn must be established immediately or where grading results in steep slopes.
2. Consider compost from local supply sources in lieu of importing topsoil. Application of recycled materials is to be encouraged in the development of the new site.

3. Introduce mowing strips adjacent to all buildings, 300 mm wide paved or crushed stone strips.
4. Specify planting to be performed as soon as practical and in stages where necessary in order to stabilize the site and limit soil erosion and sediment transport.
5. Plant material specified shall be from areas with similar climatic conditions. Use the site, soil type and those plants most likely to transplant successfully.

9.14 FENCING AND GUIDE RAILS

9.14.1 FENCING

1. Provide fencing details as applicable.

9.14.2 GUIDE RAILS

1. Place guide rails in accordance with recommendations of the Transportation Association of Canada.
2. Guide rails may be utilized as building or site structure protection.

9.15 SUPPLY AND WASTE HANDLING

1. Provide service areas large enough to maneuver trucks, minimizing the need for backing up.
2. Consider requirements for and siting of waste storage containers including recyclable waste.
3. Avoid locating truck parking areas near building air intake louvers.

9.16 SITE FURNISHINGS

1. Where site furnishings are being provided, the design is to be vandal proof, easily maintained and adequately secured to prevent quick removal.
2. Site structures include kiosks, transformer enclosures, storage bins, and ground maintenance storage facilities.
3. Assess with facility manager the site furniture requirements for seating facilities and litter collection.
4. Planters may be considered near entrances and in courtyards.

9.17 SIGNS

9.17.1 TRAFFIC CONTROL SIGNS

1. Traffic control signs required to ensure safe movement about the site are to be based on the "Canadian Uniform Sign Manual", published by the Transportation Association of Canada.
2. Detail the size, mounting method and text of each sign on the site design drawings.

9.17.2 EXTERIOR WAY FINDING AND INFORMATIONAL SIGNS

1. The way finding and informational needs of both vehicle and pedestrian traffic are to be addressed in the design. These signs are to provide direction information to the possible needs and services not otherwise obvious, such as parking areas, restricted areas, shipping and receiving.
2. The primary identification signs are to be free standing and sited according to Departmental direction.
3. Detail the size, mounting method and text of each sign on the site design drawings.

9.17.3 PROJECT SIGNS

1. Refer to the NL Master Specification Guide for Public Funded Buildings.

9.18 FLAGPOLES

1. Quantity of flagpoles will be project specific however, three (3) are common at major government buildings.

9.19 DRAWING CONTENTS

9.19.1 EXISTING CONDITIONS DRAWINGS

1. Refer to Site Surveys for drawing contents information to be prepared.
2. Provide soils information on existing conditions drawing comprised of location and logs of boreholes and test pits provided in the soils report.

9.19.2 GRADING DRAWINGS

1. The grading plan shall show sufficient grades and gradient arrows to indicate the site is adequately drained. The contour interval shall be:
    a. every 0.50 m for average site slopes up to 1:5
    b. every 1.00 m for average site slopes more than 1:5
2. Show ground floor entrance elevations of proposed buildings and finished elevations of grade at building corners and entrances.
3. Show proposed finished grades in relation to existing grades on grading plan.
4. Show location of manholes, catch basins, hydrants and valve boxes.
5. Direction and percentage of grade should be shown between all finished grades
6. Transitional sloping from proposed infrastructure to original ground should show the direction of sloping and design slope of 3:1 (H:V).

9.19.3 SITE SERVICES DRAWINGS

1. Dimension water, sanitary and storm services to existing buildings, features or survey lines to permit accurate setting out in the field during the construction stage and to facilitate location when repairs are necessary. Provide design grades to facilitate determining height of manholes and depth of watermain installation.
2. Drawings must cover:
    a. length, size, material and grade of sanitary and storm sewers between manholes
    b. inlet and outlet pipe elevations for each manhole
    c. watermain pipe material, size, bends and location of valves, connections, hydrant installations and drainage, and thrust restraint requirements
    d. normal bedding and backfilling of pipes, special backfill under roads, parking areas and driveways
    e. special bedding in rock trenches or poor ground
    f. dimensioned location of all adjacent services and method of crossing under or over, support etc.
    g. check locations of all adjacent underground services including telephone cables

h. typical details including manholes and catchbasins, manhole ladders, any modification to typical structures, water service connections, service lateral details, trench bedding and backfilling details

9.19.4 Landscaping Drawings

1. Intent is all landscaping features, such as surface cover, planting schedule and details are to be shown.
2. Provide planting schedule showing both botanical and common names of all plants, shrubs and trees. Show required plant size, height and planting spacing.
3. Coordinate with site grading plan to avoid conflicts with manholes, catch basins, hydrants, etc.

9.19.5 Pavement Plan

1. Show pavement extent and types with finished elevations, if not on grading plan.
2. Provide details for typical pavement section, curb, sidewalk, road and ditch section, and marking details.

9.20 Demolition

9.20.1 General Requirements

1. Prior to demolition the current status of environmental and health hazardous materials must be investigated and documented.
2. Subsequent to or in-conjunction with the environment abatement, two methods for demolition may be employed:
    a. Systematic demolition - to demolish a structure piece by piece in an orderly manner, which is normally carried out in the reverse order of construction.
    b. Demolition by rapid progressive failure - used to collapse a structure or a section thereof by the dismantling of the vital supporting members.
3. Systematic demolition is preferred where possible resale and/or reuse of construction materials will achieve environmental benefits.

9.20.2 Demolition Plan

1. Prior to demolition, an engineering survey should be carried out to determine the types of construction, condition of the structure to be demolished and the site conditions.
2. Utilizing the information obtained in the engineering survey, prepare a detailed demolition plan.
3. Where feasible, systematic demolition should be enforced, providing where possible the opportunity of resale, reuse, or recycling of construction materials. This should be considered in conjunction with LEED® plans.

9.20.3 Public Protection

1. Special requirements for the protection of vehicular and public thoroughfares or pedestrian traffic are to be indicated.
2. Show any site hoarding deemed necessary on site grading plan.