4.0 Community Information

Sewage Characteristic Calculations

The sewage treatment system design horizon is indicated in the previous section. Based on an implementation year of 2004, the 20 year design horizon is set at 2024. Using current population projections from the Bureau of statistics for the years 2004 through 2021 and extrapolated values to 2024, the following table summarizes the estimated sewage generation volumes as well as organic and solids loadings.

Organic and solids loadings are based on 'typical' characteristics for raw sewage generated from a truck delivery system. Calculations are provided in **Appendix B**. Site specific analytical data is not available for the community of Cape Dorset.

Table 4-1 Design Sewage Generation Values

	2004	2014	2024
Population	1327	1632	2012
Sewage Generation per capita (litre)	117.5	123.8	131.6
Organic Load (BOD_5) per capita (kg)	0.074	0.074	0.074
Solids Load (Total Suspended Solids) per capita (kg)	0.111	0.111	0.111
Average Day Sewage (m^3)	156	202	265
Average Day BOD_5	98	121	149
Average Day TSS	147	181	223

5.0 Treatment Process

In a process sense, there are five (5) major units that together make up the sewage treatment facility. These major process units are: raw sewage handling, primary screening, flow equalization, biological treatment and sludge handling.

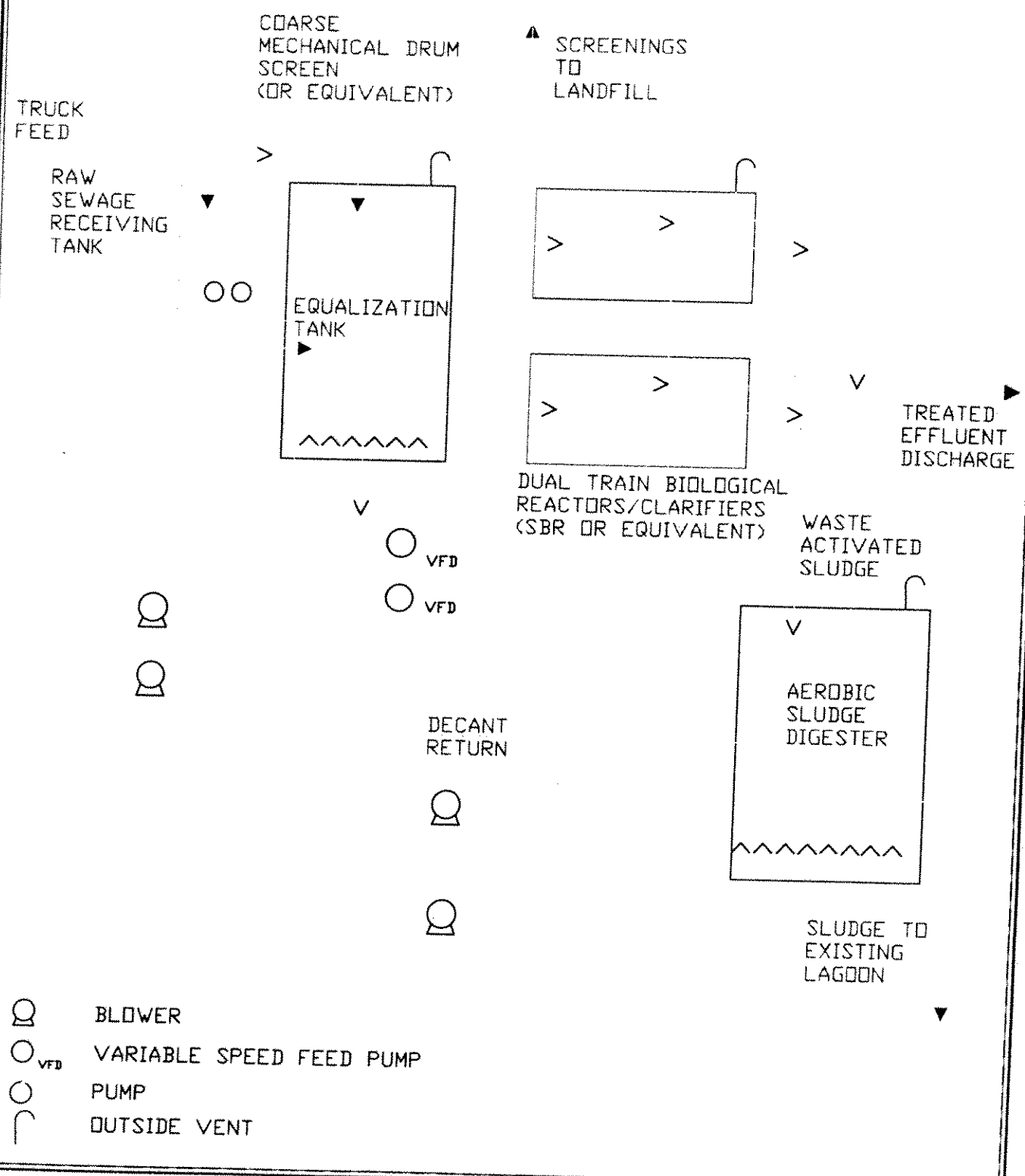
Different manufacturers and suppliers commonly offer various alternatives for the equipment/materials that together make up a pre-engineered and prefabricated sewage treatment process consisting of these major units. Accordingly, the GN will be seeking the recommendations of qualified equipment manufacturers/suppliers during a planned competitive pre-selection quotation contract process for the key process units. **Table 5.1** summarizes the preliminary design basis for each of the key process units. At the present time, the GN is working on the basis that the heart of the treatment plant, the biological process unit, is that of a Sequencing Batch Reactor (SBR). In comparing the applicable technologies of extended aeration activated sludge (EA), rotating biological contactors (RBC), and sequencing batch reactors (SBR), the GN has identified an SBR as the currently preferred process for the following reasons:

- All units can meet applicable discharge criteria
- An SBR provides an opportunity to compare/contrast performance with a fixed-film (RBC comparable) process of similar size installed in Nunavut
- In direct comparison to the EA process, the SBR is likely simpler from an operator's perspective. An SBR is also likely to have a smaller footprint then an EA.

The scope of the pre-engineered process can be described as "The design and supply (FOB Montreal) of all materials and equipment required to process sewage from the point of delivery to the point of discharge and meet stipulated treatment criteria. Materials and equipment will include, but not be limited to:

- All tanks and in-tank equipment (pumps, diffusers, piping, etc.)
- All interconnecting piping between tanks
- Ancillary equipment including all blowers and pumps
- Process controls:
    - Metering equipment
    - In-tank level controls
    - Integrated central control panel with remote monitoring capability

Due to its location, the pre-engineered sewage treatment process must be enclosed within a heated building. The design basis for the building is provided in Section 6.



DILLON CONSULTING

TITLE:	CONCEPTUAL BLOCK DIAGRAM
SITE:	CAPE DORSET SEWAGE TREATMENT PLANT
CLIENT:	GOVERNMENT OF NUNAVUT
PROJECT NO.	02-0397
SCALE:	N/A
DATE:	FEB. 2003
FIGURE NO.	5.1

Table 5-1 Preliminary Design Brief

Process Unit	Design Basis
Raw Sewage Handling	• Trucked delivery to treatment plant 5 days per week • Capacity of largest sewage truck 10 m^3 • Gravity discharge from truck to treatment plant receiving tank • Capacity of receiving tank minimum 150% of largest tank • Receiving tank enclosed and vented to outdoors
Primary Screening	• Pumped for controlled throughput • Coarse rotating drum screen or equivalent • Automatic solids removal and recovery • Solids recovery suitable for direct disposal to landfill • Nominal 12mm openings for coarse solids removal
Flow Equalization	• Single, continuously aerated tank • Tank enclosed and vented to outdoors • Coarse bubble aeration through fixed diffusers • Minimum hydraulic capacity 24 hours

Biological Treatment	• 100% redundant dual train reactors
	• Each reactor sized to accommodate 100% normal flow during upset events or maintenance (1 tank out of service)
	• Direct piped discharge to receiving environment
	• Sized for guaranteed discharge quality at 20 year design flows not exceeding:
	  ○ 20 mg/l Total Suspended Solids
	  ○ 20 mg/l BOD_5

Sludge Handling	• Single, continuously aerated tank • Coarse bubble aeration through fixed diffusers • Minimum 40% reduction in volatile solids at 20 year design flows • Solids retention time sized to meet volatile solids reduction criteria • Variable level decant returned to flow equalization • Thickened sludge discharge to existing ex-filtration lagoon
Ancillary Equipment	
Pumps and Blowers	• 100% redundancy for all units

6.0 Facility Requirements

The facility will require the items listed in Table 6.1.

Table 6-1 Facility Design Brief

Facility Unit	Design Basis
Truck Turnaround	• Hook-up to transfer sewage from trucks to facility • Prevent sewage from freezing inside the hook-up pipe after transfer completed
Screenings Discharge	• Collect for landfill disposal
Treated Effluent Discharge	• Discharged to Tellik Inlet via existing drainage swale • Freeze protected pipe to allow year round operation
Sludge Discharge	• Pumped discharge to existing lagoon • Freeze protected to allow year round operation
Building Shell	• Concrete pad, insulated metal cladding shell • Electrical/Mechanical Room • Office • Separate bathroom • Enough space to house all process equipment • Prime power supplied by Nunavut Power • Building heat provided by boiler system • Backup power through use of diesel electric generators to run boiler and blowers

7.0 Implementation Strategy

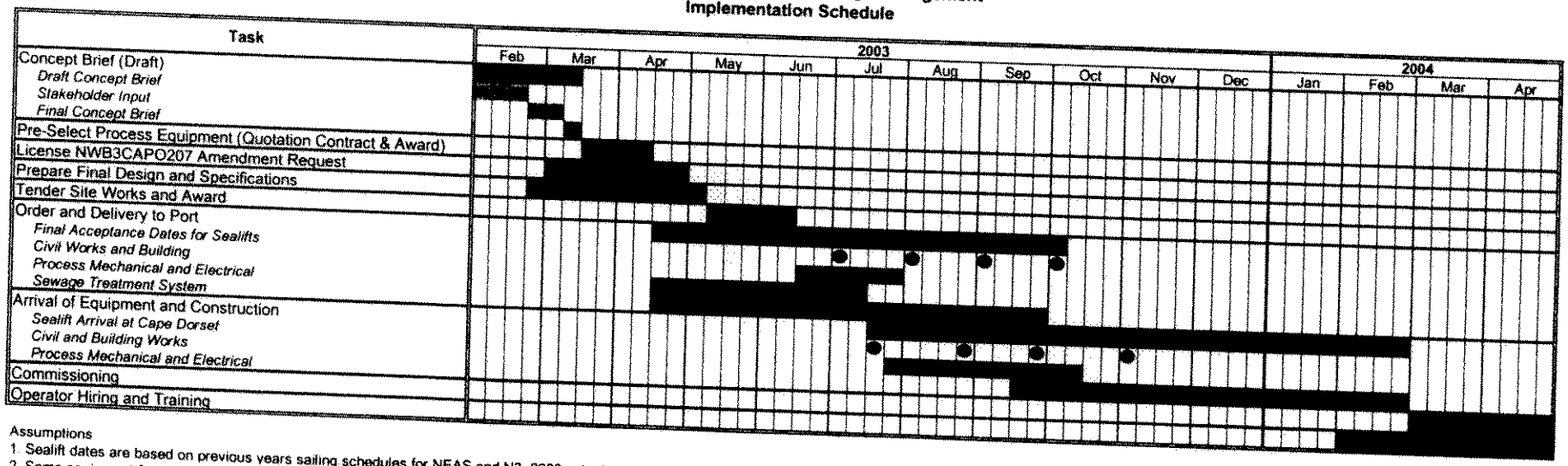
The proposed implementation schedule for this project is shown in **Table 7.1**. Given that the delivery of the process mechanical and electrical equipment is the time critical component to meet a spring 2004 start-up date, two contracts are planned for this project. One contract will be for supply of the pre-engineered, prefabricated process equipment to site and other contract would be for construction of the facility and installation of equipment.

As shown in Table 7.1, the award of the process equipment contract is tentatively scheduled for mid April with the award of the construction contract tentatively scheduled for mid June. This should provide the suppliers adequate time (18-22 weeks) to construct and deliver the process components to the port in Montreal to meet one of the four sealifts travelling to Cape Dorset. Although the sealift schedule has not yet been finalized for 2003, in previous years the first sealift has had scheduled arrival in the middle of June, with the last sealift scheduled for arrival at the beginning of November. The award of the construction contract in mid June will allow the contractor 2-6 weeks to gather equipment and supplies for delivery to the site by sealift.

The site grading and construction of the sewage treatment plant building shell must be finished before the middle of October. This enables the building to have heat and electricity connections before winter. The process equipment will be installed within the building during the winter months with commissioning occurring in the spring 2004.

This project can be completed by spring 2004 but is dependent upon the timing of the delivery of equipment and the sealift schedule. Unforeseen delays could potentially prolong the completion of the project to the following year.

Table 7.1
Cape Dorset - Long Term Sewage Management
Implementation Schedule



Assumptions
1. Sealift dates are based on previous years sailing schedules for NEAS and N3. 2003 schedule not available until May 2003
2. Some equipment for civil works arrives on first sealift
3. Process equipment must arrive on last sealift but could arrive on previous lifts
4. Process equipment will not be installed until after building is completed
5. Building must be completed and heated before middle of October

PART 1 - GENERAL

1.1 Description

.1 Design, supply, commission, and operator training for a complete sewage package plant to treat domestic, municipal wastewater for a truck delivery system in Cape Dorset, Nunavut as outlined in this specification and the attached Concept Brief.

1.2 Evaluation of Proposals

.1 The proposals will be evaluated based on:

.1 Quality of design and construction of facility.

.2 Similar experience in remote, northern operations.

.3 Capital cost.

.4 Estimated annual operation and maintenance costs.

.5 Ease of operation and maintenance.

.6 Building footprint needed to house entire proposed system. Typical building construction is in the order of $\$2,500/m^2$.

.2

1.3 Schedule

.1 The following final acceptance dates of sealift departures for Cape Dorset from Montreal are based on previous years' sailing dates. The 2003 schedule will be published sometime in April or May.

.1 First week of July

.2 First week of August

.3 First week of September

.4 First week of October

.2 All equipment must be in the port of Montreal and packaged in a form acceptable for shipment before the last final acceptance date.

.3 It is the successful tenderer's responsibility to confirm acceptance and sailing dates with the sealift companies (N3 and NEAS).

1.4 Scope

.1 The successful tenderer will be required to design and supply, FOB Montreal:

.1 Headworks, units.

.2 Sewage treatment facility and clarifier (if required).

.3 Sludge treatment units.

.4 All electrical, mechanical, instrumentation and controls for above units in accordance with the requirements of this specification and suitable for integration with other building controls.

.5 All interconnecting piping.

.6 Certification that the installation is to manufacturer's requirements and commission the facility.

.7 Training of the operators and preparation of operation and maintenance manuals.

.8 Warranty treatment process performance.

.2 Equipment shall be supplied to port of Montreal and packaged suitable for sealift delivery to Cape Dorset.

.3 The successful tenderer will enter into a subcontractual agreement with the successful General Contractor. Terms and conditions for general contractor are available upon request. It is recommended that tenderers review these documents prior to bidding.

1.5 Payment

.1 Payment is subject to terms and conditions of the general's contract as stated in Government of Nunavut Construction Contract April 2000 Terms of Payment and Government of Nunavut Construction Contract March 2001 General Conditions.

.2

1.6 Work by Others

.1 Piping up to headworks.

.2 Outfall piping and pumping.

.3 Site grading.

.4 Installation of equipment, piping and interconnecting wiring.

.5 Construction and supply of building.

.6 Supply and installation of domestic water tank, water piping, heating equipment and other building appurtenances.

.7 Extension of telephone and electricity to facility including system back-ups as required.

.8 Standby diesel electric generator.

1.7 Information to Accompany Proposal

.1 Statement of qualifications including company profile, arctic experience and similar package plant projects.

.2 Detailed description of the proposed treatment process and demonstration of suitability of design.

.3 Process diagram for treatment process.

.4 Conceptual drawings of the works proposed in sufficient detail to permit an adequate evaluation as specified in Section 1.2.

.5 Provide specifications and descriptions of the various major equipment components.

.6 Description of process control and instrumentation system, including schematics and P&IDs.

.7 Hydraulic calculations.

.8 Detailed equipment schedule.

.9 Capital cost will include all items necessary to design, supply, commission and provide operator training of complete sewage treatment plant as specified. Capital cost will be broken down in proposal by:

.1 Tankage

.2 Major Equipment

.3 Ancillary Equipment (panels, motor starters, instrumentation, piping, valves).

.4 Start-up commissioning and operator training. Assume 14 days on-site over 2 trips.

.5 Other (Commission, Operator Training, OPS Manual, etc.).

.10 Expected annual power requirements and annual operating costs. Annual costs will be based on assumed values of $0.3896/kwhr for power and $0.842/L for diesel.

.11 Expected sludge production.

.12 Labour requirements and level of training required for operators.

1.8 Design Criteria

.1 The 20 year design flows, based on typical characteristics for raw sewage generated from a truck delivery system, are as follows:

.1 Average Day Sewage = 265 m^3

.2 Average Day BOD_5 = 149 kg

.3 Average Day Total Suspended Solids = 223 kg

.2 The current flows are estimated below:

.1 Average Day Sewage = 156 m^3

.2 Average Day BOD_5 = 98 kg

.3 Average Day Total Suspended Solids = 147 kg

.3 The treatment plant shall produce an effluent not exceeding the following limits:

.1 BOD_5 = 20 mg/L

.2 Total Suspended Solids = 20 mg/L

.4 Truck delivery of sewage is 5 days/week.

.5 Plant is to operate 7 days/week.

1.9 Design Drawings Specifications and Shop Drawings

.1 Following award of contract, submit four (4) comprehensive sets of detailed design drawings and technical specifications at a mutually agreeable schedule.

.2 All design drawings shall be stamped by a professional engineer registered or licensed to practice in Nunavut.

.3 Changes to design drawings and/or Specifications shall be reviewed by the Engineer.

.4 Submit six (6) copies of the Shop Drawings for review by the Engineer prior to fabrication. Required shop drawings to be identified by Engineer after award of contract.

1.10 Operation and Maintenance Manuals

.1 The manual specified under this contract shall cover all processes associated with this specification but shall be incorporated as a section within the facility's operation and maintenance manual.

.2 Submit, a minimum of three weeks prior to commissioning, five (5) copies of the treatment plant operation and maintenance manuals.

.3 Operation and Maintenance manual submissions are to conform to the current edition of "Specifications for Operations and Maintenance Manuals", Department of Public Works and Services, Government of Nunavut and any requirements stipulated by regulating authorities (Nunavut Water Board, etc.).

.4 Provider for the following for incorporation into the plant O&M manual by the General Contractor.

.1 Names and addresses of the subcontractors and contractors.

.2 Complete list of the names, addresses and telephone numbers of equipment suppliers and local representatives from whom parts may be purchased and who can effect repair or maintenance on equipment.

.3 Copies of warranties and guarantees.

.4 Copies of approvals, certificates and similar documents for governing authorities.

.5 A final reviewed copy of all shop drawings and product data sheets.

.6 Plant start-up.

.7 Process operation, control and troubleshooting requirements.

.8 Maintenance requirements.

.5 If, during the review of the manuals, revisions are required, manuals will be returned with details of the required revisions. Revise and resubmit manuals for further review.

.6 Submission of the manuals is a condition precedent to issuing the Certificate of Substantial Performance.

1.11 Manufacturer's Inspection and Certificate Equipment Systems

.1 Have factory-trained service representative at the site to inspect installation of each item of equipment to supervise start-up and to instruct the plant operators in the proper operation and maintenance of equipment.

.2 On completion of the installation, testing and start-up of each item of equipment, submit to the Engineer the manufacturer's certificate stating the installation of the equipment has been inspected, is installed in accordance with the instructions, has been started and adjusted as necessary, the operators have been instructed in the operation and maintenance and it is in warranty condition.