Appendix B- Preliminary Design Brief

Environmental

July 20, 2006

Municipal Rural Infrastructure Fund
MRIF Coordinator
Canada-Yukon Infrastructure Secretariat
P.O. Box 2703
Whitehorse, Yukon Y1A 2C6

Attention: Jennifer Meurer, Program Coordinator YT

Re: Selkirk First Nation New Long -Term Sewage Disposal Facility

As requested, the following summarizes design data used for design on the long-term sewage disposal facility for the community of Pelly Crossing and provides additional information on construction and operation of the system. This design brief is preliminary.

This brief should be read in conjunction with the reports prepared by Vista Tek Engineering Ltd. on April 11, 2006, which provides an evaluation of SFN sewage disposal systems and provides an overall plan of action for addressing current issues, and by EBA Engineering Consultants in February 1999 that describes the geotechnical evaluation of the Site 7, the preferred site for the new long-term sewage disposal facility.

1. Background

The Selkirk First Nation community of Pelly Crossing, YT has approximately 330 residents in three subdivisions and 100 residences. The freezing of 17 septic fields resulted in the need to pump out septic tanks on a weekly basis. The volume of sewage exceeded the capacity of the existing SFN sludge disposal pit requiring the community to haul sewage to Mayo, YT.

Vista Tek Ltd was retained to assist the SFN in evaluating the cause of freeze ups and develop a plan to address immediate and long-term needs for sewage disposal in the community. The evaluation identified the need for a new temporary sewage disposal pit designed to serve two purposes:

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- Disposal and treatment for sewage until existing septic fields thaw and can be repaired – expected until July 1, 2006
- Disposal for sludge generated from routine maintenance of septic fields.

The proposed facility is intended as a temporary facility only until a new permanent facility can be designed, permitted, and constructed.

2. Existing Sludge Disposal Pit

The existing sewage sludge disposal pit is located approximately 1 km south of the existing developed area of Pelly Crossing adjacent to the west side of the Klondike Highway. The pit is located at the site of the old YTG land fill site which has been decommissioned.

Fig 1: Septage Disposal Pit with Overflow

When YTG constructed a new landfill facility for community in the late 1990's the community raised concerns with constructing a new septage disposal pit at the same location

due to potential environmental impacts. An agreement was reached with YTG and INAC that the SFN would conduct its own assessment and site selection for this facility.

EBA Engineering Consultants Ltd prepared two reports which evaluated potential sites with a new site, identified as site 7, being selected as the preferred location by the community. This site is located adjacent to the west side of the Klondike Highway, approximately 5 km south of the Pelly River Crossing.

EBA conducted geotechnical investigations of the site which was identified as being suitable for the proposed use and also presented a conceptual design of the proposed disposal facility. The report identified that work had been started on application for a Class B water licence.

Both reports are appended to this document for reference.

Permitting, design and construction of the new facility was not completed and septage has continued to be deposited at the old landfill site. It is understood that the use of this facility was permitted under a temporary land use permit which has since expired.

2. Design Data

In 1999, EBA Engineering Consultants had been contracted by Selkirk First Nation to identify a suitable site for the construction of a long-term sewage disposal facility. Work included the collection of existing geotechnical data from EBA files as well as from other previously completed geotechnical report.

Site 7, located along the west side of the North Klondike Highway approximately 5 km south of town, was chosen as the preferred site. The terrain is slightly elevated above the surrounding area, is circular in shape, and is glacial in origin. Vegetation is all second growth as a result of a forest fire in the late seventies. A single bore hole was drilled to a depth of 12 meters on site and no groundwater was encountered. Percolation tests were conducted in accordance with Environmental Health Guidelines and revealed the site was suitable for sewage disposal. Access to the site is existing, and consists of an old log haul road.

Design data is summarized as follows.

- Sand and gravel to depth, silt lenses, frost penetration up to 4m
- Percolation rate 25- 30 minutes for 25mm (low)
- Climatic conditions (historic data from Pelly Farms weather station)
  - daily mean low temperature in January -27.5°C
  - daily mean high temperature in July of 15.5°C
  - 145 frost free days per year
  - mean annual rainfall 198 mm
  - mean annual snowfall is 113 cm
  - Total yearly precipitation of 310 mm.
  - Evaporation rate 450mm per year
- Sludge production (assuming all siphon tanks volume 3400 liters per tank) for 100 residences 340,000 liters per year.
- Maximum daily sludge production assuming one 14,000 liter eductor truck at 2 trips per day (8 houses per day) 28,000 liters per day
- Current failed septic fields
- Sewage production from failed septic fields
  - Estimated based at 225 LPCD, 4 person/ house, 17 houses equals 15,300 liters per day
  - Actual based on current haul (SFN Public Works) 3 loads per week at 14,000 liters – 6,000 liters per day
  - *For design purposes use higher estimated rate at 15,300 liters per day for 17 houses or 900 liters per house per day*

3.0 Design

The new long-term sewage-disposal facility design is intended to remove solids from waste stream by mechanical filtration and treatment of liquid filtrate by creation of a bio-film in soils below the pits.

The new long-term sewage disposal facility will be comprised of three cells, two treatment cells and one evaporation cell. The two primary treatment cells will be 24m x 24 m and 3m

deep. The evaporation pit will also be 24m x 24 m but only 1 m deep. When constructing sewage disposal facilities, it is considered good practice to provide two primary disposal cells in order to allow for maintenance of one cell while using the other cell. Once the sludge layer has occluded the entire sand filter bed in the horizontal plane, discharge should be directed to the second cell and the sludge allowed to compost in place. By mixing native organic soils with the sludge, the waste will rapidly compost and be suitable for land filling within one summer season. The construction of two pits will also provide considerable excess emergency storage capacity for sewage discharge during winter months should additional septic fields freeze next winter.

Based on historical data, and to be confirmed by survey of the site, three 24m x 24m pits could be constructed in this area. Assuming a 2:1 side slope and a 3m depth (for the two primary pits) the projected horizontal area will be approximately 200 square meters per pit at half storage with a total storage volume of approximately 650 cubic meters per pit . Estimated daily dumping quantities are $28m^3$/day.

Based on available area and a maximum operating depth of 3m, the design capacity for proposed facility is summarized as follows:

Sludge disposal capacity (per pit):	392,000 liters per day 28 truckloads at 14,000 liters 450 residences
Emergency storage* (both pits):	620 x 2 = 1240 cubic meters 6 months storage for 7 residences

** Emergency storage will be governing criteria for design*

Percolation tests indicated a very low infiltration rate of 25mm of water within 30 minutes. This infiltration rate is considered very low and suitable to provide adequate treatment. An

evaporation pit will be required in addition to the two primary treatment cells due to the low rate of infiltration. Design sketches for the proposed facility are appended.

4.0 Material and Cost Estimates

A design for the facility will need to be developed in order to provide accurate cost estimates. A preliminary estimate is provided as follows for budgeting purposes only. An increase in storage volume of 50% has been assumed to allow capacity to a twenty year design horizon (240 septic tanks).

Data:	20 year sewage production	816,000 liters per year
	Evaporation: 450mm year	
	Exfiltration: 25mm in 30 min	
	Access road length	300m
	Turn around	15m radius
	Site area	100m x 100m
	Volume primary cell excavation	817 cu. m. (original)
	Volume primary cell excavation	1200 cu. m. (proposed)
	Volume secondary cell excavation	1200 cu. m. (proposed)
	Volume evap pit excavation	530 cu. m. (original)
	Volume evap pit excavation	800 cu. m. (proposed)
	Fence length	400m

Assumptions:	Excavation cost	$15/ cu m.
	Compaction cost	$5/ cu. m.
	Fencing cost	$100/ lin m.
	Clearing cost	$2500/ha
	Berms constructed of excavated material	
	Road constructed of excavated ditch material with 150mm crush surface	

Preliminary cost estimate:

Clearing road	$2,500
Clearing site	$2,500
Access Road	$35,000
Excavation	$48,000
Compaction	$16,000
Turn around	$10,000
Fencing	$40,000
Gate	$2,500
Discharge and piping	$10,000
Signage	$2,000
Subtotal	$168,500
Contingency @ 25%	$42,125
Engineering	$25,000
Permitting	$10,000
Estimated Total	$245,625
Say	**$250,000**

5.0 Other Considerations

As required by the Land Use Permit, the facility will need to be fenced and signed to reduce the potential for access by unauthorized personnel.

As the facility is intended to be in operation for twenty years. A lockable farm gate should be provided to allow access to operators. A gate should also be installed at the entrance road at the Klondike Highway.

Warning signs should be placed on each side of the fence.

6.0 Decommissioning

The preferred method for decommissioning is to allow the contents to compost in place. The contents should be allowed to thaw and drain and organic soils mixed with the contents. Nematodes and other organisms in the organics will help to break down the sludge.

The perimeter of the pits should be graded to provide positive drainage away from the cells. The off load apron in the vicinity of the discharge chutes should be graded so that any spills drain into the pits.

7.0. Conclusions and Recommendations

1. The existing sludge disposal pit does not have sufficient capacity to accept sewage from holding tanks.
2. It is recommended that design, permitting and construction of a new permanent, long term sewage disposal facility be commenced as soon as possible.
3. The conceptual design as proposed by EBA Engineering Consultants at site seven should provide a safe, long term facility for sewage disposal for the community. Consideration should be giving to constructing two cells at the new location in order to allow for draining and composting of sludge.
4. The preliminary cost estimate for a new two cell facility is approximately $250,000.

If you should have any questions or require additional information on the above, please contact the undersigned directly at 867 393-4833.

JC Environmental

Jillian Chown, B.Sc

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