

**Water and Environmental Programs
Engineering Success Stories**

State: Alaska

Borrower Name: City of Mekoryuk

Engineering Firm: Cowater International, Inc.
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Congressional Information: Don Young – Alaska

Counties: Bethel Census Area

Keywords: Septic, Hauling

Flush Tank and Haul™ Systems

Description of Problem/Issue:

The climatic and physical conditions in many Arctic communities in the Canadian North and Alaska are so severe that conventional piped water and sewerage are not feasible. In particular, permafrost conditions preclude simply burying the water and sewer pipes below the frost line. Similarly, septic tanks with leach field disposal of liquid do not function well in permafrost conditions. Piped water and sewage systems can be built, however the cost of construction as well as ongoing operation and maintenance are often too expensive, particularly for small, remote communities. In some other cases, factors such as ground conditions (rock, muskeg, etc.), remoteness and size of the community are such that piped water and sewers are not feasible. Generally, very small and remote communities find it difficult to support piped systems.

Solution:

In many northern communities there are no modern water and sanitation services in homes. Normally the “honeybucket” is used to collect and dispose of human waste. Typically, the honeybucket is a 5-gallon pail lined with a plastic bag and when the bucket is full it is carried by hand to a sewage disposal site that might be a sewage bunker, a sewage lagoon, a honeybucket haul wagon, or the ground somewhere surrounding the home. Because the honeybucket is open, subject to spillage and often carried by children to the dumpsite, it is inherently a health hazard as it exposes people to direct contact with sewage wastes. Fresh water for drinking, cooking, bathing and cleaning is carried to the household in buckets or open containers hauled by ATVs or snow machines. The water source may be a local river or a community well or river ice. Rainwater is also collected and used.

Increasingly, Federal and State Authorities in Alaska are committing themselves to developing and funding alternatives to improve water supply and sanitation systems in rural communities. In studies done by the Alaska Department of Environmental

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Conservation (ADEC) in 1993/94, out of a total of 239 villages, 103 of these (44%) used honeybuckets, pit toilets and privies for human waste disposal. On average, these villages have approximately 50 homes giving a total of some 5,000 homes in Alaskan villages where no improved systems are in use at the present time. In a recently completed study done for Cowater, it is estimated that for approximately 2,500 homes it is not feasible to construct piped water and sewer systems. This then represents the market to which the Flush Tank and Haul™ system is directed.

Cowater International, Inc. is an international consulting firm which specializes in community-based, low-cost water supply and sanitation. Since the late 1980s Cowater together with Manus Coffey Associates of Ireland have been developing a patented water and sewage haul system that uses all-terrain vehicles (ATV) and snow machines to pull small water and sewage haul tanks mounted on trailers or sleds. At the home fresh water is stored in an inside tank and sewage is collected and stored in a sewage holding tank. Because of the small size of the haul tanks it is mandatory that the in-house systems use low water-use fixtures, especially the toilet and that the residents use water sparingly in order to keep haul costs within reason. These habits come naturally to residents of these villages who are accustomed to hand carrying water and sewage.

In the mid-1980s Cowater developed and tested a flexible sewage tank that could be mounted under the floor of a home to collect sewage. The tank was made of a flexible material so that it could withstand being frozen solid when and if the home were left vacant during the winter. The tank consists of a rubber bag set in a wooden box inside the bathroom. A low water use toilet is mounted on the box platform. Water for flushing the toilet is greywater collected under the hand basin and is manually pumped to flush the toilet. Evacuation of the sewage bag is achieved by pressurizing the interior of the bag with a low pressure air blower which expels the sewage up the discharge pipe and out through the wall of the house and into a closed sewage haul tank. The tank is then hauled by ATV or snow machine to the sewage lagoon for dumping. Depending on the size of the household and the wastes disposed of in the tank, the 80 gallon tank would have a holding capacity of from one week to two months. The reuse of greywater from the handbasin for toilet flushing would reduce the total water used.

The study was carried out with a great deal of consultation with the community including public meetings, household visits and surveys and meetings with councils.

The present system, based on the latest designs, consists of a gravity system or a transfer tank system, depending on the design of the building, to remove the sewage from the building. The sewage is collected in a super insulated outside holding tank. Rubber couplers are used to provide some flexibility for differential movement. Heat tape is placed on the pipe as well as around the holding tank to assist in preventing freezing. Tie-down cables prevent movement during flooding or accidental impact. After filling the sewage is transferred to a haul tank and hauled to the lagoon for dumping.

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Water is collected from a public watering point (well or washeteria) in a 100 gallon haul tank. At the home it is “pumped” into the inside storage tank by pressurizing the tank with a blower. Many homeowners self-haul water in the traditional manner and fill the storage tank manually. Inside the home a small demand pump delivers water to the connected fixtures. Hot water heaters are installed where requested.

Construction and installation costs without planning, design and supervision run approximately \$18,000 per unit. Operation and maintenance costs have been calculated to be in the range of \$13 to \$18 per haul depending on the operator’s time per haul. Water haul costs would depend on the amount of self haul and could be up to the same amount for full self haul service. Monthly average costs for full sewage and water haul service would be in the \$36 to \$52 range. It is anticipated that in time water consumption will rise and the costs will increase.

Cowater has found that small communities usually require a great deal of training and support to develop suitable systems to manage a village-based utility such as the Flush Tank and Haul™ system. This support must be very detailed and must have a strong follow-up component which lasts long after construction is completed. Because the system requires reliable operators and clerical staff, turnover of staff can be a major risk which must be anticipated. For these reasons the management systems must be simple, visual and as straightforward as possible.

This summary is taken from a report provided by Cowater International, Inc. of Ottawa, Ontario, Canada. Further information may be obtained by contacting Cowater International, Inc.
