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REPORT ON SANITATION - CAPE DORSET, N.W.T.

J. GRAINGE
D.I.A. - EDMONTON

INTRODUCTION

This report contains general information about the community in order to establish the relative extent of the sanitation problem, both now and in the future. It includes descriptions of present conditions of sanitation and suggestions for improvement.

SUMMARY OF RECOMMENDATIONS

Community Planning

1. Give serious consideration to the fundamental faults in the site of the community, and a suggestion for moving to an alternate site.
2. Make all decisions in community planning, based on the need for pipe water and sewerage systems, so that a reasonable standard of sanitation can be reached.

Water Supply

1. Chlorinate the drinking water.
2. Protect nozzles, hoses and reservoirs from contamination.
3. Convert water tanks and reservoirs so that they can be flushed.

Wastes

1. Consider the need for a system of sewers and sewage treatment facilities, together with realistic cost estimates in order to appreciate whether or not compliance with future sewage effluent standards will be possible at the present site.
2. Use plasticized paper garbage bags for convenience and to reduce spillage of toilet wastes and the blowing of trash.

GENERAL

The Hamlet of Cape Dorset is situated at 76½°W, 64°N, on the north shore of Dorset Island, which is off-shore of Foxe Peninsula of Baffin Island. It is 250 miles west of Frobisher Bay. The buildings are in two short valleys, hemmed in by steep granite rock. In spring there is a substantial flow of runoff water funnelling through these valleys in which the settlements are situated. The soil is alluvial, consisting of fine sand, gravel and rock fragments. Permafrost prevails throughout the settlement, but generally the soil is not subject to severe frost heaving.

The climate is severe. There is inadequate climatological information to obtain mean temperatures. Estimates obtained by extrapolation of weather charts provide mean temperatures, January, July and annual which are $-20^{\circ}F$, $+43^{\circ}F$ and $+13^{\circ}F$, respectively.

Although it is situated approximately 150 miles south of the Arctic Circle, the sun sinks below the range of visibility for a period of approximately two months in mid-winter. Cape Dorset fronts a narrow strait to the north which is open water through summer months, generally from mid-June to mid-September.

Transportation to the settlement is by ship from Montreal or by Nordair's schedule and charter airline services from Frobisher Bay. The water near the shore is not deep enough to allow the off loading of cargo directly on the beach. An engineering unit of the Canadian Army is constructing a 4,000 ft. airstrip on a hill a half mile from the settlement. During the past two construction seasons, the length has been extended to 1,800 ft. The slowness of construction is attributable to the fact that deep holes required huge amounts of fill.

The rocky nature of the community site and the lack of careful planning of the road system results in road grades as high as 10%. Most of the roads within the settlement are not difficult to plough clear during and after storms. In winter, four-wheel drive vehicles using chains are adequate throughout the winter. Tracked vehicles are in use, but they are not necessary. In fact, their maintenance is costly and time consuming.

The population of the community is 675 Eskimo and 44 non-natives. It contains a two-nurse nursing station, a two-man R.C.M.P. detachment, an N.W.T. office and garage with a staff of 15, an 8-classroom school with 208 pupils, nine teachers and four trainee teachers, an HBC post, an NCPC plant with a generating capacity of 450 kva and an Eskimo cooperative with 35 employees. The cooperative is managed by Mr. Terry Ryan and is a $1,000,000 per year operation. It encourages and markets carvings, handicrafts, drawings and prints, movies and also operates a retail store, a public radio communication office, a weather station reporting to Environment Canada, and a fuel oil agency for Shell Oil Co.

The settlement was founded by the Hudson's Bay Company in 1913 by the establishment of a post. Soon thereafter, the Anglican Church built a mission although they did not officially open it until 1961. Many Eskimos moved to Cape Dorset in 1934 when the HBC closed a post at Amadjuak 120 miles to the east. The first school building was constructed and opened in 1950. The cooperative was started in 1959 and incorporated in 1961.

The main income of the native people is from handicrafts, followed by wage employment and then by hunting and trapping. There are ring seal, caribou, white fox, silver fox, arctic char, a few beluga whales, walrus and wolves. The sea mammals are harvested at the ice floe, which is extensive in the sea, coming within three miles of the settlement.

WATER SUPPLY

The main source of water is Tee Lake, which is reported to receive sufficient runoff water to provide for the community's long-range needs. There is no traffic in the vicinity of the lake other than workmen on the system.

A submersible pump is located at a depth of 85 ft., near the south shore of the lake. Water flows through approximately 6700 ft. of 3 in. steel pipe with victaulic coupling. The pipe is insulated with approximately 1½ in. of foamed plastic insulation, and protected by sheet metal. It is heated internally by means of an electrical Pyrotenx heating cable with a wattage of approximately 4½ watts/ft.

A heated house is located at the high point of the line approximately 200 ft. from the pump. It contains an open 270 gal. tank (approx. 3½ ft. diameter and 6 ft. high) which floats on the line. An electrical control in this tank shuts off the pumps when water rises to a preset level. There is an overflow pipe near the top of the tank.

The water flows downhill to a 20,000 imp. gal. steel storage tank located in a heated garage for one of the haulage vehicles. The pipeline is supported on A-frames spaced at approximately 12 ft. There is no provision for thermal expansion and contraction of the pipe, but to date this has not resulted in any problems. Some lengthwise movement is allowed at the couplings and by the wide curves of the pipeline route.

Heating for the pipeline begins two hours before the water pumps are turned on and continues till two hours after the water stops flowing. Apparently there is much difficulty in draining the line, said to be due to frost heaving of the more level sections of the line where it crosses the former airstrip. It is likely that the steep grade after it crosses the abandoned airstrip results in negative pressures and air being sucked into the line during draining. This could be improved by throttling the flow at the lower end of the pipe during the line drainage.

The receiving reservoir is a 20,000 imp. gal. horizontally-mounted, cylindrical steel tank. At the present time the water is pumped to the haulage tanks vehicle by pumps situated on the trucks. Water flows through a 15 ft. length of 4 in. suction hose from a point near the base of the tank. This hose should be supported on a hook so that the nozzle and hose do not touch the floor. It is planned to install a permanent pump in the building with a suspended over-head hose on a swinging beam.

The outlet point on the reservoir is several inches above the base of the tank. There is no drain at the base of the tank, thus the tank cannot be flushed easily. Verbal suggestions were made to install a bottom drain below the lowest convenient point of the tank.

Water is hauled to the settlement by two vehicles. Deliveries to the school are made with a Terrain Master tracked vehicle Model TM751, manufactured by Nodwell, Calgary. The tank is steel, oblong in shape, volume 2500 imp. gal. It is apparent that the severe shaking the tank receives during transport causes breakage of the welded edges. The heavy weight and hard nature of

the roads cause difficult vehicle maintenance problems. The vehicle travels a maximum speed of 2 to 2½ mph resulting in high operational costs. Water is pumped out by means of hoses on the tank, for which there is no convenient and sanitary storage space.

Most water is delivered by a tracked Musky Bombardier hauling two 250 gal steel tanks. Water is pumped out of these tanks by a small pump and 2 in fire hose. The hose and nozzle are stored in a crowded space between the two tanks. Maintenance on this track vehicle is also costly and time consuming.

The hoses on both haulage vehicles are subject to contamination by being dragged on polluted soil such as surrounds all buildings. The nozzle becomes contaminated by touching the hoses.

Ice provides a necessary supplementary source of water because the difficulties presented by the hard-to-maintain tracked vehicles used for water delivery. It is obtained from a shallow lake above the community at the southeast end of the abandoned airstrip. In mid-winter the ice is sawn into blocks. When required the ice is hauled by the DPW crews using a tracked Musky Bombardier. It is also hauled by private individuals using Skidoo-drawn komiticks.

In summer, water is piped directly from the 20,000 gal reservoir to a few buildings, including the school. In summer, when there is no snow cover on the roads, the piping of water reduces damage to vehicles, saves much manpower, and provides water which is much less subject to contamination. The pipeline should be carefully protected from contaminates by loosely capping all open ends of pipe throughout the winter season. The system should be flushed with chorine water according to instructions contained in Appendix M, of the Sanitation Manual for Isolated Regions. This manual is available from Information Canada, Catalogue No. H31-1373.

DISCUSSION OF WATER SUPPLY

One of the most important needs of the community is a safe reliable water distribution system. This can be provided by means of year-round system of water mains. The next most reliable system is a haulage truck with four-wheel drive and chains on the rear wheels. The tracked vehicles are too difficult to maintain to be reliable.

The system of mains could be begun this year by extension to the largest users, namely the school (10,000 gal/wk) and nursing station. The total distance is less than 1000 ft. Udoubtedly the piping of water in summer as is already planned, fills a dire need. However, it is likely that the cost/benefit ratio of a year-round pipe system would be lower than that for a summer system. Construction would be almost as simple as for a summer system, if it were made from a prefabricated system such as a "U'door". It should be buried with shallow cover so as to cause least interference with traffic and lowest combined cost of construction, operation and maintenance.

The water is clear, soft and of good quality. It is not being chlorinated, but should be as it is subject to contamination. Chlorine water, such as Javex, should be added to the haulage tank as it is filled. This practice was discontinued, because the people objected to the taste of the treated waters. The dosage could be controlled at a lower effective level by making chlorine tests on the water as delivered. It is then unlikely that people would object to the taste.

WATER SYSTEMS FOR SCHOOL

There are two water systems at the school, one serving the main section of the school, and the other serving the primary section (the original school). Usually water is supplied to the school from a haulage tank, but occasionally it is necessary to melt ice blocks. Each of these systems consists of a receiving tank, water reservoir(s) and a pressure distribution system.

In the main section of the school, the receiving tank is bolted steel, (10 ft x 6 ft x 5 ft). It is well painted both outside and inside. There are electric immersion heaters on the bottom which are protected by wood slatting. There is no cover on the tank and the tank is subject to much contamination. This is particularly true when ice is melted and workmen walk on the sheets of plywood lain on top of the tank. There is also no bottom drain, which is necessary if the tank is to be cleaned. The tank does in fact require cleaning as indicated by sediment on the wood slats.

The water is pumped from near the bottom of the tank by means of two Armstrong centrifugal pumps, operated in parallel. The water discharges into two horizontally-mounted cylindrical tanks, 9½ ft long and 6½ ft in diameter. Overflow pipes, 2" in copper, return water to the receiving tank. Water is pumped from the bottom of these tanks so there is no accumulation of sediment in the bottom. The covers on the tanks are satisfactory.

The pressure distribution system consists of two Leitch, horizontally mounted, centrifugal pumps driven by 5 hp Sangamo Co. electric motors.

In the primary section of the school, the aluminum receiving tank is 3 ft x 3 ft x 3½ ft depth; electrical immersion heaters on the bottom of the tank are protected by a framework of steel angle iron. The immersion heaters are used when ice is used as a source of water. Water is pumped from near the bottom of the tank by means of an Armstrong 6, horizontally mounted, centrifugal pump. It is discharged into two vertical 3 ft diameter, 7 ft high, aluminum tanks. Water is pumped from these tanks to the base of an 18 in diameter x 5 ft high pressure tank by means of a Duro centrifugal pump.

The three reservoir tanks cannot be cleaned because there are no drains from the bottom of the tanks. It would not be expensive to provide bottom drains because the tanks are mounted 3 in above the floor.

In the near future, it is likely that water will be piped to the school from the community reservoir tank. However, the present sytems will be required until the piped system has become reliable.

RECOMMENDATIONS RE SCHOOL WATER SUPPLY

1. Provide bottom drains on the receiving tank in the main section of the school and in the receiving tank and two reservoir tanks in the primary section.

2. Provide metal covers on the receiving tanks. The covers require manholes, and these should be provided with raised edges to prevent the entrance of dust from the top. There should be covers for the manholes, preferably with turned-down edges which fit around the manhole covers.

3. When ice is placed in the tanks, chlorine should be fed to the water in the tank prior to adding the ice. The chlorine in the water should be maintained at a high level, approximately 1 mg/l, in order to destroy the contamination on the outsides of the blocks which result from handling.

SEWERAGE

Waste water flows from most buildings to the ground beside the buildings. The school contains a 2000 imp gal steel tank in a crawl space below the floor. It is pumped out by the DPW refuse crew into six 45 gal oil drums on the half-ton garbage truck. This wash water is hauled to a pit near the airport, approximately 1500 ft from the edge of town. Runoff water from this disposal site flows through the main part of the community. The nursing station contains a tank (approximately 800 gal). It is not pumped out due to lack of manpower. For this reason, the wash water overflows the tank and runs down a road.

DISCUSSION OF SEWERAGE

The discharge of wash water beside all buildings presents critical public health and environmental problems. People and dogs track through the puddles in summer and over the ice mounds in winter. There is negligible seepage of wastes into the soil. The runoff water provides a transportation vehicle, so that the pollution and pathogenic organisms are distributed throughout the community.

The use of bucket toilets is esthetically unacceptable by present Canadian standards and, probably, it will be rejected by Canadians living in the North within ten to twenty years. The haulage of sewage results in some spillage in the best of practical circumstances. Its acceptance should not be considered as the final solution in present day planning for the future, because it will be rejected eventually. Therefore, a system of sewers will be required in time, and all present planning should be related to this future need.

The community plan is a vital consideration in the planning of the sewerage system. At present, the community is confined to short valleys near the sea because of the rocky terrain. It has expanded from one valley to another, but the council is anxious to avoid expanding to a third valley. The community is small, but it is strung out in a long line about a mile in length. The people's concern and objection of further expansion is

justified because the community is already diffuse. They prefer to extend the roads up the steeper slopes of the valleys. Difficult and costly as this construction would be, it would be more than justified by the avoidance of both the high transportation costs and the difficulty of ploughing the road to the next valley either west or east.

A sewerage system in this settlement would be excessively costly to construct, maintain and operate, because a separate gravity sewer system and pumping station would be required in each valley.

It is possible that the community might eventually expand to cover three or even four valleys. The construction of a sewerage system serving all the people would be delayed because of the low benefit/cost ratio, and consequently, future extensions will receive low priorities, This is an inevitable result.

Community planning should include the future needs for sewage treatment, together with realistic cost estimates. Present acceptable standards would require primary treatment (removal of settleable and floatable solids), and discharge of the effluent to the sea. This could be accomplished using a sewage lagoon with a two to three month retention time, or a treatment plant. Consideration should be given to the possible future requirement for secondary treatment. This could be accomplished using a sewage lagoon with a one-year retention time. The community plan should include a location for these facilities.

SOLID WASTES

Garbage and trash are contained at the residences in open 45 gal barrels. Honey bags (toilet sewage in plastic bags) are either stored inside the houses or on the ground beside the buildings.

Honey bags (toilet sewage in plastic bags), garbage and trash are hauled by means of a half-ton Ford crew - cab to a sloping site 1500 ft west of the community. At high tide, the site is approximately 300 ft from the shore.

The wastes are dumped along the brow of a slight incline.. In spring, a bulldozer will be used to consolidate the refuse and cover it with sand. The sand will be hauled from the pits at the new airport.

Generally, the honey bags are hauled separately from the refuse. They are collected daily, placed in 45 gal drums, and trucked to the dumping site. The workmen pick them up inside or outside the residences according to the wishes of the particular householder

Much of the refuse consists of ashes from trash which is burned in the barrels. The barrels also contain snow which often causes icing, and it is sometimes difficult to empty them. Usually the frozen material can be shaken loose by hammering the outsides of the inverted drums.

During blizzards, the road from the settlement to the nuisance grounds is subject to severe drifting. When this occurs, the wastes are hauled to a low area at the airport which is being filled in with gravel. It will be the apron for the airport when completed. Drainage from this area

flows through the central part of the community.

DISCUSSION OF SOLID WASTES

A considerable improvement in the handling and haulage of garbage and honey bags could be effected by the use of plasticized paper garbage bags at all houses. The use of these bags is discussed on page 29 of the "Sanitation Manual for Isolated Regions" (Information Canada, Cat. No. H31-1373). Toilet bags would not need to be changed daily by the workmen, but rather they could be changed as desired by the householders. The full bags could be tied tightly and deposited carefully upright in the garbage bags. Large pieces of burnable trash such as cartons should be disposed of separately.

The plasticized paper bags should be hung in protective frames as shown in the Sanitation Manual photo. In new houses, space in the kitchens could be made for them so that they may be filled from inside the houses and removed through a special doorway in the outside wall of the houses.

The plasticized paper bags should not be burned at the site because they will decompose in time, and they do provide protection from flies until soil cover is added.

The trash should be burned at the site rather than in barrels within the community. The discontinuance of the burning of trash in barrels in the community will add substantially to the cost of haulage.

DRAINAGE

In spring, the runoff water flows down the valleys into the settlement. Apparently, the road culverts are too small and not thawed early enough in the summer. Consequently, the runoff water together with waste water, which surrounds all houses, accumulates in the upper road ditches and also flows over the road.

The runoff problem should be studied to determine the best solution. Future community planning should consider the alignment of roads in order to reduce the number of culverts required.

The deposition of wastes on the watersheds of streams flowing through the valleys should be avoided as much as possible.

SWIMMING POOL

The swimming pool was not examined, because it operates only in summer.

COMMUNITY WASH HOUSE

It is understood that an LIP grant has been made for the construction of a community wash house in 1974. Insofar as bathing is concerned, facilities are already available at the school. The school washrooms contain all conveniences including showers, and these are available to the public. There is a janitorial staff for maintaining the rooms in a clean and sanitary condition. The water supply for the school and the wastes disposal from the school are the best in the community. The construction of another bathing place would cause an additional strain on the DPW water

supply forces. It is doubtful that there would be haulage of wastes from the new building, as is the present case at the school.

There may be a need for a laundry within the community.

PETROLEUM OIL STORAGE

Concrete reservoir(s) are needed around the tanks which contain oil products. The purpose is to contain the oil in the event of a spill. It is possible to construct a concrete reservoir, because foundation conditions are satisfactory and aggregate materials are available. It is unlikely that a satisfactory impermeable embankment could be constructed using locally available soil. At the same time, oil piping should be changed if necessary to conform with N.W.T. Regulations.

NEED TO MOVE TO ANOTHER SITE

The present site is not a good one. In the mid 1960's, the inhabitants pointed out the undesirable features of the site, and the location of a preferable site. The author did not examine this new site as ice near the shore was toobroken up to permit travel to the area. The site should be visited in summer. However, the following information was contained in a report by Mr. Cox, a community planner, D.I.A.N.D., Ottawa.

The desirable site is a south-facing slope on the mainland which consists of a series of raised beaches. It is on the opposite shore of the strait separating the islands of Dorset and Mallik from the mainland. The people like the site for a number of reasons, especially the south-facing aspect, which allows more sun exposure during the winter. They also like the large beaching areas, because many of them use boats for fishing and sea-hunting. In addition, the benefits of a more consolidated community have been stressed by the inhabitants.

The new site would provide a net savings within a few years, and these savings would increase with time.

Savings in the construction, maintenance and operation of water and sewage systems would result from a variety of advantages. Apparently, there is a good lake for a water source close by. Water mains and sewers could be built in the sandy soil below the surface. Because there is a gentle slope towards the shore, only one sewage lift station would be required, regardless of the growth of the community.

This would both reduce the cost of the system and improve its reliability. The savings in the construction of roads, airport and drainage culverts would be considerable, because the slopes are gentle and there is an abundance of gravel and sand for concrete.

Photos 1 & 2
Cape Dorset photographs (1) from east (2) from west.

Photos 3 & 4
Water Pipeline. Note the west valley subdivision in background

Photos 5 & 6
Ice Cutting and Delivery

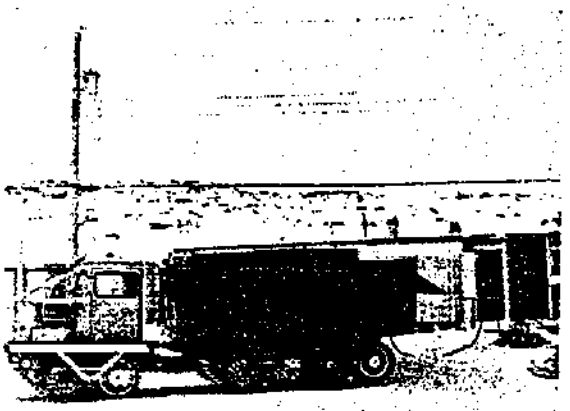
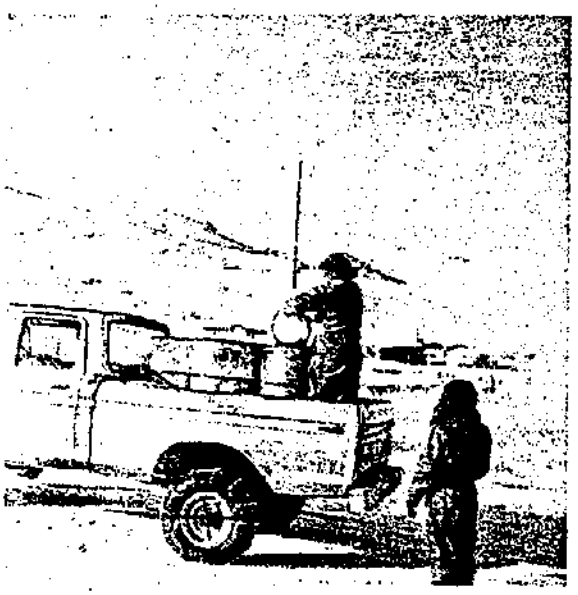


Photo 7
Waste Delivery with
Nodwell Terrain Master TM71

Photo 8
Oil Storage



Photos 9, 10, 11 & 12
Solid Wastes Haulage and Disposal