SANITATION FACILITIES PRELIMINARY ENGINEERING STUDY

TULUKSAK, ALASKA

Prepared by

Alaska Department of Environmental Conservation
Facility Construction and Operation
Village Safe Water
410 Willoughby Avenue
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I. SUMMARY AND RECOMMENDATIONS

Present sanitary conditions in Tuluksak are severe and a serious health threat to the community. It is recommended that special tactics be used to address Tuluksak's honey bucket and solid waste problems. Waiting until local institutional problems are resolved and the community is ready to manage the construction and economics of a sanitation project, would prolong the exposure of residents to the unhealthy conditions in which they live. An alternative approach should be developed to inspire the community to expediently solve its own sanitation problems.

To facilitate the development of this process, it is recommended that the first phase of sanitation facility improvements in Tuluksak involve small, incremental steps. This approach will prepare the community to accept more complex and improved sanitation facilities in the future.

A committee of committed individuals was formed through the Tuluksak Health Board to educate and increase community awareness about sanitation, specifically focusing on the health aspects of these problems. The committee can identify the problems, their resources, and the solutions to the community's poor sanitary conditions, using resources which are already in place. Work is also continuing with the Tuluksak Native Community Council, the governing body of Tuluksak. The two bodies complement each other in their responsibilities and potential roles in the community.

Small improvement projects, that can be carried out quickly and will benefit the <u>entire</u> community, are top priorities (see Summary Table, page 2). The most urgent problem in the village is the lack of an adequate facility to dump honey bucket waste. (1) It is recommended that the five old honey bucket pit bunkers still in use be decommissioned (Alternative A3), and (2) that new waste disposal pits be provided to each household as a short-term solution (Alternative A4). The location of the existing solid waste disposal site, which is too close to some homes, is also a primary concern. (3) A maintenance program should be implemented at the dump site and trash disposal outside the entrance of the dump should be controlled. Some rehabilitation work at the site to improve its present condition is recommended (Alternative A2). (4) In the future, the washeteria should be rehabilitated and reopened (Alternative A1). These projects are a high priority and will restore a basic level of sanitation service to Tuluksak.

Presently, the community has not reached a consensus regarding the type of community wide system they wish to work towards. Many residents desire a piped water and sewer system. The ATV flush/sewage haul and water haul system is also an attractive alternative for the community. It is recommended that an engineering study be prepared comparing these two alternatives in detail. An effort then should be made to convey the information in the study to the entire community to create a basis for informed decision making. The community can then decide which system they wish to pursue. The following is a proposed development schedule. The ultimate goal is to completely restore and/or upgrade sanitation facilities in Tuluksak.

Proposed Development Schedule

Priority	Estimated Capital Cost	Estimated O&M	Scheduled Completion
1. Close five honey bucket bunkers	$15,000	None	Summer 1994
2. Temporary pit construction	$75,000	None	Summer 1994
3. Rehabilitate dump	$15,000	$6/home/mo	Summer 1995
4. Rehabilitate washeteria	$150,000	$76/home/mo	Summer 1995-96
5. Prepare engineering study to compare pipe system to haul system	$100,000		Summer/ Fall 1996
6. Community selects system to implement			Winter 1996-1997

II. INTRODUCTION

Authorization: In 1991, the Alaska State Legislature appropriated $50,000 (Ch 96, SLA 91) to the Alaska Department of Environmental Conservation (ADEC), Village Safe Water (VSW) Program for the Tuluksak Native Community Council to conduct a water and sanitation improvements study. This study presents the design considerations, capital costs, and operation and maintenance costs associated with water and sanitation facility alternatives for the community.

In August 1992, VSW engineers visited Tuluksak to gather background information, inspect existing facilities and meet with the community to discuss possible water and sanitation improvements. The engineering report was formally presented and explained to the Council and residents on August 3, 1993.

III. DESCRIPTION OF THE PLANNING AREA

Location: Tuluksak is located on the south bank of the Tuluksak River near the Kuskokwim River. It is 60 miles upriver from Bethel (37 air miles northeast) and 400 miles west of Anchorage on the Yukon-Kuskokwim Delta (61º06' N, 160º58' W).

Access: Tuluksak's major means of transportation include barge, plane, small boat and snow machine. In winter, the Kuskokwim and Tuluksak Rivers can be traversed by snow machine, truck or all-terrain vehicles (ATVs).

Generally, heavy cargo is barged to Tuluksak from Seattle by oceangoing vessels traveling up the Kuskokwim River to Bethel. Cargo is off-loaded and reloaded onto smaller, shallow-draft river barges and transported up the river to Tuluksak. Tuluksak does not have a dock, and in late summer and fall, low river levels prevent the barges from getting closer than 20 feet from shore.

Several air taxi services in Bethel offer service to Tuluksak. A 1,600 foot gravel airstrip, 20°/200° magnetic north, is located southwest of the town approximately 30 feet above sea level. The surface of the runway is soft when wet and can become rutted. Snow removal in winter is managed by the Division of Aviation. Skyvans and Twin Otters use the runway unless weather or surface conditions are unsatisfactory. Seaplanes can land on the Tuluksak River close to the community in summer, and wheel and ski aircraft can land on the frozen river in winter, depending on snow depth.

Tuluksak does not have improved roads. However, trucks may be driven on some dry paths. Tuluksak is isolated from other villages and during the summer, off road transportation is not possible on the marshy lowland surrounding the village. Surface soil conditions in the summer are poor and may cause problems for heavy equipment. A boardwalk for foot traffic threads through town.

Climate: Weather in the Tuluksak area is transitional. The cold continental climate is tempered by maritime influences from the Bering Sea and is characterized by pronounced temperature variations throughout the day and year, coupled with less cloudiness, lower precipitation and less humidity than maritime climates. Strong winds generally blow from the north in winter and from the south in summer. Climatic data for the Tuluksak area is shown in Table 1.

Table 1
Tuluksak Climatic Data

Mean Annual Temperature	28.7° F.
Mean July Maximum Temperature	63° F.
Mean January Minimum Temperature	-4° F.
Extreme High Temperature	90° F.
Extreme Low Temperature	-50° F.
Mean Annual Precipitation	20 inches
Mean Annual Snowfall	60 inches
Heating Index Degree-Days	13,500*
Freezing Index Degree-Days	3,500*
Thawing Index Degree-Days	2,500*
Mean Total Days below 0 degrees F	81
Freeze up of Kuskokwim River at Tuluksak	late October
Break up of Kuskokwim River at Tuluksak	mid-May

* Degree-days refer to the quantity expressed as the product of "degrees variation from a base" and "time in days." The base for freezing and thawing degree-days is 32° F and for heating degree-days is 65° F .

Population: Tuluksak's 1990 census population was 358 people. Almost 96 percent of the population is Kuskwogmiut Eskimo (U.S. Department of Commerce, Bureau of the Census). The population trend is shown below.

Table 2
Tuluksak Population Trend

Date:	1960	1970	1980	1990
Population:	135	195	231	358
Yearly Growth Rate:		4.4	1.6	5.5

Economy: Tuluksak's major economic base is subsistence fishing and hunting. Many residents fish, either commercial or subsistence, during the summer. Employment opportunities include jobs with the post office, the schools, the clinic, the airlines, the state for airport maintenance, the National Guard and the community stores. Most residents earn their living through seasonal fishing or cannery work in Bethel. And, many residents are supported by federal and state assistance. The median household income reported for Tuluksak in the 1990 Census, based on the year of 1989, was $20,446.

Public Facilities and Housing: There are 77 houses in Tuluksak. Twenty-seven of these were constructed in 1980 by the Association of Village Council Presidents (AVCP) Housing Authority through the Department of Housing and Urban Development (HUD). The average number of occupants per home is five, as determined from the community survey. Many residents vacate their houses in summer and relocate to fish camps.

Other buildings in Tuluksak include a post office, a Yupiit School District (YSD) high school built in 1980, an elementary school built by the Bureau of Indian Affairs (BIA), a clinic, a community center, a National Guard Armory, a church, an ANICA store, three privately owned stores, a washeteria and a generator building.

The village power is owned by the Village Corporation and managed by the Tuluksak Traditional Power Company. It includes overhead lines serving all houses and public buildings, and three 75-kilowatt, three-phase generators. The system was recently upgraded by a project completed in April 1992 by the Alaska Energy Authority. The schools maintain their own on-line power generation facilities.

Public Administration: Tuluksak was incorporated as a Second Class City in 1970. The city has dissolved and the village is presently governed by the Tuluksak Native Community Council, a seven-member traditional council.

Tuluksak belongs to the Association of Village Council Presidents and the Calista Native Regional Corporation. Services and programs are available for the Tuluksak region through Yukon-Kuskokwim Health Corporation, the Association of Village Council Presidents and the Calista Corporation. Programs include local health care, employment assistance and social services.

Soil Conditions: Tuluksak is located within the Yukon-Kuskokwim Coastal Lowland in the Yukon-Kuskokwim Delta. The Delta consists of a thick accumulation of river deposited sand and silt with infrequent lenses and strata of gravel.

Tuluksak lies on a low terrace immediately adjacent to the Kuskokwim River flood plain. There is little local relief (see topography in Plat 1).

Soils are moderately well drained. Vegetation consists of tundra, tall grass along river banks, and dense alder brush and spruce.

Four water producing wells have been drilled in Tuluksak -- a BIA School well, drilled in November 1964; two PHS wells, drilled in November 1964 and July 1980; and a YSD High School well, drilled in August 1979. The static water level in the wells is located between 10.5 and 20 feet below the surface. A summary of data for the wells and well pump test data is shown in Table 3. Water quality data can be found in Appendix I.

Table 3
Well Data

Well	Total Depth	Static Water Level	Pump Rate	Drawdown
BIA School	56 feet	18.0 feet	30 gpm	13.3 feet
PHS #1	47 feet	20.4 feet	30 gpm	12.0 feet
YSD School	61 feet	14.4 feet	23 gpm	19.8 feet
PHS #2	49 feet	10.5 feet	28 gpm	17.8 feet

In early 1979, five test holes for soil samples were drilled by R & M Consultants, Inc., for the Lower Kuskokwim School District (LKSD) on the proposed site for the new high school. (The YSD evolved from the LKSD.)

A review of the existing well log data was carried out by a IHS geologist in 1979 for the then proposed washeteria/water treatment plant. This summary of the expected subsurface conditions in Tuluksak can be found in Appendix III. Also, two test holes were drilled at the proposed site for the washeteria/water treatment plant. Logs of all wells and test holes can be found in Appendix II.

In 1994, for this study, six test pits were dug throughout the village to determine the suitability of soils for drainfields. A layer of poorly graded sand underlays the organic top soil layer in a large part of the village. However, this sandy layer is not present throughout the village and most importantly, it is not present in the most developed part of the village. Permafrost was found in two of the test holes. A summary of the investigation can be found in Appendix II.

Tuluksak is located in a region of discontinuous permafrost. Permafrost is absent in areas next to large bodies of water, but is present in varying thicknesses under most land forms. The test holes drilled at the high school site encountered permafrost at 2.5 to four feet continuing to the depth of the holes (30 feet). A thermistor string placed in one test hole showed that the average temperature of the permafrost is less than 0.5° F below freezing. (See Appendix II for thermistor readings.) The logs for three of the water wells show permafrost a few feet below the surface extending 35 to 42 feet underground. The second PHS well, however, contained only seasonal frost. Permafrost was not encountered in the test holes at the washeteria site. Permafrost was found in 2 of the 6 test pits dug in 1994.

The fine grained nature of the soils (silts, silty sands and organic soils) suggests that the permafrost is ice rich. Thaw subsidence can be expected if steps are not taken to prevent thawing of the permafrost. The active layer is approximately four feet deep and is also composed of silt and organic soils. These are highly frost susceptible and there is a high potential for frost heaving.

Usable gravel sources on the Kuskokwim are located in Upper Kalskag (32 miles upriver from Tuluksak) and Birch Tree Crossing (108 miles upriver from Tuluksak and 42 miles upriver from Aniak).

Flood and Seismic Hazard Evaluation: The U.S. Army Corps of Engineers Flood Plain Management Service Branch rates the flood hazard at Tuluksak as high. Flooding over the entire village can be expected once every five to 20 years. Flooding is the result of stream overflow and spring ice jams. In 1976, the Office of Environmental Health reported that the worst flood in 15 years covered the village with four feet of water.

Tuluksak is located in Seismic Probability Zone 1, as defined by the U.S. Army Corps of Engineers. An earthquake of 3.0 to 4.5 magnitude on the Richter scale is possible and minor structural damage can be expected.

IV. SCHEDULED CAPITAL IMPROVEMENTS

There are currently no capital improvement projects scheduled in Tuluksak. An electrical project was completed in April 1992 by the Alaska Energy Authority to upgrade the electrical facilities and level of service in Tuluksak.

V. EXISTING SANITATION FACILITIES

Two previous water and sanitation projects in Tuluksak were built by PHS under Projects AN-64-426 and AN-80-220.

Project AN-64-426 began in 1961 and was completed in 1967. It provided for a drilled well, a watering point, individual sewage disposal facilities (pit privies and seepage pits), individual home sink units and a community refuse disposal facility. The water supply portion of this project failed due to flooding, electrical failures, and inadequate operation and maintenance which resulted in freezing and contamination of the well. Subsequently, the well was abandoned in 1970.

Project AN-80-220 was initiated in 1980 to construct sanitation facilities to serve 27 new Department of Housing and Urban Development (HUD) units and the 39 pre-existing homes. This project was completed in 1982 and provided a washeteria facility including a drilled well, water treatment equipment, chlorination and fluoridation facilities, a central watering point, shower and laundry facilities. Water hauling and storage containers were provided to each homeowner. A 150 x 150 foot lagoon was constructed southwest of the new housing area for wastewater discharge from the washeteria through a 665 foot, four-inch arctic pipe transmission line. Two 7,500 gallon fuel storage tanks were also provided. Seven sewage disposal bunkers were constructed throughout the community. A solid waste disposal site was developed south of the village.

The washeteria was supplied with four washing machines, three clothes dryers, four showers and one watering point. A 17.5 kw generator was provided in the washeteria building to supply backup power to the system during electrical supply failures. These facilities and responsibility for operation and maintenance were transferred to the City of Tuluksak in June of 1982.

By September 1988, the water plant and washeteria had been vandalized and abandoned. Due to power variations, the water plant no longer produced finished water and the backup generator needed a new battery. The facility lacked fuel, tools, parts and supplies.

At present, the laundromat is inoperative, and the well and water treatment equipment in the water plant are used by the Yupiit School District for water supply. The water treatment plant consists of two 9,000 gallon water tanks for raw and treated water. Backwash water is dumped on the ground under the building. The school uses approximately 1,800 gallons per day of water. A watering point is available outside the building for village use. The laundry section of the washeteria appears to be in good condition, although there are cracks in the floor, probably due to differential settling. The washers and dryers appear to be either operational or repairable.

The schools utilize their own single-celled sewage lagoon and some residents use it to dump their honey buckets. Honey buckets are also dumped or buried near homes and at the solid waste site. Of the seven sewage bunkers, five still exist but are filled up. The other two have been buried.

The solid waste dumping site has not been maintained. The fence is broken. Waste is left in front of the dump and is strewn around the village. The trash in front of the dump is close to homes. No trenching or backfilling, or covering of trash is being done.

An inventory of heavy equipment in the village and its condition can be found in Appendix VII.

VI. PROJECT ALTERNATIVES

Water and sewer systems in small arctic communities are difficult to operate and maintain due to problems associated with cold temperatures, frozen soils, small populations, and the high cost of fuel and electricity. They are also capital intensive to build on a per capita basis. Several alternate types of water distribution and wastewater collection systems exist. Each system has advantages and disadvantages in terms of (1) the cost to build and operate the system, and (2) the system's technical complexity, which determines the level of expertise required to operate it and the degree of dedication required to manage it. Physical constraints such as soils, water table level, permafrost and the availability of water also affect the feasibility of potential alternatives.

The following outlines possible improvements for the community of Tuluksak. Capital costs to construct each alternative, and operation and maintenance costs have been estimated, and are presented at the end of this report. The community of Tuluksak can use this information to determine its goals for water and sanitation improvements.

The alternatives have been divided into four categories. The first presents alternatives for rehabilitating existing centralized public facilities. The second presents alternative haul systems for water and wastewater. Haul systems generally are less expensive to build and install than piped facilities, but have relatively high operating costs because they are labor intensive. The third outlines alternatives to provide piped water and waste disposal for each home. A fourth discusses utility management and operator training -- aspects crucial to implementing a successful water and sewer program for Tuluksak.

<u>Design Criteria</u>: Criteria used to determine the sizing and costs of the various alternatives in this study are presented in Table 4. The criteria include population trends, water needs and wastewater generation.

Table 4
Design Criteria for Tuluksak Feasibility Study

Year		**1990**	**2000**	**2010**
Population		358	406	477
Water Usage	**gallons per capita per day**			
Washeteria	25	8,950	10,150	11,925
Haul	3	1,074	1,218	1,431
Piped	65	23,270	26,390	31,005
Wastewater Generated	**gallons per capita per day**			
Washeteria	25	8,950	10,150	11,925
H/B Haul	1	358	406	477
Flush/Haul	2	716	812	954
Piped	65	23,270	26,390	31,005

Assumptions: The following assumptions and methods were used when estimating costs:

- Cost of materials includes freight unless specified separately.

- Work is to be carried out locally by force account method unless contracted construction is specified.

- Replacement of capital equipment is included in operation and maintenance costs based on a five-year replacement period.

- Calculations are based on serving 85 buildings. There are currently 77 homes in Tuluksak. In addition, it is assumed that service will also be provided to three stores, the post office, clinic, community building, and the old and new parsonages.

- It is assumed that the number of residents per home is five. This assumption is based on information obtained from a house-to-house survey and the 1993 population figure of 385. Water use and waste generation rate calculations are based on the current population only.

A. Rehabilitation of Existing Facilities

1. Rehabilitation of Washeteria

Many residents have expressed a desire to have the washeteria operational again. The renovation could be accomplished quickly and would restore at least a basic level of service to the village.

The washeteria building appears to be in good condition. Some interior refinishing will be required and the washing machines and dryers may require replacement. Plumbing and fixtures will also need replacement and rehabilitation. The wastewater disposal line from the washeteria to the lagoon must be repaired. If the lagoon is to be used only for the washeteria and not for hauled sewage or septage disposal from the entire community, it most likely will not require reconditioning. Filter backwash water should be piped to the waste disposal line and into the lagoon.

If the washeteria is reopened, several management issues must be addressed. Presently, the YSD has an agreement with the City of Tuluksak to operate the water treatment plant, provide a community watering point, and pay for heating fuel and electricity for the building. This agreement could continue, even if the washeteria is reopened. Eventually, however, the school district and the Council may wish to negotiate a different agreement. The community Council could take back responsibility for the operation of the water treatment plant and charge the school district for water. If this happens, the YSD may have to be reimbursed for capital improvements it made to the water treatment system. To ensure the continuing operation of the washeteria, and eventually the water treatment system, the community must have an effective management organization in place. An operator must be hired and trained to maintain the washeteria and water treatment equipment.

Operating expenses for the washeteria can be met by revenues generated from providing water service to the school and by user fees for washers, dryers and showers. One possible revenue generating scenario follows in Table 5, based on the population in Tuluksak, and assuming the school will be charged 25 percent of the total revenue generated to cover the costs. This scheme would generate the amount of revenue needed to cover the estimated operating costs, if the community resumed responsibility for the water treatment plant. However, the assumptions, determining rates of use made in this scenario, are perhaps optimistic, and the community may need to consider other sources of funding.

Table 5
Alternative A1 - Washeteria Revenue Projection

Showers	Cost/Unit	No. of Units	Total
Washers (300 loads/week)	$2.00/load	15,600/year	31,200.00
Dryers (300 loads/week)	2.00/load	15,600/year	$31,200.00
Showers (15/week)	1.50/shower	780/year	$1,170.00
Pop Machine(50 cans/day)	0.30 can	312d/yr	$4,680.00
Soap Bar (100 boxes/wk)	0.25/box	5,200/year	$1,300.00
Water Service to School			$23,000.00
Total per year			$92,550.00
Total per week			$1,779.81

2. Rehabilitation of Solid Waste Facility

The solid waste facility is adequate to serve the needs of Tuluksak for some time. Although the site is close to the village, proper maintenance of the facility would improve its appearance and reduce health risks to residents of the community. The site should be cleaned up as soon as possible and a maintenance program should be implemented. Rehabilitation should include repairing the fence and pushing the trash near the gate into the landfill. The village must purchase or repair a suitable piece of heavy equipment. For purposes of preparing a cost estimate, it is assumed that the city-owned John Deere 350C dozer can be repaired and used to manage the solid waste facility.

A management and operation plan for the solid waste facility should be developed following rehabilitation. An operator should be hired to carry out the following maintenance activities at the landfill:

- Maintain access to the active dumping point.
- Consolidate, compact, and cover all disposed waste with six inches of soil twice monthly. Soil cover may be suspended when the

ground freezes. Only one dumping location (working face) should be used at a time. The size of the working face should not exceed 30 feet wide and five feet high.

- Pick up litter next to the site once per month or as needed.

Management of the solid waste facility can be addressed in an overall utility management plan for Tuluksak.

3. Decommissioning of Pit Bunkers

There are presently five honey bucket pit bunkers in Tuluksak used for waste disposal. These were built in 1982 and have been reported full for several years. Most of the bunkers no longer have lids and waste is dumped around the area of the pits. These bunkers should be decommissioned when an alternative (temporary or permanent) method of disposal is provided.

Decommissioning should be carried out as follows:

- Mix fuel oil in with the contents of the bunker.
- Burn the bunker as much as possible.
- Dig a pit next to the bunker and put the remains of the bunker into the pit or bury the remains in a pit at the dump.
- Apply hydrated lime to the contents inside the pit.
- Cover the pit with at least two feet of fill material.
- Use the community equipment to compact the covered pit.

4. Constructing New Temporary Pits for Waste Disposal

A project to decommission old pits should include the provision of new waste disposal pits for each household. Individual household pits would provide temporary waste disposal until an improved waste disposal method can be provided. The location of the pits should be recorded and a homeowner's agreement signed with each household to ensure the pits are maintained properly.

5. Upgrade Washeteria Lagoon for Community-Wide Septage Disposal

The lagoon near the solid waste facility is a 150 x 150 foot single-cell, unlined lagoon for the discharge of wastewater from the washeteria. The discharge line from the washeteria to the lagoon is damaged so there is currently no discharge to the lagoon. Consequently, brush and grass have grown in the lagoon. Another single cell, unlined lagoon is located nearby and serves the school property.

The washeteria lagoon is basically a percolation cell. To provide a facility for disposal of septage from septic tanks (Alternative C2) or for hauled wastes (Alternatives B3, B4 and B5), the lagoon should be modified and an additional lined cell built to allow solids to settle out. The liquid portion from this cell will overflow into a second smaller cell where the waste will further degrade and then percolate into the soil. Figure 1 shows a typical configuration.

B. Haul Systems

In a water haul system, water is hauled to individual homes and is stored in containers. Tuluksak residents currently haul water from the one watering point in the village or from natural sources (rainwater, river water, creeks, etc.). Increasing the number of watering points in the village is one option available to Tuluksak. Another option is a trucked water haul system administered by the community government, which would deliver water to homes for a fee. A smaller version of the truck water haul system would use a water tank mounted on a trailer, pulled by an all-terrain vehicle (ATV) or snow machine.

Disadvantages of the water haul system are that water in the home can become contaminated, if the containers remain open, and people may use less water than required for good health, if they are concerned about conserving water and hauling wastewater away.

Currently, there are three types of sewage haul systems -- the conventional honey bucket haul system, trucked sewage haul and ATV flush/haul. In a conventional honey bucket container haul system, honey bucket wastes are dumped into 80-gallon containers placed throughout the community. These containers are emptied periodically by a village employee. Both the trucked sewage haul and ATV flush/haul systems use flush toilets and plumbing. Wastes are stored in tanks at the home which are periodically emptied and hauled away by community employees. The truck haul system requires a good road system, whereas the flush/haul system utilizes ATVs or snow machines to haul the sewage away.

Although, typically, a trucked water and trucked sewage system or the ATV flush/haul and ATV water haul systems would be implemented together, there is no reason why a

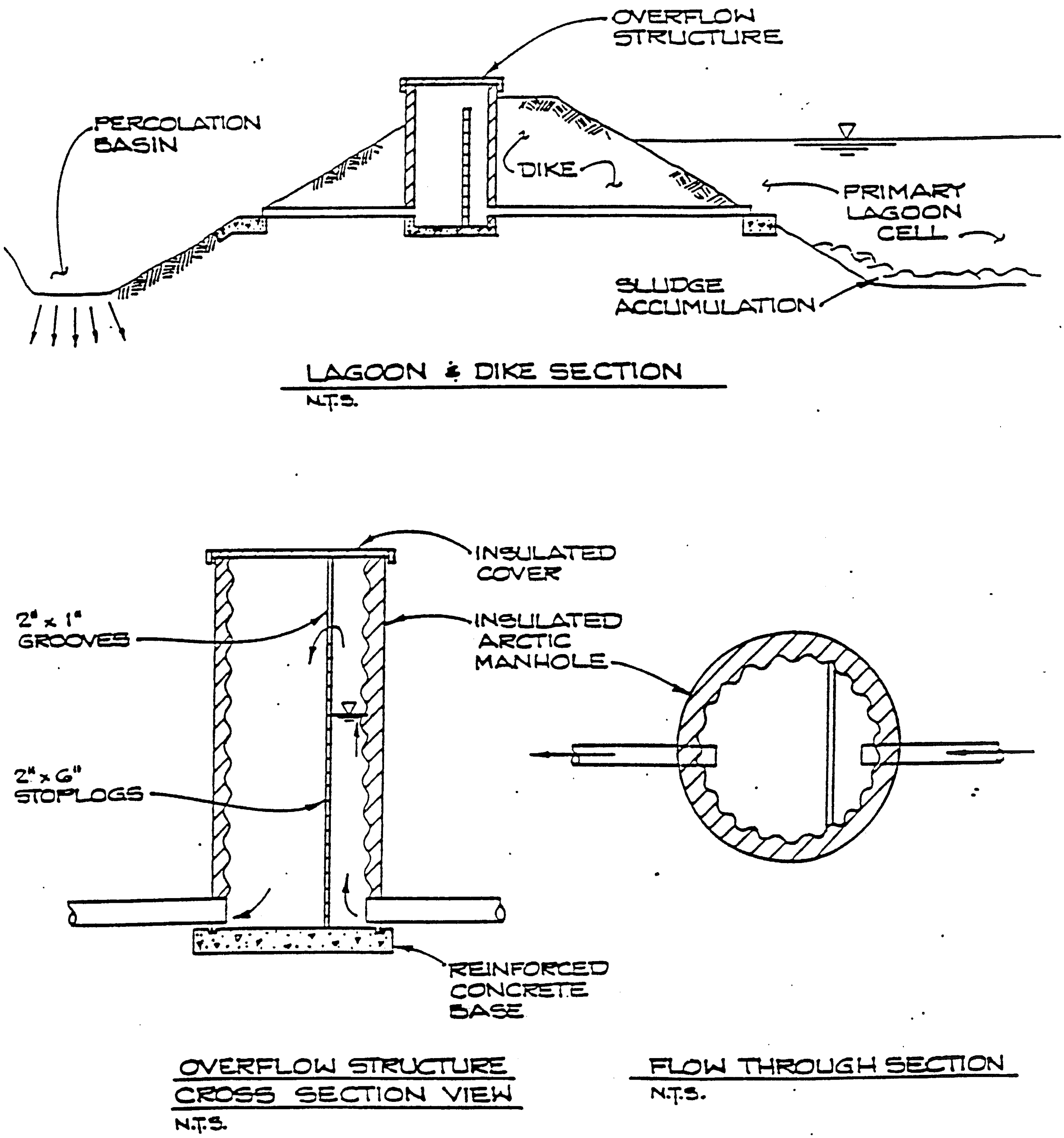


Figure 1 SEWAGE LAGOON WITH CONTROLLED DISCHARGE TO PERCOLATION BASIN

single system or combination of systems could not be set up. For example, the ATV flush/haul system could be installed even when watering points are the only method of water distribution available. A honey bucket container haul system could be implemented with a trucked water haul system.

Each alternative will be discussed separately.

1. Watering Points/Self Haul

The provision of additional watering points in the community would decrease the hardship of hauling water considerable distances. At present, the only watering point in the community is at the washeteria. Figure 2 shows possible locations for four new year-round watering points selected to give all residents access to water within 500 feet of their homes. It is assumed that all the watering points will be individual wells.

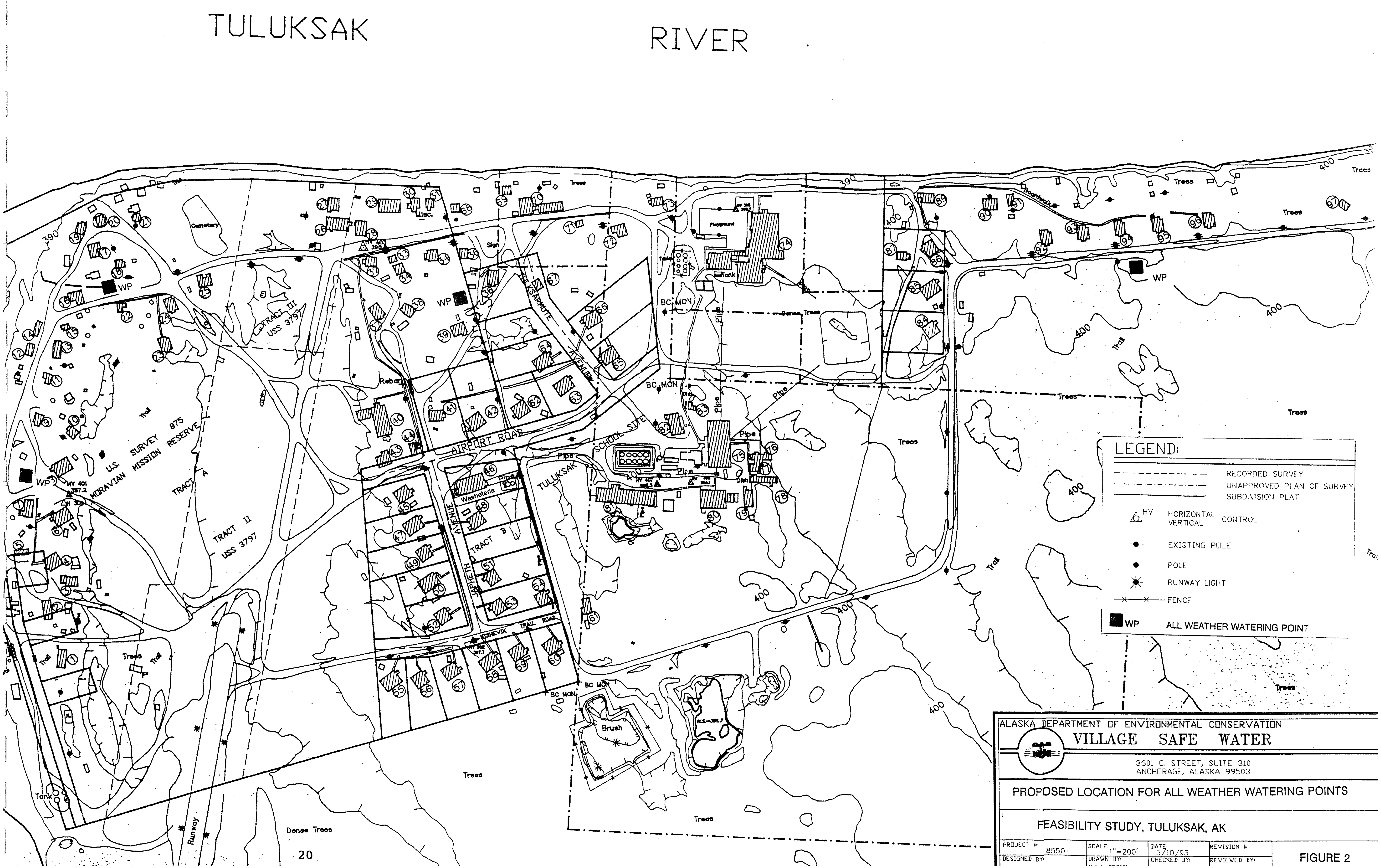
2. Summer Water Distribution System

For a relatively low cost, a piped water distribution system can be installed in the village to provide several watering points during the summer months only. Because the system is only to be used in the summer, arctic construction is not required, which significantly reduces the cost of installation. A possible layout with ten watering points is shown in Figure 3.

3. Honeybucket Container Haul System

A honey bucket container haul system has been implemented in many villages with varying degrees of success. The system involves placing 80-gallon polyethylene containers at elevated disposal stations throughout the village. The containers are emptied periodically by a community employee who hauls the containers on a trailer pulled by an ATV to a lagoon disposal site. The employee then empties the containers and returns them to the disposal station.

This system requires a dedicated operator and is expensive because it is labor intensive. The most serious drawback is that the potential for contact with sewage is high. Honey buckets are still used in the home, and there are many opportunities for spillage. Advantages, however, are that this system reduces indiscriminate dumping of honey buckets, eliminates the need to dig pits for waste disposal, and ends the hauling of wastes long distances to safe disposal locations.


TULUKSAK RIVER
U.S. SURVEY 875 MORAVIAN MISSION RESERVE
TRACT A
TRACT II USS 3797
TRACT III USS 3797
TRACT B
AIRPORT ROAD
JAPHETH AVENUE
TULUKSARMUTE AVENUE
TULUKSAK SCHOOL SITE
Washeteria
Cemetery
Playground
Tank
BC MON
WP
Runway
Dense Trees
Trees
Brush
LEGEND:
RECORDED SURVEY
UNAPPROVED PLAN OF SURVEY
SUBDIVISION PLAT
HV HORIZONTAL VERTICAL CONTROL
EXISTING POLE
POLE
RUNWAY LIGHT
FENCE
WP ALL WEATHER WATERING POINT
ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
VILLAGE SAFE WATER
3601 C. STREET, SUITE 310
ANCHORAGE, ALASKA 99503
PROPOSED LOCATION FOR ALL WEATHER WATERING POINTS
FEASIBILITY STUDY, TULUKSAK, AK
PROJECT #: 85501
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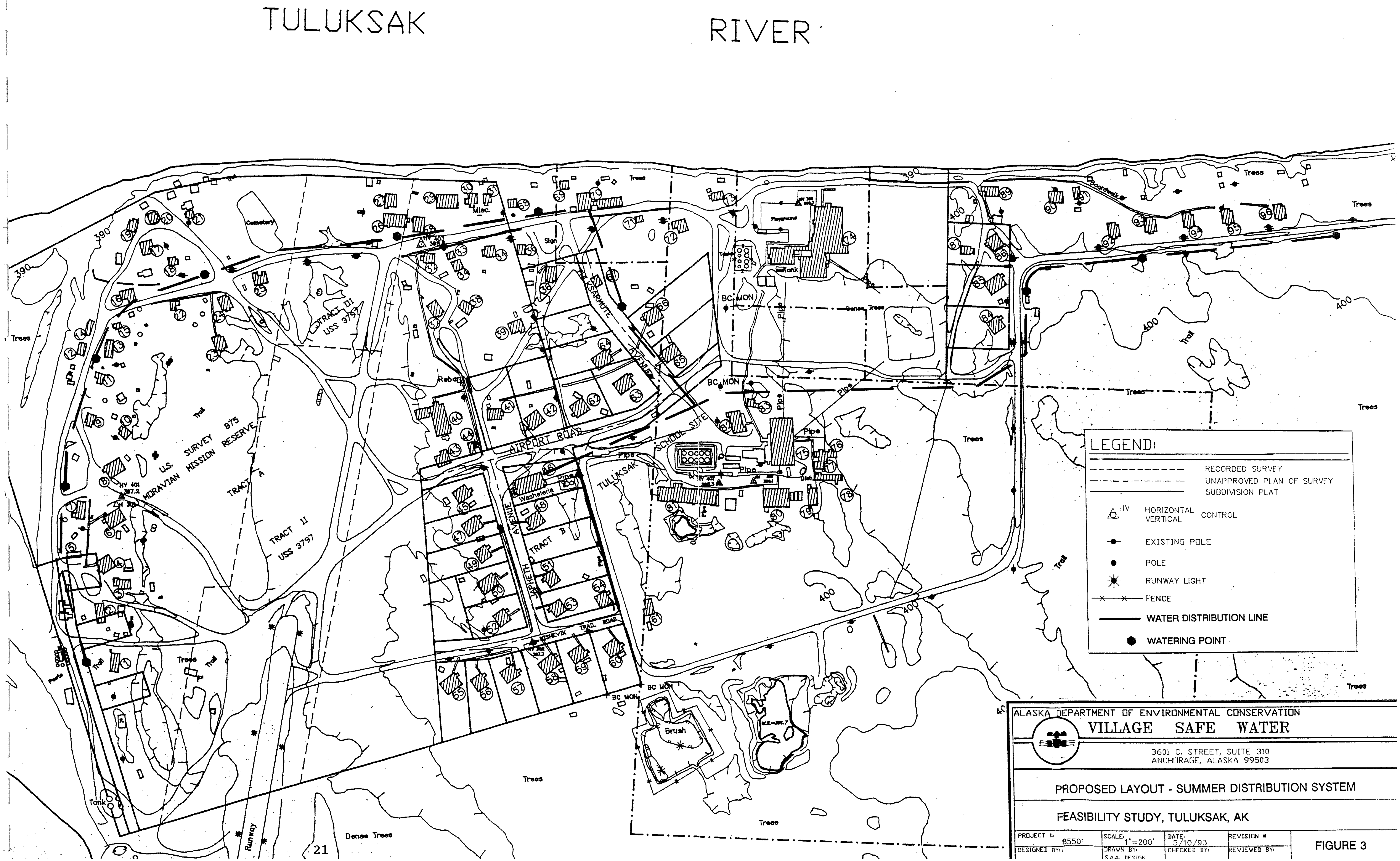
DATE: 5/10/93
REVISION #
DESIGNED BY:
DRAWN BY:
CHECKED BY:
REVIEWED BY:
FIGURE 2


TULUKSAK
RIVER
Cemetery
TRACT III
USS 3797
U.S. SURVEY 875
MORAVIAN MISSION RESERVE
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TRACT II
USS 3797
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Washeteria
Playground
BC MON
Dense Trees
Trees
Trail
Runway
Tank
Brush
Boardwalk
LEGEND:
RECORDED SURVEY
UNAPPROVED PLAN OF SURVEY
SUBDIVISION PLAT
HV HORIZONTAL VERTICAL CONTROL
EXISTING POLE
POLE
RUNWAY LIGHT
FENCE
WATER DISTRIBUTION LINE
WATERING POINT
ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
VILLAGE SAFE WATER
3601 C. STREET, SUITE 310
ANCHORAGE, ALASKA 99503
PROPOSED LAYOUT - SUMMER DISTRIBUTION SYSTEM
FEASIBILITY STUDY, TULUKSAK, AK
PROJECT #: 85501
SCALE: 1"=200'
DATE: 5/10/93
REVISION #
DESIGNED BY:
DRAWN BY: S.A.A. DESIGN
CHECKED BY:
REVIEWED BY:

FIGURE 3

4. Trucked Water and Sewage Haul

A trucked water and sewage haul system uses trucks fitted with 300-500 gallon tanks to distribute water to homes and collect sewage wastes from holding tanks at the homes. Water can be stored in the homes in containers, buckets, or large holding tanks which can be piped to plumbing fixtures. The sewage system consists of a flush toilet that discharges into a holding tank at the home.

A trucked water haul system requires a good road system to provide access for a water truck. Roads should be graded regularly, using suitable heavy equipment. A heated building is needed for equipment maintenance and to store vehicles so water will not freeze when the trucks are not in use. An operator is required to operate the truck.

Trucked sewage haul is uncommon in Alaska. Villages with trucked water haul typically do not have trucked sewage haul, because trucked water haul is seen as a temporary measure until piped utilities are installed, or because trucked sewage haul is hard to implement. Bethel has a trucked haul system and is gradually phasing the system out, due to high operation and maintenance costs.

5. ATV Flush/Haul and Water Delivery System

A recently developed method of waste disposal, the ATV flush/haul system, consists of a low water volume flush toilet (one pint of water per flush) that discharges into a holding tank at the house. This tank can also be used to collect bathroom sink wastes and possibly kitchen sink wastes. The toilet uses water stored in a tank near the toilet. This water tank is fitted with an electric demand pump that provides the water needed to flush the toilet.

The sewage holding tank can be located in the house so it will not freeze, or outside the house, where it must be super insulated and heat traced.

The sewage holding tank and water storage tank typically hold 100 to 200 gallons. The water tank can be filled by the owner or water can be delivered by a village employee. Tanks can be custom sized to fit the homes in which they are installed.

The sewage tank is emptied periodically, every one to eight weeks. Waste is collected in a closed, steel tank mounted on a sled or trailer (designed for minimum spillage), and pulled by a truck, snow machine or ATV. The waste is then hauled to the sewage lagoon for disposal.

The advantages of this system are (1) it does not require piped water and is therefore less expensive to operate; (2) homes can be individually fit with the system using local skills, and units can be phased over time; (3) hauling can be done with vehicles already in the community; (4) the system is simple to operate; (5) the potential for physical contact with sewage waste is eliminated, and (6) the system can be connected to a piped system in the future. This system is attractive to communities which have received wastewater grants through the Environmental Protection Agency. The sewage haul system can be implemented and poor sanitation conditions related to the use of honey buckets eliminated, even if the community must still rely on water hauling from central watering points.

A similar system exists for water delivery. A small water tank is hauled by a snow machine or ATV.

C. Piped Utilities to Each Home

1. Individual Wells

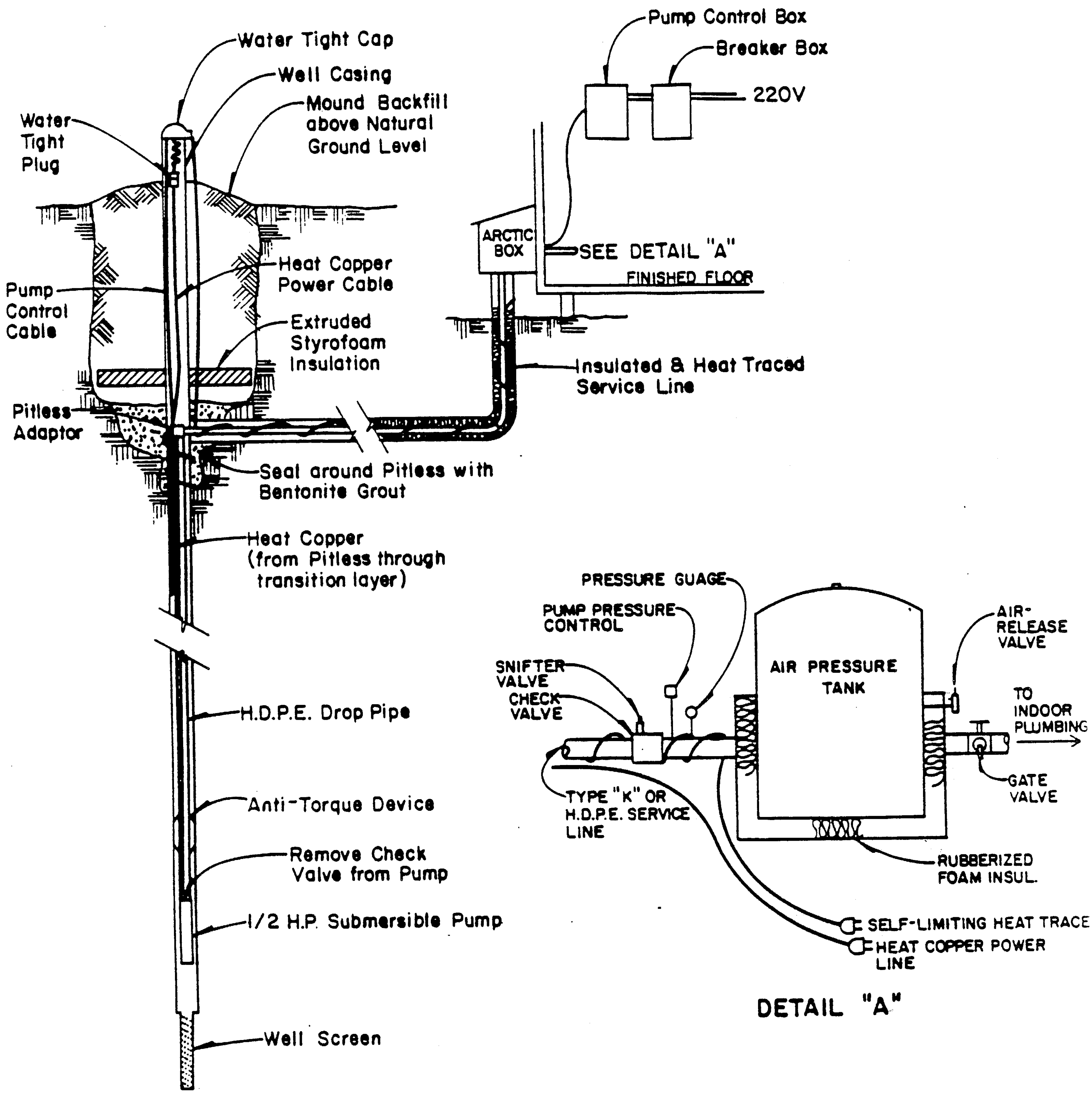
Individual water wells for each home provide the convenience of piped water and eliminate the need for an expensive community-wide distribution system built to withstand arctic conditions. The concept also places responsibility for operation and maintenance of individual wells with the homeowners rather than with the community government. Breakdowns would affect only one home, rather than the entire community.

Individual water wells must be located a safe distance from potential sources of contamination, especially septic drainfields, pit privies and pit bunkers. State law requires a 100-foot separation from potential contaminating sources for private water supplies and 200-foot separation for public water supplies. Care should also be taken to prevent contamination from leaking fuel tanks.

It is expected that wells would range from 45 to 60 feet deep, based on previous wells drilled in Tuluksak. Densely packed sand and silt above the water bearing zone will help protect the groundwater from surface water contamination.

A schematic of a typical household well with a drainback feature is shown in Figure 4. The drainback protects against freezing by allowing the water to drain back into the well from the check valve next to the air pressure storage tank. Additional protection is provided by self-limiting heat trace on the service line and heating copper from the pitless adaptor down through the seasonal frost zone.

Individual wells in Tuluksak, although attractive in terms of cost, are not recommended. The groundwater in Tuluksak has an extremely high iron content. Water from the watering point at the washeteria is treated for iron using a greensand filter. Iron treatment of the water from individual wells is feasible, but may not be effective due to the extremely high level of iron in the water.



INDIVIDUAL WATER WELL (With Drainback)

FIGURE 4 N.T.S.

2. Individual and Shared Community Drainfields

Septic tanks and drainfields, whether for one house or shared, provide piped removal of wastewater from the home without requiring a large piped community system. Again, the responsibility for the system is with the homeowner(s), and problems with a drainfield only affect the home(s) connected to it. Operation and maintenance is simpler and less expensive than for a community-wide system.

The systems must be carefully maintained to prevent the drainfields from failing. It is crucial that the sludge from the septic tanks is pumped out regularly or the system will be destroyed. A community sludge pump, trailer and septage lagoon will be needed to pump the tanks and dispose of the septage. Pumping of tanks should be done at least once every two years and a monthly fee should be charged to cover the cost of pumping and maintaining the equipment. Since it is important that septic tanks and drainfields be a safe distance from water wells, homes that are near each other could share a system.

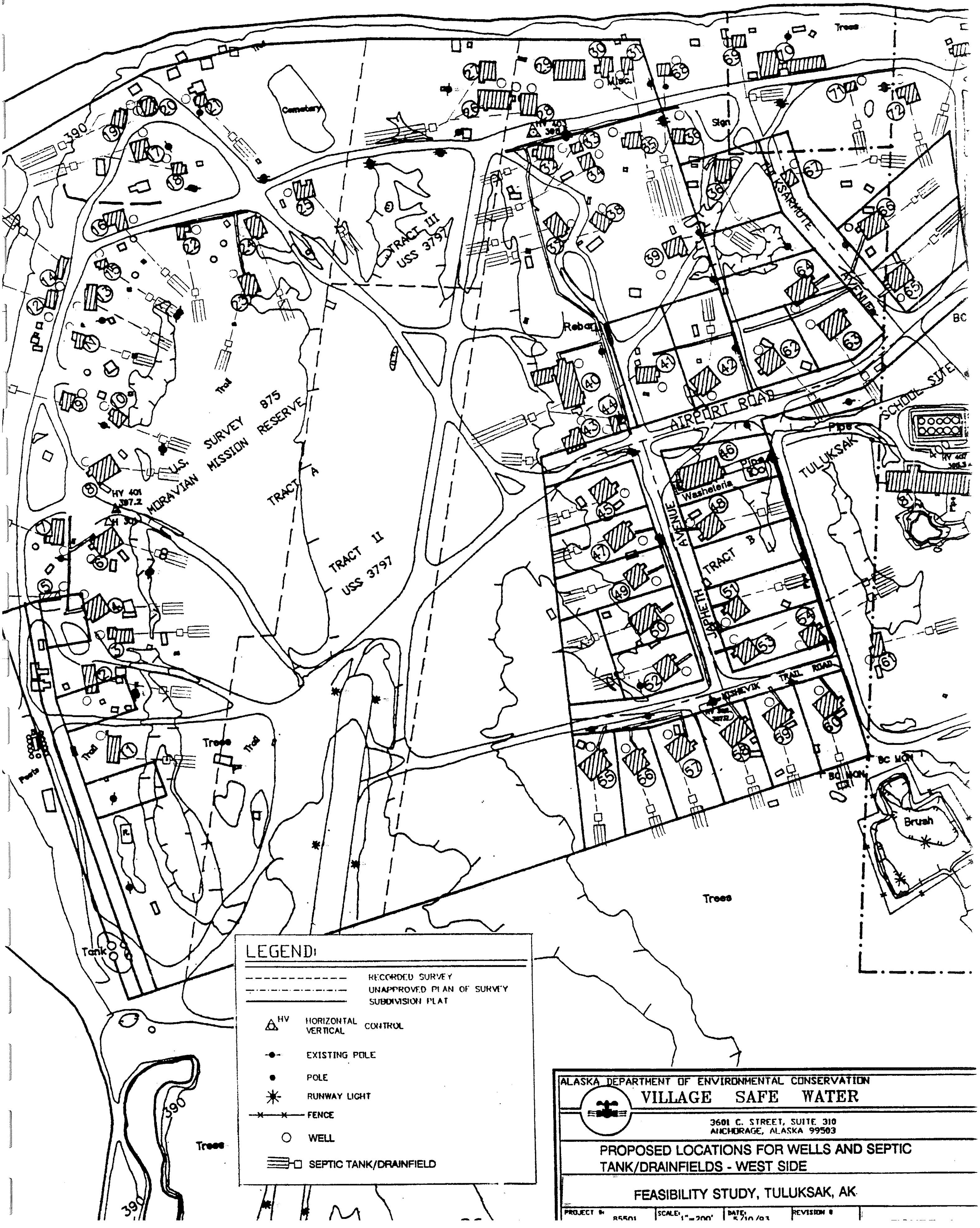
Soil testing indicates that drainfields are physically feasible in some parts of the village. However, some parts of the village are underlain by silty soils which are not suitable for drainfields. Also, permafrost is present in some parts of the village, and homes are close together in some parts of the village. An alternative waste disposal system would have to be provided to these homes where drainfields are not feasible.

Preliminary locations for septic drainfields can be found in Figures 5A and 5B (following pages). However, septic tanks and drainfields are not recommended as a community wide system. It may be appropriate to install this system for some homes but a large part of community can not be served.

3. Community-Wide Pipe Water and Wastewater System

Community-wide piped water and sewer systems are expensive to build, operate and maintain. A high level of operation and management expertise is required to operate these systems. A skilled operator is crucial to their success, as a maintenance lapse could result in loss of services to the whole village and irreversible damage to the system.

Typically, in Arctic Alaskan villages, a piped water distribution system consists of a circulating water system, either above or below ground. Above ground systems are less expensive to build, and detecting leaks and performing maintenance is easier. However, above ground pipe must be constructed to withstand arctic temperatures, which means using pre-insulated arctic pipe or placing the pipes in utilidors. The above ground pipe also impedes traffic flow in the village. Buried pipes have some advantage because they are insulated by earth and snow; however, in permafrost these effects are negligible. In either

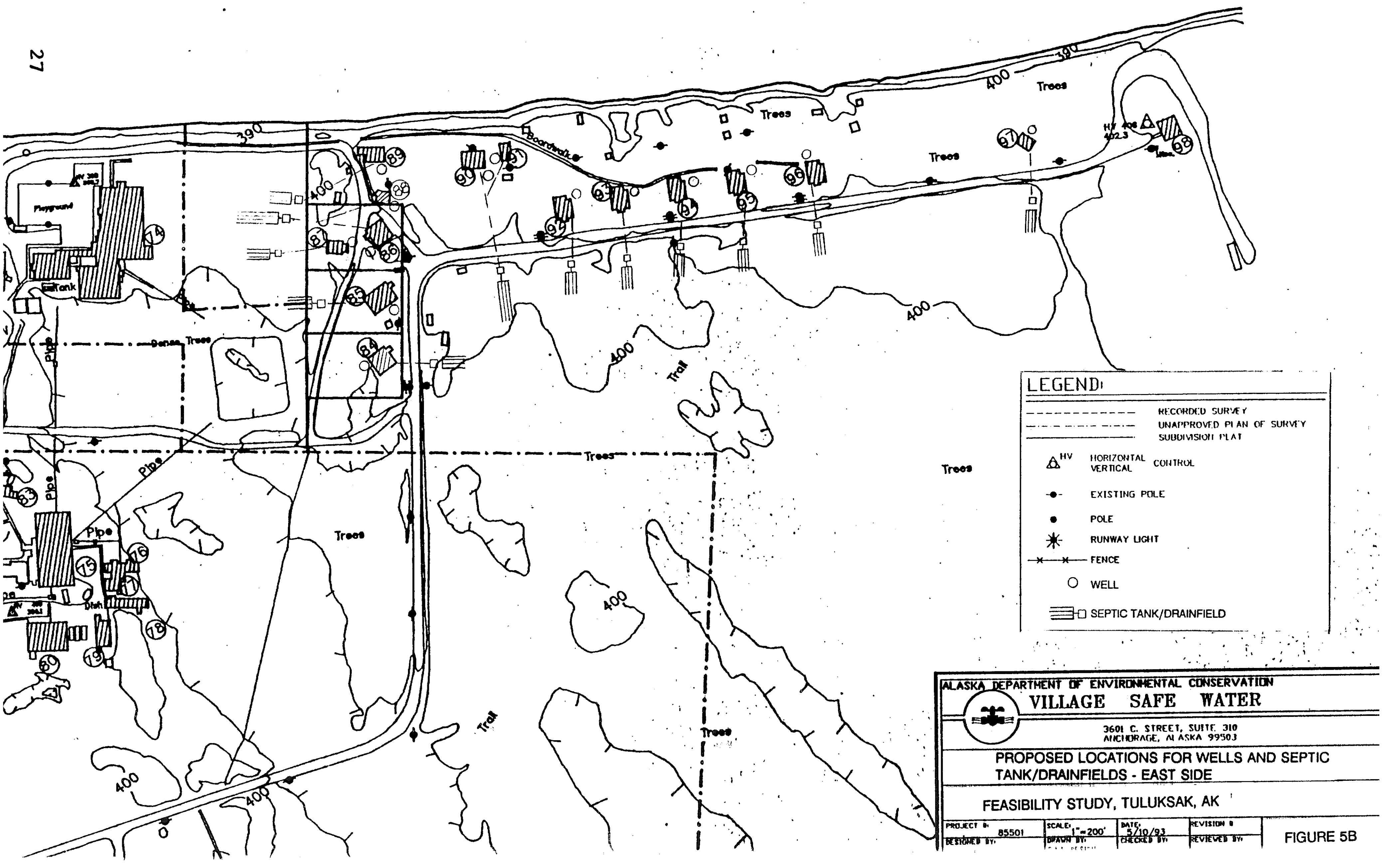


ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
VILLAGE SAFE WATER
3601 C. STREET, SUITE 310
ANCHORAGE, ALASKA 99503

PROPOSED LOCATIONS FOR WELLS AND SEPTIC TANK/DRAINFIELDS - WEST SIDE

FEASIBILITY STUDY, TULUKSAK, AK

PROJECT #: 85501 | SCALE: 1"=200' | DATE: 5/10/93 | REVISION #


LEGEND:
RECORDED SURVEY
UNAPPROVED PLAN OF SURVEY
SUBDIVISION PLAT
HV HORIZONTAL VERTICAL CONTROL
EXISTING POLE
POLE
RUNWAY LIGHT
FENCE
WELL
SEPTIC TANK/DRAINFIELD
Trees
Trail
Boardwalk
Playground
Tank
Pipe
Dense Trees
400
390
ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
VILLAGE SAFE WATER
3601 C. STREET, SUITE 310
ANCHORAGE, ALASKA 99503
PROPOSED LOCATIONS FOR WELLS AND SEPTIC TANK/DRAINFIELDS - EAST SIDE
FEASIBILITY STUDY, TULUKSAK, AK
PROJECT #: 85501
SCALE: 1"=200'
DATE: 5/10/93
FIGURE 5B

case, public right-of-way must be established and the easements recorded so that there is legal access to property where the distribution lines are located.

Piped wastewater collection systems can be classified into three general types -- gravity, pressure and vacuum. A gravity collection system uses buried pipes sloped downhill to transport wastewater to a low point. It is then treated, or a lift station pumps it to a higher elevation where it can be further transported or treated. Gravity sewer systems have the advantage in that they are less mechanically complex and less expensive to operate. Pressure sewers, also called force mains, pump wastewater through pipes. In a pressure sewer system, each home must be supplied with a collector sump to grind the wastewater, so that it can be pumped through mains to the treatment facility. Pressure sewer systems do not need to be laid to grade and do not require deep excavations, manholes or lift stations. However, the sumps used in pressure sewers are complex and maintenance intensive, and this outweighs the system's advantages. Most wastewater collection systems use a combination of gravity sewers and pressure sewers (force mains).

The third alternative for wastewater collection is a vacuum sewer system, which in the Arctic is usually installed above ground because soil conditions prohibit the use of buried gravity sewers. Vacuum sewers are mechanically complex and expensive to maintain. A vacuum sewer system consists of a vacuum pump and reservoir, a sewage collection tank, a network of vacuum mains, gray water sumps equipped with vacuum valves at each home (or cluster of homes) and vacuum toilets. The vacuum mains can be installed above or below ground and are configured in a series of sloped lines and traps called transport pockets, which facilitate the movement of wastewater in measured amounts.

Piped water and sewer systems are expensive. In a feasibility study prepared for the City of Noatak, population 300, the capital cost estimated to install a piped water and sewer system was $8.2 million. Operation and maintenance costs were estimated at $85/month per household. A community-wide water and sewer system for Akiachak, population 500, was an estimated $7.5 million with operation and maintenance costs of $192/month per household.

Because of the high cost, and the variety of types of piped systems, detailed cost estimates for a community-wide piped water and sewer system for Tuluksak has not been estimated at this time. If the community considers a piped water and sewer system to be a serious option, it is recommended that a detailed engineering study be prepared to compute the capital and operations and maintenance costs of the system. The community must fully understand the degree of commitment required to build, maintain and manage such a system.

D. Establishment of Water, Sewer and Solid Waste Utility

This section outlines the tasks required for the Council to manage the operation and maintenance of water, sewer and solid waste facilities. The Council must:

- Establish ordinances
- Establish an effective management organization
- Provide personnel training
- Provide operation and maintenance manuals

Table 6 breaks down these steps and identifies who is responsible for the various tasks.

Table 6
Establishment of Water and Sewer Utility

Activity	Responsibility Of
Ordinances	
Draft Ordinances	VSW/DCRA
Review Ordinances	Community
Ratify Ordinances	Community
Administration	
Draft Handbook	VSW/DCRA
Review Handbook	Community
Recruit Personnel	Community
Personnel Training	
Specify Training Needs	Community/VSW
Organize Attendance at Training Seminars	Community/Others
Over-The-Shoulder Training	Superintendent/RMW
OIT Training Seminar/Exam	Community/Others
Management Training	Community/Others
(AWWA Small Systems Management Training Module, RUBA training, Utility Management Training)	
O&M Manual	
Equipment/Material Cut Sheets	Superintendent
Draft O&M Manual	Engineer/Community/VSW
Prepare/Review Final O&M Manual	Engineer/Community/VSW
Draft Homeowner Manuals	Engineer/Community/VSW
Final Homeowner Acceptance of Manual	Engineer/Community/VSW
As-Builts	Superintendent/Engineer

1. Utility Ordinances

Establishing a utility ordinance gives government a means to define and enforce its goals by providing an administrative structure and regulations for community facilities. The establishment of ordinances should define the following elements: (1) utility organization, (2) policies and regulations, (3) utility service rate structure.

Typical components of an ordinance are given in Table 7.

Table 7
Ordinance Components for a Utility

1. Definition of general terms
2. Disposal of liquid and solid wastes
3. Operation of individual systems
4. Illegal discharge
5. Alterations of individual systems
6. Easements and right of way
7. Connection to community water and sewer system
8. Application for water and sewer service and/or connection
9. Approval of application/appeal
10. Installation of service lines
11. Permits for construction of individual water and sewer systems
12. Maintenance of plumbing system
13. Responsibility of consumer
14. Authorized inspection
15. Administration and enforcement
16. Public inspection of rates
17. Use of monies collected
18. Accounting and disbursement
19. Additional regulations
10. Utility operator
20. Quarterly report
21. Consequences for non-payment of service charges
22. Limitation of liability

2. Utility Organization

Effectively running a water, sewer and solid waste utility depends on responsible management and administration, as well as on a competent operator. The role of management is to set policy while administrative personnel take care of the day-to-day tasks of running an organization, including recordkeeping and billing.

The role of each is as follows:

> Management: The management role is assumed by the Council and generally tasks include: (1) conducting meetings concerning utility business, (2) adopting rules, regulations and policies, (3) setting user rates, (4) reviewing and approving budgets, (5) approving hiring of personnel, (6) reviewing and approving new systems and modifications of the existing system, and (7) monitoring performance of administration and field operations.
>
> Administration: The administrative duties required to carry out the activities of the utility include: (1) billing and collecting user fees, (2) hiring personnel, (3) recordkeeping, (4) budget preparation, (5) public relations, (6) supervising personnel, and (7) monitoring performance of field operations.

The maintenance of good financial records is important, so that the Council can make informed planning and management decisions. Recordkeeping will also aid the Council in obtaining financial assistance and grants. Bookkeeping of organized financial information and records ensures that the assets that belong to the utility are received, properly recorded, safely protected and properly disbursed.

Basic bookkeeping records include: (1) check and deposit register, (2) accounts receivable ledger, (3) billing statement, (4) receipts, and (5) expense and income report.

Field Operations: Operators carry out all the activities necessary to operate and maintain the facilities of the utility, including the water treatment plant and distribution system, the sewage collection and treatment system and the solid waste facility. A competent operator is extremely important to the success of a utility.

3. Personnel Training

It will be necessary to determine the management training needs of the community before a training agenda is developed. The training agenda should include administrative responsibilities such as budgeting, rate scheduling, bookkeeping and recordkeeping, as well as operator training.

Operator training includes on-the-job training during construction, over-the-shoulder training during the start-up phase, classroom training and follow-up operator training.

Examples of job descriptions and requirements for typical utility personnel are in Appendix VIII.

4. Operation and Maintenance Manuals

An operation and maintenance (O&M) manual for any new facilities would be provided to the community. In addition, homeowner manuals (which include homeowner inspection and acceptance documents) would be provided.

O&M manuals contain the following information:

- System description and explanation on how to use the O&M manual
- Materials and tool lists
- Material and equipment cut sheets and operation manuals
- Preventive maintenance schedules
- Operation record forms
- As-built drawings

The O&M manual is usually prepared through the cooperative efforts of the community, VSW, the project engineer and the project superintendent.

Discussion of Alternatives: A summary of the estimated capital, and operation and maintenance costs for all the alternatives is given in Table 8.

Table 8
Summary of Capital Costs and Operations & Maintenance Costs for Alternatives

Alternative	Capital Cost	O&M Cost
A1 - Rehabilitation of Washeteria	$142,255	$76.80
A2 - Rehabilitation of Solid Waste Facility	$13,915	$5.82
A3 - Decommissioning of Old Pit Bunkers	$13,455	
A4 - Providing Temporary Waste Disposal Pits	$74,002.50	
Total for Above Improvements (A1 - A4)	$243,627.50	
A5 - Lagoon Modifications for Septage Disposal	$157,550	
B1 - Four New Watering Points	$409,400	$58.92
B2 - Summer Water Distribution System	$118,286.70	$4.54
B3 - Honeybucket Container Haul System	$294,975	$48.04
B4 - Truck Water Haul System Truck Sewage Haul System Total	15,611,250 1,273,050 $16,884,300	119.82 72.02 $191.84
B5 - ATV Flush/Haul System ATV Water Haul System Total	1,110,210 32,890 $1,143,100	58.81 84.54 $143.35
C1 - Individual Water Wells	$1,140,915	$18.40
C2 - Individual & Shared Community Drainfields	$2,798,525	$14.48
Total C1 + C2	$3,939,440	$32.88

The selection of alternatives should be based on:

- Level of service desired by the community residents
- Time frame for improvement desired
- Capital cost of construction
- Availability of funding
- Ability and willingness of community to pay for operation and maintenance
- Overcoming management deficiencies to develop a viable operations and maintenance program

Alternatives A1-A4 (rehabilitation of the washeteria and the dump, decommissioning of the pit bunkers and the provision of new temporary household pits) should be carried out first for several reasons. (1) Health conditions in the village would improve; (2) the projects are small and have relatively small capital costs and therefore may be easier to fund; and (3) to obtain funding for larger projects, the community must gain experience and prove its capability to manage facilities; these projects will provide the community with this opportunity.

The highest possible level of water and sewer service is a community-wide, piped water and sewer system. Although desirable, such a system would take years to fully implement in Tuluksak. Funding for the high capital costs must be phased over time. In order for large projects to proceed, communities must have demonstrated management capabilities, as shown by employing certified operators, collecting user fees, preparing and implementing balanced budgets and maintaining records.

It is recommended that the community consider a less complex alternative in the short-term, such as a haul system. A haul system has lower capital costs, is easier to operate and maintain, and is more likely to be within the management capabilities of the community.

Presently, the community has not made a decision regarding the type of community wide system they wish to work towards. Many residents desire a piped water and sewer system. The ATV flush/sewage haul and water haul system is also an attractive alternative for the community. It is not physically feasible to serve the entire community with individual household wells and septic tank/drainfield systems. The community has rejected installing additional watering points and the honeybucket haul system in favor of working towards more sophisticated improvements.

Because of the lack of consensus in the community about whether the community should pursue a piped system or a haul system, it is recommended that an engineering study be prepared comparing these two alternatives in detail. A concerted effort should be made to convey the information in the study to the entire community to create a basis for informed decision making. The community can then decide which system they wish to pursue. The following is a proposed development schedule. The ultimate goal is to completely restore and/or upgrade sanitation facilities in Tuluksak.

Proposed Development Schedule

Priority	Estimated Capital Cost	Estimated O&M	Scheduled Completion
1. Close five honey bucket bunkers	$15,000	None	Summer 1994
2. Temporary pit construction	$75,000	None	Summer 1994
3. Rehabilitate dump	$15,000	$6/home/mo	Summer 1995
4. Rehabilitate washeteria	$150,000	$76/home/mo	Summer 1995-96
5. Prepare engineering study to compare pipe system to haul system	$100,000		Summer/ Fall 1996
6. Community selects system to implement			Winter 1996-1997

VII. REQUIRED PERMITS AND ESTIMATED DATES

Federal Agency Permits and Approvals: Since the community of Tuluksak has received funding from the U.S. Environmental Protection Agency (EPA) through the Indian Set-Aside Program (ISA), any portion of a waste disposal project funded with ISA money must be implemented according to the guidelines set for the ISA program and must be approved by the EPA before construction can begin.

For any major projects implemented with EPA/ISA funds, an environmental assessment report must be prepared to fulfill the requirements of NEPA (the National Environmental Policy Act). The report requires an analysis of the effects of the project on wetlands and water resources, floodplains, endangered and threatened species/critical habitats, coastal zones, cultural resources, wild and scenic rivers, coastal barrier, wilderness areas and significant agricultural lands.

The U.S. Army Corps of Engineers is frequently involved in permitting for civil projects. The two permits of concern are (1) Discharge of Dredged or Fill Material into U.S. Waters (required if construction takes place in waters or wetlands), and (2) a permit for Structures or Work in or Affecting Navigable Waters of the U.S. (typically required to remove gravel close to a river). Any work carried out on federal lands will also require appropriate leases, permits and easements for public lands through the Department of the Interior, Bureau of Land Management.

State Agencies Permits and Approvals: Since Tuluksak is located in a coastal zone, completion of the Coastal Zone Questionnaire and certification for consistency with the Alaska Coastal Management Plan, is required.

The Alaska Department of Environmental Conservation (ADEC) will require Plan Review for all construction work. In addition, a wastewater disposal permit will be required for a public sewerage system to dispose of wastewater into state waters or onto state land. On-site septic systems do not require a permit, if they are of conventional design. For discharges into "navigable" waters, a state issued Certificate of Reasonable Assurance is required to meet the requirements of Section 401 of the Water Quality Act.

Since Tuluksak is a small "bush" community, if the community elects to begin a proper management program for the solid waste facility, the community should submit a Rural Solid Waste Management Plan to ADEC instead of obtaining a Solid Waste Disposal Permit.

A permit may be required by the Alaska Department of Fish and Game for any work in a waterway known as an anadromous fish stream or spawning area.

The Alaska Department of Natural Resources (DNR) requires a Special Material Use Permit to extract gravel from waters of the state and requires a lease, right-of-way or easement for any construction on state-owned property. A Water Rights Permit will also be required for public use of a water source.

The state Historical Preservation Office of DNR may be involved in a construction project where there is a likelihood of excavating archaeological materials. The village of Tuluksak has been occupied continuously since the early historic period. In 1880, the population of Tuluksak was 150 people. The Moravian Church has influenced the village since 1895. Gold was discovered on the upper Tuluksak River in 1907.

The Alaska Department of Transportation and Public Facilities will require building permits, utility permits, leases or right-of-way for all projects that will cross onto state airport land.

Finally, the Alaska Department of Public Safety requires a plan review by the fire marshall for all publicly owned buildings.

<u>Other Agreements</u>: Any construction involving the 23 AVCP homes will require AVCP approval and agreement.

Work on school property will require approval from the Yupiit School District (YSD). A reworking of the arrangement between the YSD and the Council, regarding the use of water treatment facilities in the washeteria building and the sale of water to the school, will be necessary. Compensation for improvements made to the water treatment plant by YSD will also need to be considered.

Individual agreements with homeowners are required for any construction on their land and for access to facilities on private property if village maintenance is necessary.

<u>Estimated Dates</u>: The required permits must be in place prior to the beginning of construction and should be sought during the design phase. Most permit applications can be processed concurrently, but with requests by agencies for additional information or public notice requirements, a lead time of two to six months is suggested. Projects that require public hearings or that involve complicated property agreements will require longer processing times.

VIII. LOCAL COMMITMENT

A commitment by the residents and the Council in Tuluksak is lacking. It has been difficult to establish contact with the community or to develop a working relationship between VSW and a community representative. Two trips to the village by VSW engineers -- planned in advance and agreed upon by Council members -- were unattended by the Council. It has been difficult to find anyone in the village with which to discuss the project.

Village residents do not yet understand that community involvement is required to implement a water and sewer program. The community government does not currently manage or operate any facility. The management of the washeteria failed, resulting in a feeling of disillusionment in the community. Also, the government does not have an income source and does not keep records or books. In short, the community has some severe obstacles to overcome. To begin setting up any type of service in the community will require rehabilitation of abandoned facilities and education regarding management techniques. Funds are not available to do either.

<u>Local Spark Plugs:</u> No "spark plugs" have been identified. However, an employee at the school who maintains the working order of the water plant, Jack Kinegak, is competent and knowledgeable.

<u>Cohesiveness of Community</u>: The community is not active in organizing community-wide activities or ventures.

<u>Strong Local Perception of Problem:</u> Approximately two-thirds of the residents in the community feel that there is a health hazard present due to the lack of sanitation facilities and current health practices in the village (see survey results). The <u>desire</u> of residents for sanitation improvements is very strong (100% of those surveyed). Residents feel that sanitation improvements will improve their quality of life and reduce health risks. They also view them as a right to which they are entitled, and that they deserve to have services equal to those of other villages.

Discussions with residents gave the impression that the community believes facilities will be provided by the state. This is probably due to past state work in the village conducted without significant involvement from the community. Residents seem to lack the understanding that their government must take an active role in the facilitation of a project.

<u>Top Local Priority:</u> As of the writing of this report, although improvements are very much desired, the community has not <u>demonstrated</u> that a water and sewer project is a high priority. Council members have not attended planned meetings or identified a contact person for the project.

Public and Private Willingness to Pay Increased Cost: Results of the house-to-house survey, conducted in the village, suggest that residents are willing to pay for running water and sewer by user fees (see survey results). Many residents feel that the community government should help pay for operation and maintenance with community funds. Although most residents report that they would pay $60-$80 per month, the impression given was that the amount they would be willing to pay would depend on the level and reliability of the service. It would also depend on whether the residents believe that the cost is reasonable for the services they receive.

Effective Local Government/Council: The community has a city and traditional council (Tuluksak Native Community Council) form of government. The community wishes to improve its government and feels that this can be better accomplished by having only one form. Plans are, therefore, in the works to dissolve the city government. Although this has not been accomplished officially, the city government is presently not operating.

The Traditional Council is in place and has meetings. Currently they are not active in "municipal" activities. Although the Council could provide some level of service with existing facilities, it has not seen a need to do so.

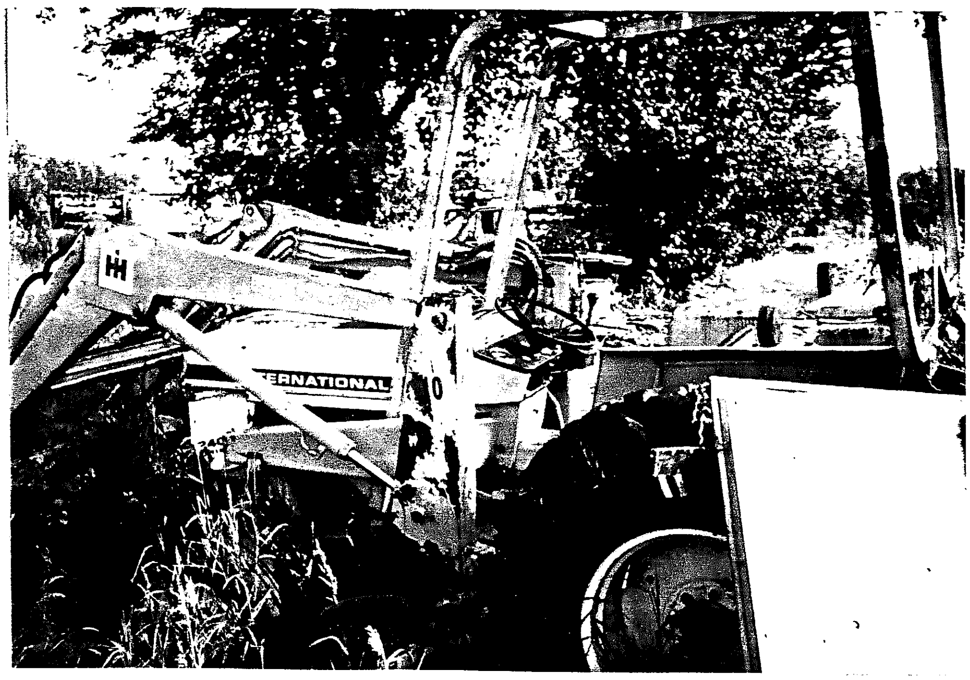
PROJECT PHOTOGRAPHS

SOLID WASTE SITE

(note trash dumped at entrance near road)

John Deere
350 Dozer

Dump Truck

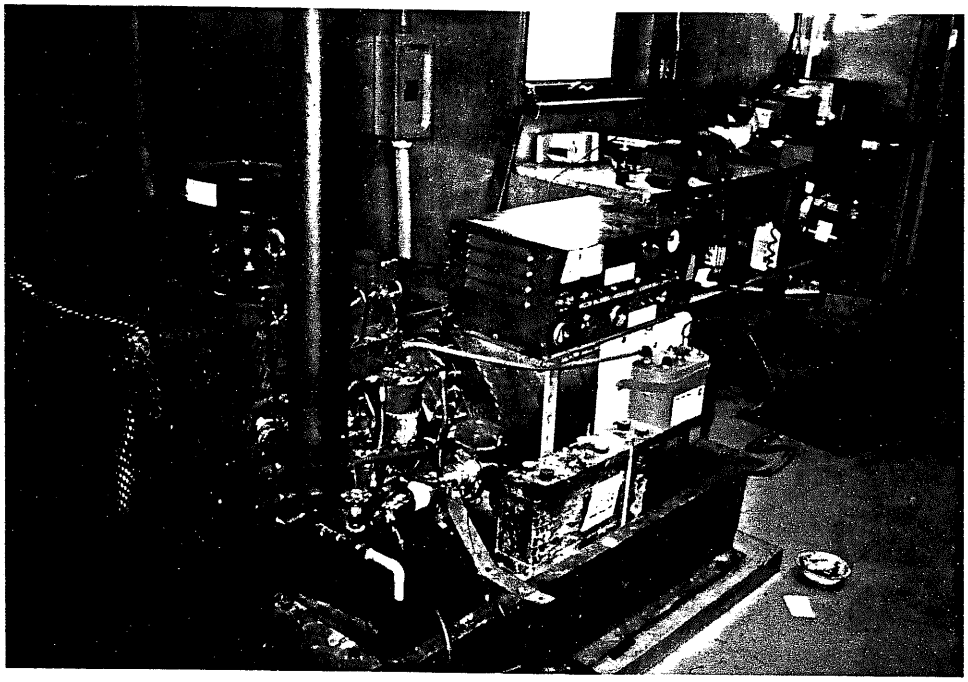


International
Loader

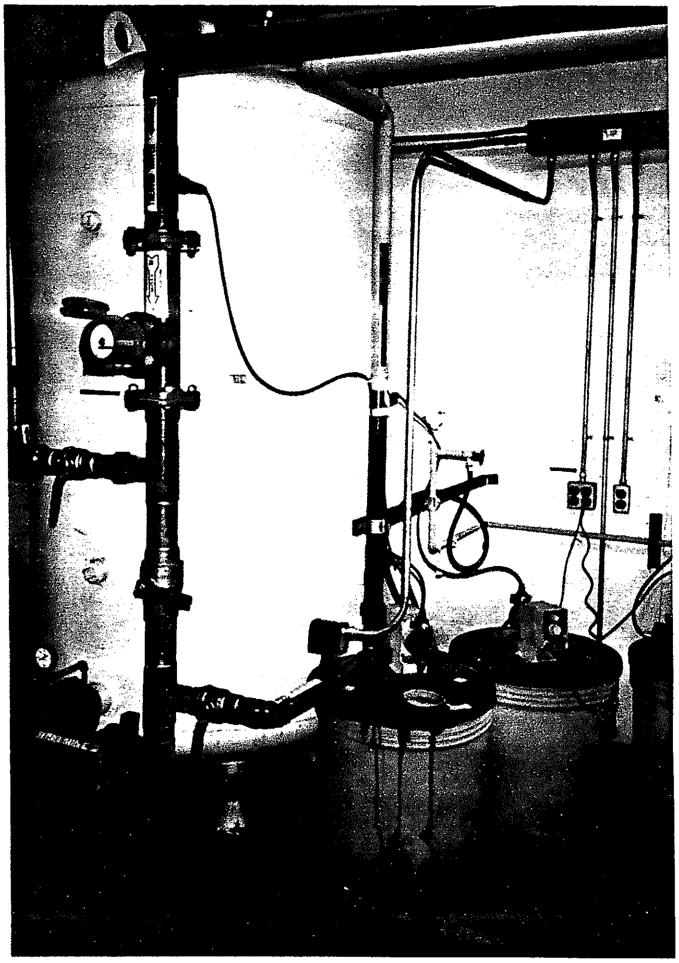
Caterpillar
D3B Dozer

Huber Warco Grader

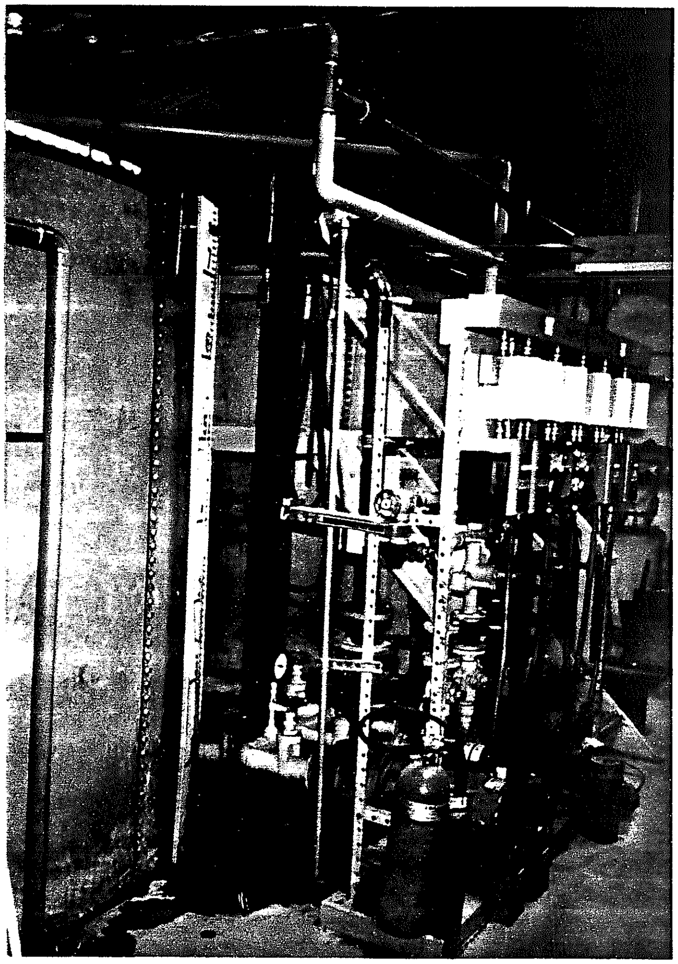
John Deere
444C Loader



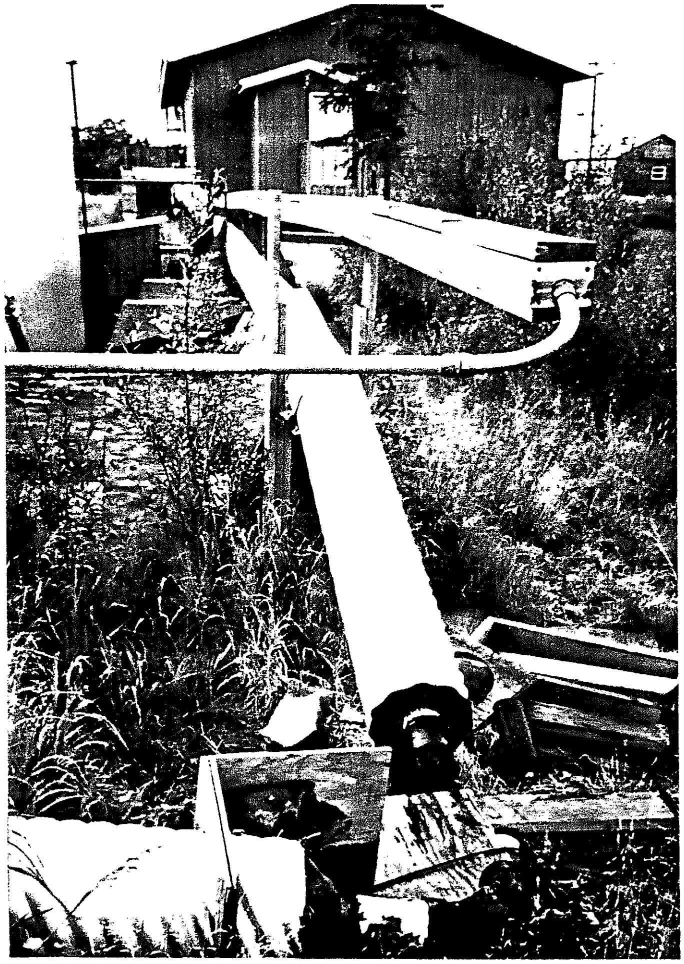
WATER TREATMENT PLANT STANDBY GENERATOR



GREENSAND FILTER AND CHEMICAL ADDITION



WATER TANKS

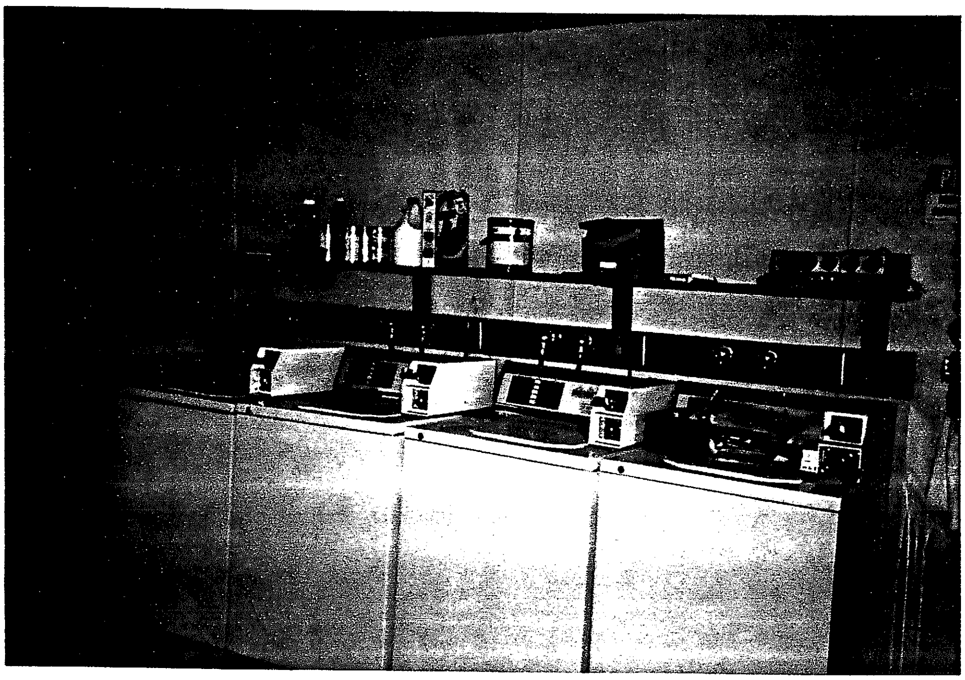


BROKEN WASTE DISPOSAL LINE FROM WASHETERIA TO SEWAGE LAGOON

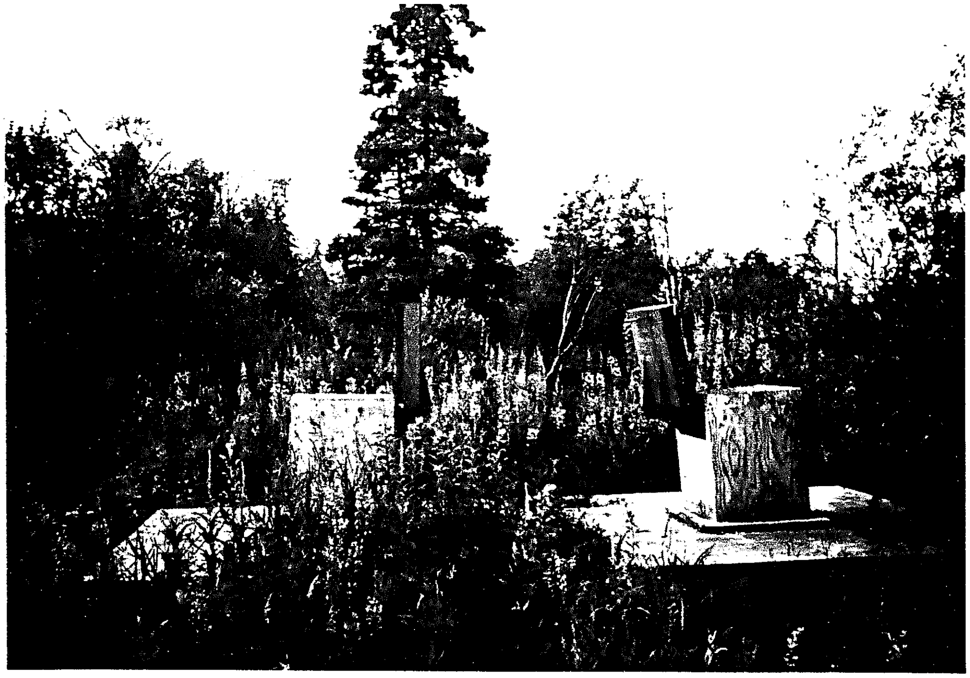
WASHETERIA AND WATER TREATMENT PLANT BUILDING

SHOWERS

DRYERS



WASHING MACHINES

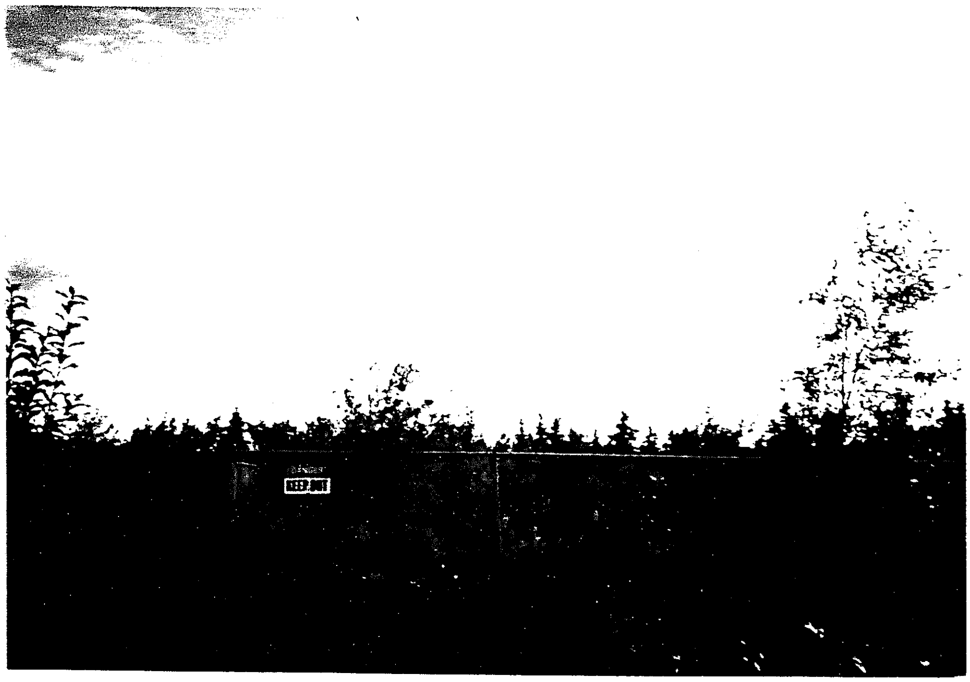


HONEY BUCKET
DISPOSAL BUNKERS

HONEY BUCKET
WASTES DUMPED
ON GROUND NEAR
BUNKERS SINCE
BUNKERS ARE FULL

TYPICAL ROAD
CONDITIONS IN TULUKSAK

SOIL SECTION AT
SOLID WASTE SITE



WASHETERIA SEWAGE LAGOON

TABLES

CAPITAL COSTS
AND
OPERATIONS AND MAINTENANCE COSTS
FOR WATER, SEWER AND SOLID WASTE ALTERNATIVES

Table 9

Alternative A1 - Capital Costs
Rehabilitation of Washeteria

Unit	Cost per Unit	No. of Units	Total
Interior Refinish			$20,000
Plumbing Rehabilitation			$20,000
Washers	$1,200	4	$ 4,800
Dryers	$4,000	3	$12,000
Vending Equipment			$ 1,000
Freight			$15,000
Repair disposal line to Lagoon (incl. backwash)			$40,000
Surface Seal for Well			$ 500
Labor Foreman	1 x $35/hr	8hr/d x 5d/wk x 4wks	$ 5,600
Labor	2 x $15/hr	8hr/d x 5d/wk x 4wks	$ 4,800
Sub-Total			$123,700
Contingency (15%)			$ 18,555
Total			$142,255

Table 10

Alternative A1 - Yearly Operations and Maintenance Costs for Washeteria

Unit	Cost/Unit	No. of Units	Total
Water Treatment Plant Operator	$15/hr	1/3time x 52wks x 7d/wk x 8hrs/d	$ 14,560
Attendant	$8/hr	52wks x 7d/wk x 4hrs/d	$ 11,648
Fuel			$ 10,000
Electricity			$ 20,000
Equipment Replacement and Parts			$ 15,000
Water Testing			$ 1,500
Expendables (supplies, chemicals, etc.)			$ 2,500
Insurance			$ 5,000
Telephone and Misc. Expenses			$ 1,500
Sub-Total			81,708.00
Contingency (15%)			$12,256.20
Total			$93,964.20

Table 11

Alternative A2 - Capital Costs
Rehabilitation of Solid Waste Facility

Heavy Equipment Repair	$2,000
Fencing Replacement	$7,500
Labor Foreman	$35/hr x 8hrs/d x 5d = 1,400
Labor	2 people x $15/hr x 8hrs/d x 5d = 1,200
Sub-Total	$12,100
Contingency (15%)	$ 1,815
Total	$13,915

Table 12

Alternative A2 - Operations and Maintenance Costs
for Solid Waste Facility

Item	Unit Cost	No. of Units	Total
Operator	$15/hr	52wks x 1d/wk x 4hrs/d	$ 3,120
Fuel for Heavy Equipment	$2/gal	10gal x 52wks	$ 1,040
Heavy Equipment Maintenance			$ 1,000
Sub-Total			$ 5,160
Contingency (15%)			$ 774
Total per Year			$ 5,934
Total per Month			$ 494.50
Total/month/home			$ 5.82

Table 13

Alternative A3 - Decommissioning of Pit Bunkers

Item	Unit Cost	No. of Units	Total
Lime	$80/pit	5 pits	$ 400
Vehicle Rental	$50/day	10days	$ 500
Labor Foreman	$35/hr	10d x 8hrs/d	$ 2,800
Labor	5 x $15/hr	10d x 8hrs/d	$ 6,000
Equipment			$ 2,000
Total			$11,700
Contingency (15%)			$ 1,755
Total			$13,455

Table 14

Alternative A4 - Construction of New Temporary Pits for Waste Disposal

Item	Unit Cost	No. of Units	Total
Labor	$500/pit	70	$ 35,000
Materials	$110/pit	70	$ 7,700
Heavy Equipment Rental	$15/hour	70 pits x 2hrs/pit	$ 2,100
Purchase Pickup Truck			$ 15,000
Freight	$65/pit	70	$ 4,550
Sub-total			$64,350
Contingency (15%)			$ 9,652.50
Total			$74,002.50

Table 15

Alternative A5 - Capital Costs
Lagoon Modifications for Septage Disposal

Lagoon Modifications	$130,000
Access for Haul Vehicles	$ 7,000
Sub-Total	$137,000
Contingency	$ 20,550
Total	$157,550

Table 16

Alternative B1 - Capital Costs
All Weather Watering Points

Item	Unit	No. of Units	Total Cost
Mobilization - Demobilization			$ 20,000
6" wells @ 60' deep	$150/ft	4wells x 60ft	$ 36,000
Building and Equipment	$75,000	4	$300,000
Sub-total			$356,000
Contingency (15%)			$ 53,400
Total			$409,400
Total Cost (each) for 4 Watering Points			$102,350

Table 17

Alternative B1 - Operation and Maintenance Costs
Watering Points

Item	Cost per Watering Point
Electricity for Pump	$ 300.00
Maintenance and Equipment Replacement	$ 6,000.00
Fuel for Heating Building	$ 525.00
Operator	$15/hr x 1d/wk x 8hrs/d x 52wks/year = $6,240
Sub-Total	$13,065.00
Contingency (15%)	$ 1,959.75
Total per Watering Point	$15,024.75
Total for 4 Watering Points	$60,099.00
Total/ month/ home	$ 58.92

Table 18

Alternative B2 - Capital Costs
Summer Water Distribution System

Item	Unit Cost	No. of Units	Total
3" PE water line	$ 17.00/ft.	4,875	$ 82,858.00
Water Supply Points	$2,000.00	10	$ 20,000.00
Sub-total			$102,858.00
Contingency (15%)			$ 15,428.70
Total			$118,286.70

Table 19

Alternative B2 - Operations and Maintenance Costs
Summer Water Distribution System

Item	Unit Cost	No. of Units	Total
Line Maintenance	$15/hr	200hrs	$3,000.00
Replacement Parts			$1,000.00
Electricity			$ 25.00
Sub-total			$4,025.00
Contingency (15%)			$ 603.75
Total			$4,628.75
Total/ month/ home			$ 4.54

Table 20

Alternative B3 - Capital Costs
Honey Bucket Container Haul System

Item	Unit Cost	No. of Units	Total
Honey Bucket Containers	$390	20	$ 7,800
Frame for Containers	285	20	$ 5,700
Container Lids	190	20	$ 3,800
Travel Lids	300	4	$ 1,200
Carriage Trailer	1,500	4	$ 6,000
Summer Haul Vehicle	6,000	2	$ 12,000
Winter Haul Vehicle	3,000	2	$ 6,000
Platform Lumber	10,000	1	$ 10,000
Turnarounds			$ 20,000
Storage Shed			$ 20,000
Wash Equipment			$ 4,000
Lagoon Modifications			$137,000
Construction			$ 10,000
Freight			$ 13,000
Sub-total			$256,500
Contingency (15%)			$ 38,475
Total			$294,975

Table 21

Alternative B3 - Operation and Maintenance Costs for Honey Bucket Container Haul System

Item	Unit Cost	No. of Units	Total
Labor	$15/hr	1hr/trip x 1,766 trips	$26,490.00
Fuel for Vehicle	$0.50/trip	1,766 trips	$ 883.00
Haul Vehicle Replacement	$18,000	0.2	$ 3,600.00
Replacement of Containers and Carriage	$24,500	0.25	$ 6,125.00
Vehicle and Equipment Maintenance			$ 972.50
Heating Fuel for Storage Shed	$1.75/gal	300 gal	$ 525.00
Sub-total			$38,595.50
Contingency (15%)			$ 5,789.33
Total/year			$44,384.83
Total/ month/ home			$ 48.04

Table 22

Alternative B4 - Capital Costs
Trucked Water Haul System

Item	Unit Cost	No. of Units	Total Cost
500 Gallon Tanks with Appurtenances (Installed)	$5,000	85 bldgs.	$ 425,000
Road Grader	100,000	1	$ 100,000
Water Truck	60,000	2	$ 120,000
Road Construction	90/ft	142,000	$12,780,000
Heated Garage	150,000	1	$ 150,000
Sub-total			$13,575,000
Contingency (15%)			$ 2,036,250
Total			$15,611,250

Table 23

Alternative B4 - Capital Costs
Trucked Sewage Haul System

Item	Unit Cost	No. of Units	Total Cost
500 Gallon Tanks with Appurtenances (installed)	$10,000	85 bldgs.	$ 850,000
Pumper Truck	60,000	2	$ 120,000
Lagoon Modifications			$ 137,000
Sub-total			$1,107,000
Contingency (15%)			$ 166,050
Total			$1,273,050

Table 24

Alternative B4 - Operating and Maintenance Costs for Trucked Water Haul System

Item	Unit Cost	Units	Total
Vehicle Operators	$15/hr	800 trips x 4hrs/trip	$ 48,000.00
Road Grader Operator	$15/hr	1d/wk x 8hrs/d x 52wks	$ 6,240.00
Mechanic	$15/hr	1d/wk x 8hrs/d x 52wks	$ 6,240.00
Equipment Parts			$ 1,000.00
Truck Fuel	$2/gal	800 trips x 1/2gal/trip	$ 800.00
Heating Fuel for building			$ 15,000.00
Electricity for building			$ 5,000.00
Vehicle Replacement (two, every 5 years)	$120,000	0.2	$ 24,000.00
Sub-total			$106,280.00
Contingency (15%)			$ 15,942.00
Total/Year			$122,222.00
Cost/ month/ home			$ 119.82

Table 25

Alternative B4 - Operating and Maintenance Costs for Trucked Sewage Haul System

Item	Unit Costs	No. of Units	Total
Vehicle Operator	$15/hr	535 trips x 4hrs/trip	$32,100.00
Mechanic	$15/hr	1d/wk x 8hrs/d x 52wks	$ 6,240.00
Equipment and Parts			$ 1,000.00
Truck Fuel	$2/gal	535 trips x 1/2gal/trip	$ 535.00
Vehicle Replacement	$120,000	0.2	$24,000.00
Sub-total			$63,875.00
Contingency (15%)			$ 9,581.25
Total			$73,456.25
Total/month/home			$ 72.02

Table 26

Alternative B5 - Capital Costs
ATV Flush/Haul System

Item	Unit Cost	Units	Total Cost
Flush Toilet, Storage Bladder, Water Reservoir, Piping, and Appurtenances	$7,500	85 bldgs.	$ 637,500.00
Structural Renovations	$1,500	85	$ 127,500.00
Sewage Tank, Trailer, Sled, Hoses, Blower	$5,200	2	$ 10,400.00
Summer Haul Vehicle	$6,000	2	$ 12,000.00
Winter Haul Vehicle	$3,000	2	$ 6,000.00
Storage Shed			$ 20,000.00
Washing Equipment			$ 4,000.00
Freight			$ 11,000.00
Add Lagoon Cell			$ 137,000.00
Sub-Total			$ 965,400.00
Contingency (15%)			$ 144,810.00
Total			$1,110,210.00

Table 27

Alternative B5 - Capital Costs
ATV Water Haul System

Item	Unit Cost	Units	Total Cost
Summer Haul Vehicle	$6,000	2	$12,000.00
Winter Haul Vehicle	$3,000	2	$ 6,000.00
Water Tank, Trailer, Sled, Hoses, Blower	$5,300	2	$10,600.00
Sub-Total			$28,600.00
Contingency (15%)			$ 4,290.00
Total			$32,890.00

Table 28

Alternative B5 - Operating and Maintenance Costs
ATV Flush/Haul System

Item	Unit Cost	Units	Total Costs
Operator	$15/hr	2,945 trips/yr x 1hr/trip	$44,175.00
Fuel for Haul Vehicles	$0.50/trip	2,945 trips	$ 1,472.50
Maintenance for Vehicles and Equipment			$ 568.00
Haul Vehicles Replacement	18,000	0.2	$ 3,600.00
Haul Equip. Replacement	10,400	0.2	$ 2,080.00
Fuel to Heat Storage Shed	$1.75/gal	150	$ 262.50
Sub-total			$52,158.00
Contingency (15%)			$ 7,823.70
Total			$59,981.70
Total/month/home			$ 58.81/mo

Table 29

Alternative B5 - Operating and Maintenance Costs
ATV Water Haul

Item	Unit Cost	Units	Total Costs
Operator	$ 15/hr	4,415 trips/yr x 1hr/trip	$66,225.00
Fuel for Haul Vehicles	$0.50/trip	4,415 trips/yr	$ 2,207.50
Maintenance for Vehicles and Equipment			$ 572.00
Haul Vehicles Replacement	$18,000	0.2	$ 3,600.00
Haul Equip. Replacement	$10,600	0.2	$ 2,120.00
Fuel to Heat Storage Shed	$1.75/gal	150 gal	$ 262.50
Sub-total			$74,987.00
Contingency (15%)			$11,248.05
Total			$86,235.05
Total/month/home			$ 84.54/mo

Table 30

Alternative C1 - Capital Costs
Individual Water Wells

Item	Unit	No. of Units	Total Cost
Mobilization - Demobilization			$ 20,000.00
6" wells @ 60' deep	$150/ft	85bldgs x 60ft	$ 765,000.00
Plumbing & Fixtures	1,500	85	$ 127,500.00
Iron Treatment Unit	400	85	$ 34,000.00
Labor Foreman	$35/hr	8hrs/d x 5d/wk x 12 wks	$ 16,800.00
Labor	4 x $15/hr	8hrs/d x 5d/wk x 12wks	$ 28,800.00
Sub-total			$ 992,100.00
Contingency (15%)			$ 148,815.00
Total			$1,140,915.00
Total/ well			$ 16,298.79

Table 31

Alternative C1 - Operation and Maintenance Costs
Individual Water Wells

Item	Cost per Month per Home
Electricity for Pump	$ 4.00
Well Maintenance/Pump Replacement	$ 5.00
Treatment Unit Filters	$ 5.00
Electricity for Heat Tracing	$ 2.00
Sub-Total	$16.00
Contingency (15%)	$ 2.40
Total	$18.40

Table 32

Alternative C2 - Capital Costs
Individual and Shared Community Drainfields

Item	Unit Cost	No. of Units	Total
Community Septic Tanks	$3,000	10	$ 30,000.00
Individual Septic Tanks	$2,000	61	$ 122,000.00
Community Drainfields	$25/ft	3,105	$ 77,625.00
Individual Drainfields	$25/ft	8,235	$ 205,875.00
Sewer Mains	$100/ft	11,000	$1,100,000.00
Manholes	$5,000	23	$ 115,000.00
Cleanouts	$1,500	142	$ 213,000.00
Sewer Service Lines	$35/ft	15,000	$ 525,000.00
Soil Testing			$ 5,000.00
Sludge Pump Trailer	$20,000	2	$ 40,000.00
Sub-Total			$2,433,500.00
Contingency (15%)			$ 365,025.00
Total			$2,798,525.00
Cost/ bldg			$ 32,923.82

Table 33

Alternative C2 - Operations and Maintenance Costs
Individual and Shared Community Drainfields

Item	Unit Cost	No. of Units	Total
Septic Tank Pumping Labor	2 x $15/hr	0.5d/tank x 8hrs/d x 0.5/yr x 55 tanks	$ 3,300.00
Fuel	$2/gallon	0.5gal/tank x 55 tanks	$ 55.00
Rental Vehicle	$50/day	0.5d/tank x 0.5/yr x 55 tanks	$ 687.50
Maintenance on Pumper			$ 800.00
Parts and Replacement of Pumper Trailers	40,000	0.2	$ 8,000.00
Sub-Total			$12,842.50
Contingency (15%)			$ 1,926.38
Total			$14,768.88
Total/month/home			$ 14.48