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City of Tanana Water and Sewer Feasibility Study

Prepared for

Too'gha, Inc., Tanana, Alaska
and Village Safe Water, Alaska Department
of Environmental Conservation

JANUARY 1997

Prepared by

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301 W. Northern Lights, Suite 601
Anchorage, Alaska 99503

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SECTION 1

Summary and Recommendations

A water and sewer feasibility study has been completed for the Too'gha, Inc., Tanana, Alaska. That effort included evaluating sanitation facilities alternatives and obtaining public input on the alternatives. The following summarizes the findings of this feasibility study.

- Options were evaluated and capital and operation and maintenance costs estimated for each option.
- Native and City councils eliminated all haul options, leaving three options for the residents to consider:
  - Piped water and gravity sewer
  - Piped water and vacuum sewer
  - Replace the existing Laundromat/ Water Treatment Plant (WTP) only
- Two house-to-house surveys were conducted to solicit local input on sanitation facilities alternatives. One was conducted within the area bounded by the Elders' Residence on the west and Sunshine Subdivision on the east. In this survey the residents overwhelmingly selected piped water and gravity sewer. A second survey was conducted for the residents living in the outlying areas (i.e., Site Road, Mission Hill, and Old Mission areas). These residents selected individual wells as the preferred water supply option. They would continue to use outhouses for sewage disposal.
- The estimated capital cost for a piped water and gravity sewer system for the area bounded by the Elders' Residence on the west and Sunshine Subdivision on the east is approximately $12 million. The monthly user fee for an individual residence is estimated at $103 when the entire system is put into service.
- The estimated capital cost for 27 individual wells for the outlying areas is $135,000 (27 wells x 50 feet/well x $100/foot). Outlying residents would be responsible for the operation and maintenance of their well and sewage disposal system.
- Because of the size and cost of this project, it is recommended that the construction activities be conducted in phases. If possible, funding requests should be limited to $1,000,000. An exception is Phase 3, which consists of the design and construction of a new piped gravity sewer system to serve the buildings that are now served by the existing system. The proposed water system and sewer system phases are shown in Figures 1-1 through 1-6 (at the end of this section) and the costs are shown on Table 1-1.
  - Phase 1 will consist of conducting a design study for the development of a water source, developing a new water source, replacing the existing lagoon level control structure and effluent line, and designing a new WTP and Laundromat.
  - Phase 2 will be the construction of a new water treatment facility and Laundromat. The new Laundromat would be approximately the same size as the existing

The estimated costs for Phase 1 and Phase 2 are approximately $900,000 and $1,800,000 respectively. A 25 percent construction contingency allows for unforeseen circumstances and provides a realistic estimate for the purpose of financial planning. An allowance has also been added for engineering design and construction administration.

Currently, there are approximately $1.8 million in available funds. It is recommended that the $900,000 for Phase 1 be funded and that work begin immediately. The remaining $900,000 of available funding should be applied toward Phase 2 work. An additional $900,000 in funding is required for the completion of Phase 2.

This study was funded through a Village Safe Water grant to the City of Tanana under SB 363, CH 4, SLA 94, administered by Village Safe Water.

TABLE 1-1
Estimated Cost by Phase

Phase	Cost
1	$900,000[a]
2	$1,800,000[a]
3	$2,000,000[b]
4	$750,000[b]
5	$660,000[b]
6	$750,000[b]
7	$740,000[b]
8	$750,000[b]
9	$730,000[b]
10	$850,000[b]
11	$800,000[b]
12	$750,000[b]
13	$580,000[b]
Total	$12,060,000[c]

[a]See Appendix C for detailed cost estimates.
[b]Detailed cost estimates were not performed for Phases 3-13. Estimated costs for these phases are based on an average price per foot for water and sewer pipe installed.
[c]See Appendix C for detailed cost estimate for Option 1.

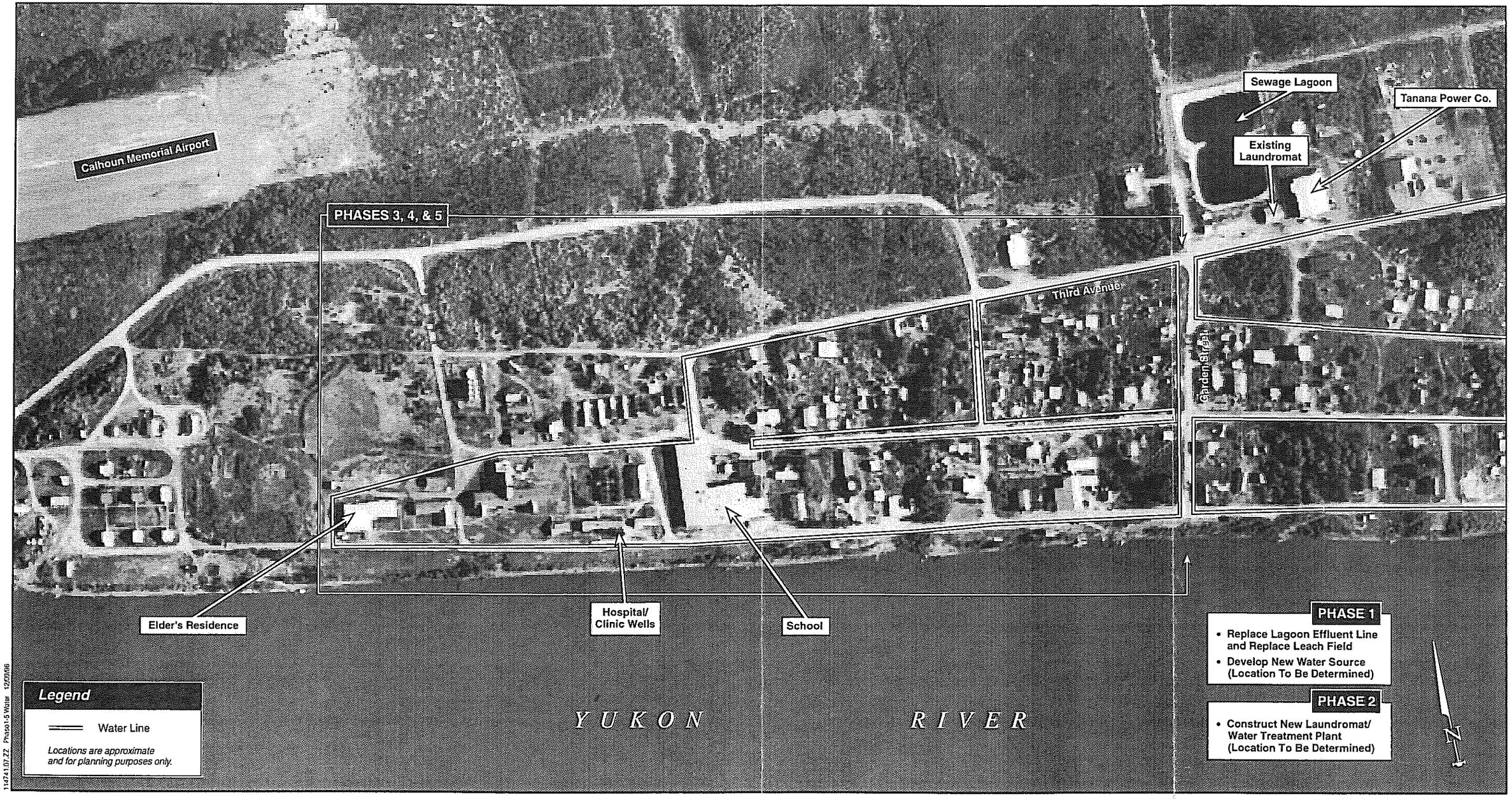


Figure 1-1

Proposed Water System, Phases 1-5
Too'gha, Inc. and VSW
Water and Sewer Feasibility Study

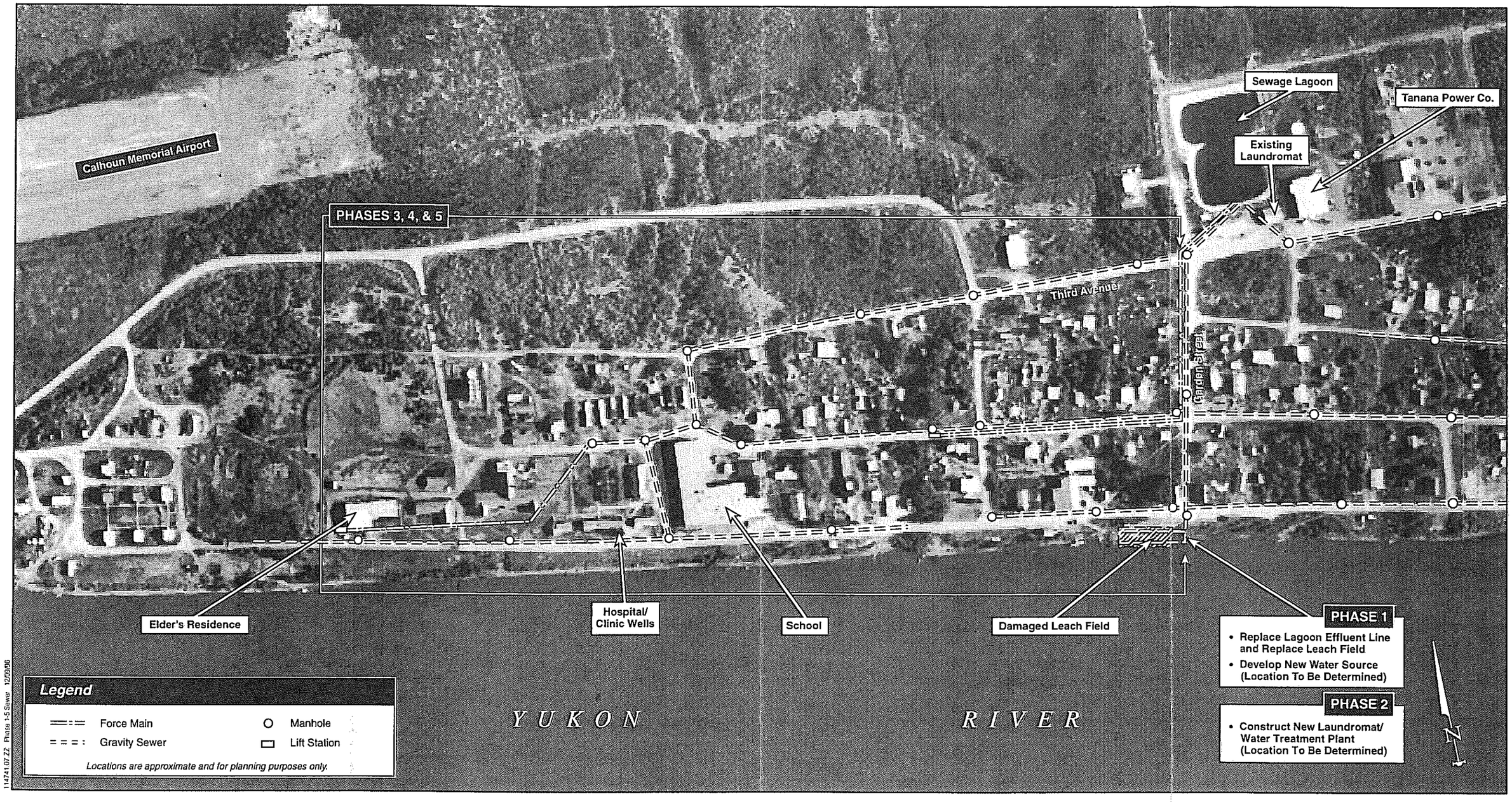


Figure 1-2

Proposed Sewer System, Phases 1-5
Too'gha, Inc. and VSW
Water and Sewer Feasibility Study

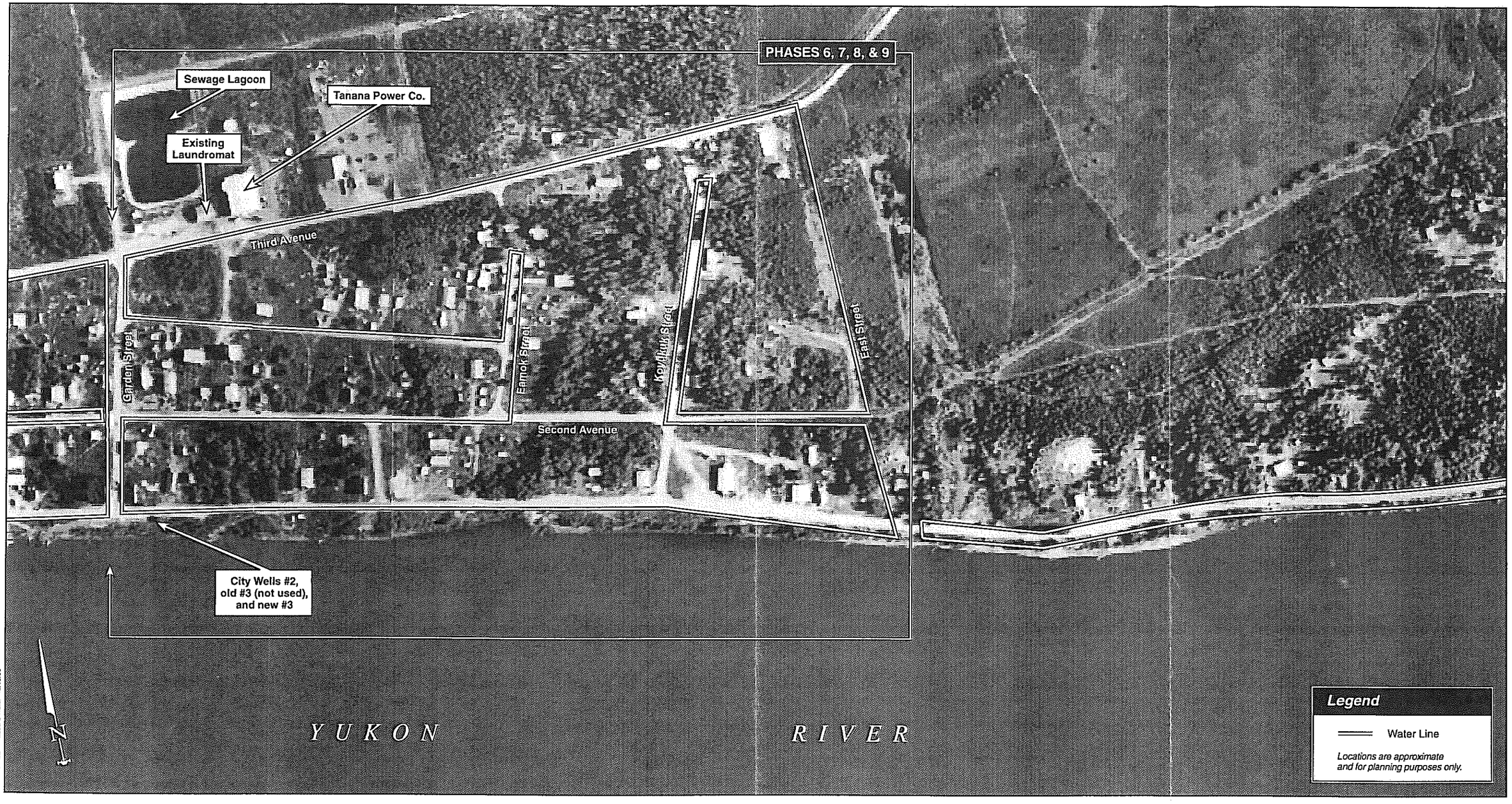


Figure 1-3

Proposed Water System, Phases 6-9
Too'gha, Inc. and VSW
Water and Sewer Feasibility Study

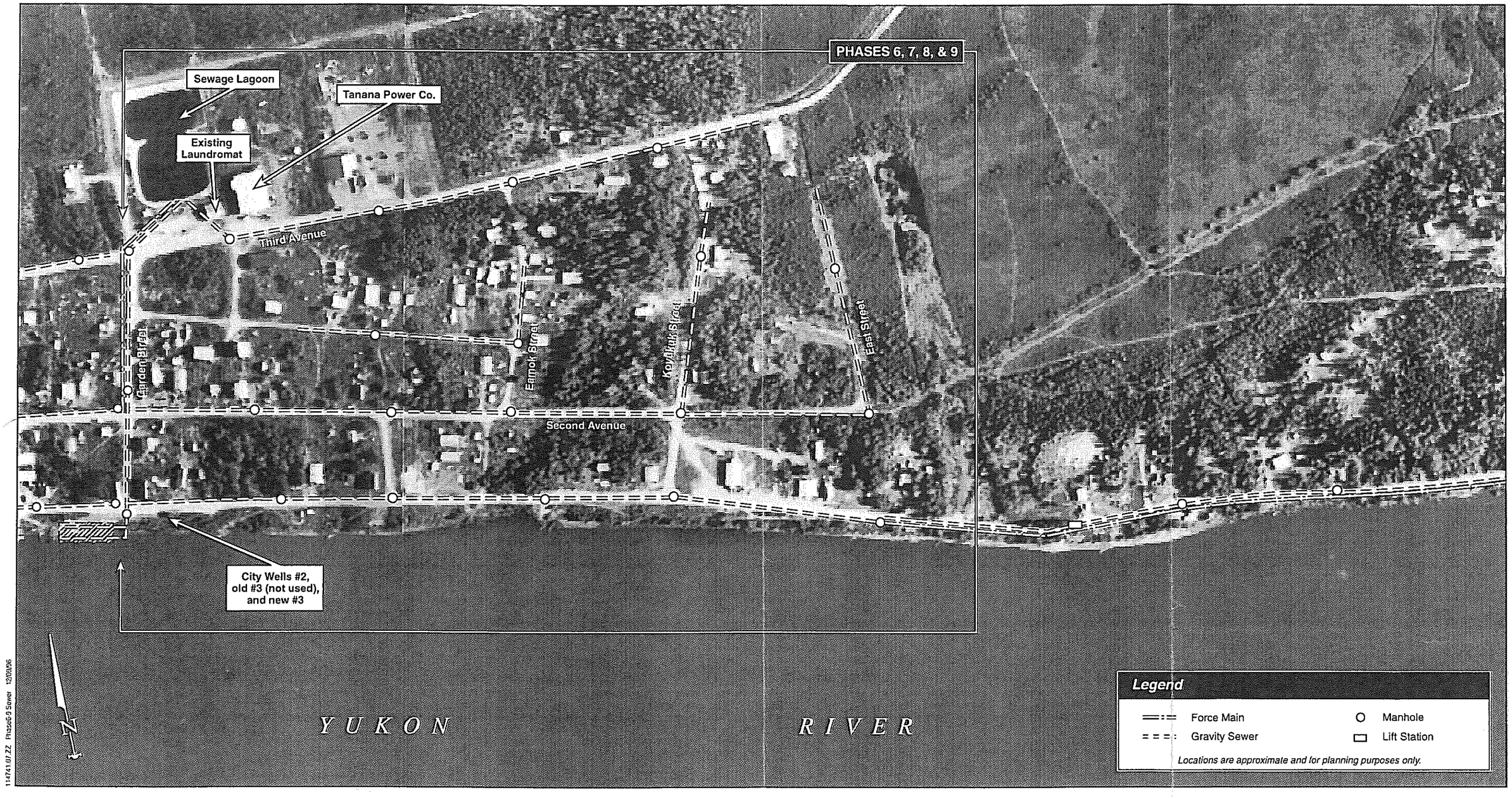


Figure 1-4

Proposed Sewer System, Phases 6-9
Too'gha, Inc. and VSW
Water and Sewer Feasibility Study

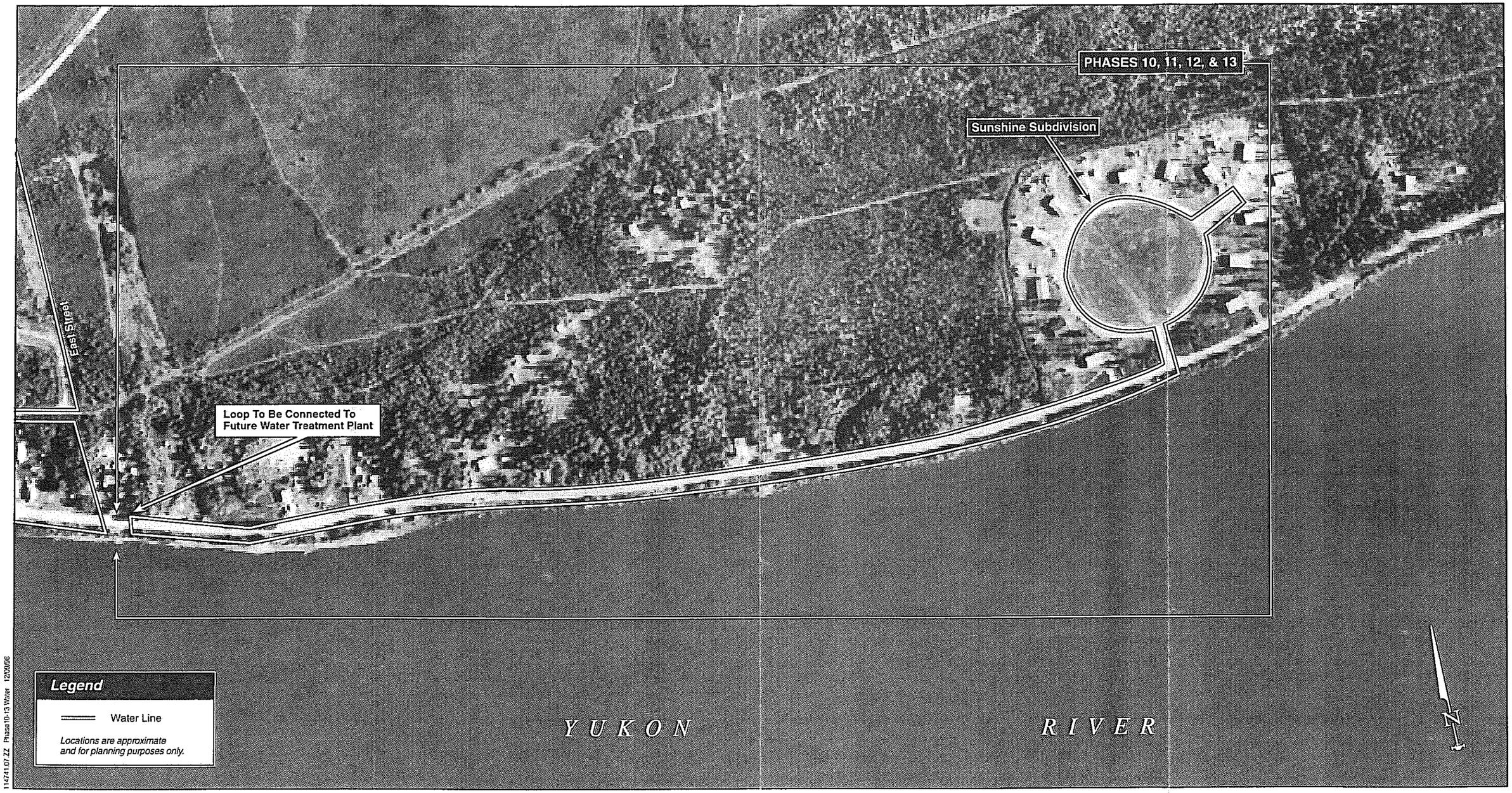


Figure 1-5

Proposed Water System, Phases 10-13
Too'gha, Inc. and VSW
Water and Sewer Feasibility Study

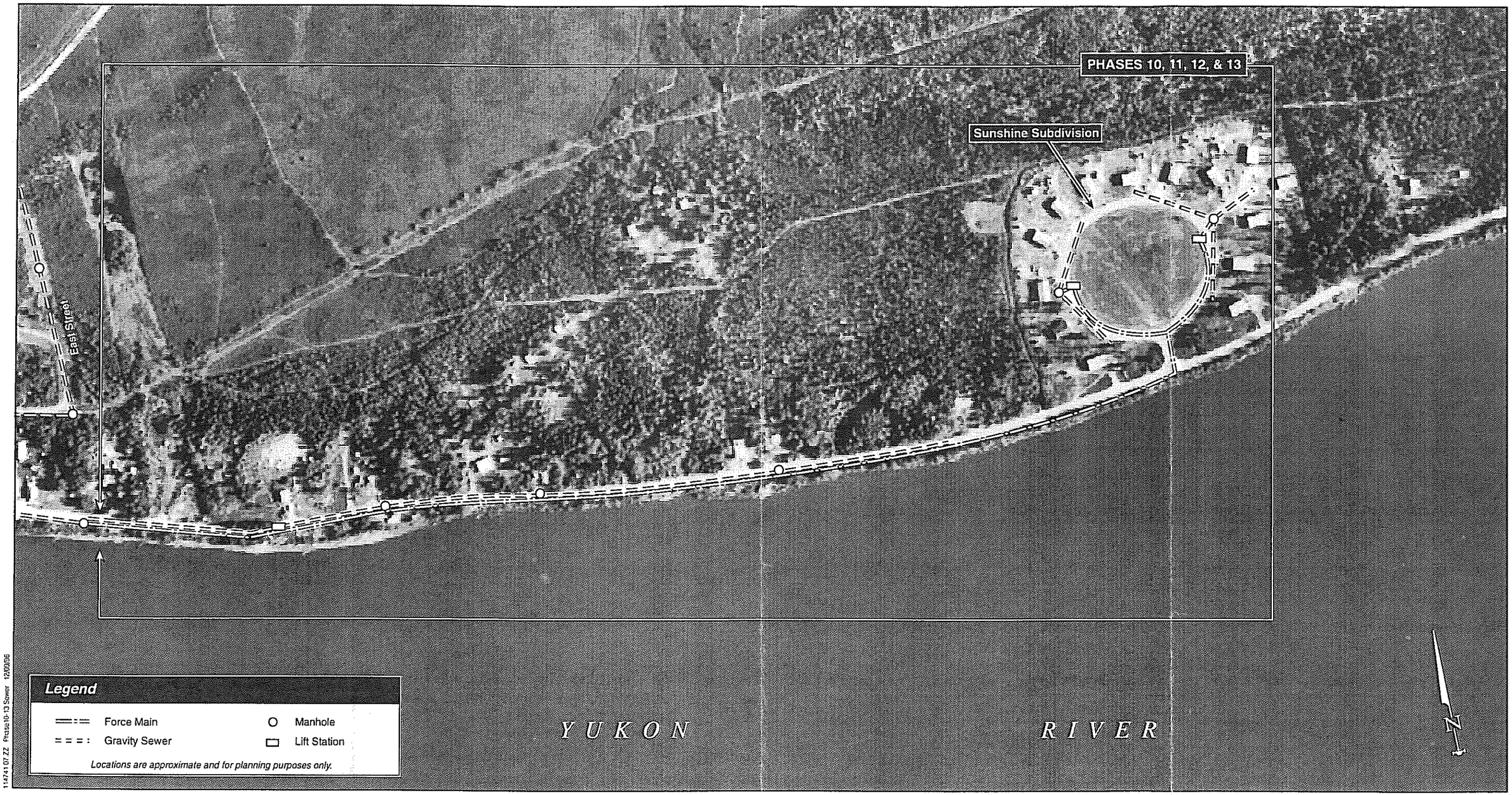


Figure 1-6

Proposed Sewer System, Phases 10-13
Too'gha, Inc. and VSW
Water and Sewer Feasibility Study

SECTION 2

Introduction

Background

The City of Tanana is in Interior Alaska about 2 miles west of the junction of the Tanana and Yukon Rivers, 125 air miles west of Fairbanks as shown in Figure 2-1. The current population is estimated at 344.

History

Tanana is within the traditional Koyukon Athabaskan territory, although members of other Athabaskan groups also reside in the area. Long before European contact, Tanana's prime location at the confluence of two major rivers made the site well suited to its role as a trading hub for nearby Koyukon and Tanana Indians. In the century since missionaries established a station 8 miles downriver from the present townsite, Tanana has been the site of trading posts and two now-closed military outposts. A mission complex that was developed between 1887 and 1890 and included a hospital and a school continued to grow. The hospital was transferred to Bureau of Indian Affairs (BIA) administration in the 1920s, and new facilities were built in 1949. Hospital administration was transferred to the U. S. Public Health Service (PHS) in the 1950s, and, until the complex was closed in 1982, the hospital was a major employer in Tanana. A new school was built in 1963, and a major addition was added in 1971. In 1982, a fire hall was built, and Tanana took over operation of its own school district. Television came to Tanana in 1981, and in 1986 viewer service greatly expanded with the introduction of private cable television.

Over the years there have been several sanitation facilities projects in Tanana. The following is a summary of the major PHS or Village Safe Water (VSW) Program projects:

- In 1967 individual wells and outhouses were constructed for Native-owned homes.
- In 1972 PHS drilled a new well for the hospital.
- In 1974 the hospital well was contaminated by an oil spill. A new 97-foot-deep well was drilled in August, 1976.
- In 1978 VSW, with some funds from PHS, built the existing Water Plant/Laundromat and improved the existing community well.
- A 1981 PHS project provided funds for offsite sanitation facilities improvements for the City of Tanana and the Sunshine Subdivision. PHS provided a new community well, well house, water transmission line from the well to the community Laundromat and watering point, and a 300-gallon water haul truck. The Interior Housing Authority constructed the onsite sanitation facilities for the subdivision.
- A 1982 VSW project provided emergency funds for a heating system to prevent the hospital compound sewer lines from freezing.

- A 1984 PHS project provided for the installation of fluoridation equipment in the City's water treatment plant.
- In March 1989 a PHS project provided funds to install pit bunkers, outhouses, and site drainage for the Sunshine Subdivision and to construct outhouses for two homes in the townsite area and repair two sewage lift stations in the City.
- A 1990 PHS project provided for a new well, well house improvements, and a 2-inch raw water transmission loop from the well to the Laundromat/WTP.

Local Government

The City of Tanana has been incorporated since 1961 and became a first class City in 1982. Tanana is also a Native Village, reorganized and chartered under the Indian Reorganization Act (IRA). The Tanana Native Council is recognized as the legal governing body of the tribe and is able to contract for any federal services that are Indian- or Alaska Native-specific. Tozitna, Limited, is the Village Native Cooperation for Tanana and was established under the terms of the Alaska Native Claims Settlement Act (ANCSA). Recently, the City of Tanana and the Tanana Native Council jointly formed a corporation, Too'gha, Inc., organized to engage in design, construction, ownership, and management of sanitation facilities for Tanana. In addition, Tanana is a member of Doyon Limited, the ANCSA Regional Corporation, and is also a member of the Fairbanks Subregion of the Tanana Chiefs Conference, Inc.

Community Services

Important public and private facilities in Tanana include the health clinic, elders' residence, a post office, two general stores, and a primary-through-grade-12 school operated by the Tanana City Schools. The City maintains an office building, fire station, and Laundromat. Electrical power for the community is produced by a private company, Tanana Power, using diesel generators. Gasoline and fuel oil are available at a local store. Cable television and telephone services are also available.

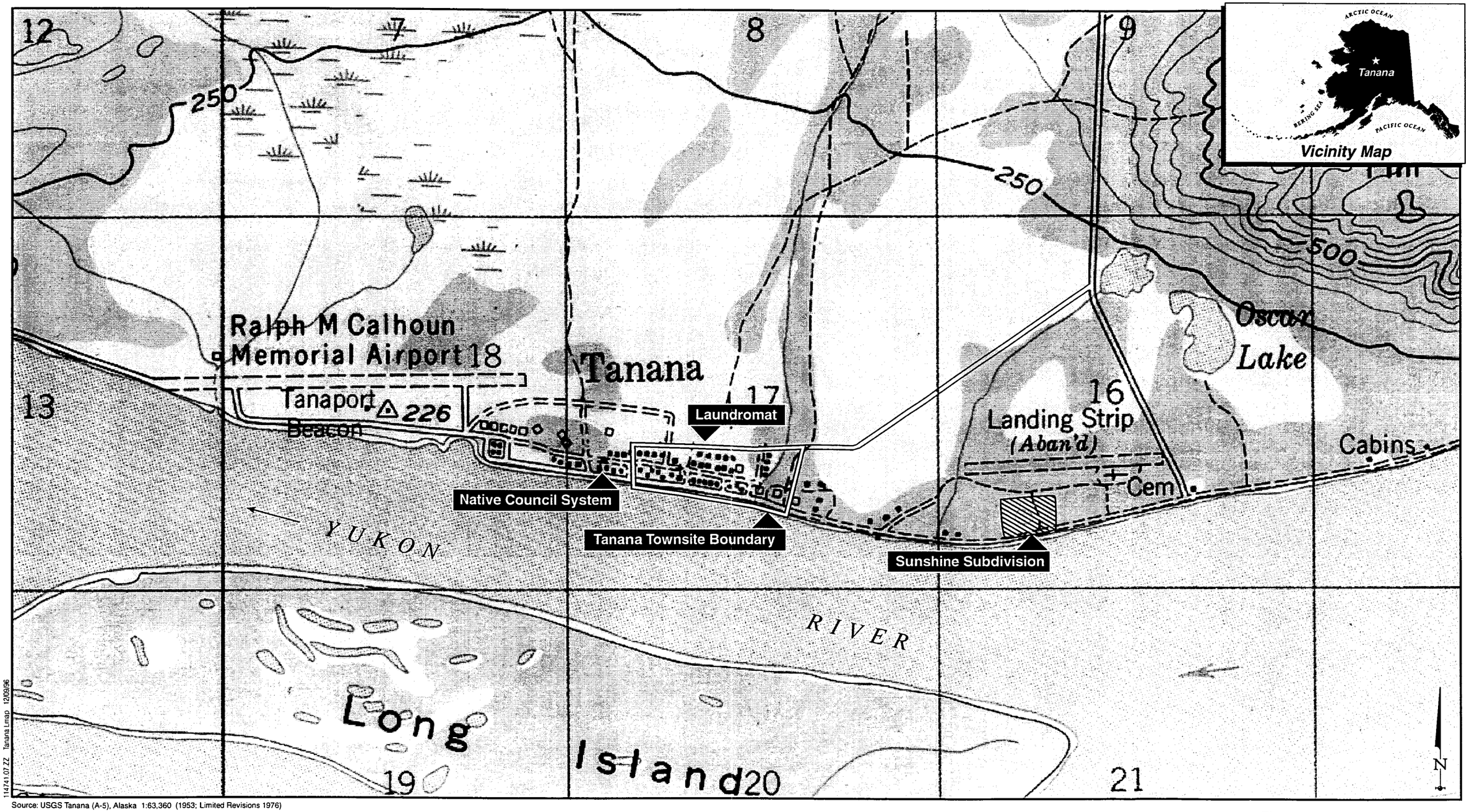
Geologic Setting

The area surrounding Tanana is surrounded by gently rolling terrain characteristic of the Yukon River valley. Peaks of the Ray Mountains are to the north of Tanana. Schist, sandstone, siltstone, claystone, and shale underlie the community at depths of 35 to 140 feet but most regularly at depths of 50 to 60 feet.

Soils in the vicinity of the community consist of 5 to 15 feet of silt, sandy silt and silty sand overlying gravel sediments, which exist from depths of 35 to 70 feet.

Tanana lies at the northernmost extent of the discontinuous permafrost zone. The town is generally underlain by permafrost 35 to 65 feet thick, but permafrost is likely to be absent in areas adjacent to the Yukon River. Seasonal frost has been reported to depths of 20 feet.

The main community area is generally elevated above the floodplain of the Yukon River, and soils are well drained. There is a wetland area north of the town.



Source: USGS Tanana (A-5), Alaska 1:63,360 (1953; Limited Revisions 1976)

114741 07 ZZ Tanana Lmap 12/09/96

Figure 2-1

Location Map
Too'gha, Inc. and VSW
Water and Sewer Feasibility Study

Flood Hazard

The U.S. Army Corps of Engineers Flood Plain Management Service Branch rates the flood hazard potential at Tanana as low, with flooding capable of inundating 10 percent of the community occurring less often than once in 100 years. There is some river erosion described by the Corps as "slight." According to residents, a flood inundated the community in the 1930s. Also, the road between the townsite and Sunshine Subdivision is subject to flooding.

Seismic Hazard

Tanana is in a seismic zone 3, where major structural damage can be expected from earthquakes measuring greater than 6.0 on the Richter scale.

Flora and Fauna

The following information is from the PHS *Project Summary for Project AN-90-30* (1990).

> Tanana's vegetation consists of upland spruce-hardwood forest. This is a fairly dense forest of white spruce, birch, aspen, and balsam poplar, with black spruce replacing white spruce in poorly drained areas and north-facing slopes. High bush cranberries, raspberries, lingonberries, currants, grasses, and mosses are among the important plants of the area; willows, roses, and fireweed also grow in the area.
>
> Moose may concentrate along the riverbank near Tanana, but generally the upland spruce-hardwood forest supports few animals. The red squirrel and pine marten are exceptional in being able to meet all their habitat requirements in this single environment. Shrews, bats, voles, porcupine, fox, bear, lynx, and weasel are among the other animals identified with the area.
>
> Tanana is in a medium density waterfowl range and the Yukon River harbors significant runs of salmon as well as grayling, pike, and other fish.

Economy

Fully 75 percent of the full-time jobs in Tanana are with the City, school district, or Native Council. Fire-fighting, trapping, and commercial fishing are important seasonal cash sources. There are only a few state and federal positions (Alaska Department of Community and Regional Affairs [ADCRA] 1994).

Condition of Existing Water and Sewer Systems

The residents of Tanana are served by several different water and sewer systems (Figure 2-2):

- The Native Council water system, originally built to service the PHS hospital compound, includes a well; water treatment plant; a 60,000-gallon buried concrete water storage tank; and a distribution system that serves the school and teacher housing, the

clinic, the elders' residence, and the Native Council offices. This system can be used as a backup to the City system.

- The City system, originally built in 1979, consists of a Laundromat, two wells, water treatment plant, and a circulating water system serving the Head Start building, fire station, power plant, and city offices.
- Miscellaneous wells serve individual homes and the FAA housing area.
- Miscellaneous springs and the Yukon River are used at various times of the year.
- Miscellaneous outhouses serve individual homes and commercial structures.
- A dual-cell sewage lagoon serves the Native Council and City water systems and the Laundromat. The lagoon is drained annually through a buried effluent line to a leach field near the river.

The existing facilities are either aging and constructed using what would now be considered outdated technology, are no longer in compliance with state regulations, or are generally considered unacceptable by the residents of Tanana. Some of the known problems with existing facilities include the following:

- The community water wells are typically low-production wells with water quality characterized by high concentrations of iron. The wells may also be influenced by surface water. The City wells go dry each spring for approximately one month. The Laundromat and watering point close, and residents obtain water from the Native Council.
- The buried water and sewer pipes within the community do not meet current standards for materials and construction and have been subject to periodic freezeups.
- The Laundromat's foundation has been damaged by spring runoff and needs to be replaced. The Laundromat's treatment plant is not providing treatment for iron, and the operation of the plant needs to be simplified.
- Residents worry that seepage from honey bucket dump sites and outhouses will contaminate the groundwater.
- Some residents report a year-round odor problem from the lagoon and would like to see the lagoon relocated away from the center of the community.
- The lagoon effluent pipe and leachfield have reportedly been damaged and need to be inspected and repaired or replaced.
- The lagoon water level control structure valves are reportedly no longer operational.
- The lift stations have experienced pump control problems, do not comply with current standards, and are in general need of upgrading or replacement.

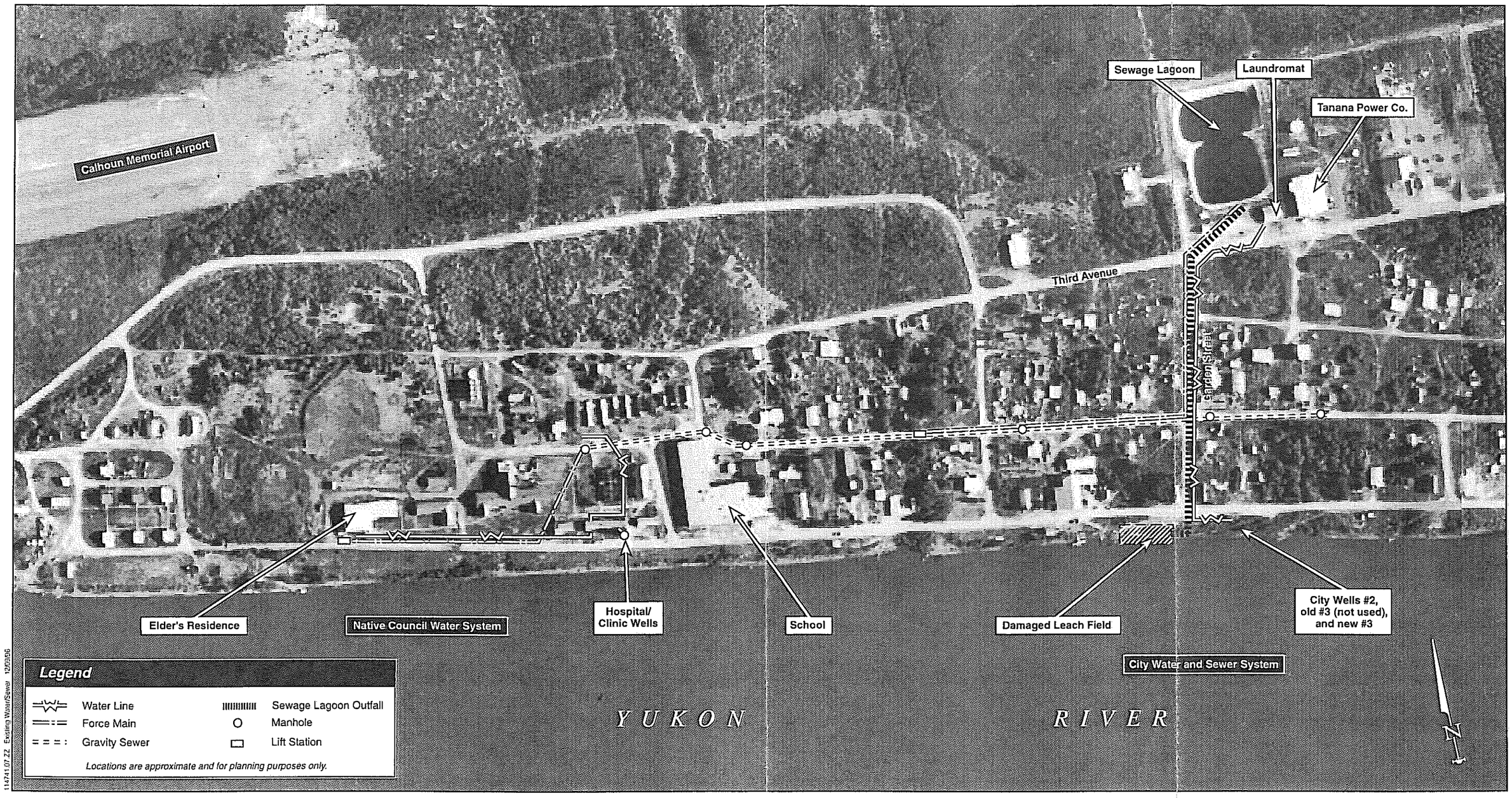


Figure 2-2

Existing Water and Sewer Systems
Too'gha, Inc. and VSW
Water and Sewer Feasibility Study

Objectives of this Study

This water and sewer feasibility study for Tanana has the following objectives:

1. To identify and evaluate alternative water and sewer systems
2. To present estimates of capital and operational costs for community water and wastewater system alternatives
3. To present alternatives to Tanana residents through a public involvement process
4. To recommend a water and sewer system on the basis of community input and engineering analysis
5. To provide a conceptual design of a new water treatment plant

These objectives will be addressed in subsequent sections of this plan. In addition to these objectives, the report also includes a Land Status chapter prepared by Robert S. Means of Alaska Department of Community and Regional Affairs and Nina Miller of Too'gha, Inc.

SECTION 3

Planning and Analysis Assumptions and Local Conditions

Introduction

The section outlines the design and analysis assumptions underlying the comparison of water and sewer system alternatives in Section 6.

Planning Period

The planning period is 20 years. Construction is anticipated in 1996. The planning period for this study will extend to the year 2016.

Population Projections

The BIA Juneau Area Transportation Plan provides a community profile for the rural communities of Alaska. This source states that in 1988 Tanana's population was 415. The BIA's projected population for the City is shown in Figure 3-1. Using the BIA data, the projected populations for the years 2000 and 2010 are 583 and 692, respectively. Extrapolating this data out to 20 years, the projected population for the year 2016 is 757.

The U.S. Census Bureau collects population data every 10 years throughout the country. The 1990 census reported that Tanana's population was 345 and that there were 169 housing units, 123 of which were occupied. These data are also shown in Figure 3-1.

The ADCRA community profile for Tanana dated September 23, 1994, reports historical census data for 1990, and a 1994 population of 374. Mr. Greg Williams, demographer for the Alaska Department of Labor, reported that the ADCRA's 1994 figure was really the 1993 revenue-sharing population, which he said was 344. In other words, Tanana's population hasn't varied much in 30 years, and, if these data are projected to the year 2016, the population of Tanana will be approximately the same as it is today.

Mr. Williams said that there is a connection between availability of employment and population. Population growth will not exceed the availability of jobs, and the lack of jobs could provide incentive for people to leave Tanana. It was Mr. Williams' opinion that the BIA study did not take this factor into account in its projections.

The population will not grow unless there are economic projects that provide more employment opportunities in Tanana. A reliable community water and sewer system would be part of the infrastructure required to support needed economic growth.

For purposes of this study, the design population for the year 2016 will be assumed to be 540. This figure assumes a population growth of 200 people. Any population growth will be contingent on new employment opportunities becoming available in Tanana. Tanana is

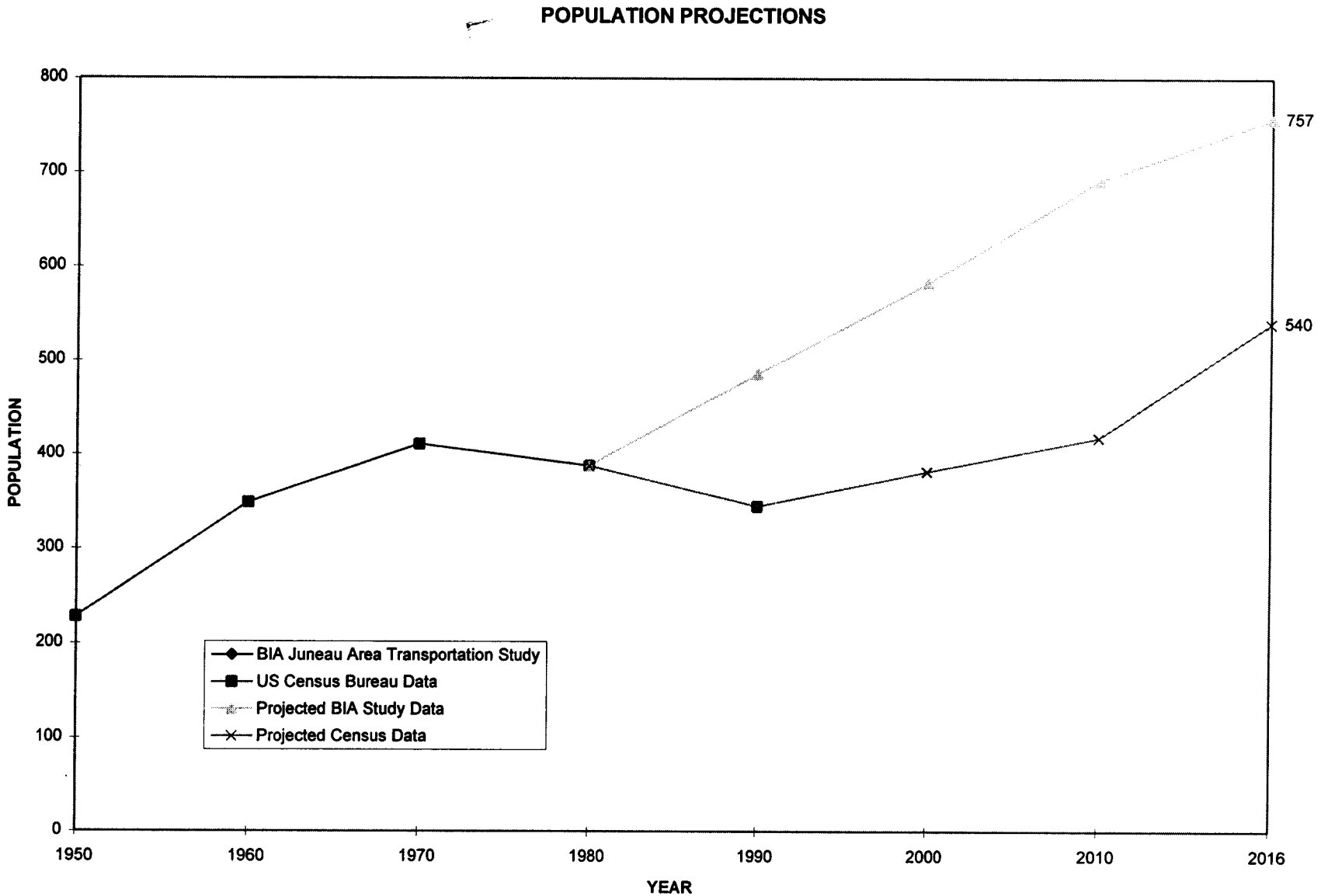


Figure 3-1
Population Projections
Too'gha, Inc. and VSW
Water and Sewer Feasibility Study

pursuing opportunities in tourism and believes a new water and sewer system will help support these endeavors.

Water Consumption

Water consumption demand will vary according to the type of sanitation facilities ultimately selected by the community. The following water consumption rates were derived from the *Cold Climate Utilities Manual* (Smith, 1986) and from historical consumption data from other rural Alaskan communities.

- Self-haul – less than 5 gallons/(capita-day)
- Laundromat/watering point – 10 gallons/(capita-day)
- Small-vehicle haul system – 2 to 4 gallons/(capita-day)
- Large-vehicle haul system – 30 gallons/(capita-day)
- Piped systems (including school) – 55 gallons/(capita-day)

Local Labor Rates

The following wage rates were obtained from the City of Tanana:

- Water/Wastewater System Operator – $15/hour
- Laundromat/Watering Point Attendant – $10/hour
- Janitor – $9/hour
- Equipment Operator – $15/hour
- Carpenter – $15/hour
- Laborer – $12/hour

Power Costs

Electricity is provided by the Tanana Power Company. The current power rates are as follows:

Residential

- First 200 kWh - $0.470 per kWh
- Next 200 kWh - $0.445 per kWh
- More than 400 kWh - $0.409 per kWh

Small Commercial

- First 10,000 kWh - $0.390 per kWh
- Next 10,000 kWh - $0.376 per kWh
- More than 20,000 kWh - $0.356 per kWh

The State power equalization subsidy reduces the cost for the first 750 kWh by $0.1752/kWh. There is also a fuel surcharge subsidy of $0.0211/kWh.

Note: The rates have not changed since 1986. The same rates were published in the 1987 *Tanana Community Profile* by Fison and Associates. However, for the purposes of this study

and to account for future rate increases, a rate of $.40 per kWh will be used and the subsidy will not be applied.

Environmental Data

The following climatic data was taken from the PHS publication *Sanitation Facilities Alternatives, Sunshine Subdivision, Tanana, Alaska,* dated October 1987:

• Mean annual precipitation, inches	13
• Mean annual temperature, °F	24
• Mean annual snowfall, inches	50
• Maximum temperature recorded, °F	94
• Minimum temperature, °F	-71
• Mean January minimum temperature,° F	-18
• Mean July maximum temperature, °F	70
• Thawing index, degree days	2,500
• Freezing index, degree days	5,500
• Design freezing index, 1 year in 10, degree days	6,500

SECTION 4

Existing Water and Sewage Systems

Introduction

This section describes Tanana's existing water and sewer utility systems.

Laundromat and Water Treatment Plant

The existing Laundromat with a watering point and WTP was built with funds primarily provided by the state's VSW Program and was opened in June 1979. The facility has 10 washing machines, 6 dryers, 8 showers (4 men's and 4 women's), and men's and women's restrooms. (The men's restroom has a toilet and urinal. The women's restroom has two toilets.) It also provides residents with a source of treated water for home use and is the water source for firefighting equipment.

The building that houses the Laundromat and WTP has an all-weather wood foundation that has been badly damaged by spring runoff water. The WTP is in the basement of the building. The basement is hot, has low ceilings, and is not a pleasant place for the operators to work. Process piping has been modified over the years and has become more complicated than it needs to be. The building has inadequate ventilation. High humidity and condensation are a problem.

Wells

Many shallow wells have been drilled in Tanana. About half of the wells are in frozen soils and have marginal or unusable well yields. Records of 55 shallow water wells constructed in the immediate town vicinity are available. Most of these wells were constructed in 1967 by PHS, have an average depth of about 50 feet, are cased most of their depth with 6-inch casing and, though occasionally open-ended in an aquifer, are generally perforated in an effort to increase yield.

Preliminary pump tests from the wells with the higher yields show flow rates of up to 40 gallons per minute (gpm) and specific capacities (specific capacity = flow rate/drawdown) of 1 to about 5 gpm/ft.

Water quality tests from the higher-yield Tanana wells show relatively high alkalinity, hardness, iron, and manganese. The presence of these minerals gives the water an undesirable taste and may lead to precipitation of deposits on and around well screens, causing diminished specific capacities through time.

Three wells now provide water for the two community water systems. The City operates two wells on the Yukon River bank just east of Garden Street. The Native Council operates one well near the river in front of their water treatment plant and underground water storage tank.

For a more detailed analysis of the potential for developing a groundwater water source, see the Terrain Unit Analysis in Appendix B.

Native Council System

Water

The Native Council water system is supplied with water from a 150-foot-deep well. The water is treated and stored in a three-compartment, 60,000-gallon underground tank. The system serves the former Tanana hospital compound including the school, teacher housing, the clinic, the elder's residence, and the Native Council offices.

The system has reportedly operated dependably through the efforts of a dedicated maintenance staff. However, the well reportedly has periods of low yield when the Yukon River level drops in the late winter and early spring.

Wastewater

Wastewater from the Native Council system is collected in the City's sewer system and conveyed via two lift stations to the City's sewage lagoon. The condition of the City's sewer system is discussed under the "City System" descriptions.

City System

Water

The City system consists of two community wells (both wells are approximately 50 feet deep), a 500-foot circulating treated water loop, and approximately 1,100 feet of buried 2-inch polyethylene (PE) circulating raw water transmission line from the well to the water plant. The PE line is sliplined through, and replaces, a ductile iron pipeline that froze in 1990. The PE line froze in March 1996. The City water loop serves the City offices, fire house, Head Start, Tanana Power, and several residences. Water treatment is provided in the basement of the Laundromat and includes chlorination, fluoridation, and iron removal. However, the fluoridation system was disconnected after a resident of Hooper Bay died from a fluoride overdose. The water softener that removed iron is not operational.

Wastewater

More than 90 percent of the houses in Tanana use honey buckets and outhouses for wastewater disposal. Many households dispose of their gray water by dumping it on the ground. A combination gravity sewer and force main extends from the elders' residence to the sewage lagoon adjacent to the Laundromat. There are approximately 5,000 feet of gravity sewer mains, 3,200 feet of sewer force mains, two lift stations, and a two-cell lagoon. This system provides sewer service for the Laundromat, health clinic, elders' residence, Native Council offices, the school and teacher housing, Federal Aviation Administration (FAA) complex, City buildings, one privately owned store, and several residences.

The lift stations have experienced pump control problems, and the shelters located above the lift station wet wells have low ceilings and do not provide adequate space for operation and maintenance activities.

The two-cell sewage lagoon was completed in 1986 and was sized for 8 months of hydraulic storage at 14,000 gallons per day sewage flow. Some residents have reported odor problems from the lagoon.

Effluent flow from the lagoon is seasonally discharged by gravity through a heat-traced effluent line to a drainfield below the riverbank. The drainfield has been damaged and is reported to be inoperable. There are also operational problems with the valves on the lagoon level control device.

SECTION 5

Land Status

This section was prepared by Robert S, Means, Natural Resources Manager of the Municipal Land Trustee Program, Alaska Department of Community and Regional Affairs; and Nina Miller, Land Examiner, Too'gha, Inc.

Introduction

It is a fundamental rule of real property law that "title always vests"; that is, land is always owned by someone. It is also fundamental that a landowner enjoys the exclusive right to make improvements (within certain limits) on his land. Put another way, someone planning to build a project must acquire the land or an interest in the land and thereby demonstrate ownership. The purpose of this chapter is to review the status of land ownership in Tanana in anticipation of the construction of the water and sewer system described in the previous chapters. This chapter also describes various land transactions that might be necessary depending on the scope of the final project design.

Real Property Law

Source of Land Title

The source of land title in Alaska begins with the United States government. Title to any piece of land can be traced backwards through each previous owner to the federal government. The Bureau of Land Management (BLM) is the agency chiefly responsible for administering and managing these public lands. Through a variety of federal public land laws, land in Tanana has been transferred to the State of Alaska, the City of Tanana, ANCSA Native Corporations, Native Allottees, Homesteaders and other kinds of applicants. The federal government also reserves or withdraws land for its own use, most commonly by means of a Public Land Order. Some examples include national parks, military withdrawals and Public Health Service withdrawals.

BLM keeps records of the land it retains and of the land it has conveyed to third parties, but does not record what happens to the land after that. The federal land records are the starting point for researching land status in Tanana. Once land is conveyed from the federal government to a third party, the State of Alaska's recording office system is used. In this system, land transfer documents are "recorded" so that the public is given constructive notice of a land transfer or other transactions affecting real property. Both the federal and state systems were used to prepare this chapter.

Types of Land Title

The following list describes some common terms used in discussions of real property:

- Fee Simple–A complete set of all the interests and rights in land that can be transferred from one party to another.
- Less than Fee–A partial interest or estate in the land such as the surface estate, which is an interest or ownership in the surface of the land and everything of value upon it. Subsurface estate is interest or ownership in the land below the surface and everything of value therein.
- Patent–The original title document from the federal (or state) government conveying *surveyed* land.
- Interim Conveyance or IC–A title document issued to a Native corporation by BLM to show proof of land ownership until a survey can be done and a patent issued.
- Deed–Legal document used to convey title to property. A quitclaim deed conveys only the interest(s), if any, which the owner, or grantor, has. A warranty deed incorporates an enforceable guarantee that the grantee is getting good title.
- Lease–The exclusive right to use a parcel of land for a specific use for a specific period of time.
- Easement–A right to use (for a specific purpose) land that is owned by someone else, often used interchangeably with right-of-way. An easement can be created by dedication on a survey plat, by an express grant in an easement document or by reserving an easement in a conveyance document. Easements are typically perpetual.
- Permit–Revocable permission to do something on or to occupy land, usually temporarily.
- Probate–A judicial process validating a will and consequently deciding the ownership of property.
- Lien–A right to take property to satisfy taxes or an unpaid debt incurred by the owner. A well driller may file a lien against a property if the owner fails to pay for the driller's services.
- Encumbrance, Restriction, Covenant or Reservation–A condition that limits or narrows the rights of the landowner or requires the landowner to perform certain acts. A restricted townsite lot or a Native Allotment is not taxable and may be sold only with the approval of the Tanana Native Council acting on behalf of the Bureau of Indian Affairs (BIA). The interim conveyance to Tozitna, Ltd. contains a covenant requiring the corporation to convey some land to the City of Tanana under Section 14(c)(3) of the Alaska Native Claims Settlement Act (ANCSA). One of the patents to Tozitna, Ltd. reserves an existing road for continued public access across corporation land.
- Quiet Title Action–A judicial process that examines conflicting land title claims and establishes title to a parcel in one of the claimants by court order.

In examining title to real property, it is critical to account for the specific factors that affect a parcel of land. Authenticating the ownership interests in land will ensure that subsequent site control transactions are based on good clear title. Bank financing, where land is used as collateral, requires clear title. Likewise, major investments in capital improvement projects require clear title.

Transfers of Land

Title to real property can be transferred, or conveyed, in many ways. Buildings and other permanent improvements attached to the land are considered part of real property and are transferred along with the real property, unless the improvements are specifically excluded. To be valid, a transfer must be in writing. A written document must state the parties involved in the transfer, include a description of the land being transferred, describe what interest(s) in the land is being transferred, be for valuable consideration (usually money), contain the appropriate signatures and be accepted by the grantee.

Sale

After land has been conveyed from the federal government, perhaps the most common method of transfer is the land sale. Both the buyer and seller must be willing participants and be knowledgeable about the terms of the sale. A quitclaim deed is the most common method of completing the transaction.

The owner of the land has the right to grant a utility easement across the property or to enter into a service line agreement that provides water and sewer hook-up from the main lines to the dwelling.

Exchange

A land exchange is a variation of a land sale. However, instead of money the buyer gives the seller land (valuable consideration). Money can also be used to equalize the value of the parcels being exchanged. The terms of an exchange are spelled out in a land exchange agreement signed by both parties. The terms of an exchange should include a description of the lands being exchanged, a statement defining which party is responsible for any survey costs and dates by which each party is required to complete its part of the transaction.

ANCSA 14(c)

Section 14(c) of the Alaska Native Claims Settlement Act provides that when a village corporation like Tozitna, Ltd. receives title to land from the federal government, it must then convey title to certain occupants and organizations with valid claims to the land. Under 14(c)(1), Tozitna, Ltd. must convey to any occupant, without consideration, title to the tract of land occupied as of December 18, 1971 as a personal place of residence or business, as a subsistence campsite or a headquarters for reindeer husbandry. The size of the claim and what constitutes use and occupancy are matters for Tozitna, Ltd. to decide. Non-profit organizations, under 14(c)(2), are entitled to the tract occupied as of December 18, 1971, either with or without consideration. Under 14(c)(3), improved land, land for community expansion, rights of way for public use and land for foreseeable community needs must be conveyed to the municipal government in Tanana. 1,280 acres must be

conveyed, unless the city and the corporation agree in writing to less. Section 14(c)(4) involves airports and doesn't apply in Tanana since the State of Alaska had already acquired title to the Ralph Calhoun airport by 1971.

Eminent Domain

The City of Tanana has the power to condemn private property for public purposes and acquire the land only after paying fair market value. State law in Alaska Statute 29.35.030 describes the procedures the city must follow. This is a judicial proceeding that is used in exceptional cases where negotiation to acquire land needed by the public has otherwise failed.

Donation

A common method of acquiring land for a public purpose is by donation. For some landowners, there is a strong incentive to donate land if the project serves a public purpose.

Recording

Recording is not a means of transferring land or making a transfer legal; it is a means of giving legal notice to the world that a land transfer, or any other transaction affecting land, has taken place. As such, it protects subsequent bona fide purchasers of property from the unknown, unrecorded interests of others. A deed may be valid if it is not recorded, but an invalid deed cannot be validated by recording. It is up to the person recording the deed to make sure the information is accurate. Tanana is located in the Ft. Gibbon Recording District. The place of recording is 1648 S. Cushman, Suite 201, Fairbanks, AK 99701, Phone 452-3521.

Documents from the early 1900's to 1975 are bound into books and have not been microfilmed or entered into the computer system. This required paging through each volume and photocopying relevant documents.

Documents from 1975 to the present are microfilmed and available on the statewide computer system. Recording office staff provided a staff workstation and technical assistance to query the system and obtain a brief description of each transaction.

Affected Landowners

The following landowners may be affected by easement acquisition and service line hook-ups, depending on the scope of this project. This section of the chapter should be read with reference to the land status maps (Figure 5-1) and the table of property ownership (Table 5-1, at the end on this section). Every attempt has been made to accurately describe the land tenure in Tanana. However, not every recorded document was critically examined and some gaps in the chain of title do exist. Additional research is necessary to authenticate ownership.

State of Alaska, Department of Transportation and Public Facilities

The federal government conveyed the airport land to the State of Alaska by quitclaim deed dated October 1, 1965 under Sec. 45 of the Omnibus Act. A record of survey was filed on December 8, 1992 as Plat No. 92-1RS, containing 714.95 acres.

QCD
10/1/65
SoA
DOT&PF
Plat
92-1RS

F 13586
Par A
Native
Allotment
Estate of
Thomas
Swenson

Lot 3

USS 397

Eller
Subd.
Plats
81-3
81-4
83-2

Sixth Ave
Fifth Ave
Fourth Ave
Third Ave
Eamole Street
Yukon Street
Koyukuk Street

EIN100 C4
60' road
elec. & Tel.

EIN102 C4
60' road
elec. & Tel.

U.S. BLM
Selected by
Tozitna, Ltd.

Lot 2

USS
5958

Lot
11

P.H.S.

Lot
12

USS
10815

Lot 1

Adriana
P.
Parker

Lot 4

Water
Plant
and
Sewage
Lagoon

City
Shop

Ice
Rink

USS 2754 A & B

Yukon River

City of Tanana

Tozitna, Ltd.

14(c) Claims

Proposed Water Line

Proposed Sewer Line

House

Figure 5-1
Land Status Map
Sheet 1 of 3

83-2

USS 11168

Estate of
Frank Folger

Teekona Road
F-70272

Koyukuk Street

T4N, R22W, FM
Sec. 17
Lot 9

USS 10812
Lot 4

T4N, R22, FM
Sec. 16
Lot 12

T4N, R22W, FM
Sec. 16
Lot 11

U.S. BLM
Selected by
Tozitna, Ltd.

USS 11148

Estate of R. Albert

USS 4104

Center Line of
White Alice Road
EIN5FC3,C5,D9-60' Road

Sec. 17
Lot 7

Center Line of
White Alice Road

Sunshine Subd.
Plat. 89-1

Sec. 16
Lot 11

Yukon River

City of Tanana

Tozitna, Ltd.

14(c) Claims

Proposed Water Line

Proposed Sewer Line

House

Figure 5-1
Land Status Map
Sheet 2 of 3

Figure 5-1
Land Status Map
Sheet 3 of 3

USS 10812
Lot 4

Sec. 16

USS 10811
Lot 7
Estate of
Kathryn J. Dick

USS 10811
Lot 6
Alfred Grant

USS 10811, Lot 5
Estate of Marion E.
Charley John

USS 10811, Lot 4
Estate of Marion E.
Charley John

USS 10811
Lot 1
Harry Nicholia

USS 10811
Lot 2
Jimmie Rivers
Reed

Sec. 16
Lot 11

USS 10812
Lot 1
Estate of
Marion E.
Charley John

USS 10812
Lot 2
William Carlo
Jachetta

USS 10812
Lot 5
Estate of
Hardy Allen
Peters

Charles L.
Wareham

USS
5203

Robert W.
Mitchell Jr.

USS
5234

EIN
1aC1,C3,C5,D1,L
60' Road
Easement

USS 10812
Lot 4
Estate of
Lawrence Antoski

USS 10812
Lot 3
Estate of
Maudrey Sommer

USS 10812
Lot 9
Helena M. Carlo

USS 10811
Lot 3
Marion Joseph

9 4

USS 10813
Lot 1
Milton Moses

10 3

USS 1753
F86555
In Litigation
Fannie Barr
Petition
(Walter R. Carlo)

USS 10812
Lot 7
Harriet R.
McCarter

USS
10812
Lot 8
Teddy
Luke

USS 10812
Lot 6
Anna G. Barker

USS 10813
Lot 6
Wayne Nicholia

USS 10813
Lot 3
Susie Nicholia

USS
10813
Lot 2

Wayne Nicholia

21 11
1 10
13 7
1 6

TEEKONA
SUBDIVISION
77-1

BOGHON-L-AA
GEEDLIL
SUBDIVISION
83-3

2 1
3
4
5
6
10
11

YUKON
HEIGHTS
SUBDIVISION
83-1

USS
721

USS 10813
Lot 7
Native
Allotment
Application
Estate of
Linda S.
Nicholia
Evans

USS 10813
Lot 5
Estate of
Ambrose
Kozevnikoff
AA78103
In Litigation

USS 10813
Lot 4
Estate of
Ambrose
Kozenvikoff
Native
Allotment
Application

10 3

T4N, R22W, FM
11 2

Tozitna, Ltd.

Scale: 1"=1000'

Contact: Homer Doty
Department of Transportation & Public Facilities
2301 Peger Rd.
Fairbanks, AK 99709-5316
Phone: 451-5484

United States, Public Health Service

Public Land Order No. 1977, dated September 10, 1959, withdrew land for the Tanana Hospital Site and is administered by the Public Health Service. The land is now described as Lot 12 of USS 5958, containing 11.25 acres.

Contact: Paula Poncho
U.S. Public Health Service
3925 Tudor Center Dr.
Anchorage, AK 99508
Phone: 273-0157

State of Alaska, Mental Health Trust Land Authority

Lot 2 of US Survey No. 10815, containing 12.15 acres was tentatively approved for conveyance to the State of Alaska under the Mental Health Act in 1966. However, this land was subsequently selected by Tozitna, Ltd. This lot has not been conveyed from the State of Alaska to the Mental Health Trust Land Authority. BLM retains jurisdiction over this lot and is adjudicating the land interests for eventual conveyance to Tozitna, Ltd.

Tozitna, Ltd./Doyon, Ltd.

Under ANCSA, Tozitna, Ltd. received title to the surface estate and Doyon, Ltd. received title to the corresponding subsurface estate to Lot 11 of US Survey No. 5958, subject to a 60 foot easement for existing roads and telephone and electric lines (EIN 100 C4 and EIN 102 C4); Lot 7 of Block 11 of US Survey No. 2754 A and B and Lots 1, 2 and 4-12 of US Survey No. 4104, subject to a 60 foot easement for an existing road (EIN 5F C3, C5, D9). These lands are also subject to the requirements of Section 14(c) (see below - 14(c) claimants). Tozitna, Ltd. and Doyon, Ltd. can expect to receive additional land in the near future (see below - Bureau of Land Management). Doyon, Ltd., as owner of the subsurface estate, considers buried water and sewer lines an incidental use of the surface estate. Therefore, an easement for subsurface use is not required, unless gravel is moved from one location to another.

Contact: Adriana Parker, President
Tozitna, Ltd.
P.O. Box 129
Tanana, AK 99777
Phone: 366-7255

Bill Merry
Land Department
Doyon, Ltd.
201 First Avenue
Fairbanks, AK 99701
Phone: 452-4755

City of Tanana

The City of Tanana owns 9 lots in the townsite and 3 parcels in US Survey No. 397 which were purchased from J. Clifton Eller. The city office, teen center, day care center, firehall, apartments, sewage lagoon, laundromat, shop and hockey rink are on these parcels. Under Section 14(c)(3) of ANCSA, Tozitna, Ltd. is required to convey certain land to the city for

community expansion, rights of way for public use and for other foreseeable community needs. This requirement has not been completed and it appears that some land needed for this project could be identified under 14(c)(3) for eventual conveyance to the city.

Contact: Donna Folger, Mayor
City of Tanana
P.O. Box 77249
Tanana, AK 99777
Phone: 366-7159

United States, Bureau of Land Management

The Bureau of Land Management retains jurisdiction over Lot 3 of US Survey No. 4104; Lots 1, 2, and 4 of US Survey 10815; and those portion of Sections 16 and 17 of T4N, R22W, FM, excluding US Survey Nos. 4104, 11148,11168 and 10812. BLM is adjudicating these lands for eventual conveyance to Tozitna, Ltd. and Doyon, Ltd. The conveyance to Tozitna, Ltd. could come as early as February 1997 (except for Lot 3 of US Survey No. 4104, which Tozitna, Ltd. has requested not be conveyed until the oil contamination is cleaned up).

Contact: Liz Sherwood
Bureau of Land Management
222 W. 7th Ave. #13
Anchorage, AK 99513
Phone: 271-3233

Native Allotments

A certificate of allotment was issued to the estate of Frank Folger for US Survey No. 11168, containing 39.97 acres and to the estate of Ralph Albert for US Survey No. 11148, containing 19.98 acres. The parcels are not taxable and are inalienable (can't be sold or taken to satisfy a judgment) without the approval of the Tanana Native Council, acting on behalf of BIA. There are 24 other native allotments within 3 miles of Tanana.

Contact: Gerald Nicholia
Realty Specialist
Tanana Native Council
P.O. Box 77093
Tanana, AK 99777
Phone: 366-7160

Tanana Townsite

The federal townsite was surveyed in 1957 as US Survey No. 2754 A and B. The 131 lots range in size from 2,754 sq. ft. to 32,656 sq. ft. By 1962, the townsite trustee had issued 138 deeds (6 restricted deeds) to all of the lots. Since that time, there have been numerous land transactions, both recorded and unrecorded. After talking with Tanana landowners, searching local files, and thoroughly searching the recording office, we believe that of the approximately 92 lots with houses on them (a total of 101 houses), about half involve questions of land title and will require further research or corrective action.

14(c)(1) Claimants

Under Section 14(c)(1) of ANCSA, individuals who occupied a tract of Tozitna, Ltd. land as their primary place of residence, business or subsistence campsite as of December 18, 1971 are entitled to a deed from Tozitna, Ltd. At this time, Tozitna, Ltd. has decided to approve 12 applications, while three additional applications require probate proceedings, and two others await further action by Tozitna, Ltd. (they are on land selected by, but not yet conveyed to, Tozitna, Ltd.). Once these lots are surveyed by BLM, Tozitna, Ltd. can issue deeds to the claimants. These claims are within Lots 2 and 4-9 of US Survey No. 4104, Lot 11 of US Survey No. 5958, a portion of Section 16 of T4N, R22W, FM, and will be subject to an existing 60 foot road easement.

Contact: Adriana Parker, President
Tozitna, Ltd.
P.O. Box 129
Tanana, AK 99777
Phone: 366-7255

Interior Region Housing Authority

The Interior Region Housing Authority (IRHA) constructed 14 houses in the Sunshine Subdivision (Plat No. 89-1) under the terms of a land exchange agreement with Tozitna, Ltd., which was recorded on Dec. 2, 1981 in Book 6, Pages 892-900. The subdivision streets are dedicated to public use and can be used to bury water and sewer lines. Under the terms of the agreement, Tozitna, Ltd. agreed to convey 14 lots in the Sunshine Subdivision to IRHA for 14 lots IRHA had acquired in the Eller Subdivision. IRHA has conveyed 14 lots it had owned in the Eller Subdivision to Tozitna, Ltd., but not all parts of the agreement have been satisfied. The parties need to completely satisfy the terms of the agreement in order for title to eventually be conveyed to the individual homebuyers.

Contact: Dene Sommer
Interior Regional Housing Authority
1514 Cushman St.
Fairbanks, AK
Phone: 452-8315

Eller Subdivision

US Survey No. 397 is located immediately north of the townsite and is owned, except as noted herein, by J. Clifton and Paula Eller. The Eller Subdivision (Plat no. 81-3), the First Addition (Plat no. 81-4) and the Second Addition (Plat no. 83-2) created 25 lots of 20,000 square feet or larger. The streets, which form a natural extension of the townsite streets, are dedicated for public use. Almost all of the lots have been conveyed to third parties. Under the terms of the land exchange described above, Tozitna, Ltd. received title to Lots 1 - 14 from the Interior Region Housing Authority. Lots 1 and 12 have since been conveyed to third parties.

Tanana Power Company

The existing power and telephone lines enjoy easements throughout much of Tanana. It will be necessary to work with the power company if distribution lines are routed along the same corridor.

Distribution Lines

Townsite Streets

The streets in the Tanana townsite have their origin in the survey of the townsite in 1957. Lots, blocks and roads were all designed around existing improvements and established uses. When the townsite survey plat was officially filed, it had the legal effect of dedicating the streets for use as roads and utilities. No further action is needed to establish site control for the distribution lines within the townsite as long as the lines are located within the dedicated streets.

East Street has not been developed and a house now encroaches into the street.

Service Lines

A service line is a water and sewer hook-up from the main distribution line to a dwelling. By its nature a service line crosses private property. The property owner, therefore, must give permission for the installation of the service line. That permission is in the form of a Right of Entry and Service Line Agreement (Appendix F). The agreement obligates each party to perform maintenance on the system. The owner of each dwelling would be required to sign an agreement with Too'gha before receiving water and sewer service. Too'gha should determine what degree of title each owner must demonstrate to be eligible for service.

Right of Way and Land Acquisition

Acquiring land and interests in land for this project will be based on the final design of the project. Conversely, the final design may be significantly influenced by the existing land ownership patterns in Tanana. Too'gha, as a public utility, possesses the authority to acquire (and dispose of) real property and interests in real property necessary for the construction, operation and maintenance of this water and sewer project. For major capital improvement projects like this one, it is best, if possible, to acquire fee simple title to the water treatment plant and sewage lagoon and perpetual easements for the main water and sewer lines. At a minimum, Too'gha should acquire a leasehold interest in the land that gives it the exclusive right to use the property for the expected life of the project - 30 years.

Water Treatment Plant

The existing water treatment plant and laundromat are on land owned by the City of Tanana. Too'gha should acquire fee simple title to or a lease for the property from the city. If a new well and water treatment plant are constructed in a different location, site control will have to be acquired from the appropriate landowner.

Sewage Lagoon

The existing sewage lagoon is located on the same parcel as the water treatment plant and is owned by the City of Tanana. Too'gha should acquire either fee simple title or a lease to the property from the city.

Distribution Lines

The streets within the Tanana townsite are dedicated for public use and may be used to place water and sewer main lines. No additional easement acquisition is required. Outside of the townsite, the proposed distribution lines cross parcels belonging to 4 landowners: the Public Health Service, the City of Tanana, BLM (validly selected for conveyance to Tozitna, Ltd.) and Tozitna, Ltd., subject to 10 valid 14(c)(1) claims. A 30 foot utility easement could be included in the 14(c) map of boundaries and resulting survey plat where it crosses the 14(c)(1) claims. Alternatively, Too'gha could acquire an easement from each of the individuals separately.

Service Lines

Service line agreements will be needed with each lot owner. A sample is attached as Appendix F. Too'gha should decide what constitutes an acceptable level of title before signing an agreement with a lot owner.

Corrective Actions

It may be necessary for an owner to take corrective action where probate is not complete, where conflicts exist or where the title is clouded. About 51 lots, with houses on them, fall into this category. The remedy may be for the individual to simply obtain an appropriate quitclaim deed(s) so that clear title is vested in the rightful owner. The parties should obtain a legal review of the transaction to protect their respective interests.

In cases where title to a lot is very clouded, it may be necessary for the individual to file an action to quiet title to the lot. This judicial process requires the services of a lawyer. The decision to pursue this course of action should be made by the individual.

Table 5-1
Table of Property Ownership

TITLE	USS#	PLAT#	BLK#	LOT#	GRANTEE(S)	HOUSE
C	397				Eller, J. Clifton, Sr. and Paula E. Eller	
C	397			M/B	Parker, Adriana B.	Y
C	397	81-3		1	Butler, Glenn S.	Y
C	*397*	*81-3*		*2*	*Tozitna, Ltd.*	
C	*397*	*81-3*		*3*	*Tozitna, Ltd.*	
C	*397*	*81-3*		*4*	*Tozitna, Ltd.*	
C	*397*	*81-3*		*5*	*Tozitna, Ltd.*	
C	*397*	*81-3*		*6*	*Tozitna, Ltd.*	
C	397	81-3		7	Tozitna, Ltd.	
C	*397*	*81-3*		*8*	*Tozitna, Ltd.*	
C	*397*	*81-3*		*9*	*Tozitna, Ltd.*	
C	397	81-3		10	Kozevnikoff, Aaron	
C	*397*	*81-3*		*11*	*Tozitna, Ltd.*	
C	*397*	*81-3*		*12*	*Tozitna, Ltd. (Adele Grant's House)*	*Y*
C	397	81-3		13	Grant, Adele (House is on Lot 12)	
C	*397*	*81-3*		*14*	*Tozitna, Ltd.*	
C	*397*	*81-3*		*15*	*IRHA*	
C	*397*	*81-3*		*16*	*Eller Subdivision /J. Clifton Eller*	
C	397	81-4		17	IRHA	
C	397	81-4		18	IRHA	
C	397				Tanana, City of (Sewage Lagoon)	Y
C	397	82-2		"B"	Tanana, City of (City Shop)	Y
C	397	82-2		"C"	Tanana, City of (Ice Rink)	
C	397	83-2		19	Tamai, Sandor Alex	Y
C	397	83-2		20	Tozitna, Ltd.	Y
C	397	83-2		21	Eller Subdivision/ J. Clifton Eller	
C	397	83-2		22	Bowen, Patricia Jean & David Bruce	Y
U	397	83-2		23	Scharf, Marty	Y
C	397	83-2		24	Moore, Patrick	Y
U	397	83-2		25	Rychta, Christian	Y
C	*721*	*77-1*		*1*	*Tozitna, Ltd*	
C	2754A&B		1	1	Johnson, Robert Howard, Jr.	
U	2754A&B		1	2	Greenway, John	
C	2754A&B		1	3	Benson, Richard Lionel	
C	2754A&B		1	4	Johnson, Robert Howard, Jr.	
C	2754A&B		1	5	Campbell, Charles S./Althoff, Ruth D.	Y
C	2754A&B		1	6	Johnson, Robert Howard	
C	2754A&B		1	7	Joseph, Benjamin, Sr., Heirs of (9 listed)	Y
C	2754A&B		1	8	Antoski, Mary Louise	
C	2754A&B		1	9	Wallace, Georjeana	Y
C	2754A&B		1	10	King, John D.	
C	2754A&B		1	11	Johnson, Robert Howard	
C	2754A&B		1	12	Hyslop, Floyd E., Heirs of (6 listed)	Y
C	2754A&B		1	13	Hyslop, Floyd E., Heirs of (6 listed)	Y
C	2754A&B		1	14	Johnson, Robert Howard	
C	2754A&B		2	1	Johnson, Robert Howard, Jr.	
C	2754A&B		2	2	Jonhson, Barbara Jean	
C	2754A&B		2	3	Dick, Arland & Zelma	Y
C	2754A&B		2	4	Ballard, Donald O.	
U	2754A&B		2	5	Nicholia, Milton L., Heirs of	Y
C	2754A&B		2	6	Hardesty, B.W. and M.V.	
C	2754A&B		2	7	Greenway, Darrell J./Greenway, Connie S.	Y
C	2754A&B		2	8	Starr, Jacob	Y
U	2754A&B		2	9	IRHA	Y
C	2754A&B		2	10	Ella, Madeline A.	Y
C	2754A&B		3	1	McDonald, R.D.	
C	2754A&B		3	2	McDonald, R.D.	

Table 5-1
Table of Property Ownership

TITLE	USS#	PLAT#	BLK#	LOT#	GRANTEE(S)	HOUSE
C	2754A&B		3	3	Johnson, Robert Howard, Jr.	
C	2754A&B		3	4	Johnson, Robert Howard, Jr.	
C	2754A&B		3	5	Benson, Richard Harry	
C	2754A&B		3	6	Tanana, City of	Y
C	2754A&B		3	7	Hardesty, B.W. and M.V.	
C	2754A&B		3	8	Johnson, Robert Howard	
C	2754A&B		3	9	Tanana, City of	
C	2754A&B		3	10	Tanana, City of	Y
C	2754A&B		3	11	Huntington, John	
U	2754A&B		3	12	Edwin, Lee, Heirs of	Y
C	2754A&B		3	13P	Hyslop, Annie/Hyslop, Tyler Thomas	Y
U	2754A&B		3	13P	Hyslop, Annie/Hyslop, Tyler Thomas	
U	2754A&B		3	13P	Hyslop, Annie/Hyslop, Tyler Thomas	
U	2754A&B		3	14	Albert, Jimmy, Heirs of	Y
U	2754A&B		3	15	John, Lige H., Heirs of	Y
U	2754A&B		3	16	IRHA	Y
C	2754A&B		3	17	Johnson, Donald	Y
U	2754A&B		4	1	IRHA	Y
C	2754A&B		4	2	Roberts, Josephine	Y
C	2754A&B		4	3W	Kokrine, Marvin B.	Y
C	2754A&B		4	3E	Estes, Clarence L.	
C	2754A&B		4	4	Howard Rock Foundation	
U	2754A&B		4	5	Kennedy, Mary P., Heirs of	Y
C	2754A&B		4	6N	Roberts, Josephine	
C	2754A&B		4	6S	Kokrine, Effie	
C	2754A&B		4	7	Sam, William O. & Janice	Y
C	2754A&B		4	8	Tanana, City of	Y
C	2754A&B		4	9	Grant, Alfred, Jr.	Y
C	2754A&B		4	10	Kozevnikoff, Eileen	Y
C	2754A&B		5	1	Johnson, Robert Howard	
U	2754A&B		5	2	Dick, Esias, Heirs of	
C	2754A&B		5	3	Folger, Russell C.	
C	2754A&B		5	4	Folger, Andrew J.	Y
U	2754A&B		5	5	Folger, Donna M.	Y
C	2754A&B		5	6	Delay, Ronald E.	Y
C	2754A&B		5	7	Tanana City School District	Y
U	2754A&B		5	8	John, Lige H., Heirs of	Y
U	2754A&B		5	9	Nicholia, Peter P., Heirs of	Y
U	2754A&B		5	10	Starr, Deanna	Y
C	2754A&B		5	11	Meyburg, Peter	Y
U	2754A&B		5	12E	Joseph, Percy?	Y
C	2754A&B		5	12W	Folger, James R.	Y
U	2754A&B		5	13	Joseph, Marian	
U	2754A&B		5	14	Folger, William, Sr., Heirs of	Y
C	2754A&B		6	1	Meyburg, Peter	
C	2754A&B		6	2	Miller, Mary Ellen	Y
U	2754A&B		6	3	Nicholia, Hudson, Heirs of	
C	2754A&B		6	4	IRHA	Y
C	2754A&B		6	5	Henning, Gerald L./Henning, Suzanne L.	Y
C	2754A&B		6	5E	IRHA	
C	2754A&B		6	6	Eller, Ralph E.	Y
C	2754A&B		6	7	Thompson, Morris	
C	2754A&B		6	8	Thompson, Morris	
C	2754A&B		6	9	Yukon-Koyukuk School District	Y
C	2754A&B		6	10	Thompson, Morris	Y
U	2754A&B		6	11	Nicholia, Walter, Heirs of	Y
C	2754A&B		6	12	Evans, Linda Starr	Y

Table 5-1
Table of Property Ownership

TITLE	USS#	PLAT#	BLK#	LOT#	GRANTEE(S)	HOUSE
C	2754A&B		6	13	Folger, Elizabeth & Swenson, Thomas, Heirs of	Y
U	2754A&B		6	14	Nicholia, Hudson, Heirs of	Y
C	2754A&B		6	15	Gaede, Elmer E.	
C	2754A&B		6	16	Folger, Judy Ellen	Y
C	2754A&B		7	1	Roberts, Josephine B./Roberts, Julie M.	Y
C	2754A&B		7	2	Protestant Episcopal Church in the U.S.A, Domestic and Foreign Missionary Society of the	Y
C	2754A&B		7	3	Protestant Episcopal Church in the U.S.A, Domestic and Foreign Missionary Society of the	
U	2754A&B		7	4	Terry's, Inc.	Y
C	2754A&B		7	5	Tanana, City of	Y
U	2754A&B		7	6	Bidzy ta hot'aana Corporation	Y
C	2754A&B		7	7	Catholic Bishop of Northern Alaska, a Corporation Sole	Y
C	2754A&B		7	8	Catholic Bishop of Northern Alaska, a Corporation Sole	Y
C	2754A&B		7	9	Catholic Bishop of Northern Alaska, a Corporation Sole	
C	2754A&B		7	10	Tanana, City of	Y
C	2754A&B		7	street	City of Tanana	Y
C	2754A&B		7	11	Tanana, City of	Y
U	2754A&B		8	1	Ella, David, Heirs of	Y
C	2754A&B		8	2	Protestant Episcopal Church in the U.S.A, Domestic and Foreign Missionary Society of the	
C	2754A&B		8	3	Erickson, Dale & Cynthia	Y
U	2754A&B		8	4	Edwin, Marian (and Louise Antoski?)	Y
C	2754A&B		8	5	Erickson, Dale & Cynthia	Y
C	2754A&B		8	6W	Burkett, Jake A.	
C	2754A&B		8	6E	Burkett, Jake A.	Y
C	2754A&B		8	7	Protestant Episcopal Church in the U.S.A, Domestic and Foreign Missionary Society of the	
C	2754A&B		9	1E	Arctic Missions Inc.	
U	2754A&B		9	1W	Starr, Allen, Heirs of	Y
C	2754A&B		9	2	Arctic Missions Inc.	Y
C	2754A&B		9	3	IRHA	Y
U	2754A&B		9	4	Swenson, Pauline	
C	2754A&B		9	5	Blair, Elizabeth	
C	2754A&B		9	6	Thompson, Morris	
U	2754A&B		9	7	Grasso, Leo & Angela	
C	2754A&B		9	8E	Peters, Helen	
C	2754A&B		9	8W	Mitchell, Robert W., Jr./Mitchell, Elaine	Y
U	2754A&B		9	9	Roberts, Shawn	Y
C	2754A&B		9	10E	Mitchell, Robert W., Jr./Mitchell, Elaine	
U	2754A&B		9	M/B of 10E	Roberts, Shawn	
C	2754A&B		9	10W	Episcopal Diocese of Alaska	
U	2754A&B		9	M/B of 10W	Mayo, Willard & Yvonne	
C	2754A&B		9	11	Peters, Helen Sarah	Y
C	2754A&B		10	1E	Howard Rock Foundation	Y
C	2754A&B		10	1W	Mogg, Tom & Marge	Y
C	2754A&B		10	2	Howard Rock Foundation	
C	2754A&B		10	3	Howard Rock Foundation	
C	2754A&B		10	4E	Alaska Rural Investments, Inc.	
C	2754A&B		10	4W	Woodbury, George	
C	2754A&B		10	5	Thompson, Morris	
U	2754A&B		10	6	Antoski, Harper, Heirs of	
C	2754A&B		10	7	IRHA	Y
U	2754A&B		10	8W	Eller, Clifton/Eller, Paula E.	
C	2754A&B		10	8E	Eller, Clifton	

Table 5-1

Table of Property Ownership

TITLE	USS#	PLAT#	BLK#	LOT#	GRANTEE(S)	HOUSE
C	2754A&B		11	1	Elia, Madeline A.	
C	2754A&B		11	2	Roberts, Thomas J. & Bernadette	Y
C	2754A&B		11	3	Howard Rock Foundation	
C	2754A&B		11	4	Howard Rock Foundation	
C	2754A&B		11	5	Howard Rock Foundation	
C	2754A&B		11	6	Howard Rock Foundation	
C	2754A&B		11	7	Tozitna, Ltd./ Doyon, Ltd. (subsurface)	
C	2754A&B		11	8	Howard Rock Foundation	Y
C	2754A&B		11	9	Howard Rock Foundation	
C	2754A&B		11	10	Howard Rock Foundation	
U	2754A&B		11	11	Josephine?	Y
U	2754A&B		11	12	Josephine?	Y
C	*4104*			*1*	Tozitna, Ltd., Doyon, Ltd (subsurface)	
C	4104			2A	Grant, Richard, Sr., Estate of 14(c)(1) claim	Y
U	4104			2B	Grant, Rose Ann (heir to Larry Grant/Helen Grant) 14(c)(1)	Y
U	4104			3	Tozitna, Ltd. (Pending)	
C	4104			4C	Erhart, Lester 14(c)(1) claim	Y
C	4104			5D	Albert, Alfred 14(c)(1) claim	Y
C	4104			5E	Edwin, Melvin 14(c)(1) claim	Y
C	4104			5F	Starr, John, Jr. 14(c)(1) claim	Y
U	4104			6G	Lee Albert, Jr./Nelson, Hannah 14(c)(1) claim	Y
C	4104			6H	Edwardsen, Ava 14(c)(1) claim	Y
C	4104			7I	IRHA 14(c)(1) claim	Y
C	4104			7J	Aragon, Bernice 14(c)(1) claim	Y
C	*4104*			*8*	*Tozitna, Ltd., Doyon, Ltd (subsurface)*	
U	4104			9K	McLaughlin, William H. & Sara J. 14(c)(1) claim	Y
U	4104	89-1		1-14	IRHA Sunshine Subdivision	
U	4104			12	Bean, Bob and Pat	Y
U	W of 4104				Moore, Judy & Peter	Y
C	5958			11	Tozitna, Ltd.	
C	5958			12	Public Health Service	
U	10815			1	Tozitna, Ltd. (IC pending)	
U	10815			2	Tozitna, Ltd. (IC pending)	
U	10815			4	Tanana, Native Village of	
U	10816			3	Swenson, Thomas, Estate of (Application)	
U	11148				Albert, Ralph, Estate of	Y
U	11168				Folger, Frank, Estate of	

Note:
c = clear
u = unclear
y = yes

SECTION 6

Sanitation Facility Alternatives

Identification of Alternative Water Systems

Following are the alternatives for community water sources, treatment, and potable water distribution. Advantages and disadvantages of each are discussed in the Analysis of Alternatives.

Replace Existing Laundromat and Water Treatment Plant

This alternative would provide a new Laundromat and watering point to replace the existing facility and would be part of any water system alternative. A new Laundromat and watering point would be built with all treatment equipment on the ground floor. A garage and shop area would be provided for maintenance vehicle storage and equipment maintenance and repair. The foundation would be designed to avoid the problems with spring runoff experienced by the all-weather wood foundation at the existing Laundromat. A conceptual design is presented in Section 8.

Water Sources

Conventional Wells

Drill a new vertical community well in an area with proven yields (e.g. near the old hospital) or in an area identified by a water source study, and drill individual wells to serve outlying homes.

Rehabilitated Existing Operational Wells

Rehabilitate existing wells to improve yield. Rehabilitating a well involves wire brushing the well and screen, injecting an acid to dissolve calcium and iron/manganese precipitates, surging the well, and pumping the acids and scale from the well.

Angle Wells

Angle wells are water wells drilled at an angle to vertical. They are used to tap into water-bearing strata that are not directly beneath the wellhead. An angle well configuration drilled from the riverbank has the advantage of intercepting the thaw bulb beneath the Yukon River with the potential of improved well-water quality and increased well yield.

Any well drilled adjacent to the river could be under the direct influence of surface water (the river) and fall under the Surface Water Treatment Rule (SWTR) regulations. The SWTR requires all public water systems using surface water or ground water under the direct influence of surface water to provide a dual barrier treatment process to prevent pathogenic protozoan microbes from entering the drinking water supply. The dual barrier must include both filtration and disinfection.

Yukon River Surface Water Intake

The Yukon River could serve as a water source. An intake structure would be constructed on the river bank to house the necessary pumping equipment.

Water Treatment

Depending on the quality of the water from the water source, there are several treatment alternatives available. On the basis of the water quality information showing high levels of iron and manganese in the water, the following two alternative treatment processes were considered:

Slow Sand Filtration

This alternative is a water filtration process that is very simple to operate with a minimum of mechanical equipment. A variation of this process, developed recently for a community in British Columbia, Canada, is slow sand filtration preceded by limestone contactors and alum coagulation. For source waters with organic color, the limestone contactors provide sufficient alkalinity for alum coagulation of dissolved organic material and very limited amounts of iron and manganese. If the source water color is predominantly organic, slow sand filters can produce good quality water, meet all requirements of the SWTR, and are well-suited for small rural communities.

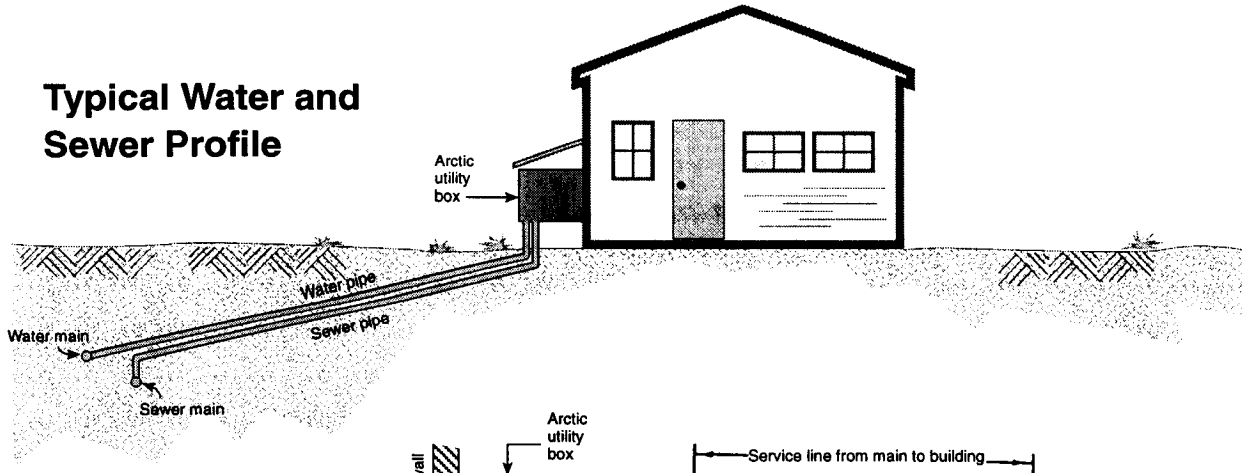
Manganese Greensand Zeolite Filtration

If iron and manganese concentrations exceed the levels that can be treated with a slow sand filter/limestone contactor/alum coagulation process, but are less than 10 and 1 milligrams per liter (mg/L), respectively, manganese greensand zeolite filtration is an acceptable treatment process. In this alternative the water is first prechlorinated to oxidize the iron. Then potassium permanganate is added before filtration to maintain the manganese oxide surface coating on the greensand filter media, which is critical to the absorption process. Following addition of the permanganate the water is filtered and chlorinated before distribution.

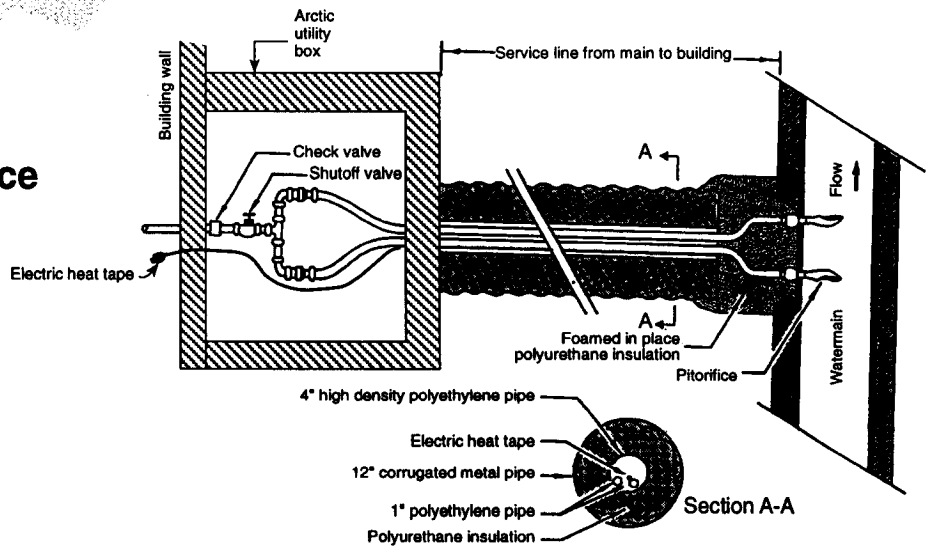
Piped Systems

A piped system is a network of pipes configured to deliver water directly to homes connected to the system (Figure 6-1). An appropriate piped system for Tanana is a buried, heat traced, and insulated circulating water system with pitorifice-type house water service loops. A pitorifice system uses a mechanical device in the water main to promote continuous flow through a service line. Pitorifice systems are self regulating as long as the velocity in the main is at least 1 to 2 feet per second. A pumphouse would be necessary to house water treatment equipment, water circulating pumps, and boilers to heat the water. A water storage tank would be necessary so that water is available regardless of demand to provide reserve storage capacity during emergency situations. The storage tank can also be used for chlorine contact if required for compliance with the SWTR.

Typical Water and Sewer Profile



Water Service



Sewer Service

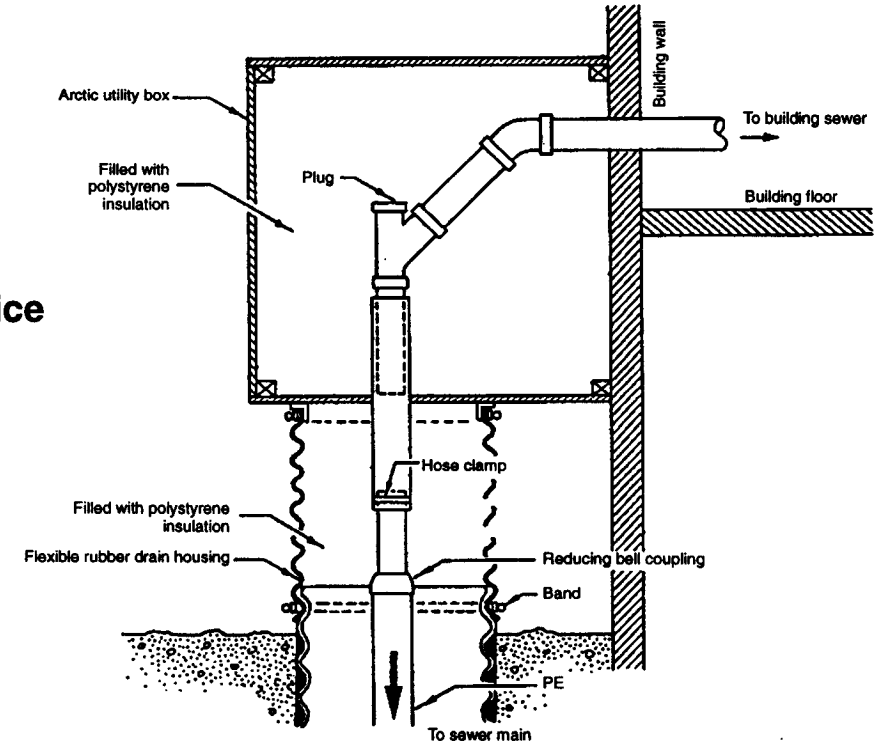


Figure 6-1

Piped Water and Sewer System
Too'gha, Inc. and VSW
Water and Sewer Feasibility Study

Haul Systems

Self-Haul

Self-haul is currently the only option available to most residents of Tanana (Figure 6-2). With this alternative, water is obtained from either a stand-alone watering point or a watering point operated in conjunction with another facility (e.g., a Laundromat or water treatment plant).

Self-haul could be used in combination with other systems to serve residents who do not want to be part of a community system or residents who live in outlying areas.

Watering points can be designed to allow the user to either draw water from outside a building or from a sheltered or interior location. A watering point should be a durable, sanitary, and convenient way for people to obtain water. Problems such as ice buildup must be considered in the design of a watering point.

Small-Vehicle Haul

With this alternative a small vehicle, such as a four-wheeler, is used to deliver water to the houses in the community (Figure 6-2). Each house would be fitted with an outside water fill point and an interior water holding tank for water storage (less than 100 gallons). The houses could also be fitted with low water use plumbing fixtures.

Large-Vehicle Haul

A large-vehicle haul system is similar to the small-vehicle haul except the haul vehicle is much larger (typically 1,500 to 3,000 gallons) and requires roads to operate (Figure 6-2). With this system houses could be furnished with larger water storage tanks and could be fully furnished with conventional pressurized water systems and plumbing fixtures.

Large-vehicle haul system costs are directly proportional to water consumption. With more extensive interior plumbing, water consumption, and utility system operating costs increase.

Onsite Systems

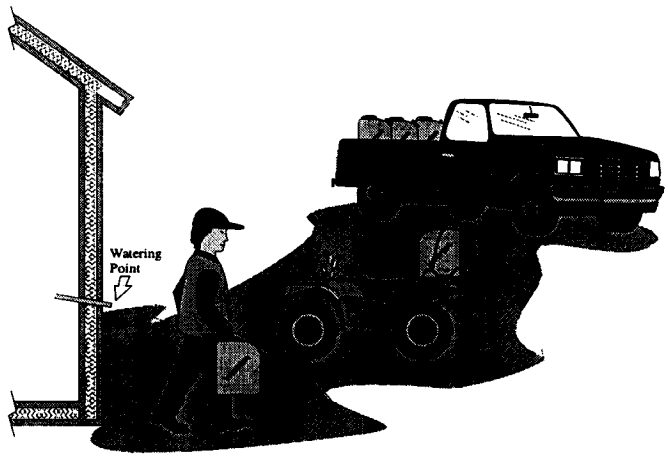
Onsite water systems would consist of water wells drilled on individual lots. Property owners would be responsible for operation and maintenance of the well and for installation of any water treatment equipment they wish to use on their well water supply. Success with individual wells has been very limited in Tanana and is very site dependent.

Identification of Alternative Wastewater Systems

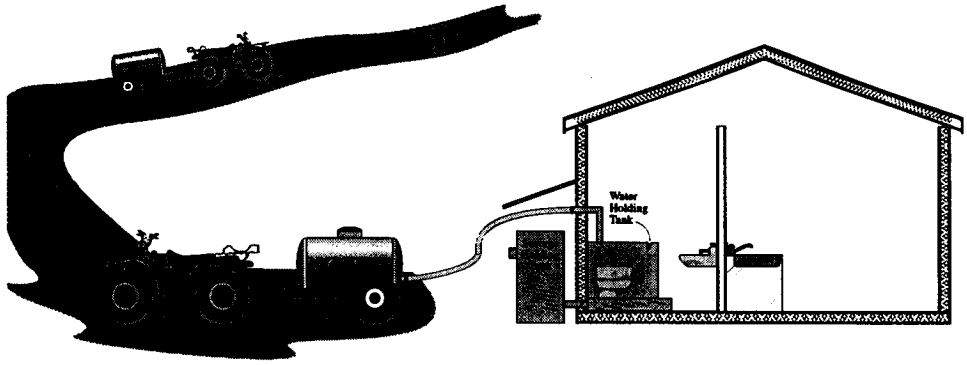
Following are alternatives for community wastewater collection and disposal. Primary advantages and disadvantages of each system are presented in the Analysis of Alternatives.

Piped Systems

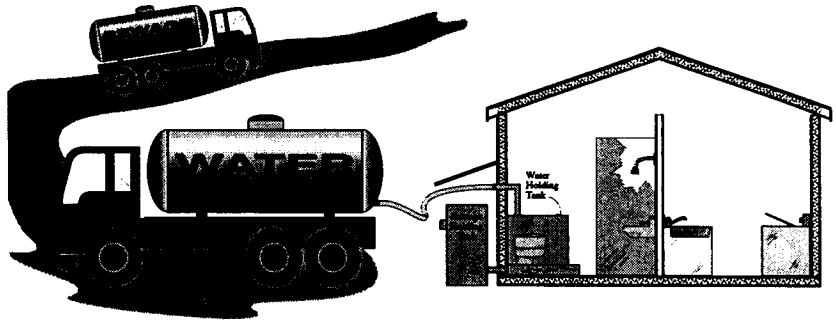
Piped wastewater collection systems carry the sewage directly away from the house to the disposal site. Three types of piped systems have been considered and presented to Tanana for input. The following paragraphs briefly describe the three options.



Self Haul



Small Vehicle Haul



Large Vehicle Haul

Figure 6-2

Water and Sewer Haul System Alternatives
Too'gha, Inc. and VSW
Water and Sewer Feasibility Study

Gravity

A gravity, or conventional, sewage collection system uses proven methods of construction and maintenance and has lower operation and maintenance costs that other types of sewer systems. Where topography does not permit gravity flow, lift stations (facilities for pumping sewage) must be installed. Force mains (pressurized sewer lines) may also be required. As previously described in Section 4, a portion of Tanana is currently served by gravity sewer lines in combination with force mains and two lift stations.

Pressure

If soil conditions, topography, or community layout preclude the use of gravity systems, pressure systems can be used. A small grinder pump at or near each building conveys sewage through a pressure pipe system. Pressure sewers have an advantage over gravity systems in that pipelines do not have to be installed with the sloping grades required to maintain gravity flow. Construction costs are usually less for pressure systems, but operation and maintenance costs are higher because of the number of individual grinder pumps and the requirement to heat the sewer. Heating the sewer is necessary because it is normally filled with water that can remain stationary for extended periods and freeze.

Vacuum

Vacuum sewers are an alternative to both gravity and pressure sewers. Many of the advantages and disadvantages of pressure systems apply to vacuum sewers. Not having to maintain grades for gravity flow and less expensive smaller pipes are the main advantages. Also, special vacuum toilets are available that use as little as 10 percent of the water of a conventional toilet. Disadvantages include the requirement for a vacuum valve in every house in addition to the central vacuum station and the need to maintain accurate pipe grades between the lift points for proper system operation.

Haul Systems

Self-Haul

With self-haul, residents haul their own honey bucket wastes to a disposal point. Currently in Tanana most residents dispose of their honey bucket wastes in the outhouses located on their property. However, gray water is routinely discharged onto the ground. There has been a concern expressed in the community about possible contamination of the ground around the outhouses and potentially the groundwater from wastes seeping from the outhouses. Constructing new outhouses or installing community honey bucket waste-disposal bunkers will probably not alleviate this concern. A self-haul system should only be considered as part of a small-vehicle haul alternative with community holding tanks that are emptied periodically as required.

Small-Vehicle Haul

Wastewater from each house could be collected by a small vehicle (four-wheeler) pulling a small trailer-mounted tank (see Figure 6-2). Each house would have a wastewater holding tank that is approximately 50 percent larger than the water storage tank. The holding tank can be located either inside or outside the house. An alternative to the individual holding tanks would be to have community holding tanks located in strategic locations throughout the community.

Large-Vehicle Haul

This system is similar to the small-vehicle haul except on a larger scale (see Figure 6-2). This option would require a sewage truck in addition to a water truck. As described in the water section, this option requires a maintained road system including grading and snow removal.

Onsite Systems

Septic Tank and Leach Field

The most common method for onsite treatment is the conventional septic tank. Its principal function is to remove settlable and floatable material from the wastewater. Normal design requires 24-hour retention at the average expected flow. Where soil conditions permit (no permafrost or excessive frost penetration), the tank can be installed in the ground outside the dwelling. In cold regions, insulation is often placed on the outside of the tank and the tank is pumped out annually.

Leach fields are generally constructed with perforated plastic pipe. The soil around and under the leach fields must remain unfrozen throughout the winter for effective performance. Frost penetration into the surrounding soil can block the pipes. Because of poor soil conditions and inadequate maintenance, the failure rate of leach fields in remote, rural Alaskan communities is high. In addition, removal and disposal of septic tank sludge is an onerous and often neglected requirement for proper operation.

Outhouses

Outhouses are currently used in Tanana. The outhouse is one of the earliest methods of human waste disposal. The main features of concern in cold regions are locating the pit in unfrozen soil and elevating the entrance to account for snow accumulation. The outhouse should be designed and constructed so that it can be moved when necessary.

Analysis of Alternatives

This analysis begins with a comparison of the advantages and disadvantages of the identified water and sewage system alternatives. The water and wastewater system alternatives were assembled in various combinations to form 11 different sanitation facilities options. Then, capital and operation and maintenance costs were estimated. The operation and maintenance costs were calculated as monthly user fees.

Water Source Alternatives

Conventional Wells

Advantages:

- Proven technology
- Good yield is probable if the well is installed with a designed intake screen in an area with proven yields

Disadvantage:

- Finding a location to drill a successful well in Tanana

Rehabilitated Existing Operational Wells

Advantages:

- Low cost
- Can be performed in any season with limited downtime for water system
- Proven technology

Disadvantage:

- Results are uncertain. It may not be possible to attain the original specific capacity.

Angle Wells

Advantage:

- Ability to tap an aquifer within the thaw bulb of the river by drilling from the river bank

Disadvantage:

- Requires specialized drilling equipment

Yukon River Surface Water Intake

Advantage:

- Unlimited supply of water available from the river

Disadvantages:

- Cost of an expensive intake structure
- The possibility of damage to the intake structure from ice flows, river erosion, and changing water levels
- The high cost of treating turbid river water in accordance with the SWTR

Water and Wastewater System Alternatives

Laundromat and Watering Point Only

Advantages:

- Provides laundry, bathing, and toilet facilities at lower cost than piped or haul system
- Requires less maintenance than piped systems

Disadvantages:

- Inconvenient
- Must leave residence for bathing and laundry

Self-Haul

Advantages:

- Low capital and operation and maintenance costs
- Low water use and associated treatment costs
- Low monthly user fee

Disadvantages:

- High potential for contamination of water
- Honey bucket and gray water disposal problems

Small-Vehicle Haul

Advantages:

- Low capital costs compared to piped systems and large vehicle haul
- Service is easily discontinued if a user does not pay
- Road maintenance and snow removal not essential
- Low water use and associated treatment costs

Disadvantages:

- System is labor and equipment intensive
- If any one household in the town center does not subscribe to the service, potential health hazards will not be eliminated
- Houses need specialized, low-water-use fixtures

Large-Vehicle Haul

Advantages:

- Low capital costs compared to piped system
- Service is easily discontinued if a user does not pay
- Houses can be furnished with conventional pressurized water systems and plumbing fixtures

Disadvantages:

- Higher capital costs compared to small-vehicle haul
- System is labor and equipment intensive
- Requires road maintenance and snow removal
- If any one household in the town center does not subscribe to the service, potential health hazards will not be eliminated

Piped Water System

Advantages:

- Convenience
- Less potential for drinking water contamination during delivery

Disadvantages:

- High capital cost
- High monthly user fee
- Cannot let houses freeze up during the winter

Piped Gravity Sewer System

Advantages:

- Convenience
- Eliminates the potential health hazards of surface dumping of gray water and honey buckets
- Proven construction and maintenance methods
- Lower operation and maintenance cost than alternative piped systems

Disadvantages:

- Requires greater water use than vacuum system
- Could require expensive lift stations

Piped Pressure Sewer System

Advantages:

- Convenience
- Requires less costly, smaller diameter pipe than a gravity system
- Pipe does not have to be sloped downhill

Disadvantages:

- Higher operation and maintenance costs than gravity sewer
- Requires grinder pump at every house
- Liquid wastes remain in sewer for extended periods of time. High risk of freeze-up with pressure and/or heat source failure.

Piped Vacuum Sewer System

Advantages:

- Convenience
- Requires less water use than a gravity system

Disadvantages:

- Higher operation and maintenance costs than gravity sewer
- Requires vacuum valve in every house
- Requires central vacuum station
- Requires accurate control of pipe grade for proper system operation

Sanitation Facilities Options

The various water and wastewater system alternatives were grouped into 11 different sanitation facilities options to serve the area bounded by the Elders' Residence on the west and Sunshine Subdivision on the east. A pressure sewer system, as a stand-alone system, was not included in the 11 options. Gravity sewer, which is cheaper and simpler to operate, can feasibly continue to serve the community. In other words, pressure sewer, although possible, is not required in Tanana. Nor is vacuum sewer.

Vacuum sewer was, however, included in the 11 options to provide one piped alternative to gravity sewer. Adding pressure sewer would have increased the number of options to 15, an unworkable number. Some of the components of a pressure sewer system (lift stations and force mains) have been considered in the analysis because a "gravity" system in Tanana would necessarily require some pumping, with the sewage under pressure in the force mains.

All options included the following:

- Facilities to improve water quality and increase the volume of water available to residents
- Replacement of the sewage lagoon effluent line and drainfield
- Replacement of the existing Laundromat/water plant facilities

The advantages and disadvantages of the system alternatives that make up each of these options were discussed earlier in this section.

Option 1:

- Piped water and piped gravity sewer in Townsite and in Sunshine Subdivision

Option 2:

- Piped water and piped vacuum sewer in Townsite and in Sunshine Subdivision

Option 3:

- Piped water in Townsite
- Haul treated water from the Townsite water plant to a storage and pumping facility at Sunshine Subdivision with a circulating piped water loop for the subdivision
- Piped gravity sewer in Townsite
- Piped gravity sewer from the subdivision flowing to 5-to 7-day-storage holding tank(s) with holding tank pumping and large vehicle haul to the Townsite lagoon

Option 4:

- Piped water in Townsite
- Haul treated water with a large vehicle from the Townsite water plant to a storage and pumping facility at Sunshine Subdivision with a circulating piped water loop for the subdivision
- Piped vacuum sewer in Townsite
- Piped gravity sewer from the subdivision flowing to 5- to 7-day-storage holding tank(s) with holding tank pumping and large vehicle haul to the Townsite lagoon

Option 5:

- Piped water in Townsite
- Large-vehicle water haul for Sunshine Subdivision
- Gravity sewer system in Townsite
- Large-vehicle sewage haul for Sunshine Subdivision

Option 6:

- Piped water in Townsite
- Large-vehicle water haul for Sunshine Subdivision
- Vacuum sewer system in Townsite
- Large-vehicle sewage haul for Sunshine Subdivision

Option 7:

- Piped water in Townsite
- Small-vehicle water haul for Sunshine Subdivision
- Gravity sewer system in Townsite
- Small-vehicle sewage haul for Sunshine Subdivision

Option 8:

- Piped water in Townsite
- Small-vehicle water haul for Sunshine Subdivision

- Vacuum sewer system in Townsite
- Small-vehicle sewage haul for Sunshine Subdivision

Option 9:

- Replace existing Laundromat with new Laundromat
- Continue self-haul

Option 10:

- Replace existing Laundromat with new Laundromat
- Small-vehicle water haul everywhere
- Small-vehicle sewage haul everywhere

Option 11:

- Replace existing Laundromat with new Laundromat
- Large-vehicle water haul everywhere
- Large-vehicle sewage haul everywhere

Estimated Capital and Operation and Maintenance Costs of Sanitation Facilities Options

Capital costs and operation and maintenance costs for the 11 sanitation facilities were estimated on the basis of preliminary conceptual designs. These are estimates, and should be used only as a relative measure of costs and an indication of the magnitude of the overall cost of the options.

A summary of the capital costs and monthly user fees for the various options is presented in Table 1 and in more detail in Appendix C.

TABLE 6-1
Costs of Sanitation Facilities Options

Option	Capital Cost[a]	Monthly User Fee[a]
1	$12,061,505	$103
2	$10,589,395	$108
3	$10,907,914	$139
4	$10,327,488	$147
5	$10,189,871	$137
6	$9,520,615	$145
7	$10,009,673	$142
8	$9,399,637	$150
9	$2,634,809	$72
10	$4,190,039	$141
11	$4,787,879	$188

[a]The capital costs and monthly user fees shown above are based on revisions to the planning assumptions requested by the Too'gha Board at the 65% submittal stage and are different from the costs and fees shown on the graphics in Appendix D.

SECTION 7

Public Involvement Program

Introduction

This section describes the program that was undertaken to involve the residents of Tanana in the process of deciding the type of sanitation facilities appropriate for their community.

The eleven sanitation facilities options described in Section 6 were presented to a joint meeting of the City and Native councils on June 12, 1995. The graphics produced for the meeting are in Appendix D. The two councils considered the advantages and disadvantages of each option and compared the relative capital and operational costs. The councils eliminated all haul options, and narrowed the options for further consideration by the residents of the area bounded by the Elders' Residence on the west and Sunshine Subdivision on the east, to three:

- Piped water and gravity sewer
- Piped water and vacuum sewer
- Replacement of the existing water treatment plant and Laundromat only

A house-to-house survey was conducted in the area bounded by the Elders' Residence on the west and Sunshine Subdivision on the east to determine which of the three options were preferred by the residents of Tanana. The survey form used is in Appendix E. Representatives of the City and Native councils selected local surveyors to be trained and to conduct the survey. Two days of training were provided and the surveys were conducted from mid-July until early August. The results of the survey were presented at a public meeting on August 14, 1995.

At the public meeting some residents living beyond the townsite and the Sunshine Subdivision expressed concern that they weren't surveyed and may have been overlooked by the feasibility study. Various sanitation options were discussed at the meeting, and it was decided to survey the residents living in the outlying areas. As a result, an additional survey was conducted to determine which sanitation facilities these residents preferred. The survey form described the available options and the pros and cons of each option. The survey form is also in Appendix E. Piped water and sewer for areas outside of the Townsite and the Sunshine Subdivision is not currently economically feasible because construction and operation and maintenance costs would be too high for the limited number of houses served. Therefore, the residents of outlying areas were asked to choose among the following options:

- Individual wells
- A community well with a centrally located watering point
- A watering point at Sunshine Subdivision
- A haul system

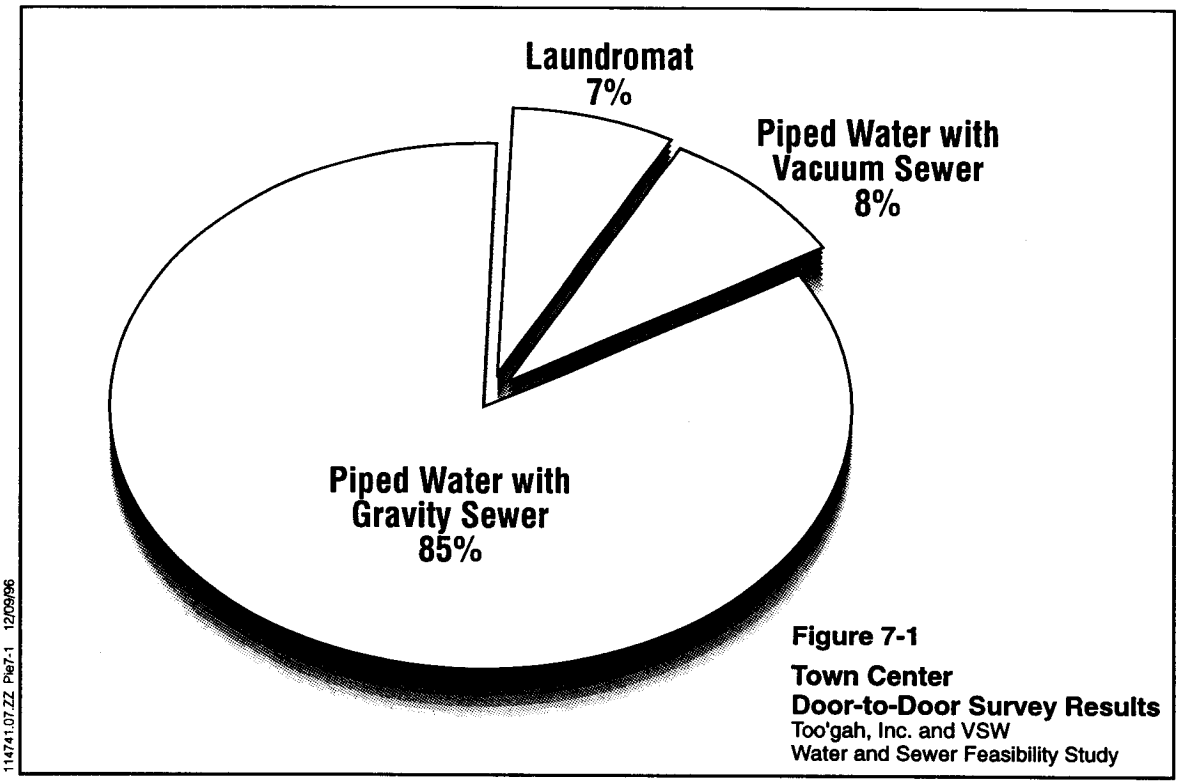
Because the distance from town eliminates the feasibility of piped sewage and because permafrost eliminates the feasibility of septic tanks, the outlying homes will continue to use outhouses and honey buckets for sewage disposal.

In addition to the surveys, an 800 number was set up so residents could call at no cost, express their opinions, and ask questions regarding water and sewer system improvements.

Survey Results

Ninety-six occupied homes were identified in the area bounded by the Elders' Residence on the west and Sunshine Subdivision on the east and the surveyors were able to conduct 72 surveys. Five households wanted to continue with a watering point/ Laundromat, six selected piped water and vacuum sewer, and 61 (85 percent) selected piped water and gravity sewer. These results are illustrated in Figure 7-1.

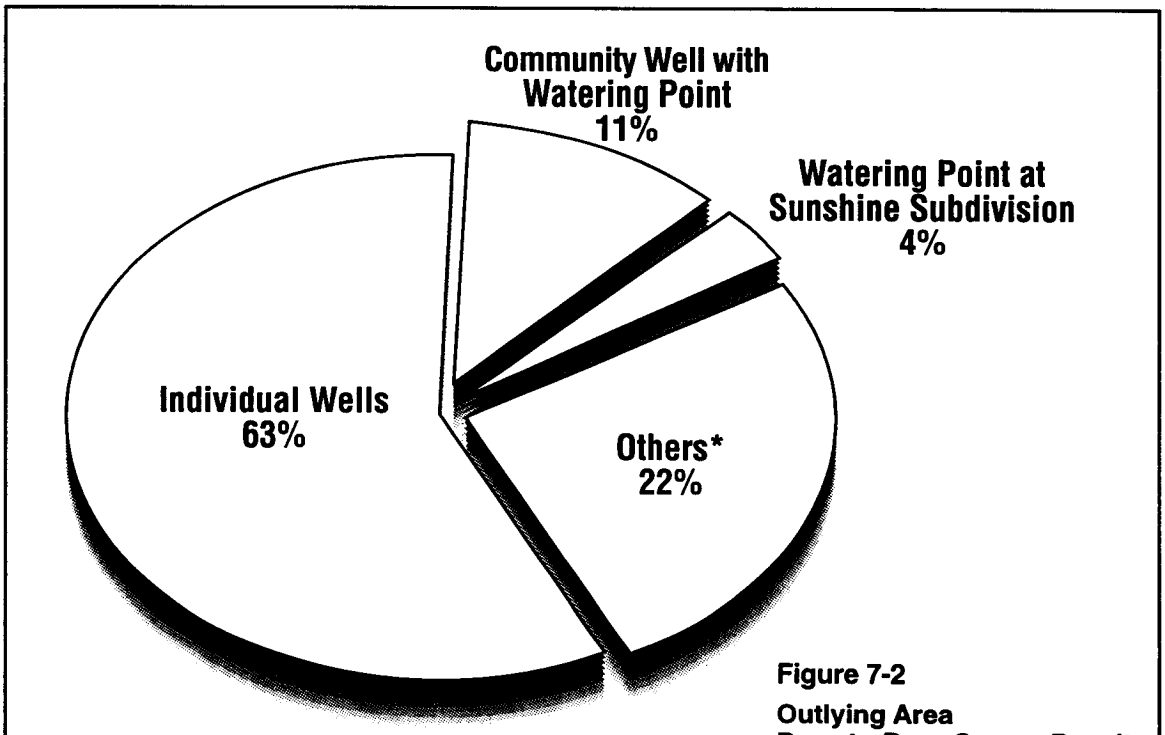
There were 27 occupied houses and one empty HUD house identified in the outlying areas. The surveyor, Cathy Fliris, was able to survey the occupants of all 27. These residents chose individual wells as their preferred option. These results are illustrated in Figure 7-2 and are also explained in a report by Ms. Fliris. The report is included in Appendix E.



114741.07.ZZ Pie7-1 12/09/96

Figure 7-1

Town Center
Door-to-Door Survey Results
Too'gah, Inc. and VSW
Water and Sewer Feasibility Study



114741.07.ZZ PieChart 12/09/96

* Keep system as is – haul from Laundromat, Yukon River, springs, creek; melt snow or collect rainwater.

Figure 7-2

Outlying Area
Door-to-Door Survey Results
Too'gha, Inc. and VSW
Water and Sewer Feasibility Study

SECTION 8

Water Plant Conceptual Design

The water treatment plant conceptual design is based on available water quality data, conversations with past treatment plant operators, and consideration of future water system expansion. The water plant, as conceived in this study, will be a combination WTP (Figure 8-1) and Laundromat with a watering point (Figure 8-2). The WTP will be designed to allow for system expansion. The existing community electrical distribution system will be extended to the new water plant. New fuel oil storage tanks will be sized to provide adequate capacity for year-round operation. Vehicle storage and emergency power generation will also be provided. The building will be approximately 3,840 square feet in size (Figure 8-3). Water storage will be provided in two 100,000-gallon, insulated, welded-steel tanks.

The conceptual design assumes the following:

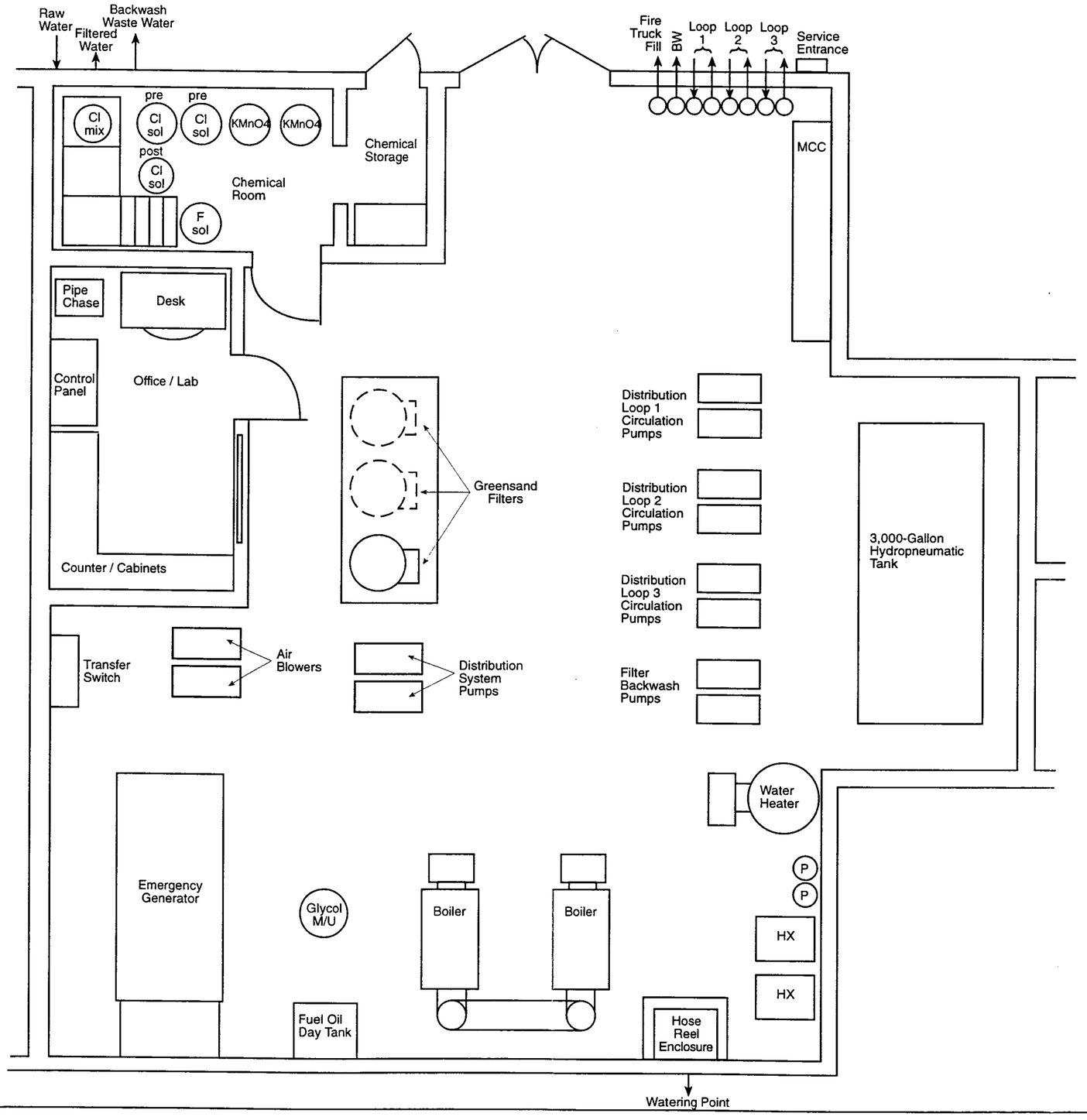
- A well water source will be found and developed that is not under the direct influence of a surface water. If the Alaska Department of Environmental Conservation (ADEC) criteria for groundwater cannot be met, and it is determined that the new water source is under the direct influence of surface water, bag filters and extended chlorine contact should be considered in the final design.
- The source water quality contaminants are assumed to include excessive iron concentrations (2 to 5 mg/L), high manganese concentrations (0.3 mg/L), and high hardness (340 mg/L as $CaCO_3$). It is assumed that high turbidity and high color reported for a 1986 source water quality analyses were a result of oxidation of iron in transit to the lab and not due to the presence of organics.
- Initially sized for the flow rate required to serve the Laundromat and watering point, the existing Native Council water system, and the City water system (6,900 gpd)

The recommended process (assuming organics are not a problem) includes prechlorination, addition of permanganate, greensand filtration, storage, postchlorination, and fluoridation.

We considered slow sand filtration but the potential source water has too much iron to be compatible with the slow sand filtration process.

The water treatment process flow diagram is shown in Figure 8-4.

At ultimate development of the piped water system, the per capita water consumption rate will be 55 gallons per day and 540 people will be served. The maximum daily demand will be 170 gallons per minute. A typical demand curve presented by ADEC was used to develop a maximum day hydrograph (Figure 8-5). Water storage volume required to meet the hour-to-hour water use variations (equalization storage) is estimated to be 56,000 gallons. Because standby power generation and duplication of equipment will be provided, only 12 hours of reserve storage will be provided. The total water storage requirement at ultimate development is 200,000 gallons. To accommodate initial storage requirements, one 100,000-gallon storage tank will be constructed. The second water storage tank will be constructed in Phase 12 of the project.



Legend	
P	Pump
HX	Heat Exchanger
MCC	Motor Control Center
M/U	Make Up

Figure 8-1

Concept Drawing
Water Treatment Plant
Too'gha, Inc. and VSW
Water and Sewer Feasibility Study

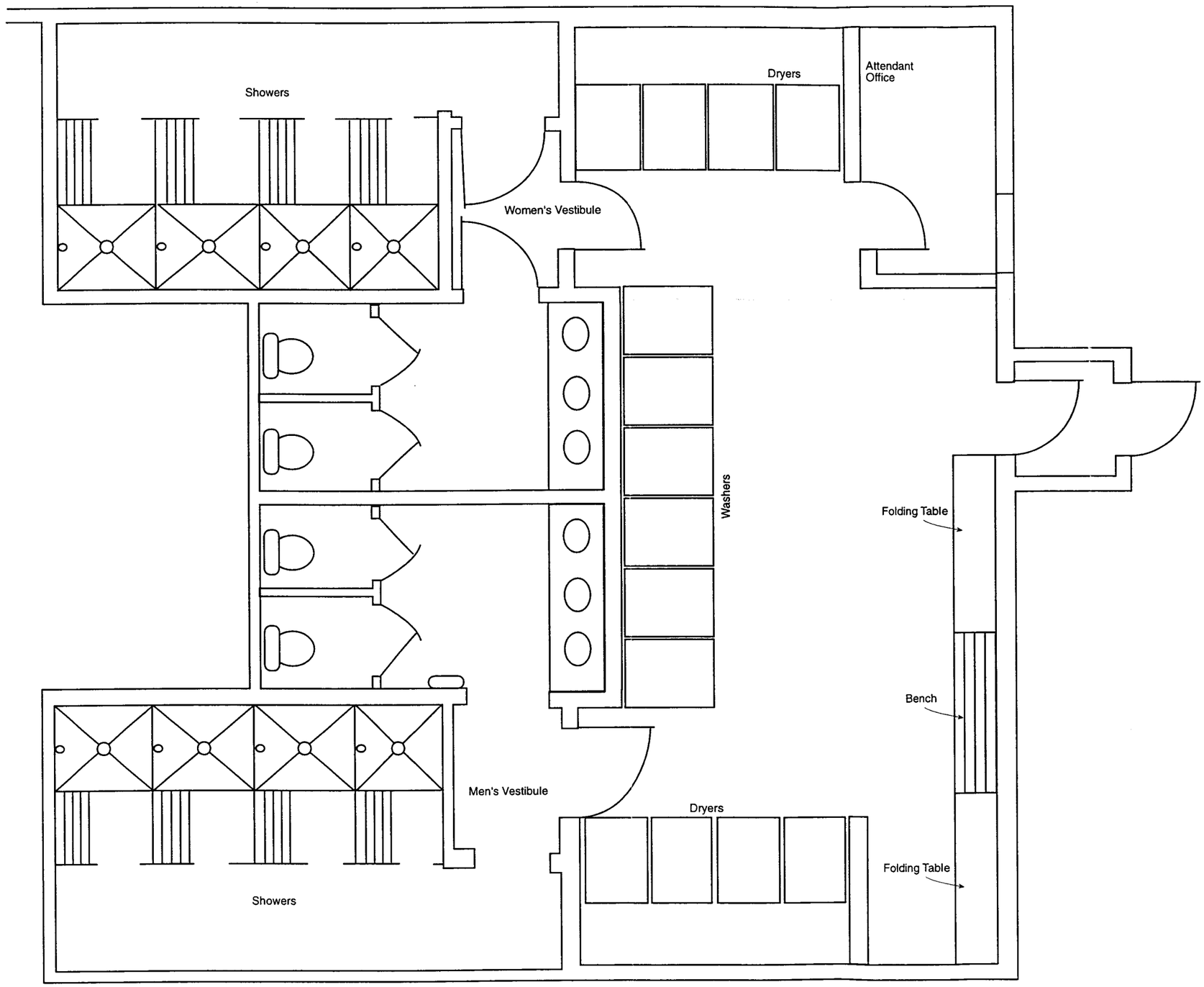


Figure 8-2

Concept Drawing
Laundromat
Too'gha, Inc. and VSW
Water and Sewer Feasibility Study

114741.07.22 Floor Plans.FH5 12/09/96

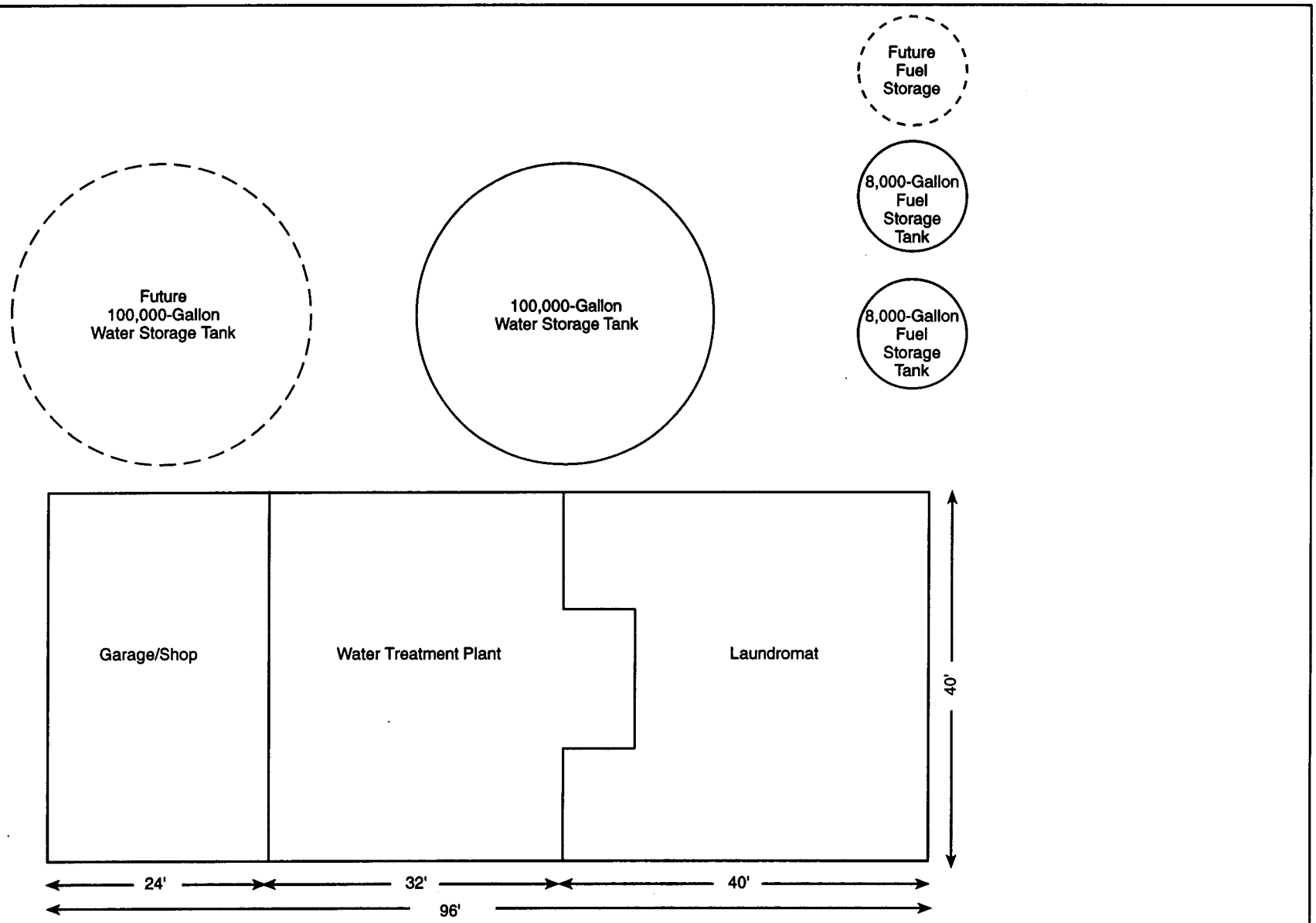


Figure 8-3

Concept Drawing
Tanana WTP and Laundromat
Too'gha, Inc. and VSW
Water and Sewer Feasibility Study

114741.07.ZZ Laundromat 12/09/96

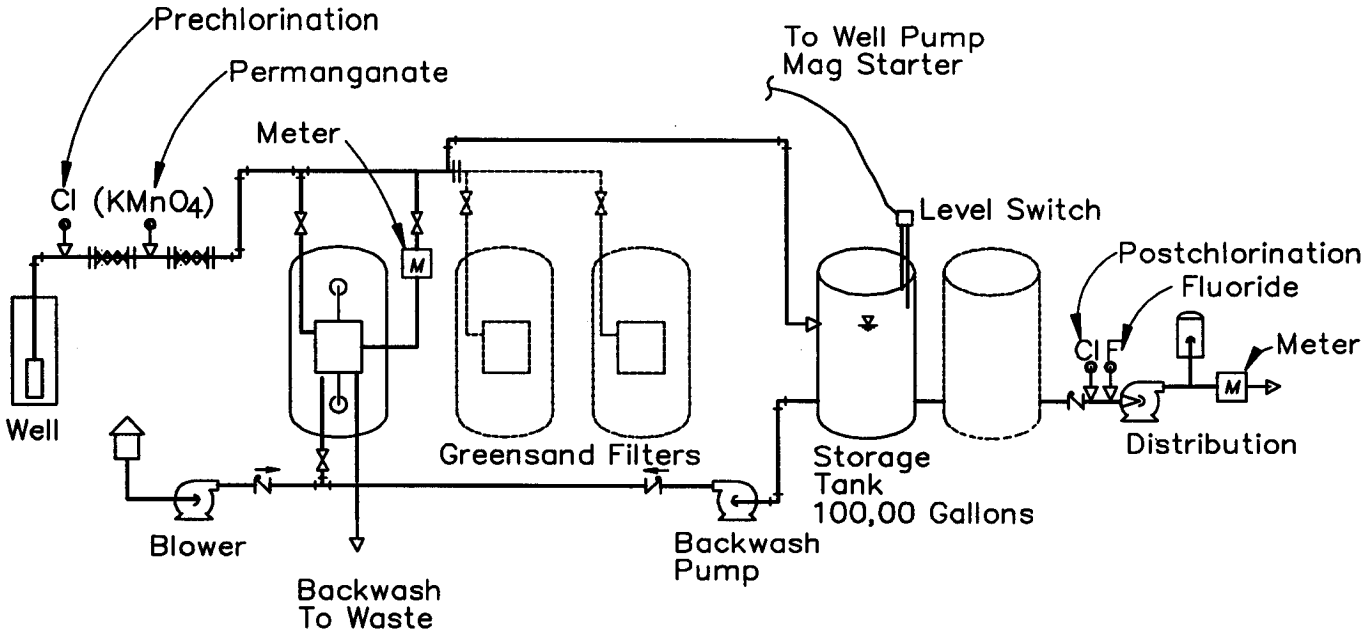


Figure 8-4
Water Treatment Process Flow Diagram
Too'gha, Inc. and VSW Water and Sewer Feasibility Study

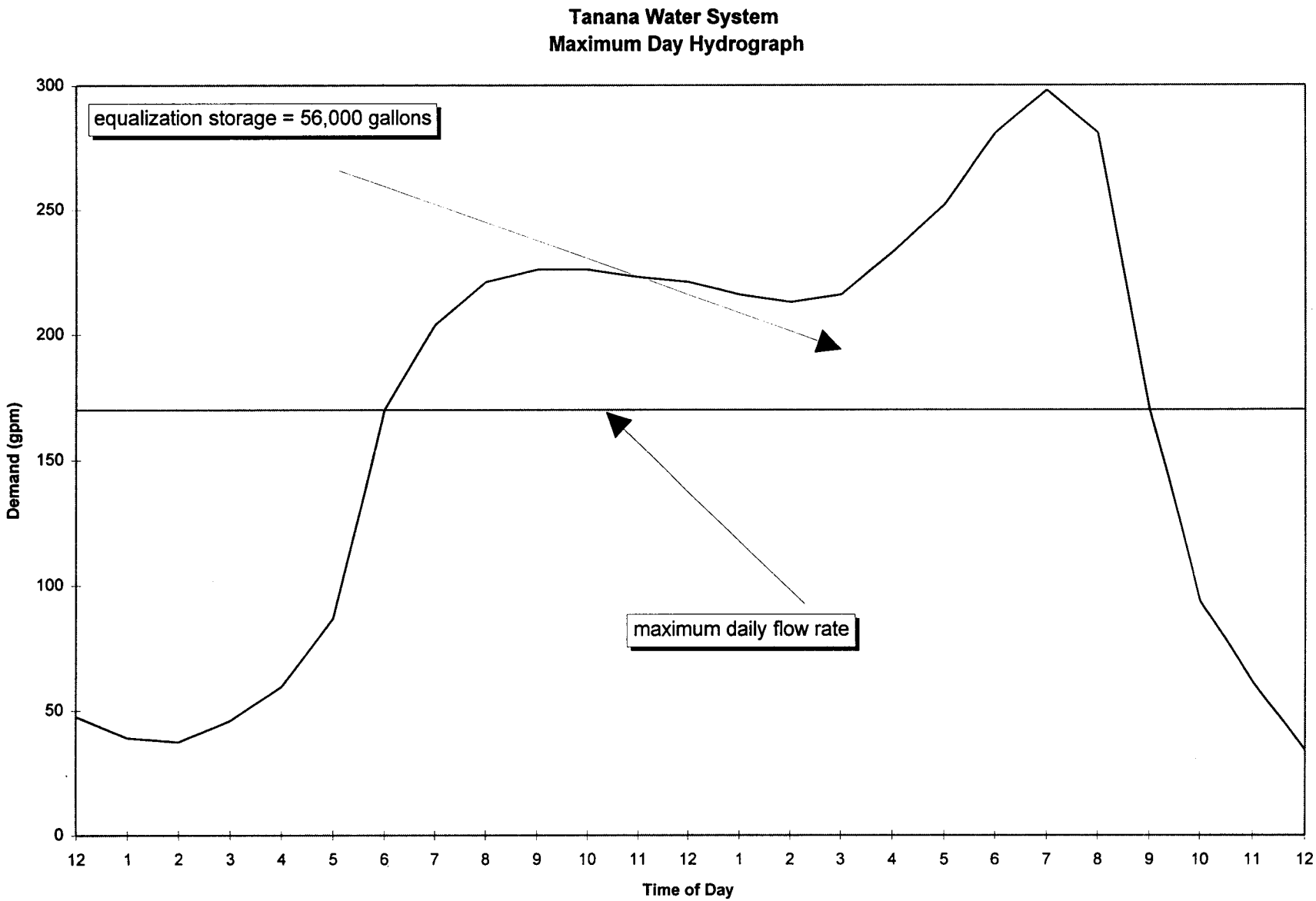


Figure 8-5
Maximum Day Hydrograph
Too'gha, Inc. and VSW
Water and Sewer Feasibility Study

SECTION 9

References

Alaska Department of Community and Regional Affairs. "Community Profiles: Tanana." September, 1994.

Alaska Department of Environmental Conservation. *Final Report, Sanitation Facility Improvements, Tanana, Alaska.* July 1983.

Arctic Slope Consulting Group. *Juneau Area Transportation Plan, Fairbanks Agency Report.* U.S. Bureau of Indian Affairs. 1990.

Fison and Associates. *Tanana Community Profile.* State of Alaska Department of Community and Regional Affairs, Division of Municipal Assistance. June 1987.

Gillam, Harold. Personal Communication. May 1995.

Kangas, Gary. Personal Communication. September 1995.

Lee of Ice Water Well, Inc. Personal Communication. April 1995.

Smith, Daniel. *Cold Climates Utilities Manual.* Canadian Society for Civil Engineering, 1986.

U.S. Public Health Service. *Final Report, Sanitation Facilities Construction, City of Tanana Project No. AN-81-231.* August 1986.

_____. *Project Summary, Sanitation Facilities Construction, City of Tanana Project No. AN-81-231.* December 1980.

_____. *Project Summary, Sanitation Facilities Construction, City of Tanana Project No. AN-86-338.* February 1989.

_____. *Project Summary, Sanitation Facilities Construction, City of Tanana Project No. AN-90-030.* September 1990.

Weaver, Steven. *Sanitation Facilities Alternatives for Sunshine Subdivision, Tanana, Alaska.* U.S. Public Health Service. October 1987.

Wheaton, Scott. *Shallow Groundwater Resources at Tanana, Alaska.* U.S. Public Health Service. October 1980.

Williams, Greg. Personal Communication. February 1995.

Appendix A
Study Criteria Technical Memorandum

PREPARED FOR: Lynn Marino, VSW

PREPARED BY: Tom Wolf

COPIES: Connie Greenway, Tanana City Manager

Herbie Edwin, Tanana Tribal Council

DATE: March 6, 1995

SUBJECT: Assumed Study Criteria

PROJECT: NPW39993.A0.03

This technical memorandum documents the assumed criteria to be used in conducting the analysis portion of the feasibility study. Please review and comment on the assumptions. Let us know whether or not we are on the right track. Your input at this early stage will help us provide Tanana with a feasibility study that can be used for community planning and to support Tanana's requests for water and sewer system improvement funding.

Water and Wastewater Facilities to be Considered

Water Sources

Wells

By reviewing the extensive information available on previous well drilling efforts and using terrain unit analysis, we will identify locations likely to support a water well or well fields of sufficient yield to meet the needs of Tanana. We will consider new wells in both conventional and angle configurations.

Angle wells are water wells drilled at an angle. They are used to tap into aquifers of water-bearing strata that are not directly beneath the well-head. The angle well configuration drilled from the riverbank has the advantage of intercepting the thaw bulb beneath the Yukon River with the potential of improved well-water quality and increased well yield over conventional vertical wells that have been drilled in Tanana in the past.

Any well drilled adjacent to the river could be under the direct influence of surface water (i.e., the river) and fall under the Surface Water Treatment Rule (SWTR) regulations. The SWTR requires all public water systems using surface water or groundwater under the direct influence of surface water to remove or inactivate disease-causing microorganisms. Microorganisms can be removed through filtration processes or inactivated through disinfection.

Water Treatment

We have reviewed water quality data for Tanana wells cited in the IHS publication *Sanitation Facilities Alternatives Sunshine Subdivision Tanana, Alaska,* dated October 1987. We also contacted Mr. Lee Johnson, ADEC Fairbanks, to see if he had any more recent water-quality information. He sent us the most recent information (exclusive of the SWTR sampling data). It was some of the same information included in the IHS report. Those data provide a general indication of the water quality that could be expected from a new or upgraded existing well. On the basis of our review of the existing water-quality data, we will consider the following alternatives:

Slow Sand Filtration

This water filtration process is very simple to operate with a minimum of mechanical equipment. Slow sand filters operate at very low loading rates and remove particulate matter (turbidity) in an organic slime that develops on the surface of the sand. Once clogged, the surface of the sand media is scraped off and wasted . We will configure the treatment process with batch excess lime treatment preceding the filter for iron, manganese, and organic color removal. The slow sand filters produce excellent quality water, meet all requirements of the SWTR, and are well suited for small communities with limited operations budgets.

Direct Filtration Using a Primary Coagulant

Direct filtration uses two to three pressure vessels filled with filter media to filter well water preconditioned with a primary coagulant (e.g., a polyaluminum chloride or a ferric based polymer). It is typically used for waters with low turbidity, minimal iron, and color.

Both of these options are low-technology alternatives. The City should be aware that these processes need to be verified in at least a bench-scale performance test before adopting them into design or construction phases of the project.

Ion Exchange (Water Softener)

In the past, the City has used a water softener for iron removal. Currently, the water softener at the washeteria is not operational. Softeners work to remove iron when iron is in its reduced state; however, if it becomes oxidized the iron can reduce the life of the exchange resin and require more frequent changing of the resin. We will not consider ion exchange for iron removal unless directed to do so by VSW and the City.

Water Distribution

Self-Haul

This alternative is currently the only option available to most of the residents of Tanana. Water is obtained from either a standalone watering point or a watering point operated in conjunction with another facility (washeteria or water plant).

Self-haul could be used in combination with other systems to serve residents who do not want to be part of a community system or by residents who live in outlying areas.

We will look at watering points that allow the user to either draw water from outside of a building or from a sheltered/interior location. Our objective will be to provide a durable, sanitary, and convenient way for people to obtain water. We will consider problems like vandalism and ice buildup in the alternative analysis.

Small-Vehicle Haul

With this alternative, a small vehicle, such as a four-wheeler, is used to deliver water to the houses in the community. Each house would be fitted with an outside water fill point and an interior water holding tank for water storage (less than 100 gallons). The houses could also be fitted with low-water-use plumbing fixtures.

Truck Haul

A truck-haul system is similar to the small-vehicle haul. except the haul vehicle is much larger (typically 1,500 to 3,000 gallons) and requires roads on which to operate. With this system, houses could be furnished with larger water-storage tanks and could be fully furnished with conventional pressurized water systems and plumbing fixtures.

Truck-haul system costs are directly proportional to water consumption. With more extensive interior plumbing, water consumption and utility system operating costs will increase.

Piped Systems

A piped system is a network of pipes configured to deliver water directly to homes connected to the system. The piped system to be evaluated will be a buried, heat-traced, and insulated circulating water system with pitorifice-type house water service loops. A pumphouse would be necessary to house water-treatment equipment, water-circulating pumps, and boilers to heat the water. A water-storage tank would be necessary for water flow equalization and would be sized for reserve storage capacity for emergency situations.

Replace Washeteria/Watering Point Only

This option would provide a new washeteria/watering point to replace the existing facility. A new washeteria/watering point would be built with all process equipment on the ground floor. It would be designed with efficiency and ease of operation in mind. A washeteria could be a component of any of the options.

Wastewater Collection

Self-Haul

In this option, residents haul their own honey-bucket wastes to a disposal point. Currently in Tanana, most residents dispose of their honey-bucket wastes in the pit privies located on their property. In the past, concern has been expressed in the community about possible contamination of the ground around the pit privies and potentially the groundwater supply

from wastes seeping from the pit privies. Constructing new pit privies or community honey-bucket waste disposal bunkers will probably not alleviate this concern. A self-haul system should only be considered as part of a small-vehicle-haul alternative with community holding tanks that are emptied periodically as required.

Small Vehicle Haul

Wastewater from each house will be collected by a small vehicle (four-wheeler) that pulls a small, trailer-mounted tank. Each house would have a wastewater holding tank sized approximately 50 percent larger than the water-storage tank. The holding tank can be located either inside or outside the house. An alternative to the individual holding tanks would be to have community holding tanks located in strategic locations throughout the City.

Truck Haul

This system is similar to the small-vehicle haul except on a larger scale. This option would require a truck in addition to the water truck. As described for the water section, this option requires a maintained road system.

Piped Systems

Piped wastewater-collection systems carry the sewage directly away from the house to the disposal site. Three types of piped systems will be considered and presented to the residents for input. The following paragraphs briefly describe the three options.

Gravity. Gravity or conventional sewer lines are in limited use in Tanana. A gravity-type collection system has lower operation and maintenance (O&M) costs than other types of sewer systems. Where topography does not gravity flow, lift stations (facilities for pumping the sewage) would be installed.

Pressure. If soil conditions or community layout preclude the use of gravity systems, pressure systems could be used. A small grinder pump at or near each building provides the conveyance of sewage through a pressure-pipe system. Pressure sewers have an advantage over gravity systems in that pipelines do not have to be installed with sloping grades required to maintain gravity flow. Construction costs are usually less for pressure systems, but O&M costs are higher due to the operation and maintenance of individual grinder pumps.

Vacuum. Vacuum sewers are an alternative to both gravity and pressure sewers. Many of the advantages of pressure systems apply to vacuum sewers. Not having to maintain grades for gravity flow and smaller pipe size are the main advantages. Special vacuum toilets are available that use a little as 10 percent of the water that a conventional toilet uses.

Disposal and Treatment

We will evaluate two options: a lagoon and a package plant treatment. Tanana currently uses a lagoon for wastewater treatment. The existing two-cell sewage lagoon was completed in 1986 and sized for 8 months of hydraulic storage at 14,000 gallons per day of sewage flow. The lagoon was sized to accommodate flows from the PHS hospital, which closed in 1982.

At this time, we recommend continuing to use lagoon treatment with a lagoon sized for the wastewater generation rates expected for the planning period.

Lagoon Drain Leachfield R&R

The existing leachfield receives lagoon effluent through a heat-traced outfall line. The outfall line has frozen in the past and should be replaced as part of a future improvement project.

Planning and Analysis Assumptions

Planning Period

The planning period, as required by the Request for Proposals, is 20 years. Construction is anticipated in 1996. The planning period for this study will extend to the year 2016.

Population Projection

The BIA *Juneau Area Transportation Plan* provides a community profile for the rural communities of Alaska. This source states that in 1988 the City population was 415 with 162 occupied housing units (1986). Projected population for the City as determined by a cohort survival methodology with limited migration from Tanana is shown in Figure 1. Using the BIA data, the projected populations for the years 2000 and 2010 are 583 and 692, respectively. Extrapolating these data out to 20 years, the population for the year 2016 is 757.

The U.S. Census Bureau collects population data for communities throughout the country every 10 years. The State Department of Community and Regional Affairs (DCRA) community profile for Tanana dated September 23, 1994, reports historical census data for 1990 and a current population of 374. Mr. Greg Williams, demographer for the State Department of Labor reported that the DCRA's 1994 figure was really the 1993 revenue-sharing population.. He said the 1994 revenue-sharing population was 344. The 1990 census reported that the population was 345 and that there were 169 total housing units, 123 of which were occupied. The census data are also plotted in the attached figure. Projecting this data out to the year 2016, the population of Tanana in 20 years is estimated to be approximately the same as at is today.

Mr. Williams was contacted to get his opinion on future population figures for Tanana. He indicated that there is a connection between availability of employment and population. Population growth will not exceed the availability of jobs. In other words, a lack of jobs could provide incentive to people to out-migrate (leave Tanana). According to Mr. Williams the BIA study appears to miss this connection.

The population will not grow unless there are economic projects that provide more employment opportunities in Tanana. A reliable community water and sewer system would be part of the infrastructure required to support needed economic growth.

For purposes of this study, the design population for the year 2016 will be assumed to be 440. This figure is based on a straight-line projection of recent census and revenue sharing

population numbers with an allowance for modest population growth (Mr. Williams recommended an population growth allowance of no more than 100 people). Any population growth will be contingent on new employment opportunities becoming available in Tanana.

Per Capita Water Demand

Water consumption rates (demand) will vary according to the type of sanitation facilities ultimately selected by the City. The following assumed water consumption rates were derived from information obtained from the *Cold Climate Utilities Manual* and historical consumption data from other rural Alaskan communities.

- Self-Haul--less than 5 gallons/(capita-day)
- Washeteria/Watering Point--10 gallons/(capita-day)
- Small-Vehicle-Haul System--2 to 4 gallons/(capita-day)
- Truck-Haul System--30 gallons/(capita-day)
- Piped Systems (including school)--40 gallons/(capita-day)

Labor Rates

The following wage rates were obtained from the City of Tanana:

- Water/Wastewater System Operator--$12/hour
- Washeteria/Watering Point Attendant--$10/hour
- Janitor--$7/hour
- Equipment Operator--$15/hour
- Carpenter--$17/hour
- Laborer--$10/hour

Equipment Rates

For estimating purposes, Blue Book rates will be used for the rental of City-owned equipment. The City owns the following pieces of equipment: 1980 John Deere 850 dozer, 1981 John Deere 672A grader, 1981 Case 680H loader/backhoe, 1980 or 1981 John Deere 644C loader, and GMC 7600 dump truck.

Barge Freight Rates

Yutana Barge Lines of Nenana provides barge service to Tanana. They were contacted for freight rates to Tanana. The base rate for 1995 is $6.69 per hundred weight. There are many exceptions to this base rate which can increase the cost as much as 400 percent. A copy of the exceptions is attached.

Fuel and Gasoline Costs

Yukon Fuel of Nenana was contacted for costs of fuel and gasoline delivered to Tanana. Historically, No. 1 heating fuel costs between $1.25 and $1.30 per gallon, and unleaded

gasoline, without tax, costs between $1.03 and $1.40 per gallon. These costs are based on a bulk purchase of 10,000 to 50,000 gallons.

The cost of No. 1 heating fuel delivered in a 55-gallon drum is $120 per drum, and the cost of unleaded gasoline delivered in a drum is $130 per drum. These costs include the deposit of $35 to $40 on the drums.

A skidded, 10,000-gallon tank can be rented from Yukon Fuel for approximately $0.25 per gallon, which is the cost of the freight on the tank.

Electrical Power Rates

Electricity is provided by the Tanana Power Company. The current power rates, which will be used for the study, are as follows:

Residential

- First 200 kWh: $0.470 per kWh
- Next 200 kWh: $0.445 per kWh
- Over 400 kWh: $0.409 per kWh

Small Commercial

- First 10,000 kWh: $0.390 per kWh
- Next 10,000 kWh: $0.376 per kWh
- Over 20,000 kWh: $0.356 per kWh

The state power equalization subsidy reduces the cost for the first 750 kWh by $0.1752/kWh. There is also a fuel surcharge subsidy of $0.0211/kWh.

Note: The rates have not changed since 1986. The same rates were published in the 1987 *Tanana Community Profile* written by Fison and Associates.

Capital Costs for Improvement Components

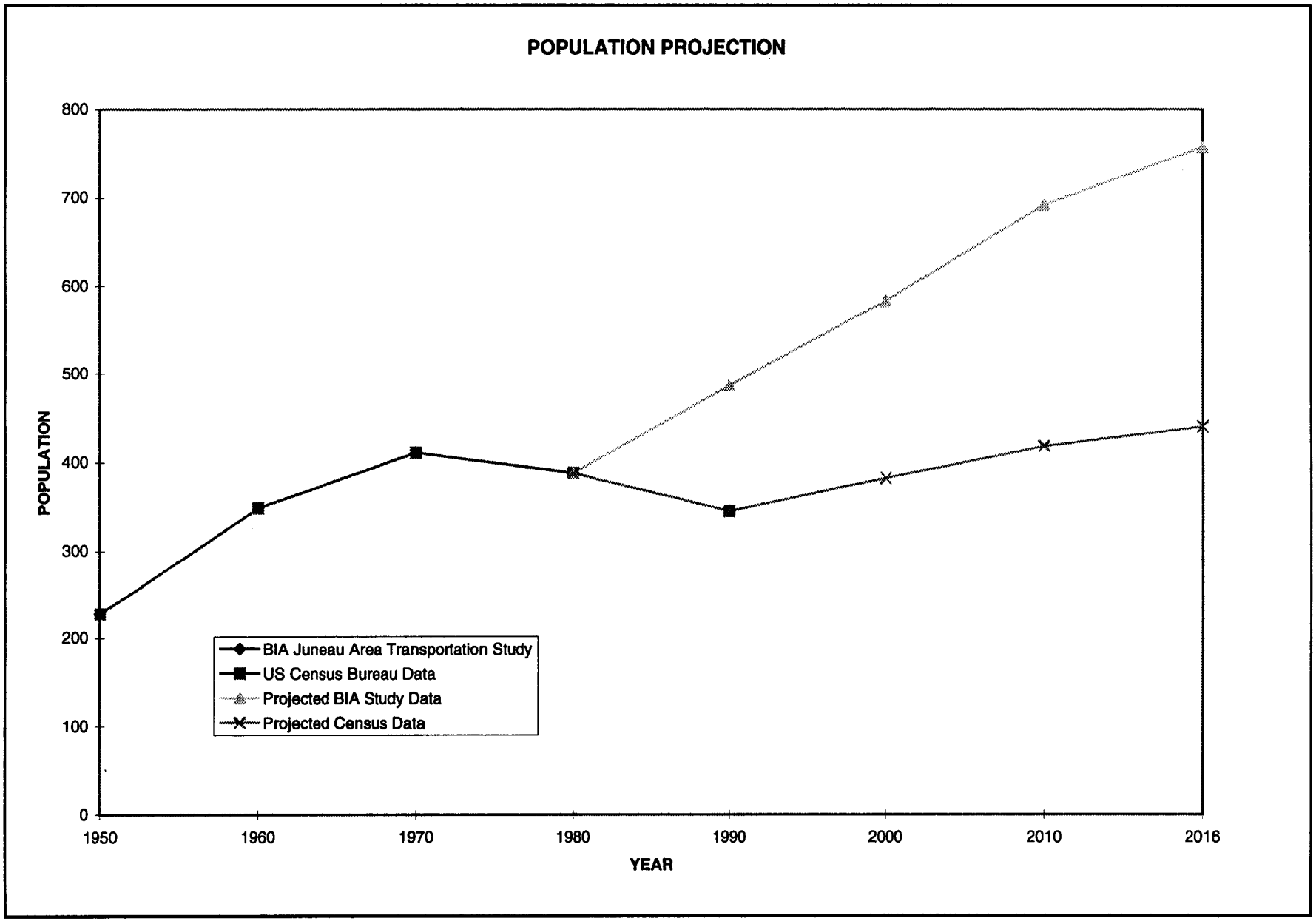
We will use unit costs for constructed improvements based on similar projects constructed using force account labor elsewhere in rural Alaska

Environmental Planning Criteria

The following climatic data were taken from the IHS publication *Sanitation Facilities Alternatives, Sunshine Subdivision, Tanana, Alaska,* dated October 1987:

- Mean annual precipitation , inches 13
- Mean annual temperature, degrees F 24
- Mean annual snowfall, inches 50
- Maximum temperature recorded, degrees F 94

•	Minimum temperature, degrees F	-71
•	Mean January minimum temperature, degrees F	-18
•	Mean July maximum temperature, degrees F	70
•	Thawing index, degree days	2,500
•	Freezing index, degree days	5,500
•	Design freezing index, 1 year in 10, degree days	6,500



POPULATION PROJECTIONS FOR THE CITY OF TANANA FIGURE 1 CH2M HILL

YUTANA BARGE LINES, INC.

DATE: 2-20-95	TO: Tom Wolf	
TIME:	COMPANY: CH2M Hill	TELEPHONE: 277-9336 9736
PAGE(S): (INCLUDING COVER) 3	FROM: Capt. Endit/Moore	

COMMENTS:

To Tanana Base = $6.69/cwt

Terminal = $2.84/cwt Vehicles = 2.25/cwt

Here are the exceptions to that base Rate.

Capt Endit Moore

(

Operations Office: P.O. Box 00220 • Nenana, Alaska 99760 • (907) 832-5505 • FAX (907) 832-5282

Yutana Barge Lines

Effective May 1, 1992

Commodity	Description	% Base Rate	Remarks
290	Motorcycles	150.00%	
220	Motor Trucks	150.00%	Able to move under own power
		175.00%	Not able to move under own power
280	Personal Effects	300.00%	Value not to exceed $.10 per lb
276	Plasterboard	110.00%	Banded or strapped in bundles
		150.00%	Loose, not banded or strapped in bundles
240	Platforms, freight carrying	100.00%	Loading/Unloading of contents $2.50/cwt
275	Plywood	125.00%	
250	Powder	200.00%	
270	Rockwool	300.00%	
230	Roof Trusses	300.00%	
285	Silos	200.00%	
290	Snowmobiles	150.00%	
270	Styrofoam	300.00%	
285	Tanks	200.00%	
288	Trailers	200.00%	25 feet long or less
		300.00%	over 25 feet but not over 45
		400.00%	over 45 feet in length (call office)
220	Trucks	150.00%	Able to move under own power
		175.00%	Not able to move under own power
285	Vats	200.00%	
290	Vehicles, All Terrain	150.00%	
295	Wanagans	300.00%	N/A if not on skids, over 40' long or 12' wide
230	Windows & Window Frames	300.00%	

Yutana Barge Lines

Effective May 1, 1992

Commodity	Description	% Base Rate	Remarks
210	Airplane	400.00%	
220	Automobiles	150.00%	able to move under own power
		175.00%	not able to move under own power
225	Boats	300.00%	not on trailers
295	Buildings	300.00%	N/A if not on skids, over 40' long or 12' wide
230	Building Materials	300.00%	
230	Building Sections	300.00%	
203	Back Haul, Empty Propane	50.00%	No terminal charges
202	Back Haul	Same as outbound charge(s)	
225	Canoes	300.00%	Not on trailers
285	Cisterns	200.00%	
240	Containers, freight carrying	100.00%	Loading/Unloading of contents $2.50/cwt
285	Culverts	200.00%	
230	Doors & Door Frames	300.00%	
250	Dynamite	200.00%	
280	Emigrant's Movables	300.00%	Value not to exceed $.10 per lb
220	Equipment	150.00%	Able to move under own power
		175.00%	Not able to move under own power
270	Fiberglass	300.00%	
250	Fireworks	200.00%	
230	Floor Trusses	300.00%	
255	Freight N.O.S.	100.00%	
265	Furniture	300.00%	
289	Freight Trailers	100.00%	If over 45 feet long call office
250	Hazardous Marterials	200.00%	
200	Heavy Freight	Rate +	$.80 /CWT Over 8000 lbs to 20,000 lbs
			$2.60/CWT Over 20,000 to 40,000 lbs
			$4.67/CWT Over 40,000
250	High Explosives	200.00%	
280	Household Goods	300.00%	
288	House Trailers	200.00%	25 feet long or less
		300.00%	over 25 feet but not over 45
		400.00%	over 45 feet in length (call office)
270	Insulating Materials	300.00%	
272	Insulated Pipe	300.00%	
275	Lumber	125.00%	loose not banded or strapped
205	Long Articles:	Rate+	$.04 PER 100 LBS PER FOOT OVER 40 FEET
			n/a for 288,289, & 295

City Of Tanana

Draft Water And Sewer Feasibility Study

Proposed Outline/Table Of Contents

Executive Summary

I. Introduction
   - A. Background
     1. Brief history and discription of City water and sewer systems.
   - B. Existing Water and Sewer System Condition
     1. Describe the condition of existing systems.
   - C. Objectives of this Plan
     1. Identify and evaluate alternative water and sewer systems.
     2. Present opinions of costs for community water and wastewater system alternatives.
        - a. Capital costs
        - b. Monthly cost of service charges to City
     3. Present alternatives to City through a public involvement process.
     4. Recommend a water and sewer system based on City imput.

2. Existing Water and Sewage Systems
   - A. Introduction
   - B. Washeteria/Water Treatment Plant
   - C. Wells
   - D. Native Council System
   - E. City System

3. Identification of Alternative Water Systems
   - A. Introduction
   - B. Replace washeteria/water plant
   - C. Piped Water Systems
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4. Identification of Alternative Wastewater Systems
   - A. Introduction
   - B. Piped Systems
   - C. Haul Systems
   - D. On-Site Systems

5. Planning and Analysis Assumptions
   - A. Introduction
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D. Water Consumption
E. Local Labor Rates
F. Power Costs
G. Environmental Data

6. Analysis of Alternatives
   A. Introduction
   B. Water System Alternatives
   C. Water Source Location
   D. Capital Costs of Water System Alternatives
   E. Wastewater System Alternative
   F. Capital Costs of Wastewater System Alternatives
   G. Operation and Maintenance Costs of Alternatives

7. Public Involvement Program
   A. Introduction
   B. Survey Results
   C. Summary

8. Recommended Water and Sewer Systems
   A. Introduction
   B. Recommendations
   C. Water Plant Conceptual Design
   D. Improvements Phasing Consideration

Terrain Unit Analysis

Prepared by
Geosphere, Inc.

FEBRUARY 1996

Contents

Site Soil Conditions

Soil conditions in Tanana have been documented in several reports by the Public Health Service (PHS), in PHS water well drilling logs, and in soil borings by the Alaska Department of Transportation and Public Facilities. These references indicate that Tanana is on a stream terrace of the Yukon River. In the Tanana townsite area soil stratigraphy is reported to consist of the following layers:

- 5 to 15 feet of silt and silty sand deposited as a floodplain cover deposit over the stream terrace surface, overlying
- 30 to 65 feet of generally coarse-grained stream channel sediments varying from fine sands to bouldery gravels, overlying
- Zero to 60 feet of fine-grained silt and clay, overlying
- An undulating bedrock surface. The bedrock surface has been encountered at depths of about 35 to 140 feet. Where the bedrock is shallow the fine silt and clays overlying the bedrock are generally thin or absent.

Terrain Units

Landforms are elements of the landscape that generally form through similar geologic processes and have similar compositions and visual characteristics. Terrain units identify landforms or groups of landforms that are expected to occur from the ground surface to a depth of about 25 feet. At Tanana, the terrain units have been mapped on aerial photographs (Figure 1). The terrain unit maps can be used to identify soil characteristics in areas without soil boring information and to extend or place limits on the extension of data from areas with soil borings.

The terrain unit mapping correlates with and draws from the existing soils data. The following terrain units have been used in the mapping:

- Fpt-c/Fpt-r = Floodplain Terrace Cover (overbank) Deposits overlying Floodplain Terrace Channel Deposits. This terrain unit lies along the Yukon River and consists of cover or overbank silts deposited during flood stages of the river, overlying sandy gravelly channel sediments. Drilling logs show that the silts are 5 to 15 feet thick. Discontinuous permafrost occurs throughout the terrain unit; however, the soils have enough drainage to support white spruce and birch.
- Fpt-c = Floodplain Terrace Cover Deposits. This terrain unit consists primarily of overbank silty sands with a high organic content. The soils were deposited across the terrace surface at flood stages (when the terrace was an active floodplain) and by smaller streams draining the hills to the north. In the area mapped as Fpt-c the gravel deposits are about 25 to 30 or more feet thick, as indicated by drilling logs from the Eller Subdivision; likely have shallow continuous permafrost with a high moisture content and massive ice lenses; and have poor surface and subsurface drainage resulting in muskeg with black spruce, sedges, and sphagnum vegetation.
- Fp = Floodplain. An active floodplain has been mapped along a small tributary stream flowing across the larger Yukon River terrace. The soils in this terrain unit probably

Residential Utility
Service Agreement

This Agreement is made between Too'gha, Inc., Water and Sewer Utility as the Utility and _____ as the Applicant.

The Applicant requests that the residence on the property described in Appendix A, be connected to the Utility's water/sewer system.

As part of the request, the Applicant agrees:

1. To abide by the water and sewer ordinances, rules, and policies adopted by the Utility.

2. To grant at no cost, a Right-of-Entry (form attached as Appendix B) to the Utility to construct the connection to the Applicant's residence.

3. If necessary, grant at no cost, an Easement (form attached as Appendix C) to the Utility for construction of water/sewer **main lines** across the Applicant's property.

4. To pay the Utility, a monthly service fee for water/sewer at the rate established by the Utility for residential customers.

5. To pay any deposits required by the Utility prior to connection of service.

6. That delinquent bills (more than 30 days past due) are subject to collection actions. These actions can include, but are not limited to, interest charges, late payment fees, deposit forfeiture, suits in small claims court, and disconnection of service.

7. Maintain the plumbing on the Applicant's property and within the residence, including all plumbing, piping, fixtures, and other appurtenances intended to carry water, sewage, waste water and drainage in accordance with the Uniform Plumbing Code.

8. To use the heat tape and maintain adequate insulation for the system to prevent freezing during the winter. The Applicant agrees that they will not continuously run water during cold weather to keep the pipes from freezing, or that they will pay an "Excessive Use Charge" as set by the Utility for continuously running water.

9. To allow the Utility to enter onto the property to make emergency repairs to the service line up to the connection to the residence in order to save the Utilities pipes, lines, equipment and facilities from damage.

10. In the event of water shortages, the Applicant agrees to work with the Utility on measures to conserve water use.

11. That by signing this Agreement, the Applicant grants to the Utility, its officers, employees, agents and assigns, the right of ingress and egress to the property and residence for purposes of inspection of piping, plumbing, fixtures and other appurtenances intended to carry water, sewage, and waste water. The ingress and egress shall be at a reasonable time, and whenever possible the Utility shall provide advance notice of any inspection.

12. Be available in-person to complete and sign an individual service Work Order. Prior to the meeting where the Work Order is completed, the Applicant should plan where they would like the fixtures located.

The Utility agrees to:

1. Connect the facility to the Utility's existing water/sewer system.

2. As much as possible, provide a continuous and sufficient supply of potable water at adequate pressure to the customer.

3. Bill the applicant on a monthly basis for water/sewer service.

4. Work to continue to improve sanitary conditions in Tanana by placing a high priority on planned capital improvements for water and waste disposal facilities, administering the operation of future improvements, and administering and enforcing the ordinances, rules, and policies designed to improve sanitation practices in Tanana.

All bills, invoices, statements, payments, notices or correspondence shall be sent to the respective parties at the address stated below:

Applicant	Utility
_____	Utility Manager
_____	Too'gha, Inc.
_____	Water/Sewer Utility
_____	P.O. Box
	Tanana, AK 99777

This agreement takes effect on this _____ day of _____, 199__.

_____ _____

Applicant Water and Sewer Utility

ATTACHMENTS: Appendix A - Legal Description
Appendix B - Sample Right-of-Entry
Appendix C - Sample Easement

ACKNOWLEDGMENT

State of Alaska)
: ss
Second Judicial District)

This is to certify that on this _____ day of _____, 199__, before me, the undersigned Notary Public, in and for the State of Alaska, duly commissioned and sworn as such, personally appeared _____, an individual, who acknowledged to me that (s)he executed the within and foregoing Agreement as a voluntary act and deed for the uses and purposes therein mentioned.

_____
Notary Public in and for Alaska
My Commission expires: _____

ACKNOWLEDGMENT

State of Alaska)
: ss
Second Judicial District)

This is to certify that on this _____ day of _____, 199__, before me, the undersigned Notary Public, in and for the State of Alaska, duly commissioned and sworn as such, personally appeared _____, to me known to be the _____, for the Too'gha, Inc., organized and existing under the laws of the State of Alaska, and who acknowledged to me that (s)he executed the within and foregoing Agreement on behalf of the Too'gha, Inc., by authority of its Board, as the voluntary act and deed of said entity, for the uses and purposes therein mentioned.

_____
Notary Public in and for Alaska
My Commission expires: _____

RIGHT-OF-ENTRY

WITNESSETH:

WHEREAS, Too'gha, Inc. proposes to construct water/sewer distribution lines to connect private residences in Tanana.

WHEREAS, the various owners and/or occupants are in agreement with Too'gha's desire to construct said water and sewer distribution lines.

WHEREAS, it will be the owners' and/or occupants' responsibility to maintain the distribution lines once constructed, such that a permanent easement is not required.

NOW THEREFORE, the parties mutually agree as follows:

1. In consideration of the mutual benefits to be derived from the construction of the distribution lines, _____, as the Grantor, does hereby grant this Right-of-Entry to Too'gha, as the Grantee.

2. The Grantor does grant to the Grantee, its contractors, employees, agents, and assigns, the right to enter upon the following described real property for the purposes of constructing water and sewer distribution lines over, through, and across said lands, said property being situated in the City of Tanana, Fourth Judicial District, Ft. Gibbon Recording District, Alaska, and more particularly described in Appendix A.

3. That in the event no water and sewer distribution lines are constructed within 2 years from the date that this Right-of-Entry is executed by the Grantee, the Right-of-Entry will automatically expire.

4. This Right-of-Entry is granted subject to the stipulations attached as Appendix B.

5. This Agreement is effective on the date signed by both parties.

IN WITNESS WHEREOF, the parties have executed this Agreement.

_____ _____

GRANTOR'S SIGNATURE Date

_____ _____

GRANTEE'S SIGNATURE Date

ATTACHMENTS: Appendix A–Legal Description
Appendix B–Stipulations

APPENDIX B

STIPULATIONS

A. The Grantee, its contractors, subcontractors and all personnel (herein after referred to as the permittee) shall indemnify and hold harmless the Grantor against and from any and all demands, claims, or liabilities of every nature whatsoever, arising directly or indirectly from, or in any way connected with, their actions or activities executed under the provisions of this Right-of-Entry.

B. All waste generated during construction and operation under this Right-of-Entry shall be removed or otherwise disposed of in a manner acceptable to the Grantor.

C. This Right-of-Entry does not authorize any other activity other than that which is applied for. Other uses of the right-of-way area including modifications, relocations and future expansion shall require additional permit approval prior to making any such modifications.

D. This Right-of-Entry, and the rights and privileges granted thereby is subject to all valid existing rights.

E. In the event the Grantor determines that the permittee has failed or refused to comply with the provisions of this Right-of-Entry the Grantor by written or oral order, may suspend or terminate any or all of the permittee's activities insofar as they apply to this Right-of-Entry. The permittee shall not resume such suspended or terminated activities until given written authorization to do so by the Grantor.

I have read the foregoing stipulations and I agree to comply with all stipulations included within this Right-of-Entry.

_____ _____

GRANTEE'S SIGNATURE Date

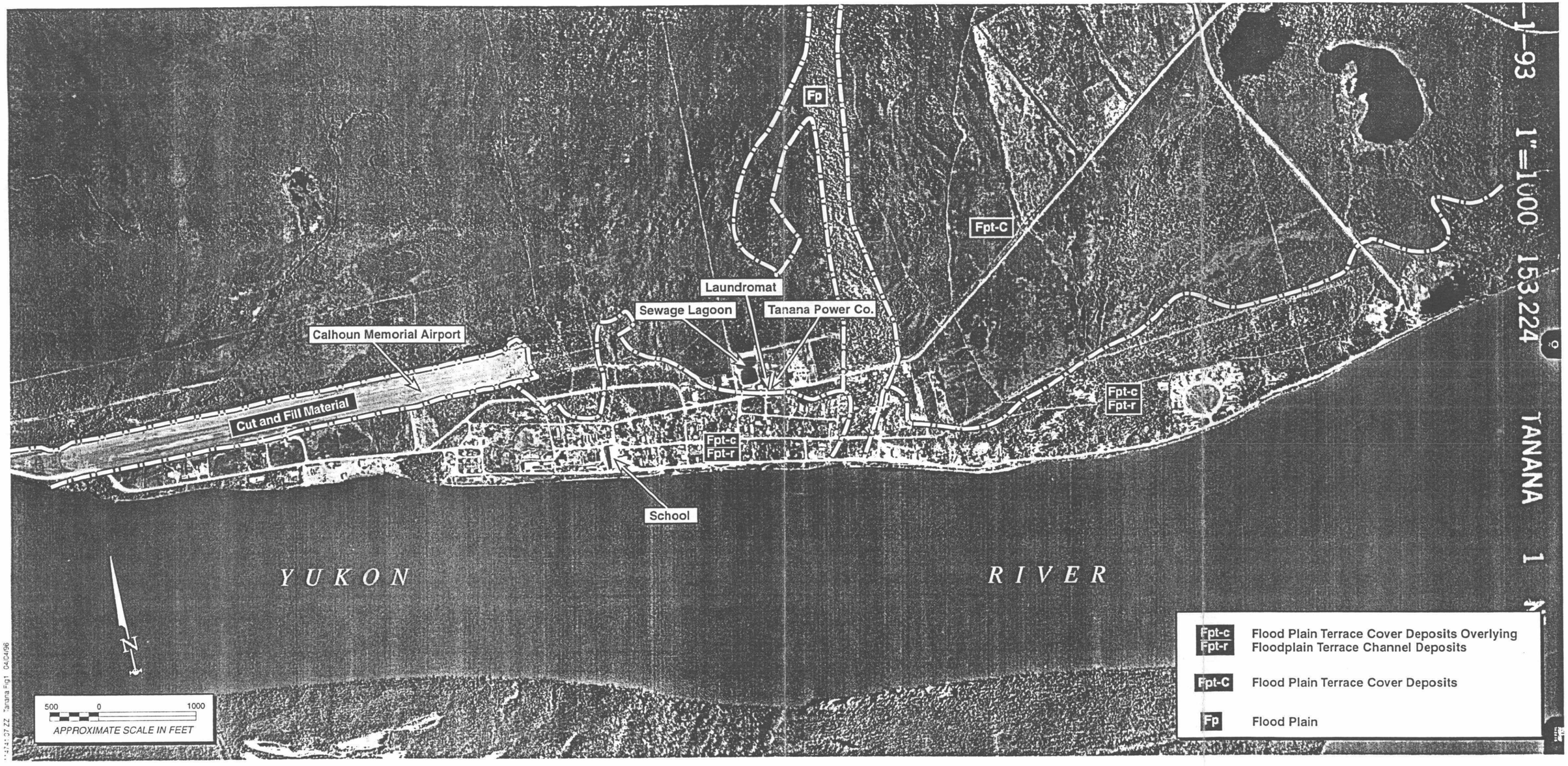


Figure 1

Terrain Units
City of Tanana
Water and Sewer Feasibility Study

consist of reworked silts and sands with some fine gravel in the stream bed. Permafrost in the Fp unit is expected to be discontinuous and the top of the permafrost may be encountered at slightly greater depth than in adjacent Fpt-c units. This provides better soil drainage, allowing growth of white spruce and birch.

Permafrost Conditions

Permafrost may be encountered throughout the Tanana area. Along the Yukon River, in the Fpt-c/Fpt-r terrain unit, permafrost is expected to be discontinuous and to extend from about 5 to 15 feet below grade to 30 to 50 feet below grade. North of the river, in the Fpt-c terrain unit, permafrost is expected to be continuous and to extend from about 5 feet below grade to 50 or more feet below grade. Permafrost is probably discontinuous in the Fp terrain unit and may be encountered at depths of about 10 to 50 or more feet below the Yukon River.

Groundwater Conditions

Groundwater conditions in Tanana are controlled by the site geology and permafrost conditions. The piezometric surface is expected to be similar to the Yukon River level and to generally rise and fall with the river. However, soils in Tanana are commonly frozen to below the river level so that groundwater is not encountered in borings until the boring encounters unfrozen soils below the piezometric surface. Water then enters the boring and rises to the piezometric surface level. Usable quantities of groundwater have been generally derived from the sandy and gravelly soils at depths of about 30 to 60 feet (below the permafrost and above the fine grained silts and clays). Some groundwater maybe derived from wells completed in the fractured bedrock.

Numerous shallow wells have been installed in Tanana. About half of the wells have encountered only frozen soils or have had unusable well yields. Preliminary pump tests from the wells with the higher yields show flow rates of up to 40 gallons per minute (gpm) and specific capacities (specific capacity = flow rate/drawdown) of 1 to about 5 gpm/ft.

Water quality tests from the higher-yielding Tanana wells show relatively high alkalinity, hardness, iron, and manganese levels (Table 1). The presence of these ions gives the water an undesirable taste and can lead to precipitation of mineral deposits on and around well screens, resulting in diminished specific capacities through time.

Existing Water Supply in Tanana

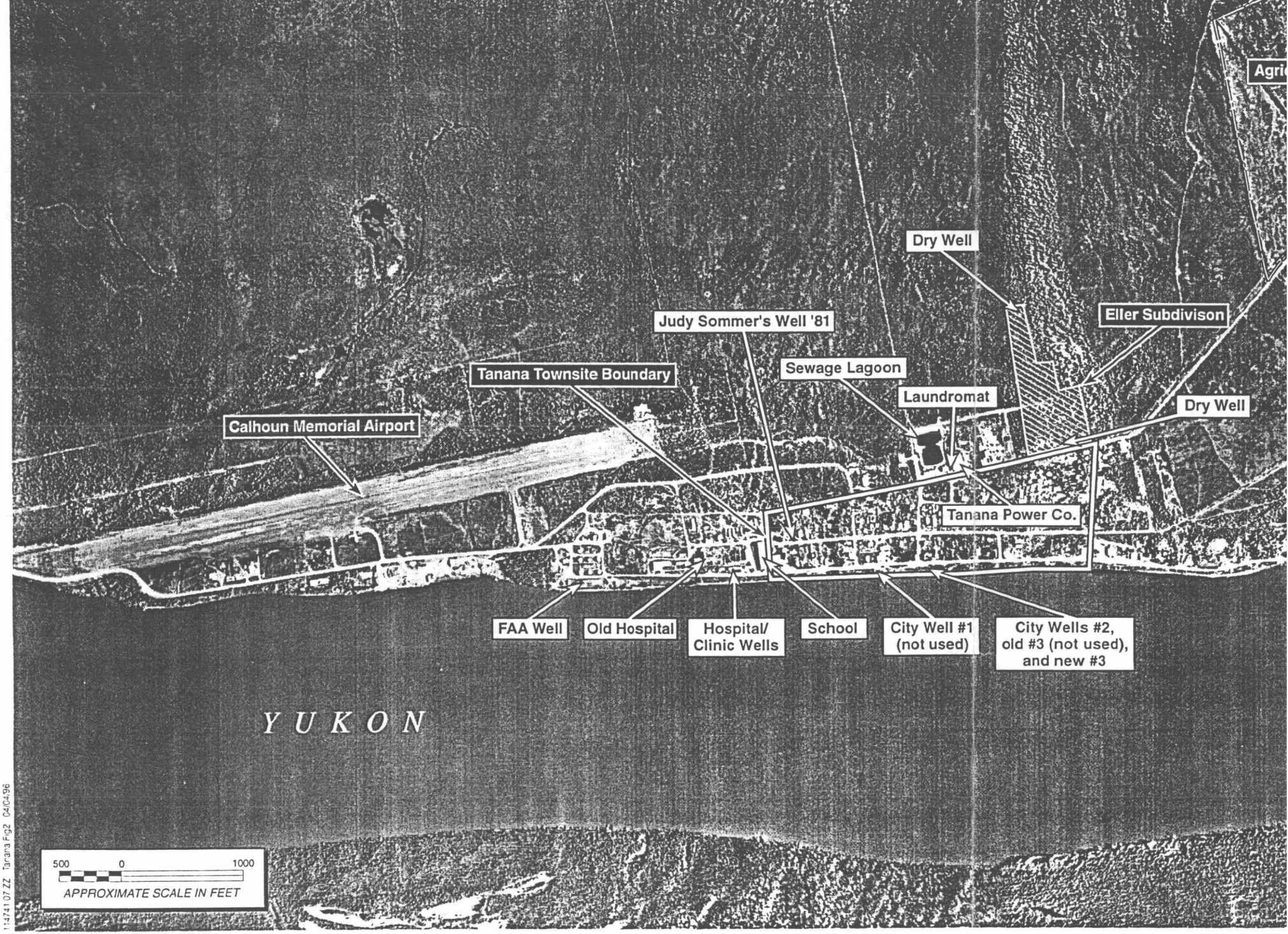
Tanana is served by several different wells and water supply systems (Figure 2 and Table 2). These include the following:

- The "Native Council" system, which consists of a groundwater well, treatment equipment, and a distribution system serving the school, clinic, tribal council office, teachers housing, and the Elders residence. The system was constructed by PHS to serve the old hospital compound.
- The "City" system, which consists of City Wells 2 and 3, water treatment facilities, and a circulating water system serving the laundromat, Head Start building, fire station,

TABLE 1
Selected Tanana Water Quality Data

Well Number (PHS 1980 Report)	Owner	Year Drilled	Sample Date	Sample By	Iron (SMCL=0.3)	Manganese (SMCL=.05)	Alkalinity	Hardness ($CaCO_3$)
27	Pvt	67	8/80	PHS	7.6	0.51		496
32	Pvt	67	8/80	PHS	4.7	0.55		540
34	Pvt	67	7/80	PHS	0.31	0.05		220
35	Pvt	67	7/80	PHS	6.0	0.51		245
15	Pvt	67	8/80	PHS	0.78	0.16		513
52	Pub	67	5/74	PHS	0.3			409
52	Pub	67	11/77	AE	0.3			251
52	Pub	67	1/78	AE	1.5	0.3		507
52	Pub	67	4/78	AE	2.9			583
Hospital/Clinic PHS 72 @ 42'	PHS	72	3/72	PHS	3.3	0.72		455
Hospital/Clinic PHS 72 @ 52' Hosp 2	PHS	72	3/72	PHS	4.1	0.74		430
Hospital/Clinic PHS 76	PHS	76	8/76	PHS	0.1			56
Hospital/Clinic PHS 76	PHS	76	11/79	VSW	1.1	0.97		
City Well 1[a]					0.52	0.67	240	290
City Well 2					0.14	0.38	170	
Old City Well 3[a]					0.85	0.54	410	550
City Well 4[a]					2.19	0.30	320	342
New City Well 3 (Ice Water Well 91)			9/11/91		3.11	1.31	446.4	434

Notes: [a]Well not in use
PHS = U.S. Public Health Service, Anchorage
AE = Arctic Engineers, Inc., Anchorage
VSW = Village Safe Water Program, State of Alaska
SMCL=Secondary Maximum Contaminant Level



11474107 ZZ Tanana Fig2 04/04/96

TABLE 2
Summary of Existing Community Water Wells

Well	Reference Source	Installation Date	Screen Length/Slot	Screen Depth (ft)	Reported Static Water Level (ft) (date)	Pumping Rate (gpm)	Draw Down (ft)	Specific Capacity (gpm)	Water System Connection and Notes
New City Well #3	-Well Log, ICE Water Well, Inc., 1991 -Record Drawings, USPHS Proj. No. AN-90-030 -Project Summary, USPHS 90-030	9/6 to 9/11/91	10 ft/ #40 stainless	38 to 48	27.9 (9-11-91)	15	5.6	2.6	
City Water Well #1	-Final Report, USPHS Proj. No. AN-81-231 -Sunshine Subd. Rept., USPHS Proj. No. AN-86-336, 10/87	3/17 to 3/20/81	5 ft/#40	44 to 49	32	10	10	1.0	Poor yield in late winter (1987). Connected to City circulating system, Laundromat, watering points, 10 businesses and residences
City Well #2 (originally drilled 1967, renumbered by PHS)	-Well Log, A&L Drilling Co., 1967 -As-built, VSW Project, 1979 -Sunshine Subd. Rept., USPHS Proj. No. AN-86-336, 10/87	1967 Rehab 1978	~ 50' bgs = TOTAL DEPT.						Poor yield in late winter (1987). Connected to City circulating system, Laundromat, watering points, 10 businesses and residences
City Well #3	-Sunshine Subd. Rept., USPHS Proj. No. AN-86-336, 10/87 -Project Summary, USPHS 90-030	autumn 1986		20					Primary water supply in late winter (1987). Under influence of surface water. Connected to City circulating system, Laundromat, watering points, 10 businesses and residences. No longer in use.

TABLE 2
Summary of Existing Community Water Wells

Well	Reference Source	Installation Date	Screen Length/Slot	Screen Depth (ft)	Reported Static Water Level (ft) (date)	Pumping Rate (gpm)	Draw Down (ft)	Specific Capacity (gpm)	Water System Connection and Notes
City Well #4	-Sunshine Sub. Rept., USPHS Proj. No. AN-86-336, 10/87	winter-spring 1986	10 ft	20 to 30	0	50			Well installed below Yukon River high water level. Not connected to water system or used as of 1987. Under influence of surface water. Needs pump and power.
Hospital/ Clinic Well "Hospital 2" (good ?)	PHS Well Log	8/18 to 8/28/76	10 ft/#40	39 to 49	25.5	50	9.1	5.5	Water supply to health clinic compound and public school
Hospital/ Clinic Well "Hospital" (contaminated)	PHS Well Log	1/21 to 3/10/72	42 to 47 ft 52 to 55 ft 108 to 120 ft/ 1/2-inch perforations	42 to 47 52 to 55 108 to 120	41 ?	40 (42- to 47-ft interval)	3	13.3	Well contaminated with diesel fuel and filled in
Judy Sommers Well	PHS Well Log	3/22 to 3/24/81	5 ft/#20	45 to 50 ?	31	20	18 or 6	1.1 gpm/ft 3.3 gpm/ft	

Note: gpm = gallons per minute

power plant, and city offices. Residents can obtain water to haul to their homes from the watering point at the laundromat. A community water truck was used in the past, but is not currently operated.

- Miscellaneous wells serving individual homes and the Federal Aviation Administration and Bureau of Land Management complex

The existing well water supply systems are reported to have low water yields. Tanana wells are thought to have had low efficiencies (efficiency = drawdown outside the well/drawdown inside the well) when installed because of their perforated casing construction (instead of a more efficient wire wrap screen), and through time precipitation of iron, manganese, and calcium carbonate have probably significantly reduced the specific capacity of the wells.

Several options exist for increasing the quantity of water available to the community, including the following:

- Rehabilitate existing operational city wells
- Connect existing non-operational wells to the water supply system
- Drill new conventional well(s) and connect to the water supply system
- Drill new angle well(s) under the Yukon River
- Construct a surface water intake in the Yukon River

The scope of work, benefits, and drawbacks of these options are summarized in Table 3.

Routine water system maintenance will be required for any water supply option selected for Tanana. For groundwater well systems, maintenance may include rehabilitation via screen brushing and acid treatment. Maintenance requirements may be minimized by having large-screen open areas and limiting the pumping rate from each well to less than about 5 gpm. To meet the city's peak demand of more than 5 gpm, several wells could be operated simultaneously.

Groundwater Contamination Potential

Groundwater contamination from fuel spills and leaks and from wastewater disposal is relatively common. In Tanana, the presence of the low-permeability surface soils and permafrost reduces, but does not eliminate, the potential for groundwater contamination. For example, the PHS hospital well was contaminated with diesel fuel in 1974 and had to be abandoned. Fuel could contaminate the groundwater where underground fuel tanks or piping extend through the fine-grained soils and into unfrozen gravels, or where fuel tanks and piping are near a well with a poor grout seal. The following precautions may minimize the potential for fuel contamination of groundwater resources at Tanana:

- Inspecting the fuel storage facilities, equipping them with secondary containment, and monitoring them for leaks
- Physically separating water wells from fuel tanks and piping in accordance with State of Alaska regulations
- Maintaining impermeable grout seals on wells from groundwater to the land surface

TABLE 3
Tanana Water Supply Options

Water Supply Options	Scope of Work	Benefits	Drawbacks	Relative Capital Cost	Relative Maintenance Cost
Rehabilitation (acid treatment) of existing operational well(s)	Wire brush well walls and screen; inject acid to dissolve calcium and iron/maganese precipitates; surge well; pump acids and scale from the well	Low cost, short water system downtime, potential to attain near the original specific capacity; should be part of any well maintenance program; low tech, accomplished in any season	Few drawbacks; results uncertain–probably will not attain original specific capacity, but increase in water yield likely	Low	Low
Extend electric power to and install pump in existing non-operational City Well No. 4 and/or other wells	Install submersible pump and extend electric power to the pump; connect to existing insulated water pipe system	Low cost; proven water supply potential	Pump installation and maintenance limited to periods of low water in Yukon River; may need to comply with Surface Water Treatment Rule. May need operational backup in case pump fails at high water levels	Low to moderate	Low
Drill new conventional well(s) (near proven wells or in locations recommended in a water source development study)	Mobilize drill rig; drill well and install screen; develop well; install pump and provide electric power; connect to existing treatment distribution system	Proven technology, simple construction; likely to have good yield if installed with a designed wire wrap screen and is in area with proven high yields (or in locations recommended in a water source development study)	Cost of new well is greater than use of existing wells	Moderate	Low
Drill new angle well(s) under Yukon River	Mobilize air rotary drill rig; drill well and install screen; develop well; install pump and provide electric power; connect to existing distribution system	Minimizes risk of a low yield well	Need specialized well-drilling equipment; more likely to have to comply with Surface Water Treatment Rule	Moderate to high	Low
Use Yukon River surface water intake	Design intake structure and water treatment system; build intake and water treatment system	Unlimited supply with almost no risk of shortages	Surface Water Treatment Rule applies; intake structure and treatment is likely expensive; intake structure susceptible to ice damage, river erosion, and changing water levels	High	Moderate

Groundwater contamination by wastewater could occur where wastewater from outhouses, poorly functioning leach fields, honey bucket disposal sites, or dog lots is close to a well with a poor grout seal. The following steps can minimize the potential for wastewater contamination of groundwater:

- Maintaining separation distances between water wells and wastewater sources
- Maintaining an impermeable grout seal from the surface to the water table

Engineering Characteristics of Terrain Units

The engineering characteristics of the terrain units mapped at Tanana are summarized in Table 4. The interpretations in the table are drawn from Tanana well logs and from reports by Kreig and Reger (1982). The engineering characteristics of the terrain units are presented for planning purposes only and site conditions and geotechnical parameters should be determined by drilling, sampling and laboratory analysis before design or construction.

TABLE 4
Engineering Characteristics of Terrain Units

Engineering Characteristics	Fpt-c/Fpt-r	Fpt-c	Fp
Soil Texture	Silt and silty sands 5 to 15 ft thick overlying sands and gravels	Silt and silty sands with high organic content, about 25 ft thick	Fine sand, silt and gravelly sand
Permafrost	Discontinuous, encountered 5 to 15 ft below grade	Near continuous; encountered 5 to 8 ft below grade	Discontinuous, encountered 8 to 15 ft below grade
Thaw stability	Low to moderate in silts, high in sands and gravels	Low to very low, excess moisture and massive ice lenses likely	Low to moderate
Bearing Capacity (unfrozen)	Moderate to high	Low	Low to moderate
Trench/excavation wall stability	Vertical cuts possible in silts; vertical cuts in sands and gravel will ravel	Vertical cuts possible when frozen, but will fail as walls thaw	Vertical cuts possible above the water table.
Suitability as fill material	Low to moderate in surficial silts, depending on moisture content; high in sands and gravels	Low, because of high moisture and organic content	Low to moderate depending on grain size; potential source of pipe bedding material

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF CAPITAL COSTS - PHASE 2
NEW WATER PLANT/LAUNDROMAT ALTERNATIVE
APRIL, 1996

	DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL	TOTAL
	NEW WATER PLANT/LAUNDROMAT/SHOP					
	BUILDING (40 X 96)	1	LS	$768,000	$768,000	
	WATER PLANT EQUIPMENT (for laundromat phase only)	1	LS	$200,000	$200,000	
	LAUNDROMAT EQUIPMENT	1	LS	$100,000	$100,000	
	FILTER BACKWASH LINE	1000	LF	$80	$80,000	
	WATER STORAGE RESERVOIR (100,000 GALLON)	1	LS	$200,000	$200,000	
	SUBTOTAL A					$1,348,000
	TOTAL ESTIMATED CONSTRUCTION COST					$1,348,000
	PROJECT CONTINGENCY AT 25%					$337,000
	CONSTRUCTION ADMINISTRATION AT 10%					$134,800
	TOTAL ESTIMATED PROJECT COST					$1,819,800
	ROUNDED TO NEAREST ONE HUNDRED THOUSAND					**$1,800,000**

Capital and O&M Cost Summary for the 11 Options

COSTS SUMMARY
SANITATION FACILITIES OPTIONS FOR TANANA
APRIL, 1996

OPTIONS	CAPITAL COSTS	OPERATIONS AND MAINTENANCE COSTS				
		LABOR	EQUIPMENT REPLACEMENT	CONSUMABLES	ANNUAL O&M COSTS	MONTHLY USER FEE
OPTION 1						
WATER SOURCE DEVELOPMENT	$ 380,489	$ -	$ -	$ -	$ -	$ -
CIRCULATING WATER SYSTEM WITHIN TOWNSITE +		$ 40,871	$ 5,482		$ 46,353	$ 32
WATER LOOP FROM TOWNSITE TO SUNSHINE SUBDIVISION	$ 6,083,022	$ 4,068	$ 1,434	$ 65,970	$ 71,472	$ 50
GRAVITY SEWER SYTEM WITHIN TOWNSITE +		$ 10,912	$ 11,278	$ 1,654	$ 23,844	$ 17
GRAVITY SEWER FROM SUNSHINE SUBDIVSION TO TOWNSITE LAGOON	$ 5,274,810	$ 5,412	$ 936	$ 992	$ 7,340	$ 5
REPLACE LAGOON DRAIN PIPE AND LEACHFIELD	$ 323,184	$ -	$ -	$ -	$ -	$ -
TOTAL OPTION 1	**$ 12,061,505**	$ 61,263	$ 19,130	$ 68,616	$ 149,009	**$ 103**
OPTION 2						
WATER SOURCE DEVELOPMENT	$ 380,489	$ -	$ -	$ -	$ -	$ -
CIRCULATING WATER SYSTEM WITHIN TOWNSITE +		$ 40,871	$ 5,482		$ 46,353	$ 32
WATER LOOP FROM TOWNSITE TO SUNSHINE SUBDIVISION	$ 6,083,022	$ 4,068	$ 1,434	$ 65,970	$ 71,472	$ 50
VACUUM SEWER SYSTEM WITHIN TOWNSITE +		$ 10,646	$ 11,856		$ 22,502	$ 16
VACUUM SEWER SYSTEM FROM SUNSHINE TO TOWNSITE LAGOON	$ 3,802,700	$ 2,723	$ 154	$ 12,624	$ 15,501	$ 11
REPLACE LAGOON DRAIN PIPE AND LEACHFIELD	$ 323,184	$ -	$ -	$ -	$ -	$ -
TOTAL OPTION 2	**$ 10,589,395**	$ 58,308	$ 18,926	$ 78,594	$ 155,828	**$ 108**
OPTION 3						
WATER SOURCE DEVELOPMENT	$ 380,489	$ -	$ -	$ -	$ -	$ -
CIRCULATING WATER SYSTEM WITHIN TOWNSITE +		$ 40,871	$ 5,482	$ 60,502	$ 106,855	$ 74
HAUL TREATED WATER FROM THE TOWNSITE WATER PLANT TO A STORAGE AND PUMPING FACILITY AT SUNSHINE SUBDIVISION WITH A CIRCULATING WATER LOOP FOR THE SUBDIVISION ONLY	$ 5,762,600	$ 12,377	$ 15,681	$ 14,033	$ 42,091	$ 29
GRAVITY SEWER SYTEM WITHIN TOWNSITE +		$ 10,912	$ 11,278	$ 1,654	$ 23,844	$ 17
GRAVITY SEWER WITHIN THE SUBDIVISION FLOWING TO 5 TO 7 DAY STORAGE HOLDING TANK(S) WITH HOLDING TANK PUMPING AND HAUL TO THE TOWNSITE LAGOON	$ 4,441,641	$ 4,100	$ 13,395	$ 9,711	$ 27,206	$ 19
REPLACE LAGOON DRAIN PIPE AND LEACHFIELD	$ 323,184	$ -	$ -	$ -	$ -	
TOTAL OPTION 3	**$ 10,907,914**	$ 68,260	$ 45,836	$ 85,900	$ 199,996	**$ 139**
OPTION 4						
WATER SOURCE DEVELOPMENT	$ 380,489	$ -	$ -	$ -	$ -	$ -
CIRCULATING WATER SYSTEM WITHIN TOWNSITE +		$ 40,871	$ 5,482	$ 60,502	$ 106,855	$ 74
HAUL TREATED WATER FROM THE TOWNSITE WATER PLANT TO A STORAGE AND PUMPING FACILITY AT SUNSHINE SUBDIVISION WITH A CIRCULATING WATER LOOP FOR THE SUBDIVISION ONLY	$ 5,762,600	$ 12,377	$ 15,681	$ 14,033	$ 42,091	$ 29
VACUUM SEWER SYSTEM WITHIN TOWNSITE +		$ 10,646	$ 11,856	$ 12,624	$ 35,126	$ 24
GRAVITY SEWER WITHIN THE SUBDIVISION FLOWING TO 5 TO 7 DAY STORAGE HOLDING TANK(S) WITH HOLDING TANK PUMPING AND HAUL TO THE TOWNSITE LAGOON	$ 3,861,215	$ 4,100	$ 13,395	$ 9,711	$ 27,206	$ 19
REPLACE LAGOON DRAIN PIPE AND LEACHFIELD	$ 323,184	$ -	$ -	$ -	$ -	$ -

COSTS SUMMARY
SANITATION FACILITIES OPTIONS FOR TANANA
APRIL, 1996

OPTIONS	CAPITAL COSTS	OPERATIONS AND MAINTENANCE COSTS				
		LABOR	EQUIPMENT REPLACEMENT	CONSUMABLES	ANNUAL O&M COSTS	MONTHLY USER FEE
TOTAL OPTION 4	**$ 10,327,488**	$ 67,994	$ 46,414	$ 96,870	$ 211,278	**$ 147**
OPTION 5						
WATER SOURCE DEVELOPMENT	$ 380,489	$ -	$ -	$ -	$ -	$ -
CIRCULATING WATER SYSTEM WITHIN TOWNSITE +		$ 40,871	$ 5,482	$ 60,502	$ 106,855	$ 74
LARGE VEHICLE HAUL FOR SUNSHINE SUBDIVISION	$ 5,318,238	$ 9,227	$ 13,935	$ 9,997	$ 33,159	$ 23
GRAVITY SEWER SYSTEM WITHIN TOWNSITE +		$ 10,912	$ 11,278	$ 1,654	$ 23,844	$ 17
LARGE VEHICLE HAUL FOR SUNSHINE SUBDIVISION	$ 4,167,960	$ 10,300	$ 12,940	$ 9,997	$ 33,237	$ 23
REPLACE LAGOON DRAIN PIPE AND LEACHFIELD	$ 323,184	$ -	$ -	$ -	$ -	$ -
TOTAL OPTION 5	**$ 10,189,871**	$ 71,310	$ 43,635	$ 82,150	$ 197,095	**$ 137**
OPTION 6						
WATER SOURCE DEVELOPMENT	$ 380,489	$ -	$ -	$ -	$ -	$ -
CIRCULATING WATER SYSTEM WITHIN TOWNSITE +		$ 40,871	$ 5,482	$ 60,502	$ 106,855	$ 74
LARGE VEHICLE HAUL FOR SUNSHINE SUBDIVISION	$ 5,318,238	$ 9,227	$ 13,935	$ 9,997	$ 33,159	$ 23
VACUUM SEWER SYTEM WITHIN TOWNSITE+		$ 10,646	$ 11,856	$ 12,624	$ 35,126	$ 24
LARGE VEHICLE HAUL FOR SUNSHINE SUBDIVISION	$ 3,498,704	$ 10,300	$ 12,940	$ 9,997	$ 33,237	$ 23
REPLACE LAGOON DRAIN PIPE AND LEACHFIELD	$ 323,184	$ -	$ -	$ -	$ -	$ -
TOTAL OPTION 6	**$ 9,520,615**	$ 71,044	$ 44,213	$ 93,120	$ 208,377	**$ 145**
OPTION 7						
WATER SOURCE DEVELOPMENT	$ 380,489	$ -	$ -	$ -	$ -	$ -
CIRCULATING WATER SYSTEM WITHIN TOWNSITE +		$ 40,871	$ 5,482	$ 60,502	$ 106,855	$ 74
SMALL VEHICLE HAUL FOR SUNSHINE SUBDIVISION	$ 5,193,030	$ 6,503	$ 19,399	$ 5,648	$ 31,550	$ 22
GRAVITY SEWER SYTEM WITHIN TOWNSITE +		$ 10,912	$ 11,278	$ 1,654	$ 23,844	$ 17
SMALL VEHICLE HAUL FOR SUNSHINE SUBDIVISION	$ 4,112,970	$ 6,503	$ 30,709	$ 5,648	$ 42,860	$ 30
REPLACE LAGOON DRAIN PIPE AND LEACHFIELD	$ 323,184	$ -	$ -	$ -	$ -	$ -
TOTAL OPTION 7	**$ 10,009,673**	$ 64,789	$ 66,868	$ 73,452	$ 205,109	**$ 142**
OPTION 8						
WATER SOURCE DEVELOPMENT	$ 380,489	$ -	$ -	$ -	$ -	$ -
CIRCULATING WATER SYSTEM WITHIN TOWNSITE +		$ 40,871	$ 5,482	$ 60,502	$ 106,855	$ 74
SMALL VEHICLE HAUL FOR SUNSHINE SUBDIVISION	$ 5,193,030	$ 6,503	$ 19,399	$ 5,648	$ 31,550	$ 22
VACUUM SEWER SYTEM WITHIN TOWNSITE +		$ 10,646	$ 11,856	$ 12,624	$ 35,126	$ 24
SMALL VEHICLE HAUL FOR SUNSHINE SUBDIVISION	$ 3,502,934	$ 6,503	$ 30,709	$ 5,648	$ 42,860	$ 30
REPLACE LAGOON DRAIN PIPE AND LEACHFIELD	$ 323,184	$ -	$ -	$ -	$ -	$ -
TOTAL OPTION 8	**$ 9,399,637**	$ 64,523	$ 67,446	$ 84,422	$ 216,391	**$ 150**
OPTION 9						
WATER SOURCE DEVELOPMENT	$ 380,489	$ -	$ -	$ -	$ -	$ -
REPLACE EXISTING WASHETERIA WITH NEW WASHETERIA	$ 1,931,136	$ 57,220	$ 5,482	$ 40,437	$ 103,139	$ 72

COSTS SUMMARY SANITATION FACILITIES OPTIONS FOR TANANA APRIL, 1996						
OPTIONS	**CAPITAL COSTS**	**OPERATIONS AND MAINTENANCE COSTS**				
		LABOR	**EQUIPMENT REPLACEMENT**	**CONSUMABLES**	**ANNUAL O&M COSTS**	**MONTHLY USER FEE**
CONTINUE SELF HAUL	$ -	$ -	$ -	$ -	$ -	$ -
REPLACE LAGOON DRAIN PIPE AND LEACHFIELD	$ 323,184	$ -	$ -	$ -	$ -	$ -
TOTAL OPTION 9	**$ 2,634,809**	$ 57,220	$ 5,482	$ 40,437	$ 103,139	**$ 72**
OPTION 10						
WATER SOURCE DEVELOPMENT	$ 380,489	$ -	$ -	$ -	$ -	$ -
REPLACE EXISTING WASHETERIA WITH NEW WASHETERIA +		$ 57,220	$ 5,482	$ 40,837	$ 103,539	$ 72
SMALL VEHICLE WATER AND SEWAGE HAUL	$ 3,486,366	$ 62,910	$ 30,709	$ 6,572	$ 100,191	$ 70
REPLACE LAGOON DRAIN PIPE AND LEACHFIELD	$ 323,184	$ -	$ -	$ -	$ -	$ -
TOTAL OPTION 10	**$ 4,190,039**	$ 120,130	$ 36,191	$ 47,409	$ 203,730	**$ 141**
OPTION 11						
WATER SOURCE DEVELOPMENT	$ 380,489	$ -	$ -	$ -	$ -	$ -
REPLACE EXISTING WASHETERIA WITH NEW WASHETERIA +		$ 57,220	$ 5,482	$ 40,837	$ 103,539	$ 72
LARGE VEHICLE WATER AND SEWAGE HAUL	$ 4,084,206	$ 122,411	$ 26,875	$ 17,433	$ 166,719	$ 116
REPLACE LAGOON DRAIN PIPE AND LEACHFIELD	$ 323,184	$ -	$ -	$ -	$ -	$ -
TOTAL OPTION 11	**$ 4,787,879**	$ 179,631	$ 32,357	$ 58,270	$ 270,258	**$ 188**

Detailed Capital Costs

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF CAPITAL COSTS
PIPED GRAVITY/PRESSURE SEWER SYSTEM ALTERNATIVE
APRIL, 1996

OPTION	DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL	TOTAL
A	**PIPED SEWER SYSTEM (TOWNSITE AREA)**					
	GRAVITY SEWER MAIN (8-INCH)	13,200	LF	$80	$1,056,000	
	MANHOLES	35	EA	$5,000	$175,000	
	FORCE MAIN (4-INCH)	2,100	LF	$60	$126,000	
	LIFT STATIONS	2	EA	$75,000	$150,000	
	SERVICE LINES (80 FT.)	110	EA	$8,500	$935,000	
	MINIMUM HOUSE PLUMBING ALLOWANCE	110	EA	$3,000	$330,000	
	CLEAN-OUTS	7	EA	$3,000	$21,000	
	SUBTOTAL A					$2,793,000
	TOTAL ESTIMATED CONSTRUCTION COST					$2,793,000
	PROJECT CONTINGENCY AT 25%					$698,250
	ENGINEERING DESIGN AT 6%					$167,580
	CONSTRUCTION ADMINISTRATION AT 10%					$279,300
	TOTAL ESTIMATED PROJECT COST					$3,938,130
B	**PIPED SEWER FROM SUBDIVISION**					
	GRAVITY SEWER MAIN (8-INCH)	3,200	LF	$80	$256,000	
	MANHOLES	8	EA	$5,000	$40,000	
	SERVICE LINES (80 FT.)	14	EA	$8,000	$112,000	
	MINIMUM HOUSE PLUMBING ALLOWANCE	14	EA	$3,000	$42,000	
	FORCE MAIN	3800	LF	$100	$380,000	
	LIFT STATIONS	2	EA	$50,000	$100,000	
	CLEAN-OUTS	6	EA	$3,000	$18,000	
	SUBTOTAL B					$948,000
	TOTAL ESTIMATED CONSTRUCTION COST (A + B)					$3,741,000
	PROJECT CONTINGENCY AT 25%					$935,250
	ENGINEERING DESIGN AT 6%					$224,460
	CONSTRUCTION ADMINISTRATION AT 10%					$374,100
	TOTAL ESTIMATED PROJECT COST (A + B)					$5,274,810
C	**PIPED SEWER W/I SUBDIVISION/HAUL SEWAGE TO LAGOON**					
	SEWAGE HAUL VEHICLE	1	EA	$65,000	$65,000	
	GRAVITY SEWER MAIN	1,230	LF	$70	$86,100	
	MANHOLES	2	EA	$5,000	$10,000	
	CLEAN-OUTS	6	EA	$3,000	$18,000	
	SERVICE LINES (80 FT.)	14	EA	$8,000	$112,000	
	MINIMUM HOUSE PLUMBING ALLOWANCE	14	EA	$3,000	$42,000	
	HOLDING TANKS (6,000 GALLONS)	2	EA	$12,000	$24,000	
	SUBTOTAL C					$357,100
	TOTAL ESTIMATED CONSTRUCTION COST (A + C)					$3,150,100
	PROJECT CONTINGENCY AT 25%					$787,525
	ENGINEERING DESIGN AT 6%					$189,006
	CONSTRUCTION ADMINISTRATION AT 10%					$315,010
	TOTAL ESTIMATED PROJECT COST (A + C)					$4,441,641
D	**LARGE VEHICLE HAUL SUBDIVISION ONLY**					
	SEWAGE HAUL VEHICLE	1	EA	$65,000	$65,000	
	SEWAGE HOLDING TANKS (900 GALLONS)	14	EA	$4,000	$56,000	
	MINIMUM HOUSE PLUMBING ALLOWANCE	14	EA	$3,000	$42,000	
	SUBTOTAL D					$163,000
	TOTAL ESTIMATED CONSTRUCTION COST (A + D)					$2,956,000
	PROJECT CONTINGENCY AT 25%					$739,000
	ENGINEERING DESIGN AT 6%					$177,360
	CONSTRUCTION ADMINISTRATION AT 10%					$295,600
	TOTAL ESTIMATED PROJECT COST (A + D)					$4,167,960
E	**SMALL VEHICLE HAUL SUBDIVISION ONLY**					
	COLLECTION TANK AND TRAILER	1	EA	$6,000	$6,000	
	TOILET SYSTEM	14	EA	$5,500	$77,000	
	HOUSE MODIFICATIONS/INSTALLATION	14	EA	$2,500	$35,000	
	4-WHEELER TOW VEHICLE	1	EA	$6,000	$6,000	
	SUBTOTAL E					$124,000
	TOTAL ESTIMATED CONSTRUCTION COST (A + E)					$2,917,000
	PROJECT CONTINGENCY AT 25%					$729,250
	ENGINEERING DESIGN AT 6%					$175,020
	CONSTRUCTION ADMINISTRATION AT 10%					$291,700
	TOTAL ESTIMATED PROJECT COST(A + E)					$4,112,970

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF CAPITAL COSTS
PIPED VACUUM SEWER SYSTEM ALTERNATIVE
APRIL, 1996

OPTION	DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL	TOTAL
A	**PIPED SEWER SYSTEM (TOWNSITE AREA)**					
	VACUUM SEWER MAIN (6-INCH)	5,500	LF	$75	$412,500	
	VACUUM SEWER MAIN (4-INCH)	8,150	LF	$65	$529,750	
	DIVISION VALVES	11	EA	$1,100	$12,100	
	VACUUM STATION	1	LS	$175,000	$175,000	
	VACUUM STATION BUILDING (24 X 24)	1	LS	$120,000	$120,000	
	HOME VALVES	110	EA	$1,100	$121,000	
	MINIMUM HOUSE PLUMBING ALLOWANCE	110	EA	$4,000	$440,000	
	SERVICE LINES (2-INCH X 80 FT.)	110	EA	$5,000	$550,000	
	SUBTOTAL A					$2,360,350
	TOTAL ESTIMATED CONSTRUCTION COST					$2,360,350
	PROJECT CONTINGENCY AT 25%					$590,088
	ENGINEERING DESIGN AT 6%					$141,621
	CONSTRUCTION ADMINISTRATION AT 10%					$236,035
	TOTAL ESTIMATED PROJECT COST					$3,328,094
B	**PIPED SEWER FROM SUBDIVISION**					
	VACUUM SEWER MAIN (6-INCH)	1,500	LF	$75	$112,500	
	VACUUM SEWER MAIN (4-INCH)	2,100	LF	$65	$136,500	
	DIVISION VALVES	2	EA	$1,100	$2,200	
	HOME VALVES	14	EA	$1,100	$15,400	
	SERVICE LINES (80 FT.)	14	EA	$5,000	$70,000	
	MINIMUM HOUSE PLUMBING REQUIREMENTS	14	EA	$4,000	$56,000	
	SUBTOTAL B					$336,600
	TOTAL ESTIMATED CONSTRUCTION COST (A + B)					$2,696,950
	PROJECT CONTINGENCY AT 25%					$674,238
	ENGINEERING DESIGN AT 6%					$161,817
	CONSTRUCTION ADMINISTRATION AT 10%					$269,695
	TOTAL ESTIMATED PROJECT COST (A + B)					$3,802,700
C	**PIPED SEWER W/I SUBDIVISION/HAUL SEWAGE TO LAGOON**					
	SEWAGE HAUL VEHICLE	1	EA	$65,000	$65,000	
	GRAVITY SEWER MAIN	1,230	LF	$70	$86,100	
	MANHOLES	2	EA	$5,000	$10,000	
	CLEAN-OUTS	6	EA	$3,000	$18,000	
	SERVICE LINES (80 FT.)	14	EA	$8,500	$119,000	
	MINIMUM HOUSE PLUMBING REQUIREMENTS	14	EA	$4,000	$56,000	
	HOLDING TANKS (6,000 GALLONS)	2	EA	$12,000	$24,000	
	SUBTOTAL C					$378,100
	TOTAL ESTIMATED CONSTRUCTION COST (A + C)					$2,738,450
	PROJECT CONTINGENCY AT 25%					$684,613
	ENGINEERING DESIGN AT 6%					$164,307
	CONSTRUCTION ADMINISTRATION AT 10%					$273,845
	TOTAL ESTIMATED PROJECT COST (A + C)					$3,861,215
D	**LARGE VEHICLE HAUL SUBDIVISION ONLY**					
	SEWAGE HAUL VEHICLE	1	EA	$65,000	$65,000	
	HOLDING TANKS (900 GALLONS)	14	EA	$4,000	$56,000	
	MINIMUM HOUSE PLUMBING REQUIREMENTS	14	EA	$4,000	$56,000	
	SUBTOTAL D					$121,000
	TOTAL ESTIMATED CONSTRUCTION COST (A + D)					$2,481,350
	PROJECT CONTINGENCY AT 25%					$620,338
	ENGINEERING DESIGN AT 6%					$148,881
	CONSTRUCTION ADMINISTRATION AT 10%					$248,135
	TOTAL ESTIMATED PROJECT COST (A + D)					$3,498,704
E	**SMALL VEHICLE HAUL SUBDIVISION ONLY**					
	COLLECTION TANK AND TRAILER	1	EA	$6,000	$6,000	
	4-WHEELER TOW VEHICLE	1	EA	$6,000	$6,000	
	TOILET SYSTEM	14	EA	$5,500	$77,000	
	HOUSE MODIFICATIONS/INSTALLATION	14	EA	$2,500	$35,000	
	SUBTOTAL E					$124,000
	TOTAL ESTIMATED CONSTRUCTION COST (A + E)					$2,484,350
	PROJECT CONTINGENCY AT 25%					$621,088
	ENGINEERING DESIGN AT 6%					$149,061
	CONSTRUCTION ADMINISTRATION AT 10%					$248,435
	TOTAL ESTIMATED PROJECT COST(A + E)					$3,502,934

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF CAPITAL COSTS
PIPED WATER SYSTEM ALTERNATIVE
APRIL, 1996

OPTION	DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL	TOTAL
A	**PIPED WATER SYSTEM (TOWNSITE AREA)**					
	CIRCULATING 6-INCH WATER MAIN	17,500	LF	$70	$1,225,000	
	SERVICE LINES (80 FT.)	110	EA	$9,800	$1,078,000	
	MAIN TREATMENT PLANT/PUMPHOUSE/SHOP (48' X 36')	1	LS	$400,000	$400,000	
	TREATMENT EQUIPMENT	1	LS	$300,000	$300,000	
	STORAGE RESERVOIR (150,000 GALLONS)	1	LS	$300,000	$300,000	
	MINIMUM HOUSE PLUMBING ALLOWANCE	110	EA	$3,000	$330,000	
	SUBTOTAL A					$3,633,000
	TOTAL ESTIMATED CONSTRUCTION COST					$3,633,000
	PROJECT CONTINGENCY AT 25%					$908,250
	ENGINEERING DESIGN AT 6%					$217,980
	CONSTRUCTION ADMINISTRATION AT 10%					$363,300
	TOTAL ESTIMATED PROJECT COST					$5,122,530
B	**WATER LOOP TO SUNSHINE SUBDIVISION**					
	CIRCULATING 6-INCH WATER MAIN	7,100	LF	$70	$497,000	
	SERVICE LINES (80 FT.)	14	EA	$9,800	$137,200	
	ADDITIONAL PUMPING EQUIPMENT	1	LS	$5,000	$5,000	
	MINIMUM HOUSE PLUMBING ALLOWANCE	14	EA	$3,000	$42,000	
	SUBTOTAL B					$681,200
	TOTAL ESTIMATED CONSTRUCTION COST (A + B)					$4,314,200
	PROJECT CONTINGENCY AT 25%					$1,078,550
	ENGINEERING DESIGN AT 6%					$258,852
	CONSTRUCTION ADMINISTRATION AT 10%					$431,420
	TOTAL ESTIMATED PROJECT COST (A + B)					$6,083,022
C	**HAUL WATER TO SUBDIVISION/PIPED DISTR W/I SUBDIVISION**					
	WATER HAUL VEHICLE	1	EA	$70,000	$70,000	
	CIRCULATING 4-INCH WATER MAIN	1,230	LF	$65	$79,950	
	SERVICE LINES (80 FT.)	14	EA	$8,000	$112,000	
	MINIMUM HOUSE PLUMBING ALLOWANCE	14	EA	$3,000	$42,000	
	PUMPHOUSE (20' X 20')	1	LS	$80,000	$80,000	
	PUMPHOUSE EQUIPMENT	1	LS	$30,000	$30,000	
	STORAGE RESERVOIR (10,000 GALLONS)	1	LS	$30,000	$30,000	
	MODIFICATIONS TO MAIN TREATMENT PLANT/PUMPHOUSE	1	LS	$10,000	$10,000	
	SUBTOTAL C					$453,950
	TOTAL ESTIMATED CONSTRUCTION COST (A + C)					$4,086,950
	PROJECT CONTINGENCY AT 25%					$1,021,738
	ENGINEERING DESIGN AT 6%					$245,217
	CONSTRUCTION ADMINISTRATION AT 10%					$408,695
	TOTAL ESTIMATED PROJECT COST (A + C)					$5,762,600
D	**LARGE VEHICLE HAUL SUBDIVISION ONLY**					
	WATER HAUL VEHICLE	1	EA	$70,000	$70,000	
	INDIVIDUAL WATER STORAGE TANKS (600 GALLONS)	14	EA	$1,200	$16,800	
	MINIMUM HOUSE PLUMBING ALLOWANCE	14	EA	$3,000	$42,000	
	MODIFICATIONS TO MAIN TREATMENT PLANT/PUMPHOUSE	1	LS	$10,000	$10,000	
	SUBTOTAL D					$138,800
	TOTAL ESTIMATED CONSTRUCTION COST (A + D)					$3,771,800
	PROJECT CONTINGENCY AT 25%					$942,950
	ENGINEERING DESIGN AT 6%					$226,308
	CONSTRUCTION ADMINISTRATION AT 10%					$377,180
	TOTAL ESTIMATED PROJECT COST (A + D)					$5,318,238
E	**SMALL VEHICLE HAUL SUBDIVISION ONLY**					
	WATER TANK AND TRAILER	1	EA	$6,000	$6,000	
	4-WHEELER TOW VEHICLE	1	EA	$6,000	$6,000	
	LAVATORY AND VANITY	14	EA	$1,000	$14,000	
	HOUSE MODIFICATIONS/INSTALLATION	14	EA	$1,000	$14,000	
	MODIFICATIONS TO MAIN TREATMENT PLANT/PUMPHOUSE	1	LS	$10,000	$10,000	
	SUBTOTAL E					$50,000
	TOTAL ESTIMATED CONSTRUCTION COST (A + E)					$3,683,000
	PROJECT CONTINGENCY AT 25%					$920,750
	ENGINEERING DESIGN AT 6%					$220,980
	CONSTRUCTION ADMINISTRATION AT 10%					$368,300
	TOTAL ESTIMATED PROJECT COST(A + E)					$5,193,030

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF CAPITAL COSTS
NEW LAUNDROMAT/WATER PLANT ALTERNATIVE
APRIL, 1996

OPTION	DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL	TOTAL
A	**NEW LAUNDROMAT/WATER PLANT/SHOP**					
	BUILDING (40 X 120)	1	LS	$960,000	$960,000	
	WATER PLANT EQUIPMENT	1	LS	$200,000	$200,000	
	LAUNDROMAT EQUIPMENT	1	LS	$100,000	$100,000	
	FILTER BACKWASH LINE	120	LF	$80	$9,600	
	WATER STORAGE RESERVOIR (50,000 GALLON)	1	LS	$100,000	$100,000	
	SUBTOTAL A					$1,369,600
	TOTAL ESTIMATED CONSTRUCTION COST					$1,369,600
	PROJECT CONTINGENCY AT 25%					$342,400
	ENGINEERING DESIGN AT 6%					$82,176
	CONSTRUCTION ADMINISTRATION AT 10%					$136,960
	TOTAL ESTIMATED PROJECT COST					$1,931,136
B	**LARGE VEHICLE HAUL**					
	WATER HAUL VEHICLE (2000 GALLON)	1	EA	$70,000	$70,000	
	SEWAGE HAUL VEHICLE (2000 GALLON)	1	EA	$65,000	$65,000	
	MINIMUM HOUSE PLUMBING REQUIREMENT	120	LS	$6,000	$720,000	
	INDIVIDUAL WATER STORAGE TANKS (600 GALLONS)	120	EA	$1,600	$192,000	
	INDIVIDUAL SEWAGE HOLDING TANKS (900 GALLONS)	120	EA	$4,000	$480,000	
	SUBTOTAL D					$1,527,000
	TOTAL ESTIMATED CONSTRUCTION COST (A + B)					$2,896,600
	PROJECT CONTINGENCY AT 25%					$724,150
	ENGINEERING DESIGN AT 6%					$173,796
	CONSTRUCTION ADMINISTRATION AT 10%					$289,660
	TOTAL ESTIMATED PROJECT COST (A + B)					$4,084,206
C	**SMALL VEHICLE HAUL**					
	TOILET SYSTEM	120	EA	$5,500	$660,000	
	LAVATORY AND VANITY	120	EA	$1,000	$120,000	
	HOUSE MODIFICATIONS/INSTALLATION	120	EA	$2,500	$300,000	
	WATER TANK AND TRAILER	1	EA	$5,000	$5,000	
	COLLECTION TANK AND TRAILER	1	EA	$6,000	$6,000	
	4-WHEELER TOW VEHICLE	2	EA	$6,000	$12,000	
	SUBTOTAL E					$1,103,000
	TOTAL ESTIMATED CONSTRUCTION COST (A + C)					$2,472,600
	PROJECT CONTINGENCY AT 25%					$618,150
	ENGINEERING DESIGN AT 6%					$148,356
	CONSTRUCTION ADMINISTRATION AT 10%					$247,260
	TOTAL ESTIMATED PROJECT COST(A + C)					$3,486,366

Detailed Labor Costs

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF NEW WATER PLANT AND TOWNSITE WATER LOOPS OPERATIONS AND MAINTENANCE COSTS
LABOR COSTS
APRIL, 1996

LABOR

LABOR CLASSIFICATION	NUMBER OF UNITS	ANNUAL FREQUENCY	TIME PER TASK (MINUTES)	TIME PER YEAR (HOURS)	HOURLY RATE	TOTAL	TOTAL
WATER PLANT OPERATOR							
WATER PLANT OPERATIONS							
INSPECT PLANT OPERATION - DAILY LOG	1	313	15	78.25	$15.00	$1,173.75	
CHECK, RECORD WATER USE	1	313	3	15.65	$15.00	$234.75	
CHECK, RECORD STORAGE TANK LEVEL	1	313	3	15.65	$15.00	$234.75	
CHECK , RECORD TAP CHLORINE RESIDUAL	1	365	5	30.42	$15.00	$456.25	
CHECK , RECORD TREATED WATER CL RESID.	1	313	5	26.08	$15.00	$391.25	
CHECK, RECORD pH	1	313	5	26.08	$15.00	$391.25	
CHECK, RECORD TREATED WATER TEMP	1	313	2	10.43	$15.00	$156.50	
CHECK, RECORD TREATED WATER TURBIDITY	1	313	5	26.08	$15.00	$391.25	
CHECK, RECORD FLUORIDE CONCENTRATION	1	365	5	30.42	$15.00	$456.25	
COLLECT AND ANALYZE COLIFORM SAMPLE	1	12	15	3.00	$15.00	$45.00	
BACKWASH FILTERS	3	122	10	61.00	$15.00	$915.00	
RUN JAR TEST FOR COAGULANT CONTROL	1	100	45	75.00	$15.00	$1,125.00	
PREPARE COAGULANT SOLUTION	1	52	10	8.67	$15.00	$130.00	
PREPARE CHLORINE SOLUTION	1	26	10	4.33	$15.00	$65.00	
PREPARE FLUORIDE SOLUTION	1	26	10	4.33	$15.00	$65.00	
PREPARE POTASSIUM PERMANGANATE SOL'N	1	26	10	4.33	$15.00	$65.00	
TEST ALARM PANELS	1	12	3	0.60	$15.00	$9.00	
RUN STANDBY GENERATOR	1	12	40	8.00	$15.00	$120.00	
INSPECT FILTER MEDIA	3	313	3	46.95	$15.00	$704.25	
REPAIR PRESSURE AND CIRC PUMPS	6	2	120	24.00	$15.00	$360.00	
REPAIR CHEMICAL FEED PUMPS	3	12	60	36.00	$15.00	$540.00	
INSPECT, CALIBRATE TURBIDIMETERS	4	12	15	12.00	$15.00	$180.00	
INSPECT GAGES	18	2	2	1.20	$15.00	$18.00	
CHECK PRESSURE SWITCH SETTINGS	3	2	5	0.50	$15.00	$7.50	
DRAIN PRESSURE TANK	1	1	60	1.00	$15.00	$15.00	
DRAIN, CLEAN, INSPECT STOR. TANK	1	1	480	8.00	$15.00	$120.00	
LUBE PUMPS	6	2	5	1.00	$15.00	$15.00	
EXERCISE VALVES	125	1	3	6.25	$15.00	$93.75	
WATER PLANT BOILERS							
CHECK BOILER OPERATION	2	313	10	104.33	$15.00	$1,565.00	
CHECK AND RELIGHT BURNERS	2	12	15	6.00	$15.00	$90.00	
CHECK HYDRONIC HEAT SYSTEM OPER.	1	313	10	52.17	$15.00	$782.50	
CHECK DAY TANK LEVELS	1	52	15	13.00	$15.00	$195.00	
FILL DAY TANKS	1	26	30	13.00	$15.00	$195.00	
DRAIN WATER FROM OIL TANKS	1	52	3	2.60	$15.00	$39.00	
ALTERNATE BOILERS, PUMPS	2	52	2	3.47	$15.00	$52.00	
BLOW OFF BOILER PRESSURE RELIEF	2	12	2	0.80	$15.00	$12.00	
BOILER STACK TESTING AND ADJUST	2	4	120	16.00	$15.00	$240.00	
SERVICE BOILER BURNERS	2	1	120	4.00	$15.00	$60.00	
CLEAN BOILER STACKS	2	1	180	6.00	$15.00	$90.00	
CHANGE FUEL OIL FILTERS	2	1	30	1.00	$15.00	$15.00	
RUN HYDRONIC CIRC PUMPS UNDER LOAD	1	12	60	12.00	$15.00	$180.00	
GENERAL - WATER PLANT							
REPAIR AND SERVICE WATERING POINT	1	8	60	8.00	$15.00	$120.00	
CHECK FIRE EXTINGUISHERS	1	1	5	0.08	$15.00	$1.25	
TEST ALARM PANELS	1	12	3	0.60	$15.00	$9.00	
GENERAL CLEAN UP IN WATER PLANT	1	52	30	26.00	$15.00	$390.00	
PAINTING AND BUILDING UPKEEP	1	2	60	2.00	$15.00	$30.00	
PIPELINE INSPECTIONS AND REPAIRS							
INSPECT WELL WATER TRANSMISSION LINE	1	12	15	3.00	$15.00	$45.00	
INSPECT TOWNSITE WATER LOOPS	2	12	60	24.00	$15.00	$360.00	
INSPECT BACKWASH WATER LINE	1	12	10	2.00	$15.00	$30.00	
MISCELLANEOUS							
WATERLINE THAWING	2	24	300	240.00	$15.00	$3,600.00	
GENERAL REPAIR (INCLUDING WATERLINE)	3	12	480	288.00	$15.00	$4,320.00	
ADMINISTRATIVE							
SEND IN DEC OPERATIONS REPORT	1	12	15	3.00	$15.00	$45.00	
PREPARE WEEKLY WRITTEN REPORT	1	52	15	13.00	$15.00	$195.00	
MAKE VERBAL REPORT TO SUPERVISOR	1	52	10	8.67	$15.00	$130.00	
ORDER SUPPLIES, PARTS AND CHEMICALS	1	12	30	6.00	$15.00	$90.00	

OPERATOR TRAINING	1	2	960	32.00	$15.00	$480.00	
DRAIN WASTEWATER LAGOON	1	1	480	8.00	$15.00	$120.00	
WATER PLANT OPERATOR LABOR SUBTOTAL							$21,959
GENERAL LIABILITY AND WORKMANS COMP							$1,735
CONTINGENCY @ 10% FOR WATER PLANT							$2,196
ADMINISTRATIVE							
WATER & SEWER SYSTEM ADMINISTRATIVE LABOR	1	52	300	260.00	$15.00	$3,900.00	
GENERAL LIABILITY AND WORKMANS COMP							$308
ADMINISTRATIVE LABOR SUBTOTAL							$3,900
BOOKKEEPING							
WATER & SEWER SYSTEM BOOKKEEPING	1	52	960	832.00	$12.00	$9,984.00	
GENERAL LIABILITY AND WORKMANS COMP							$789
BOOKKEEPING LABOR SUBTOTAL							$9,984
WATER SYSTEM TOTAL ANNUAL LABOR COST							$40,871

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF SUNSHINE SUBDIVISION WATER LOOP OPERATIONS AND MAINTENANCE COSTS
LABOR COSTS
APRIL, 1996

LABOR

LABOR CLASSIFICATION	NUMBER OF UNITS	ANNUAL FREQUENCY	TIME PER TASK (MINUTES)	TIME PER YEAR (HOURS)	HOURLY RATE	TOTAL	TOTAL
REPAIR PRESSURE AND CIRC PUMPS	2	2	120	8.00	$15.00	$120.00	
INSPECT SUBDIVISION WATER LOOP	1	12	30	6.00	$15.00	$90.00	
WATERLINE THAWING	1	24	300	120.00	$15.00	$1,800.00	
GENERAL REPAIR	1	12	480	96.00	$15.00	$1,440.00	
WATER PLANT OPERATOR LABOR SUBTOTAL							$3,450
GENERAL LIABILITY AND WORKMANS COMP							$273
CONTINGENCY @ 10% FOR WATER PLANT							$345
WATER SYSTEM TOTAL ANNUAL LABOR COST							$4,068

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF SUNSHINE SUBDIVISION HAUL/LOCAL WATER LOOP OPERATIONS AND MAINTENANCE COSTS
LABOR COSTS
APRIL, 1996

LABOR

LABOR CLASSIFICATION	NUMBER OF UNITS	ANNUAL FREQUENCY	TIME PER TASK (MINUTES)	TIME PER YEAR (HOURS)	HOURLY RATE	TOTAL	TOTAL
SUBDIVISION WATER PLANT OPERATIONS							
INSPECT PLANT OPERATION - DAILY LOG	1	313	15	78.25	$15.00	$1,173.75	
CHECK, RECORD WATER USE	1	313	3	15.65	$15.00	$234.75	
CHECK, RECORD STORAGE TANK LEVEL	1	313	3	15.65	$15.00	$234.75	
RUN STANDBY GENERATOR	1	12	40	8.00	$15.00	$120.00	
REPAIR PRESSURE AND CIRC PUMPS	4	2	120	16.00	$15.00	$240.00	
INSPECT GAGES	18	2	2	1.20	$15.00	$18.00	
CHECK PRESSURE SWITCH SETTINGS	3	2	5	0.50	$15.00	$7.50	
DRAIN PRESSURE TANK	1	1	60	1.00	$15.00	$15.00	
DRAIN, CLEAN, INSPECT STOR. TANK	1	1	480	8.00	$15.00	$120.00	
LUBE PUMPS	6	2	5	1.00	$15.00	$15.00	
EXERCISE VALVES	125	1	3	6.25	$15.00	$93.75	
WATER PLANT BOILERS							
CHECK BOILER OPERATION	2	313	10	104.33	$15.00	$1,565.00	
CHECK AND RELIGHT BURNERS	2	12	15	6.00	$15.00	$90.00	
CHECK HYDRONIC HEAT SYSTEM OPER.	1	313	10	52.17	$15.00	$782.50	
CHECK DAY TANK LEVELS	1	52	15	13.00	$15.00	$195.00	
FILL DAY TANKS	1	26	30	13.00	$15.00	$195.00	
DRAIN WATER FROM OIL TANKS	1	52	3	2.60	$15.00	$39.00	
ALTERNATE BOILERS, PUMPS	2	52	2	3.47	$15.00	$52.00	
BLOW OFF BOILER PRESSURE RELIEF	2	12	2	0.80	$15.00	$12.00	
BOILER STACK TESTING AND ADJUST	2	4	120	16.00	$15.00	$240.00	
SERVICE BOILER BURNERS	2	1	120	4.00	$15.00	$60.00	
CLEAN BOILER STACKS	2	1	180	6.00	$15.00	$90.00	
CHANGE FUEL OIL FILTERS	2	1	30	1.00	$15.00	$15.00	
RUN HYDRONIC CIRC PUMPS UNDER LOAD	1	12	60	12.00	$15.00	$180.00	
INSPECT SUBDIVISION WATER LOOP	1	12	30	6.00	$15.00	$90.00	
WATERLINE THAWING	1	24	240	96.00	$15.00	$1,440.00	
GENERAL REPAIR	1	6	480	48.00	$15.00	$720.00	
WATER PLANT OPERATOR LABOR SUBTOTAL							$8,038
GENERAL LIABILITY AND WORKMANS COMP							$635
CONTINGENCY @ 10% FOR LABOR							$804
LARGE VEHICLE HAUL OPERATORS							
DELIVER POTABLE WATER TO SUBDIVISION	1	260	30	130.00	$15.00	$1,950.00	
REPAIR AND MAINTAIN HAUL EQUIPMENT	1	2	180	6.00	$15.00	$90.00	
FILL WATER TRUCK WITH FUEL	1	112	15	28.00	$15.00	$420.00	
LARGE VEHICLE HAUL LABOR SUBTOTAL							$2,460
GENERAL LIABILITY AND WORKMANS COMP							$194
CONTINGENCY @ 10% FOR LABOR							$246
SUBDIVISION HAUL/LOOP TOTAL ANNUAL LABOR COST							$12,377

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF TOWNSITE GRAVITY/PRESSURE SEWER OPERATIONS AND MAINTENANCE COSTS
LABOR COSTS
APRIL, 1996

LABOR

LABOR CLASSIFICATION	NUMBER OF UNITS	ANNUAL FREQUENCY	TIME PER TASK (MINUTES)	TIME PER YEAR (HOURS)	HOURLY RATE	TOTAL	TOTAL
TOWNSITE SEWER SYSTEM OPERATIONS							
INSPECT TOWNSITE SEWER LINES	1	4	480	32.00	$15.00	$480.00	
INSPECT TOWNSITE MANHOLES	35	4	15	35.00	$15.00	$525.00	
INSPECT TOWNSITE FORCE MAINS	2	2	60	4.00	$15.00	$60.00	
INSPECT TOWNSITE LIFT STATIONS	2	52	30	52.00	$15.00	$780.00	
SEWER LINE THAWING	1	24	300	120.00	$15.00	$1,800.00	
SEWER LINE MAINTENANCE/CLEANING	1	12	480	96.00	$15.00	$1,440.00	
MANHOLE MAINTENANCE	35	2	60	70.00	$15.00	$1,050.00	
FORCE MAIN MAINTENANCE	2	1	480	16.00	$15.00	$240.00	
LIFT STATION EQUIPMENT MAINTENANCE	2	12	480	192.00	$15.00	$2,880.00	
SEWER OPERATIONS LABOR SUBTOTAL							$9,255
GENERAL LIABILITY AND WORKMANS COMP							$731
CONTINGENCY @ 10% FOR LABOR							$926
TOWNSITE GRAVITY/PRESSURE SEWERS TOTAL ANNUAL LABOR COST							$10,912

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF SUNSHINE GRAVITY/PRESSURE SEWER OPERATIONS AND MAINTENANCE COSTS
LABOR COSTS
APRIL, 1996

LABOR

LABOR CLASSIFICATION	NUMBER OF UNITS	ANNUAL FREQUENCY	TIME PER TASK (MINUTES)	TIME PER YEAR (HOURS)	HOURLY RATE	TOTAL	TOTAL
SUBDIVISION SEWER SYSTEM OPERATIONS							
INSPECT SUBDIVISION SEWER LINES	1	2	480	16.00	$15.00	$240.00	
INSPECT SUBDIVISION MANHOLES	8	2	15	4.00	$15.00	$60.00	
INSPECT SUBDIVISION FORCE MAINS	1	2	60	2.00	$15.00	$30.00	
INSPECT SUBDIVISION LIFT STATIONS	2	52	30	52.00	$15.00	$780.00	
SEWER LINE THAWING	1	24	300	120.00	$15.00	$1,800.00	
SEWER LINE MAINTENANCE/CLEANING	1	4	480	32.00	$15.00	$480.00	
MANHOLE MAINTENANCE	8	1	60	8.00	$15.00	$120.00	
FORCE MAIN MAINTENANCE	1	1	480	8.00	$15.00	$120.00	
LIFT STATION EQUIPMENT MAINTENANCE	2	4	480	64.00	$15.00	$960.00	
SEWER OPERATIONS LABOR SUBTOTAL							$4,590
GENERAL LIABILITY AND WORKMANS COMP							$363
CONTINGENCY @ 10% FOR LABOR							$459
SUBDIVISION GRAVITY/PRESSURE SEWERS TOTAL ANNUAL LABOR COST							$5,412

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF SUNSHINE SUBDIVISION LOCAL GRAVITY SEWER/HAUL OPERATIONS AND MAINTENANCE COSTS
LABOR COSTS
APRIL, 1996

LABOR

LABOR CLASSIFICATION	NUMBER OF UNITS	ANNUAL FREQUENCY	TIME PER TASK (MINUTES)	TIME PER YEAR (HOURS)	HOURLY RATE	TOTAL	TOTAL
INSPECT SUBDIVISION SEWER LINES	1	2	120	4.00	$15.00	$60.00	
INSPECT SUBDIVISION MANHOLES	6	2	15	3.00	$15.00	$45.00	
SEWER LINE MAINTENANCE/CLEANING	1	2	480	16.00	$15.00	$240.00	
SEWER LINE THAWING	1	24	300	120.00	$15.00	$1,800.00	
MANHOLE MAINTENANCE	6	1	60	6.00	$15.00	$90.00	
SEWER OPERATIONS LABOR SUBTOTAL							$2,235
GENERAL LIABILITY AND WORKMANS COMP							$177
CONTINGENCY @ 10% FOR LABOR							$224
LARGE VEHICLE HAUL OPERATORS							
PUMP HOLDING TANKS & HAUL TO LAGOON	1	52	60	52.00	$15.00	$780.00	
REPAIR AND MAINTAIN HAUL EQUIPMENT	1	2	180	6.00	$15.00	$90.00	
FILL SEWAGE TRUCK WITH FUEL	1	52	15	13.00	$15.00	$195.00	
LARGE VEHICLE HAUL LABOR SUBTOTAL							$1,065
GENERAL LIABILITY AND WORKMANS COMP							$177
CONTINGENCY @ 10% FOR LABOR							$224
SUBDIVISION GRAVITY SEWERS/HAUL TOTAL ANNUAL LABOR COST							$4,100

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF SMALL VEHICLE HAUL SYSTEM OPERATIONS AND MAINTENANCE COSTS
CITY WIDE
LABOR COSTS
APRIL, 1996

LABOR

LABOR CLASSIFICATION	NUMBER OF UNITS	ANNUAL FREQUENCY	TIME PER TASK (MINUTES)	TIME PER YEAR (HOURS)	HOURLY RATE	TOTAL	TOTAL
SMALL VEHICLE HAUL OPERATORS							
DISTRIBUTE POTABLE WATER	120	30	35	2100.00	$15.00	$31,500.00	
COLLECT AND HAUL WASTEWATER	120	30	20	1200.00	$15.00	$18,000.00	
REPAIR AND MAINTAIN HAUL EQUIPMENT	1	2	180	6.00	$15.00	$90.00	
FILL WATER 4-WHEELER WITH FUEL	1	255	15	63.75	$15.00	$956.25	
FILL WASTEWATER 4-WHEELER WITH FUEL	1	255	15	63.75	$15.00	$956.25	
SMALL VEHICLE LABOR SUBTOTAL							$51,503
GENERAL LIABILITY AND WORKMANS COMP							$4,069
CONTINGENCY @ 10% FOR LABOR							$5,150
ADMINISTRATIVE							
SMALL VEHICLE HAUL SYSTEM ADMINISTRATIVE LABO	1	52	60	52.00	$15.00	$780.00	
GENERAL LIABILITY AND WORKMANS COMP							$62
ADMINISTRATIVE LABOR SUBTOTAL							$780
BOOKKEEPING							
SMALL VEHICLE HAUL SYSTEM BOOKKEEPING	1	52	120	104.00	$12.00	$1,248.00	
GENERAL LIABILITY AND WORKMANS COMP							$99
BOOKKEEPING LABOR SUBTOTAL							$1,248
SMALL VEHICLE HAUL SYS. TOTAL ANNUAL LABOR COST							$62,910

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF SMALL VEHICLE HAUL SYSTEM OPERATIONS AND MAINTENANCE COSTS
WASTEWATER SERVICE ONLY/SUNSHINE SUBDIVISION
LABOR COSTS
APRIL, 1996

LABOR

LABOR CLASSIFICATION	NUMBER OF UNITS	ANNUAL FREQUENCY	TIME PER TASK (MINUTES)	TIME PER YEAR (HOURS)	HOURLY RATE	TOTAL	TOTAL
SMALL VEHICLE HAUL OPERATORS							
COLLECT AND HAUL WASTEWATER	14	30	30	210.00	$15.00	$3,150.00	
REPAIR AND MAINTAIN HAUL EQUIPMENT	1	2	180	6.00	$15.00	$90.00	
FILL WASTEWATER 4-WHEELER WITH FUEL	1	112	15	28.00	$15.00	$420.00	
SMALL VEHICLE HAUL LABOR SUBTOTAL							$3,660
GENERAL LIABILITY AND WORKMANS COMP							$289
CONTINGENCY @ 10% FOR LABOR							$366
ADMINISTRATIVE							
SMALL VEHICLE HAUL SYSTEM ADMINISTRATIVE LAB	1	52	60	52.00	$15.00	$780.00	
GENERAL LIABILITY AND WORKMANS COMP							$62
ADMINISTRATIVE LABOR SUBTOTAL							$780
BOOKKEEPING							
SMALL VEHICLE HAUL SYSTEM BOOKKEEPING	1	52	120	104.00	$12.00	$1,248.00	
GENERAL LIABILITY AND WORKMANS COMP							$99
BOOKKEEPING LABOR SUBTOTAL							$1,248
SMALL VEHICLE HAUL SYS. TOTAL ANNUAL LABOR COST							$6,503

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF SMALL VEHICLE HAUL SYSTEM OPERATIONS AND MAINTENANCE COSTS
WATER SERVICE ONLY/SUNSHINE SUBDIVISION
LABOR COSTS
APRIL, 1996

LABOR

LABOR CLASSIFICATION	NUMBER OF UNITS	ANNUAL FREQUENCY	TIME PER TASK (MINUTES)	TIME PER YEAR (HOURS)	HOURLY RATE	TOTAL	TOTAL
SMALL VEHICLE HAUL OPERATORS							
DISTRIBUTE POTABLE WATER	14	30	30	210.00	$15.00	$3,150.00	
REPAIR AND MAINTAIN HAUL EQUIPMENT	1	2	180	6.00	$15.00	$90.00	
FILL WATER 4-WHEELER WITH FUEL	1	112	15	28.00	$15.00	$420.00	
SMALL VEHICLE HAUL LABOR SUBTOTAL							$3,660
GENERAL LIABILITY AND WORKMANS COMP							$289
CONTINGENCY @ 10% FOR LABOR							$366
ADMINISTRATIVE							
SMALL VEHICLE HAUL SYSTEM ADMINISTRATIVE LAB	1	52	60	52.00	$15.00	$780.00	
GENERAL LIABILITY AND WORKMANS COMP							$62
ADMINISTRATIVE LABOR SUBTOTAL							$780
BOOKKEEPING							
SMALL VEHICLE HAUL SYSTEM BOOKKEEPING	1	52	120	104.00	$12.00	$1,248.00	
GENERAL LIABILITY AND WORKMANS COMP							$99
BOOKKEEPING LABOR SUBTOTAL							$1,248
SMALL VEHICLE HAUL SYS. TOTAL ANNUAL LABOR COST							$6,503

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF LARGE VEHICLE HAUL SYSTEM OPERATIONS AND MAINTENANCE COSTS
CITY WIDE
LABOR COSTS
APRIL, 1996

LABOR

LABOR CLASSIFICATION	NUMBER OF UNITS	ANNUAL FREQUENCY	TIME PER TASK (MINUTES)	TIME PER YEAR (HOURS)	HOURLY RATE	TOTAL	TOTAL
LARGE VEHICLE HAUL OPERATORS							
DISTRIBUTE POTABLE WATER	120	52	30	3120.00	$15.00	$46,800.00	
COLLECT AND HAUL WASTEWATER	120	52	35	3640.00	$15.00	$54,600.00	
REPAIR AND MAINTAIN HAUL EQUIPMENT	1	4	180	12.00	$15.00	$180.00	
FILL WATER TRUCK WITH FUEL	1	52	15	13.00	$15.00	$195.00	
FILL WASTEWATER TRUCK WITH FUEL	1	52	15	13.00	$15.00	$195.00	
LARGE VEHICLE LABOR SUBTOTAL							$101,970
GENERAL LIABILITY AND WORKMANS COMP							$8,056
CONTINGENCY @ 10% FOR LABOR							$10,197
ADMINISTRATIVE							
LARGE VEHICLE HAUL SYSTEM ADMINISTRATIVE LAB	1	52	60	52.00	$15.00	$780.00	
GENERAL LIABILITY AND WORKMANS COMP							$62
ADMINISTRATIVE LABOR SUBTOTAL							$780
BOOKKEEPING							
LARGE VEHICLE HAUL SYSTEM BOOKKEEPING	1	52	120	104.00	$12.00	$1,248.00	
GENERAL LIABILITY AND WORKMANS COMP							$99
BOOKKEEPING LABOR SUBTOTAL							$1,248
LARGE VEHICLE HAUL SYS. TOTAL ANNUAL LABOR COST							$122,411

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF LARGE VEHICLE HAUL SYSTEM OPERATIONS AND MAINTENANCE COSTS
WASTEWATER SERVICE ONLY/SUNSHINE SUBDIVISION
LABOR COSTS
APRIL, 1996

LABOR

LABOR CLASSIFICATION	NUMBER OF UNITS	ANNUAL FREQUENCY	TIME PER TASK (MINUTES)	TIME PER YEAR (HOURS)	HOURLY RATE	TOTAL	TOTAL
LARGE VEHICLE HAUL OPERATORS							
COLLECT AND HAUL WASTEWATER	14	52	35	424.67	$15.00	$6,370.00	
REPAIR AND MAINTAIN HAUL EQUIPMENT	1	2	180	6.00	$15.00	$90.00	
FILL WASTEWATER TRUCK WITH FUEL	1	112	15	28.00	$15.00	$420.00	
LARGE VEHICLE HAUL LABOR SUBTOTAL							$6,880
GENERAL LIABILITY AND WORKMANS COMP							$544
CONTINGENCY @ 10% FOR LABOR							$688
ADMINISTRATIVE							
LARGE VEHICLE HAUL SYSTEM ADMINISTRATIVE LAB	1	52	60	52.00	$15.00	$780.00	
GENERAL LIABILITY AND WORKMANS COMP							$62
ADMINISTRATIVE LABOR SUBTOTAL							$780
BOOKKEEPING							
LARGE VEHICLE HAUL SYSTEM BOOKKEEPING	1	52	120	104.00	$12.00	$1,248.00	
GENERAL LIABILITY AND WORKMANS COMP							$99
BOOKKEEPING LABOR SUBTOTAL							$1,248
LARGE VEHICLE HAUL SYS. TOTAL ANNUAL LABOR COST							$10,300

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF LARGE VEHICLE HAUL SYSTEM OPERATIONS AND MAINTENANCE COSTS
WATER SERVICE ONLY/SUNSHINE SUBDIVISION
LABOR COSTS
APRIL, 1996

LABOR

LABOR CLASSIFICATION	NUMBER OF UNITS	ANNUAL FREQUENCY	TIME PER TASK (MINUTES)	TIME PER YEAR (HOURS)	HOURLY RATE	TOTAL	TOTAL
LARGE VEHICLE HAUL OPERATORS							
DISTRIBUTE POTABLE WATER	14	52	30	364.00	$15.00	$5,460.00	
REPAIR AND MAINTAIN HAUL EQUIPMENT	1	2	180	6.00	$15.00	$90.00	
FILL WATER TRUCK WITH FUEL	1	112	15	28.00	$15.00	$420.00	
LARGE VEHICLE HAUL LABOR SUBTOTAL							$5,970
GENERAL LIABILITY AND WORKMANS COMP							$472
CONTINGENCY @ 10% FOR LABOR							$597
ADMINISTRATIVE							
LARGE VEHICLE HAUL SYSTEM ADMINISTRATIVE LAB	1	52	60	52.00	$15.00	$780.00	
GENERAL LIABILITY AND WORKMANS COMP							$62
ADMINISTRATIVE LABOR SUBTOTAL							$780
BOOKKEEPING							
LARGE VEHICLE HAUL SYSTEM BOOKKEEPING	1	52	120	104.00	$12.00	$1,248.00	
GENERAL LIABILITY AND WORKMANS COMP							$99
BOOKKEEPING LABOR SUBTOTAL							$1,248
LARGE VEHICLE HAUL SYS. TOTAL ANNUAL LABOR COST							$9,227

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF VACUUM SEWER SYSTEM OPERATIONS AND MAINTENANCE COSTS
TOWNSITE
LABOR COSTS
APRIL, 1996

LABOR

LABOR CLASSIFICATION	NUMBER OF UNITS	ANNUAL FREQUENCY	TIME PER TASK (MINUTES)	TIME PER YEAR (HOURS)	HOURLY RATE	TOTAL	TOTAL
VACUUM STATION				400	$15.00	$6,000	
PIPING				80.00	$15.00	$1,200	
VACUUM VALVES	110			2.00	$15.00	$30	
SEWER LINE THAWING	1	24	300	120.00	$15.00	$1,800	
VACUUM SEWER LABOR SUBTOTAL							$9,030
GENERAL LIABILITY AND WORKMANS COMP							$713
CONTINGENCY @ 10% FOR LABOR							$903
VACUUM SYS. TOTAL ANNUAL LABOR COST							$10,646

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF VACUUM SEWER SYSTEM OPERATIONS AND MAINTENANCE COSTS
SUBDIVISION
LABOR COSTS
APRIL, 1996

LABOR

LABOR CLASSIFICATION	NUMBER OF UNITS	ANNUAL FREQUENCY	TIME PER TASK (MINUTES)	TIME PER YEAR (HOURS)	HOURLY RATE	TOTAL	TOTAL
PIPING				80.00	$15.00	$1,200	
VACUUM VALVES	14			2.00	$15.00	$30	
SEWER LINE THAWING	1	24	180	72.00	$15.00	$1,080	
VACUUM SEWER LABOR SUBTOTAL							$2,310
GENERAL LIABILITY AND WORKMANS COMP							$182
CONTINGENCY @ 10% FOR LABOR							$231
VACUUM SYS. TOTAL ANNUAL LABOR COST							$2,723

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF NEW LAUNDROMAT AND EXISTING PIPED SYSTEMS OPERATIONS AND MAINTENANCE COSTS
LABOR COSTS
APRIL, 1996

LABOR

LABOR CLASSIFICATION	NUMBER OF UNITS	ANNUAL FREQUENCY	TIME PER TASK (MINUTES)	TIME PER YEAR (HOURS)	HOURLY RATE	TOTAL	TOTAL
WATER PLANT OPERATOR							
WATER PLANT OPERATIONS							
INSPECT PLANT OPERATION - DAILY LOG	1	313	15	78.25	$15.00	$1,173.75	
CHECK, RECORD WATER USE	1	313	3	15.65	$15.00	$234.75	
CHECK, RECORD STORAGE TANK LEVEL	1	313	3	15.65	$15.00	$234.75	
CHECK , RECORD TAP CHLORINE RESIDUAL	1	365	5	30.42	$15.00	$456.25	
CHECK , RECORD TREATED WATER CL RESID.	1	313	5	26.08	$15.00	$391.25	
CHECK, RECORD pH	1	313	5	26.08	$15.00	$391.25	
CHECK, RECORD TREATED WATER TEMP	1	313	2	10.43	$15.00	$156.50	
CHECK, RECORD TREATED WATER TURBIDITY	1	313	5	26.08	$15.00	$391.25	
CHECK, RECORD FLUORIDE CONCENTRATION	1	365	5	30.42	$15.00	$456.25	
COLLECT AND ANALYZE COLIFORM SAMPLE	1	12	15	3.00	$15.00	$45.00	
BACKWASH FILTERS	3	122	10	61.00	$15.00	$915.00	
RUN JAR TEST FOR COAGULANT CONTROL	1	100	45	75.00	$15.00	$1,125.00	
PREPARE COAGULANT SOLUTION	1	52	10	8.67	$15.00	$130.00	
PREPARE CHLORINE SOLUTION	1	26	10	4.33	$15.00	$65.00	
PREPARE FLUORIDE SOLUTION	1	26	10	4.33	$15.00	$65.00	
TEST ALARM PANELS	1	12	3	0.60	$15.00	$9.00	
RUN STANDBY GENERATOR	1	12	40	8.00	$15.00	$120.00	
INSPECT FILTER MEDIA	3	313	3	46.95	$15.00	$704.25	
REPAIR PRESSURE AND CIRC PUMPS	6	2	120	24.00	$15.00	$360.00	
REPAIR CHEMICAL FEED PUMPS	3	12	60	36.00	$15.00	$540.00	
INSPECT, CALIBRATE TURBIDIMETERS	4	12	15	12.00	$15.00	$180.00	
INSPECT GAGES	18	2	2	1.20	$15.00	$18.00	
CHECK PRESSURE SWITCH SETTINGS	3	2	5	0.50	$15.00	$7.50	
DRAIN PRESSURE TANK	1	1	60	1.00	$15.00	$15.00	
DRAIN, CLEAN, INSPECT STOR. TANK	1	1	480	8.00	$15.00	$120.00	
LUBE PUMPS	6	2	5	1.00	$15.00	$15.00	
EXERCISE VALVES	125	1	3	6.25	$15.00	$93.75	
WATER PLANT BOILERS							
CHECK BOILER OPERATION	2	313	10	104.33	$15.00	$1,565.00	
CHECK AND RELIGHT BURNERS	2	12	15	6.00	$15.00	$90.00	
CHECK HYDRONIC HEAT SYSTEM OPER.	1	313	10	52.17	$15.00	$782.50	
CHECK DAY TANK LEVELS	1	52	15	13.00	$15.00	$195.00	
FILL DAY TANKS	1	26	30	13.00	$15.00	$195.00	
DRAIN WATER FROM OIL TANKS	1	52	3	2.60	$15.00	$39.00	
ALTERNATE BOILERS, PUMPS	2	52	2	3.47	$15.00	$52.00	
BLOW OFF BOILER PRESSURE RELIEF	2	12	2	0.80	$15.00	$12.00	
BOILER STACK TESTING AND ADJUST	2	4	120	16.00	$15.00	$240.00	
SERVICE BOILER BURNERS	2	1	120	4.00	$15.00	$60.00	
CLEAN BOILER STACKS	2	1	180	6.00	$15.00	$90.00	
CHANGE FUEL OIL FILTERS	2	1	30	1.00	$15.00	$15.00	
RUN HYDRONIC CIRC PUMPS UNDER LOAD	1	12	60	12.00	$15.00	$180.00	
GENERAL - WATER PLANT							
REPAIR AND SERVICE WATERING POINT	1	8	30	4.00	$15.00	$60.00	
CHECK FIRE EXTINGUISHERS	1	1	5	0.08	$15.00	$1.25	
TEST ALARM PANELS	1	12	3	0.60	$15.00	$9.00	

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF NEW LAUNDROMAT AND EXISTING PIPED SYSTEMS OPERATIONS AND MAINTENANCE COSTS
LABOR COSTS
APRIL, 1996

LABOR CLASSIFICATION	NUMBER OF UNITS	ANNUAL FREQUENCY	TIME PER TASK (MINUTES)	TIME PER YEAR (HOURS)	HOURLY RATE	TOTAL	TOTAL
LABOR							
GENERAL CLEAN UP IN WATER PLANT	1	52	30	26.00	$15.00	$390.00	
PAINTING AND BUILDING UPKEEP	1	2	60	2.00	$15.00	$30.00	
LAUNDROMAT							
WASHER/DRYER REPAIR	19	12	120	456.00	$15.00	$6,840.00	
CLEAN WASHER SCREENS	11	1	240	44.00	$15.00	$660.00	
LUBE WASHERS	11	1	60	11.00	$15.00	$165.00	
LUBE DRYERS	8	1	60	8.00	$15.00	$120.00	
LAUNDROMAT BOILERS							
CHECK BOILER OPERATION	2	313	10	104.33	$15.00	$1,565.00	
CHECK AND RELIGHT BURNERS	2	12	15	6.00	$15.00	$90.00	
CHECK HYDRONIC HEAT SYSTEM OPER.	1	313	10	52.17	$15.00	$782.50	
CHECK DAY TANK LEVELS	1	52	15	13.00	$15.00	$195.00	
FILL DAY TANKS	1	26	30	13.00	$15.00	$195.00	
DRAIN WATER FROM OIL TANKS	1	52	3	2.60	$15.00	$39.00	
ALTERNATE BOILERS, PUMPS	2	52	2	3.47	$15.00	$52.00	
BLOW OFF BOILER PRESSURE RELIEF	2	12	2	0.80	$15.00	$12.00	
BOILER STACK TESTING AND ADJUST	2	4	120	16.00	$15.00	$240.00	
SERVICE BOILER BURNERS	2	1	120	4.00	$15.00	$60.00	
CLEAN BOILER STACKS	2	1	180	6.00	$15.00	$90.00	
CHANGE FUEL OIL FILTERS	2	1	30	1.00	$15.00	$15.00	
RUN HYDRONIC CIRC PUMPS UNDER LOAD	1	12	60	12.00	$15.00	$180.00	
TEST ALARM PANELS	1	12	3	0.60	$15.00	$9.00	
GENERAL - LAUNDROMAT							
CHECK FIRE EXTINGUISHERS	1	1	5	0.08	$15.00	$1.25	
PAINTING AND BUILDING UPKEEP	1	2	60	2.00	$15.00	$30.00	
PIPELINE INSPECTIONS AND REPAIRS							
INSPECT WELL WATER TRANSMISSION LINE	1	12	15	3.00	$15.00	$45.00	
INSPECT EXISTING WATER & SEWER LINES	1	12	30	6.00	$15.00	$90.00	
INSPECT EXISTING LIFTSTATIONS	2	52	15	26.00	$15.00	$390.00	
INSPECT BACKWASH WATER LINE	1	12	10	2.00	$15.00	$30.00	
MISCELLANEOUS							
PIPELINE THAWING	1	24	300	120.00	$15.00	$1,800.00	
GENERAL REPAIR	1	2	180	6.00	$15.00	$90.00	
ADMINISTRATIVE							
SEND IN DEC OPERATIONS REPORT	1	12	15	3.00	$15.00	$45.00	
PREPARE WEEKLY WRITTEN REPORT	1	52	15	13.00	$15.00	$195.00	
MAKE VERBAL REPORT TO SUPERVISOR	1	52	10	8.67	$15.00	$130.00	
ORDER SUPPLIES, PARTS AND CHEMICALS	1	12	30	6.00	$15.00	$90.00	
OPERATOR TRAINING	1	2	960	32.00	$15.00	$480.00	
DRAIN WASTEWATER LAGOON	1	1	240	4.00	$15.00	$60.00	
WATER PLANT OPERATOR LABOR SUBTOTAL							$27,205
GENERAL LIABILITY AND WORKMANS COMP							$2,149
CONTINGENCY @ 10% FOR WATER PLANT							$2,721
LAUNDROMAT ATTENDANTS							
WORK IN LAUNDROMAT	1	313	300	1565.00	$12.00	$18,780.00	
GENERAL LIABILITY AND WORKMANS COMP							$1,484
LAUNDROMAT ATTENDANTS LABOR SUBTOTAL							$18,780

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF NEW LAUNDROMAT AND EXISTING PIPED SYSTEMS OPERATIONS AND MAINTENANCE COSTS
LABOR COSTS
APRIL, 1996

LABOR

LABOR CLASSIFICATION	NUMBER OF UNITS	ANNUAL FREQUENCY	TIME PER TASK (MINUTES)	TIME PER YEAR (HOURS)	HOURLY RATE	TOTAL	TOTAL
ADMINISTRATIVE							
WATER & SEWER SYSTEM ADMINISTRATIVE LABOR	1	52	60	52.00	$15.00	$780.00	
GENERAL LIABILITY AND WORKMANS COMP							$62
ADMINISTRATIVE LABOR SUBTOTAL							$780
BOOKKEEPING							
WATER & SEWER SYSTEM BOOKKEEPING	1	52	360	312.00	$12.00	$3,744.00	
GENERAL LIABILITY AND WORKMANS COMP							$296
BOOKKEEPING LABOR SUBTOTAL							$3,744
WATER SYSTEM TOTAL ANNUAL LABOR COST							$57,220

Detailed Equipment Replacement Costs

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF NEW LAUNDROMAT AND EXISTING PIPED SYSTEMS OPERATIONS AND MAINTENANCE COSTS
WATER PLANT EQUIPMENT REPLACEMENT COSTS
APRIL, 1998

EQUIPMENT REPLACEMENT													
DESCRIPTION	NUMBER OF UNITS	LIFE EXPECTANCY (PERIOD) (MONTHS)	INTEREST RATE (PERCENT)	REPLACMENT OR PERIODIC COST**	NUMBER PERIODS WITHIN 20-YEARS	INDEX COLUMN	PERIOD (MONTHS)	PRESENT WORTH FACTOR	PRESENT WORTH COST	SERIES PRESENT WORTH FACOTR	PRESENT WORTH ANNUAL COST	TOTAL ANNUAL REPLACEMENT COST
WATER PLANT												
WELL PUMP	1	48	5.00	$1,050.00	5.00	1	48	0.8227	863.84			
						2	96	0.6768	710.68			
						3	144	0.5568	584.68			
						4	192	0.4581	481.02			
						5	240	0.3769	395.73			
										12.4622	$3,035.95	$243.61
REPLACE SEALS IN CIRCULATION PUMPS	6	60	5.00	$900.00	4.00	1	60	0.7835	705.17			
						2	120	0.6139	552.52			
						3	180	0.4810	432.92			
						4	240	0.3769	339.20			
										12.4622	$2,029.81	$162.88
REMOVE, REPAIR AND REPLACE CIRCULATION	6	60	5.00	$3,300.00	4.00	1	60	0.7835	2585.64			
PUMPS						2	120	0.6139	2025.91			
						3	180	0.4810	1587.36			
						4	240	0.3769	1243.74			
										12.4622	$7,442.64	$597.22
REPLACE SEALS IN SERIVCE PUMPS	2	60	5.00	$300.00	4.00	1	60	0.7835	235.06			
						2	120	0.6139	184.17			
						3	180	0.4810	144.31			
						4	240	0.3769	113.07			
										12.4622	$676.60	$54.29
REMOVE, REPAIR AND REPLACE SERVICE	2	60	5.00	$1,800.00	4.00	1	60	0.7835	1410.35			
PUMPS						2	120	0.6139	1105.04			
						3	180	0.4810	865.83			
						4	240	0.3769	678.40			
										12.4622	$4,059.62	$325.75
REPLACE SEALS IN BACKWASH PUMP	1	60	5.00	$200.00	4.00	1	60	0.7835	156.71			
						2	120	0.6139	122.78			
						3	180	0.4810	96.20			
						4	240	0.3769	75.38			
										12.4622	$451.07	$36.19
REPLACE BACKWASH PUMP	1	60	5.00	$1,100.00	4.00	1	60	0.7835	861.88			
						2	120	0.6139	675.30			
						3	180	0.4810	529.12			
						4	240	0.3769	414.58			
										12.4622	$2,480.88	$199.07
REBUILD FILTER VALVES	18	48	5.00	$2,250.00	5.00	1	48	0.8227	1851.08			
						2	96	0.6768	1522.89			
						3	144	0.5568	1252.88			
						4	192	0.4581	1030.75			
						5	240	0.3769	848.00			
										12.4622	$6,505.61	$522.03
REPLACE FILTER MEDIA	3	60	5.00	$3,600.00	4.00	1	60	0.7835	2820.69			

						2	120	0.6139	2210.09			
						3	180	0.4810	1731.66			
						4	240	0.3769	1356.80			
										12.4622	$8,119.25	$651.51
REPLACE TURBIDIMETERS	4	120	5.00	$8,000.00	2.00	1	120	0.6139	4911.31			
						2	240	0.3769	3015.12			
										12.4622	$9,283.22	$744.91
REPLACE FILTER LIGHTS	3	24	5.00	$195.00	10.00	1	24	0.9070	176.87			
						2	48	0.8227	160.43			
						3	72	0.7462	145.51			
						4	96	0.6768	131.98			
						5	120	0.6139	119.71			
						6	144	0.5568	108.58			
						7	168	0.5051	98.49			
						8	192	0.4581	89.33			
						9	216	0.4155	81.03			
						10	240	0.3769	73.49			
										12.4622	$1,185.43	$95.12
REBUILD CHEMICAL FEED PUMP HEADS	3	24	5.00	$75.00	10.00	1	24	0.9070	68.03			
						2	48	0.8227	61.70			
						3	72	0.7462	55.97			
						4	96	0.6768	50.76			
						5	120	0.6139	46.04			
						6	144	0.5568	41.76			
						7	168	0.5051	37.88			
						8	192	0.4581	34.36			
						9	216	0.4155	31.16			
						10	240	0.3769	28.27			
										12.4622	$455.93	$36.59
REPLACE CHEMICAL FEED PUMPS	3	120	5.00	$1,800.00	2.00	1	120	0.6139	1105.04			
						2	240	0.3769	678.40			
										12.4622	$1,783.44	$143.11
REPAIR, REPLACE CHEMICAL SOLUTION	3	36	5.00	$1,050.00	7.00	1	36	0.8638	907.03			
MIXERS						2	72	0.7462	783.53			
						3	108	0.6446	676.84			
						4	144	0.5568	584.68			
						5	180	0.4810	505.07			
						6	216	0.4155	436.30			
						7	240	0.3769	395.73			
										12.4622	$4,289.17	$344.17
REPLACE SMALL TOOLS	1	60	5.00	$500.00	4.00	1	60	0.7835	391.76			
						2	120	0.6139	306.96			
						3	180	0.4810	240.51			
						4	240	0.3769	188.44			
										12.4622	$1,127.67	$90.49
REPLACE HEAT EXCHANGERS	4	180	5.00	$880.00	1.00	1	180	0.4810	423.30			
						2	240	0.3769	331.66			
										12.4622	$754.96	$60.58
REMOVE, REPAIR AND REPLACE HYDRONIC	4	60	5.00	$1,400.00	4.00	1	60	0.7835	1096.94			
HEATING PUMPS						2	120	0.6139	859.48			
						3	180	0.4810	673.42			
						4	240	0.3769	527.65			
										12.4622	$3,157.48	$253.36

REMOVE, REPLACE HYDRONIC HEATING ZONE	6	120	5.00	$750.00	2.00	1	120	0.6139	460.43			
VALVES						2	240	0.3769	282.67			
										12.4622	$743.10	$59.63
REMOVE AND REPLACE TEMP AND PRESSURE	12	96	5.00	$780.00	3.00	1	96	0.6768	527.93			
GAGES						2	192	0.4581	357.33			
						3	240	0.3769	293.97			
										12.4622	$1,179.24	$94.62
REMOVE AND REPLACE FLOW METERS	4	72	5.00	$1,000.00	3.00	1	72	0.7462	746.22			
						2	144	0.5568	556.84			
						3	240	0.3769	376.89			
										12.4622	$1,679.94	$134.80
REPLACE FUEL OIL TRANSFER PUMPS	2	96	5.00	$1,100.00	3.00	1	96	0.6768	744.52			
						2	192	0.4581	503.92			
						3	240	0.3769	414.58			
										12.4622	$1,663.02	$133.45
SUBTOTAL												$4,983.39
CONTINGENCY @ 10%												$498.34
TOTAL WATER SYSTEM/PLANT REPLACEMENT COSTS												$5,481.73
** COST INCLUDES SHIPPING AND INSTALLATION												

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF NEW LAUNDROMAT AND EXISTING PIPED SYSTEMS OPERATIONS AND MAINTENANCE COSTS
LAUNDROMAT EQUIPMENT REPLACEMENT COSTS
APRIL 1996

EQUIPMENT REPLACEMENT												
DESCRIPTION	NUMBER OF UNITS	LIFE EXPECTANCY (PERIOD) (MONTHS)	INTEREST RATE (PERCENT)	REPLACMENT OR PERIODIC COST**	NUMBER PERIODS WITHIN 20-YEARS	INDEX COLUMN	PERIOD (MONTHS)	PRESENT WORTH FACTOR	PRESENT WORTH COST	SERIES PRESENT WORTH FACOTR	PRESENT WORTH ANNUAL COST	TOTAL ANNUAL REPLACEMENT COST
WASHETERIA												
REMOVE AND REPLACE WASHING MACHINES	12	120	5.00	$10,800.00	2.00	1	120	0.6139	6630.26			
						2	240	0.3769	4070.41			
										12.4622	$10,700.67	$858.65
REMOVE AND REPLACE DRYERS	8	120	5.00	$16,000.00	2.00	1	120	0.6139	9822.61			
						2	240	0.3769	6030.23			
										12.4622	$15,852.84	$1,272.07
REMOVE AND REPLACE EXTRACTOR	1	120	5.00	$4,000.00	2.00	1	120	0.6139	2455.65			
						2	240	0.3769	1507.56			
										12.4622	$3,963.21	$318.02
REPLACE HEAT EXCHANGERS	4	180	5.00	$880.00	1.00	1	180	0.4810	423.30			
						2	240	0.3769	331.66			
										12.4622	$754.96	$60.58
REMOVE, REPAIR AND REPLACE HYDRONIC	6	60	5.00	$2,100.00	4.00	1	60	0.7835	1096.94			
HEATING PUMPS						2	120	0.6139	859.48			
						3	180	0.4810	673.42			
						4	240	0.3769	527.65			
										12.4622	$3,157.48	$253.36
REMOVE, REPLACE HYDRONIC HEATING ZONE	6	120	5.00	$750.00	2.00	1	120	0.6139	460.43			
VALVES						2	240	0.3769	282.67			
										12.4622	$743.10	$59.63
REMOVE AND REPLACE TEMP AND PRESSURE	12	96	5.00	$780.00	3.00	1	96	0.6768	527.93			
GAGES						2	192	0.4581	357.33			
						3	240	0.3769	293.97			
										12.4622	$1,179.24	$94.62
REPLACE FUEL OIL TRANSFER PUMPS	2	96	5.00	$1,100.00	3.00	1	96	0.6768	744.52			
						2	192	0.4581	503.92			
						3	240	0.3769	414.58			
										12.4622	$1,663.02	$133.45
SUBTOTAL												$3,050.38
CONTINGENCY @ 10%												$305.04
TOTAL WATER SYSTEM REPLACEMENT COSTS												$3,355.42
** COST INCLUDES SHIPPING AND INSTALLATION												

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF OPERATIONS AND MAINTENANCE COSTS
CITY WIDE SMALL VEHICLE HAUL EQUIPMENT REPLACEMENT COSTS
APRIL, 1996

EQUIPMENT REPLACEMENT												
DESCRIPTION	NUMBER OF UNITS	LIFE EXPECTANCY (PERIOD) (MONTHS)	INTEREST RATE (PERCENT)	REPLACMENT OR PERIODIC COST**	NUMBER PERIODS WITHIN 20-YEARS	INDEX COLUMN	PERIOD (MONTHS)	PRESENT WORTH FACTOR	PRESENT WORTH COST	SERIES PRESENT WORTH FACOTR	PRESENT WORTH ANNUAL COST	TOTAL ANNUAL REPLACEMENT COST
WASTEWATER SYSTEM												
4-WHEELER HAUL VEHICLE	2	36	5.00	$10,800.00	7.00	1	36	0.8638	9329.45			
						2	72	0.7462	8059.13			
						3	108	0.6446	6961.78			
						4	144	0.5568	6013.84			
						5	180	0.4810	5194.98			
						6	216	0.4155	4487.62			
						7	240	0.3769	4070.41			
										12.4622	$44,117.21	$3,540.08
4-WHEELER HAUL TANK AND TRAILER	2	60	5.00	$7,600.00	4.00	1	60	0.7835	5954.80			
						2	120	0.6139	4665.74			
						3	180	0.4810	3655.73			
						4	240	0.3769	2864.36			
										12.4622	$17,140.63	$1,375.41
SEWAGE BLADDERS	120	96	5.00	$78,000.00	3.00	1	96	0.6768	52793.47			
						2	192	0.4581	35732.70			
						3	240	0.3769	29397.38			
										12.4622	$117,923.55	$9,462.49
TOILETS	120	72	5.00	$36,000.00	3.00	1	72	0.7462	26863.75			
						2	144	0.5568	20046.15			
						3	240	0.3769	13568.02			
										12.4622	$60,477.92	$4,852.90
AIR BLOWERS FOR BLADDERS	120	60	5.00	$30,000.00	4.00	1	60	0.7835	23505.78			
						2	120	0.6139	18417.40			
						3	180	0.4810	14430.51			
						4	240	0.3769	11306.68			
										12.4622	$67,660.38	$5,429.24
WATER PUMPS FOR TOILET FLUSHING	120	60	5.00	$18,000.00	4.00	1	60	0.7835	14103.47			
						2	120	0.6139	11050.44			
						3	180	0.4810	8658.31			
						4	240	0.3769	6784.01			
										12.4622	$40,596.23	$3,257.55
SUBTOTAL												$27,917.67
CONTINGENCY @ 10%												$2,791.77
TOTAL CITY WIDE SYSTEM REPLACEMENT COSTS												$30,709.44
** COST INCLUDES SHIPPING AND INSTALLATION												

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF OPERATIONS AND MAINTENANCE COSTS
WATER SERVICE ONLY/SUNSHINE SUBDIVISION SMALL VEHICLE HAUL EQUIPMENT REPLACEMENT COSTS
APRIL, 1996

EQUIPMENT REPLACEMENT												
DESCRIPTION	NUMBER OF UNITS	LIFE EXPECTANCY (PERIOD) (MONTHS)	INTEREST RATE (PERCENT)	REPLACMENT OR PERIODIC COST**	NUMBER PERIODS WITHIN 20-YEARS	INDEX COLUMN	PERIOD (MONTHS)	PRESENT WORTH FACTOR	PRESENT WORTH COST	SERIES PRESENT WORTH FACOTR	PRESENT WORTH ANNUAL COST	TOTAL ANNUAL REPLACEMENT COST
WASTEWATER SYSTEM												
4-WHEELER HAUL VEHICLE	1	36	5.00	$5,400.00	7.00	1	36	0.8638	9329.45			
						2	72	0.7462	8059.13			
						3	108	0.6446	6961.78			
						4	144	0.5568	6013.84			
						5	180	0.4810	5194.98			
						6	216	0.4155	4487.62			
						7	240	0.3769	4070.41			
										12.4622	$44,117.21	$3,540.08
4-WHEELER HAUL TANK AND TRAILER	1	60	5.00	$3,800.00	4.00	1	60	0.7835	5954.80			
						2	120	0.6139	4665.74			
						3	180	0.4810	3655.73			
						4	240	0.3769	2864.36			
										12.4622	$17,140.63	$1,375.41
SEWAGE BLADDERS	14	96	5.00	$9,100.00	3.00	1	96	0.6768	52793.47			
						2	192	0.4581	35732.70			
						3	240	0.3769	29397.38			
										12.4622	$117,923.55	$9,462.49
WATER PUMPS	14	60	5.00	$2,100.00	4.00	1	60	0.7835	14103.47			
						2	120	0.6139	11050.44			
						3	180	0.4810	8658.31			
						4	240	0.3769	6784.01			
										12.4622	$40,596.23	$3,257.55
SUBTOTAL												$17,635.52
CONTINGENCY @ 10%												$1,763.55
TOTAL SUBDIVISION SYSTEM REPLACEMENT COSTS												$19,399.08
** COST INCLUDES SHIPPING AND INSTALLATION												

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF OPERATIONS AND MAINTENANCE COSTS
WASTEWATER SERVICE ONLY/SUNSHINE SUBDIVISION SMALL VEHICLE HAUL EQUIPMENT REPLACEMENT COSTS
APRIL, 1998

EQUIPMENT REPLACEMENT DESCRIPTION	NUMBER OF UNITS	LIFE EXPECTANCY (PERIOD) (MONTHS)	INTEREST RATE (PERCENT)	REPLACMENT OR PERIODIC COST**	NUMBER PERIODS WITHIN 20-YEARS	INDEX COLUMN	PERIOD (MONTHS)	PRESENT WORTH FACTOR	PRESENT WORTH COST	SERIES PRESENT WORTH FACOTR	PRESENT WORTH ANNUAL COST	TOTAL ANNUAL REPLACEMENT COST
WASTEWATER SYSTEM												
4-WHEELER HAUL VEHICLE	1	36	5.00	$5,400.00	7.00	1	36	0.8638	4664.72			
						2	72	0.7462	4029.56			
						3	108	0.6446	3480.89			
						4	144	0.5568	3006.92			
						5	180	0.4810	2597.49			
						6	216	0.4155	2243.81			
						7	240	0.3769	2035.20			
										12.4622	$22,058.60	$1,770.04
4-WHEELER HAUL TANK AND TRAILER	1	60	5.00	$3,800.00	4.00	1	60	0.7835	2977.40			
						2	120	0.6139	2332.87			
						3	180	0.4810	1827.86			
						4	240	0.3769	1432.18			
										12.4622	$8,570.31	$687.70
SEWAGE BLADDERS	14	96	5.00	$9,100.00	3.00	1	96	0.6768	6159.24			
						2	192	0.4581	4168.81			
						3	240	0.3769	3429.69			
										12.4622	$13,757.75	$1,103.96
TOILETS	14	72	5.00	$4,200.00	3.00	1	72	0.7462	3134.10			
						2	144	0.5568	2338.72			
						3	240	0.3769	1582.94			
										12.4622	$7,055.76	$566.17
AIR BLOWERS FOR BLADDERS	14	60	5.00	$3,500.00	4.00	1	60	0.7835	2742.34			
						2	120	0.6139	2148.70			
						3	180	0.4810	1683.56			
						4	240	0.3769	1319.11			
										12.4622	$7,893.71	$633.41
WATER PUMPS FOR TOILET FLUSHING	14	60	5.00	$2,100.00	4.00	1	60	0.7835	1645.40			
						2	120	0.6139	1289.22			
						3	180	0.4810	1010.14			
						4	240	0.3769	791.47			
										12.4622	$4,736.23	$380.05
SUBTOTAL												$5,141.33
CONTINGENCY @ 10%												$514.13
TOTAL SUBDIVISION SYSTEM REPLACEMENT COSTS												$5,655.47
** COST INCLUDES SHIPPING AND INSTALLATION												

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OPERATIONS AND MAINTENANCE COSTS
CITY WIDE LARGE VEHICLE HAUL SYSTEM EQUIPMENT REPLACEMENT COSTS
APRIL, 1995

EQUIPMENT REPLACEMENT DESCRIPTION	NUMBER OF UNITS	LIFE EXPECTANCY (PERIOD) (MONTHS)	INTEREST RATE (PERCENT)	REPLACMENT OR PERIODIC COST**	NUMBER PERIODS WITHIN 20-YEARS	INDEX COLUMN	PERIOD (MONTHS)	PRESENT WORTH FACTOR	PRESENT WORTH COST	SERIES PRESENT WORTH FACOTR	PRESENT WORTH ANNUAL COST	TOTAL ANNUAL REPLACEMENT COST
WATER AND WASTEWATER SYSTEM												
WATER HAUL TRUCK	1	60	5.00	$70,000.00	4.00	1	60	0.7835	54846.83			
						2	120	0.6139	42973.93			
						3	180	0.4810	33671.20			
						4	240	0.3769	26382.26			
										12.4622	$157,874.22	$12,668.24
SEWAGE HAUL TRUCK	1	60	5.00	$65,000.00	4.00	1	60	0.7835	50929.20			
						2	120	0.6139	39904.36			
						3	180	0.4810	31266.11			
						4	240	0.3769	24497.82			
										12.4622	$146,597.49	$11,763.36
SUBTOTAL												$24,431.60
CONTINGENCY @ 10%												$2,443.16
TOTAL CITY WIDE SYSTEM REPLACEMENT COSTS												$26,874.76
** COST INCLUDES SHIPPING AND INSTALLATION												

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OPERATIONS AND MAINTENANCE COSTS
WASTEWATER SERVICE ONLY/SUNSHINE SUBDIVISION LARGE VEHICLE HAUL SYSTEM EQUIPMENT REPLACEMENT COSTS
APRIL, 1996

EQUIPMENT REPLACEMENT												
DESCRIPTION	NUMBER OF UNITS	LIFE EXPECTANCY (PERIOD) (MONTHS)	INTEREST RATE (PERCENT)	REPLACMENT OR PERIODIC COST**	NUMBER PERIODS WITHIN 20-YEARS	INDEX COLUMN	PERIOD (MONTHS)	PRESENT WORTH FACTOR	PRESENT WORTH COST	SERIES PRESENT WORTH FACOTR	PRESENT WORTH ANNUAL COST	TOTAL ANNUAL REPLACEMENT COST
WASTEWATER SYSTEM												
SEWAGE HAUL TRUCK	1	60	5.00	$65,000.00	4.00	1	60	0.7835	50929.20			
						2	120	0.6139	39904.36			
						3	180	0.4810	31266.11			
						4	240	0.3769	24497.82			
										12.4622	$146,597.49	$11,763.36
SUBTOTAL												$11,763.36
CONTINGENCY @ 10%												$1,176.34
TOTAL CITY WIDE SYSTEM REPLACEMENT COSTS												$12,939.70
** COST INCLUDES SHIPPING AND INSTALLATION												

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OPERATIONS AND MAINTENANCE COSTS
WATER SERVICE ONLY/SUNSHINE SUBDIVISION LARGE VEHICLE HAUL SYSTEM EQUIPMENT REPLACEMENT COSTS
APRIL 1998

EQUIPMENT REPLACEMENT DESCRIPTION	NUMBER OF UNITS	LIFE EXPECTANCY (PERIOD) (MONTHS)	INTEREST RATE (PERCENT)	REPLACMENT OR PERIODIC COST**	NUMBER PERIODS WITHIN 20-YEARS	INDEX COLUMN	PERIOD (MONTHS)	PRESENT WORTH FACTOR	PRESENT WORTH COST	SERIES PRESENT WORTH FACOTR	PRESENT WORTH ANNUAL COST	TOTAL ANNUAL REPLACEMENT COST
WATER SYSTEM												
WATER HAUL TRUCK	1	60	5.00	$70,000.00	4.00	1	60	0.7835	54846.83			
						2	120	0.6139	42973.93			
						3	180	0.4810	33671.20			
						4	240	0.3769	26382.26			
										12.4622	$157,874.22	$12,668.24
SUBTOTAL												$12,668.24
CONTINGENCY @ 10%												$1,266.82
TOTAL CITY WIDE SYSTEM REPLACEMENT COSTS												$13,935.06
** COST INCLUDES SHIPPING AND INSTALLATION												

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF NEW WATER PLANT AND TOWNSITE LOOPS OPERATIONS AND MAINTENANCE COSTS
EQUIPMENT REPLACEMENT COSTS
APRIL, 1998

EQUIPMENT REPLACEMENT												
DESCRIPTION	NUMBER OF UNITS	LIFE EXPECTANCY (PERIOD) (MONTHS)	INTEREST RATE (PERCENT)	REPLACMENT OR PERIODIC COST**	NUMBER PERIODS WITHIN 20-YEARS	INDEX COLUMN	PERIOD (MONTHS)	PRESENT WORTH FACTOR	PRESENT WORTH COST	SERIES PRESENT WORTH FACOTR	PRESENT WORTH ANNUAL COST	TOTAL ANNUAL REPLACEMENT COST
WATER PLANT												
WELL PUMP	1	48	5.00	$1,050.00	5.00	1	48	0.8227	863.84			
						2	96	0.6768	710.68			
						3	144	0.5568	584.68			
						4	192	0.4581	481.02			
						5	240	0.3769	395.73			
										12.4622	$3,035.95	$243.61
REPLACE SEALS IN CIRCULATION PUMPS	4	60	5.00	$600.00	4.00	1	60	0.7835	705.17			
						2	120	0.6139	552.52			
						3	180	0.4810	432.92			
						4	240	0.3769	339.20			
										12.4622	$2,029.81	$162.88
REMOVE, REPAIR AND REPLACE CIRCULATION	4	60	5.00	$2,200.00	4.00	1	60	0.7835	2585.64			
PUMPS						2	120	0.6139	2025.91			
						3	180	0.4810	1587.36			
						4	240	0.3769	1243.74			
										12.4622	$7,442.64	$597.22
REPLACE SEALS IN SERIVCE PUMPS	2	60	5.00	$300.00	4.00	1	60	0.7835	235.06			
						2	120	0.6139	184.17			
						3	180	0.4810	144.31			
						4	240	0.3769	113.07			
										12.4622	$676.60	$54.29
REMOVE, REPAIR AND REPLACE SERVICE	2	60	5.00	$1,800.00	4.00	1	60	0.7835	1410.35			
PUMPS						2	120	0.6139	1105.04			
						3	180	0.4810	865.83			
						4	240	0.3769	678.40			
										12.4622	$4,059.62	$325.75
REPLACE SEALS IN BACKWASH PUMP	1	60	5.00	$200.00	4.00	1	60	0.7835	156.71			
						2	120	0.6139	122.78			
						3	180	0.4810	96.20			
						4	240	0.3769	75.38			
										12.4622	$451.07	$36.19
REPLACE BACKWASH PUMP	1	60	5.00	$1,100.00	4.00	1	60	0.7835	861.88			
						2	120	0.6139	675.30			
						3	180	0.4810	529.12			
						4	240	0.3769	414.58			
										12.4622	$2,480.88	$199.07
REBUILD FILTER VALVES	18	48	5.00	$2,250.00	5.00	1	48	0.8227	1851.08			
						2	96	0.6768	1522.89			
						3	144	0.5568	1252.88			
						4	192	0.4581	1030.75			
						5	240	0.3769	848.00			
										12.4622	$6,505.61	$522.03

REPLACE FILTER MEDIA	3	60	5.00	$3,600.00	4.00	1	60	0.7835	2820.69			
						2	120	0.6139	2210.09			
						3	180	0.4810	1731.66			
						4	240	0.3769	1356.80			
										12.4622	$8,119.25	$651.51
REPLACE TURBIDIMETERS	4	120	5.00	$8,000.00	2.00	1	120	0.6139	4911.31			
						2	240	0.3769	3015.12			
										12.4622	$9,283.22	$744.91
REPLACE FILTER LIGHTS	3	24	5.00	$195.00	10.00	1	24	0.9070	176.87			
						2	48	0.8227	160.43			
						3	72	0.7462	145.51			
						4	96	0.6768	131.98			
						5	120	0.6139	119.71			
						6	144	0.5568	108.58			
						7	168	0.5051	98.49			
						8	192	0.4581	89.33			
						9	216	0.4155	81.03			
						10	240	0.3769	73.49			
										12.4622	$1,185.43	$95.12
REBUILD CHEMICAL FEED PUMP HEADS	3	24	5.00	$75.00	10.00	1	24	0.9070	68.03			
						2	48	0.8227	61.70			
						3	72	0.7462	55.97			
						4	96	0.6768	50.76			
						5	120	0.6139	46.04			
						6	144	0.5568	41.76			
						7	168	0.5051	37.88			
						8	192	0.4581	34.36			
						9	216	0.4155	31.16			
						10	240	0.3769	28.27			
										12.4622	$455.93	$36.59
REPLACE CHEMICAL FEED PUMPS	3	120	5.00	$1,800.00	2.00	1	120	0.6139	1105.04			
						2	240	0.3769	678.40			
										12.4622	$1,783.44	$143.11
REPAIR, REPLACE CHEMICAL SOLUTION	3	36	5.00	$1,050.00	7.00	1	36	0.8638	907.03			
MIXERS						2	72	0.7462	783.53			
						3	108	0.6446	676.84			
						4	144	0.5568	584.68			
						5	180	0.4810	505.07			
						6	216	0.4155	436.30			
						7	240	0.3769	395.73			
										12.4622	$4,289.17	$344.17
REPLACE SMALL TOOLS	1	60	5.00	$500.00	4.00	1	60	0.7835	391.76			
						2	120	0.6139	306.96			
						3	180	0.4810	240.51			
						4	240	0.3769	188.44			
										12.4622	$1,127.67	$90.49
REPLACE HEAT EXCHANGERS	4	180	5.00	$880.00	1.00	1	180	0.4810	423.30			
						2	240	0.3769	331.66			
										12.4622	$754.96	$60.58
REMOVE, REPAIR AND REPLACE HYDRONIC	4	60	5.00	$1,400.00	4.00	1	60	0.7835	1096.94			
HEATING PUMPS						2	120	0.6139	859.48			
						3	180	0.4810	673.42			
						4	240	0.3769	527.65			

										12.4622	$3,157.48	$253.36
REMOVE, REPLACE HYDRONIC HEATING ZONE	6	120	5.00	$750.00	2.00	1	120	0.6139	460.43			
VALVES						2	240	0.3769	282.67			
										12.4622	$743.10	$59.63
REMOVE AND REPLACE TEMP AND PRESSURE	12	96	5.00	$780.00	3.00	1	96	0.6768	527.93			
GAGES						2	192	0.4581	357.33			
						3	240	0.3769	293.97			
										12.4622	$1,179.24	$94.62
REMOVE AND REPLACE FLOW METERS	4	72	5.00	$1,000.00	3.00	1	72	0.7462	746.22			
						2	144	0.5568	556.84			
						3	240	0.3769	376.89			
										12.4622	$1,679.94	$134.80
REPLACE FUEL OIL TRANSFER PUMPS	2	96	5.00	$1,100.00	3.00	1	96	0.6768	744.52			
						2	192	0.4581	503.92			
						3	240	0.3769	414.58			
										12.4622	$1,663.02	$133.45
SUBTOTAL												$4,983.39
CONTINGENCY @ 10%												$498.34
TOTAL WATER SYSTEM/PLANT REPLACEMENT COSTS												$5,481.73
** COST INCLUDES SHIPPING AND INSTALLATION												

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF SUNSHINE SUBDIVISION LOOP OPERATIONS AND MAINTENANCE COSTS
EQUIPMENT REPLACEMENT COSTS
APRIL 1995

EQUIPMENT REPLACEMENT												
DESCRIPTION	NUMBER OF UNITS	LIFE EXPECTANCY (PERIOD) (MONTHS)	INTEREST RATE (PERCENT)	REPLACMENT OR PERIODIC COST**	NUMBER PERIODS WITHIN 20-YEARS	INDEX COLUMN	PERIOD (MONTHS)	PRESENT WORTH FACTOR	PRESENT WORTH COST	SERIES PRESENT WORTH FACOTR	PRESENT WORTH ANNUAL COST	TOTAL ANNUAL REPLACEMENT COST
WATER PLANT												
REPLACE SEALS IN CIRCULATION PUMPS	2	60	5.00	$300.00	4.00	1	60	0.7835	705.17			
						2	120	0.6139	552.52			
						3	180	0.4810	432.92			
						4	240	0.3769	339.20			
										12.4622	$2,029.81	$162.88
REMOVE, REPAIR AND REPLACE CIRCULATION	2	60	5.00	$1,100.00	4.00	1	60	0.7835	2585.64			
PUMPS						2	120	0.6139	2025.91			
						3	180	0.4810	1587.36			
						4	240	0.3769	1243.74			
										12.4622	$7,442.64	$597.22
REPLACE HEAT EXCHANGERS	1	180	5.00	$220.00	1.00	1	180	0.4810	423.30			
						2	240	0.3769	331.66			
										12.4622	$754.96	$60.58
REMOVE, REPAIR AND REPLACE HYDRONIC	2	60	5.00	$700.00	4.00	1	60	0.7835	1096.94			
HEATING PUMPS						2	120	0.6139	859.48			
						3	180	0.4810	673.42			
						4	240	0.3769	527.65			
										12.4622	$3,157.48	$253.36
REMOVE AND REPLACE TEMP AND PRESSURE	4	96	5.00	$260.00	3.00	1	96	0.6768	527.93			
GAGES						2	192	0.4581	357.33			
						3	240	0.3769	293.97			
										12.4622	$1,179.24	$94.62
REMOVE AND REPLACE FLOW METERS	1	72	5.00	$250.00	3.00	1	72	0.7462	746.22			
						2	144	0.5568	556.84			
						3	240	0.3769	376.89			
										12.4622	$1,679.94	$134.80
SUBTOTAL												$1,303.47
CONTINGENCY @ 10%												$130.35
TOTAL WATER SYSTEM/PLANT REPLACEMENT COSTS												$1,433.81
** COST INCLUDES SHIPPING AND INSTALLATION												

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF SUNSHINE SUBDIVISION HAUL/LOCAL WATER LOOP OPERATIONS AND MAINTENANCE COSTS
EQUIPMENT REPLACEMENT COSTS
APRIL, 1996

EQUIPMENT REPLACEMENT DESCRIPTION	NUMBER OF UNITS	LIFE EXPECTANCY (PERIOD) (MONTHS)	INTEREST RATE (PERCENT)	REPLACMENT OR PERIODIC COST**	NUMBER PERIODS WITHIN 20-YEARS	INDEX COLUMN	PERIOD (MONTHS)	PRESENT WORTH FACTOR	PRESENT WORTH COST	SERIES PRESENT WORTH FACOTR	PRESENT WORTH ANNUAL COST	TOTAL ANNUAL REPLACEMENT COST
WATER PLANT												
REPLACE SEALS IN CIRCULATION PUMPS	2	60	5.00	$300.00	4.00	1	60	0.7835	705.17			
						2	120	0.6139	552.52			
						3	180	0.4810	432.92			
						4	240	0.3769	339.20			
										12.4622	$2,029.81	$162.88
REMOVE, REPAIR AND REPLACE CIRCULATION	2	60	5.00	$1,100.00	4.00	1	60	0.7835	2585.64			
PUMPS						2	120	0.6139	2025.91			
						3	180	0.4810	1587.36			
						4	240	0.3769	1243.74			
										12.4622	$7,442.64	$597.22
REPLACE SMALL TOOLS	1	60	5.00	$500.00	4.00	1	60	0.7835	391.76			
						2	120	0.6139	306.96			
						3	180	0.4810	240.51			
						4	240	0.3769	188.44			
										12.4622	$1,127.67	$90.49
REPLACE HEAT EXCHANGERS	1	180	5.00	$220.00	1.00	1	180	0.4810	423.30			
						2	240	0.3769	331.66			
										12.4622	$754.96	$60.58
REMOVE, REPAIR AND REPLACE HYDRONIC	2	60	5.00	$700.00	4.00	1	60	0.7835	1096.94			
HEATING PUMPS						2	120	0.6139	859.48			
						3	180	0.4810	673.42			
						4	240	0.3769	527.65			
										12.4622	$3,157.48	$253.36
REMOVE, REPLACE HYDRONIC HEATING ZONE	2	120	5.00	$250.00	2.00	1	120	0.6139	460.43			
VALVES						2	240	0.3769	282.67			
										12.4622	$743.10	$59.63
REMOVE AND REPLACE TEMP AND PRESSURE	4	96	5.00	$260.00	3.00	1	96	0.6768	527.93			
GAGES						2	192	0.4581	357.33			
						3	240	0.3769	293.97			
										12.4622	$1,179.24	$94.62
REMOVE AND REPLACE FLOW METERS	1	72	5.00	$250.00	3.00	1	72	0.7462	746.22			
						2	144	0.5568	556.84			
						3	240	0.3769	376.89			
										12.4622	$1,679.94	$134.80
REPLACE FUEL OIL TRANSFER PUMPS	1	96	5.00	$550.00	3.00	1	96	0.6768	744.52			
						2	192	0.4581	503.92			
						3	240	0.3769	414.58			
										12.4622	$1,663.02	$133.45
WATER HAUL TRUCK	1	60	5.00	$70,000.00	4.00	1	60	0.7835	54846.83			
						2	120	0.6139	42973.93			
						3	180	0.4810	33671.20			
						4	240	0.3769	26382.26			

										12.4622	$157,874.22	$12,668.24
SUBTOTAL												$14,255.26
CONTINGENCY @ 10%												$1,425.53
TOTAL WATER SYSTEM/PLANT REPLACEMENT COSTS												$15,680.79
** COST INCLUDES SHIPPING AND INSTALLATION												

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF TOWNSITE GRAVITY/PRESSURE SEWER OPERATIONS AND MAINTENANCE COSTS
EQUIPMENT REPLACEMENT COSTS
APRIL, 1996

EQUIPMENT REPLACEMENT												
DESCRIPTION	NUMBER OF UNITS	LIFE EXPECTANCY (PERIOD) (MONTHS)	INTEREST RATE (PERCENT)	REPLACMENT OR PERIODIC COST**	NUMBER PERIODS WITHIN 20-YEARS	INDEX COLUMN	PERIOD (MONTHS)	PRESENT WORTH FACTOR	PRESENT WORTH COST	SERIES PRESENT WORTH FACOTR	PRESENT WORTH ANNUAL COST	TOTAL ANNUAL REPLACEMENT COST
WATER PLANT												
REPLACE SEALS IN LIFT STATION PUMPS	4	60	5.00	$600.00	4.00	1	60	0.7835	705.17			
						2	120	0.6139	552.52			
						3	180	0.4810	432.92			
						4	240	0.3769	339.20			
										12.4622	$2,029.81	$162.88
REMOVE, REPAIR AND REPLACE LIFT STATION	4	60	5.00	$2,200.00	4.00	1	60	0.7835	2585.64			
PUMPS						2	120	0.6139	2025.91			
						3	180	0.4810	1587.36			
						4	240	0.3769	1243.74			
										12.4622	$7,442.64	$597.22
REPLACE PORTABLE STEAM BOILER	1	24	5.00	$10,000.00	10.00	1	24	0.9070	9070.29			
						2	48	0.8227	8227.02			
						3	72	0.7462	7462.15			
						4	96	0.6768	6768.39			
						5	120	0.6139	6139.13			
						6	144	0.5568	5568.37			
						7	168	0.5051	5050.68			
						8	192	0.4581	4581.12			
						9	216	0.4155	4155.21			
						10	240	0.3769	3768.89			
										12.4622	$60,791.27	$4,878.05
PICKUP TRUCK	1	60	5.00	$25,000.00	4.00	1	60	0.7835	19588.15			
						2	120	0.6139	15347.83			
						3	180	0.4810	12025.43			
						4	240	0.3769	9422.24			
										12.4622	$56,383.65	$4,524.37
REPLACE SMALL TOOLS	1	60	5.00	$500.00	4.00	1	60	0.7835	391.76			
						2	120	0.6139	306.96			
						3	180	0.4810	240.51			
						4	240	0.3769	188.44			
										12.4622	$1,127.67	$90.49
SUBTOTAL												$10,253.00
CONTINGENCY @ 10%												$1,025.30
TOTAL SEWER SYSTEM REPLACEMENT COSTS												$11,278.30
** COST INCLUDES SHIPPING AND INSTALLATION												

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF SUNSHINE GRAVITY/PRESSURE SEWER OPERATIONS AND MAINTENANCE COSTS
EQUIPMENT REPLACEMENT COSTS
APRIL, 1996

EQUIPMENT REPLACEMENT												
DESCRIPTION	NUMBER OF UNITS	LIFE EXPECTANCY (PERIOD) (MONTHS)	INTEREST RATE (PERCENT)	REPLACMENT OR PERIODIC COST**	NUMBER PERIODS WITHIN 20-YEARS	INDEX COLUMN	PERIOD (MONTHS)	PRESENT WORTH FACTOR	PRESENT WORTH COST	SERIES PRESENT WORTH FACOTR	PRESENT WORTH ANNUAL COST	TOTAL ANNUAL REPLACEMENT COST
WATER PLANT												
REPLACE SEALS IN LIFT STATION PUMPS	4	60	5.00	$600.00	4.00	1	60	0.7835	705.17			
						2	120	0.6139	552.52			
						3	180	0.4810	432.92			
						4	240	0.3769	339.20			
										12.4622	$2,029.81	$162.88
REMOVE, REPAIR AND REPLACE LIFT STATION	4	60	5.00	$2,200.00	4.00	1	60	0.7835	2585.64			
PUMPS						2	120	0.6139	2025.91			
						3	180	0.4810	1587.36			
						4	240	0.3769	1243.74			
										12.4622	$7,442.64	$597.22
REPLACE SMALL TOOLS	1	60	5.00	$500.00	4.00	1	60	0.7835	391.76			
						2	120	0.6139	306.96			
						3	180	0.4810	240.51			
						4	240	0.3769	188.44			
										12.4622	$1,127.67	$90.49
SUBTOTAL												$850.58
CONTINGENCY @ 10%												$85.06
TOTAL SEWER SYSTEM REPLACEMENT COSTS												$935.64
** COST INCLUDES SHIPPING AND INSTALLATION												

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OPERATIONS AND MAINTENANCE COSTS
SUNSHINE SUBDIVISION LOCAL GRAVITY/HAUL SYSTEM EQUIPMENT REPLACEMENT COSTS
APRIL, 1996

EQUIPMENT REPLACEMENT												
DESCRIPTION	NUMBER OF UNITS	LIFE EXPECTANCY (PERIOD) (MONTHS)	INTEREST RATE (PERCENT)	REPLACMENT OR PERIODIC COST**	NUMBER PERIODS WITHIN 20-YEARS	INDEX COLUMN	PERIOD (MONTHS)	PRESENT WORTH FACTOR	PRESENT WORTH COST	SERIES PRESENT WORTH FACOTR	PRESENT WORTH ANNUAL COST	TOTAL ANNUAL REPLACEMENT COST
WASTEWATER SYSTEM												
SEWAGE HAUL TRUCK	1	60	5.00	$65,000.00	4.00	1	60	0.7835	54846.83			
						2	120	0.6139	42973.93			
						3	180	0.4810	33671.20			
						4	240	0.3769	26382.26			
										12.4622	$157,874.22	$12,668.24
SUBTOTAL												$12,668.24
CONTINGENCY @ 10%												$1,266.82
TOTAL SEWER SYSTEM REPLACEMENT COSTS												$13,935.06
** COST INCLUDES SHIPPING AND INSTALLATION												

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OPERATIONS AND MAINTENANCE COSTS
TOWNSITE VACUUM SEWER SYSTEM EQUIPMENT REPLACEMENT COSTS
APRIL 1996

EQUIPMENT REPLACEMENT DESCRIPTION	NUMBER OF UNITS	LIFE EXPECTANCY (PERIOD) (MONTHS)	INTEREST RATE (PERCENT)	REPLACMENT OR PERIODIC COST**	NUMBER PERIODS WITHIN 20-YEARS	INDEX COLUMN	PERIOD (MONTHS)	PRESENT WORTH FACTOR	PRESENT WORTH COST	SERIES PRESENT WORTH FACOTR	PRESENT WORTH ANNUAL COST	TOTAL ANNUAL REPLACEMENT COST
VACUUM STATION												
VACUUM PUMPS*												$2,000.00
SEWAGE PUMPS*												$800.00
COLLECTION TANK*												$550.00
CONTROL PANEL*												$1,250.00
MISCELLANEOUS EQUIPMENT*												$200.00
VACUUM VALVE												
VACUUM VALVE*	110										$1.75	$192.50
CONTROLLER*	110										$7.00	$770.00
MISCELLANEOUS PARTS*	110										$1.25	$137.50
*DATA FROM AIRVAC												
REPLACE PORTABLE STEAM BOILER	1	24	5.00	$10,000.00	10.00	1	24	0.9070	9070.29			
						2	48	0.8227	8227.02			
						3	72	0.7462	7462.15			
						4	96	0.6768	6768.39			
						5	120	0.6139	6139.13			
						6	144	0.5568	5568.37			
						7	168	0.5051	5050.68			
						8	192	0.4581	4581.12			
						9	216	0.4155	4155.21			
						10	240	0.3769	3768.89			
										12.4622	$60,791.27	$4,878.05
PICKUP TRUCK	1	60	5.00	$25,000.00	4.00	1	60	0.7835	19588.15			
						2	120	0.6139	15347.83			
						3	180	0.4810	12025.43			
						4	240	0.3769	9422.24			
										12.4622	$56,383.65	$4,524.37
SUBTOTAL												$10,778.05
CONTINGENCY @ 10%												$1,077.80
TOTAL SEWER SYSTEM REPLACEMENT COSTS												$11,855.85
** COST INCLUDES SHIPPING AND INSTALLATION												

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OPERATIONS AND MAINTENANCE COSTS
SUBDIVISION VACUUM SEWER SYSTEM EQUIPMENT REPLACEMENT COSTS
APRIL 1998

EQUIPMENT REPLACEMENT												
DESCRIPTION	NUMBER OF UNITS	LIFE EXPECTANCY (PERIOD) (MONTHS)	INTEREST RATE (PERCENT)	REPLACMENT OR PERIODIC COST**	NUMBER PERIODS WITHIN 20-YEARS	INDEX COLUMN	PERIOD (MONTHS)	PRESENT WORTH FACTOR	PRESENT WORTH COST	SERIES PRESENT WORTH FACOTR	PRESENT WORTH ANNUAL COST	TOTAL ANNUAL REPLACEMENT COST
VACUUM VALVE												
VACUUM VALVE*	14										$1.75	$24.50
CONTROLLER*	14										$7.00	$98.00
MISCELLANEOUS PARTS*	14										$1.25	$17.50
*DATA FROM AIRVAC												
SUBTOTAL												$140.00
CONTINGENCY @ 10%												$14.00
TOTAL SEWER SYSTEM REPLACEMENT COSTS												$154.00
** COST INCLUDES SHIPPING AND INSTALLATION												

Detailed Consumables Costs

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF WATER PLANT/WATER LOOPS OPERATIONS AND MAINTENANCE COSTS
ANNUAL WATER SYSTEM CONSUMABLES COSTS
APRIL, 1996

CONSUMABLES										
DESCRIPTION										
FUEL OIL - WATER PLANT SPACE HTG.	AREA	HEATING	INSULATION	INFILTRATION	ANNUAL	FUEL OIL	HEATING	FUEL	TOTAL	TOTAL
	(SF)	TEMP	R-VALUE	RATE	HEATING	HEATING	MECHANICAL	OIL		
		DELTA	(HR- F-SF/BTU)	(CFM)	LOAD	VALUE	EFFICIENCY	COST		
		(FAHRENHEIT)			(BTU/YR)	(BTU/GAL)	(PERCENT)	($/GAL)		
WALLS - 2@10X40 & 2@10X96 + END WALL PEAK	2720	40	19.00		50162526	140,000	0.55	$1.30	$ 847	
ROOF - 40X96 @ 1:3 PITCH	4032	40	19.00		74358568	140,000	0.55	$1.30	$ 1,255	
FLOOR - 40X96	3840	40	38.00		35408842	140,000	0.55	$1.30	$ 598	
INFILTRATION		40		4	1667119	140,000	0.55	$1.30	$ 28	
WINDOWS	64	40	4.00		5606400	140,000	0.55	$1.30	$ 95	
SUBTOTAL										$ 2,823
FUEL OIL - WATER PIPELINE FREEZE	ANNUAL	FUEL								
PROTECTION	FUEL	OIL								
	USE	COST								
	(GAL/YR)	($/GAL)								
TOWNSITE LOOP	8,261	$1.30							$ 10,739	
SUNSHINE SUBDIVISION LOOP	3204	$1.30							$ 4,165	
SUBTOTAL										$ 14,905
FUEL OIL - STORAGE TANK HEATING	ANNUAL	FUEL								
	FUEL	OIL								
	USE	COST								
	(GAL/YR)	($/GAL)								
200,000 GALLON H20 STORAGE TANK	8,973	$1.30								$ 11,665
ELECTRIC POWER - PUMPS	PUMP	OPERATION	MECHANICAL	MONTHLY	ELECTRIC	MONTHLY				
	HP	DURATION	EFFICIENCY	POWER	POWER	POWER				
		(MIN/MONTH)	(PERCENT)	CONSUMPTION	COSTS	COSTS				
				(KWH/MONTH)	($/KWH)					
BACKWASH PUMP	5	390.00	70.00	16.96	0.40	$6.79			$ 81	
TOWNSITE LOOP CIRCULATION PUMP	5	43200.00	75.00	2013.39	0.40	$805.36			$ 9,664	
SUBDIVISION LOOP CIRCULATION PUMP	5	43200.00	75.00	2013.39	0.40	$805.36			$ 9,664	
WELL PUMP	3	8790.00	50.00	163.87	0.40	$65.55			$ 787	
RAW WATER TRANSMISSION CIRCULATION PUMP	1	43200.00	75.00	402.68	0.40	$161.07			$ 1,933	
BOILER HYDRONIC HEAT CIRC PUMP	0.5	43200.00	70.00	187.92	0.40	$75.17			$ 902	
SUBTOTAL										$ 23,031
ELECTRIC POWER - BOILERS	BURNER	OPERATION	MONTHLY	ELECTRIC	MONTHLY					
	PUMP	DURATION	POWER	POWER	POWER					
	HP	(MIN/MONTH)	CONSUMPTION	COSTS	COSTS					
			(KWH/MONTH)	($/KWH)						
	0.2	25000	62.14	0.40	24.86					$ 298

ELECTRIC POWER - LIGHTING	LIGHTING	FLOOR	DURATION	MONTHLY	ELECTRIC	MONTHLY				
	INTENSITY	AREA	OF	POWER	POWER	POWER				
	(WATTS/SF)	(SF)	OPERATION	CONSUMPTION	COSTS	COSTS				
			(HOURS/WEEK)	(KWH/MONTH)	($/KWH)					
	1.2	3200	40.00	665.09	0.40	$266.04				$ 3,192
ELECTRIC POWER - MISCELLANEOUS	MONTHLY	ELECTRIC	MONTHLY							
CHEMICAL SOLUTION MIXERS,	POWER	POWER	POWER							
INSTRUMENTATION AND CONTROL SYSTEMS,	CONSUMPTION	COSTS	COSTS							
LAB EQUIPMENT, COFFEE POT, MICROWAVE	(KWH/MONTH)	($/KWH)								
	650	0.40	$260.00							$ 3,120
BURNER PARTS	NUMBER/YEAR	UNIT COST								
FIRE EYES	4	$6.50								$ 26
PAINT AND CLEANING SUPPLIES	MISCELLANEOUS									
	ALLOWANCE									
	($/MONTH)									
	75									$ 900
FIRE EXTINGUISHER MAINTENANCE	NUMBER/YEAR	UNIT COST								
SEND EXTINGUISHERS IN FOR RECHARGING	3	$50.00								$ 150
FUEL OIL - SAVINGS FOR USE										$ (7,348)
OF WASTE HEAT										
TREATMENT SUPPLIES ALLOWANCE										$ 7,210
SUBTOTAL TOWNSITE LOOP										$ 55,002
CONTINGENCY @ 10%										$ 5,500
TOTAL TOWNSITE LOOP CONSUMABLES COSTS										$ 60,502
SUBTOTAL SUNSHINE SUBDIVISION LOOP										$ 48,428
CONTINGENCY @ 10%										$ 4,843
TOTAL SUNSHINE SUBD LOOP CONSUMABLES COSTS										$ 53,271
SUBTOTAL TOWNSITE + SUBDIVISION LOOPS										$ 59,972
CONTINGENCY @ 10%										$ 5,997
TOTAL TOWNSITE + SUBD LOOPS CONSUMABLES COSTS										$ 65,970

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF LAUNDROMAT WATER PLANT OPERATIONS AND MAINTENANCE COSTS
ANNUAL WATER SYSTEM CONSUMABLES COSTS
APRIL, 1996

CONSUMABLES										
DESCRIPTION										
FUEL OIL - WATER PLANT SPACE HTG.	AREA	HEATING	INSULATION	INFILTRATION	ANNUAL	FUEL OIL	HEATING	FUEL	TOTAL	TOTAL
	(SF)	TEMP	R-VALUE	RATE	HEATING	HEATING	MECHANICAL	OIL		
		DELTA	(HR- F-SF/BTU)	(CFM)	LOAD	VALUE	EFFICIENCY	COST		
		(FAHRENHEIT)			(BTU/YR)	(BTU/GAL)	(PERCENT)	($/GAL)		
WALLS - 2@10X56 & 2@10X40 + END WALL PEAK	1920	40	19.00		35408842	140,000	0.55	$1.30	$ 598	
ROOF - 40X56 @ 1:3 PITCH	2352	40	19.00		43375832	140,000	0.55	$1.30	$ 732	
FLOOR - 40X56	2240	40	38.00		20655158	140,000	0.55	$1.30	$ 349	
INFILTRATION		40		4	1667119	140,000	0.55	$1.30	$ 28	
WINDOWS	64	40	4.00		5606400	140,000	0.55	$1.30	$ 95	
SUBTOTAL										$ 1,802
FUEL OIL - STORAGE TANK HEATING	ANNUAL	FUEL								
	FUEL	OIL								
	USE	COST								
	(GAL/YR)	($/GAL)								
50,000 GALLON H20 STORAGE TANK	4880	$1.30								$ 6,344
ELECTRIC POWER - PUMPS	PUMP	OPERATION	MECHANICAL	MONTHLY	ELECTRIC	MONTHLY				
	HP	DURATION	EFFICIENCY	POWER	POWER	POWER				
		(MIN/MONTH)	(PERCENT)	CONSUMPTION	COSTS	COSTS				
				(KWH/MONTH)	($/KWH)					
BACKWASH PUMP	5	390.00	70.00	16.96	$0.40	$6.79			$ 81	
WELL PUMP	3	8790.00	50.00	163.87	$0.40	$65.55			$ 787	
RAW WATER TRANSMISSION PUMP	1	43200.00	70.00	375.83	$0.40	$150.33			$ 1,804	
BOILER HYDRONIC HEAT CIRC PUMP	0.5	43200.00	70.00	187.92	$0.40	$75.17			$ 902	
SUBTOTAL										$ 3,574
ELECTRIC POWER - BOILERS	BURNER	OPERATION	MONTHLY	ELECTRIC	MONTHLY					
	PUMP	DURATION	POWER	POWER	POWER					
	HP	(MIN/MONTH)	CONSUMPTION	COSTS	COSTS					
			(KWH/MONTH)	($/KWH)						
	0.2	25000	62.14	$0.40	24.86					$ 298
ELECTRIC POWER - LIGHTING	LIGHTING	FLOOR	DURATION	MONTHLY	ELECTRIC	MONTHLY				
	INTENSITY	AREA	OF	POWER	POWER	POWER				
	(WATTS/SF)	(SF)	OPERATION	CONSUMPTION	COSTS	COSTS				
			(HOURS/WEEK)	(KWH/MONTH)	($/KWH)					
	1.2	3200	40.00	665.09	$0.36	$239.43				$ 2,873
ELECTRIC POWER - MISCELLANEOUS	MONTHLY	ELECTRIC	MONTHLY							
CHEMICAL SOLUTION MIXERS,	POWER	POWER	POWER							
INSTRUMENTATION AND CONTROL SYSTEMS,	CONSUMPTION	COSTS	COSTS							

LAB EQUIPMENT, COFFEE POT, MICROWAVE	(KWH/MONTH)	($/KWH)								
	650	$0.40	$260.00							$ 3,120
BURNER PARTS	NUMBER/YEAR	UNIT COST								
FIRE EYES	4	$6.50								$ 26
PAINT AND CLEANING SUPPLIES	MISCELLANEOUS									
	ALLOWANCE									
	($/MONTH)									
	75									$ 900
FIRE EXTINGUISHER MAINTENANCE	NUMBER/YEAR	UNIT COST								
SEND EXTINGUISHERS IN FOR RECHARGING	3	$50.00								$ 150
FUEL OIL - SAVINGS FOR USE										$ (2,036)
OF WASTE HEAT										
TREATMENT SUPPLIES ALLOWANCE										$ 2,290
SUBTOTAL LAUNDROMAT WATER PLANT										$ 19,341
CONTINGENCY @ 10%										$ 1,934
TOTAL LAUNDROMAT WATER PLANT CONSUMABLES COSTS										$ 21,275

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF SUNSHINE SUBDIVSION WATER BUILDING OPERATIONS AND MAINTENANCE COSTS
ANNUAL WATER SYSTEM CONSUMABLES COSTS
APRIL, 1996

CONSUMABLES										
DESCRIPTION										
FUEL OIL - WATER PLANT SPACE HTG.	AREA	HEATING	INSULATION	INFILTRATION	ANNUAL	FUEL OIL	HEATING	FUEL	TOTAL	TOTAL
	(SF)	TEMP	R-VALUE	RATE	HEATING	HEATING	MECHANICAL	OIL		
		DELTA	(HR- F-SF/BTU)	(CFM)	LOAD	VALUE	EFFICIENCY	COST		
		(FAHRENHEIT)			(BTU/YR)	(BTU/GAL)	(PERCENT)	($/GAL)		
WALLS - 2@10X20 & 2@10X20 + END WALL PEAK	860	40	19.00		15860211	140,000	0.55	$1.30	$ 267.77	
ROOF - 20X20 @ 1:3 PITCH	440	40	19.00		8114526	140,000	0.55	$1.30	$ 137.00	
FLOOR - 20X20	400	40	38.00		3688421	140,000	0.55	$1.30	$ 62.27	
INFILTRATION		40		4	1667119	140,000	0.55	$1.30	$ 28.15	
WINDOWS	32	40	4.00		2803200	140,000	0.55	$1.30	$ 47.33	
SUBTOTAL										$ 543
FUEL OIL - WATER PIPELINE FREEZE	ANNUAL	FUEL								
PROTECTION	FUEL	OIL								
	USE	COST								
	(GAL/YR)	($/GAL)								
LOCAL SUBDIVISION LOOP	1500	$1.30								$ 1,950
ELECTRIC POWER - PUMPS	PUMP	OPERATION	MECHANICAL	MONTHLY	ELECTRIC	MONTHLY				
	HP	DURATION	EFFICIENCY	POWER	POWER	POWER				
		(MIN/MONTH)	(PERCENT)	CONSUMPTION	COSTS	COSTS				
				(KWH/MONTH)	($/KWH)					
LOCAL SUBDIVISION LOOP CIRCULATION PUMP	2.5	43200.00	75.00	1006.70	$0.40	$402.68			$ 4,832	
BOILER HYDRONIC HEAT CIRC PUMP	0.5	43200.00	70.00	187.92	$0.40	$75.17			$ 902	
SUBTOTAL										$ 5,734
ELECTRIC POWER - BOILERS	BURNER	OPERATION	MONTHLY	ELECTRIC	MONTHLY					
	PUMP	DURATION	POWER	POWER	POWER					
	HP	(MIN/MONTH)	CONSUMPTION	COSTS	COSTS					
			(KWH/MONTH)	($/KWH)						
	0.2	25000	62.14	$0.40	24.86					$ 298
ELECTRIC POWER - LIGHTING	LIGHTING	FLOOR	DURATION	MONTHLY	ELECTRIC	MONTHLY				
	INTENSITY	AREA	OF	POWER	POWER	POWER				
	(WATTS/SF)	(SF)	OPERATION	CONSUMPTION	COSTS	COSTS				
			(HOURS/WEEK)	(KWH/MONTH)	($/KWH)					
	1.2	400	40.00	83.14	$0.40	$33.25				$ 399
ELECTRIC POWER - MISCELLANEOUS	MONTHLY	ELECTRIC	MONTHLY							
INSTRUMENTATION AND CONTROL SYSTEMS,	POWER	POWER	POWER							
LAB EQUIPMENT, COFFEE POT, MICROWAVE	CONSUMPTION	COSTS	COSTS							
	(KWH/MONTH)	($/KWH)								

	650	$0.40	$260.00							$ 3,120
BURNER PARTS	NUMBER/YEAR	UNIT COST								
FIRE EYES	2	$6.50								$ 13
PAINT AND CLEANING SUPPLIES	MISCELLANEOUS									
	ALLOWANCE									
	($/MONTH)									
	50									$ 600
FIRE EXTINGUISHER MAINTENANCE	NUMBER/YEAR	UNIT COST								
SEND EXTINGUISHERS IN FOR RECHARGING	2	$50.00								$ 100
SUBTOTAL LOCAL SUNSHINE SUBDIVISION LOOP										$ 12,757
CONTINGENCY @ 10%										$ 1,276
TOTAL LOCAL SUBD LOOP CONSUMABLES COSTS										$ 14,033

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF WATER SYSTEM OPERATIONS AND MAINTENANCE COSTS
ANNUAL LAUNDROMAT CONSUMABLES COSTS
APRIL, 1998

CONSUMABLES										
DESCRIPTION									TOTAL	TOTAL
LIGHT FIXTURES - LAUNDROMAT	NUMBER	UNIT								
	PER YEAR	COST								
FLUORESCENT TUBES	30	$3.00							$90	
INCANDESCENT BULBS	4	$0.75							$3	
SODIUM VAPOR LIGHTS	1	$50.00							$50	
SUBTOTAL										$143
FUEL OIL - LAUNDROMAT SPACE HTG.	AREA	HEATING	INSULATION	INFILTRATION	ANNUAL	FUEL OIL	HEATING	FUEL		
	(SF)	TEMP	R-VALUE	RATE	HEATING	HEATING	MECHANICAL	OIL		
		DELTA	(HR- F-SF/BTU)	(CFM)	LOAD	VALUE	EFFICIENCY	COST		
		(FAHRENHEIT)			(BTU/YR)	(BTU/GAL)	(PERCENT)	($/GAL)		
WALLS - 2@10x40 & 2@10X40 + END WALL PEAK	1880	40	19.00		34671158	140,000	0.55	$1.30	$585	
ROOF - 40X40 @ 1:3 PITCH	880	40	19.00		16229053	140,000	0.55	$1.30	$274	
FLOOR - 40X40	1600	40	38.00		14753684	140,000	0.55	$1.30	$249	
INFILTRATION		40		4	1667119	140,000	0.55	$1.30	$28	
WINDOWS	150	40	4.00		13140000	140,000	0.55	$1.30	$222	
SUBTOTAL										$1,358
FUEL OIL - WASHER HOT WATER	HOT	HEATING	ANNUAL	FUEL OIL	HEATING	FUEL				
	WATER	TEMP	HEATING	HEATING	MECHANICAL	OIL				
	USAGE	DELTA	LOAD	VALUE	EFFICIENCY	COST				
	(GAL/MONTH)	(FAHRENHEIT)	(BTU/YR)	(BTU/GAL)	(PERCENT)	($/GAL)				
	30,000	105.0	315,252,000	140,000	0.55	$1.30			$5,322	$5,322
FUEL OIL - DRYER HEAT	LOADS	HOURS	HEAT	ANNUAL	FUEL OIL	HEATING	FUEL			
	PER	PER	INPUT	HEATING	HEATING	MECHANICAL	OIL			
	DAY	LOAD	TO DRYERS	LOAD	VALUE	EFFICIENCY	COST			
			(BTU/LOAD)	(BTU/YR)	(BTU/GAL)	(PERCENT)	($/GAL)			
	12	0.25	3,181	11,948,775	140,000	0.55	$1.30		$202	$202
FUEL OIL - SAVINGS FOR USE										($1,721)
OF WASTE HEAT										
ELECTRIC POWER - PUMPS	WATER	PUMPING	TOTAL	MECHANICAL	MONTHLY	ELECTRIC	MONTHLY			
	PUMP	DURATION	HEAD	EFFICIENCY	POWER	POWER	POWER			
	RATE	(MIN/MONTH)	(FT)	(PERCENT)	CONSUMPTION	COSTS	COSTS			
	(GPM)				(KWH/MONTH)	($/KWH)				
BOILER HYDRONIC HEAT CIRC PUMP	3	43200	15.00	70.00	8.72	$0.40	$3.49		$42	
SUBTOTAL										$42

ELECTRIC POWER - BOILERS	BURNER	OPERATION	MONTHLY	ELECTRIC	MONTHLY					
	PUMP	DURATION	POWER	POWER	POWER					
	HP	(MIN/MONTH)	CONSUMPTION	COSTS	COSTS					
			(KWH/MONTH)	($/KWH)						
	0.2	25000	62.14	$0.40	24.86				$298	$298
ELECTRIC POWER - LIGHTING	LIGHTING	FLOOR	DURATION	MONTHLY	ELECTRIC	MONTHLY				
	INTENSITY	AREA	OF	POWER	POWER	POWER				
	(WATTS/SF)	(SF)	OPERATION	CONSUMPTION	COSTS	COSTS				
			(HOURS/WEEK)	(KWH/MONTH)	($/KWH)					
	1.2	2460	40	511.29	$0.40	$204.51			$2,454	$2,454
ELECTRIC POWER - MISCELLANEOUS	MONTHLY	ELECTRIC	MONTHLY							
SODA VENDING MACHINE, RADIO, TV	POWER	POWER	POWER							
	CONSUMPTION	COSTS	COSTS							
	(KWH/MONTH)	($/KWH)								
	350	$0.40	$140.00						$1,680	$1,680
ELECTRIC POWER - WASHERS	MONTHLY	ELECTRIC	MONTHLY							
	POWER	POWER	POWER							
	CONSUMPTION	COSTS	COSTS							
	(KWH/MONTH)	($/KWH)								
	368	$0.40	$147.20						$1,766	$1,766
ELECTRIC POWER - DRYERS	MONTHLY	ELECTRIC	MONTHLY							
	POWER	POWER	POWER							
	CONSUMPTION	COSTS	COSTS							
	(KWH/MONTH)	($/KWH)								
	1104	$0.40	$441.60						$5,299	$5,299
BURNER PTS - BOILERS & WATER HTR	NUMBER/YEAR	UNIT COST								
FIRE EYES	6	$6.50							$39	$39
PAINT AND CLEANING SUPPLIES	MISCELLANEOUS									
	ALLOWANCE									
	($/MONTH)									
	75								$900	$900
SUBTOTAL										$17,784
CONTINGENCY @ 10%										$1,778
TOTAL LAUNDROMAT CONSUMABLES COSTS										$19,562

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF WATER AND SEWER OPERATIONS AND MAINTENANCE COSTS
ANNUAL SMALL VEHICLE HAUL CONSUMABLES COSTS - CITY WIDE
APRIL, 1998

CONSUMABLES										
DESCRIPTION									TOTAL	TOTAL
FUEL FOR 4-WHEELER/SNOWMACHINE	MILES	MILES	GAS/OIL							
	DRIVEN	PER	COST							
	ANNUALLY	GALLON	($/GAL)							
	8,000	15	$2.00						$1,067	$1,067
MISCELLANEOUS 4-WHEELER PARTS	NUMBER	COST								
	PER	PER								
	YEAR	EACH								
ENGINE AIR FILTERS	4	12							$48	
SPARK PLUGS	8	3							$24	
TIRES	8	500							$4,000	
MISCELLANEOUS	1	300							$300	
SUBTOTAL										$4,372
MISCELLANEOUS SNOWMACHINE PARTS	NUMBER	COST								
	PER	PER								
	YEAR	EACH								
ENGINE AIR FILTERS	2	12							$24	
SPARK PLUGS	4	3							$12	
MISCELLANEOUS	1	500							$500	
SUBTOTAL										$536
SUBTOTAL										$5,975
CONTINGENCY @ 10%										$597
TOTAL SMALL VEHICLE HAUL CONSUMABLES COSTS										$6,572

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF WATER AND SEWER OPERATIONS AND MAINTENANCE COSTS
ANNUAL SMALL VEHICLE HAUL CONSUMABLES COSTS - SUBDIVISION ONLY
APRIL 1996

CONSUMABLES										
DESCRIPTION									TOTAL	TOTAL
FUEL FOR 4-WHEELER/SNOWMACHINE	MILES	MILES	GAS/OIL							
	DRIVEN	PER	COST							
	ANNUALLY	GALLON	($/GAL)							
	1700	15	$2.00						$227	$227
MISCELLANEOUS 4-WHEELER PARTS	NUMBER	COST								
	PER	PER								
	YEAR	EACH								
ENGINE AIR FILTERS	4	12							$48	
SPARK PLUGS	8	3							$24	
TIRES	8	500							$4,000	
MISCELLANEOUS	1	300							$300	
SUBTOTAL										$4,372
MISCELLANEOUS SNOWMACHINE PARTS	NUMBER	COST								
	PER	PER								
	YEAR	EACH								
ENGINE AIR FILTERS	2	12							$24	
SPARK PLUGS	4	3							$12	
MISCELLANEOUS	1	500							$500	
SUBTOTAL										$536
SUBTOTAL										$5,135
CONTINGENCY @ 10%										$513
TOTAL SMALL VEHICLE HAUL CONSUMABLES COSTS										$5,648

TANANA WATER AND SEWER FEASIBILITY STUDY ESTIMATE OF WATER AND SEWER OPERATIONS AND MAINTENANCE COSTS ANNUAL LARGE VEHICLE HAUL CONSUMABLES COSTS - CITY WIDE APRIL, 1996										
CONSUMABLES										
DESCRIPTION									TOTAL	TOTAL
FUEL FOR HAUL TRUCKS	HOURS	GALLONS	FUEL/OIL							
	DRIVEN	PER	COST							
	ANNUALLY	HOUR	($/GAL)							
	6000	1	$1.30						$7,800	$7,800
MAINTENANCE FOR HAUL TRUCKS										$5,000
MISCELLANEOUS TRUCK PARTS	NUMBER	COST								
	PER	PER								
	YEAR	EACH								
ENGINE FILTERS	4	12							$48	
TIRES	4	500							$2,000	
MISCELLANEOUS	1	1000							$1,000	
SUBTOTAL										$3,048
SUBTOTAL										$15,848
CONTINGENCY @ 10%										$1,585
TOTAL LARGE VEHICLE HAUL CONSUMABLES COSTS										$17,433

TANANA WATER AND SEWER FEASIBILITY STUDY ESTIMATE OF WATER AND SEWER OPERATIONS AND MAINTENANCE COSTS ANNUAL LARGE VEHICLE HAUL CONSUMABLES COSTS - SUBDIVISION ONLY APRIL 1998										
CONSUMABLES										
DESCRIPTION									TOTAL	TOTAL
FUEL FOR HAUL TRUCKS	HOURS	GALLONS	FUEL/OIL							
	DRIVEN	PER	COST							
	ANNUALLY	HOUR	($/GAL)							
	800	1	$1.30						$1,040	$1,040
MAINTENANCE FOR HAUL TRUCKS										$5,000
MISCELLANEOUS TRUCK PARTS	NUMBER	COST								
	PER	PER								
	YEAR	EACH								
ENGINE FILTERS	4	12							$48	
TIRES	4	500							$2,000	
MISCELLANEOUS	1	1000							$1,000	
SUBTOTAL										$3,048
SUBTOTAL										$9,088
CONTINGENCY @ 10%										$909
TOTAL LARGE VEHICLE HAUL CONSUMABLES COSTS										$9,997

TANANA WATER AND SEWER FEASIBILITY STUDY										
ESTIMATE OF WATER AND SEWER OPERATIONS AND MAINTENANCE COSTS										
ANNUAL LARGE VEHICLE HAUL CONSUMABLES COSTS - BULK HAUL										
APRIL, 1996										
CONSUMABLES										
DESCRIPTION									**TOTAL**	**TOTAL**
FUEL FOR HAUL TRUCKS	HOURS	GALLONS	FUEL/OIL							
	DRIVEN	PER	COST							
	ANNUALLY	HOUR	($/GAL)							
	600	1	$1.30						$780	$780
MAINTENANCE FOR HAUL TRUCKS										$5,000
MISCELLANEOUS TRUCK PARTS	NUMBER	COST								
	PER	PER								
	YEAR	EACH								
ENGINE FILTERS	4	12							$48	
TIRES	4	500							$2,000	
MISCELLANEOUS	1	1000							$1,000	
SUBTOTAL										$3,048
SUBTOTAL										$8,828
CONTINGENCY @ 10%										$883
TOTAL LARGE VEHICLE HAUL BULK CONSUMABLES COSTS										$9,711

TANANA WATER AND SEWER FEASIBILITY STUDY ESTIMATE OF TOWNSITE LIFTSTATIONS OPERATIONS AND MAINTENANCE COSTS ANNUAL WATER AND SEWER SYSTEM CONSUMABLES COSTS APRIL, 1998										
CONSUMABLES										
DESCRIPTION									**TOTAL**	**TOTAL**
ELECTRIC POWER - PUMPS	PUMP	OPERATION	MECHANICAL	MONTHLY	ELECTRIC	MONTHLY				
	HP	DURATION	EFFICIENCY	POWER	POWER	POWER				
		(MIN/MONTH)	(PERCENT)	CONSUMPTION	COSTS	COSTS				
				(KWH/MONTH)	($/KWH)					
2 EACH SEWAGE PUMPS @ 2 LIFTSTATIONS	5	7200.00	70.00	313.19	$0.40	$125.28			$ 1,503	$ 1,503
SUBTOTAL TOWNSITE LIFTSTATIONS										$ 1,503
CONTINGENCY @ 10%										$ 150
TOTAL TOWNSITE LIFTSTATIONS CONSUMABLES COSTS										$ 1,654

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF SUBDIVISION LIFT STATIONS OPERATIONS AND MAINTENANCE COSTS
ANNUAL WATER AND SEWER SYSTEM CONSUMABLES COSTS
APRIL, 1996

CONSUMABLES										
DESCRIPTION									TOTAL	TOTAL
ELECTRIC POWER - PUMPS	PUMP	OPERATION	MECHANICAL	MONTHLY	ELECTRIC	MONTHLY				
	HP	DURATION	EFFICIENCY	POWER	POWER	POWER				
		(MIN/MONTH)	(PERCENT)	CONSUMPTION	COSTS	COSTS				
				(KWH/MONTH)	($/KWH)					
2 EACH SEWAGE PUMPS @ 2 LIFTSTATIONS	3	7200.00	70.00	187.92	$0.40	$75.17			$ 902	$ 902
SUBTOTAL SUBDIVISION LIFTSTATIONS										$ 902
CONTINGENCY @ 10%										$ 90
TOTAL SUBDIVISION LIFTSTATIONS CONSUMABLES COSTS										$ 992

TANANA WATER AND SEWER FEASIBILITY STUDY
ESTIMATE OF VACUUM SYSTEM STATION OPERATIONS AND MAINTENANCE COSTS
ANNUAL WATER SYSTEM CONSUMABLES COSTS
APRIL, 1996

CONSUMABLES										
DESCRIPTION										
FUEL OIL - WATER PLANT SPACE HTG.	AREA	HEATING	INSULATION	INFILTRATION	ANNUAL	FUEL OIL	HEATING	FUEL	TOTAL	TOTAL
	(SF)	TEMP	R-VALUE	RATE	HEATING	HEATING	MECHANICAL	OIL		
		DELTA	(HR- F-SF/BTU)	(CFM)	LOAD	VALUE	EFFICIENCY	COST		
		(FAHRENHEIT)			(BTU/YR)	(BTU/GAL)	(PERCENT)	($/GAL)		
WALLS - 2@10X24 & 2@10X24 + END WALL PEAK	1056	40	19.00		19474863	140,000	0.55	$1.30	$ 328.80	
ROOF - 24X24 @ 1:3 PITCH	607	40	19.00		11194358	140,000	0.55	$1.30	$ 189.00	
FLOOR - 24X24	576	40	38.00		5311326	140,000	0.55	$1.30	$ 89.67	
INFILTRATION		40		4	1667119	140,000	0.55	$1.30	$ 28.15	
WINDOWS	32	40	4.00		2803200	140,000	0.55	$1.30	$ 47.33	
SUBTOTAL										$ 683
ELECTRIC POWER - PER AIRVAC	NUMBER	COST	MONTHLY							
$1.50/CUSTOMER FOR LOWER 48 FOR RURAL AK	OF	PER	POWER							
SAY $7.00/CUSTOMER	CUSTOMERS	CUSTOMER	COSTS							
	120.00	$ 7.00	840.00							$ 10,080
BURNER PARTS	NUMBER/YEAR	UNIT COST								
FIRE EYES	2	$6.50								$ 13
PAINT AND CLEANING SUPPLIES	MISCELLANEOUS									
	ALLOWANCE									
	($/MONTH)									
	50									$ 600
FIRE EXTINGUISHER MAINTENANCE	NUMBER/YEAR	UNIT COST								
SEND EXTINGUISHERS IN FOR RECHARGING	2	$50.00								$ 100
SUBTOTAL VACUUM SYSTEM										$ 11,476
CONTINGENCY @ 10%										$ 1,148
TOTAL VACUUM SYSTEM CONSUMABLES COSTS										$ 12,624

Funding Currently Available for Capital Costs

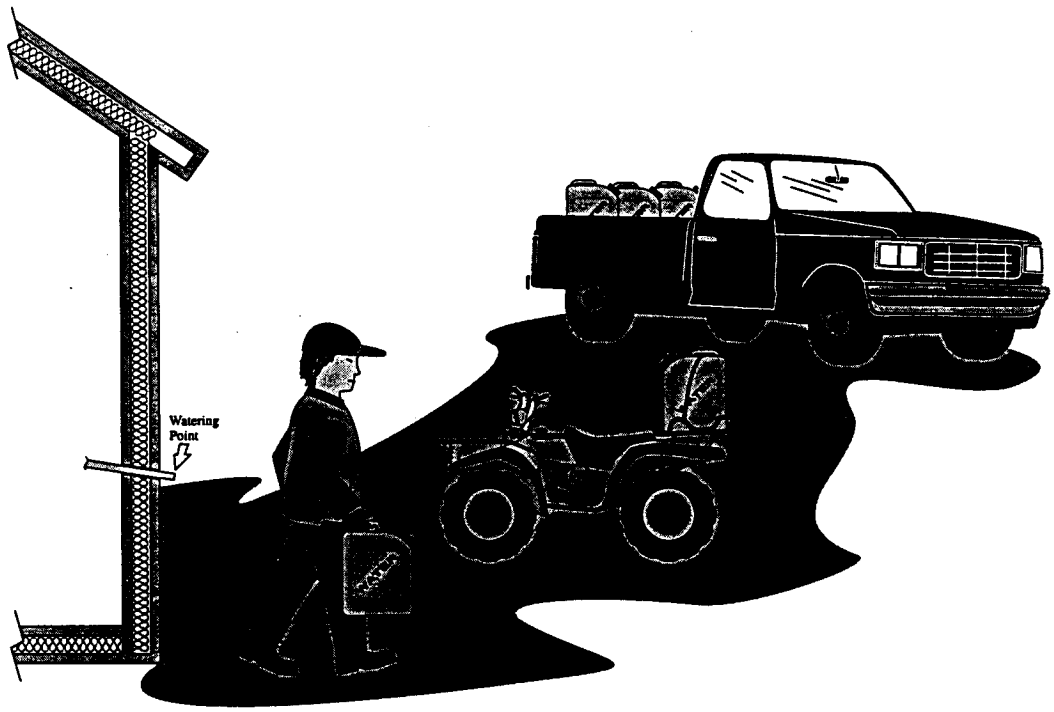
	City of Tanana	Tanana Native Council
Village Safe Water	$338,800	
Rural Economic Community Development	$338,800	
Public Health Service		$1,125,000
Environmental Protection Agency		$329,000
SUBTOTALS	**$677,600**	**$1,454,000**
GRAND TOTAL	**$2,131,600**	

Advantages of City and Native Council Working Together on One Water and Sewer System

- ☑ One system will be cheaper to operate than two systems—one water plant, one set of required water tests, one set of spare parts and tools, etc.
- ☑ Reduced monthly costs per household
- ☑ Less likely to run out of water—three wells to rely on
- ☑ Service will be uniform—town won't be split between competing water and sewer services
- ☑ Can combine resources and talents from both systems
- ☑ Free programs such as RUBA and RMW will be able to focus on one system and therefore provide better service to Tanana
- ☑ More likely to get state funds
- ☑ Easier to get federal funds
- ☑ More funding possibilities—city is eligible for some funding sources; Native Council is eligible for other funding sources
- ☑ Feasibility study can serve as the basis for future funding requests for a water and sewer system to serve the entire community
- ☑ Can reduce the number of agencies working in the village
- ☑ Tanana will have more local control

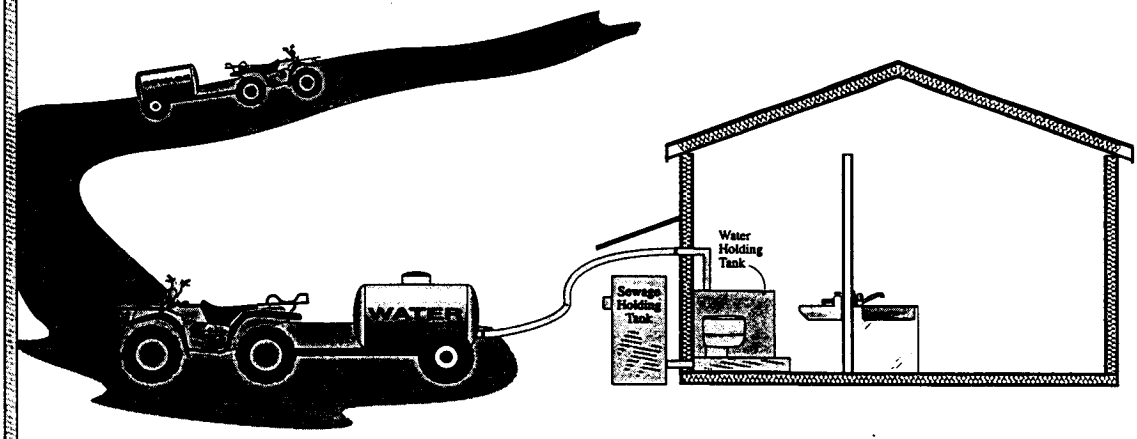
Decisions to Consider Today

- ☑ Which options should be considered in the survey of residents?
- ☑ Will the city and the Native Council work together on one water and sewer system?
- ☑ Who will run the system?
- ☑ Should Mission Hill residents be responsible for their own water and sewer?



Self Haul

Advantages	Disadvantages
☑ Low capital and O&M costs	☑ High potential for contamination of water
☑ Low water use and associated treatment costs	☑ Honey bucket/gray water disposal problems
☑ Low monthly user fee	



Small Vehicle Haul

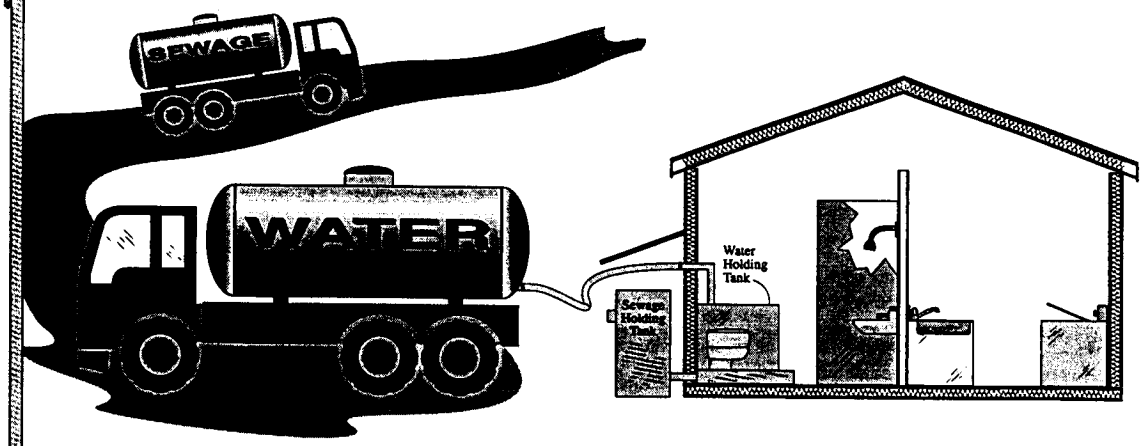
- ☑ Toilet
- ☑ Sinks

Advantages

- ☑ Low capital costs compared to piped systems and large vehicle haul
- ☑ If a user doesn't pay, service easily discontinued
- ☑ Road maintenance and snow removal not essential
- ☑ Low water use and associated treatment costs

Disadvantages

- ☑ System is labor and equipment intensive
- ☑ If any one household does not subscribe to the service, the potential health hazards will not be eliminated



Large Vehicle Haul

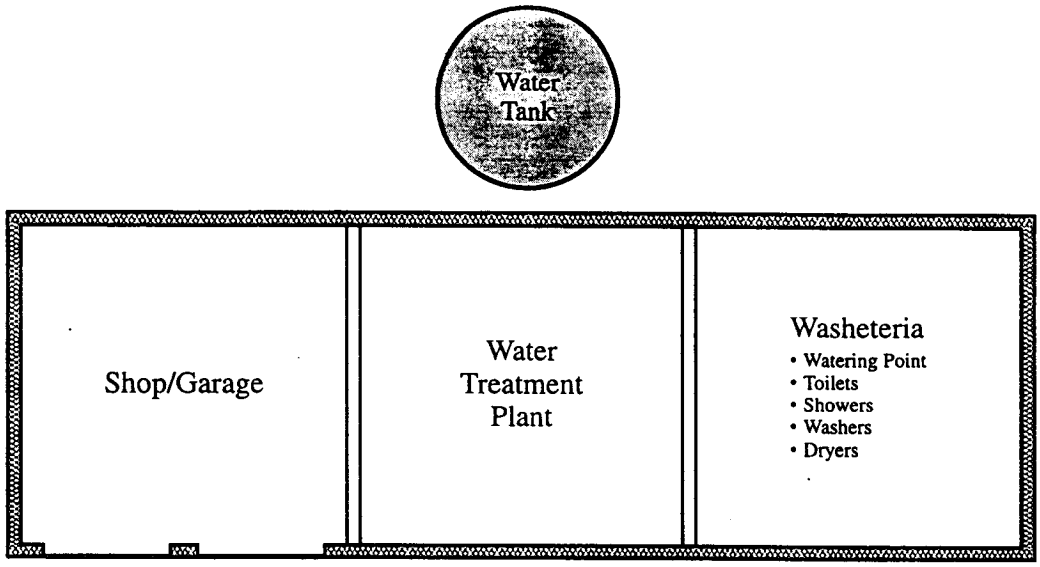
- ☑ Toilet
- ☑ Shower
- ☑ Sinks
- ☑ Washer (OPTIONAL)

Advantages

- ☑ Low capital costs compared to piped systems
- ☑ If a user doesn't pay, service easily discontinued
- ☑ Houses can be furnished with conventional pressurized water systems and plumbing fixtures

Disadvantages

- ☑ Higher capital costs compared to small vehicle haul
- ☑ System is labor and equipment intensive
- ☑ Requires road maintenance and snow removal
- ☑ If any one household does not subscribe to the service, the potential health hazards will not be eliminated



Washeteria Only

Group:

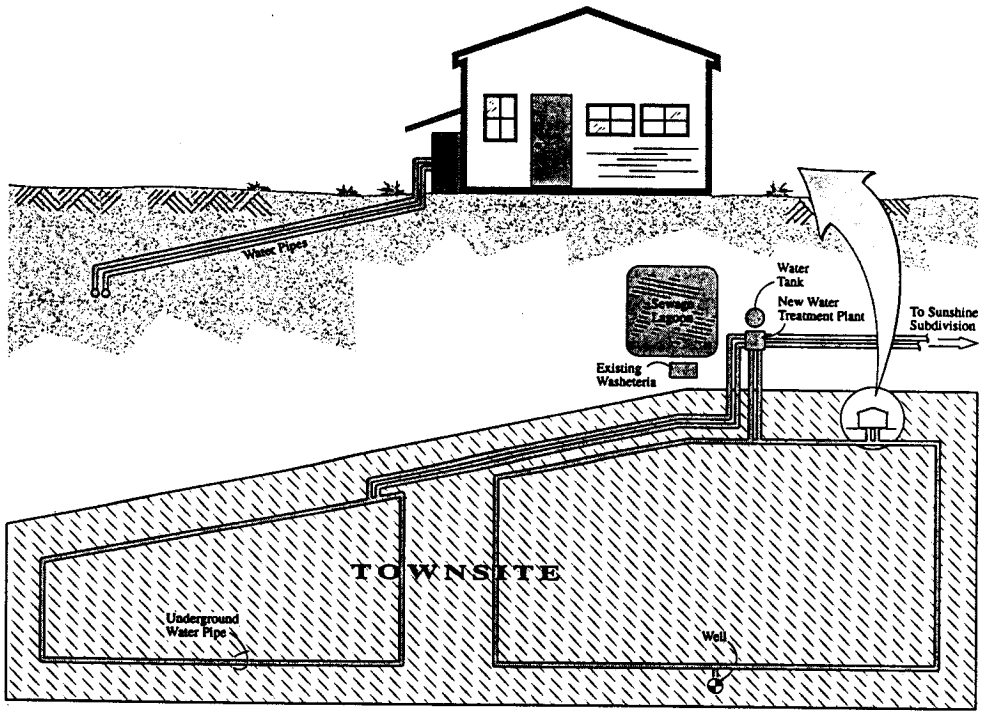
- ☑ Toilets
- ☑ Showers
- ☑ Sinks
- ☑ Washers

Advantages

- ☑ Provide laundry, bathing, and toilet facilities at lower cost than piped or haul system
- ☑ Can be used in combination with haul or piped systems
- ☑ Less maintenance required than for piped systems

Disadvantages

- ☑ Inconvenient
- ☑ Must leave residence for bathing and laundry



Circulating Water

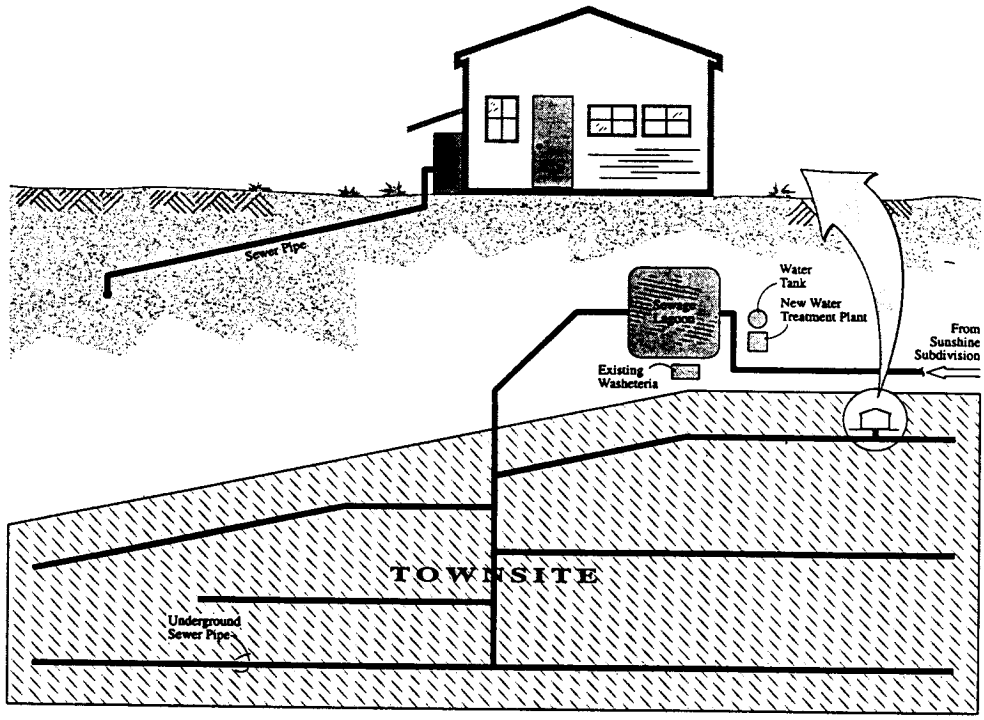
- ☑ Toilets
- ☑ Showers
- ☑ Sinks
- ☑ Washers (OPTIONAL)

Advantages

- ☑ Convenience
- ☑ Less potential for drinking water contamination during delivery

Disadvantages

- ☑ High capital cost
- ☑ High monthly user fee
- ☑ Can't let houses freeze up during the winter



Gravity Sewer

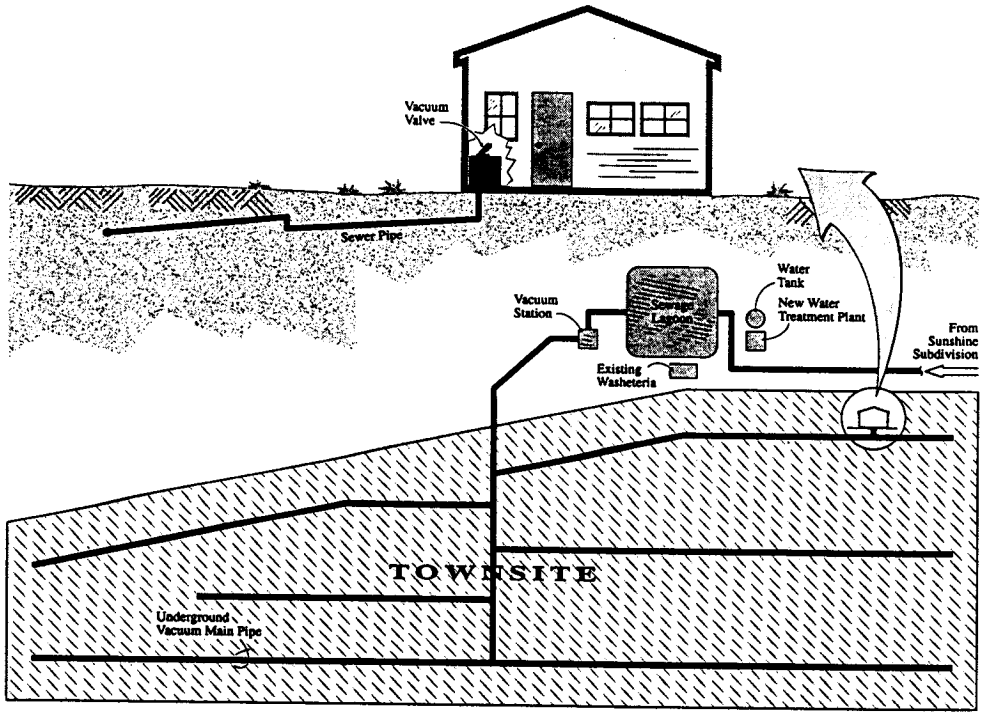
☑ Toilets

Advantages

- ☑ Convenience
- ☑ Eliminates the potential health hazards of surface dumping of graywater and/or honey buckets

Disadvantages

- ☑ Requires greater water use than a vacuum system
- ☑ Expensive lift stations are required where topography does not allow gravity flow



Vacuum Sewer

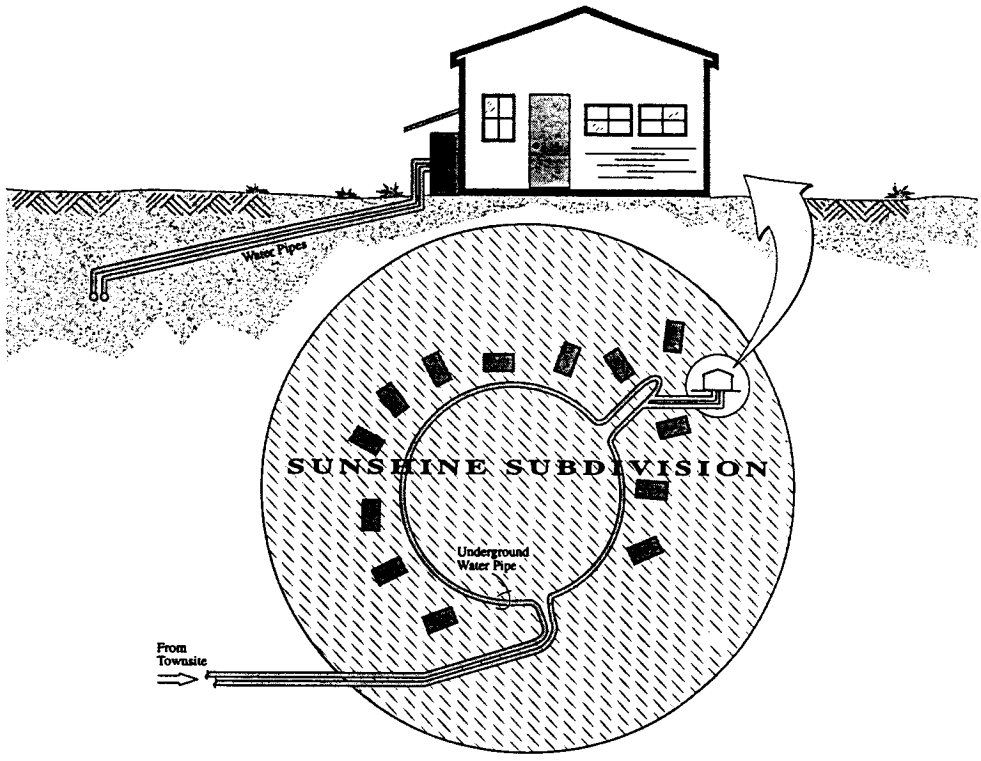
☑ Toilets

Advantages

- ☑ Convenience
- ☑ Requires less water use than a gravity system

Disadvantages

- ☑ Higher O&M costs than gravity sewer
- ☑ Requires vacuum valve in every house
- ☑ Central vacuum station required
- ☑ Accurate control of pipe grade required for proper operation



Circulating Water

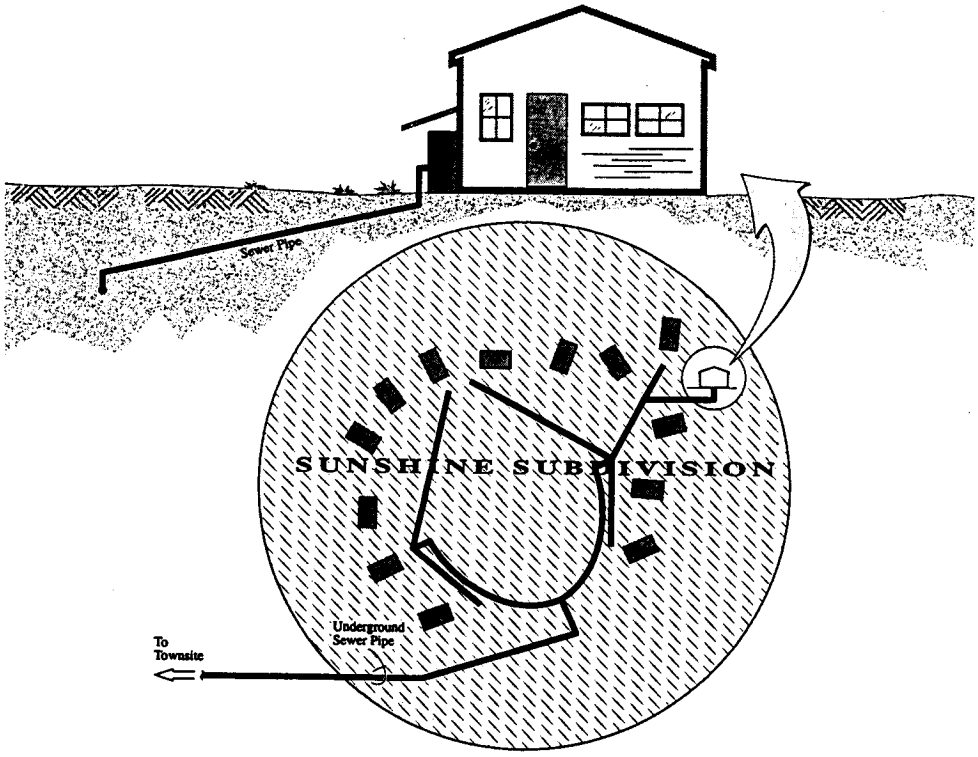
- ☑ Toilets
- ☑ Showers
- ☑ Sinks
- ☑ Washers (OPTIONAL)

Advantages

- ☑ Convenience
- ☑ Less potential for drinking water contamination during delivery

Disadvantages

- ☑ High capital cost
- ☑ High monthly user fee
- ☑ Can't let houses freeze up during the winter



Gravity Sewer

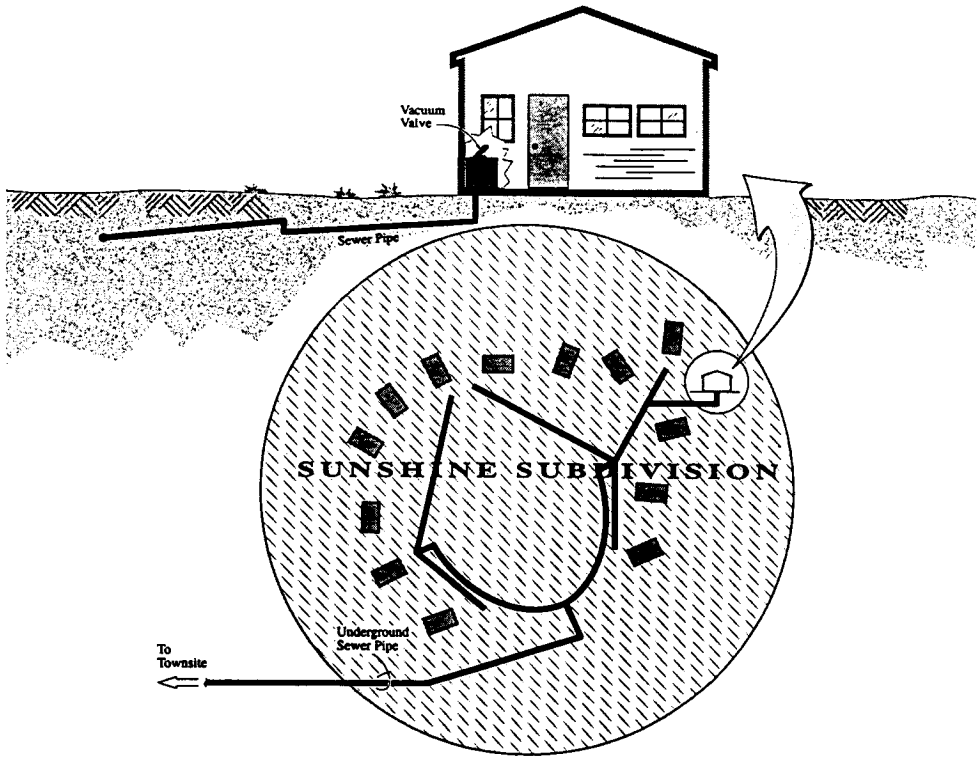
☑ Toilets

Advantages

- ☑ Convenience
- ☑ Eliminates the potential health hazards of surface dumping of graywater and/or honey buckets

Disadvantages

- ☑ Requires greater water use than a vacuum system
- ☑ Expensive lift stations are required where topography does not allow gravity flow



Vacuum Sewer

☑ Toilets

Advantages

- ☑ Convenience
- ☑ Requires less water use than a gravity system

Disadvantages

- ☑ Higher O&M costs than gravity sewer
- ☑ Requires vacuum valve in every house
- ☑ Central vacuum station required
- ☑ Accurate control of pipe grade required for proper operation

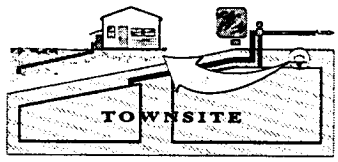
All Options Include:

- ☑ Improve quality, increase volume of water to residents
- ☑ Replace sewage lagoon drainpipe and leachfield
- ☑ New Washeteria

Tanana Option 1

Water

- Piped Water in Townsite



☑ Toilets ☑ Showers
☑ Sinks ☑ Washers (OPTIONAL)

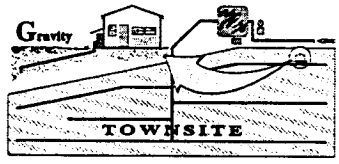
- Piped Water in Sunshine Subdivision

☑ Toilets ☑ Showers
☑ Sinks ☑ Washers (OPTIONAL)

Water Loop from Townsite to Sunshine Subdivision

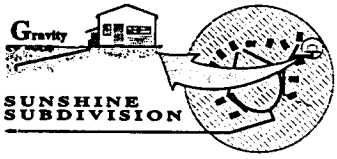
Sewer

- Gravity Sewer System in Townsite



☑ Toilets

- Gravity Sewer System in Sunshine Subdivision



☑ Toilets

Gravity Sewer from Sunshine Subdivision to Townsite Lagoon

Capital Cost: $12,016,655	Monthly User Fee: $92

NOTE: All engineering estimates are both approximate and specific to Tanana, and therefore not directly applicable to other villages. No village or city subsidies are included in these estimates.

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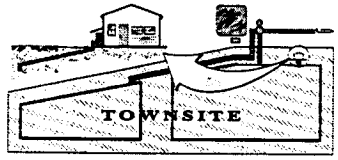
Tanana Option 2

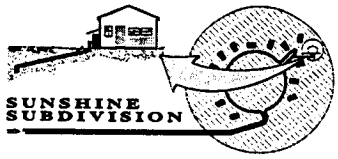
Water

- Piped Water in Townsite



☑ Toilets ☑ Showers
☑ Sinks ☐ Washers (OPTIONAL)

- Piped Water in Sunshine Subdivision

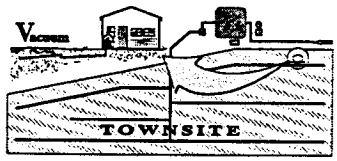


☑ Toilets ☑ Showers
☑ Sinks ☐ Washers (OPTIONAL)

Water Loop from Townsite to Sunshine Subdivision

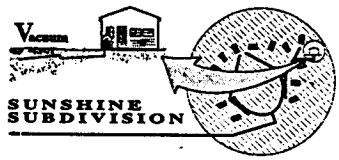
Sewer

- Vacuum Sewer System in Townsite



☑ Toilets

- Vacuum Sewer System in Sunshine Subdivision



☑ Toilets

Vacuum Sewer from Sunshine Subdivision to Townsite Lagoon

Capital Cost: $10,544,645

Monthly User Fee: $97

NOTE: All engineering estimates are both approximate and specific to Tanana, and therefore not directly applicable to other villages. No village or city subsidies are included in these estimates.

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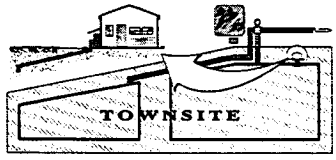
Tanana Option 3

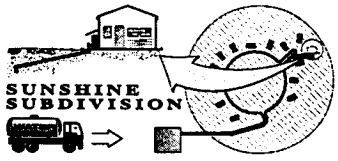
Water

- Piped Water in Townsite



☑ Toilets ☑ Showers
☑ Sinks ☐ Washers (optional)

- Hauled/Piped Water in Sunshine Subdivision

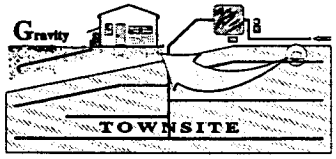


☑ Toilets ☑ Showers
☑ Sinks ☐ Washers (optional)

Haul treated water from the Townsite water plant to a storage and pumping facility at Sunshine Subdivision with a circulating water loop for the subdivision only

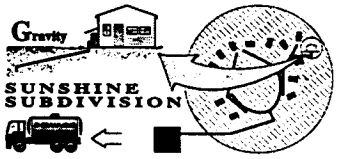
Sewer

- Gravity Sewer System in Townsite



☑ Toilets

- Haul/Gravity Sewer System in Sunshine



☑ Toilets

Gravity Sewer within the subdivision flowing to 5-to-7 day storage holding tank(s) with holding tank pumping and haul to the Townsite lagoon

Capital Cost: $10,863,064

Monthly User Fee: $127

NOTE: All engineering estimates are both approximate and specific to Tanana, and therefore not directly applicable to other villages. No village or city subsidies are included in these estimates.

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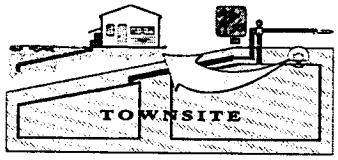
Tanana Option 4

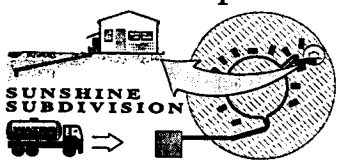
Water

- Piped Water in Townsite



☑ Toilets ☑ Showers
☑ Sinks ☑ Washers (optional)

- Hauled/Piped Water in Sunshine Subdivision

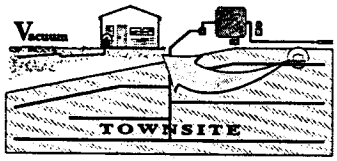


☑ Toilets ☑ Showers
☑ Sinks ☑ Washers (optional)

Haul treated water from the townsite water plant to a storage and pumping facility at Sunshine Subdivision with a circulating water loop for the Subdivision only

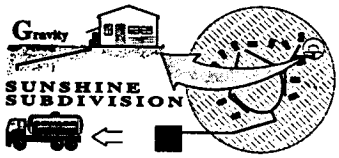
Sewer

- Vacuum Sewer System in Townsite



☑ Toilets

- Haul/Gravity Sewer System in Sunshine



☑ Toilets

Gravity Sewer within the subdivision flowing to 5-to-7 day storage holding tank(s) with holding tank pumping and haul to the Townsite Lagoon

Capital Cost: $10,282,638	Monthly User Fee: $135

NOTE: All engineering estimates are both approximate and specific to Tanana, and therefore not directly applicable to other villages. No village or city subsidies are included in these estimates.

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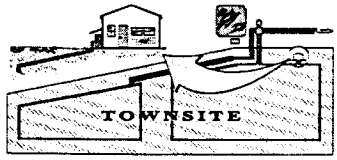
Tanana Option 5

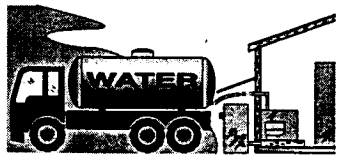
Water

- Piped Water in Townsite



☑ Toilets ☑ Showers
☑ Sinks ☑ Washers (optional)

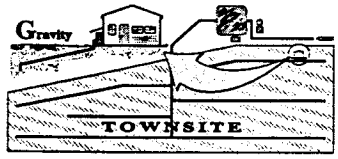
- Large Vehicle Haul for Sunshine Subdivision



☑ Toilets ☑ Showers
☑ Sinks ☑ Washers (optional)

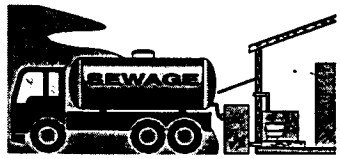
Sewer

- Gravity Sewer System in Townsite



☑ Toilets

- Large Vehicle Haul for Sunshine Subdivision



☑ Toilets

Capital Cost: $10,145,021

Monthly User Fee: $121

NOTE: All engineering estimates are both approximate and specific to Tanana, and therefore not directly applicable to other villages. No village or city subsidies are included in these estimates.

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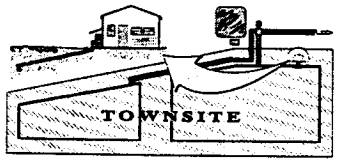
Tanana Option 6

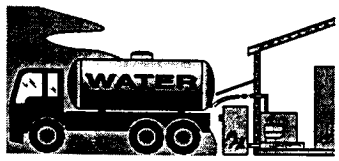
Water

- Piped Water in Townsite



☑ Toilets ☑ Showers
☑ Sinks ☑ Washers (optional)

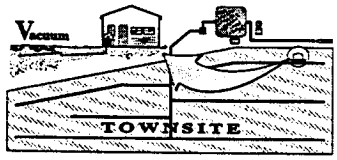
- Large Vehicle Haul for Sunshine Subdivision



☑ Toilets ☑ Showers
☑ Sinks ☑ Washers (optional)

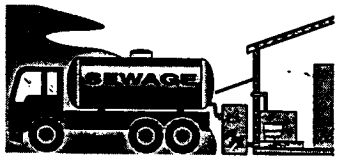
Sewer

- Vaccum Sewer System in Townsite



☑ Toilets

- Large Vehicle Haul for Sunshine Subdivision



☑ Toilets

Capital Cost: $9,475,765

Monthly User Fee: $129

NOTE: All engineering estimates are both approximate and specific to Tanana, and therefore not directly applicable to other villages. No village or city subsidies are included in these estimates.

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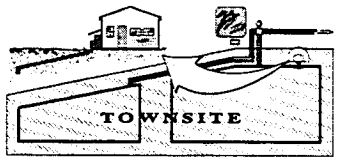
Tanana Option 7

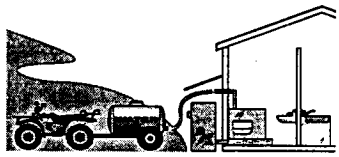
Water

- Piped Water in Townsite



☑ Toilets ☑ Showers
☑ Sinks ☑ Washers (OPTIONAL)

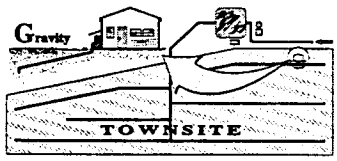
- Small Vehicle Haul for Sunshine Subdivision



☑ Toilets ☐ Showers
☑ Sinks ☐ Washers

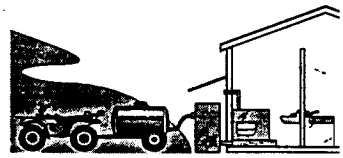
Sewer

- Gravity Sewer System in Townsite



☑ Toilets

- Small Vehicle Haul for Sunshine Subdivision



☑ Toilets

Capital Cost: $9,964,823

Monthly User Fee: $131

NOTE: All engineering estimates are both approximate and specific to Tanana, and therefore not directly applicable to other villages. No village or city subsidies are included in these estimates.

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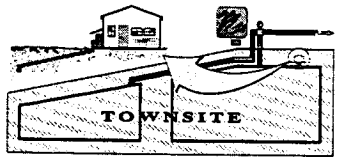
Tanana Option 8

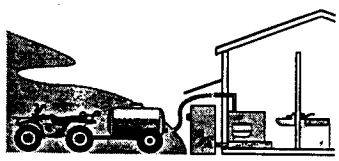
Water

- Piped Water in Townsite



☑ Toilets ☑ Showers
☑ Sinks ☑ Washers (optional)

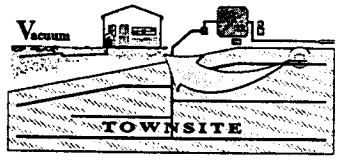
- Small Vehicle Haul for Sunshine Subdivision



☑ Toilets ☐ Showers
☑ Sinks ☐ Washers

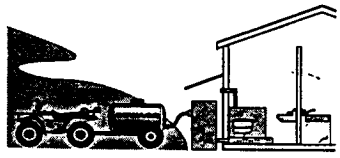
Sewer

- Vacuum Sewer System in Townsite



☑ Toilets

- Small Vehicle Haul for Sunshine Subdivision



☑ Toilets

Capital Cost: $9,354,787

Monthly User Fee: $139

NOTE: All engineering estimates are both approximate and specific to Tanana, and therefore not directly applicable to other villages. No village or city subsidies are included in these estimates.

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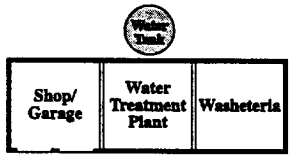
Tanana Option 9

Water and Sewer

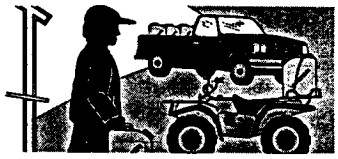
- Replace Existing Washeteria with New Washeteria



Group:

- ☑ Toilets
- ☑ Showers
- ☑ Sinks
- ☑ Washers

- Continue Self Haul



Capital Cost: $2,589,959	Monthly User Fee: $69

NOTE: All engineering estimates are both approximate and specific to Tanana, and therefore not directly applicable to other villages. No village or city subsidies are included in these estimates.

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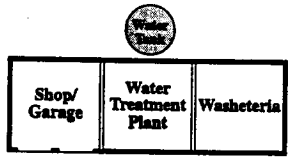
Tanana Option 10

Water

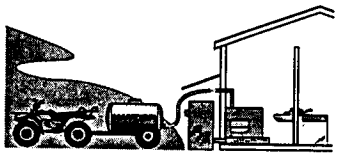
- Replace Existing Washeteria with New Washeteria



Group:

- ☑ Toilets
- ☑ Showers
- ☑ Sinks
- ☑ Washers

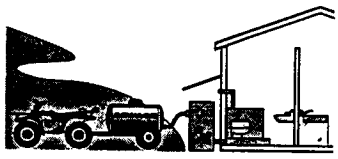
- Small Vehicle Water Haul Everywhere



- ☑ Toilets
- ☐ Showers
- ☑ Sinks
- ☐ Washers

Sewer

- Small Vehicle Sewage Haul Everywhere



- ☑ Toilets

Capital Cost: $4,145,189

Monthly User Fee: $137

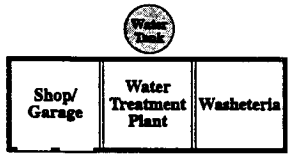
NOTE: All engineering estimates are both approximate and specific to Tanana, and therefore not directly applicable to other villages. No village or city subsidies are included in these estimates.

CH2MHILL

Tanana Option 11

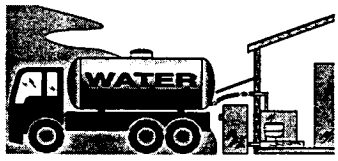
Water

- Replace Existing Washeteria with New Washeteria



Group:
- ☑ Toilets
- ☑ Showers
- ☑ Sinks
- ☑ Washers

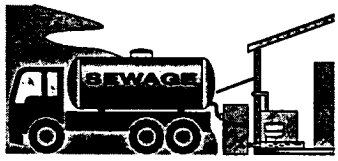
- Large Vehicle Water Haul Everywhere



- ☑ Toilets
- ☑ Showers
- ☑ Sinks
- ☑ Washers (OPTIONAL)

Sewer

- Large Vehicle Sewage Haul Everywhere



- ☑ Toilets

Capital Cost: $4,743,029

Monthly User Fee: $181

NOTE: All engineering estimates are both approximate and specific to Tanana, and therefore not directly applicable to other villages. No village or city subsidies are included in these estimates.

CH2MHILL

Tanana Water and Sewer Survey

July 1995

Dear Resident of Tanana,

Village Safe Water (VSW) has been working with both the City of Tanana and the Tanana Native Council to try to figure out how to meet the community's goal of improved water and sewer facilities. Our engineering consultant on this project, CH2M Hill's Tom Wolf, has developed a variety of water and sewer options based on site specific considerations here in Tanana. VSW's project manager Lynn Marino and Tom Wolf traveled to Tanana on June 12th to discuss these options in a joint work session with both the City and Native Councils. Because the leaders on both councils are committed to consensus decision making in the village, they have asked that the workable options be presented to the entire community. This survey asks each household in Tanana to select which option you would prefer and which monthly operating fee your household can afford.

We know that everyone would prefer to have piped water and sewer, but we don't know if each household would be willing to pay the monthly fees that come with piped systems compared to what you already pay. In some cases, when residents add up what they spend each month to use the showers, washers and dryers at the laundromat, and what they spend on gas to get there, their monthly costs are quite similar. Either way, we need to know what you would prefer. This is important information because in order for Tanana to really achieve safer water and sewer, <u>everyone</u> living close together must participate. If even one household doesn't, then everyone in the village is subjected to the same public health and environmental risks that we currently experience when human waste and bleach or disinfectant are dumped on the ground.

Once the survey is completed and analyzed, we will hold a joint city council/native council meeting where decisions will be made about our approach to future water and sewer systems.

You will notice that the capital or construction costs that go along with the piped systems, Option 1 and Option 2, are much higher than the capital costs for a new washeteria. What does this mean to you as a resident? It means that it could probably take about 12 years to complete a piped system if funding was available. If there is clearly community consensus and commitment in Tanana regarding which approach to take, then funding agencies will be more likely to support the project because it looks like it will work. We would have to take a phased approach.

- Phase I might include a new water plant/washeteria and may be completed within 2 years.
- Phase II might include completion of piped water and sewer service to the townsite area and may be completed within 7 years .
- The last portion, Phase III, might include piped water and sewer service to Sunshine Subdivision and may be completed within 12 years.

The fees in this survey are preliminary estimates. The fees are also based on service to the townsite and out to Sunshine Subdivision. If houses beyond the circle and out to Mission Hill were included, the monthly fees would be much higher. Thank you for the time that you are taking to participate in this important survey effort. If you have any questions during the survey process or later on about these water and sewer issues, please call engineer Tom Wolf at 800-278-2555. He'll be able to answer any technical or cost questions you might have.

Sincerely,

Connie Greenway, Mayor
City of Tanana

Julie Roberts
Executive Director
Tanana Native Council

Lynn Marino
Project Engineer
Village Safe Water

Tanana Water and Sewer Survey

- The City and the Native Councils are cooperating on a project to improve village water and sewer services in Tanana.
- The councils need to know if you'd be willing to pay for piped water and sewer.
- This is important because if Tanana is going to really achieve safe water and sewer, everyone who lives close together, that is out to the Circle, must participate.
- If even one household doesn't, then everyone in the village will be subjected to the same public health risks we experience now when human waste is dumped on the ground.
- Once the survey is completed and analyzed, the city and Native councils will meet jointly to decide on the approach for our new water and sewer services.
- At this point, do you have any questions?
- Now, let's get to the survey.
- First we need to figure out how much you're already paying to use the Laundromat.

Tanana Water and Sewer Survey

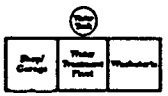
July 1995

Now, please choose only one of the following three options. Remember to think about how much your household can afford to pay per month. Also consider how much you are paying each month to use the facilities at the Laundromat.

Tanana Option 1

Water and Sewer

- Replace Existing Laundromat with New Laundromat



Group:
☑ Toilets ☑ Showers
☑ Sinks ☑ Washers

- Continue Self Haul

Capital Cost: $2,589,959	Monthly User Fee Varies: $70 to $200

Consider your current costs:

_____ • Washer and Dryer Fees
_____ • Shower Fees
_____ • Hot Water Fees
_____ • Gas to Get to the Laundromat
$

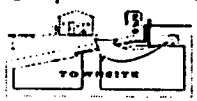
NOTE: All engineering estimates are both approximate and specific to Tanana, and therefore not directly applicable to other villages. No village or city subsidies are included in these estimates.

_____ I choose this as the best option for our village.

Tanana Option 2

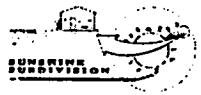
Water

- Piped Water in Townsite



☑ Toilets ☑ Showers
☑ Sinks ☐ Washers

- Piped Water in Sunshine Subdivision

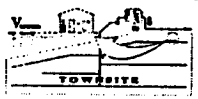


☑ Toilets ☑ Showers
☑ Sinks ☐ Washers

Water Loop from Townsite to Sunshine Subdivision

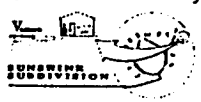
Vacuum Sewer

- Vacuum Sewer System in Townsite



☑ Toilets

- Vacuum Sewer System in Sunshine Subdivision



☑ Toilets

Vacuum Sewer from Sunshine Subdivision to Townsite Lagoon

Capital Cost: $10,544,645	Monthly User Fee: $97

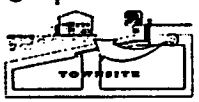
NOTE: All engineering estimates are both approximate and specific to Tanana, and therefore not directly applicable to other villages. No village or city subsidies are included in these estimates.

_____ I choose this as the best option for our village.

Tanana Option 3

Water

● Piped Water in Townsite



☑ Toilets ☑ Showers
☑ Sinks ☐ Washers

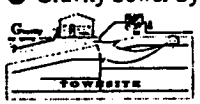
● Piped Water in Sunshine Subdivision

☑ Toilets ☑ Showers
☑ Sinks ☐ Washers

Water Loop from Townsite to Sunshine Subdivision

Gravity Sewer

● Gravity Sewer System in Townsite



☑ Toilets

● Gravity Sewer System in Sunshine Subdivision

☑ Toilets

Gravity Sewer from Sunshine Subdivision to Townsite Lagoon

Capital Cost: $12,016,655	Monthly User Fee: $92

NOTE: All engineering estimates are both approximate and specific to Tanana, and therefore not directly applicable to other villages. No village or city subsidies are included in these estimates.

_____ I choose this as the best option for our village.

Now we need to have a better understanding of how people get their water and dispose of sewage now. This information may help to secure funding for future water and sewer improvements. So, please answer these questions. Your answers will be used by VSW for planning purposes; other than this we will strive to protect your confidentiality.

1) How does your household dispose of sewage?

___ honeybucket ___ outhouse ____ laundromat
___ honeybucket/outhouse combination
___ other_____

2) How does your household dispose of used water from the sinks or the washer?

___ dump in yard ___ dump in remote location ___ outhouse
___ dump under house ___ other _____

3) Where do you get your home's water supply?

laundromat ___ ___ Yukon River ___ springs
___ other _____

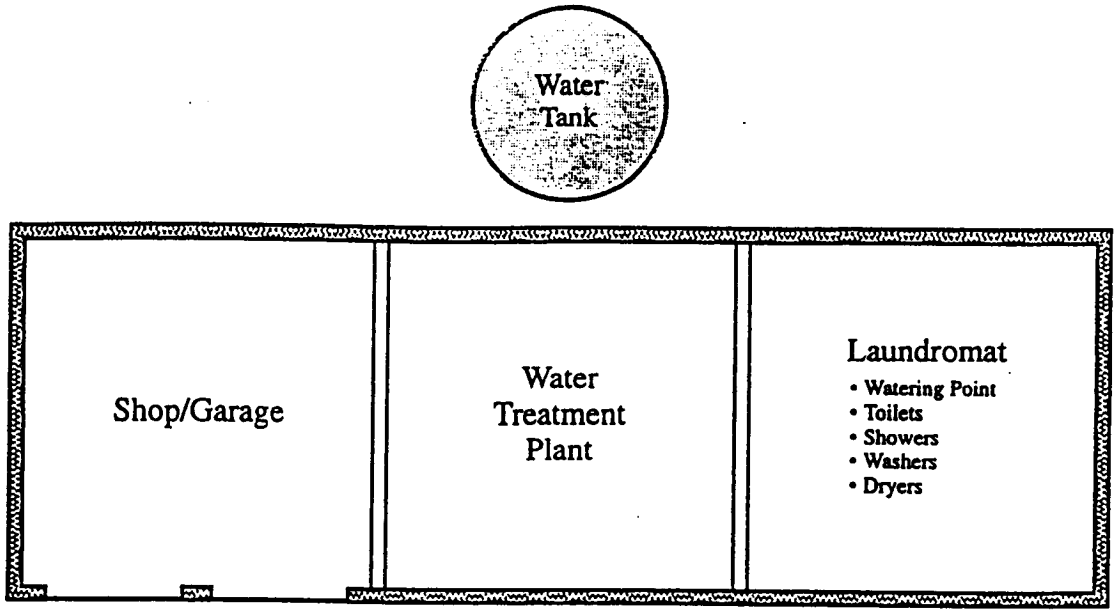
4) Is there space for a bathroom in your house now? _____
Which of the following fixtures are in your house?

___ toilet ___ bathroom sink ___ bath tub ___ shower
___ kitchen sink ___ no bathroom fixtures at all
___ other_____

5) Please estimate how much your household spends each month to use the showers, washers and dryers at the Laundromat, and for gas to get there.

We spend about $_____ each month at the Laundromat.

Name:_____ Date:_____
Location:_____ Owner?_____
If no, owners name:_____
Number of people in household:_____
Candidate for new HUD House?_____
Signature:_____
Administered by:_____



Laundromat Only

Group: _____

☑ Toilets ☑ Showers

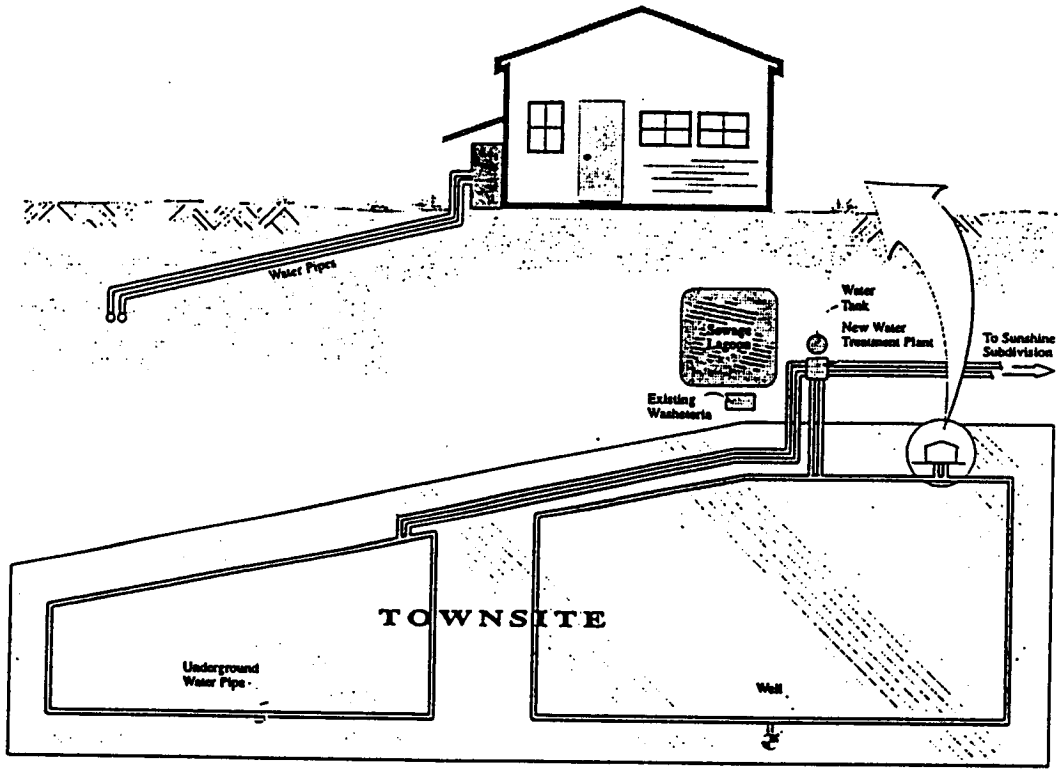
☑ Sinks ☑ Washers

Advantages

- ☑ Provide laundry, bathing, and toilet facilities at lower cost than piped or haul system
- ☑ Can be used in combination with haul or piped systems
- ☑ Less maintenance required than for piped systems

Disadvantages

- ☑ Inconvenient
- ☑ Must leave residence for bathing and laundry



Piped Water

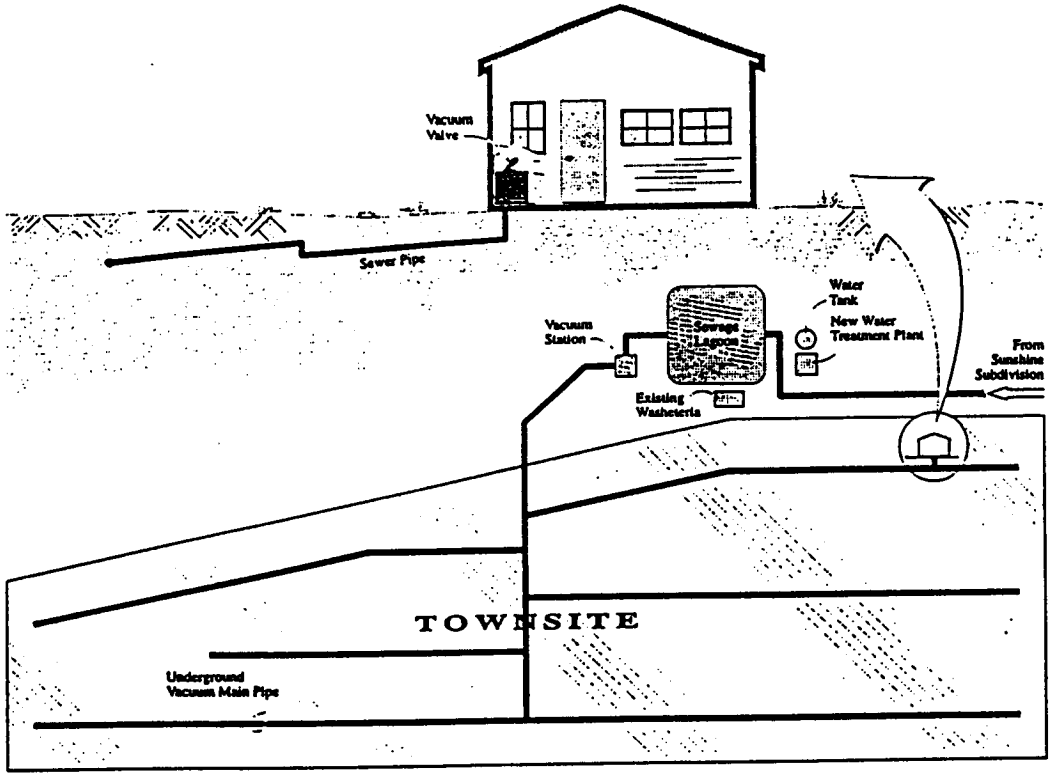
- ☑ Toilets
- ☑ Showers
- ☑ Sinks
- ☑ Washers

Advantages

- ☑ Convenience
- ☑ Less potential for drinking water contamination during delivery

Disadvantages

- ☑ High capital cost
- ☑ High monthly user fee
- ☑ Can't let houses freeze up during the winter



Vacuum Sewer

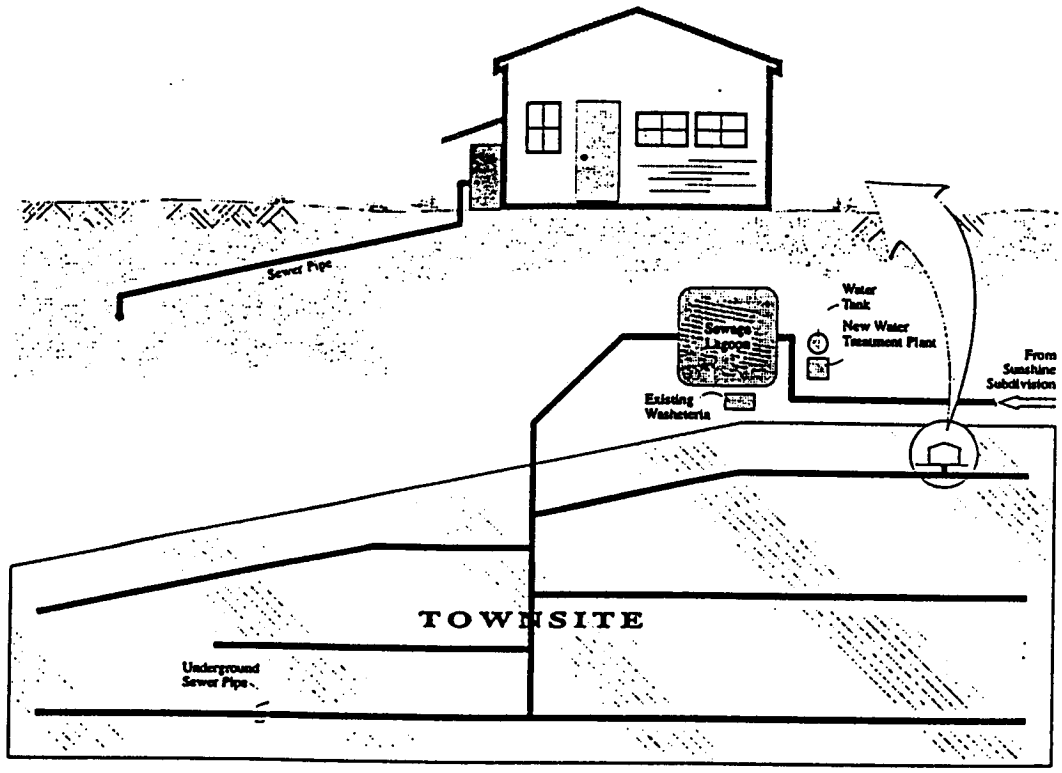
☑ Toilets

Advantages

- ☑ Convenience
- ☑ Requires less water use than a gravity system

Disadvantages

- ☑ Higher O&M costs than gravity sewer
- ☑ Requires vacuum valve in every house
- ☑ Central vacuum station required
- ☑ Accurate control of pipe grade required for proper operation



Gravity Sewer

☑ Toilets

Advantages

- ☑ Convenience
- ☑ Eliminates the potential health hazards of surface dumping of graywater and/or honey buckets

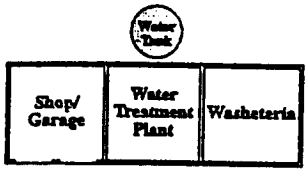
Disadvantages

- ☑ Requires greater water use than a vacuum system
- ☑ Expensive lift stations are required where topography does not allow gravity flow

Tanana Option 1

Water and Sewer

- Replace Existing Laundromat with New Laundromat



Group:
- ☑ Toilets
- ☑ Showers
- ☑ Sinks
- ☑ Washers

- Continue Self Haul

Capital Cost: $2,589,959	Monthly User Fee: $69

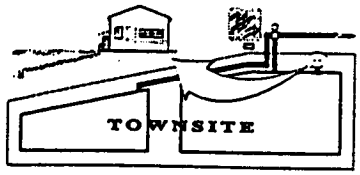
NOTE: All engineering estimates are both approximate and specific to Tanana, and therefore not directly applicable to other villages. No village or city subsidies are included in these estimates.

CH2MHILL

Tanana Option 2

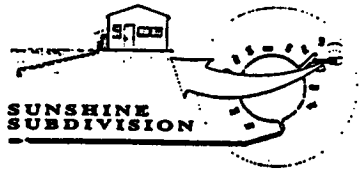
Water

- Piped Water in Townsite



☑ Toilets	☑ Showers
☑ Sinks	☑ Washers

- Piped Water in Sunshine Subdivision

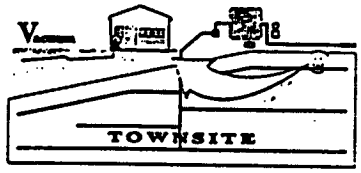


☑ Toilets	☑ Showers
☑ Sinks	☑ Washers

Water Loop from Townsite to Sunshine Subdivision

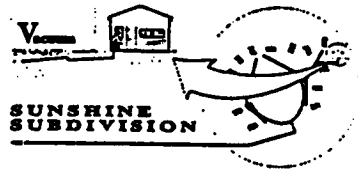
Sewer

- Vacuum Sewer System in Townsite



☑ Toilets

- Vacuum Sewer System in Sunshine Subdivision



☑ Toilets

Vacuum Sewer from Sunshine Subdivision to Townsite Lagoon

Capital Cost: $10,544,645	Monthly User Fee: $97

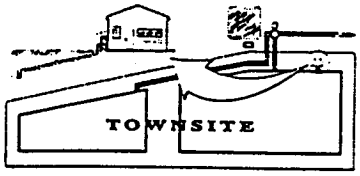
NOTE: All engineering estimates are both approximate and specific to Tanana, and therefore not directly applicable to other villages. No village or city subsidies are included in these estimates.

CH2MHILL

Tanana Option 3

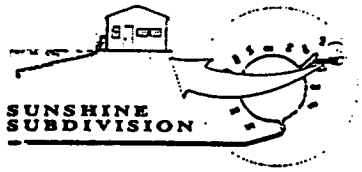
Water

- Piped Water in Townsite



☑ Toilets ☑ Showers
☑ Sinks ☑ Washers

- Piped Water in Sunshine Subdivision

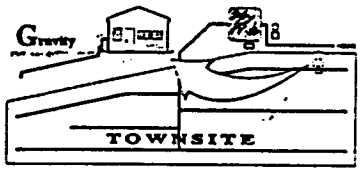


☑ Toilets ☑ Showers
☑ Sinks ☑ Washers

Water Loop from Townsite to Sunshine Subdivision

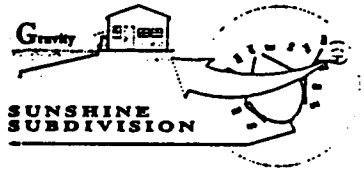
Sewer

- Gravity Sewer System in Townsite



☑ Toilets

- Gravity Sewer System in Sunshine Subdivision



☑ Toilets

Gravity Sewer from Sunshine Subdivision to Townsite Lagoon

Capital Cost: $12,016,655

Monthly User Fee: $92

NOTE: All engineering estimates are both approximate and specific to Tanana, and therefore not directly applicable to other villages. No village or city subsidies are included in these estimates.

CH2M HILL

Tanana Water and Sewer Survey

September 1995

To Residents of Tanana residing beyond the Townsite and the Sunshine Subdivision (Circle):

Village Safe Water (VSW) has been working with both the City of Tanana and the Tanana Native Council to try to figure out how to meet the community's goal of improved water and sewer facilities. Our engineering consultant on this project, CH2M HILL's, Tom Wolf, developed eleven different water and sewer options based on site specific considerations here in Tanana. VSW's project manager Lynn Marino and Tom Wolf traveled to Tanana on June 12th to discuss these options in a joint session with both the City and Native Councils. The Councils decided that haul options were not acceptable for Tanana. Eliminating the haul options reduced the number of options to three: piped water and vacuum sewer, piped water and gravity sewer, and a new laundromat only. A house-to-house survey was conducted and the residents of the townsite, Sunshine subdivision, and the houses in between selected piped water and gravity sewer as their preferred option. Because only limited construction funds will be available on a yearly basis, a piped water and sewer system could take as long as 12 years to complete.

At the recent public meeting on August 14th, some residents living beyond the townsite and the "Circle" expressed concern that they weren't surveyed and may have been overlooked by the feasibility study. Various sanitation options were discussed at the meeting and it was decided to survey the residents living in the outlying areas. Therefore, the purpose of this survey is to give you the opportunity to express your opinions on options, to find out how far away from the townsite your house is located, and to gather other information that may be beneficial in obtaining future project funding.

At this time piped water and sewer for the areas outside of the Townsite and the Circle is not economically feasible. Construction and operation and maintenance costs would be too high for the limited number of houses served.

Thank you for the time that you are taking to participate in this important survey effort. If you have any questions during the survey process or later on about these water and sewer issues, please call engineer Tom Wolf at 800-278-2555. He will be able to answer any technical questions that you might have.

Given the following options and **taking into consideration the pros and cons** of each option, which option would you prefer?

____**Individual Wells** - This option is only marginally feasible. Some individuals have had wells successfully drilled on their property; most have not. A PHS project in the late 60's drilled 55 individual wells. More than half were dry holes. Many of the others had poor water quality or for other reasons failed within a few years. Well drilling experience in Tanana shows that the chances of a successful well get lower as the distance between the well location and the Yukon River increases.

___**Community well with Watering Point** - This option would consist of drilling wells and installing watering points at each of the three remote locations (Site road, Mission Hill, and the old Mission area.) For this option to be economically feasible the well water would have to be of high enough quality to only require chlorination as treatment. If the well water is high in iron like most wells in Tanana, treatment plants would have to be built at each location. Multiple treatment plants would be very expensive to operate and difficult to maintain. The monthly cost of water to each individual household would be very high.

___**Watering Point at the "Circle"** - When the piped water system is extended to the "Circle", a watering point could be easily added without greatly increasing the project costs, thus keeping monthly costs to outlying residents who haul from there low.

___**Haul System** - A haul system using either large vehicle (truck) or small vehicle (four-wheeler), would be very expensive to operate because of the haul distance to the outlying areas and the wear and tear on the vehicles from hauling water up Mission Hill. This would mean high monthly costs.

Now we need to have a better understanding of how people get their water and dispose of sewage now. This information may help to secure funding for future water and sewer improvements. So, please answer these questions. Your answers will be used by VSW for planning purposes; other than this we will strive to protect your confidentiality.

1) Where is your home located?
___Mission Hill ___Between the "Circle" and the old Mission
___Site Road

2) How far away do you live from the laundromat?_____miles

3) How does your household dispose of sewage?
___honeybucket ___outhouse ___laundromat
___honeybucket/outhouse combination
___other_____

4) How does your household dispose of used water from the sinks or the washer?
___dump in yard ___dump in remote location ___outhouse
___dump under house ___other_____

5) Where do you get your home's water supply?
___laundromat ___Yukon River ___springs
___well (depth____) ___other_____

6) Is there space for a bathroom in your house now?____
Which of the following fixtures are in your house?
___toilet ___bathroom sink ___bath tub ___shower
___kitchen sink ___no bathroom fixtures at all
___other_____

7) Please estimate how much your household spends each month to use the showers, washers, and dryers at the laudromat, and for gas to get there.

We spend about $_____ each month at the laundromat.

Name:_____ Date:_____
Location:_____ Owner?_____
Number of people in household:_____
Candidate for new HUD House?_____
Signature:_____
Administered by:_____

Tom ·W

Tanana Water and Sewer Survey
September 23, 1995

To: The Tanana Native Council and the Tanana City Council:
Re: Survey of residents of Tanana residing beyond the Townsite and the Sunshine Subdivision, submitted by Cathy Fliris:

At a recent public meeting on August 14th, some residents living beyond the townsite and the "Circle" expressed concern that they were not being included in the plans for and the surveys about options for the community's goal of improved water and sewer facilities. VSW's project manager, Lynn Marino and CH2M Hill's engineering consultant, Tom Wolf, were present and several options were discussed. It was agreed that a survey would be created by Tom Wolf and sent to Cathy Fliris, who volunteered to survey the 27 households located out of town.

Many people surveyed had very little or no knowledge of the major water and sewer project for the downtown area and all were very appreciative of the chance to be surveyed. Many people had questions about where the water project money is coming from, what the associated costs were for each option, who would do maintenance, etc. Some people who live on the edge of the townsite (already surveyed) were also interested in the individual well option. Another question that came up was whether any provision would be present to allow non-tribal members to speak on the <u>water project subject only</u> if the Tanana Native Council were to assume responsibility for it.

POLL RESULTS

Number of people polled: 27
Number of residences identified: 27 plus 1 empty HUD house
HUD houses 2
HIP houses 2
Percent polled: 100%
Number of tribal members: 14
Number of non-tribal members: 13
Number of people currently living out of town: 57

Preferred options:

#1	Individual Wells 17	63%
#2	Community Well with Watering Point 3	11%
#3	Watering Point at the "Circle" 1	4%
#4	Haul System 0	0%
#5	Other 6	22%

-Keep system as it is - haul from laundromat, Yukon River, springs, creek, melt snow or collect rainwater.

The individual well option was chosen by 17 of the residents:

Tribal Members	9	53%
Non-Tribal	8	47%

Resident Locations:

#Site Road Residents: 11	41%
#Mission Hill Residents: 4	15%
#"Teekona" Subdivision 11	41%
#Between the "Circle" and the Old Mission on the river: 1	3%

All houses have outhouses and dispose of waste water in the outhouse, yard, or small septic system. Everyone got water from a variety of sources, according to the season, such as the laundromat, Yukon River, snow melt, springs, well, local creek, and rainwater.

Money Spent at Laundromat:

$0-29	10	37%
$30-89	11	41%
$90+	6	22%
Combined: $30-90+	17	63%

Money spent monthly at the laundromat also varied with season, availability of rainwater or move to fishcamp.

Comments:

-I would be happy if my neighbor had a well that I could use.
-A watering point at the Circle would be just as far a haul and would be

less convenient.

- Wind generators might work on Mission Hill.
-Joint councils should rethink the whole system and consider declining monetary resources in all areas of government and reconsider the more flexible haul system.
-If TCC/PHS monies can be used to drill wells in the out-lying Fairbanks area (i.e. Chena Pump Road, Army Road) for individuals with one well being over 300 feet deep, what is the difference drilling for individuals out here? We had to drill our own well and would like to be reimbursed $8000 for it.
-We have a well now but it is too rusty for human drinking and the treatment equipment would cost $1500.
-Gary Kangas, from Ruby, has his own well drilling business and has drilled several wells in Tanana in the last few years. His phone number is 468-4462. The cost is about $100+ per foot.

One resident wanted to fill out a survey although their house is in the Townsite. Tribal member and non-Tribal member want an individual well, spend $90 per month at the laundromat, and currently have an 18 foot well. They would rather have individual control over their water system through well water versus the piped water system.

TANANA WATER AND SEWER FEASIBILITY STUDY
PHASE 1 IMPROVEMENTS
COST SUMMARY
APRIL, 1996

DESCRIPTION	QUANTITY	UNITS	UNIT COST	TOTAL	TOTAL
DEVELOP NEW WATER SOURCE					
WATER SOURCE DEVELOPMENT STUDY	1	LS	$55,838	$55,838	
DRILL AND DEVELOP WELL	1	LS	$150,000	$150,000	
INSTALL TRANSMISSION LINE FROM WELL TO WATER PLANT	1,000	LF	$70	$70,000	
SUBTOTAL					$275,838
TOTAL ESTIMATED CONSTRUCTION COST					$275,838
PROJECT CONTINGENCY AT 25%					$55,000
ENGINEERING DESIGN AT 8%					$22,067
CONSTRUCTION ADMINISTRATION AT 10%					$27,584
TOTAL ESTIMATED PROJECT COST					$380,489
REPLACE LAGOON OUTFALL AND DRAINFIELD					
REMOVE AND REPLACE PIPE	1,125	LF	$90	$101,250	
REMOVE AND REPLACE LAGOON LEVEL CONTROL STRUCTUR	1	EA	$12,000	$12,000	
REMOVE AND REPLACE MANHOLES	3	EA	$8,000	$24,000	
REMOVE AND REPLACE DRAINFIELD (48' X 200')	1	LS	$60,000	$60,000	
SUBTOTAL					$197,250
TOTAL ESTIMATED CONSTRUCTION COST					$197,250
PROJECT CONTINGENCY AT 25%					$49,313
ENGINEERING DESIGN					$56,896
CONSTRUCTION ADMINISTRATION AT 10%					$19,725
TOTAL ESTIMATED PROJECT COST					$323,184
DESIGN NEW WTP/LAUNDROMAT	1	LS	$200,000	$200,000	
TOTAL ESTIMATED DESIGN COST					$200,000
TOTAL ESTIMATED PHASE 1 COST					$903,672
ROUND TO NEAREST ONE HUNDRED THOUSAND					**$900,000**