

Agency: Commerce, Community and Economic Development**Grants to Municipalities (AS 37.05.315)****Grant Recipient: Kenai****Federal Tax ID: 92-6001599****Project Title:****Project Type: Remodel, Reconstruction and Upgrades**

Kenai - Wastewater Treatment Plant Upgrades and Renovations Design

State Funding Requested: \$200,000**House District: Kenai Areawide (28-30)**

One-Time Need

Brief Project Description:

Design of improvements and upgrades to the City of Kenai Wastewater Treatment Plant

Funding Plan:

Total Project Cost:	\$250,000
Funding Already Secured:	(\$50,000)
FY2015 State Funding Request:	(\$200,000)
Project Deficit:	\$0

*Funding Details:**FY2014, City of Kenai Water & Sewer Fund, \$50,000**FY2015, State of Alaska, \$200,000***Detailed Project Description and Justification:**

This appropriation, including the City of Kenai's local contribution, would accomplish the design for upgrades to the City of Kenai's Wastewater Treatment Plant (WWTP). By accomplishing the design more accurate cost estimates for construction may be prepared and will increase the opportunity for construction funding through the ADEC Municipal Matching Grant (MMG) Program.

The WWTP was constructed in 1982. It was sized to accommodate a population of 11,650 people and an average wastewater flow of 1.3 million gallons per day (mgd). The present population of Kenai is approximately 8,000 and average wastewater flow is 0.90 mgd, or 70% of the plant design capacity.

A Wastewater Facility Master Plan was completed in March 2004 by CH2MHill. The cost estimate for recommended improvements totaled \$5,198,000 (in 2004 dollars) and were identified as being accomplished in four phases. Estimated costs have been increased by 32% to account for construction inflation.

The four phases identified by CH2MHill are not consistent with the proposed phasing as a result of funding constraints and improvements that have already been accomplished.

The issues to be addressed by this project are as follows:

1. The City's WWTP Alaska Pollution Discharge Elimination System (APDES) permit will be renewed in 2015. Presently, the

City's permit does not specify a limit for ammonia in the wastewater plant discharge. Our research has shown that recent permit renewals have required relatively low ammonia levels for the effluent (i.e. Palmer). The ammonia levels in the City's WWTP discharge may fail to meet what appears to be the standard required by ADEC.

2.The existing sludge belt press is 25 years old, and while not functionally obsolete, it requires major maintenance/upgrades in the near future to maintain system reliability and compatibility with control systems. Because the WWTP has only a single sludge belt press the press, cannot be taken out of service to accomplish major maintenance tasks.

3.Two of the aeration basins exhibit a structural failure of the concrete wall which separates the basins. There is a breach between the two and as such the two basins must be operated as a single unit.

4.The existing rotary screen has been removed from operation, resulting in excess solids being introduced into the treatment process. The screen has been removed from the process because it often clogged resulting in raw waste flowing onto the floor in the headworks facility.

5.The present system does not provide an efficient method to control aeration. Blowers provide three to four times the necessary oxygen to the aeration basins.

6.Existing coarse bubble diffusers are not efficient.

7.Existing system does not effectively manage sludge.

The following is a description of improvements proposed to be designed under this project:

Sludge Belt Press

The installation of a second sludge belt press will provide system redundancy and allow for the existing sludge belt press to be taken out of service for an extended period (4-6 months) while major maintenance upgrades can be accomplished. A new belt press and conveyer system will address the ADEC observation during the 2009 inspection that the transfer of solids to trucks resulted in solids falling onto the floor in the headworks facility.

Solids Removal System

The installation of a solids removal system to work in conjunction with the existing grinder will result in solid s removal meeting the EPA paint test and decrease demands on the treatment plant/system.

Activated Sludge System Improvements

1.Upgrade Fine Bubble Aeration

Upgrade Aerobic Digester Blower System

The blowers currently provide three to four times the necessary oxygen concentration to the aeration basins and there is no way to efficiently control this with the existing equipment. The installation of one small blower with a variable speed motor, the installation of variable speed motors on the existing blowers, the installation of a new control system, and replacing the coarse bubble diffusers with fine bubble diffusers will result in improved treatment and a significant drop in power consumption.

2.Upgrade Waste Activated Sludge (WAS) System

Upgrade Return Activated Sludge (RAS) System

The activated sludge treatment process works best when a steady low flow of sludge is returned to the aeration basin (RAS). The pumps currently in use return too much sludge in too short a time to the aeration basin resulting in system failures, increased maintenance and increased energy consumption.

The WAS pumps currently in service are a progressive cavity type that require frequent service. Replacement with a simple centrifugal pump system would lower maintenance costs and improve treatment efficiency by allowing a steady flow of sludge to the aerobic digestion tank rather than large intermittent flows.

The upgrades to the RAS & WAS Systems, and the upgrades to the aeration system will significantly improve the performance of the WWTP in terms of decreasing the costs of aeration, improving the settleability of the sludge, and minimizing/eliminating permit non-compliance incidents.

WWTP Control Building Expansion (+/- 1,000 s.f.)

The addition of a second sludge belt press will require the re-location of the WWTP laboratory. There is not sufficient space anywhere within the existing building to accommodate laboratory operations. The construction of a 1,000 s.f. addition to the WWTP Control Building will provide the room necessary for a fully functioning laboratory sufficient to support the operations of the WWTP.

Operations and maintenance costs will be significantly reduced (+/- \$150,000 annually) as a result of improvements constructed under this project.

Project Timeline:

FY2015 - Design

Entity Responsible for the Ongoing Operation and Maintenance of this Project:

City of Kenai

Grant Recipient Contact Information:

Name: Rick Koch
 Title: City Manager
 Address: 210 Fidalgo Avenue
 Kenai, Alaska 99611
 Phone Number: (907)283-8222
 Email: rkoch@ci.kenai.ak.us

Has this project been through a public review process at the local level and is it a community priority? Yes No

**CITY OF KENAI
COST ESTIMATE FOR
WASTEWATER TREATMENT PLANT UPGRADES & RENOVATIONS**

Belt Filter Press

Item Description	Unit	Quantity	Unit Cost	Sub-Total
1.2 meter Klampress	EA	1	\$ 20,000.00	\$ 20,000.00
Skid	EA	1	\$ 30,000.00	\$ 30,000.00
Water Pump, Sludge Pump & Polymer System	EA	1	\$ 45,000.00	\$ 45,000.00
Electric Touch Control Panel for Press/Pumps & Polymer System	EA	1	\$ 30,000.00	\$ 30,000.00
Labor /Training/Per Diem & Travel	LS	1	\$ 15,000.00	\$ 15,000.00
Freight	LS	1	\$ 30,000.00	\$ 30,000.00
			Sub-Total	\$ 170,000.00
			Design @ 15%	\$ 25,500.00
			Construction Management @ 12%	\$ 20,400.00
			Contingency @ 15%	\$ 32,385.00
			Total Belt Press Filter	\$ 248,285.00

Solids Removal System

Item Description	Unit	Quantity	Unit Cost	Sub-Total
Screenings Washer Monster	EA	1	\$ 90,000.00	\$ 90,000.00
Installation	LS	1	\$ 30,000.00	\$ 30,000.00
			Sub-Total	\$ 120,000.00
			Design @ 15%	\$ 18,000.00
			Construction Management @ 12%	\$ 14,400.00
			Contingency @ 15%	\$ 22,860.00
			Total Solids Removal System	\$ 175,260.00

**CITY OF KENAI
COST ESTIMATE FOR
WASTEWATER TREATMENT PLANT UPGRADES & RENOVATIONS**

Activated Sludge System Improvements

Item Description	Unit	Quantity	Unit Cost	Sub-Total
Upgrade Fine Bubble Aeration	LS	1	\$ 300,000.00	\$ 300,000.00
Upgrade Aerobic Digester Blower System	LS	1	\$ 300,000.00	\$ 300,000.00
Upgrade Waste Activated Sludge System	LS	1	\$ 220,000.00	\$ 220,000.00
Upgrade Return Activated Sludge System	LS	1	\$ 50,000.00	\$ 50,000.00
		Sub-Total		\$ 870,000.00
		Design @ 15%		\$ 130,500.00
		Construction Management @ 12%		\$ 104,400.00
		Contingency @ 15%		\$ 165,735.00
		Total Activated Sludge System Improvements		\$ 1,270,635.00

Control Building Expansion (+/- 1,000 s.f.)

Item Description	Unit	Quantity	Unit Cost	Sub-Total
1,000 S.F. Addition to WWTP Control Building	SF	1000	\$ 450.00	\$ 450,000.00
		Sub-Total		\$ 450,000.00
		Design @ 15%		\$ 67,500.00
		Construction Management @ 12%		\$ 54,000.00
		Contingency @ 15%		\$ 85,725.00
		Total Control Building Expansion		\$ 657,225.00

Cost Estimate Summary	Cost Estimate
Belt Filter Press	\$ 248,285.00
Solids Removal System	\$ 175,260.00
Activated Sludge System Improvements	\$ 1,270,635.00
Control Building Expansion	\$ 657,225.00
Total	\$ 2,351,405.00

Final

City of Kenai Wastewater Facility Master Plan

Prepared for
City of Kenai

Public Works Department
210 Fidalgo Avenue
Kenai, Alaska 99611

March 2004

CH2MHILL

301 West Northern Lights Boulevard, Suite 601
Anchorage, Alaska 99503-2662
(907) 278-2551



This report has been prepared under the supervision of a registered Professional Engineer.

167125.A1.FP

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Abbreviations

ABF	average base flow
AC	asbestos-cement
ADEC	Alaska Department of Environmental Conservation
AFD	adjustable frequency drive
BFP	belt filter press
BOD	biochemical oxygen demand
cfm	cubic feet per minute
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
GBT	gravity belt thickener
GIS	geographic information system
gpd	gallons per day
I/I	inflow and infiltration
mg/L	milligrams per liter
mgd	million gallons per day
MLVSS	mixed liquor volatile suspended solids
O&M	operations and maintenance
PLC	programmable logic controller
RAS	return activated sludge
RSD	return sludge digester
SCADA	System Control and Data Acquisition
scfm	standard cubic feet per minute
SVI	sludge volume index
TSS	total suspended solids
USDA	U.S. Department of Agriculture
WAS	waste activated sludge
WWTF	Wastewater Treatment Facility

Executive Summary

The City of Kenai (City) last prepared a Wastewater Facility Plan in 1978, during a time of rapid growth. Nearly 25 years has passed since the last update, and Kenai's rapid growth has stabilized. It is appropriate to prepare a new Wastewater Facility Master Plan to assist the City to plan for the next 20 years.

The City's present Wastewater Treatment Facility (WWTF) and sewage collection system were sized upon growth predictions from over 20 years ago, which did not entirely materialize. As a result, the City's wastewater collection and treatment systems have not yet reached their design capacities. There is, however, a need for planning to provide continued operations and maintenance (O&M) and expansion for the modest growth expected over the next 20 years.

One of the main recommendations of this study is that the City's WWTF can be upgraded to meet the modest growth predicted over the next 20 years without expanding its existing footprint. Instead of adding new structures, the WWTF capacity can be increased by improving the efficiency of the existing treatment system. In addition, certain capital improvements to the WWTF could result in substantial O&M savings with a payback period as short as 7 years.

Table ES-1 provides a recommended capital improvements summary.

Sewage Collection System Evaluation

The collection system currently includes approximately 46 miles of sewer main and 16 sewage lift stations. The available data indicates that 42 percent of the sewer main is asbestos-cement (AC) pipe while 44 percent is ductile iron. The material type for 14 percent of the existing sewer main is unknown or not included within the available geographic information system (GIS) data set.

Although the soil types within the City provide generally good bedding for AC pipe, maintenance crews find that AC pipe does break and requires occasional repairs. This is not sufficient reason for replacing all the AC pipe. Instead, it will be worthwhile to develop a tracking system to document when, where, and how a particular pipe has broken and what steps were necessary to repair it. An evaluation of this information collected over a period of time may determine trends, areas, soil types, and other valuable data for making collective system improvements.

The sewage lift stations have sufficient capacity for the current peak flows. Future growth within the City's developable land will add sewage flow. The two lift stations most impacted by growth will be the Lawton Street and Broad Street lift stations. The peak flow capacity of these lift stations can be increased by replacing the pumps with larger units. If the interior of the wet well begins to deteriorate to an unacceptable degree, the interior can be relined with grout or proprietary plastic coatings.

TABLE ES-1
Capital Improvements Summary for City of Kenai Wastewater Treatment and Collection

Phase	Description of Improvement	Capital Investment	Annual O&M Cost	Additional and/or Reduced O&M	Present-Worth Costs for 20-Year Period ^a
1	Activated Sludge System Improvements				
	Upgraded Fine Bubble Aeration	\$300,000	\$37,000		\$900,000
	Upgraded Aerobic Digester Blower System	\$200,000	\$39,000		\$800,000
	Subtotal	\$500,000			
	Filament Control Improvements	\$1,588,000	\$400 ^b		\$1,800,000
	Subtotal	\$1,600,000	^c	-\$75,600	
	RAS/WAS Process Improvements				
	Upgraded Waste Activated Sludge	\$142,000	\$4,700		\$208,000
	Upgraded Return Activated Sludge	\$22,000	\$4,700		\$89,000
	Subtotal	\$164,000	\$9,400^d	-\$13,600	\$297,000
	Total Activated Sludge Improvements	\$2,300,000	\$85,800	-\$89,200	\$3,800,000
2	Suction/Jetter (Vactor) Truck	\$400,000	\$3,500	0	\$430,000 ^e
3	Pretreatment Process Improvements				
	New Pump House	\$329,000	\$3,030		\$395,000
	Influent Manhole Modifications	\$47,000	\$840		\$59,000
	Grit Removal Cyclone	\$89,000	\$840		\$101,000
	Bar Screens	\$633,000	\$1,680		\$657,000
	Total Pretreatment Process Improvements	\$1,098,000	\$6,390	+\$6,390	\$1,212,000
4	Aerobic Digester Solids Handling				
	Mechanical Upgrades for Aerobic Digester	\$528,000	\$3,400		\$576,000
	Upgraded Solids Handling System	\$510,000	\$2,100		\$539,000
	Recoating of Aerobic Digester	\$350,000	N/A		\$350,000
	Total Aerobic Digestion Solids Handling	\$1,400,000	\$5,500^f	0	\$1,465,000
	Total for All Recommended Improvements	\$5,198,000		-\$82,810	\$6,907,000

^a Present value of Capital and O&M costs over a 20-year period at 4 percent interest.

^b Approximately the same as present O&M costs in labor. The energy cost for operating the blowers are considered in Phase 3.

^c This represents an annual O&M cost savings of approximately \$76,000 over the present O&M costs for the aeration system or a 5-year payback period for the capital costs.

^d This is an annual O&M cost savings of approximately \$14,000 from the current WAS/RAS pumping system or a 12-year payback period for the capital costs.

^e A 10-year period was used for the Present Value of the Vactor truck.

^f Same as present O&M costs for conveying waste sludge to the aerobic digester.

O&M = operations and maintenance

Inflow and Infiltration Evaluation

Rainfall-derived collection system inflow and infiltration (I/I) is not significant through most of the system's 46-mile length. The most significantly impacted areas are served by the Golf Course, Mission Street, and Mile 14 (North Road) lift stations. In these areas, the problem appears to come from surface inflow to the manholes. This problem may be addressed by installing inflow protectors under the manhole covers for some of the lowest-lying manholes. Inflow protectors are plastic disks that sit between the manhole cover and the frame. They can reduce the amount of surface inflow through the manhole cover.

Sewage Treatment Evaluation

Changes can be made to allow the WWTF operate with lower operation and maintenance costs and greater waste loading capacity without adding new tanks or expanding the existing footprint. This can be accomplished by process improvement in the following areas:

- Aeration system and return activated sludge/waste activated sludge process improvements
- Pretreatment process improvements
- Improvements for the control of floating sludge blanket problems
- Aerobic digester and solids handling system improvements

These improvements should provide sufficient wastewater loading capacity for the next 20 years. A more detailed outline of the proposed improvements is provided in Section 5 of this report.

Sewage Rate Study

CH2M HILL prepared a Wastewater Management Financial Plan in March 2003, which recommended an across-the-board sewage rate increase of 35 percent for fiscal year 2003/2004 followed by three annual increases of 4 percent over the next 3 years. A separate report was prepared for the City's drinking water system, which is not part of this Wastewater Facilities Master Plan (CH2M HILL, March 2003, City of Kenai Water Rate Study and Financial Plan). This separate report recommended a 30 percent increase in all water-rate classes with a subsequent increase of 4 percent over the next 3 years.

These rate increases were proposed in order to cover O&M expenses, increase the operating fund reserve balance, and fund the capital improvements recommended in this wastewater facilities master plan. A conservative assumption was made that grants would no longer be available for capital construction projects so that all capital construction would be funded through loans or municipal bond sales.

By Resolution No. 2003-16, the Kenai City Council opted to increase the water rates by 10 percent and the sewer rates by 12 percent, effective June 15, 2003. While these increases are less than ideal, they will be adequate, assuming grants become available for most of the proposed capital improvements.

Improvements to the City's Geographic Information System

Some improvements to the City's GIS are incidental to this study. GIS can be a valuable tool in planning for sewage systems and infrastructure in general. Currently, the City can access an inventory of 1,305 construction drawing sheets through the GIS system. This information can have practical day-to-day use in helping City staff quickly locate sewer main and other features in a particular area. GIS can also be an effective planning and management tool.

The problems have been that GIS access to the record drawings has been awkward and the quality of some of the scanned images (TIF files) is poor. CH2M HILL staff sorted through all 1,305 scanned construction drawings and identified them by file name, plan set name, sheet title, page number, engineer of record, and other pertinent variables. A summary spreadsheet in MS Excel was compiled with these data, and scanned images were reviewed for their image quality. This spreadsheet can serve as a basis for upgrading the file access process since the record drawings can now be identified by fields other than the file name. Thirty-two images of poor quality were rescanned from originals found in the City's plan room.

SECTION 1

Introduction

1.1 Authorization

The City of Kenai (City) retained CH2M HILL to develop this Wastewater Facility Master Plan. This effort was approved by City Council resolution No. 2001-40 on June 20, 2001. The work was accomplished under City purchase order number 43081.

1.2 Purpose

The main purpose of this Wastewater Facility Master Plan is to lay out a strategy for the continued reliable and economical operation of the City's wastewater collection system and Wastewater Treatment Facility (WWTF). This plan is intended to support the City's planning and funding efforts for this goal.

The objective of this wastewater facility plan is as follows:

- Evaluate the existing wastewater facilities
- Project future waste loads
- Evaluate wastewater collection, treatment, and disposal alternatives
- Provide cost analysis of alternatives
- Recommend an alternative based upon engineering, economic, and environmental considerations
- Develop and recommend implementation and funding alternatives

1.3 Planning Area

This study includes the City of Kenai and areas that have potential for future inclusion in the City's sewer service area. Figure 1-1 shows the project planning area.

This Wastewater Facility Plan was prepared in coordination with the City of Kenai's Comprehensive Plan (Kevin Waring and Associates, 2003). Similar population projections were used for both plans.

1.4 Scope

Based on the request for proposals provided by the City, the letter proposal from CH2M HILL dated July 31, 2001, and subsequent discussions and with the City of Kenai staff, a scope of work was developed to:

- Evaluate the excess infiltration (groundwater) and inflow (surface water) to the sewage collection system and identify those sources that are practical to eliminate.
- Evaluate the sewage collection system and its potential for expansion.
- Evaluate wastewater treatment capacity, determine specific alternatives for increasing the capacity to accommodate growth over the next 20 years, and make specific recommendations for modifying the facility to satisfy the anticipated need.
- Develop a financial implementation plan for the recommended improvements. This includes an evaluation of the current sewage rates and recommendations for adjusting the rate structure to support the existing and future costs.
- Improve the City's geographic information system (GIS) to a limited extent within the available budget for the plan.

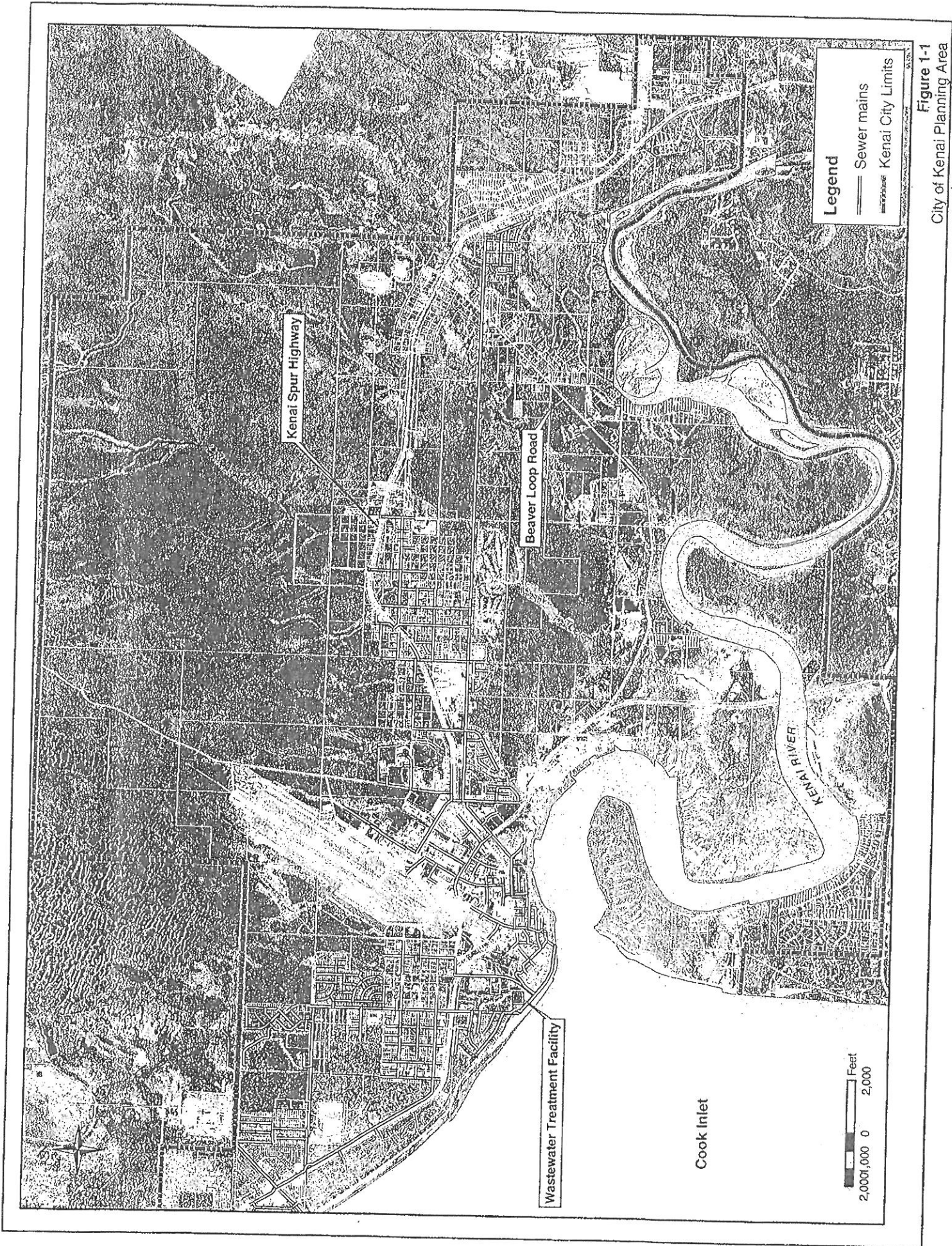


Figure 1-1
City of Kenai Planning Area