Agency: Commerce, Community and Economic Development

Grants to Municipalities (AS 37.05.315)

Grant Recipient: Akhiok **Federal Tax ID:** 92-0045466

Project Title: **Project Type:** Maintenance and Repairs

Akhiok - Water and Sewer Critical Repairs

State Funding Requested: $955,000 **House District:** 35 / R

One-Time Need

Brief Project Description:

This project will provide a modular water treatment plant, a water storage tank, and repair the sewage ocean outfall.

Funding Plan:

Total Project Cost:	$1,130,000
Funding Already Secured:	($175,000)
FY2014 State Funding Request:	($955,000)
Project Deficit:	$0

Funding Details:

In 2012, The Alaska Native Tribal Health Consortium provided $175,000 of funding for project design and limited immediate repairs

Detailed Project Description and Justification:

Akhiok's water and sewer system has critical deficiencies that threaten public health and the environment. The water treatment system is not in compliance with EPA regulatory drinking water requirements (insufficient water filtration and inadequate disinfection time) therefore the entire community is on a boil water notice. The community does not have the equipment or facilities required to properly maintain the sewage collection system, and, consequently, components of the system are in poor condition and/or have failed e.g. the community's sewage outfall line is severed and currently discharges sewage to a beach in the middle of town that children routinely swim in.

The ANTHC and the City of Akhiok have pursued funding from traditional sources, but due to the small size of the community and the diverse nature of the proposed scope, traditional funding sources seem unlikely.

The ANTHC has contributed $175K for this project to
1) document and provide solutions construction costs for Akhiok's most critical water and sewer deficiencies
2) design a small containerized water treatment plant, and
3) complete immediate repairs to the water treatment plant and distribution system to prevent the complete loss of the entire system.

This legislative grant request will
1) construct the small containerized water treatment plant and connect it to the system providing adequate treatment,
2) Provide a disinfection tank to ensure adequate time,
3) repair the sewage outfall line to remove the sewage from the beach, and
4) provide equipment to pump the community septic tanks and a septic tank sludge disposal area to ensure the outfall line

Contact Name: Astrid Rose
Contact Number: 465-3271

For use by Co-chair Staff Only:

$955,000 Approved

2:00 PM 5/9/2013

does not separate again.

Project Timeline:

August 2013 - Project Awarded
September to December 2013 - Construct containerized water plant in Anchorage
April 2014 - Mobilize to Akhiok and begin onsite construction
April 2014 to June 2014 - Complete all onsite construction
July 2014 - Demobilize

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

The residents of Akhiok through the collection of water and sewer user fees

Grant Recipient Contact Information:

Name:	Linda Amodo
Title:	Mayor
Address:	P.O. Box 5050
	Akhiok, Alaska 99615
Phone Number:	(907)836-2229
Email:	city_of_akhiok@yahoo.com

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

For use by Co-chair Staff Only:

2:00 PM 5/9/2013

Contact Name: Astrid Rose
Contact Number: 465-3271

Resolution # 13-01

A RESOLUTION OF THE AKHIOK CITY COUNCIL REQUESTING $955,000 FUNDING FOR WATER AND SEWER CRITICAL IMPOVEMENTS

WHEREAS the City of Akhiok's water and sewer system has critical deficiencies that threaten public health and the environment; and

WHEREAS the water treatment plant being out of compliance with EPA regulatory drinking water regulations requires the community to be on a boil water notice; and

WHEREAS the sewage outfall line is severed and currently discharges sewage to a beach in the middle of town that children routinely swim in because the community lacks the equipment or facilities required to properly maintain the septic tanks; and

WHEREAS engineers from the Alaska Native Tribal Health Consortium (ANTHC) have studied the water and sewer deficiencies in Akhiok and have provided recommendations in form of an update to the City of Akhiok Master Plan; and

WHEREAS the ANTHC recommends $955,000 of critical improvements to the water and sewer system that will make the water safe to drink and eliminate the health hazard of raw sewage spilling on our beach; and

WHEREAS the ANTHC's history of constructing water/sewer in rural Alaska and their knowledge of our water/sewer system make them uniquely qualified to accomplish this work;

THEREFORE BE IT RESOLVED that the Akhiok City Council requests $955,000 of State of Alaska Legislative grant funds to construct water and sewer critical improvements for the Akhiok sanitation system thereby greatly improving the health of the residents living in Akhiok.

ENACTED THIS 23 **DAY OF** January **2013 by a vote of** 7 **in favor and** 0 **opposed.**

Linda Amodo
City, Mayor

ATTEST:
Kim Amodo

MEMORANDUM STATE OF ALASKA

DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Department of Water, Operations Assistance Program
Remote Maintenance Worker
555 Cordova St, 4th fl.
Anchorage, AK 99501
Office 269-7609
Fax 269-7509

DATE: 1/25/13

TO: City of Akhiok

FROM: Steven W. Evavold, ADEC, and Remote Maintenance

SUBJECT: Akhiok improvements

Good Day,
I've had the pleasure of working with the good people of Akhiok Alaska for the last 14 years. The critical needs of your community have been many from the start and are well documented.
Public health is threatened by not having the capability in the water plant of producing potable water with the quality required by EPA standards. It cannot meet the Surface water treatment rule nor does the system have the ability to provide any contact time for chlorine to react and disinfect. Chlorine is injected and water is sent directly out to the distribution loop.
There is inadequate water storage with just two 10,000 gallon tanks. These tanks "float" on the system; meaning the water that does not go to demand is pumped up to overflow. A break in the water mains will drain the 20,000 gallons in the tanks, the water mains, and residences in a very short time. The water mains are old ductile iron and very brittle PVC and need replacing.
There is currently no means to pump the septic tanks and discharge to a lagoon. The ocean outfall was documented in 1981 as "Rising and falling with the tide". The community had no choice but to cut the outfall at the beach to relieve the back up of septage. Much of the outfall still is seen floating and is a threat to the maritime traffic.
Not having potable water for the new clinic and the 22 students in the school is dangerous and has to stop. There is no more room for band aides here.
Thanks for your consideration.

State of Alaska, ADEC
Remote Maintenance Worker
Steven W. Evavold

Alaska Native Tribal Health Consortium

Division of Environmental Health and Engineering
3900 Ambassador Drive • Suite 301 • Anchorage, Alaska 99508 • Phone: (907) 729-3600 • Fax: (907) 729-4090 • www.anthc.org

January 30, 2013

Honorable Linda Amodo
Mayor of Akhiok
PO Box 5030
Akhiok, AK 99615

Dear Honorable Ms. Amodo,

I am pleased to hear of the efforts being made to procure funding for water and sewer improvements in the Village of Akhiok. I visited the community on July 26, 2011 to survey the system and observed the hazardous conditions which could impact the health and safety of operators and residents of Akhiok. The water storage tanks, filters, pumphouse, sewage outfall line, and collection system are all in need of upgrades or replacement.

A new pumper truck is needed: there are currently no means to pump the septic tanks to remove sewage. The wastewater system frequently experiences problems and raw sewage spills onto the beach in an area accessible to children and animals. This is a significant public health hazard that could expose the community to diseases such as hepatitis or *E.coli*. According to *Environmental Engineering: 5th Edition* by Salvato, Nemerow, and Agardy, "The exposure of excreta, sewage, or other wastewater (including gray water) on the surface of the ground or its improper treatment and disposal immediately sets the stage for possible disease transmission by direct contact…".

The community water system is not in compliance with current Surface Water Treatment Rules established by the Environmental Protection Agency to protect against waterborne diseases caused by organisms like *Giardia lamblia* and *Cryptosporidium spp.* The current water filters are obsolete and need to be replaced to remove *Giardia* cysts and *Cryptosporidium* protozoa. Conventional rapid sand filtration of the surface water that includes coagulation, flocculation, sedimentation, and filtration followed by disinfection are effective in removing these microbes. People with weakened immune status, such as the very young, those who are pregnant and the elderly, are most susceptible to these diseases and their symptoms, which cause diarrhea, nausea, vomiting, fever, and extreme discomfort. Complications from these diseases may result in death.

The water storage tanks are severely rusted and corroded. The deteriorated condition of the tanks makes them susceptible to holes along the surface. An uncovered water storage tank can introduce contamination from animals into the finished water supply. Water tank corrosion and earthquakes throughout the region have compromised the already delicate structural integrity of the water storage tanks and filters. These are critical components in this failing water system; a new tank and filters are required to provide adequate water treatment and storage for many years in the future.

Operators are at risk due to the questionable structural integrity of the water pumphouse. A portion of the roof has collapsed and there is no storage area for chemicals. A new pumphouse that includes an eyewash station, a dry working area, and access to emergency equipment and communication should be provided to ensure a safe and secure working environment for the operator.

This office strongly supports the community's efforts to obtain funding for water and sewer system upgrades and replacements. Safe drinking water and proper sanitary disposal of human waste are public health necessities, and are a priority for the community of Akhiok. If I can be of assistance, please do not hesitate to call me at (907) 729-3498.

Regards,

Kimberly Smith

Kimberly Smith
Environmental Health Consultant

Cc: Shad Schoppert, Project Engineer, ANTHC
Troy Ritter, Applied Sciences Manager, ANTHC

Alaska Native Tribal Health Consortium

Division of Environmental Health and Engineering
3900 Ambassador Drive • Suite 301 • Anchorage, Alaska 99508 • Phone: (907) 729-3600 • Fax: (907) 729-4090 • www.anthc.org

January 30, 2013

Honorable Linda Amodo
Mayor of Akhiok
PO Box 5030
Akhiok, AK 99615

Dear Honorable Ms. Amodo,

People who live in homes with running water and flush toilets are healthier than people who live in homes without these services. Inadequate water and sanitation services have been associated with a variety of negative health outcomes, such as diarrheal diseases; perhaps less well known are the associations between inadequate services and negative psychosocial consequences including depression and anxiety. The effects of water and sanitation are far-reaching: children with access to safe drinking water supplies and adequate handwashing facilities perform better in school due to decreased absences due to illness. Individuals with adequate water supplies report less anxiety and stress over insecure water resources. The United Nations General Assembly has even declared water and sanitation to be a "human right".

Alaska Natives disproportionately suffer from negative health outcomes associated with inadequate water and sanitation services. These include, but are not limited to, skin infections (including antibiotic resistant *Staphylococcus aureus* infections or "MRSA"), and respiratory infections, such as those caused by Respiratory Syncytial Virus (RSV). Infants who experience severe illness from RSV at an early age are at an increased risk for other respiratory problems for the rest of their lives. A lack of water and sanitation services reduces the quality of life for individuals, as well as place additional burdens on families and the healthcare system.

Inadequate sanitation facilities present a public health hazard as well as an environmental threat. Raw sewage can contain a variety of dangerous pathogens, including *Salmonella* spp. and Norovirus (which causes a highly contagious illness colloquially referred to as "winter vomiting"). Many of these pathogens can persist in the environment once introduced, as well as infect humans and other animals.

Currently, the community of Akhiok, AK lacks adequate water and sanitation services. Public health is compromised, and the environmental impact of uncontrolled raw sewage should not be underestimated. Provision of services through water and sewer improvements should curtail these impacts, and protect the health of the community in the future.

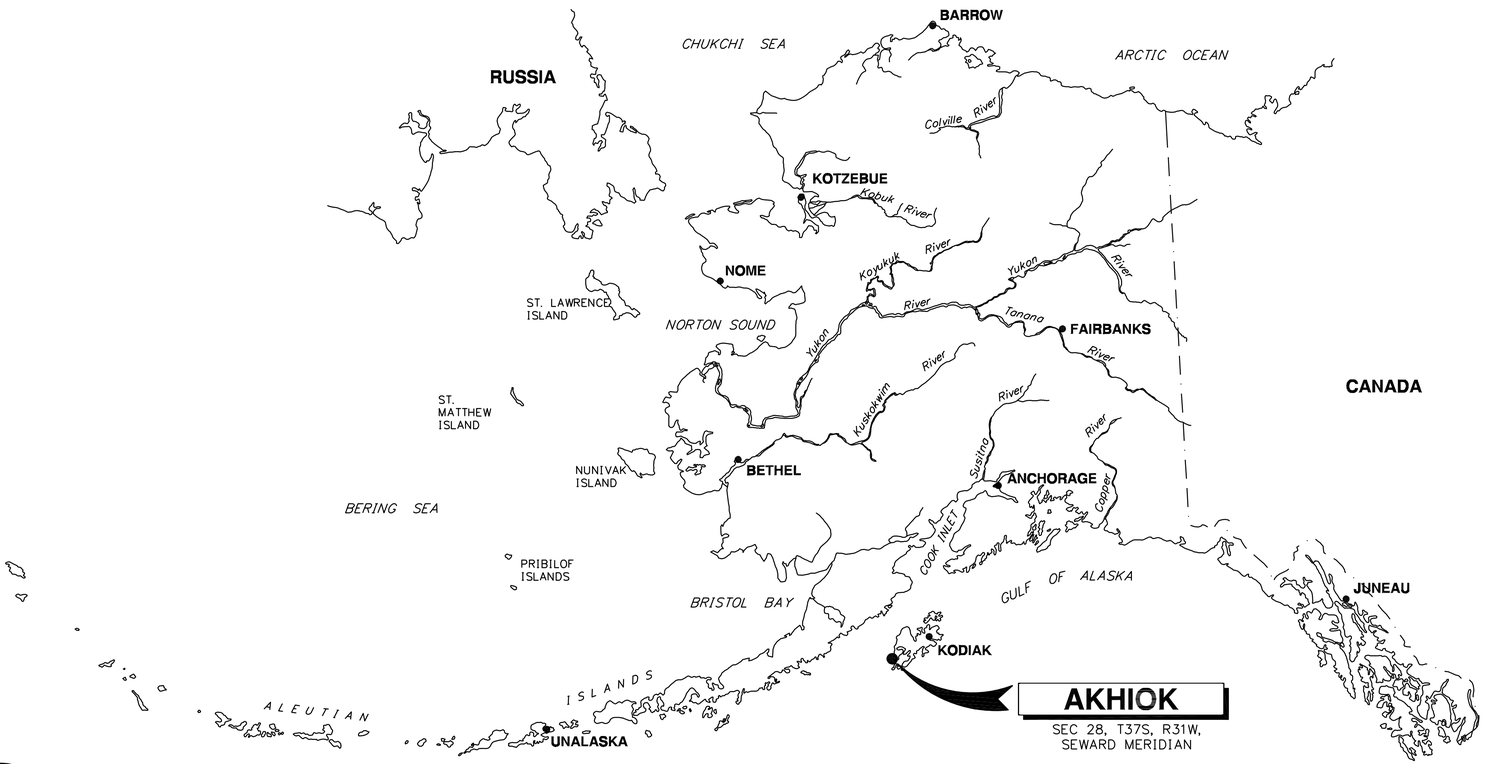
V/R,

Joanna Gaines, PhD, MPH
Senior Scientist, Alaska Native Tribal Health Consortium

Cc: Shad Schoppert, ANTHC Senior Engineering Project Manager
Kimberly Smith, ANTHC Environmental Health Officer

AKHIOK, ALASKA
MODULAR WATER TREATMENT FACILITY
PLANS FOR AGENCY REVIEW

PLAN SET NUMBER: AKK-12-005
ANTHC PROJECT NUMBER: AN-00-000



SHEET LIST TABLE	
SHEET NUMBER	**SHEET TITLE**
GENERAL	
G-001	COVER SHEET
G-002	GENERAL LEGEND
G-003	DESIGN CRITERIA
G-004	DESIGN SCHEMATIC AND SCOPE OF WORK
G-101	OVERALL SITE PLAN
CIVIL	
C-001	CIVIL LEGEND
C-101	WTP SITE PLAN
C-501	ARCTIC PRESSURE PIPE AND FITTINGS
C-502	ARCTIC PIPE CONNECTIONS
PROCESS	
D-001	PROCESS LEGEND
D-101	PROCESS PIPING FLOOR PLAN I
D-201	PROCESS PIPING ELEVATIONS I
D-202	PROCESS PIPING ELEVATIONS II
D-501	FILTER I
D-502	FILTER II
D-503	FILTER III
D-504	SCD AND TURBIDIMETER PANEL
D-505	CHLORINE INJECTION SYSTEM
D-506	POLYMER MIXING VAT
D-507	INSTRUMENT AND INJECTION CONNECTIONS I
D-508	INSTRUMENT AND INJECTION CONNECTIONS II
D-509	SUMP FABRICATION
D-601	PROCESS NARRATIVE
D-602	PROCESS SPECIFICATIONS
D-603	PROCESS INSTRUMENTATION AND EQUIPMENT SCHEDULE
D-604	PROCESS AND INSTRUMENTATION DIAGRAM
ELECTRICAL	
E-001	ELECTRICAL LEGEND
E-101	ELECTRICAL SITE PLAN
E-102	POWER AND LIGHTING PLAN
E-103	INSTRUMENTATION PLAN
E-601	ELECTRICAL PANEL SCHEDULES
E-701	ELECTRICAL PANELS

Alaska Native Tribal Health Consortium
Division of Environmental Health and Engineering
3900 Ambassador Drive, Suite 301
Anchorage, Alaska 99508
Phone: (907) 729-3600
Fax: (907) 729-4090
http://www.dehe.org

AKHIOK MODULAR WATER TREATMENT FACILITY
DESIGN CRITERIA
PUBLIC WATER SYSTEM #AK250037

GENERAL DESIGN CRITERIA

POPULATION DATA

POPULATION	82
ANNUAL POPULATION GROWTH RATE	2% ANNUALLY
DESIGN LIFE	10 YEARS
DESIGN POPULATION (2023)	100 PEOPLE

CLIMATE INFORMATION

ENVIRONMENTAL DATA
SOURCE: WESTERN REGIONAL CLIMATE CENTER (LARSEN BAY)
http://www.wrcc.dri.edu/

MEAN ANNUAL AIR TEMPERATURE:	39.9 °F
TEMPERATURE RANGE:	-5/83 °F
MEAN ANNUAL PRECIPITATION:	22 INCHES
MEAN ANNUAL SNOWFALL:	18.9 INCHES

HOUSING & SERVICE CONNECTIONS

CURRENT CONNECTIONS: 82

ELEVATIONS & STORAGE

TOTAL WATER STORAGE VOLUME	20,000 GAL
CURRENT DAYS OF STORAGE	0.67 DAYS
BASE ELEVATION OF EXISTING 10,000 GAL WSTs	115 FT
OVERFLOW ELEVATION OF EXISTING 802,000 GAL WST	127 FT
EXISTING WTP FINISHED FLOOR ELEVATION	29± FT
PROPOSED WTP FINISHED FLOOR ELEVATION	29± FT
EXISTING RAW WATER RESERVOIR ELEVATION	70 FT*

*A BOOSTER PUMP IS REQUIRED TO FILL THE EXISTING 10,000 GALLON WSTs AND PRESSURIZE THE DISTRIBUTION SYSTEM

WATER DEMAND

CURRENT USE

ESTIMATED AVERAGE WATER DEMAND PER CAPITA	365 GPCD
EXISTING AVERAGE DAY DEMAND	30,000 GPD
EXISTING DAILY AVERAGE FLOW RATE (24 HR DAY)	21 GPM

DESIGN DEMAND FOR 2023

PER CAPITA DAILY AVERAGE WATER USE	365 GPCD
DESIGN AVERAGE DAY DEMAND	36,500 GPD
DAILY AVERAGE DESIGN FLOW RATE (24 HR DAY)	25 GPM

RAW WATER PARAMETERS

PH	7.5
TURBIDITY	0.2 TO 1.0 NTU
TOC	2 MG/L
COLOR	20 PCU

*RAW WATER SAMPLES COLLECTED IN SUMMER 2012

TREATMENT OBJECTIVES

PARAMETER	MCL	UNITS	TREATMENT GOAL
TURBIDITY	0.30	NTU	<0.3O NTU*
COLOR	15	PCU	<15 PCU
TTHMs	80	UG/L	<80 UG/L
HAA5s	60	UG/L	<60 UG/L
ULTRION® 8185	40	PPM	<40 (40 Mg/L MAX PER NSF CERTIFICATION)
CHLORINE	4.0	PPM	<4.0 PPM

EXPECTED FILTER EFFICIENCY IS BETWEEN 90% AND 95%

REGULATORY CRITERIA

TREATMENT REQUIREMENTS:

GIARDIA LAMBLIA	3 LOG REMOVAL / INACTIVATION
VIRUS	4 LOG REMOVAL / INACTIVATION
CRYPTOSPORIDIUM	2.0 LOG REMOVAL / INACTIVATION

DESIGN FILTRATION CREDIT:

FILTRATION REMOVAL FOR GIARDIA	2.0 LOG
FILTRATION REMOVAL CREDIT FOR VIRUS	1.0 LOG
FILTRATION REMOVAL CREDIT FOR CRYPTOSPORIDIUM	2.0 LOG

DESIGN DISINFECTION CREDIT:

GIARDIA LAMBLIA	1.0 LOG INACTIVATION
VIRUSES	3.0 LOG INACTIVATION
CRYPTOSPORIDIUM	0.0 LOG INACTIVATION

DIRECT FILTRATION CRITERIA

THE WATER TREATMENT PROCESS WILL CONSIST OF COAGULATION USING NALCO 8185, FOLLOWED BY FILTRATION THROUGH A MULTI-MEDIA PRESSURE FILTER.

SYSTEM OPERATION	CONTINUOUS OPERATION
COAGULANT	NALCO 8185
FILTRATION, PRIMARY TYPE	1 PRESSURE DUAL MEDIA FILTER
FILTER DIAMETER	48" (EACH FILTER)
FILTER AREA	12.5 SQ FT (EACH)
NORMAL MAX FILTER LOADING	2 GPM/SQ FT
NORMAL MAX DESIGN FLOW RATE	25 GPM
EXTREME MAX FILTER LOADING*	4 GPM/SQ FT
EXTREME MAX DESIGN FLOW RATE*	50 GPM

*THE PRESSURE FILTERS CAN OPERATE UP TO 4 GPM/SQ FT WITH NO LOSS IN WATER QUALITY. HOWEVER, FILTER EFFICIENCY WILL FALL BELOW THE TARGET 95%. FLOW RATES EXCEEDING 25 GPM SHOULD ONLY BE USED IN THE EVENT OF EMERGENCY.

FILTER BACKWASH RATE (GRAVITY BACKWASH FROM 802,000 GAL WST)	(16 GPM/SQ FT) 10 MIN. @ 200 GPM
DESIGN PRESSURE OF BACKWASH WATER	20 FEET WATER MIN AT FILTER INLET
FILTER AIR SCOUR FLOW RATE	4 CFM/SQ FT (~50 CFM)
FILTER MEDIA	
ANTHRACITE	1 MM PARTICLE SIZE (16" DEEP)
SILICA SAND	0.5 MM PARTICLE SIZE (16" DEEP)
SUPPORT GARNET	#12 GARNET (4" DEEP)
SUPPORT GRAVEL	3/16-3/8 INCH (TO TOP OF HEADER)

CHLORINE DISINFECTION CALCULATIONS

THE TWO EXISTING 10,000 GALLON WATER STORAGE TANKS DO NOT PROVIDE ANY CHLORINE CONTACT TIME. AN 8,000 GALLON BAFFLED CHLORINE CONTACT TANK WILL BE PROVIDED TO SATISFY THE DISINFECTION REQUIREMENTS.

CHLORINE CT REQUIREMENTS:
DISINFECTION - SODIUM HYPOCHLORITE INJECTION (FREE CHLORINE RESIDUAL)

CT REQUIRED FOR 1.0 LOG GIARDIA INACTIVATION CREDIT:
CT FORMULA FROM ADEC 18AAC 80.655
CT = (LOG INACTIVATION)(5.057)(E^A)(E^B)(E^C)
E = 2.72
A = -0.0693 X TEMP (°C)
B = 0.361 X PH
C = 0.113 X CHLORINE CONCENTRATION (MG/L)
TRY CHLORINE CONCENTRATION = 0.3 MG/L (FREE CHLORINE RESIDUAL)
PH = 7.5
TEMPERATURE = 0.5° C
LOG INACTIVATION = 1.0
CT REQUIRED = 39 MG·MIN/L
RESULTS ALSO CROSS VERIFIED WITH CT TABLE FROM ADEC REGULATIONS

CT REQUIRED FOR 4 LOG INACTIVATION OF VIRUSES = 8 MG·MIN/L

ACTUAL CHLORINE CT OF SYSTEM:
PROPOSED CHLORINE CONTACT TANK = 8,000 GALLONS
ASSUMED TANK BAFFLE FACTOR (BF) = 0.5 (TO BE CONFIRMED BY TRACER STUDY)
MAX FLOW RATE = 25 GPM
T10 = T (BF) = (8,000 GAL/25 GPM) X 0.50 = 160 MIN
CT10 = (0.3 MG/L)(160 MIN) = 48 MG·MIN/L

GIARDIA: CT10 (ACTUAL) > CT (REQUIRED) IE. 48 MG·MIN/L > 44 MG·MIN/L = **OK**
VIRUSES: CT10 (ACTUAL) > CT (REQUIRED) IE. 48 MG·MIN/L > 8 MG·MIN/L = **OK**

CONCLUSION: GIVEN THE ABOVE CONDITIONS, THE FREE CHLORINE RESIDUAL AT THE OUTLET OF THE CHLORINE CONTACT TANK MUST BE A MINIMUM OF 0.3 MG/L TO PROVIDE THE REQUIRED DISINFECTION.

Division of Environmental Health and Engineering
3900 Ambassador Drive, Suite 301
Anchorage, Alaska 99508
(907) 729-3600

STATE OF ALASKA
4QTH
MICHAEL F. SOLTIS
CE-11257
REGISTERED PROFESSIONAL ENGINEER
1/24/13

0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING, IF NOT ADJUST SCALES ACCORDINGLY

AKHIOK, AK
MODULAR WATER
TREATMENT FACILITY
PLANS FOR AGENCY REVIEW

	INIT	DESCRIPTION	DATE	MRK

PLAN SET:	AKK-12-005
PROJ MGR:	MM
PROJ ENG:	MFS
TUS ENG:	PMC
DRAWN BY:	JEH

SHEET TITLE
DESIGN CRITERIA

G-003
SHEET 3 OF 5

1 2 3 4

D C B A

EXISTING RAW WATER INTAKE

TO EXISTING WATER STORAGE TANKS

EXISTING SCHOOL

PROJECT LOCATION

EXISTING CLINIC

EXISTING WATER TREATMENT PLANT

EXISTING LANDFILL

EXISTING POWER PLANT

EXISTING TRIBAL COUNCIL OFFICE

TO EXISTING AIRPORT

B STREET

C STREET

D STREET

E STREET

FOURTH AVENUE

THIRD AVENUE

SECOND AVENUE

CHURCH STREET

BAY DRIVE

KEMPFF BAY

AKHIOK BAY

N

A1 **OVERALL SITE PLAN**

1" = 100'

0 100' 200'

ALASKA NATIVE TRIBAL HEALTH CONSORTIUM

Division of Environmental Health and Engineering
3900 Ambassador Drive, Suite 301
Anchorage, Alaska 99508
(907) 729-3600

STATE OF ALASKA
49TH
MICHAEL F. SOLTIS
CE-11257
1/24/13
REGISTERED PROFESSIONAL ENGINEER

0 1"

BAR IS ONE INCH ON ORIGINAL DRAWING, IF NOT ADJUST SCALES ACCORDINGLY

AKHIOK, AK
MODULAR WATER TREATMENT FACILITY
PLANS FOR AGENCY REVIEW

	INIT	DESCRIPTION	DATE	MRK

PLAN SET:	AKK-12-005
PROJ MGR:	MM
PROJ ENG:	MFS
TUS ENG:	PMC
DRAWN BY:	JEH

SHEET TITLE

OVERALL SITE PLAN

G-101

SHEET **5** OF **5**

1 2 3 4

D C B A

TO SCHOOL

EXISTING SEWER LINE FROM SCHOOL

EXISTING 4" DIA POTABLE WATER LINE

EXISTING 4" DIA RAW WATER LINE

10' x 15' x 3' DEEP PERCOLATION CELL

15' x 15' x 3' DEEP BACKWASH CELL

OVERFLOW TO MATCH INVERT OF EXISTING PIPE

EXISTING 6" BACKWASH LINE

BOTTOM OF BACKWASH CELL TO BE 2'-0" BELOW INVERT OF EXISTING BACKWASH LINE

BOTTOM OF PERCOLATION CELL TO MATCH BACKWASH CELL

TOP OF BERM MINIMUM 12" ABOVE EXISTING GROUND

PROPOSED 4" DIA RAW WATER LINE

PROPOSED 4" DI GATE VALVE

REMOVE FENCE FOR CONSTRUCTION

PROPOSED 4" DIA TREATED WATER LINE

PROPOSED BACKWASH LINE CONNECTION

PROPOSED 8' DIA x 23' LONG ABOVE GROUND CONTACT TANK

PROPOSED MODULAR WATER TREATMENT FACILITY

PROPOSED 6" DIA BACKWASH LINE

PROPOSED 4" DIA POTABLE WATER LINE

PROPOSED 4" DI GATE VALVE

PROPOSED 4" PVC SEWER SERVICE LINE

EXISTING MAINTENANCE GARAGE

EXISTING SHED APPROXIMATELY THIS LOCATION TO BE DEMOLISHED

PROPOSED 1" DIA WATER SERVICE LINE

PROPOSED 1" HDPE BALL VALVE

EXISTING WATER TREATMENT PLANT

TO LANDFILL

TO AIRPORT

N

0 10' 20' 40'

A1 WTP SITE PLAN

1" = 10'

NOTES:

1. ALL ABOVE GROUND CONNECTIONS AND PIPE BURIED ABOVE A FROST DEPTH OF 4 FEET IS HDPE JACKETED ARCTIC PIPE.
2. ALL BELOW GROUND CONNECTIONS AND PIPE BELOW A FROST DEPTH OF 4 FEET IS BARE HDPE SDR 11 PIPE UNLESS OTHERWISE NOTED ON THE PLANS.
3. FIELD VERIFY LOCATION OF ALL BURIED UTILITIES PRIOR TO BEGINNING WORK.
4. DISCONNECT EXISTING PIPE AND BLIND FLANGE THE GATE VALVE AFTER PROPOSED MODULAR WATER TREATMENT FACILITY IS BROUGHT ONLINE.

ALASKA NATIVE TRIBAL HEALTH CONSORTIUM

Division of Environmental Health and Engineering
3900 Ambassador Drive, Suite 301
Anchorage, Alaska 99508
(907) 729-3600

STATE OF ALASKA 49TH
MICHAEL F. SOLTIS
CE-11257
REGISTERED PROFESSIONAL ENGINEER
11/24/13

0 1"

BAR IS ONE INCH ON ORIGINAL DRAWING, IF NOT ADJUST SCALES ACCORDINGLY

AKHIOK, AK
MODULAR WATER TREATMENT FACILITY
PLANS FOR AGENCY REVIEW

MRK	DATE	DESCRIPTION	INIT

PLAN SET:	AKK-12-005
PROJ MGR:	MM
PROJ ENG:	MFS
TUS ENG:	PMC
DRAWN BY:	JEH

SHEET TITLE

WTP SITE PLAN

C-101

SHEET 2 OF 4

EQUIPMENT

- HYDROCYCLONE
- HEAT EXCHANGER (HX–XXX)
- MOTORIZED MIXER
- CALIBRATION COLUMN
- PUMP (XXX–XXX)
- BLOWER (XXX–XXX)
- PRESSURE VESSEL
- CHEMICAL TANK WITH MIXER
- TURBIDIMETER
- STREAMING CURRENT DETECTOR
- STATIC MIXER (SM–XXX)
- VARIABLE FREQUENCY DRIVE (VFD)
- DUPLEX POWER OUTLET
- Y–STRAINER

VALVES

OPEN	CLOSED	
		GATE VALVE
		BALL VALVE
		BUTTERFLY VALVE
		SWING CHECK VALVE
		BALL CHECK VALVE
		SPRING CHECK VALVE
		PRESSURE INDEPENDENT FLOW CONTROL VALVE
		RELIEF VALVE
		PLUG VALVE
		SAMPLE TAP VERTICAL LINE
		SAMPLE TAP HORIZONTAL LINE
M	M	3–WAY MOTORIZED VALVE

FAIL OPEN	FAIL CLOSED	
M	M	MOTORIZED VALVE
S	S	SOLENOID VALVE
		PRESSURE/FLOW CONTROL VALVE

INSTRUMENT SYMBOLS

	FIELD MOUNTED	PANEL MOUNTED	FIELD MOUNTED WITH WELL
DISCRETE INSTRUMENT	XXX / XXX	XXX / XXX	XXX / XXX
COMPUTER FUNCTION	XXX / XXX	XXX / XXX	
PROGRAMMABLE LOGIC CONTROL	XXX / XXX	XXX / XXX	
CONTINUATION TO AND FROM SHEET	D–XXX		

LINE LEGEND

- PRIMARY PROCESS FLUID LINE
- SECONDARY PROCESS FLUID LINE
- EXISTING PRIMARY PROCESS FLUID LINE
- EXISTING SECONDARY PROCESS FLUID LINE
- FUTURE PRIMARY PROCESS FLUID LINE
- FUTURE SECONDARY PROCESS FLUID LINE
- CAPILLARY TUBE (I.E. MECHANICAL AQUASTATS)
- TELEMETRY SIGNAL
- INTERNAL SYSTEM LINK (SOFTWARE OR DATA LINK)
- DIGITAL OR PULSE SIGNAL (I.E. FROM PADDLE WHEEL FLOW METER)
- 120V AC — ELECTRIC POWER SUPPLY, SPECIFY I.E. 120 VAC
- AS — AIR SUPPLY
- 24V AC — ELECTRIC SIGNAL, SPECIFY I.E. 24 VAC, 4–20 MA
- CHEMICAL FEED LINE

INSTRUMENTATION, SYSTEMS, AND AUTOMATION SOCIETY (ISA) TAG IDENTIFICATION LETTERS

	FIRST LETTER		SUCCEEDING LETTERS		
LETTER	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		USER'S CHOICE
B	BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE	
C	USER'S CHOICE			CONTROL	
D	USER'S CHOICE	DIFFERENTIAL			
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO OR FRACTION			
G	GAS		GLASS, VIEWING DEVICE		
H	HAND (MANUAL)				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME OR SCHEDULE	TIME, RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	MOISTURE	MOMENTARY			MIDDLE, INTERMEDIATE
N	TURBIDITY		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE, RESTRICTION		
P	PRESSURE (OR VACUUM)		POINT (TEST) CONNECTION		
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD		
S	SPEED OR FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION			VALVE, DAMPER, LOUVER	
W	WEIGHT OR FORCE		WELL		
X	UNCLASSIFIED	X–AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE, OR PRESENCE	Y–AXIS		RELAY, COMPUTE, CONVERT	
Z	POSITION OR DIMENSION	Z–AXIS		DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

THIS TABLE IS MODIFIED FROM ISA–5.1–1984(R1992)

ALASKA NATIVE TRIBAL HEALTH CONSORTIUM
Division of Environmental Health and Engineering
3900 Ambassador Drive, Suite 301
Anchorage, Alaska 99508
(907) 729-3600

STATE OF ALASKA 49TH
MICHAEL F. SOLTIS
CE–11257
REGISTERED PROFESSIONAL ENGINEER
1/24/13

0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING, IF NOT ADJUST SCALES ACCORDINGLY

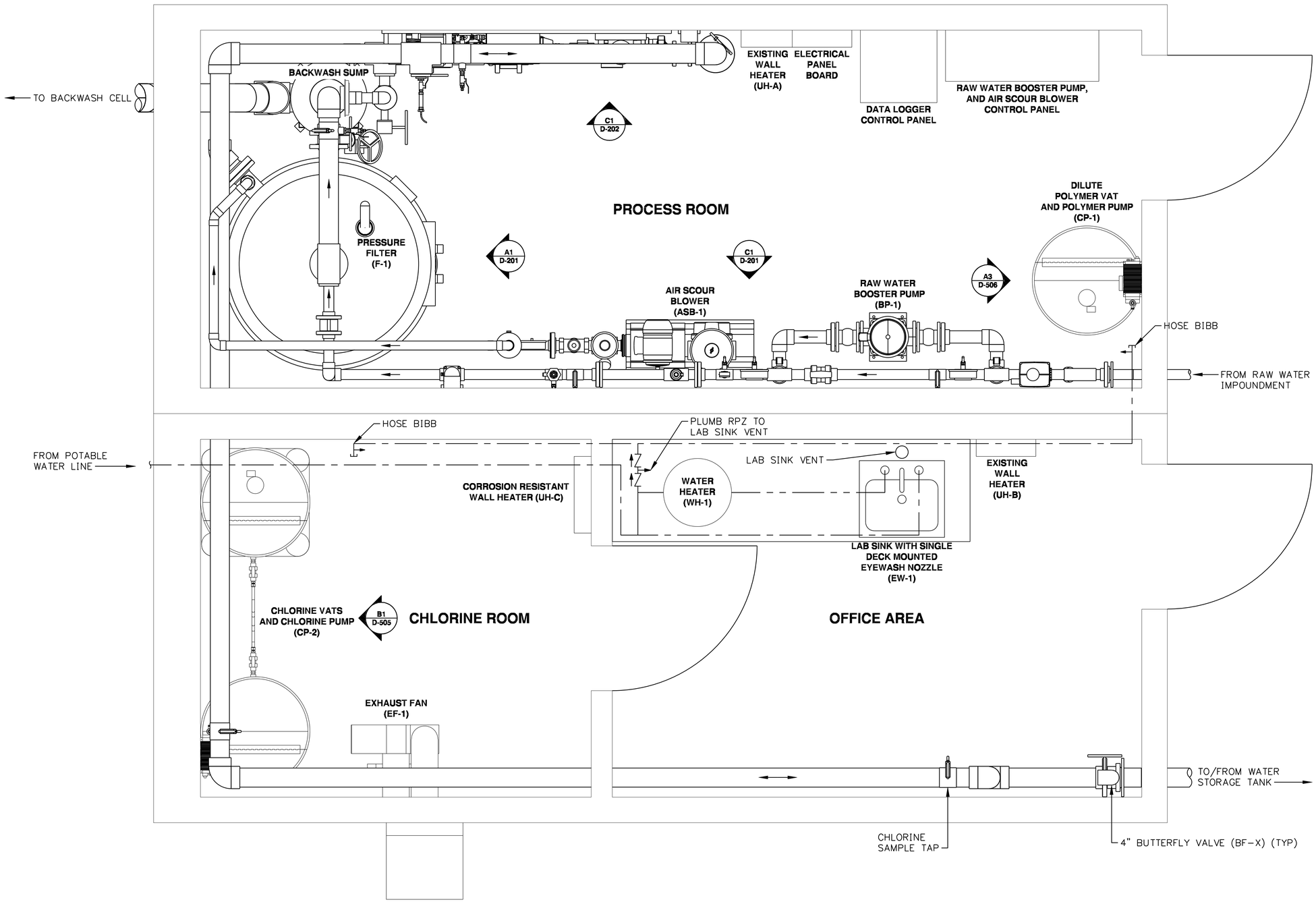
AKHIOK, AK
MODULAR WATER TREATMENT FACILITY
PLANS FOR AGENCY REVIEW

MRK	DATE	DESCRIPTION	INIT

PLAN SET:	AKK–12–005
PROJ MGR:	MM
PROJ ENG:	MFS
TUS ENG:	PMC
DRAWN BY:	JEH

SHEET TITLE
PROCESS LEGEND

D-001
SHEET **1** OF **17**



A1 PROCESS PIPING FLOOR PLAN

1" = 1'-0"

0 1/2' 1' 2'

ALASKA NATIVE TRIBAL HEALTH CONSORTIUM

Division of Environmental Health and Engineering
3900 Ambassador Drive, Suite 301
Anchorage, Alaska 99508
(907) 729-3600

STATE OF ALASKA 49TH
MICHAEL F. SOLTIS
CE-11257
1/24/13
REGISTERED PROFESSIONAL ENGINEER

0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING, IF NOT ADJUST SCALES ACCORDINGLY

AKHIOK, AK
MODULAR WATER TREATMENT FACILITY
PLANS FOR AGENCY REVIEW

MRK	DATE	DESCRIPTION	INIT

PLAN SET:	AKK-12-005
PROJ MGR:	MM
PROJ ENG:	MFS
TUS ENG:	PMC
DRAWN BY:	JEH

SHEET TITLE

PROCESS PIPING FLOOR PLAN I

D-101

SHEET **2** OF **17**

Akhiok Water and Sewer System Feasibility Study Update

Prepared By: Michael Soltis, P.E.

December 2012

Water and Sewer System Feasibility Study Update
Akhiok, Alaska

EXECUTIVE SUMMARY

Akhiok's water and sewer system has critical deficiencies that threaten public health and the environment. The water treatment system has not been in compliance with the United States Environmental Protection Agency's (USEPA's) regulatory requirements for drinking water since the introduction of the1989 Surface Water Treatment Rule (SWTR), which formed the foundation for current and much more stringent drinking water standards. The community does not have the equipment or facilities required to properly maintain the sewage collection system, and, consequently, components of the system are in poor condition and/or have failed. The community's sewage outfall line is severed and currently discharges to the beach, resulting in public exposure to sewage and a violation of the original discharge permit.

Most of these deficiencies and potential corrective actions were documented in a Sanitation Feasibility Study that was completed in 2003. However, none of the deficiencies identified in that study have been addressed over the last decade.

Obtaining adequate capital funding for new projects is currently the largest obstacle to addressing Akhiok's water and sewer system deficiencies. The corrective actions identified in the 2003 Sanitation Feasibility Study are reportedly very unlikely to be funded in the current fiscal environment because of their relatively high capital costs relative to Akhiok's current population and other scoring considerations.

The purpose of this study is to document Akhiok's critical water and sewer system deficiencies and to provide the most cost effective alternatives for addressing those deficiencies..

The following recommendations were developed based on the results of this study:

1. Provide a containerized water treatment system
2. Provide a pressurized chlorine contact-time vessel
3. Repair the existing sewage outfall line
4. Provide equipment for pumping the community septic tanks
5. Provide a septic sludge disposal area

Capital costs to implement the above recommendations are estimated to be about $955K. For comparison, capital costs in 2002 dollars to implement the recommendations from the 2003 Sanitation Feasibility Study were estimated at $5.56M.

Contents

Figures

Introduction

Akhiok's water and sewer system has critical deficiencies that threaten public health and the environment. Many of these deficiencies were documented in a 2003 *Sanitation Feasibility Study* prepared by GV Jones and Associates. However, due to Akhiok's relatively low population, a competitive funding environment, and relatively high project costs, none of the needed improvements identified by the 2003 study were funded or completed.

The Alaska Native Tribal Health Consortium (ANTHC), Division of Environmental Health and Engineering (DEHE) has conducted this study to identify potential low-cost alternatives for addressing Akhiok's water and sewer system deficiencies. The improvements identified in this study include repairs/upgrades to the existing systems and the construction of new infrastructure.

Background

Site Description

Akhiok is located at the southern end of Kodiak Island at Alitak Bay. It lies 80 miles southwest of the City of Kodiak and 340 miles southwest of Anchorage. The community lies at approximately 56.945560° North Latitude and -154.170280° West Longitude. (Sec. 28, T037S, R031W, Seward Meridian.) Akhiok is located in the Kodiak Recording District. The area encompasses 7.9 sq. miles of land and 2.5 sq. miles of water.

The climate of the Kodiak Islands is dominated by a strong marine influence. There is little or no freezing weather, moderate precipitation, and frequent cloud cover and fog. Severe storms are common from December through February. Annual precipitation is 35 inches. Temperatures remain within a narrow range, from 25 to 54 °F.

Community Description

Akhiok's population is 82 (2011 DCCED certified estimate). According to Census 2010, there were 27 housing units in the community and 19 were occupied.

Public sector employment and seasonal work provide cash flow in the community. Almost all of Akhiok's residents depend heavily on subsistence fishing and hunting. Salmon, crab, shrimp, clams, ducks, seal, deer, rabbit, and bear are utilized.

There is one school located in the community, which is attended by 17 students. Local hospitals or health clinics include the Akhiok Health Clinic, which is a Primary Health Care Facility.

Electricity is provided by the City of Akhiok. The city generators are typically shut down at night during the summer to save fuel and lower operational costs.

Water System Description

Akhiok's obtains raw water from a surface water impoundment. The raw-water gravity flows to the water treatment plant, where it is filtered through two 48-inch diameter sand filters and then chlorinated. A pressure booster pump is required to pressurize the distribution system, which uses two 10,000-gallon WSTs (located about 55 feet up-gradient of the raw water source) to provide water storage and maintain water distribution system pressure.

Existing Sewage Collection System

Akhiok has a gravity sewage collection system with three zones. Sewage gravity flows from homes located in each zone into a septic tank serving that zone. The sewage from all three septic tanks is then combined into a single ocean outfall line that discharges in Akhiok Bay.

Previous Studies

A *Sanitation Feasibility Study* for Akhiok was completed in February 2003 by GV Jones and Associates. This study presented a detailed description of Akhiok's water, sewer, and solid waste facilities, and provided recommendations for needed improvements and additions to the existing infrastructure.

Key recommendations/findings from the 2003 feasibility study are listed below:

- Increase raw water storage capacity (from 550,000 gallons to 850,000 gallons)
- Construct a new water treatment plant using a direct filtration treatment process
- Construct a new water storage tank (318,000 gallons) and new tank fill and draw lines.
- Replace portions of the existing water distribution system with six-inch mains
- Replace the water services for all homes with arctic services
- Provide a two-cell facultative lagoon, sewage lift station, and approximately one-mile sewage force main for disposing sewage. Abandon the ocean outfall.
- Provide a new solid waste landfill

Total costs in June 2002 dollars to complete the above work were estimated at about $5.6 million. Due to lack of funding, none of the above improvements were completed.

Water and Sewer System Deficiencies

Akhiok's water and sewer system has many deficiencies. For clarity in this report, these deficiencies are referred to as critical deficiencies, major deficiencies, or minor deficiencies. A critical deficiency is a deficiency that poses an imminent threat to the

public health and/or the environment, typically associated with complete failure of a portion of the system. Major deficiencies are significant deficiencies that should be addressed to improve the overall operability, sustainability, and/or performance of the system and to prevent imminent critical deficiencies. Minor deficiencies, which would include deficiencies such as water distribution system leaks, freezing water/sewer services, etc., are not addressed in this report.

Opinion-of-capital-cost estimates for the proposed improvements have been prepared based on ANTHC's 2009 Sanitation Deficiency System (SDS) cost estimator tool, supplemented with information from more recent construction projects. These estimates are provided for general guidance in project evaluation and funding and for comparative purposes.

Critical Water System Deficiencies

The following deficiencies include both water treatment process deficiencies and water-system infrastructure deficiencies. Note that the listed water treatment process deficiencies are considered "critical," because they represent violations of primary water treatment regulations that have been established by the EPA to protect public health by preventing waterborne illnesses.

1. *Akhiok's water treatment system does not meet the requirements of the EPA's 1989 SWTR.*

   The 1989 SWTR requires 3-log inactivation/removal for Giardia and 4-log inactivation/removal for viruses. The required inactivation/removal is typically achieved through a combination of filtration and chlorine disinfection. Akhiok's existing sand filtration system does not use a coagulant and is only eligible for a 1-log removal credit. The remaining inactivation therefore must occur through chlorine disinfection, which requires chlorine reaction time. This reaction time is typically provided by the WST(s) in a water distribution system, where all water must pass through the WST(s) before it is sent to the consumer. Akhiok's WSTs currently have a common fill/draw line; water flows to/from the tanks through the same line. Given this configuration, chlorinated water can bypass the WSTs and go directly to the public without receiving the required chlorine contact time. Note that even if Akhiok's existing WSTs were piped differently, they are not large enough to provide the required contact time without the use of special baffling and/or other measures.

   There are several potential options for providing the required chlorine contact time; provide a new WST with a dedicated fill line, perform modifications to use the existing WSTs, or install a pressurized, baffled, chlorine contact time vessel.

   A new WST that is adequately sized to provide the required chlorine contact time could be constructed. The 2003 *Sanitation Feasibility Study* identified several appropriate locations for a new WST. Regardless of the location, a new WST fill line would be required so all of the water treated at the WTP would pass through

the new WST and receive adequate chlorine contact time before entering the distribution system. **Estimated costs for a new WST and fill line are $580K**

Akhiok's existing WSTs could be used for chlorine contact time (CT) tanks if a new fill line is installed for the tanks and the existing fill/draw line is repurposed as a dedicated draw line. The WSTs would likely need to be plumbed in parallel, baffled, and/or have a large diameter fill pipe to provide the required contact time before the water enters the distribution system. **Estimated costs for providing a new fill line and required modifications for providing the required contact time are $400K.**

A pressurized, baffled, chlorine contact-time vessel could be installed downstream of the WTP to provide the required disinfection before the water entered the distribution system. This option would not require a new fill line for the existing WTP. This option would also allow the water distribution system to remain pressurized if the raw water booster pump was inactive for an extended period of time. **Estimated costs for providing a new baffled chlorine contact tank are $120K.**

One of Akhiok's 10,000 Gallon WSTs (the other WST is directly behind this one)

2. *Akhiok's WTP building has reached the end of its design service life and poses a life-safety threat to the operator and/or any other occupant.*

   The Akhiok WTP building is in very poor condition, with missing roofing panels, rotting structural members, and differential foundation settlement. The electric service panel has experienced a hot arcing fire that has disabled some of the building's electrical circuits. One of the two sand pressure filters is inoperable due to a failed solo-valve. The costs to refurbish the existing facility are considered comparable to replacing the existing facility in kind.

   Akhiok's WTP should be replaced with a new facility. Ideally, a new building would be constructed similar to one of the recently constructed facilities in Ouzinkie, Larsen Bay, Old Harbor, and Port Lions. **Construction costs for these facilities have averaged about $3M, including treatment equipment.**

   It is possible to install the required equipment in a portable structure, such as a shipping container, for a fraction of the price of a completely new facility. This type of system should be considered temporary, but could provide the required treatment for a period of years until funding for a more permanent facility is secured. A similar temporary system was used for a couple of years in Tyonek until a new WTP was constructed. **Estimated costs for obtaining and modifying shipping containers for containing water treatment equipment are $100K.**

Akhiok's existing WTP

3. *Akhiok's water treatment system does not meet the requirements of the EPA's 2002 Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR).*

   The LT1ESWTR requires treatment systems to provide 2-1og removal for cryptosporidium. Akhiok's current treatment system is only eligible for a 1-log removal credit. A 2-log removal credit could be achieved using a modern treatment process. Appropriate modern treatment processes include bag filtration, membrane filtration, or sand filtration with a coagulant.

   Based on raw water samples collected in August 2012, bag filters are not considered a feasible solution because the water periodically contains too much organic material for bag filters to be used efficiently. The expected change-out frequency for bag filters is expected to drive monthly bag replacement costs of greater than several thousand dollars, which is not a sustainable expense for a community the size of Akhiok.

   Membrane filtration is another possible solution. An appropriate membrane system would clean itself at little or no expense during normal operation, and the membranes could last for five years or more before requiring replacement. From a operational-cost perspective, membranes are therefore a viable solution. However, a key limitation to a membrane system is its capacity. A 5 gpm membrane system can only treat 5 gpm. Based on Akhiok's population and typical water usage, a 5 gpm system should provide adequate capacity. However, most of Akhiok's filtered water is currently lost to leaks in the distribution system and a 25 to 30 gpm treatment system would be required to meet current water demands. A 30 gpm membrane system would cost about $420K (equipment only), and may not be economically feasible from a capital cost perspective. If most of the leaks are fixed, a smaller system could be installed (10 gpm ~ $230K – equipment only). However, the existing water distribution system is old and new leaks are not considered just a possibility, they are considered a certainty. The consequence is that there may be times when a membrane system may not be able to satisfy demands until the leaks are fixed, which could take from days to years depending on available resources. **Therefore, a more conservatively sized membrane system (30 gpm) would be recommended, with equipment costs beginning at about $420K.** (note that this price would include installation of the equipment)

   A sand filtration system with a coagulant is considered the most reliable and versatile treatment systems that would provide the required treatment. This type of system can be used over a wide range of flow rates and is effective for treating raw water with wide variations in quality. A sand filtration system with a coagulant can operate completely under gravity flow, provided sufficient driving head is available. Successful use of a coagulant requires the use of modern water treatment equipment incorporating key features including a streaming current detector, air scour blower, custom filter underdrain, and some automation. **Equipment costs for a sand filtration system with coagulant that could treat up to about 50 gpm are about $125k. Labor associated with installation and preparation is estimated at about an additional $125K, for a total of about $250K.**

Major Water System Deficiencies

1. *Akhiok's raw water source periodically lacks adequate capacity, resulting in water shortages.*

   Akhiok's existing water source consists of a mountain reservoir filled by runoff from snowmelt and rain. This reservoir periodically does not have adequate recharge to satisfy community demands. There has been a need to fly in drinking water in the past. Previous evaluations have determined that the best way to increase the reliability of this source would be to increase its storage capacity by raising the reservoir dikes and providing an impermeable liner to reduce seepage losses.

   Estimated costs for improving the existing raw water source are about $600K.

Akhiok's raw water reservoir

Critical Sewage System Deficiencies

1. *Akhiok's community outfall line is severed at the beach, exposing residents to sewage.*

Akhiok's outfall line has had problems with plugging in the past. Some of these problems are associated with failed anchor weights on the outfall line that allowed portions of the outfall to "float" slightly, creating low points in which solids could accumulate. The accumulated solids then likely began undergoing anaerobic decomposition, which released gasses into the submerged pipe. These gasses accumulated at the high points of the submerged pipe, and caused portions of the pipe to float to the surface of Akhiok Bay. Residents in Akhiok have reported shooting at the pipe, which release the gasses and allowed the pipe to sink back down.

Over time, solids accumulation in the outfall line reached the point where it could not be cleared with local equipment. The community abandoned the failed outfall line by cutting it off near the beach.

Potential alternatives to address the problem of raw sewage being discharged to the beach include the construction of a sewage lagoon for managing wastewater, construction of a new community outfall line, or repairing the existing outfall line.

A new sewage lagoon would require an appropriate site, a sewage lift station, and a force main between the lift stations and the lagoon. One advantage of this approach is that the three community septic tanks could be abandoned. However, a wastewater lagoon may not be permissible in Akhiok from a regulatory perspective. Based on recent discussions with ADEC regulators, a wastewater lagoon in Akhiok is considered likely to fail, and it may not be possible to obtain approval to construct or operate such a facility. This option is not recommended.

A new outfall line would be effective for directing wastewater an appropriate distance from the community. The outfall line could operate under gravity or be pressurized. A pressurized outfall line would be smaller and less expensive to construct than a gravity outfall line, and would be less susceptible to clogging from accumulated solids. However, a pressurized outfall line would require a lift station and new gravity sewer piping to combine the outfalls near the shoreline. Although the lift station would be relatively simple and reliable, it would add new electrical (pumping) and O&M costs to the water and sewer system that are not incurred now. **Total capital costs for this alternative are about $650k.**

A new gravity outfall is the preferred potential solution in term of O&M costs. However, a new gravity outfall line would be susceptible to the same problems as the existing failed gravity outfall line. The existing gravity outfall line likely failed due to a combination of poor anchorage and solids accumulation. Current outfall anchoring methods are unlikely to fail within a 50-year period. Solids accumulation should not be an issue if the septic tanks are maintained and mechanisms are installed to allow routine maintenance flushing of the outfall line. **Estimated costs for a new gravity sewage outfall line are $520K.**

Repairing the existing outfall line is the lowest cost potential solution. Similar repairs have been conducted on other failed outfall lines. A barge and lifting equipment would be required. The end of the existing outfall line would be located and lifted to the surface. The barge would then follow the path of the

existing outfall line, lifting the outfall on one side and setting it down on the other side, while replacing the anchors and patching holes. **Estimated costs for repairing the existing outfall line are about $300K.**

Akhiok at high tide. The existing outfall is cut near the beach and is floating to the surface in the above photograph.

2. *Akhiok does not have a pumper vehicle for maintaining the community septic tanks*

   This is considered a critical deficiency because lack of septic tank maintenance will lead directly to failure of a sewage outfall (current situation in Akhiok).

   Alternatives to address this deficiency include purchasing a new pumper vehicle ($125k) or a new trailer-mounted pump and tank ($60k). A used vehicle is not recommended unless it can be hand-selected by a qualified mechanic familiar with this type of equipment.

3. *Akhiok does not have a sludge storage or disposal facility.*

   This is considered a critical deficiency for similar reasons. There is little benefit to providing a means to pump out the septic tanks if there is not a suitable place to

dispose the solids. Akhiok currently pumps their septic tanks directly onto the beach at high tide using a trash pump.

Alternatives for disposing the septage sludge include dewatering and land-filling, or disposal in a sludge storage facility. Dewatering can be accomplished using specialized mechanical dewatering equipment or a simple trench. The mechanical dewatering system includes the addition of a coagulant and filtering of solids. The equipment is somewhat labor intensive to use and must be properly maintained. The operator will be in close contact with the sludge and will require stringent use of appropriate protective gear to prevent exposure. Dewatering equipment is not considered an attractive alternative in Akhiok because it is technically challenging to operate and would be expensive for the community to maintain.

The simple trench alternative would consist of

1. Opening a trench in a permitted area,
2. Pumping the septic sludge into the trench
3. Allowing the sludge to dewater
4. Applying lime to the remaining solids
5. Covering the trench with fill material

The simple trench alternative would require an appropriate site. The areas down-gradient of the site would need to be surveyed for potential seeps and/or surface water bodies that could be impacted. Groundwater monitoring wells may be required to verify that nitrate contamination does not exceed regulatory limits at the downgradient property boundaries. **Costs for evaluating use of the simple trench method would include engineering and permitting costs, about $25K.** Costs to develop an appropriate site are unknown at this time. Other costs would be related to use of the backhoe owned by the city and lime costs, and would be considered O&M type expenses.

A sludge disposal facility would consist of a lined holding cell and a percolation cell. This type of facility is proposed for use in nearby Ouzinkie and Port Lions. The holding cell would be sized to hold about 15 to 20 years of septic solids. Most of the hydraulic loading to the cell would consist of precipitation, which would overflow into the percolation cell. These facilities rarely give off an odor except for when sludge is being pumped into them. These type of facilities are also very low maintenance and do not require lime to neutralize the waste each time it is disposed. Estimated costs for a sludge disposal facility are about **$700K.**

Major Sewage System Deficiencies

1. The community's three existing steel septic tanks are nearing the end of their useful service life

These steel septic tanks are installed in a corrosive marine environment and are likely either currently leaking or soon to be leaking into groundwater that daylights at the beach, which poses a health hazard. **Estimated costs for replacing all three septic tanks are $450K.**

Water and Sewer System Corrective Action Alternatives

Several alternatives were evaluated for correcting the critical water and sewer system deficiencies in Akhiok. These alternatives are outlined below:

Alternative 1 (worst case scenario)

- Do nothing.

Alternative 2 (best case scenario)

This scenario addresses both major and critical water and sewer system deficiencies.

IMPROVEMENT	EST. COST
WATER	
Construct a new modern WTP that satisfies all current regulatory treatment requirements ($3M)	$3M
Construct a new WST and associated piping that will provide adequate chlorine contact time for water disinfection.	$350K
Increase the capacity of Akhiok's raw water reservoir	$600K
SEWER	
Replace the existing community sewage outfall	$520K
Replace the three existing community septic tanks	$450K
Provide a new pumper truck for maintaining the septic tanks	$125K
Provide a sludge disposal facility for accepting sewage solids	$700K
	$5.75 M

Alternative 3 (minimum corrective action scenario)

This scenario only addresses current critical water and sewer system deficiencies.

IMPROVEMENT	EST. COST
Water	
Provide and configure a sand filtration system with coagulant that can produce treated water meeting current regulations	$250K
Provide and modify shipping containers to house the treatment equipment	$100K
Provide a baffled, pressurized, chlorine contact vessel	$120K
Provide and install required yard piping to connect new chlorine contact vessel and treatment equipment	$100K
Sewer	
Replace the existing community sewage outfall	$300K
Provide a new trailer-mounted vacuum pump and tank for maintaining the septic tanks	$60K
Perform site investigation and obtain permits for a trench-type sludge disposal location	$25K
	$955K

Discussion of Corrective Action Alternatives

Alternative 1

Alternative 1 does not address the existing threats to public health and the environment or bring the system into compliance with existing water and wastewater treatment regulations.

Alternative 2

Alternative 2 eliminates the current threats to public health and the environment and would bring the system into compliance with current water and wastewater regulations. These improvements are also anticipated to serve the community's sanitation needs for the foreseeable future.

Alternative 3

Alternative 3 is comparable to Alternative 2 in terms of bringing the system into regulatory compliance, addressing public health and environment issues, and providing the necessary infrastructure for proper maintenance of the sewage system. However, these improvements are not considered an optimal long-term solution.

The temporary water treatment plant will not be as energy efficient as a new facility and may not be upgradable to satisfy new regulations that may be introduced in the future. A

single filter would be used to minimize capital costs and space requirements instead of the minimum of two filter used in new facilities to provide redundancy. The temporary water treatment system will likely require refurbishment within 10 years.

The dedicated chlorine contact tank will address the need for proper water disinfection, but does not address the need for additional storage of potable water.

The community septic tanks will likely need to be addressed in the near future. These steel tanks are likely in very poor condition after serving in a marine environment.

The simple trench approach for disposing septic sludge may not be feasible, based on the results of a site investigation, engineering analysis, and permitting requirements.

The trailer-mounted vacuum pumper system will be more labor intensive to use than a truck mounted system. However, it may be advantageous and a better fit for Akhiok because any operable full-size truck would be able to pull it, and there are fewer components to maintain.

Conclusions/Recommendations

Based on the result of this study, Akhiok's water and sewer system has the following critical deficiencies:

- The existing water treatment system does not meet the requirements of the 1989 SWTR
- The existing water treatment system does not meet the requirements of the 2002 LT1ESWTR
- Akhiok's existing water treatment plant building is structural compromised and poses a health and safety hazard to the operator and any other occupants.
- Akhiok's sewage outfall is severed near the beach, exposing residents to wastewater
- Akhiok lacks the minimum equipment and facilities necessary to properly maintain their community septic tanks. The current state of the sewage outfall is directly attributable to this deficiency.

The minimum effort required to address these deficiencies is estimated to cost about $955K.

In addition to the critical deficiencies listed above, Akhiok has the following major deficiencies, which are defined as deficiencies that significantly affect the operability of the system or are likely to become critical deficiencies in the near future:

- Akhiok's three existing community septic tanks are steel construction, and are likely in poor condition after over 40 years operation adjacent to a saltwater coastline. These septic tanks should be replaced before they fail (collapse).

- Akhiok' raw water source does not have adequate storage

The effort required to address these deficiencies is estimated to cost about $1.05M.

STATE OF ALASKA

SEAN PARNELL, GOVERNOR

DEPT. ENVIRONMENTAL CONSERVATION
DIVISION OF ENVIRONMENTAL HEALTH
DRINKING WATER PROGRAM

555 Cordova St
Anchorage, AK 99501
Phone: (907) 269-6064
Fax: (907) 269-7650
http://www.dec.state.ak.us/eh/dw/

File Number: 2504.07

September 15, 2010

Ms. Linda Amodo
PO Box 5046
Akhiok, AK 99615

Re: **Akhiok**-Drinking Water Treatment Plant
Status Component Inspection
PWSID: 250037; **Classification:** Community Water System;
Source: Surface Water , Constructed Impoundment

Dear Ms. Amodo,

On April 28, 2010, the Alaska Department of Environmental Conservation (DEC) Drinking Water Program conducted a *Status Component Inspection* of your Public Water System's (PWS) surface water treatment components. DEC is conducting inspections at all of the State's surface water treatment systems to evaluate the current operational status of these systems. There have been many new rules over the past decade which affect surface water treatment. Many PWSs have completed upgrades to meet some of these rules but are unsure whether their treatment system meets the current regulatory requirements. Some PWSs are unsure of the capacity of their water treatment system and its ability to safely produce sufficient water to meet the needs of future community development. The *Status Component Inspections* help provide answers to these questions and create a baseline for planning any needed future upgrades.

The main purpose of a surface water treatment system is to provide barriers that prevent microbes, such as viruses, *Giardia*, and *Cryptosporidium*, from entering the water that the community drinks. The primary barriers in a surface water treatment system are filtration and disinfection (e.g. chlorine addition). In order to protect public health, each of these processes is required to meet a minimum treatment objective. While the most significant part of meeting a treatment rule is having adequate equipment, meeting the rule also means operating and maintaining that equipment effectively. The treatment credits awarded for filtration and disinfection are based on both current equipment and the current operations of that equipment, as observed during our visit.

Based on our inspection, your system is awarded the treatment credits summarized in the enclosed table. This means that at the time of the inspection, your system was not in full compliance with existing surface water treatment rules. You may not be able to address this issue by changing the operations of your system. System equipment upgrades may be needed.

The Akhiok public water system does not provide an effective barrier to pathogens. Because no coagulant is added prior to the single operational filter, the filter's efficacy is seriously compromised. Chlorine is added for disinfection. Chlorine's disinfection is time dependent. Chlorine concentration is required to be measured at or prior to the first service. At the first service in the Akhiok system, the chlorine has not been in contact with the water for a sufficient amount of time to be significantly effective at inactivating cysts and viruses.

This is a summary of your treatment system status. It is intended to provide a starting point for those systems that may have treatment issues or who may be considering future community needs. Please contact me for more information on this inspection or to discuss the treatment credits that you were granted. By working with the public water systems, we hope that together we can enhance the public health protection provided by your water treatment system. Thank you for your help in conducting this important assessment.

If you have any questions regarding the Status Component Inspections, please call me in Anchorage at 269-6064 or using our toll free number, 1-866-956-7656. You can also reach me via email at william.tyrell@alaska.gov.

Sincerely,

William Tyrell, P.E.
Environmental Engineer

Attachments: Treatment Status Summary
Photo log

Cc: Dan McCoy, Akhiok Public Water System
Steve Evavold, DEC Operations Assistance Program, Anchorage
David Edmunds, DEC Drinking Water Program, Anchorage

State of Alaska Department of Environmental Conservation
Drinking Water Program

PUBLIC WATER SYSTEM
TREATMENT STATUS SUMMARY

SYSTEM INFORMATION: Akhiok (250037), Akhiok, AK
Inspection Date: 04/28/10

Population Served Community / NonTransient Non Community / Transient	**90 / 0 / 0**
Filtration Type	**Alternative**
Max Filtration Flow Rate (gpm)	**18**
Filter Operation	**Continuous**
Number of Filters in Service	**1**
Filter to Waste	**NA**
Inactivation Type	**Chlorine**
Peak Hourly Flow (gpm)	**30**
***Total CT Water Storage (gal)**	**73**
***CT Baffle Factor**	**1**
***Total Inactivation (CT) Ratio at Visit (actual minutes /required minutes)** 7.3 (C), 7.1 (pH), 0.34 (mg/l)	**0.02**
* CT calculations apply to systems using chlorine or ozone for disinfection of *Giardia* or viruses.	
Master Meter Date Verified	**04/28/10**

Comments:
No coagulant added. CT volume based on plug flow in pipe; assumes first customer is Clinic and approximately 200 feet and ID of pipe is 3 inches

TREATMENT CREDITS

Filtration Credit – *Giardia / Cryptosporidium*	**0 log**	*minimum 2 log required for filtration only*
Total Inactivation Credit – Virus	**0 log**	*minimum 4 log required*
Total Inactivation Credit – *Giardia*	**0 log**	*minimum 0.5 log required for inactivation only* *minimum 3 log required for total of filtration+ inactivation*

STATUS COMPONENT SCHEMATIC DATA COLLECTION FORMS

PWSID AK2 250037

Water Systems Name Akhiok

Inspector W. Tyrell, P. Gabbert, + S. Lodoral Date 4/28/10

System Representative (s) Dan McCoy

Phone Number 836-2219 Fax _____ Email _____

Approval to Construct? _____ Operate? _____ As-Builts Available? No

Master Meter Installed Yes Where? (indicate on schematic) After filter + before chlorination

Average Daily Flow 20,000 (summer) 22,000 (winter) GPD in winter the pumps are left on for freeze protection

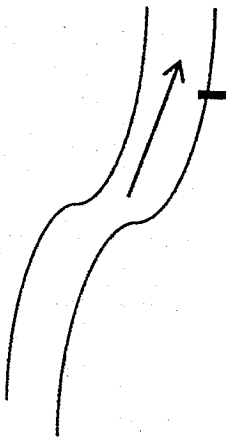
Water System Description, on separate sheet provide system schematic.

Earthen dam reservoir
Transmission main 4" PVC
2 parallel booster pumps
One sand filter (bypass available)
LMI - Calcium Hypochlorite (for swimming pools)

Population 79
Syst build ~1978

SOURCE

River or Creek



Source Name

_____

Pump Capacity _____ gpm
Surface Intake or Infiltration Gallery?

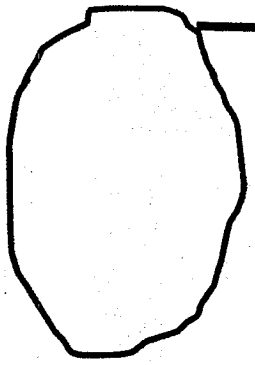
_____

Transmission Line _____ ft
Diameter _____ in
Material _____
Comments _____

_____

_____

Lake or Pond



Source Name

_____

Pump Capacity _____ gpm
Surface Intake or Infiltration Gallery?

_____

Transmission Line _____ ft
Diameter _____ in
Material _____
Comments _____

_____

_____

GWU Well

Source Name

_____

Pump Capacity _____ gpm
Transmission Line _____ Ft
Diameter _____ Ft
Material _____
Dist to SW _____ Ft
Comments _____

_____

_____

_____

T = 7.3 °C
Turbidity = 0.72 NTU
pH = 7.1

Other Earthen Dam Reservoir

Source Name

_____

Pump Capacity ___ gpm Gravity
Transmission Line 1250 Ft (per ANTHC rep
Diameter 4 inch ~~Ft~~
Material PVC
Comments _____

_____

_____

_____

_____

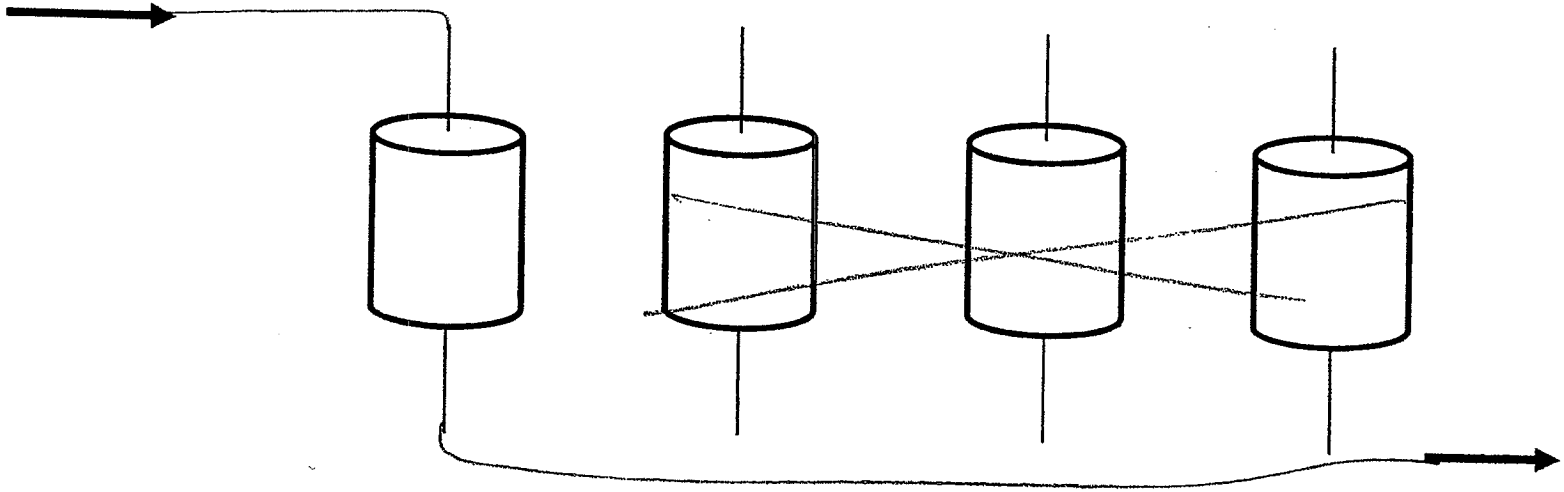
DIRECT FILTRATION – MEDIA FILTERS

1st STAGE FILTRATION

Number of Filters 1 (a second filter is out of service)
Filter Diameter 4 feet
Media Type Sand
Depth ~3 feet to top of sand (vessel 6')
Last Inspect/Replace ~2006
Filter to Waste? Yes
Surface wash /Air scour No

2nd STAGE FILTRATION

Number of Filters _____
Filter Diameter _____
Media Type _____
Depth _____
Last Inspect/Replace _____
Filter to Waste? _____
Surface wash /Air scour _____



SCD Make & Model No
Turbidimeter make & model: Raw Hach 2100 P Handheld CFE _____
Recorder make & model: Raw None CFE _____
Brief description of filtration system Single sand filter w/solo valve
Raw water turbidity = 0.58 NTU @ WTP

Max Filtration Rate (From Operator Log or Design Info) Unk gpm
Can filtered spikes above 2 NTU be recorded No continuous measure
Description of backwash type and source of water (raw, filtered, potable) Raw water from source

On separate page please provide information regarding all chemicals used.

- On the schematic please indicate the location of the following:
- SCD
- Site of chemical addition
- Piping
- Pressure gauges
- Static mixers
- Water meters
- Raw turbidity measurement site
- CFE turbidity measurement site

CHEMICAL ADDITION

Chlorine Disinfection for CT

Temperature _____

pH 7.1 @ WTP

Free Cl Residual 0.34 @ operator's home

Flow Rate 87 ~~gpm~~ speed
77 stroke

Other Disinfectant _____

Temperature _____

pH _____

Residual _____

Sequestering Agent

Name _____

Name _____

Coagulant

Name _____

Name _____

Filter Aid

Name _____

Name _____

Fluoride

Name _____

Name _____

Other

Name _____

Name _____

Other

Name _____

Name _____

Anti-Scalent

Name _____

Name _____

Flocculant Aid

Name _____

Name _____

Comments Contact time only provided in water main between Chlorine injection + first customer

OTHER?

Information on other status components 42 psi to distribution
WTP using GPS N 56.94558 W 154.17288 Elev 68' Accuracy 11.2m
Waypt 21
Turbidity after treatment = 0.5 NTU

Schematic:

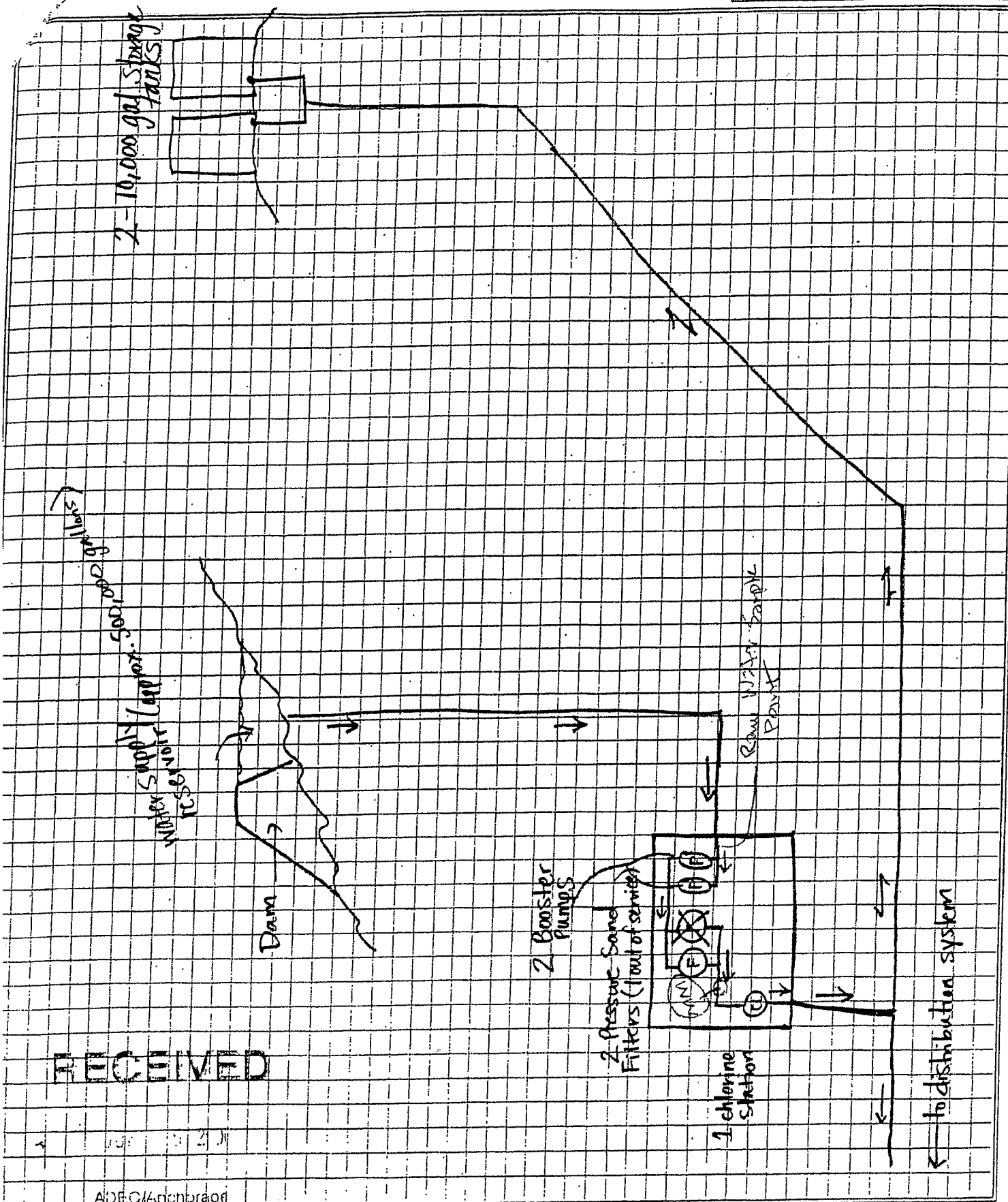
Schematic

WTP diagram, Membrane, UV, Ozone, Other

See attached

R SYSTEM OVERALL SCHEMATIC

052306 250037



RECEIVED

ADEC/Anchorage
Environmental Health

PLEASE INCLUDE NORTH ARROW, SCALE, AND ANY NEARBY BUILDINGS OR ROADS. PHOTOS ATTACHED? [X] YES [ ] NO

W - WELL
SP - SPRING
RES - RESERVOIR

CL2 — CHLORINATOR
PT — PRESSURE TANK
WH — WELL HOUSE

SB — SPRING BOX
X — VALVE LOCATION
H — HYDRANT

WHITE—FILE YELLOW—DATA ENTRY PINK—WATER SYSTEM

Page 8 of 8

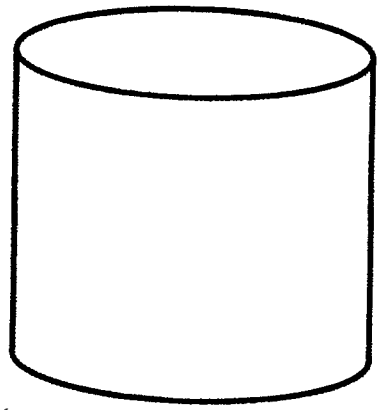
(rev. 8/93)

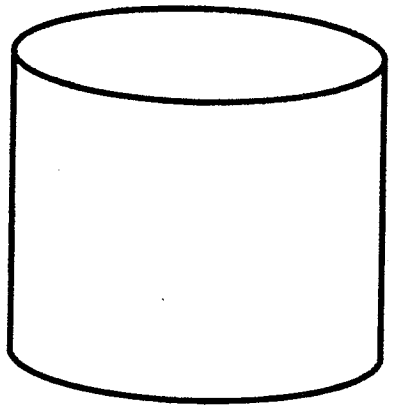
Storage & Disinfection Tanks for CT

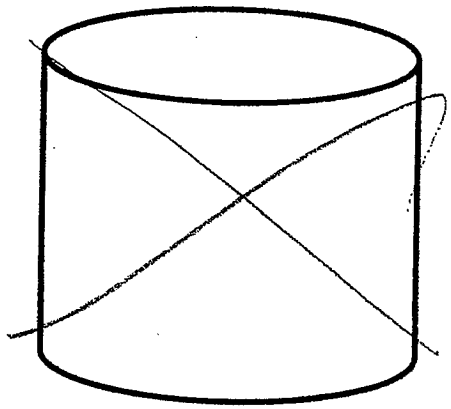
Tank # or Name _____
Volume 10,000 gal
Height _____ ft
Diameter _____ ft
Minimum Level NA ft
Baffle Factor NA
Assigned by? _____
Max hourly flow _____
Water Type? Raw _____
Filtered _____ Potable X

Tank # or Name _____
Volume 10,000 gal
Height _____ ft
Diameter _____ ft
Minimum Level NA ft
Baffle Factor NA
Assigned by? _____
Max hourly flow _____
Water Type? Raw _____
Filtered _____ Potable X

Tank # or Name _____
Volume _____ gal
Height _____ ft
Diameter _____ ft
Minimum Level _____ ft
Baffle Factor _____
Assigned by? _____
Max hourly flow _____
Water Type? Raw _____
Filtered _____ Potable _____

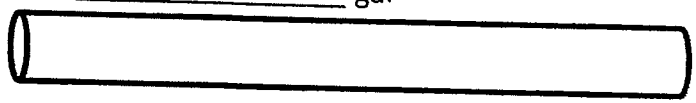






On the above schematic please indicate the location of the following:
- •Piping between tanks
- •Piping within tanks
- •Indicate if used for:
  - CT or storage only
  - Overflow level
- •Baffle configuration
  - •Inlet
  - •Outlet
  - •Internal walls
- Sample Taps

Plug Flow: Length _____ Dia _____
Volume _____ gal



Comments Tank levels are not controlled. When they fill they overflow to daylight drain. No CT assigned
steel bolted

DEC Drinking Water Program
Status Component Information

Office Preparation

****System Name:**	Akhiok
****PWSID:**	2250037
System Location:	Akhiok
Population Served:	79
SDWIS Violations:	Monitoring Violations (No operator reports from March to December 2009)
Operator Level Required:	Small Water System Treated
Boil Water Notice (last 3 yrs):	On long-term BWN
Date of Last CPE / CTA / Filter Assessment:	
Regulated Type (Govt, Company, Homeowner, Non-Profit):	Government

Field Verification

PWS Classification:	Community
Dates Water Provided to the Public:	Year round
Dates Water Treated:	Year round
**** Average Daily Flow (mgd):**	0.02 (summer) 0.027 (winter)
****Master Meter?**	Y
Treatment Operation: Continuous / Discontinuous / Fill-And-Draw	Continuous
Highest Operator Certification (at time of inspection):	P
****Did the system receive construction or operational approval?**	
****Was the system constructed as approved?**	

Final Determination Summary

Does this system have system-wide approval? Y / N / Maybe

Filtration Credit
- **Total Filtration -- Giardia:**
- **Total Filtration -- Crypto:**
- **Total Filtration --Virus :**

Inactivation Credit
- **Total Inactivation -- Giardia:**
- **Total Inactivation -- Crypto:**
- **Total Inactivation -- Virus :**

*** Info is included on the schematic fill-in-form, and is summarized here for data entry.*

Photograph 1: Akhiok from shore

Photograph 2: Water Treatment Plant

Intake
Structure

Photograph 3: Source

Photograph 4: Intake Structure at source

Photograph 5: Raw water sample tap

Photograph 6: Working sand filter (left)

Photograph 7: Chlorine tank and injection point

Photograph 8: CFE sample tap (hose)

Photograph 9: Storage tanks