95% Draft Preliminary Engineering Report
Water Treatment Plant and Washeteria
Tununak, Alaska


Photo of Washeteria, Credit BEES 2015

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This document, entitled Preliminary Engineering Report Water Treatment Plant and Washeteria Tununak, Alaska was prepared by Stantec Consulting Services Inc. (“Stantec”) for the account of the Native Village of Tununak IRA Council and Alaska Department of Environmental Conservation (ADEC) Village Safe Water Program (VSW (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in consideration of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

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Abbreviations and Acronyms

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ANTHC	Alaska Native Tribal Health Consortium
AVCP	Association of Village Council Presidents
BEES	Building Energy Efficiency Standard
BGS	Below the Ground Surface
BIA	Bureau of Indian Affairs
CWS	Community Water System
CFR	Code of Federal Regulations
DBPs	Disinfection By-Products
DNR	Alaska Department of Natural Resources
EIT	Engineer In Training
EUL	Expected Useful Life
FBRR	Filter Backwash Recycling Rule
FTH	Flush Tank Haul
GPCD	Gallons per Capita per Day
GPM	Gallons per Minute
HAA5s	Five Halo Acetic Acids
hdpe	high density polyethylene
IBC	International Building Code (used by Alaska State Fire Marshal)
IRA	Indian Reorganization Act
LCR	Lead and Copper Rule
LKSD	Lower Kuskokwim School District
LT2ESWTR	Long-Term 2 Enhanced Surface Water Treatment Rule
mg/L	Milligram per Liter
MCL	Maximum Contaminant Levels
MPH	Miles per Hour
MWH	MWH Global Engineering Company acquired by Stantec Consulting, Inc. in 2016
NPV	Net present value
NTU	Nephelometric Turbidity Units
O&M	Operations and Maintenance
pe	polyethylene
P.E.	Professional Engineer
PER	Preliminary Engineering Report
PSF	Pounds per Square Foot
PWS	Public water system
PWSID	Public Water System Identification
pvc	polyvinyl chloride
P&L	Profit and Loss Statement
RAA	running annual average
RAVG	Rural Alaska Village Grant
RMW	Remote Maintenance Work Program
RUS	Rural Utility Service
RV	Residual Value
SWTR	Surface Water Treatment Rule

SHPO	State Historic Preservation Officer
Tununak	Native Village of Tununak, Tununak IRA Council
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDA-RD	U.S. Department of Agriculture-Rural Development
USEPA	U.S. Environmental Protection Agency
TTHMs	Total Trihalomethanes
USFWS	U.S. Fish and Wildlife Service
USPHS	U.S. Department of Public Health Service or the U.S. Health, Education, & Welfare Department
USPW	Uniform Series Present Worth
VSW	Village Safe Water
WTL	Water Transmission Line
WST	Water Storage Tank
WTP	Water Treatment Plant
YKHC	Yukon-Kuskokwim Health Corporation

Foreword

This Preliminary Engineering Report (PER) will cite previous reports from various agencies, Stantec Technical Memos from 2018, Stantec Environment Review, Tununak Financial Records, and drawings from 1980 and from 1995. These sources are included in Appendix D for this PER are MWH, Stantec, RMW, and ANTHC reports for the assessment of this project. Some of these documents will also have other studies or reports included in the appendix for that document that should be reviewed for pertinent content. For improved readability, the sources that are cited multiple times will be called out in the report as:

Acronym	**Title, Topic, Location**
ANTHC 2012	ANTHC 2012 "*Comprehensive Energy Audit for Tununak Water Treatment Plant & Well House*". Report in Appendix D.1.1
ANTHC 2018	September 4, 2018 Memorandum "*Trip Report, Tununak-Water Treatment Plant and Washeteria Training Trip for Best Practice Scores-August 21-22, 2018*" The document includes utility conditions, system needs, and operational requirements. Report in Appendix D.1.3
MWH 2010	MWH December 2010 "*Report on Site Conditions and Recommended Plan of Action For Sanitation Improvements in Tununak, Alaska*" gives a base assessment of the Tununak Washeteria, WTP, infiltration gallery and community needs in 2009 and 2010. Report in Appendix D.2.1
RAVG 2017	September 4, 2018 Review of the 2012 Energy Audit, assess training needs, and identify deficiencies of system. Report in Appendix D.1.3.
RMW 2018	October 9-11,2018 Maintenance and training trip. 50,000 gallon water storage tank was emptied and cleaned. Report located Appendix D.1.4.
Stantec Tech Memo	Four Technical Memorandums Assessing the Existing Septic, Assessment of Existing Water Transmission Line, Structural Assessment of WST, and Source Assessments. Memos are located in Appendix D.2.2.
1980 As-builts	1980 Record Drawings, *"Construction Plans Sanitation Facilities Tununak, AK"* The signed As-Built record for the original Tununak Water, Septic, and Washeteria project completed between 1978-1980. Report in Appendix D.3.1.

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1.0 PROJECT PLANNING

The Native Village of Tununak, (Tununak IRA Council and herein referred to as Tununak), in cooperation with the Alaska Department of Environmental Conservation (ADEC) Village Safe Water (VSW) retained Stantec Consulting Service, Inc. (Stantec) to prepare this Preliminary Engineering Report (PER) with funding from the United States Department of Agriculture Rural Development (USDA-RD). This PER has been prepared in accordance with USDA-RD Rural Utilities Services (RUS) Bulletin 1780-2, dated April 4, 2013. All cost estimates in this document are based on 2020 dollars.

The purpose of this PER is to identify, evaluate and recommend a washeteria and water treatment plant (WTP) that will best serve the community with a safe, reliable, and affordable laundry facility and potable water for hygiene use and drinking water for many years. Tununak would like to eventually have adequate sanitation in their homes. This PER evaluated a 42 year old washeteria and water treatment plant that is currently serving the community of Tununak.

The washeteria and WTP has experienced significant degradation over the past two decades and will require replacement or renovation to meet the needs of the community. The washeteria is marginally functional with inadequate laundry equipment and no bathrooms with showers. The water treatment plant needs a new treatment system that can produce finished water that meets the U.S. Environmental Protection Agency (USEPA) Surface Water Treatment Rule (SWTR). This PER included an assessment and analyses of alternatives for upgrading or replacing the water treatment plant and washeteria that would best serve and meet the long term sanitation needs of Tununak.

1.1 LOCATION

Tununak is located in western Alaska on the northwest coast of Nelson Island along the eastern coast of the Bering Sea. The village is about 519 miles west of Anchorage and approximately 115 miles northwest of Bethel at approximately 60.5862° North Latitude and -165.2514° West Longitude. The community is located within Sections 21, 27 and 28, T06N, R91W, Seward Meridian, Alaska.

The community of Tununak is comprised of two residential areas: the original village (original Townsite herein known as original village) where most of the community is located on a narrow spit of land between the Tununak River and Tununak Bay (Bering Sea), and the new developed community area (new village or new Tununak) that is located on higher ground on the east side of Tununak encompassing primarily of the 23 homes in the Association of Village Council Presidents (AVCP). New Tununak includes the Yukon-Kuskokwim Health Corporation (YKHC) health clinic, the Lower Kuskokwim School District (LKSD) Paul Albert High School and the existing washeteria and WTP. The new village is located on the North Fork of the Tununak River at the base (foothills) of the Ugchirnak Mountains.

Tununak is only accessible by aircraft and watercraft and is not linked to a road system. Snow machines or 4-wheel ATVs are used to travel overland via trails to nearby villages. During open water times of the year, boats are used to travel along the Bering Sea to the water accessible villages. Ocean going barges

transport cargo to the village during the short summer months. The State of Alaska owns and operates a 4,000-foot-long gravel airstrip in the southeast section of the village that has scheduled weekday air services. Gravel roads and wooden board walks connects areas of the village with an upgraded gravel road connecting new Tununak with the airport. Figure 1 shows Location and Vicinity map for Tununak.

Figure 1 Vicinity and Location Map of Tununak

Source Google Earth Pro 3/1/2020

1.2 ENVIRONMENTAL RESOURCES PRESENT

1.2.1 Topography

The area surrounding Tununak is dominated by the Tununak Bay with the Bering Sea to the west, Tununak River to the south and Ugchirnak Mountain to the east. The washeteria and WTP are located on higher ground, approximately 30 feet above mean sea level, in the eastern portion of the community, overlooking the original village located on the sandspit a few feet above the sea level. Local topography surrounding the washeteria and WTP is relatively flat with the project site gently increasing in slope in a northeast direction.

1.2.2 Geology and Soils

The soil on the sandspit underlying the original village is primarily permafrost free sand deposits. Soils in the Tununak area are underlain by discontinuous permafrost. Conditions vary considerably from the toe of the Ugchirnak Mountain foothills to the Tununak River. There is very high ice content in organic soils blanketing the area that are susceptible to thaw-induced instability.

In 1978, the U.S. Department of Public Health Service (USPHS) completed a geotechnical investigation for the design of the existing washeteria and WTP. The USPHS noted the following subsurface soil conditions:

- silty sand and cobbles found from 1 to 2 feet below the ground surface (BGS)
- slightly silty sand and gravel found from 2 to 3 feet BGS
- slightly silty sand from 3.1 to 4.3 feet BGS
- bedrock was encountered in one of the test holes at a depth of 4.3 feet BGS while the other test holes did not encounter bedrock to a depth of 7 feet BGS.

The soil test borings encountered frozen soil with evidence of ice in the entire soil strata which was indicative of permafrost since the extent of the frozen soil exceeded the depth of the annual seasonal frost.

A second geotechnical investigation in 1979, was completed on LKSD's proposed site for the Paul Albert High School. Three soil borings were drilled across the site and ground water was not encountered in any of the soil borings to a maximum depth of 19.5 feet. The subsurface soils primarily consisted of ice rich silty gravel extending to a depth of 13 to 16.5 feet and underlain with fractured bedrock.

A sanitation feasibility study was completed in 1993 for Tununak describing the general soil characteristics in the project area as consisting of mostly peat, silts, and clays, with permafrost occurring between 2 and 7 feet below the surface.[1] The feasibility study noted a shallow ground water table was encountered within the active soil layer above the permafrost in the low lying areas located outside of the washeteria project area.

1.2.3 Floodplains

Flood Insurance Studies or Flood Insurance Rate Maps do not currently exist for Tununak. Longtime residents have reported flooding only occurs in the original village on the sand spit due to storm-driven waves in combination with high tides to a maximum height of approximately 6 inches above the ground surface of the sandspit.[2] The project area for the washeteria and WTP is approximately 400 feet away

[1] Phukan Consulting Engineers and Associates Inc, *Sanitation Feasibility Study and Environmental Review*,1993
[2] Phukan, 1993

from the north fork of the Tununak River and is located on higher ground that is approximately 20 to 25 feet above the river and sand spit. According to residents the project area has not been susceptible to flooding in the past. The U.S. Army Corps of Engineers (USACE) rates the flood hazard at Tununak as low average.[3]

1.2.4 Water Quality

The existing system uses a shallow infiltration gallery (the village refers to this structure as the pump house or well, herein known as gallery) installed in 1978 under a project lead by the USPHS in Unnamed Creek. The gallery consists of a 9-foot deep, 24-inch diameter perforated steel culvert pipe, constructed in the middle of the creek. The gallery is located inside a small 8-foot by 8-foot well house that is located approximately 900 feet east and downhill of the existing washeteria and WTP as shown on Figure 2 (Tununak Site Map) that is presented in Section 2.1.

The current system does not provide adequate source protection with identified vulnerabilities to biological contamination from its close proximity (less than 100 feet) to existing homes and dog yards upstream of the infiltration gallery. Some residents have previously expressed concern about the purity of the WTP's treated water from Unnamed Creek. Multiple boil water notices issued by ADEC for the system show there are historic operation and performance issues that need to be addressed.

1.2.5 Wetlands

Tununak is not in the U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory. Based on available aerial and ground photography provided by community members in 2009, the ground surrounding the existing washeteria and WTP appears to be disturbed. Evidence of saturated soil, hydrophytic vegetation, and hydrology are not visible. In lower areas outside and further west of the washeteria project area, vegetation appears to grow on tussocks. Snow machine tracks have scarred the tundra, showing evidence of darker, possibly wet soils underneath. It is likely wetlands occur within undisturbed tundra outside the project area, but that areas immediately adjacent to the existing washeteria and WTP are highly disturbed and appear to be better drained. The USACE must be consulted should any proposed activities occur outside of previously disturbed lands adjacent to existing structures within the project area.

1.2.6 Groundwater Sources

The LKSD Tununak Paul Albert HS water well (PWSID # AK2270613) is the only groundwater source being used in the community. The well is a 38 foot deep well drilled on the sandspit in 1964 by the U.S. Bureau of Indian Affair's (BIA) for the local BIA school. The geologic log for the School Well indicates that the unconfined groundwater table is normally 10 feet below ground surface, (MWH 2010 Report Appendix D.2.1). The ground surface at the school well is approximately 5 to 10-feet above the sea level and is approximately 15 to 20 feet lower than the ground surface at the washeteria and WTP. The school well

[3] Alaskan Community Flood Hazard Pertinent Data, 1977

was determined to be under the influence of surface water and is classified by ADEC as a community water system (CWS) Under the Direct Influence of Surface Water with a potential 1 mile area that can directly affect water quality. There are currently three active contaminated sites within 800 foot radius of the school well according to the ADEC Contaminated Sites Database. The LKSD owns and operates the Tununak School Well and water treatment plant which is permitted under the ADEC Public Water System (PWS) AK2270613. In 2015 the LKSD upgraded the water treatment plant to comply with all of the ADEC water quality requirements.

For over 10 years, the LKSD has provided a public watering point at their water treatment plant. The water from the LKSD BIA School Well is used as the primary drinking water source by the community at no charge. Community users haul water to their residences. Also, the Village of Tununak uses the watering point to haul water for the community's flush tank haul water and sewer system.

More recently, in the summer of 2019, Stantec directed the drilling of a 6-inch diameter steel cased exploratory well that was drilled to a depth of 180-feet. The drilling of the exploratory well was funded under a grant from the USDA-RD Program that was administered by the VSW for Tununak. The well was pump tested and determined to yield a minimum sustained flow of 50-gallons per minute (gpm) with excellent water quality characteristics. The well is located approximately 200-feet south of Unnamed Creek and approximately 100-feet west of the center of the recently constructed airport haul road as shown on Figure 2 – Tununak Site Map (provided in Section 2.1). The new well is located approximately 400-feet west of the infiltration gallery located on Unnamed Creek. Stantec prepared an engineering report dated October 16, 2019, that provides a detailed description of the new deep-water supply well. A copy of the engineering report is provided in Appendix D.4.1. In December 2019, Stantec filed a water rights application for the new deep water well on the behalf of the Village of Tununak with the Alaska Department of Natural Resources (DNR). The water rights application requested the DNR grant the village the right to use the deep water well to provide an estimated flow of 46,600 gallons per day (GPD). A copy of the water rights application is provided in Appendix D.4.2.

1.2.7 Endangered Species and Critical Habits

The community of Tununak including the project area is within the potential breeding range of the endangered Spectacled Eider; however, no critical habitat for this species has been designated in the washeteria area.[4] Consultation with the USFWS must take place to determine construction measures that may be implemented, if any, to avoid accidental takes of Eiders. Given that the project area is surrounded by development and is actively used by the community daily, it is not likely Spectacled Eiders would use the area for nesting.

1.2.8 Cultural Resources

There is little available information regarding potential cultural and historic resources present within or adjacent to the proposed project area for the existing washeteria, WTP, and associated water systems.

[4] USFWS IPaC Information for Planning Conservation website https://ecos.fws.gov/ipac/

While no visible surface resources were reported during a cultural resource survey conducted in 2000 immediately north of the proposed project area (resource classified), there is no record of any subsurface investigations having been completed in the project area. Depending on the level of disturbance proposed for foundations and utility installations, a cultural resource survey may be required prior to construction. The Alaska Department of Natural Resources Office of History and Archaeology must be consulted to determine measures to avoid impacts to cultural resources from construction of the preferred alternative.

1.3 GROWTH AREAS AND POPULATION TRENDS

1.3.1 Population Forecast

The population of Tununak has steadily increased from 327 reported in 2010 to a population of 362[5] as noted in the 2017 estimate from the Alaska Department of Labor, yielding a population growth of 10.7% in seven years. This equates to a recent population growth rate of 1.5% per year. In 2018, Tununak's population was 370 as reported by the Alaska Department of Commerce, Community, and Economic Development, Division of Community and Regional Affairs.

Tununak's annual growth of population has fluctuated between 0 - 0.9% over the past several decades[6], with a notably increased growth rate since 2010. While the future growth rate for Tununak cannot be accurately forecasted, it is reasonable to use the general Bethel Census Area population projections. Tununak currently comprises 2.0% of the Bethel Census Area population. The Bethel Census Area is currently projected to maintain a 0.87% growth rate until at least 2040. Using linear extrapolation of the State's population projections, the population of Tununak in the design year 2040 is estimated at 447 people. Population information and calculations are presented in Appendix C.

1.3.2 Growth Areas

Community growth will be probably be predominantly residential. New housing would probably be located on building sites located to the east of the existing washeteria and WTP in new Tununak.

1.4 COMMUNITY ENGAGEMENT

The Tununak Traditional Council was awarded a grant in 2008 from USDA and the State of Alaska for the development and preparation of a sanitation facilities master plan. The master plan was to evaluate and assess the possible upgrade or replacement of the existing washeteria and associated facilities that included a water treatment plant, a water storage tank, and a laundromat with bathroom and shower facilities. In 2010, MWH Global Engineering Company (MWH), was hired by the Tununak Traditional

[5] Alaska Department of Labor online database.
[6] Alaska Department of Labor and Workforce Development Research and Analysis.

Council in cooperation with the VSW program to investigate the condition of the existing sanitation facilities serving the community of the Tununak.

MWH issued a report December 2010 on their preliminary findings, titled *Report on Site Conditions and Recommended Plan of Action for Sanitation Improvements in Tununak, Alaska*, Appendix D.2.1. The report provides a photo log of the site conditions observed during the MWH site visit. Additional photos of the existing washeteria and WTP and aboveground utilidors to the school and health clinic are provided in Appendix E.

MWH and VSW's on-site assessment of sanitation facilities in Tununak included engaging the community in a two hour long public meeting, May 2010. The meeting was attended by more than 56 residents and noted to be one of the largest public turnouts ever recorded for a community meeting in Tununak. Valuable information concerning the residents' desires, experiences, and frustrations with the existing sanitation facilities was collected during the public meeting.

As a follow-up to the May 2010 public meeting, a sanitation questionnaire prepared by MWH with input from VSW was sent to all the households in Tununak. The results of the questionnaire provided valuable information on the community's position on sanitary issues. The questionnaire had an excellent return rate that represented nearly 75% of the residential population in over 60% of the housing units. Most of the respondents did not want an expansion of the Flush Tank Haul (FTH) system that served the homes in the new village, nor did they want to pay more than about $60/month for piped water and sewer service. The majority of the residents favored a new community washeteria that included laundry and public bathrooms with shower facilities.

In 2016, the Tununak Traditional Council signed a quitclaim deed that conveyed all its assets and liabilities with rights and titles to the Native Village of Tununak IRA Council. A copy of the quitclaim deed is provided in the Appendix D.5.1. On January 9, 2015, the Native Village of Tununak approved a resolution (Appendix D.5.3) that supported the plan for a new washeteria and water treatment plant to serve Tununak.

From 2017 to present, Stantec has participated in several teleconferences with VSW staff and key personnel from Tununak who included James James (Administrator), Xavier Post (Administrative Assistant), and Josephine Hooper (resident of Tununak). These individuals provided information and photos on the current conditions of the washeteria and WTP. Part of the information gathering process includes Tununak providing copies of their written records on the cost of operating the washeteria and WTP from 2014-2016, and income from the washeteria from 2009-2016. Additional financial information for the operation of Tununak's water and sewer services including the operation of the washeteria in 2019 was provided from Tununak's accountant MDM Financial Management, LLC.

In 2018 and 2019, Stantec made site visits to Tununak to conduct field work (site assessments and drilling of the exploratory well). During the site visits, Stantec met with Tununak administrative staff and had opportunities to assess the physical and operational conditions of the washeteria and WTP, inspected the infiltration gallery with pump house on Unnamed Creek and supervised the drilling of the exploratory deep water supply well.

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2.0 EXISTING FACILITIES

2.1 LOCATION MAP

Figure 2 provides a site plan that shows the layout of the existing washeteria and WTP with respect to surrounding developments in Tununak.

Figure 2 Tununak Existing Facilities Site Map

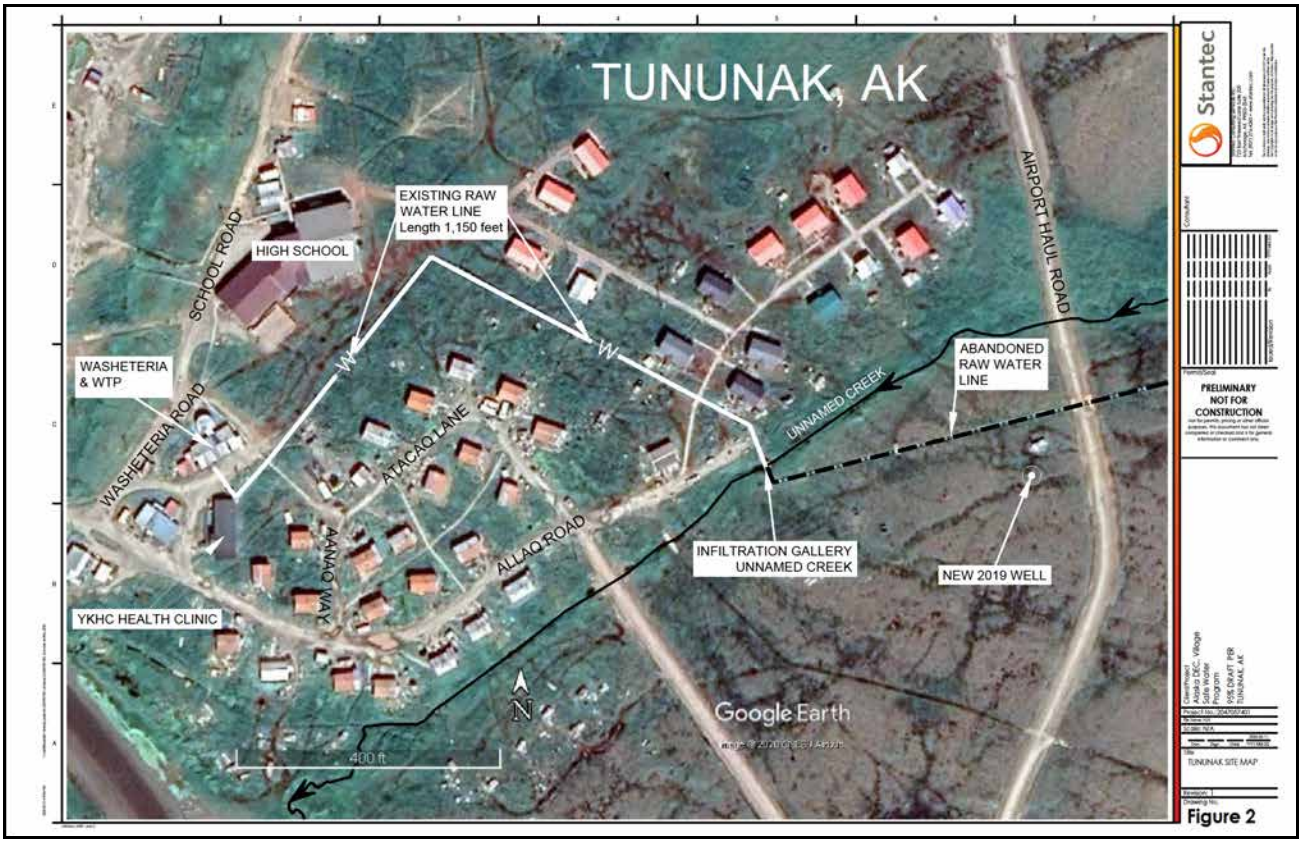

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Figure 3 provides a survey plat of the Tununak 2007 Subdivision. The location of the washeteria and WTP facility is shown on the plat map on Tract D-1A-1 in U.S. Survey 4028, Tununak Townsite which is owned by Tununak as conveyed in 2016 in the Quitclaim Deed, (Appendix D.5.1).

Figure 3 Tununak 2007 Subdivision Plat Map New Village, 11x17”

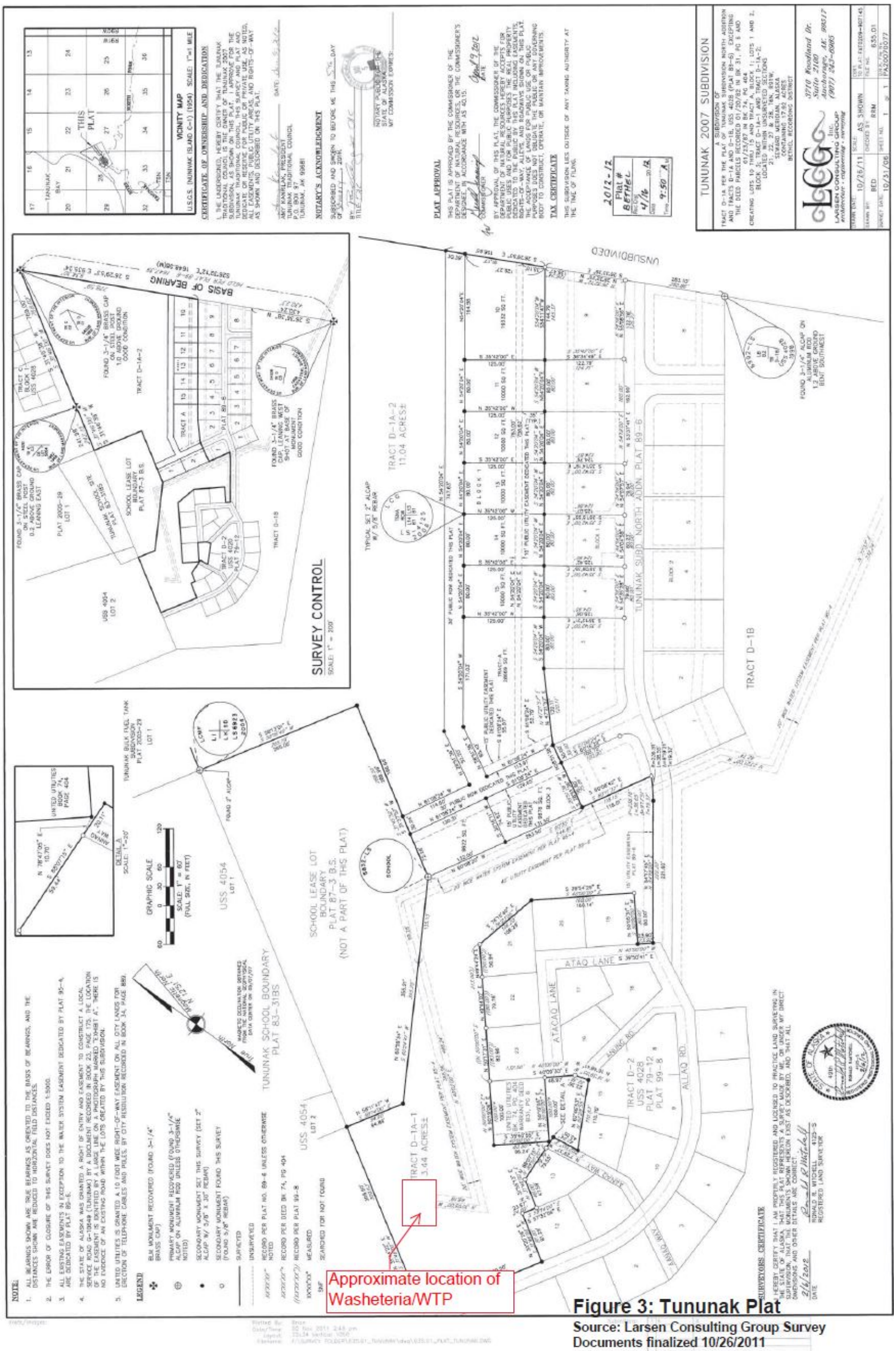

Figure 3: Tununak Plat
Source: Larsen Consulting Group Survey
Documents finalized 10/26/2011

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2.2 HISTORY

The washeteria and WTP were constructed as a combined use, single building in 1978 by the USPHS. The completed facility was based on a similar style to others designed and built by USPHS in that time period throughout many rural Alaskan communities. As-built drawings of the completed washeteria and WTP are provided in Appendix D.3.1. The washeteria and WTP is a single story building that is 32-feet wide by 64-feet long (2,048 square foot area) with spaces dedicated to:

- A washeteria with four 20 lb. washers and two 50 lb. electric dryers.
- Two public bathrooms (men's and women's) each housing one toilet, one sink and two showers.
- A mechanical room with two oil-fired boilers, a hydronic heating system, domestic hot water generators, and a standby power generator.
- A water treatment room with a pressure filter, a backwash pump, pressure pumps, and a hydropneumatic tank.
- Treated water from the WTP is pumped into a 50,000-gallon water storage tank (WST). The WST was also constructed in 1978 and is connected via an aboveground insulated utilidor to the WTP building.
- A bunkhouse room.
- A kitchen/laboratory/office

The original water distribution system was designed and constructed to circulate water to several public watering points on a community distribution system that serves the original Village of Tununak located along the sandspit. All of the watering points on the distribution system have failed and were subsequently abandoned. A public watering point was also constructed on the south side of the WTP but has been abandoned and removed due to operational problems.

2.3 CONDITION OF FACILITIES

2.3.1 Water Treatment Plant

The existing WTP was constructed over 40 years ago by the USPHS and needs complete renovation to stay in service. The treated water from the WTP does not meet current ADEC drinking water regulations for SWTR (see requirements in Section 4.2.2). During the past several years, the ADEC drinking water program regulators noted multiple serious deficiencies with the existing water treatment system; and therefore, had issued a long-term boil water orders to the community of Tununak that remain in effect to this day. Consequently, the water produced by the WTP is only used for non-drinking water purposes for the operation of the washeteria and bathrooms in the nearby health clinic.

The most of the equipment is not useable and is arranged in the same configuration when it was installed as shown on the as-built plan sheets 11 & 12 (see Figure 4 in Section 4.1.3) titled “Plumbing Schematic” prepared by USPHS for the Construction Plans for Sanitation Facilities, Tununak, Alaska, dated September 1980 (1980 As-builts) with the exception of some minor upgrades to filtration filters prior to 1995. The primary components of the WTP’s treatment processes are:

- Granular Media Filtration, 4-foot diameter pressure granular media filter with pressure filter backwash pump
- Injection of Fluorine (the system was in original design is no longer in use)
- Disinfection by Hypochlorination with a Chlorine injection system equipped with chemical pumps and mixing tanks
- 1 backwash sump for discharge water
- “Upstream” bag filter, nominal 5 microns (3M 500 LP Series filter, product #525A). Installed 1995.
- “Downstream” bag filter, nominal 1 to 3 microns (Wetco Filter HE Series filter, product #4200PYLOO555) installed in 1995.
- 2 pressure pumps and 2 water distribution circulating pumps with heat exchanger
- 1 620 gallon hydropneumatic pressure tank and 1 80 gallon hydropneumatic pressure tank (Well X Trol)
- 325 gallon hot water heater
- 2 boilers with hydronic water lines
- 2 water meters

On June 14, 2012, the ADEC issued Tununak a letter of determination that reclassified the community water treatment system to a non-public water system, because the system no longer had a bathroom, shower, or a watering point that could be utilized by the public and was no longer regulated as was Community Water System under 18 AAC 80. A copy of the ADEC determination letter is provided in Appendix D.4.3. This re-classification was determined as the washeteria did not have working shower or bathroom facilities and one operating washing machine. The WTP only supplied non-potable water to the nearby health clinic for toilets and flushing/cleaning purposes.

In March 2017, ANTHC conducted a Rural Alaska Village Grant Assessment (RAVG, Appendix D.1.2) that identified several non-compliant items on the water system that were considered potential health risks and safety concerns. Many of these water treatment deficiencies with the building and distribution system were documented during the MWH site assessment May 2010. Issues with the building having mold, insulation damage, exposed wiring, non-functioning equipment, building settling, blocked emergency exits, leaking underground septic pipes, broken windows, and sanitation facilities being inoperable were noted. Issues with the water system included proximity of a 300 fuel tank to the water treatment plant, malfunctioning heat trace for freeze protection, and inoperable pumps.

The Remote Maintenance Work Program (RMW) performed an inspection in Aug. 2018 and completed some system repairs in October of 2018. The RMW reports for both visits are in Appendix D.1.3 and D.1.4 respectively. RMW recommended replacement of the chlorinator from the vat to the injection point and replacement of the roof of the WTP building as several leaks were found throughout the building.

Reports conflict on if there is a working shower and toilet, there was not a working facility during the 2018 condition assessment by Bob Gilfilian, P.E. If the shower facility has been repaired, the Tununak infiltration gallery and WTP would be classified as CWS with ADEC because the system is community owned and the number of permanent residents that could use the facility is greater than 25.

2.3.2 Condition of the Washeteria

The Washeteria side of the building needs extensive repairs. Floors have hole caused by wood rotting through, concrete slabs within the building are noticeably sloped, there are plumbing issues, exposed wiring in common areas, and egress exits are permanently blocked. Some of the building's exterior issues were documented with a photo in 2009 then compared with ANTHC and Stantec condition assessment completed in 2018. Photo 1 has red arrows with numbers for seven issues on the seen from the northeast side of the building and they are:

1. Sealed/boarded over egress door on Water Treatment half of building.
2. Abandoned Watering Point
3. Board up window
4. Decaying, damaged, and missing siding. Siding needs to be sealed/painted. Foundation lower at corner than center of building.
5. Soil under foundation washing out under foundation cribbing.
6. Handrail unstable and requiring repair/replacement.
7. Missing Chimney Caps.

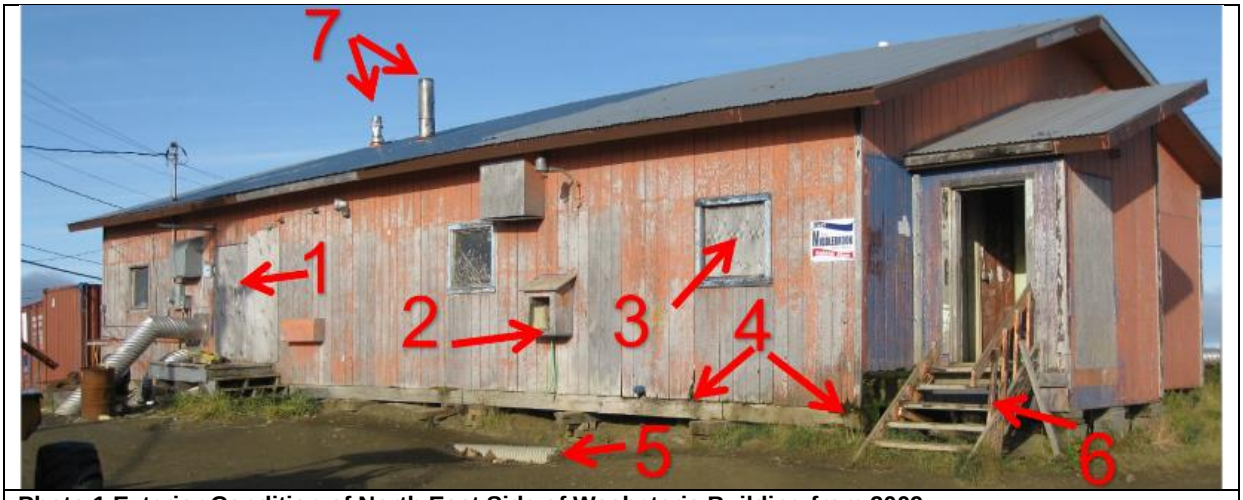

Photo 1 Exterior Condition of North East Side of Washeteria Building from 2009
Visual inspection of building finds a minimum of 7 items that need to be addressed. (File photo 9/24/2009)

Photo 2 is the same view of the Washeteria taken almost 8 years later as part of the Rural Alaska Village Grant (RAVG) assessment in March of 2017. All of the deficiencies present in 2009 are present in the 2017 photo. White arrows and numbers matching the callouts of the items identified in photo 1 that were not identified by the RAVG assessment. One chimney stack is shorter, the handrail at entrance of the washeteria is gone, more siding is missing and there are no longer stairs leading up to the boarded up mechanical room entrance on the east side of the building.

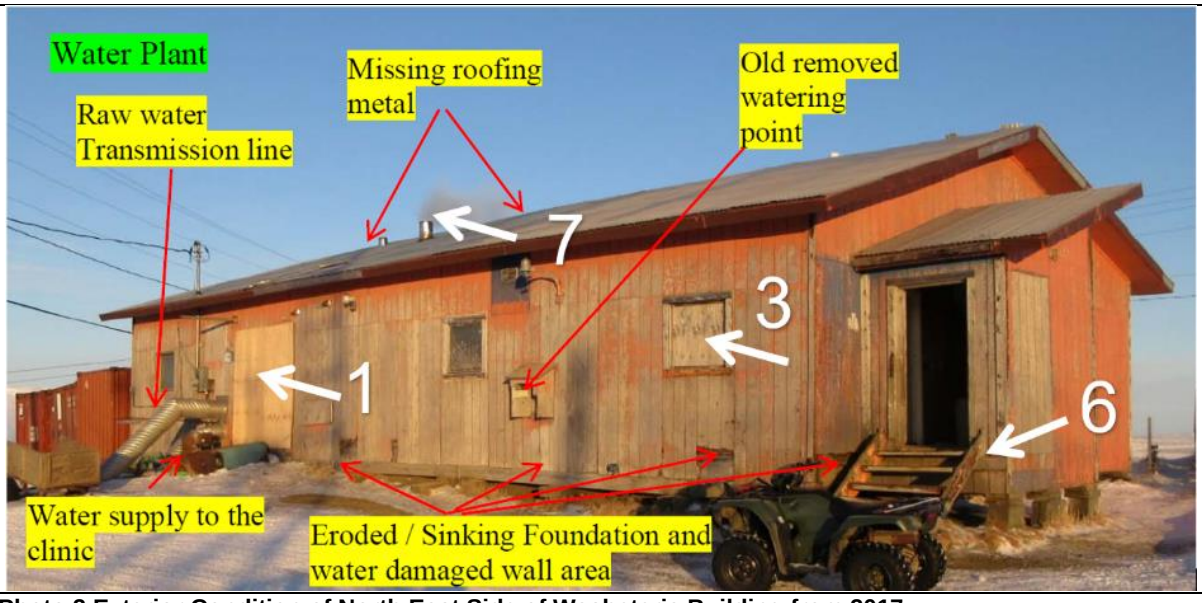

Photo 2 Exterior Condition of North East Side of Washeteria Building from 2017
Visual inspection of building finds a that the 7 items identified in the 2009 Photo were not addressed and the building condition continued to deteriorate further. (RAVG 3/21/2017)

There are issues that pose a hazard to the washeteria patrons. Missing and mis-wired light fixtures, a broken with the heating unit, and interior plywood walls so water damaged and dry rotted that a set of

blunt plyers can be pushed the through wood. Water damage from the roof leaking previously had caused the sheet rock to fall of the ceiling of the public hallway, leaving exposed wiring and mechanical piping components visible. The wall and floor rim joint on the SE side of the building was rotting (RAVG 2017).

Stantec completed an initial assessment in 2017 and a utility condition assessment in 2018, finding that every system almost inoperable due missing components, dangerous wiring, mold and decay involving the structure, and that all of the system would require extensive upgrades or complete replacement to bring the Washeteria back into a safe operational status. The current facility is not meeting the needs of the community and the limited laundry facilities are failing. The overall condition of the facilities is dangerous for both the patrons and the facility staff. Images 3-7 show conditions that are hazardous both inside and outside of the Washeteria as documented by Bob Gilfilian in June of 2018.

Photo 3 Rotting Floors
Plywood floor is rotting out next to toilet, hole circled in yellow. (Stantec 6/2018)

Photo 4 Shower Stall
There is an unfinished plywood floor with nail head protruding. It is unknown if the shower was operational. (Stantec 6/2018)

ANTHC completed an Energy Audit in September of 2018 (Table 1) of the facility which listed structural, plumbing, electrical, and operational issues throughout the building. Most notably was that the current electrical transformer for the facility is not sized correctly for the system if every system and appliance was repaired and replaced. The original energy audit by ANTHC in 2012 stated that during the winter dryer exhaust is venting into the building for supplemental heating because the ambient heat from the boiler was not enough to keep the space comfortable.

Images 3 through 7 show the conditions in 2018 of interior and exterior issues with the Washeteria.

		
Photo 5 Incorrect Plumbing of Washers Incorrect venting of washer septic drain line inside of building. Water supply line hooked up incorrectly. Large holes (Stantec 6/2018)	**Photo 6 Entrance to Washeteria is Unsafe** Railing is missing, stairs have need to be replaced, siding is heavily weather damaged. (Stantec 6/2018)	**Photo 7 Foundation Issue** Red Arrow, concrete floor is sloped. Wall has water damage. Black Arrow shows window that has been boarded over.

2.3.3 2018 Assessment of 50,000 Gallon Water Storage Tank

Treated water from the WTP is pumped to a 50,000 gallon water storage tank (WST). The WST is attached to the Washeteria and WTP via an insulated aboveground utilidor/manway as shown on Figure 4 (see Section 4.1.3). The WST is filled on an as needed basis dependent on the water usage in the Washeteria and the nearby clinic. The operators pump raw water via the water transmission line from the Unnamed Creek infiltration gallery to the WTP for treatment prior to pumping to the WST according to the WTP operator. Operator said that tank is normally filled approximately four times a year. Freeze protection for the WST is provided by foam board insulation sheathed in aluminum siding.

The structural integrity and usability/functionality of the WST and its foundation system was non-intrusively observed in June 2018 by Stantec. The interior of the tank was visually checked from the roof hatch to assess the tank's interior condition above the tank's water level. The observable portion of the tank foundation was assessed to the greatest extent possible. The inspection of the WST did not involve intrusive measurements of the tank material nor the foundation as destructive testing was outside of the contract scope. The findings and recommendations of the tank's assessment including photographs of the tank are reported in Stantec Tech Memo #3 (Appendix D.2.2) and summarized as follows:

- The exterior of the WST appeared to be in reasonable condition for a tank installed in 1978. On the northwest exterior side of the tank there are rust stains on the aluminum siding. The access

ladder to the tank is missing as well as a section of siding located just below the top of the tank. There was one small section of siding on the exterior of the tank that was missing siding, but the remainder of the exterior appeared to be intact and completely covered the underlying foam insulation. The overflow drain needs to be screened to prevent anything from nesting or crawling into it.

- Overall, the timber and high-density foam insulation board appeared to be in fair condition. The lumber members of the foundation visually appeared to be in good condition with no obvious signs of significant deterioration; however, some minor weather-worn sections of the exterior side panels on the lumber foundation were noted
- The exterior of WST's cover was checked for deficiencies and was found to be in fair condition, with small sections of foam insulation missing. There was a missing section of insulation over the roof hatch. The condition of the ladder cage at the tank top appeared to be intact and functional.
- The interior of the WST was visually checked via access through the roof hatch. The water surface in the tank was observed to have a considerable amount of floating debris that included an empty soda pop can, fragments of foam insulation, and rust particles. The tank's north side interior wall appeared to be in good condition above the water surface; however, the remaining exposed interior wall had obvious signs of surficial deterioration. The underside of the WST cover appeared to be in fair to good condition.

Photos 8-10 are photos taken of the Water Storage Tank in 2018.

		
Photo 8 Damaged Siding on Water Tank Missing access ladder and siding with exposed insulation circled in red. (Stantec 6/2018)	**Photo 9 Damaged Insulation** Roof insulation showing sun damage where missing protective paint has left it exposed. Insulation missing from hatch. (Stantec 6/2018)	**Photo 10 Missing Tank Lining** Interior condition prior tank cleaning. Tank lining is floating in water, outflow assemble is bent. (RMW 10/2018)

In October 2018, Allan Paukan, a YKHC Remote Maintenance Worker (RMW), completed a site visit to Tununak. On that site visit, he and the WTP operator emptied and cleaned the WST (RMW 2018). His trip report and findings showed that the lining within the reservoir tank has completely failed and will need to be replaced for the tank to meet potable water storage regulations. The red arrow in photo 4 is pointing to one of several pieces of tank lining floating at the bottom of the tank during the maintenance work. The tank lining is unrepairable, and tank will need to be relined for the system to be capable of storing potable water. Damage to the outflow assembly is also evident in the photos. The current condition of the tank will require further assessment to gauge where the conditions seen have compromised of the steel tank wall strength.

2.3.4 2018 Assessment of Wastewater Disposal System (Septic Tank/Drainfield)

Assessment of the operating condition of the existing septic tank and drainfield system serving the Tununak Washeteria and WTP was completed in June 2018 by Stantec. The purpose of the assessment was to provide recommendations for future use and/or corrective action for the septic tank system. The assessment of the existing septic tank system was based on conducting an adequacy flow test in accordance with the standards and procedures adopted by the ADEC.

There are two septic tanks, one is 4,000 gallons and one is 2,000 gallons arranged in a series flow. The manholes on the septic tanks were uncovered and inspected. Their locations and configuration matched the 1980's as-built drawings in D3.1, prepared by the USPHS. As shown on as-built plans from LKSD, in 2015 the school district constructed a separate, new replacement drainfield system that consisted of several buried Infiltrators™. Connected to the outlet of the 2,000-gallon septic tank is a sewage lift station that pumps effluent into the buried header pipe on the south end of the new drainfield system. A sewer pipe in the lift station is connected to the school's new wastewater treatment plant located to the west of the septic system which would be used as an emergency backup system in the event the school district's wastewater treatment plant had operational problems.

The findings and recommendations of the septic system's assessment including photographs of the surficial site conditions are reported in Stantec Tech Memo #1. Based on the findings of the adequacy test reported by Bob Gilfilian, P.E., in the Tech Memo, the existing septic tank and drainfield system serving the Tununak Washeteria and WTP appeared to be functioning properly and was determined to be adequate to serve the facility. The 4,000- and 2,000-gallon septic tanks will need to be periodically cleaned out to remove septage by the Village waste management workers with a vacuum tanker at least once every 3 to 4 years for the existing drainfield system of the four 125-foot long laterals of Infiltrators™ to handle the discharge of a minimum of 1,400 gallons of wastewater effluent per day.

2.3.5 2018 Assessment of Existing Water Transmission Line

The existing water transmission line (WTL) was built in two sections (zones). The original water transmission line was installed in 1978 by the USPHS for the purpose of supplying raw water from an infiltration gallery on Unnamed Creek (current water source) to the WTP. The original WTL installed by

USPHS was approximately 1,153 feet in length and consisted of a 2-inch diameter polyethylene (pe) pipe with a heat trace line that was located within a 4-inch diameter insulated Arctic pipe.

The second section (zone) was commissioned in 1995 when the WTL was replaced as part of a VSW and USDA-RD sanitation improvement project. The water line included replacement of the WTL from Unnamed Creek to the WTP and extended the water line approximately 3,000 feet to connect to a new infiltration gallery located at Muskox Creek. The Muskox Creek water source failed in 1997 and has since been abandoned. As a result, the community resumed water production from the infiltration gallery on Unnamed Creek which remains as the current water source for the washeteria and WTP.

The second section (zone) of WTL connected the pump house at Unnamed Creek infiltration gallery to the Washeteria and WTP building. The 1995 replacement WTL consists of two 2-inch diameter high density polyethylene (hdpe) water lines and a ¾-inch copper tubing heat trace line enclosed in an aboveground Arctic pipe utilidor that consists of a 6-inch diameter polyvinyl chloride (pvc) pipe (carrier) located within a high density insulated outer wall and 15-inch diameter aluminum jacket.

The WTL traverses above the ground surface supported by two types of foundation systems. Most of the WTL is supported on a timber foundation system but a small portion near the Unnamed Creek pump house is held on a wire rope suspension connected to steel screw-piles. The WTL has three insulated wooden access boxes for maintenance of to the water line which are located on 90 degree turns in the alignment of the pipeline.

There are two short, buried sections of pipe within the second zone. The first is the water supply line between the WTP and the health clinic. The second is a short section of buried water line between Access Box #1 and the WTP.

Photo 11 Failed Waterline Supports
Support has failed and is pulling waterline down. (Stantec 6/2018)

Photo 12 Waterline Sagging on Failing Supports
Supports are unstable and falling over, line has visible sagging. (Stantec 6/2018)

Stantec completed a visual assessment in June 2018 on the structural integrity and usability/functionality of the WTL and the foundation support system, including the water line turn boxes. The assessment involved a physical inspection of the visible components of the WTL to determine the usefulness of the WTL for serving the Tununak water supply system. The findings and recommendations of the WTL's assessment conducted by Bob Gilfillan, P.E., included photographs of the water line are reported in Stantec Tech Memo #2 and summarized as follows:

- The WTL was found to be barely functional as reported by the operator. Operational problems with the circulating glycol heat trace system historically has caused the water line to freeze up and requires considerable effort to thaw. On many past occasions, the operators had to wait over a week or two until they could receive assistance from YKHC RMW.
- The operators typically attempt to treat and fill the community 50,000-gallon water storage tank prior to the onset of winter. Most winters, the washeteria runs out of water which requires the operators to refill the tank with the WTL from the infiltration gallery.
- There are many sections on the WTL that have been repaired in the past as a result of line freeze up. Operators have inserted replacement glycol heat trace lines inside the Arctic pipe utilidor that has resulted in a "band-aid" repair effort that has compromised the integrity of the WTL.
- As shown in Photos 11-12, the failing condition of the timber foundation system supporting many sections of the WTL has caused water line to developed significant sags in the water line profile. The sags in the water line causes air entrapment and is difficulty for the operators to clear from the lines. Normally, the lines can only be the flushed when ambient temperatures are above freezing. The WTP operator has stated that the effort required for flushing with compressed air requires additional labor and can take more than a day to complete.

2.3.6 2018 Assessment of the Infiltration Gallery on Unnamed Creek

The current water source for the existing washeteria and WTP uses an infiltration gallery located in Unnamed Creek that was constructed in 1978 by the USPHS. A pump house structure encloses the infiltration gallery. A submersible well pump is used to pump raw water to the WTP for treatment prior to storage in the WST. The gallery remains in the same configuration as it did when it was installed in Unnamed Creek. The gallery consists of a 9-foot deep, 24-inch diameter, perforated (slotted) corrugated metal culvert, that was installed vertically in the middle of the Unnamed Creek. The top of the well's culvert is approximately 3.5 feet above the surface of the creek.

Unnamed Creek flows through a tundra area and has a width that varies from 1 foot to a few feet and has a shallow depth of approximately 1 to 2 feet. The flow of the creek varies throughout the year, depending on precipitation and snow accumulation. During the winter, the creek freezes and often develops aufeis (overflow ice conditions). The drainage basin for Unnamed Creek is on the south side of Ugchirnak Mountains and has a surface water drainage area of approximately 1 to 1.5 square miles.

The gallery is located inside an 8- by 8-foot wooden well house structure. The pump house is located approximately 900 feet east and downhill of the existing washeteria and WTP. The raw water from the well house is pumped via a 2-inch diameter HDPE pipe inside a 4-inch diameter Arctic pipe in an aboveground utilidor to the WTP.

Stantec completed an assessment June of 2018 on the structural integrity and usability/functionality of the infiltration gallery. The findings and recommendations of the infiltration gallery's assessment conducted

by Bob Gillian, P.E., including photographs of the infiltration gallery are reported in Stantec Tech Memos #2 and #4 and summarized as follows:

- Stantec observed the water in the infiltration gallery had floating scum. The original 9-foot-deep infiltration gallery has filled in several feet with mud and debris. The WTP operators reported they have attempted, in vain, to remove the mud, but the gallery quickly refills with mud – resulting in reduced the flow of raw water.
- Tununak experiences severe windstorms that cause very dense and deep snowdrifts around the pump house and block the entrance. Consequently, the operators often have to gain entry into the pump house via the opening in the building's roof. Accessing the building this way is dangerous due to it becoming both a confined space and creates a fall hazard that requires fall protection (Federal Occupational Hazard Agency standards 29 CFR 1910.146 2 and 29 CFR 1926.501, respectively.)
- The WTP operator is exposed to dangerous electrical wiring in multiple areas of the pump house and within the gallery. Previously, a submersible pump had been installed to pump raw water from the gallery but was found to be too dangerous to utilize due to the exposed electrical wiring and the deteriorated pump control located inside the pump house infiltration gallery.

Photos 5-7 show the pumphouse on Unnamed Creek.

Photo 13 Unnamed Creek Pumphouse
Looking north. The fencing around the gallery is falling into the stream. (Stantec 6/2018)

Photo 14 Inside Pumphouse
Red arrows point to open electrical connections. Roof access panel is used to get into building in winter (yellow arrow). (Stantec 6/2018)

Photo 15 Pumphouse Flood Levels
In the winter and spring, it is common for winter ice to cause flooding. (MWH 2010)

In summary, the pump house with foundation needs to be replaced, the current structure would cost more to repair than a new structure and the foundation for the structure is failing. A new infiltration gallery needs to be installed to meet Tununak's continued water demand from Unnamed Creek.

2.3.6.1 Water Treatment Requirements for Unnamed Creek Infiltration Gallery

At such time in the future when the existing WTP is upgraded or replaced, the new WTP would then be reclassified to a public water system by the ADEC. The upgraded WTP would produce treated drinking water for the new washeteria that would be used by more than 25 customers per day. The WTP would be required to meet the drinking water requirements given in 18 AAC 80 which requires compliance with the regulatory requirements described herein below that may be applicable to the nature of the source water from the Unnamed Creek infiltration gallery. The operator for this water system would be required to hold a Level 1 Water Treatment Certification. Currently, the operator for the WTP is not certified by the ADEC.

The design, operation and monitoring of public drinking water systems is regulated by federal and state agencies. The USEPA has granted the State of Alaska the authority to administer these regulations and the ADEC has been designated the state agency responsible for enforcement and compliance. The State has adopted the federal regulations pertaining to water system operation, monitoring and reporting requirements which are presented in the following regulations: Drinking Water Regulations in 18 AAC 80; and Water and Wastewater Operator Certification and Training regulations in 18 AAC 74. The regulations in 18 AAC 80 stipulate primary and secondary maximum contaminant levels (MCLs) for selected water contaminants.

The primary standards protect public health by limiting the levels of contaminants in drinking water. The contaminants addressed in the primary standards include microorganisms, disinfectants, disinfection byproducts, inorganic chemicals, organic chemicals and radionuclides. The secondary standards are non-enforceable guidelines regulating contaminants that may cause cosmetic and aesthetic effects - such as odor, taste, or color.

The water source(s) must be tested for water quality, and after treatment, found to be in compliance with the maximum contaminant levels (MCLs) referenced in 18 AAC 80.300 and 40 Code of Federal Regulations (CFR) 141. To facilitate achieving this goal, and to satisfy State plan review requirements for use of new sources, the water quality parameters listed in Table B of 18 AAC 80.205 must be identified, including: total coliform bacteria, inorganic chemicals, nitrate, nitrite, volatile organic chemicals and secondary contaminants (iron, manganese, color, etc).

2.4 FINANCIAL STATUS OF EXISTING FACILITIES

The most recent financial status of the existing WTP/Washeteria is not known; however, past financial records with a breakdown of budgeted operating expenditures for the years 2014, 2015 and 2016 (Appendix D.5.2) was provided by Tununak for the operation of the existing washeteria, water treatment plant and the flush haul system. Additional financial information (Profit and Loss Statement for 2019) for

the operation of Tununak's water and sewer services including the operation of the washeteria was provided in February 2020 from Tununak's accountant MDM Financial Management, LLC. A copy of the P&L Statement is provided in Appendix D.5.4. Currently, Village of Tununak charges a washeteria user $3 per single load cycle for either washing or drying. Tokens are used to operate the laundry machines. The washeteria is open to users 10-hours per day, 6 days per week and an attendant is available on a 4 hour per day basis.

2.5 WATER/ENERGY/WASTE AUDITS

In 2012 the Alaska Native Tribal Health Consortium (ANTHC) conducted an energy audit of the existing washeteria and WTP. The ANTHC prepared a report on its findings titled "Comprehensive Energy Audit for Tununak Water Treatment Plant Well House" dated June 12, 2012, (ANTHC 2012).

The scope of the ANTHC report was a comprehensive energy study, which included an analysis of building shell, interior and exterior lighting systems, HVAC systems, and plug loads. Based on electricity and fuel oil prices at the time of the audit, the annual predicted energy costs for the building analyzed are $7,847 for electricity and $14,672 for fuel oil, for a total energy cost of $22,519 per year. The facility receives a power cost equalization subsidy from the State of Alaska.

The following energy efficiency measures were recommended in the ANTHC audit and remain to be implemented:

- disconnect heat tape on old watering point loop
- lower the heating set point to 40° in the well house
- fill the empty 2"x6" cavity in the cathedral ceiling of the WTP with R-19 fiberglass insulation
- remove insulation in the posed floor of the water treatment plant and replace with R–21 insulation
- remove existing glass windows and replace with double pane glass

A follow-up energy audit on the existing washeteria and WTP was conducted in 2017 by Kelli Whelan (ANTHC Energy Auditor) and Allan Paukan (RMW). The ANTHC prepared a trip report memorandum dated September 4, 2018, on its findings and recommendations, (ANTHC 2018), Table 1 provides a summary table of the operational, energy, safety, and health issues identified in memorandum.

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Table 1 Summary of September 4, 2018 ANTHC Energy Audit Findings

System	Item(s)	Finding	Solution	Repair	Replace	Training
Alarms	Smoke, CO_2, General Alarm Panel	Alarms and fire suppression equipment missing, Alarm Panel Inoperable	Replace all life & safety equipment, repair/replace alarms	Yes	Yes	Yes
Electrical	Generator	Inoperable and cannot be repaired	Replacement		Yes	Yes
Electrical	Exposed Wiring	Exposed wiring on wall outside of shower	Bring up to code	Yes		Yes
Electrical	Transformer	Building Transformer is undersized for previous design demand	Replace to meet system needs		Yes	
Heating	Maintenance	Boiler Maintenance not being completed, valves not exercised	Service/repair, develop standard operating procedures (SOP).	Yes		Yes
Heating	Operation	Boiler is Short Cycling	Need SOP			Yes
Heating	Redundancy	Boiler #2 is non-functional	Replacement of missing parts	Yes		Yes
Heating	Electrical	Both Boilers have dangerous wiring	Bring all wiring up to current codes	Yes		Yes
Heating	Ventilation	Both boilers not ventilated correctly	Correct deficiencies, replace missing parts	Yes		Yes
Heating	Gauges missing	Heat ADD system missing pressure or temperature gauge	Install working gauges		Yes	Yes
Plumbing	Septic Tank	Septic Tank not being maintained	Training, develop standard operating procedures	Yes		Yes
Plumbing	Toilet and Shower	Floor around toilet rotten, mold & mildew	Repair existing facilities, remediate mold/mildew	Yes		Yes
Septic	Broken Sewage Line	Sewage line to drainage field is broken. System not maintained.	Repair or replace immediately. Training, develop SOP	Yes		Yes
Structural	Pumphouse	Building not level, deck & fence for building broken	Repair building foundation, deck, & fence	Yes		Yes
Structural	Washeteria	Mold and Mildew, non-functioning Ventilation	Repair systems and remediate mold/mildew	Yes		Yes
Structural	Water Storage Tank	Foundation Disrepair, Insulation Damage, Sanitation issues	Proper maintenance/upkeep and installation of screening	Yes		Yes
Water	Distribution Pumps	Only one pump operable & labeled "BAD need to change ASAP"	Replace pumps		Yes	Yes
Water	Heat ADD System	System not regulated; system can be drained to below the thermostatic control sensors	Training, develop SOP, fill the tank more frequently			Yes
Water	Exposed Wires, No Redundancy	Pumphouse has exposed pump wires, Controls are outdated. Only one pump	Needs to be brought up to code or replaced as needed, keep a spare pump on hand	Yes		Yes
Water	Valve Seizure	Few valves within system have been exercised	Training, develop SOP, replace worn/seized valves	Yes	Yes	Yes
Water	System Flow and Temperatures	Missing flow meters & temp gauges on all supply and distribution systems	Install necessary flow meters	Yes		Yes
Water	Treatment System in Disrepair	All filters missing, chorine pump inoperable, parts unavailable	Replacement of systems Training, develop SOP		Yes	Yes

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3.0 NEED FOR PROJECT

Sanitation is a critical priority for the residents of Tununak. The Village is actively seeking to improve the quality of life for its residents. A significant part of their effort is focused on improving the community sanitation facilities consisting primarily of the washeteria and WTP with a safe, potable water supply that has the capacity to serve the community. In January 2015, Tununak passed Resolution #2015-02 (Appendix D.5.3) giving highest priority to sanitation need through the development of a new washeteria and water treatment plant. The resolution addresses:

- Sanitation issues as a high priority for the Village Tununak. They have requested USDA-RD funding for a new washeteria-water plant in 2017 but to date has not been approved.
- Funding is required to provide upgrades to the washeteria and the production of potable water.
- The existing WTP cannot produce potable water that meets the federal and state regulations for a potable community water system. As a result, the WTP's inability to adequately treat the raw surface water leads to decreased usage of the public health facilities for drinking water and laundry staining.
- The washeteria restrooms and showers are simply not working so that residents do not have access to the bathing facilities necessary, increasing the likelihood of preventable wash-related diseases.
- The project under consideration for this PER will improve hygiene, health and safety conditions for the community and meet anticipated growth for the 20-year planning period.
- The washeteria and watering point are critical to the community's health and their current deteriorated condition does not allow for the facilities to be used as intended to improve community health.

3.1 HEALTH, SANITATION, AND SECURITY

During the past decade, Tununak has been operating a washeteria that cannot meet the current laundry, bathing, and restroom needs of the community. The WTP as designed in 1976, no longer produces potable water meeting the current state and federal drinking water regulations required for shower facilities in communities with over 25 residents. In addition, the quality of the treated water is not reliable nor consistent due to operational difficulties caused by equipment that cannot be maintained or is still in use long after it should have been replaced.

The structure of the washeteria and WTP has rotting floors, mold caused by leaks and ventilation issues, egress exits that are not functional, and main floor supports that are decaying on a shifting foundation. The entire roof needs to be replaced due to a history of leaks that have caused extensive interior damage and mold. The washeteria portion of the building does not meet the need of the community for accessible

toilets, showers, and laundry equipment. The equipment within the building has deteriorated to a point that the facility can no longer serve its intended purpose with any reliability. The laundry equipment is in poor condition with only one working washer and one working dryer. The showers and toilets in both public bathrooms are nonfunctional.

Some of the more serious problems with the current washeteria and WTP facility, described in Section 2.3, may pose health and safety risks for the community. The ventilation systems have been inoperable during assessments in the past three years. It is not safe for anyone with any type of respiratory sensitive to use the facility cause of the mold caused by poor ventilation and leaks.

Most of the residents haul additional water from the LKSD school well watering point to their home so they can bathe, and hand wash their clothes because there are no shows safe to use at the Washeteria and the working washer and dryer are prone to frequent breakdowns. This really limits the frequency that people are able to bath, especially in the winter months when hauling extra water is more difficult during the frequent winter storms. It is understood many residents rely on the use of graywater for washing their laundry.

The residents of Tununak strongly support and encourage their local government to provide a water treatment system that will deliver dependable and safe potable water, a modern washeteria for laundry with public showers, and bathrooms that has the capacity to serve the entire community. Improving or replacing the existing WTP and the washeteria has clearly been identified as a critical sanitation need for Tununak.

3.2 AGING INFRASTRUCTURE

The Tununak Washeteria and WTP is more than 40 years old and was not built to meet current building, plumbing, or electrical codes. The facility requires constant, high level of maintenance for all systems. The existing washeteria and WTP facility was constructed in 1980. If it were built to meet today's standards, it would have an expected to be constructed to have useful life of 35 years with routine maintenance and be built to meet the Arctic conditions of the Yukon-Kuskokwim Area. Today's standards would also have the building with thick walls that use rigid insulation with an higher insulation factor than batt insulation. The roof would be a "cold" roof to reduce heat loss and the windows would have vinyl casings that cannot decay.

There are breakdowns caused by constant use and overloading of the laundry equipment because there are not enough machines to meet the laundry demands of the community. The emergency generator can't be repaired because parts are no longer made for it. The redundancies necessary for normal operations are broken and offline, making the likelihood of entire system like heating or water will require a complete shut down if a major component like a boiler or water pump breaks down.

Structurally, the entire building is falling apart as the foundation continues to move, the floor joists rot, and the weight of the exterior walls cause the floor to visibly slope in multiple directions. Water damage from roof leaks has caused many of the ceilings to collapse in, has ruined the roof batt insulation, and caused mold throughout the building. Leaking pipes and bathroom fixtures have rotted the bathroom floors.

Dangerous electrical issues exist in every room of the facility, with the current, inefficient electrical system demanding more power than the utility transformer is sized for.

The existing washeteria and WTP are substandard, and adversely impacts the health of the community. The existing WTP process does not meet the USEPA Safe Drinking Water Act (SDWA) or ADEC drinking water requirements under 18AAC 80 regulations.

The infiltration gallery is failing, filling in with silty material quicker than the operators can clear it. The pumphouse operational controls no longer function. The electrical wiring is dangerous and poses a real risk of shock or death to the operator. Accessing the pumphouse through roof in the winter is very dangerous but necessary to refill the reservoir manually. Climbing ladders in the winter is exposing the operator to an increased risk of falling within a confined space that has dangerous, live wires that are not correctly secured within conduit and control boxes.

Almost all of the equipment in the WTP is inoperable or no longer has replacement part available because of the age of the equipment. The WTP lacks the necessary equipment to consistently produce high quality water for the washeteria and health clinic. In addition, significant oversight is needed by an experienced operator who understands all the nuances associated with the treatment plant and its aging equipment. Most of the electrical equipment within the building has deteriorated past its useful life. The power distribution and utilization equipment show signs of significant deterioration due to corrosion. Building code violations were found throughout the facility in the power distribution and lighting systems.

The upgrade and/or replacement of the existing washeteria and WTP facilities that are proposed in the Alternative sections of this PER will have a major positive impact on the ability of Tununak to provide reliable and adequate treated water and washeteria facilities to the community. The WTP will be capable of treating water to meet the original design production rate of 20 gpm. The following provides a summary of the deficiencies that were identified during the ANTHC sponsored 2017 RAVG Assessment and the 2010 MWH site visits:

- The operation of the WTP did not meet current ADEC drinking water regulations.
- The WTP was in poor physical condition and disrepair.
- Circulation was the main source of heating for the pipelines. All existing community watering points on the WTP's water distribution system were found to be non-functional. The local clinic use of less than 100 gpd is not enough system demand for correct system circulation.
- Limited circulation requires additional freeze protection in the winter. The heat trace controllers were not operating properly, making the pipelines vulnerable to freezing and requires frequent maintenance during the winter operation.
- The toilet and shower facilities were non-functional due to missing fixtures and equipment.
- Only one of the two water supply pressure pumps were operational.

- The laundry equipment consisted of only one working washer and one dryer. The equipment is not enough to meet community needs, requiring continuous maintenance over-use by the residents.
- Heat loss is primarily through broken windows replaced with Plexiglas or plywood, improperly sealed window frames, and roof insulation becoming damaged from prior roof leaks.
- Life and safety concerns exist due to an emergency exit exterior door from the boiler room being sealed shut and a back-up heater has a stack too close to combustible materials.
- Proximity of an aboveground heating fuel tank that approximately 300 gallons within 5 feet of the building. The tank should be replaced with a double walled tank and located to a safer separation distance (to be determined) from the building.
- The building has settled with a noticeable slope to the interior floors due to exterior foundation erosion caused by improperly discharged backwash water from the existing water treatment filtration.
- Wastewater from the existing washeteria is discharged into the existing sewer drain connected to the septic tank system that is no longer shared with the LKSD Paul Albert High School. The approximate location of the washeteria sewer line and septic tank system is shown on Figure 2.

3.3 REASONABLE GROWTH

The community of Tununak is expected to continue to grow for the next 20 years. The decayed building and lack of water treatment equipment capable of producing safe drinking and potable water poses a health risk for the growing community. The WTP that is marginally operable and washeteria has limited capacity that is not enough for the current population of the community. This combined facility will not be able to meet the needs the projected future growth or be able to provide for the sanitation needs of a healthy community.

4.0 ALTERNATIVES CONSIDERED

The alternatives presented in this PER were developed with input from Tununak's Administrator and staff, Stantec staff and representatives from VSW. Given the limited resources available in Tununak and using good engineering judgment, three alternatives were selected for the PER.

The following three alternatives were evaluated in this PER for the Tununak Washeteria and WTP:

Alternative 1: No Build (continue to operate the existing Water Treatment Plant/Washeteria)

Alternative 2: Rehabilitate the Washeteria and Water Treatment Plant; Reline the Interior of the 50,000 Gallon Water Storage Tank, Decommission the existing Water Line, Replace the Infiltration Gallery and install of a New Water Transmission Line.

Alternative 3: Construct Modular Combined Washeteria and Water Plant, Reline the Interior of the 50,000 Gallon Water Storage Tank, Decommissioning the Existing Water Line and Infiltration Gallery while commissioning the 2019 Deep Water Supply Well and a New Water Transmission Line between the Well and the WTP.

4.1 ALTERNATIVE 1 – NO BUILD

4.1.1 Description

This No Build (No Action) Alternative would result in the continued use of the existing 40 year old, washeteria and WTP facility. This alternative would result in the continued production of water that is only suitable for laundry and toilet flushing but not for drinking, showering, hand washing, or consumption. The WTP would only be used to serve the existing washeteria and the neighboring health clinic. The existing washeteria, deficient in its current condition, would continue to be used, as is, without upgrades. While the option of doing nothing is not viable as it perpetuates the use of the existing system that produces finished water quality not suitable for public water systems. This alternate is included here for comparison with the other alternatives, and as the basis for incremental operational cost estimating. The No Build Alternative 1 does not meet the purpose and need of the project.

Alternative 1 assumes the continuation of routine repairs and maintenance for the operation of the washeteria and WTP facility. During the past couple of years, the Tununak staff made some improvements (painting and minor repairs) to the interior of the washeteria which are shown in the photos in Appendix E. The structure would still have a failing foundation and will continue to have exterior walls that are only 2x4 construction, with doors that don't seal, a ventilation system that doesn't work and limited to only having one working dryer because of building transformer being too small to handle the building power demand for a second dryer.

The existing water supply source from Unnamed Creek would continue to be used and partially treated with the existing direct (pressure) filtration water treatment process that is not in compliance with SWTR requirements.

Wastewater from the existing washeteria would continue to be discharged into the existing sewer line that flows to the off-site septic tank system (consisting of a 4,000 gallon and 2,000 tanks) and soil absorption system (drainfield). Also, backwash water from the existing water filtration process in the WTP would continue to be discharged directly onto the ground surface along the exterior of the washeteria and WTP building as discussed in Section 3.0.

4.1.2 Design Criteria

Since Alternative 1 proposes to continue the use of the existing washeteria and WTP for an indefinite period of time; consequently, the design life and other pertinent design criteria would not apply. The existing washeteria and WTP would continue to be maintained with its existing processes and resources without capital improvements. There would be no changes to the current operation of the existing washeteria/water treatment plant facility. Also, there would be no reduction in the operator time and labor but rather probably result in an increase in labor to repair old worn equipment.

4.1.3 Historic Floor Plan

On the page that follows, Figure 4 is an as-built drawing of the existing Washeteria and WTP that shows the floor plan and elevation view of Alternative 1. It should be noted that the Arctic entrances on the As-builts do not match the configuration shown in photos in 2.3.2, there may be other aspects that were not built as designed in 1978.

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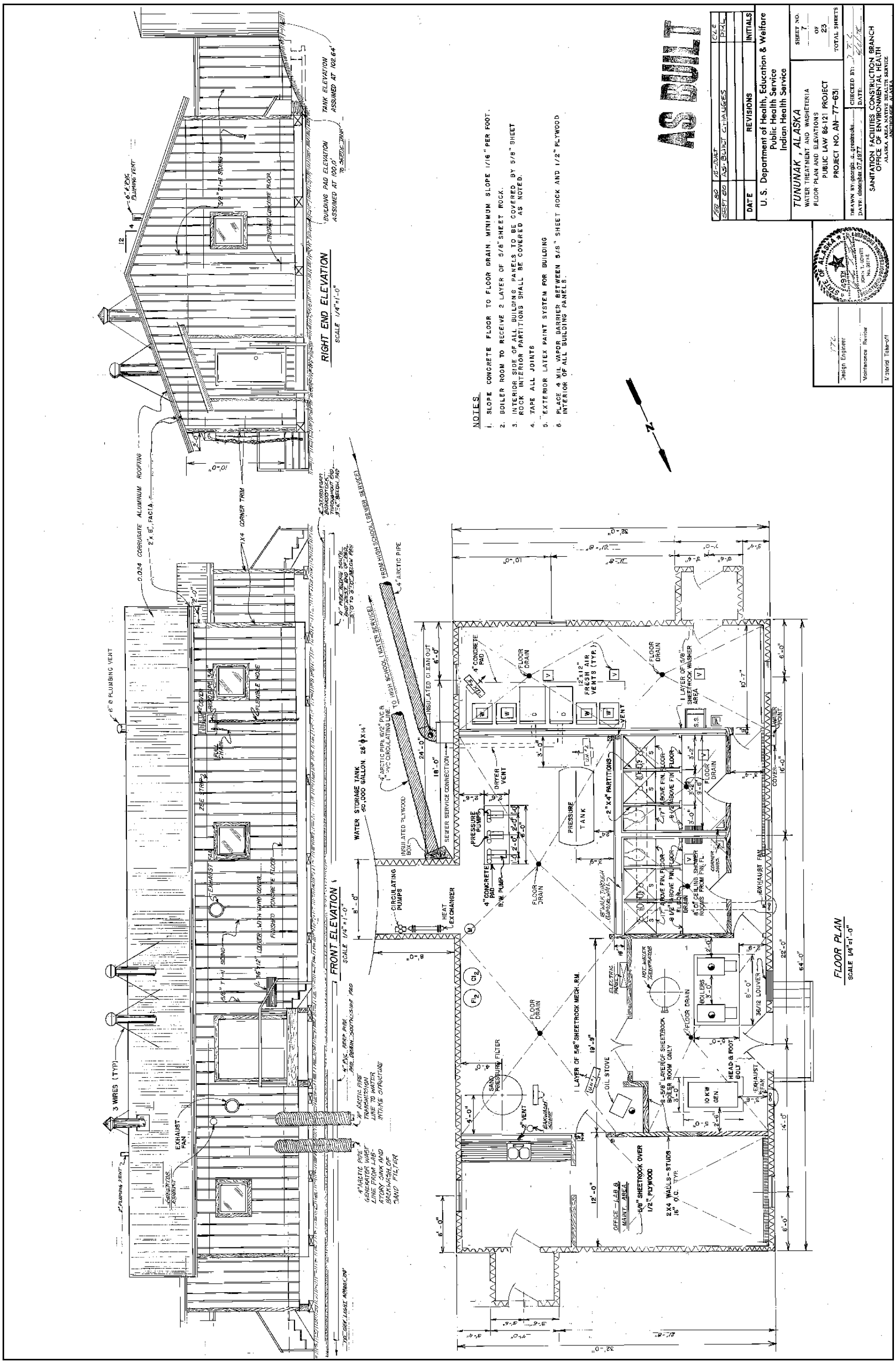
Figure 4 Existing Facility Drawing, 11x17”



Source: Alaska Area Native Health Service, Office of Environmental Health, September 1980 As-Built

4.1.4 Environmental Impacts

No environmental impacts are anticipated for Alternative 1 since it presents no new development, however, the continuation of the direct land discharge of the backwash water would result in prolongation of environmental damage.

4.1.5 Land Requirements

No additional land requirements are anticipated for Alternative 1.

4.1.6 Potential Construction Problems

No potential construction problems are anticipated for Alternative 1.

4.1.7 Sustainability Considerations

The No Build Alternative would not provide a reliable and affordable sanitation facility for the community. Over time, this alternative would require more operator attention and expertise due to the continued degradation of the existing equipment in the washeteria and WTP. The No Build alternative will result in steadily increasing cost to operate and maintain the existing facility.

The aging equipment has deteriorated to a point that the WTP can no longer serve its intended purpose with any reliability. As noted in Section 3.0, the washeteria currently has only 1 non-commercial grade washer and 1 dryer that would continue to decline due to overuse.

4.1.7.1 Water and Energy Efficiency

Alternative 1 would result in the continued operation of an energy inefficient water treatment plant and washeteria. Given the 40 year plus age of the facility, the operation of the existing facility is less energy efficient compared to a renovated or new facility that would be built with new insulated walls having improved R values for reduction of heat loss. The walls are only 2x4” construction with batt insulation, windows and doors have been boarded over to reduce heat loss, and electrical wiring issues throughout the utility would continue to negatively affect the P&L for this facility.

4.1.7.2 Green Infrastructure

Green infrastructure is the management of stormwater runoff which is not applicable to this project.

4.1.7.3 Other

The community will not experience the beneficial health and environmental effects associated with a properly functional WTP and washeteria.

4.1.8 Cost Estimates

No capital costs are expected for this No Build Alternative 1 as it features no new development. A summary of the estimated annual Operating and Maintenance (O&M) expenses for Alternative 1 are presented below in Table 2., Detailed cost estimates are provided in Appendix A. In 2016, Tununak took over the operation of the existing washeteria and WTP, and consequently, does not have long term records for operational costs. The following costs were estimated from Tununak's limited records and include other costs from sources that have similar washeteria and water treatment plant operations in other communities in this general area of Alaska.

Table 2 Alternative 1 Annual O&M Expenses

Category	Cost
Operator Labor[1]	$18,357
Electricity[2]	$9,000
Heating Fuel Oil[3]	$17,000
Chemicals, Supplies, Freight, and Expendables[4]	$1,699
Office and Administrative[4]	$2,500
Equipment Replacement[5]	$2,500
Other Line Items[6]	$5,000
Estimated Annual O&M Cost	**$56,056**

Notes:

1 Tununak employs operator at $14 per hour for 4 hours per day for 6 days a week equates to $17,472 plus $885 for fringe benefit ((P&L) Statement for 2019 in Appendix D)

2 2017 Costs in 2020 dollars (adjusted at 4.1% annual inflation).

3 Cost based on 2019 cost estimate with a 4.1% inflation factor for 2020 cost

4 P&L Numbers supplied from Tununak

5 Cost based on similar facilities per VSW and ANTHC experience.

6 Assumed cost for insurance, training, lab costs and miscellaneous operating expenses.

Table 3 provides a summary of the estimated construction (capital), annual O&M expenses (assuming 2042 water demands), and a life-cycle cost analysis for Alternative 1. Detailed cost estimates calculations are provided in Appendix A. The estimated life-cycle costs for Alternative 1, in 2020 dollars, assuming uniform series present worth based on a 20 year life is $1,424,562.

Table 3 Alternative 1 Summary Table of Capital, O&M, and Life Cycle Cost

Total Construction Cost	Annual O&M	20 Year Life Cycle Cost
$0	$56,056	$1,424,562

4.2 ALTERNATIVE 2 - REHABILITATION OF CURRENT BUILDING

Rehabilitate Washeteria and Water Treatment Plant; Reline the interior of the 50,000 Gallon Water Storage Tank; and Decommission and Replace Water Transmission Line and Infiltration Gallery

4.2.1 Description

Alternative 2 would rehabilitate the existing washeteria and WTP facility and replace its foundation at its current location. Alternative 2 provides for the upgrade of the existing WTP facility to treat the current surface water source from Unnamed Creek to produce drinking water that complies with the SWTR for use at the rehabilitated washeteria and health clinic. This alternative includes relining the interior of the existing 50,000 gallon water storage tank (WST), decommissioning and replacement of the water transmission line (WTL) from the Infiltration Gallery to the WTP, and decommissioning and replacement of the Infiltration Gallery on Unnamed Creek.

The rehabilitation alternative would mitigate the current risk to the operators and public users. In addition, this alternative would upgrade/replace the washeteria and public bathrooms to meet the original operating conditions and functionality as shown on Figure 4.

The following list describes the proposed improvements that are included in scope of work for Alternative 2 for the rehabilitation of the existing washeteria and WTP:

1. The existing wooden frame structure would be temporarily elevated to remove the 40 year old rotting post and pad foundation system. The water piping connections for the incoming water supply line, piping to the water storage tank, and water supply lines exiting the building would be temporarily disconnected. The sewer line connection would be temporarily disconnected while the building structure was raised to accommodate the removal and replacement of the foundation system. A multipoint foundation system, equivalent to the Triodetic type, would be used to replace the deteriorated wood foundation system. The building structure would be lowered and leveled onto the new Triodetic foundation. The plumbing system would be reconnected to the sewer drain lines and waterlines to the water storage tank and other waterlines entering and exiting the building.

2. The existing structure would be rehabilitated to include replacement of the entire facility's electrical and mechanical components along with necessary structural components. It would also include new insulation and interior wall coverings (sheetrock) and painted as required to bring the facility to meet current applicable building codes and standards. All interior wall finishes will be removed and replaced with new wall finishes.

3. All windows will be replaced with energy efficient thermal windows consisting of high-performance triple-pane windows with composite frames and screens.

4. The WTP equipment would be replaced with new equipment and be upgraded to meet the current SWTR drinking water requirements and produce the equivalent flow of treated water as originally designed, i.e., 20 gallons per minute (gpm).

5. Ventilation will be rehabilitated to indoor-air quality code for the dryer, process area, and general building exhaust air. Ventilation systems with local controls meeting current code criteria and recommendations would be provided for mechanical room, WTP, and occupied spaces. Combustion air and ventilation for boiler room will be provided. Install new ventilation fans in all bathrooms.

6. The glycol heat exchangers for water treatment and power plant waste heat recovery will be replaced with new modern controls, adequately sized glycol heat exchangers, and a new heat exchanger for heating the exterior insulated water storage tank.

7. The washeteria portion of the building would be reconstructed as originally designed. The washeteria would include 4 new commercial grade energy efficient 20-pound top load washers and 2 commercial grade energy efficient 50 pound load hydronic dryers to match the number of laundry units that were originally installed in the washeteria.

8. The washeteria would be rehabilitated with new electrical wiring, wall surfaces with insulation and mechanical equipment as needed or required.

9. The existing windows and doors would be replaced with thermally efficient doors and windows.

10. The existing boilers in the mechanical room will be replaced with new adequately sized boilers, flues, hydronic heating system with local controls, and a new interior double wall fuel oil day tank.

11. Replacement of the domestic water pressure pumps, distribution piping and fixtures, and hot water generator sized for washeteria demands.

12. The glycol heat exchangers for water treatment will be replaced with new modern controls, adequately sized glycol heat exchangers, and a new heat exchanger for heating the exterior insulated water storage tank.

13. The exterior siding of the building would be replaced as needed with a similar material (T-111 siding) as currently in place. The new siding would be painted.

    a. The existing metal roof surface has deteriorated and will be replaced with 6-inches of rigid insulation.

14. The exterior stairs and entrances to the building would be replaced with new weather resistant material and new stairs and ramps meeting handicap access requirements including a parking space for a handicap vehicle.

15. The bathrooms would be reconstructed as originally designed to provide 1 men's and 1 women's room, equipped with 2 showers, 1 sink and 1 toilet, each.

16. The 10 KW standby (emergency) generator would be replaced with a new equivalent diesel fueled generator.
17. Wastewater from the existing washeteria would continue to be discharged into the existing sewer drain that is connected to the existing off-site septic tank system.
18. Backwash water from the water treatment pressure granular filter would be plumbed to discharge to the existing sewer drain line that flows to the existing off-site septic tank system.
19. All electrical wiring and panels would be replaced to support the renovation efforts. All receptacles will be replaced to extend their useful life.
20. Replace the vinyl composite tile flooring throughout the washeteria except install new sheet vinyl flooring in bathrooms, and clean/re-seal concrete floor in the WTP.
21. Replace all interior and exterior lighting with new high efficiency LED lighting.
22. Install zoned fire alarm system with a new analog addressable fire alarm system.
23. Re-paint all painted interior walls and ceilings including existing beams. Replace fiberglass reinforced panels (FRP).
24. Install new baseboard units throughout the entire facility.
25. Enclose hot domestic water piping in chases in order to protect public from hot water piping and to prevent vandalism of piping.
26. Install new benches and folding table(s) in laundry area.
27. Install new utility sink in laundry area.
28. Install new drinking fountain that meets accessibility requirements.
29. Install new doors and hardware throughout, solid core painted wood doors on interior and insulated fiberglass doors on the exterior.
30. Install all new water-saving plumbing fixtures and accessories in all bathrooms including the showers and replace toilet partitions.
31. Install additional new 6 inches of rigid insulation under building, held in place with new soffit plywood and install skirt fence around base of building for security.
32. Install new fascia and trim on the roof eaves.
33. Remove the abandoned water and sewer aboveground utilidor pipelines between the WTP and the Paul Albert High School and dispose waste material in Tununak sanitary landfill.

34. The existing exterior diesel fuel storage tank will be replaced with a double wall 5,000-gallon AST connected to the building via above grade schedule 80 welded pipe supply and return lines and connect to an interior double wall 50-gallon fuel oil day tank located in the mechanical room.

35. Recommendations presented in Section 2.3.3 regarding the findings reported in Tech Memo #3 for the 50,000 gallon WST, the tank would continue to be used as is for a few more years provided the tank is thoroughly cleaned and its interior coating relined. Also, repairs and modifications to the tank's overflow pipe and vent will be made.

36. The aboveground manway/utilidor between the 50,000 gallon WST and WTP be upgraded with new insulated walls. The existing pair of water lines (in-out flow) with heat-add lines will be replaced connected via the manway between the WTP and WST.

37. Recommendations presented in Section 2.3.5 would replace the entire WTL from the infiltration gallery on Unnamed Creek to the WTP. In addition, the WTL access boxes also will be replaced with new boxes that are more functional for use by the operators. The foundation system for the replacement Arctic pipe will be similar to the type used for the elevated sections of the former water transmission line from Muskox Creek.

38. Recommendations presented in Section 2.3.6 the Infiltration Gallery and pump house on Unnamed Creek will be replaced and located in near proximity to the existing gallery.

39. The abandoned water line and wastewater lines in the aboveground arctic pipe utilidor will be removed and disposed in Tununak's sanitary landfill.

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4.2.2 Design Criteria

All major system components in Alternative 2 would be constructed with materials and methods to provide a minimum 20-year life. Design criteria for the rehabilitation of the existing washeteria/water treatment plant includes the following:

- Most Recent Measured Population — 370 (2018)
- Design Population — 447 (2040)
- Freezing Index (Typical Year) — 3,000 °F days
- Thawing Index (Typical Year) — 2,000 °F days
- Heating Degree Days — 13,000 °F days
- Design Ground Snow Load
  - 10-year reoccurrence — 74 pounds per square foot (PSF)
  - 25-year reoccurrence — 93 PSF
  - 50-year reoccurrence — 117 PSF
- Design Wind Speed
  - 10-year reoccurrence — 90 miles per hour (MPH)
  - 25-year reoccurrence — 100 MPH
  - 50-year reoccurrence — 110 MPH
- Design Snow Load — 30 PSF
- Design Live Load — 125 PSF
- Seismic Zone — Zone 1
- Water Demand — 541 Gallons Per Day (GPD), with a flow rate of 20 GPM
- Water Treatment — Meet Regulatory SWTR Drinking Water Standards

The design, operation and monitoring of public drinking water systems is regulated by federal and state agencies. The USEPA has granted the State of Alaska the authority to administer these regulations and the ADEC has been designated the state agency responsible for enforcement and compliance. The State has adopted the federal regulations pertaining to water system operation, monitoring and reporting requirements which are presented in the following regulations: Drinking Water Regulations in 18 AAC 80; and Water and Wastewater Operator Certification and Training regulations in 18 AAC 74. The regulations in 18 AAC 80 stipulate primary and secondary maximum contaminant levels (MCLs) for selected water contaminants.

The primary standards protect public health by limiting the levels of contaminants in drinking water. The contaminants addressed in the primary standards include microorganisms, disinfectants, disinfection byproducts, inorganic chemicals, organic chemicals and radionuclides. The secondary standards are non-enforceable guidelines regulating contaminants that may cause cosmetic and aesthetic effects - such as odor, taste, or color.

The water source(s) must be tested for water quality, and after treatment, found to be in compliance with the maximum contaminant levels (MCLs) referenced in 18 AAC 80.300 and 40 Code of Federal Regulations (CFR) 141. To facilitate achieving this goal, and to satisfy State plan review requirements for

use of new sources, the water quality parameters listed in Table B of 18 AAC 80.205 must be identified, including: total coliform bacteria, inorganic chemicals, nitrate, nitrite, volatile organic chemicals and secondary contaminants (iron, manganese, color, etc).

The use of Unnamed Creek as Tununak's water source requires treatment in accordance with the SWTR established by USEPA in 1989 which sets the maximum contaminant levels for specific pathogenic microbial contaminants. The SWTR requires the use of filtration and disinfection that will result in a prescribed level of contaminant removal or inactivation in accordance with Long-Term Stage 1 Enhanced variation of the SWTR to achieve the following treatment levels:

- 2-Log (99%) removal or inactivation of Cryptosporidium
- 3-log (99.9%) removal or inactivation of Giardia
- 4-log (99.99%) removal or inactivation of viruses

Under the SWTR, the filtration system must provide a maximum of 0.3 Nephelometric Turbidity Units (NTU) in 95% of monthly turbidity measurements with no excursions above 1 NTU. In addition, the disinfectant residual for chlorine at the distribution system entry point may not be less than 0.2 milligrams/liter (mg/L) for four hours and trace chlorine residual must be maintained in more than 95% of samples collected throughout the distribution system.

The following section provides a description of additional water testing requirements that Tununak would be expected to comply with if the water source is under the influence of surface water or a surface water source such as the infiltration gallery

Total Coliform Rule

Tununak is also under the Total Coliform Rule (TCR) that was established by USEPA in 1989. The TCR sets MCLs and monitoring requirements for coliforms in drinking water which includes periodic collection and testing of a number of samples based on size of the water system. Also, the TCR requires sanitary surveys be completed every 3 years.

Interim Enhanced Surface Water Treatment Rule and Long-Term 1 Enhanced Surface Water Treatment Rule

Critically important to Tununak is the presence of naturally occurring dissolved organic materials in their source water. When exposed to chlorine as a disinfectant, these naturally occurring organic substances form disinfection by-products (DBPs) that include total trihalomethanes (TTHMs), five haloacetic acids (HAA5s), chlorite, bromate and other compounds. USEPA has found evidence that when these compounds are consumed in drinking water at elevated levels over a period of time, they can cause cancer and other illnesses. Consequently, in 1999 USEPA promulgated the Stage 1 and Stage 2 Disinfectants and Disinfection By-Products Rule (D/DBPR) that set a maximum residual disinfectant level for chlorine at 4.0 mg/L and established an MCL for TTHM and HAA5s of 0.080 mg/L and 0.060 mg/L,

respectively. Compliance with the MCL is based on a running annual average (RAA) of samples taken quarterly from the distribution system.

Lead and Copper Rule

In addition to the above rules that impact Tununak's water treatment system is the Lead and Copper Rule (LCR) that USEPA promulgated in 1991 that set limits of lead and copper at consumers' drinking water taps. The source water may be aggressive or corrosive that causes lead and copper to leach out from water piping materials. When water systems exceed the "action levels" for lead (0.015 mg/L) and copper (1.3 mg/L) in more than 10% of samples taken, then USEPA requires a three step mitigation approach be implemented. The first step involves collecting and testing representative samples for specific parameters to determine the characteristics of the water with regard to its reactivity to the piping/plumbing materials. The next step involves performing a "desk-top" study to identify a corrective action program which is submitted to ADEC for approval. As the final step, the approved corrective action program is implemented and evaluated to determine its effectiveness.

Long-Term 2 Enhanced Surface Water Treatment Rule

The USEPA under the 1996 reauthorization of the 1986 Safe Drinking Water Act developed a set of interrelated regulations to strengthen the control of microbial and DBP contaminants which are referred to as the "Microbial/Disinfection By-Products Rules". Currently, the rules which became effective on March 6, 2006, consist of the Long-Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) and Stage 2 D/DBPR. Basically, these rules require source water monitoring for microbial quality, and improved treatment for microbial inactivation.

The LT2ESWTR addresses the control of the occurrence of Cryptosporidium in samples from surface water sources. The water systems using surface water will need to establish the microbial quality of their source waters unless their treatment system processes provide for better than 5.5 log removal/inactivation of Cryptosporidium found. Water systems serving less than 10,000 persons, will sample for E. coli in lieu of Cryptosporidium every two weeks for 12 months beginning in October 2008 as determined by the State. Tununak needs to complete the routine E-coli samples of their source water and demonstrate they would remain below the trigger level of 100 col/100 mL. These findings would determine if Tununak would be exempt from being required to treat for Cryptosporidium.

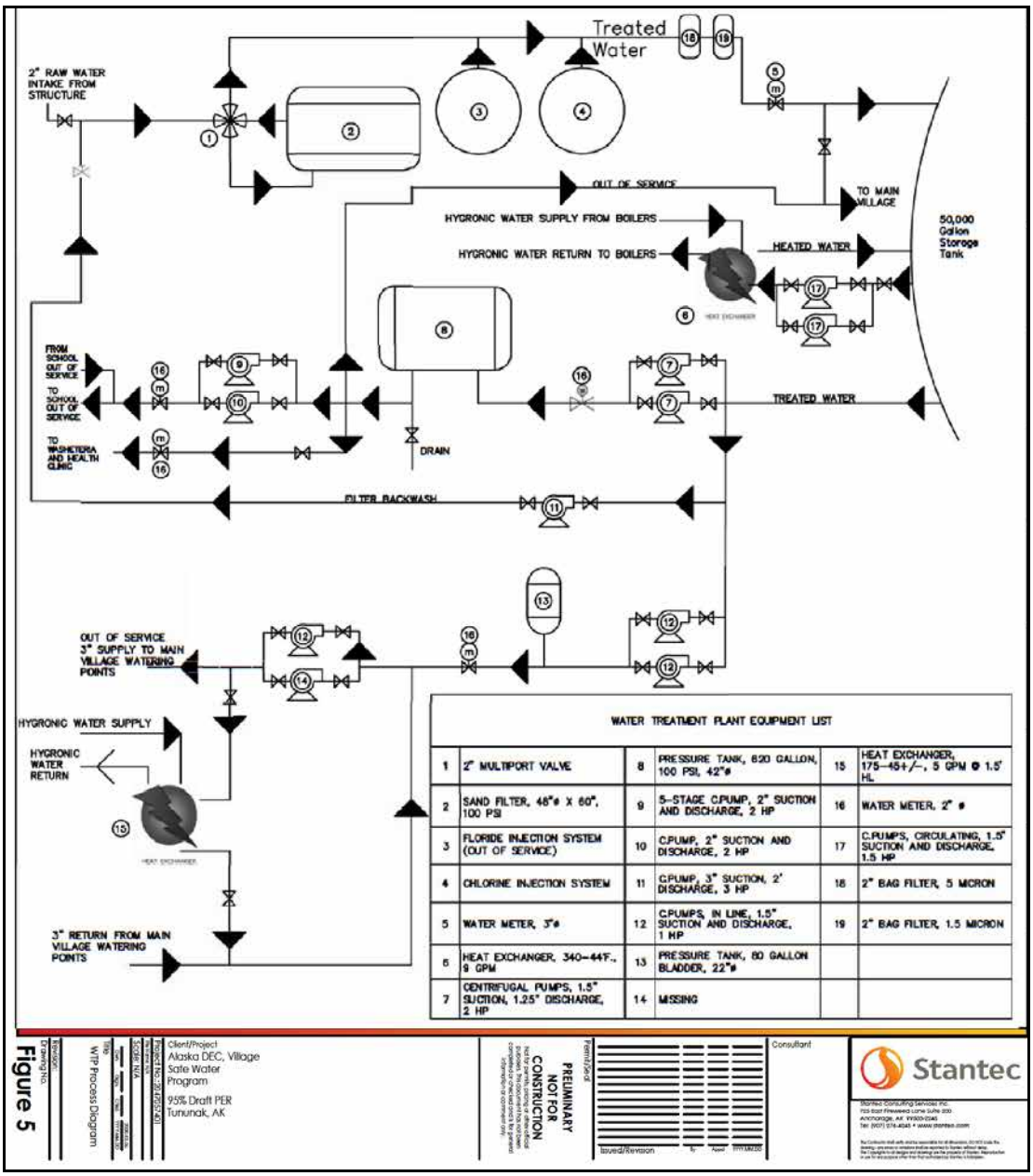
Filter Backwash Recycling Rule

The Filter Backwash Recycling Rule (FBRR) was promulgated in 2001 and requires public water systems operating direct and conventional filtration plants to review their backwash water recycling practices and make approved changes as necessary to ensure they do not compromise pathogenic microbial control, particularly by passing Cryptosporidium oocysts through the filter. Generally, the FBRR requires that impacted systems introduce waters to be recycled to the head of the water treatment plant, treat recycled waters through all existing unit processes, report to the ADEC the configuration and operation of the system, and maintain records of recycle operations. This rule may affect the design and implementation of future upgraded treatment systems for Tununak.

4.2.3 Water Treatment Process Flow

Figure 4, Existing Facilities Map under Section 4.1.3, shows the layout of Alternative 2. Figure 5 presented below provides a Process Flow Diagram for the replacement water treatment plant – the treatment process would be designed and altered to comply with the water treatment requirements for a surface water source and will only include one service to the neighboring health clinic.

Figure 5 Process Flow Diagram of Water Treatment Plant



4.2.4 Environmental Impacts

No environmental impacts are anticipated for Alternative 2 since it presents no new ground disturbance. Minimal ground disturbance may occur during installation of the new foundation under the existing building; however, no excavation is anticipated. Should excavation be required to install the new foundation, the State Historic Preservation Officer (SHPO) must be consulted and measures to avoid adverse impacts to cultural resources will be implemented. In addition, the USFWS must be consulted to determine any proposed avoidance measures that can be incorporated into the project construction methods that would avoid accidental impacts to Spectacled Eiders. In addition, Alternative 2 would eliminate the discharge of the backwash water onto the ground surface adjacent to the WTP since the backwash flow would be discharged to the septic tank and drainfield system.

4.2.5 Land Requirements

No additional land requirements are anticipated for Alternative 2.

4.2.6 Potential Construction Problems

No potential construction problems are anticipated for Alternative 2.

4.2.7 Sustainability Considerations

Alternative 2 would provide an improvement in meeting the sanitation needs in Tununak. However, this alternative would probably not generate sufficient revenue based on current user fees to cover the estimated annual O&M costs presented below due to the limited number of laundry units and bathrooms. Also, the proposed renovation of the washeteria would probably be too small to meet sanitation needs expected from the future growth in Tununak.

4.2.7.1 Water and Energy Efficiency

The rehabilitated building including replacement of WTP equipment and washeteria laundry equipment will be energy efficient, thereby decreasing energy and resources currently used. The renovation of the building would also allow for replacement of doors and windows, reinsulating areas with damaged insulation, repairing the ventilation system, and upgrading lighting to LED lighting throughout the building.

4.2.7.2 Green Infrastructure

Not applicable.

4.2.7.3 Other

A disadvantage to Alternative 2 is that the water treatment process would have to be temporarily shut down to allow for the replacement of the treatment equipment. However, the operators could treat a enough water to store in the 50,000 gallon WST and continue to provide non-potable water to the health

clinic. A temporary water line for the WST to the clinic may need to be provided in order to make this possible. In addition, the community would experience another disadvantage from Alternative 2 since they will not be able to have laundry services during the upgrade of the existing washeteria that may last for several months.

The operators would also have to achieve a Level 1 Water Treatment Certification before the WTP could achieve compliance with ADEC.

4.2.8 Alternative 2 Cost Estimates

Project costs associated with this alternative are broken down in terms of construction and non-construction costs. The construction costs are based on material and labor for 2020 with all the work being advertised and bid under one contract. Planners and designers will also need to adjust prices and contingency as the project progresses depending on the proposed year of construction, portions of work to be completed by Tununak crews (if any), and specific project parameters (e.g. funding requirements, environmental documentation). The construction contingency is to address unforeseen conditions or other change orders that may occur during construction.

Non-construction costs which have been estimated as a percentage of construction are stated below. Additional non-construction costs related to environmental compliance and cleanup, legal services, bonds, property and easement acquisition, and interest charges could also be encountered and should be considered by Tununak in the final formulation of project budgets. These are the other costs associated with implementing the construction project – engineering, design, permitting and administration.

- Engineering costs are estimated at 10% herein to address the design, construction document preparation and permitting of the projects prior to construction.
- Administration costs are estimated at 8% herein to cover Tununak's costs associated with procuring construction contractors, grant administration and agency project involvement.
- Construction administration costs are estimated herein at 10% to cover inspections, submittal reviews, construction contract administration, and other functions required by or on the Tununak's behalf for oversight of the construction project.

For this report, O&M costs associated with each alternative are qualitative comparison that does not allow for a concrete comparison on a cost basis. The final configuration, selection of equipment, and finishes can have a huge effect on the O&M work that is necessary to maintain the facility. Overhead costs will vary depending on if there is an increase in usage of the facility. A practical effort has been made to analysis of the alternatives to identify the major changes that will occur in the O&M activities with the implementation of each alternative. Materials costs for parts and equipment replacement are estimated using 2020 values for an O&M cost change.

O&M budgets for each alternative specifically address labor (e.g. salaries, benefits), utilities and supplies for the identified O&M tasks. No contract services have been identified for the existing system or

alternatives considered (e.g. water purchase, waste treatment, other). Insurance, engineering, legal, and other costs associated with new or existing wastewater treatment has not been estimated and will be covered by Tununak as part of current operations.

O&M costs for Alternate 2 are expected to increase over the existing WTP and washeteria, with the costs associated with operations and maintenance of the new equipment including the chemical systems. The detail of these increases are summarized in Table 4. Note that these represent only cost increases to the existing O&M and do not address deferred maintenance, unfunded short-lived assets accounts, short staffing or other deficiencies within the existing O&M program.

Table 4 Alternative 2 Annual O&M Expenses

Category	Cost
Operator Labor[1] (for WTP and Washeteria)	$39,000
Electricity and Utilities[2]	$10,000
Heating Fuel Oil[3]	$14,400
Chemicals, Supplies, Freight, and Expendables[2]	$3,000
Office and Administrative[2]	$2,500
Emergency Repair Budget[2]	$2,000
Short Lived Asset Reserve[2]	$10,784
Other Line Items[4] (Insurance, etc.)	$5,000
Estimated Annual O&M Cost	**$86,684**

Notes:

1 Based on operator time estimated at 30 hours per week at a pay rate of $25/hr includes benefits.

2 Cost assumed based on similar facilities per VSW and ANTHC experience. Annual cost was increased over the cost for the no-build due to assumed higher power demand for operation.

3 Cost based on 2017 cost estimate with a 3% inflation factor for 2020 cost

4 Assumed costs for insurance, training, lab costs and miscellaneous operating expenses

Table 5 provides a summary of the estimated construction (capital), annual O&M expenses (assuming 2042 water demands), and a life-cycle cost analysis for Alternative 2. Detailed cost estimates calculations are provided in Appendix A.

Table 5 Alternative 2 Summary Table of Capital, O&M, and Life Cycle Cost

Total Construction Cost	Annual O&M	20 Year Life Cycle Cost
$6,230,400	$86,684	$7,096,447

The estimated life-cycle costs for Alternative 2, in 2020 dollars, assuming uniform series present worth based on a 20 year life cycle cost as provided in Table 4 is $7,096,447. The building improvements, relining the water tank, and other long term assets continue to have a depreciated value after 2042.

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4.3 ALTERNATIVE 3 – NEW MODULAR BUILDING AND DEEP WELL

This alternative proposes to demolish the existing washeteria and WTP and replace it with the construction of a Modular Combined Washeteria/Water Plant and include the following water system improvements: Reline the Interior of the 50,000 Gallon Water Storage Tank; Decommission and Replace Water Transmission Line; and decommission Existing Source of Water Supply (Infiltration Gallery on Unnamed Creek) and Replace water source with the 2019 Deep Water Supply Well.

4.3.1 Description

Alternative 3 would demolish the existing washeteria and WTP and foundation. A new foundation would be installed at the same location to support a new 40-foot by 60-foot (2,400 square foot) modular building that would house a combined washeteria and water plant constructed on a new foundation system. The existing washeteria building and all unusable equipment would be hauled to the Tununak sanitary landfill for disposal. In addition, the scope of this alternative includes the following water system improvements:

- Relining the existing 50,000 gallon water storage tank (WST).,
- Decommissioning the raw water transmission line (WTL) from the Infiltration Gallery to the WTP
- Install a new raw water transmission line between the new deep water well and the WTP
- Decommissioning the existing source of water supply consisting of the Infiltration Gallery on Unnamed Creek and replacing the water source with the 2019 deep water supply well

Alternative 3 consists of the following components:

1. The new modular combined washeteria/water plant would be shipped by barge to Tununak and transported in sections overland from the Tununak barge site to the location of the former washeteria and WTP.
2. The modular building would be erected on a new multipoint steel frame foundation.
3. The modular building would consist of a 2,400 square foot (40’ by 60’) structure that would include a 1,600 square foot fully functional washeteria and a 800 square foot area for the new Water Plant Figure 6 shows the conceptual floor plan for the modular combined washeteria and water plant. The modular building will have a footprint that is 350 feet larger than the original footprint of current building.
4. The new modular building would have arctic insulated walls 8” thick, energy efficient vinyl clad windows, and the warranties that come with new construction.
5. The Water Plant would house equipment needed to pump and control the distribution of water to the WST and the nearby clinic. Treatment of the raw water would not be required due to the exceptional quality of raw water from the new deep-water supply well. The well would be

equipped with a submersible well pump that would produce a minimum flow rate of 50 gpm. In addition, the level of operator required by the ADEC would be the minimum level classified Small Water System Operator. Given the simplicity of the water plant operation, the same operator would have sufficient time and qualifications to operate the washeteria.

6. The new Water Plant would be plumbed to deliver water via a new aboveground insulated utilidor (manway) to the existing 50,000-gallon WST and pump water to the washeteria and to the neighboring health clinic.

7. The modular washeteria would be designed to accommodate 5 commercial grade washers and dryers, and 2 bathrooms (separate men and women) equipped with 5 toilets, 1 urinal, 2 sinks, and 4 showers that are designed for handicap access.

8. The exterior stairs and entrances to the modular building would be constructed with new weather resistant material and include stairs and ramps meeting handicap access requirements and a parking space for a handicap vehicle.

9. The wastewater from the modular washeteria would be plumbed to discharge into the existing sewer drain that flows to the existing off-site septic tank and drainfield system.

10. The 50,0000 WST would continue to be used until the condition warrants a capital project, provide the interior coating on the tank is relined. Also, repairs and modifications to the tank's overflow pipe and vent will be made.

11. This alternative includes the decommissioning and disposal of the 1,150-foot long WTL including the water line access boxes from the Infiltration Gallery to the WTPT.

12. The new 180-foot deep water well that was drilled in Tununak during the summer of 2019 will replace the Infiltration Gallery and serve as Tununak's water source. The approximate location of the well is shown on Figure 2 in Section 2.1. The well will be connected via a 1,435-foot long aboveground arctic pipe water line to the new water plant as shown below in Section 4.3.3 on Figure 7. The foundation system for the replacement aboveground Arctic pipe utilidor will be similar to the type used for the abandoned WTL from Muskox Creek.

4.3.2 Design Criteria

All major system components in Alternative 3 would be constructed with materials and methods to provide a minimum 20-year life. Design criteria for the new modular combined washeteria and water plant are identical for the criteria for Alternative 2 with the exception of the total daily flow rate which would increase to 673 GPD due to the increase in the size of the proposed bathrooms and the number of clothes washing machines in the new washeteria. The wastewater flow from the water plant would not include backwash since water treatment is not required for the use of the new deep water well. The water well is capable to provide a sustained flow rate that is greater than 50 gpm and would be available in the future to serve the entire community of Tununak with a piped water system. The wastewater flow from

the water plant would not include backwash since water treatment is not required for the use of the new deep water well.

The new water system would be subject to regulation as a CWS under 18 AAC 80.007. A certified operator would be required to operate the system and would need to comply with regulations for routine monitoring and reporting under the Revised Total Coliform Rule.

4.3.3 Alternative 3 Conceptual Drawings

The proposed modular washeteria and water plant will be located at the same location of the existing washeteria and WTP as shown in Figure 1. Figure 6 shows the conceptual floor plan for the modular combined washeteria and water plant. The outer dimension of the building are 60 feet by 40 feet, resulting in a footprint of 2,400 square feet.

Figure 6 Conceptual Floor Plan for Alternative 3

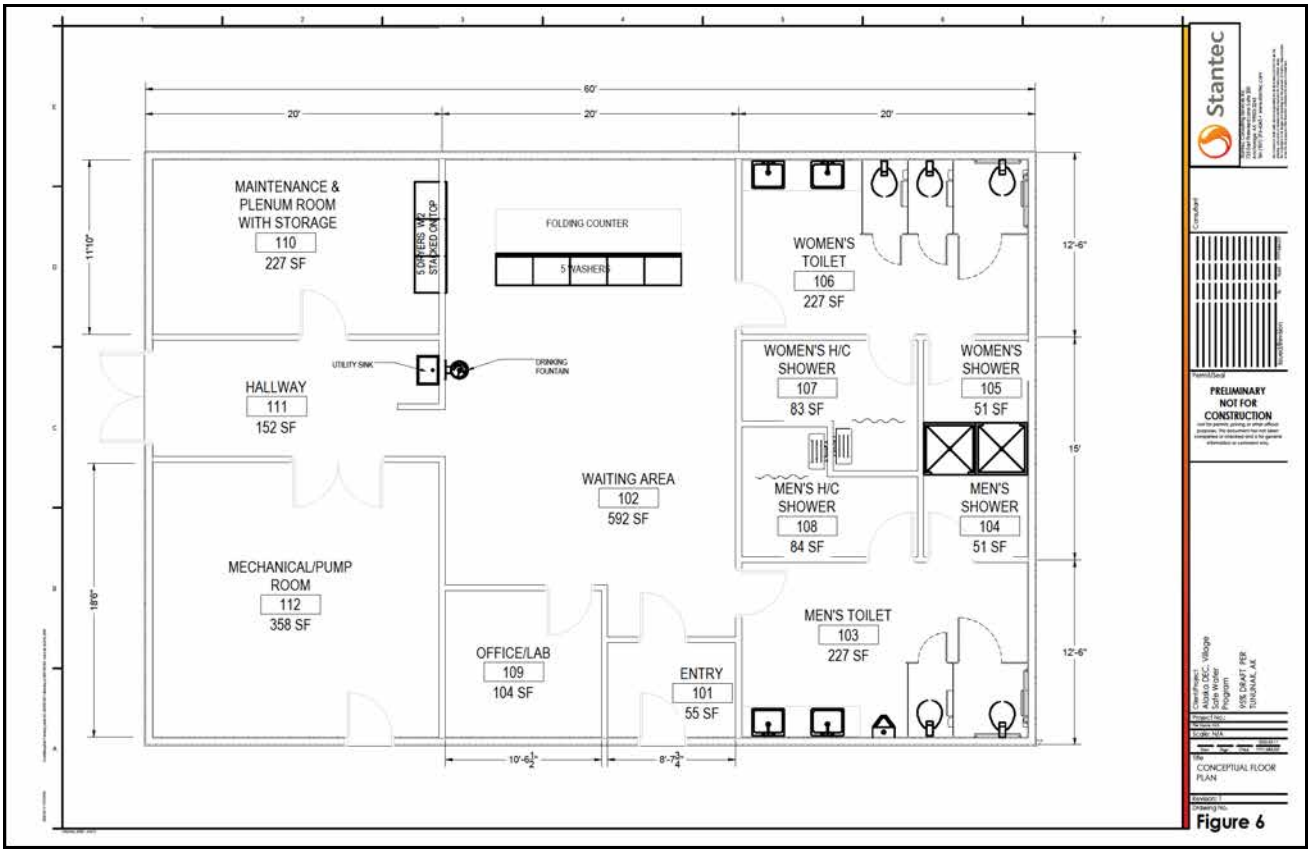
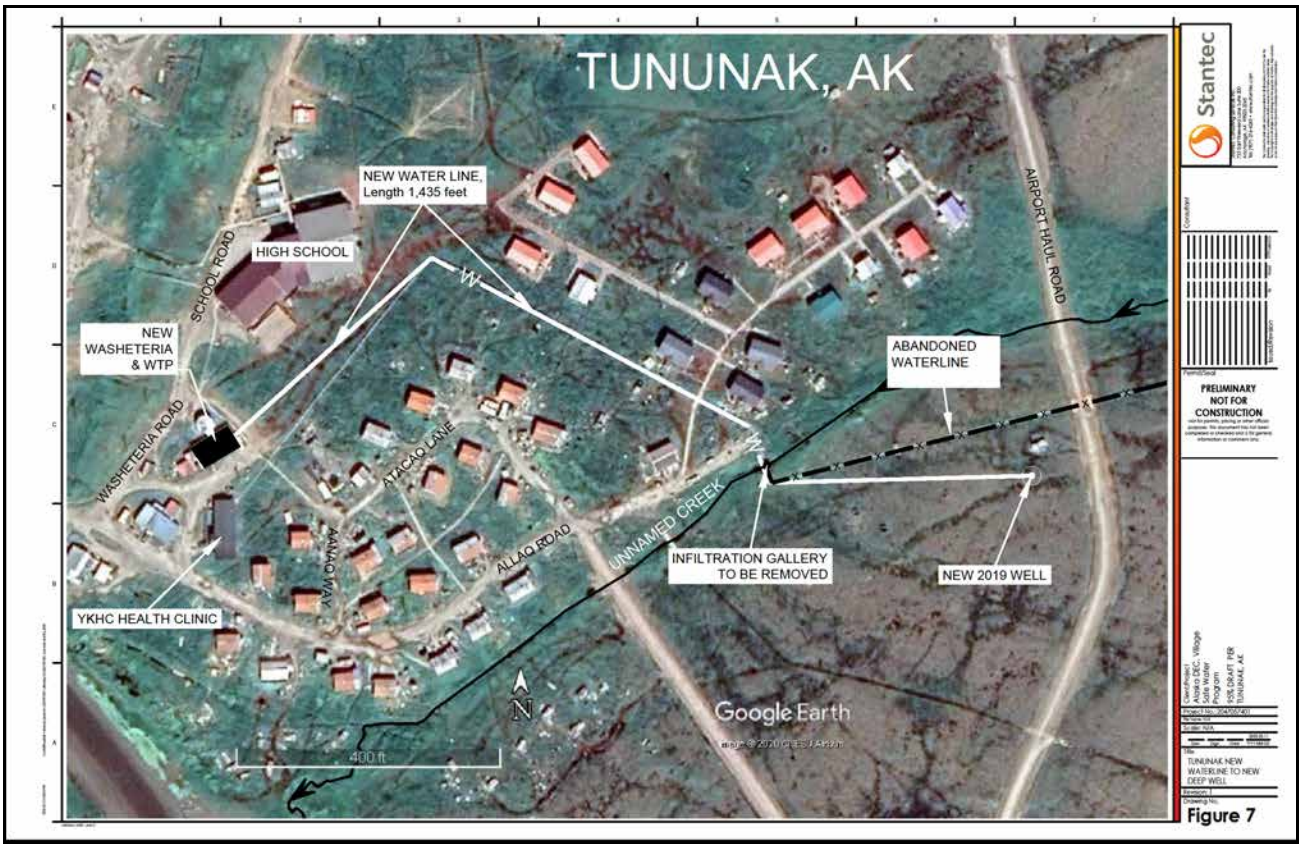


Figure 7 is a site plan layout of the connection to the new deep water well and proposed alignment of the replacement water transmission line is shown in aerial view on Figure 2.

Figure 7 Alternative 3: New Waterline to Deep Well



4.3.4 Environmental Impacts

No environmental impacts are anticipated for Alternative 3 since it presents minimal new ground disturbance. Minimal ground disturbance may occur during installation of the new foundation. Should excavation be required to install the new foundation, the SHPO must be consulted and measures to avoid adverse impacts to cultural resources will be implemented. In addition, the USFWS must be consulted to determine any proposed avoidance measures that can be incorporated into the project construction methods that would avoid accidental impacts to Spectacled Eiders during construction. Also, the Corps of Engineers must be consulted if any excavation and/or wetlands disturbance is anticipated. Land Requirements

Alternative 3 proposes to place the new modular washeteria building in very close proximity to the existing washeteria/water plant. According to the administrators of Tununak, they have site control (ownership) of all property surrounding the existing washeteria/water plant. This area is adequate in size to accommodate the placement of the new modular washeteria/water plant building. Also, Tununak has

site control of property along the alignment of the proposed WTL from the new 2019 well to the water plant.

4.3.5 Potential Construction Problems

No potential construction problems are anticipated for Alternative 3. Minimum ground surface preparation may be required for the construction of the foundation for the new modular washeteria and water plant building, and manway utilidor to the WST and health clinic.

4.3.6 Sustainability Considerations

Alternative 3 would construct a reliable and affordable sanitation facility that will meet the current and future 20-year design life washeteria water treatment plant needs in Tununak. Alternative 3 is anticipated to generate enough revenue to cover the estimated annual O&M and repair and replacement costs presented in the table below.

4.3.6.1 Water and Energy Efficiency

The new modular building with new equipment for the washeteria and water treatment plant would be energy efficient, thereby, decreases energy and resources compared to that currently used.

4.3.6.2 Green Infrastructure

Not applicable.

4.3.6.3 Other

A new modular washeteria and water plant would provide long life and be less expensive and easier to operate and maintain for the community of Tununak. Prior to the erection of the modular building, the abandoned washeteria and WTP would be demolished and disposed of at the local sanitary landfill operated by the Village of Tununak.

4.3.7 Alternative 3 Cost Estimates

O&M costs for Alternate 3 are expected to increase compared to the current the existing WTP and washeteria, with the costs associated with operations and maintenance of the new equipment. However, the estimated O&M costs for Alternative 3 are lower than Alternative 2 since there is no water treatment equipment to operate which results in employing a lower level of operator certification. The detail of these increases is summarized in Table 6. Note that these represent only cost increases relative to the existing O&M costs for the current washeteria/WTP and do not address deferred maintenance, unfunded short-lived assets accounts, short staffing or other deficiencies within the existing O&M program.

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Table 6 Alternative 3 Annual O&M Costs

Item #	Item / Work Description	Estimated Labor	Unit	Hours Per Year	Annual Estimated Labor, $20/hour	Power / Supply Cost	Estimated Annual O&M Cost
1	Operator Labor[1]	24	hours/week	1248	$24,960		$24,960
2	Electricity and Utilities[2]		annual cost			$7,500	$7,500
	Heating Fuel Oil		annual cost			$7,500	$7,500
3	Chemicals, Supplies, Freight, and Expendables[2]		annual cost			$1,500	$1,500
4	Office and Administrative[2]		annual cost			$2,500	$2,500
5	Emergency Repair Budget[2]		annual cost			$1,000	$1,000
12	Short Lived Asset Reserve[2]		annual cost			$15,794	$15,794
13	Other Line Items[3] (Insurance, etc.)		annual cost			$4,000	$4,000
14							$0
15							$0
	Estimated Initial Annual O&M		**0.60 FTE**	**1248 hours**	$24,960	$39,794	**$64,754**

Notes:
1 Based on operator time estimated at 24 hours per week at a rate $20/hr
2 Cost based on similar facilities per VSW and ANTHC experience.
3 Assumed costs for insurance, training, lab costs and miscellaneous operating expenses

Estimated construction (capital) costs, annual O&M expenses (assuming 2042 water demands with a minimum flow rate of 50 gpm), and a life-cycle cost analysis for Alternative 3 are presented in Table 7. Detailed cost estimates calculations are provided in Appendix A. The estimated life-cycle costs for Alternative 3, in 2020 dollars, assuming uniform series present worth based on a 20 year life is $5,529,581.

Table 7 Alternative 3 Summary Table of Capital, O&M, and Life Cycle Cost

Total Construction Cost	Annual O&M	20 Year Life Cycle Cost
$4,990,800	$64,754	$5,259,581

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5.0 SELECTION OF AN ALTERNATIVE

5.1 LIFE CYCLE COST ANALYSIS

Life cycles can be considered in a number of ways over to address the variability that can be expected when projecting O&M costs over 20 years. Table 8 shows the 2020 estimated costs for construction, non-construction, project and O&M cost increases. The total life cycle cost over 20 years is then calculated assuming either constant, arithmetic or geometric growth (see calculations in Appendix A). For this PER, the values generated with the arithmetic growth are used for Life Cycle comparisons.

Table 8 Life Cycle Analysis of Alternatives

Life Cycle Cost Analysis	Alternative 1 - Do Nothing	Alternative 2 - Rehabilitation of Existing	Alt 3 - Replacement with New
CONSTANTS			
Construction Cost	$0	$3,894,000	$3,119,250
Non-Construction Cost	$0	$1,362,900	$1,091,738
Total Project Cost, PC	$0	$6,230,400	$4,990,800
Residual Value (RV) in n years	$0	$1,336,870	$1,376,826
Annual O&M, first year	$56,056	$86,684	$64,754
Annual O&M Increase (g)	3.0%	3.0%	3.0%
Annual O&M Increase, arithmetic gradient	$1,682	2600.52	$1,943
Geometric Gradient Factor	22.86	22.86	22.86
		ANALYSIS	
Assuming Constant Costs			
Equivalent Annual O&M, Constant Cost	$56,056	$86,684	$64,754
Present Worth of O&M, Constant Cost	$967,166	$1,495,608	$1,117,237
Total Present Worth	$967,166	$7,726,008	$6,108,037
Total Cost at End of Lifecycle (20 years)	**$1,121,120**	**$6,627,210**	**$4,909,054**
Assuming Arithmetic Growth			
Equivalent Annual O&M, Arithmetic Growth	$71,228	$110,146	$82,280
Present Worth of O&M, Arithmetic Growth	$1,228,939	$1,900,409	$1,419,628
Total Present Worth	$1,228,939	$8,130,809	$5,630,616
Total Cost at End of Lifecycle (20 years)	**$1,424,562**	**$7,096,447**	**$5,259,581**
Assuming Geometric Growth			
Equivalent Annual O&M, Geometric Growth	$74,257	$114,830	$85,780
Present Worth of O&M, Geometric Growth	$1,281,203	$1,981,229	$1,480,002
Total Present Worth	$1,281,203	$8,211,629	$6,470,802
Total Cost at End of Lifecycle (20 years)	**$1,485,146**	**$7,190,133**	**$5,329,565**

For the Life Cycle analysis, assumptions for useful life for structures and waterlines is 35 years. This gives Alternate 2 and Alternate 3 Table 9 presents a Life Cycle cost comparison of the three alternatives:

Table 9 Comparison between Life Cycle Costs of Alternatives

Cost	Alternative		
	Do Nothing	Rehabilitate	New Construction
Construction	$0	$4,867,500	$3,899,063
Non-Construction	$0	$1,362,900	$1,091,738
Total Project	$0	$6,230,400	$4,990,800
Annual O&M	$56,056	$86,684	$64,754
20 Year Life Cycle	$1,424,562	$7,096,447	$5,259,581

The No Build Alternative 1 has the lowest Life Cycle cost of the three alternatives; however, the No Build Alternative does not address any of the community's current or future sanitation need. The O&M costs will remain high for a facility that doesn't not meet the minimum needs of the community and will lead to a Life Cycle Cost of almost $1.5M.

Alternative 2 will address the current sanitary deficiencies as well as the health and safety issues throughout the facility. It has the highest Life Cycle Cost because the annual O&M and the overall project cost is highest out of the three alternatives.

Alternative 3 addresses the health, safety, and sanitation deficiencies of the current washeteria and WTP. The lifecycle cost for Alternative 3 is higher than Alternative 1 (No Build) because there is an initial capital investment. In providing a functional facility with the ability to generate revenue with 5 washers, 5 dryers, and four showers, Alternative 3 has the potential to generate higher gross profits during peak use times that is not possible with either Alternate 1 or Alternate 2. The investment in Alternative 3 is less that Alternative 2 and results in both a lower capital cost and a significantly lower 20 year Life Cycle.

5.2 RECOMMENDED ALTERNATIVE

Alternative 3 (New Modular Combined Washeteria and Water Plant and other improvements to the water system) is the recommended alternative to meet the current and future sanitation needs of Tununak. Alternative 3 has the additional benefit of new construction that is superior to Alternative 1 and the renovations of Alternative 2.

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6.0 PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)

6.1 PRELIMINARY PROJECT DESIGN

6.1.1 Drinking Water

6.1.1.1 Water Supply

The source of water for the recommended Alternative 3 (modular combined washeteria/water plant and other improvements to the water system) will be the deep water supply well that was drilled in 2019.

6.1.1.2 Treatment

In accordance with the requirements given in 18 AAC 80 for Drinking Water, the 2019 deep water well requires no treatment.

6.1.1.3 Storage

Treated water from the new water plant will be pumped and stored in the existing 50,000 gallon WST. The interior coating in the WST will relined.

6.1.1.4 Pumping Stations

Not applicable.

6.1.1.5 Distribution Layout

Not applicable.

6.1.2 Wastewater/Reuse

Not applicable – wastewater would continue to be discharged to the existing off-site septic tank system.

6.1.2.1 Collection System/Reclaimed Water System Layout

Not applicable.

6.1.2.2 Pumping Stations

Not applicable.

6.1.2.3 Storage

Not applicable.

6.1.2.4 Treatment

Not applicable.

6.1.3 Solid Waste

6.1.3.1 Collection

Not applicable.

6.1.3.2 Storage

Not applicable.

6.1.3.3 Processing

Not applicable.

6.1.3.4 Disposal

Not applicable.

6.1.4 Stormwater

6.1.4.1 Collection System Layout

Not applicable.

6.1.4.2 Pumping Stations

Not applicable.

6.1.4.3 Treatment

Not applicable.

6.1.4.4 Storage

Not applicable.

6.1.4.5 Green Infrastructure

Not applicable.

6.2 PROJECT SCHEDULE

The schedule for the construction of the recommended alternative #3 (Modular Combined washeteria and water plant and other water system improvements) is solely dependent upon the availability of funding. An important factor in the scheduling for this project is the discontinuation of current services that would be disrupted to the community users during the construction of the proposed modular building. When funding becomes available, the design of the recommended alternative could take approximately 4 to 8 months and several more months for the agency review process. The construction, delivery and erection of the modular building could take approximately 12 months depending on the time of year and availability of barging services.

6.3 PERMIT REQUIREMENTS

Construction of the new water plant and use of the new (2019) deep water supply well will require an Approval to Construct from the ADEC Drinking Water program. Engineering plans and specifications for the proposed water system will need to be submitted to the ADEC for review and approval. The project would anticipate receiving an approval to construct within 90 days of submittal of the 95% design. After installation of the water plant the ADEC will issue an interim approval to operate the treatment system for a period of one year and then a final approval to operate.

6.4 SUSTAINABILITY CONSIDERATIONS (IF APPLICABLE).

6.4.1 Water and Energy Efficiency

Alternative 3 (modular water plant with washeteria and other water system improvements) is expected to have an overall process efficiency of at least 95%. Power consumption is also expected to be lower than the current operation of the existing washeteria and WTP. These efficiencies will benefit the community and provide a means in the future to provide a piped water system to the entire community.

6.4.2 Green Infrastructure

Not applicable.

6.4.3 Other

The new washeteria will have modern equipment that will be a substantial improvement for the laundry facilities. Also, the operators of the existing washeteria are familiar with the routine maintenance of the laundry equipment. In addition, in consideration of the lack of piped water system in Tununak, the new public bathrooms/restrooms will be valued by the community residents.

6.5 TOTAL PROJECT COST ESTIMATE (ENGINEER'S OPINION OF PROBABLE COST)

Table 10 presents the anticipated construction and non-construction costs for the recommended Alternative 3, a new Modular Water Plant with Washeteria and other water system improvements. Based on the proposed schedule provided above, the project cost of $5.0M in 2020 dollars. Land and right-of-way costs are not included as the project is located within property owned by Tununak.

Table 10 Alternative 3 Estimates of Total Cost

Proposed Alternative	
Alternative 3 – New Modular Building and Deep Well	
Estimated Construction Cost	$3.9M
Non-Construction Costs	$1.1M
Total Estimated Project Cost	$5M
Initial O&M Cost	$65,000
Annual Short-Lived Assess Reserve Payment	$16,000

6.6 ANNUAL OPERATING BUDGET

6.6.1 Income

It is understood Tununak would continue their current user fee program for water services and washeteria usage. A copy of Tununak's operation budget for the past several years includes the water treatment plant and washateria as provided in Appendix C. It is anticipated that the user fee program to cover the projected O&M budget presented in Table 8 for the future operation of the water plant and washeteria proposed in Alternative 3 will have to be adjusted accordingly (user fees) by Tununak to cover the additional costs of approximately $9,000 per year to operate the new facility. However, the user fee charges may not have to be increased when the community realizes the benefits of the improved washers and dryers thereby increasing the number of users which in turn increases the income.

Leslie Petre, EIT, reviewed of cost for laundry and shower facilities in Fairbanks and in North Pole, Alaska current to 3/9/2020 and found that the rates being charged in Tununak, Alaska are notably lower. A single load of laundry is $3.50-$4.50 to wash and $3.00-$4.00 to dry. The rate for a double load machine is $5.50-$6.00 and a rate of $7.50-$8.00 is common for a triple load washer. Showers are $5 for 10 minutes.

The Initial O&M of $65,000 would require that the Washeteria generates a monthly average of $5,520 to cover all expenses and to save money for the reserve fund. The Washeteria is open 6 days a week and would need to have sales of $230 a day on average. It would be necessary for every machine and shower to be operated a minimum of 5 times at $3 a cycle each day of operation to make this level of

sales. If $4 a cycle was charged, each piece of equipment/shower would only need to be run 4 times a day.

6.6.2 Annual O&M Costs

The annual O&M budget of $65,000for Alternative 3 was presented in Table 6 in Section 4.3.8.

6.6.2.1 Debt Repayments

Tununak does not currently maintain debt.

6.6.2.2 Reserves

Debt Service Reserve

Tununak does not currently maintain debt.

Short-Lived Asset Reserve

Table 11 presents the detailed costs of the annual Short-lived reserve for the recommended alternative, Alternative 3 Combined Modular Washeteria and Water Plant. See Appendix A for a breakdown and basis for the costs. The Annual Short-lived reserve is the money that needs to be saved every year so that the utility can fund replacement of equipment as it wears out. The estimated amount of savings (in 2020 dollars) is $15,794 per year. This would mean that the utility would need to be able to bank $1320/month or for less than $3 per resident per month.

Table 11 Short Lived Assets Annualized Cost

Alternative 1 - New Modular, Combined Washeteria and Water Treatment Plant with Deep Well Source Short-Lived Asset Reserve					
Item #	Item Description'	Expected Useful Life (EUL)	Estimated Replacement Cost (C)	Number of Units (#)	Annualized Replacement Cost =#*C*(A/F)*(F/P)
1	Commercial Washer	6	$7,650	5	$7,951
2	Commercial Dryer	6	$5,700	5	$5,925
3	Commercial Hot Water Heater	8	$4,000	1	$602
4	Circulation Pumps	10	$400	4	$173
5	Expansion Tank	15	$225	2	$49
6	Heat Circ Pumps	10	$400	2	$87
7	Heat Exchanger	10	$1,150	2	$249
8	Flow Meter	10	$2,000	1	$216
9	Hydropneumatic Tank (100 gal)	10	$1,000	2	$216
10	Distribution Pumps	8	$650	2	$196
11	Submersible Pump	15	$1,200	1	$130
			Total Annual Reserve Payment		$15,794

Short-lived assets are those with an EUL of 20 years or less

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7.0 CONCLUSIONS AND RECOMMENDATIONS

Three options were reviewed to answer the Tununak Community's need for a washeteria and water treatment plant that produces safe, potable water. Alternative 1 is a "No Build" approach examining the feasibility of changing nothing. Alternative 2 is a "Rehabilitation of Existing Building and Systems" approach that would involve a large capital investment to restore a building and infiltration gallery that is more than 40 years old with modern building supplies on the originally framework. Alternative 3 is a "New Modular Building and Connection to the 2019 Deep Well" approach that could involve a smaller capital investment that Alternative 2 and would give the Community of Tununak a modern facility that would address the Village's needs.

Alternative 1 considered continuing with the existing building and making no capital investment. This alternative's "Do Nothing" approach fails to address:

1. Tununak's need and desire for a working Washeteria where the community can bathe and do their laundry safely.
2. The failed mechanical, electrical, plumbing, and structural issues that are a health and safety issue for the community.
3. The water quality issues due to equipment that is non-functional or the lack of an operator qualified to run a CWS in Alaska.
4. The issue that the Unnamed Creek Infiltration Gallery is failing and that the pump house on Unnamed Creek has dangerous electrical issues and poses a safety risk when the operator must access the gallery through the roof in the winter in order to refill the 50,000 WST. It would also make necessary repairs to the WST.

Alternative 1 does nothing to address the Village of Tununak's need for a reliable, working Washeteria to serve the community for the next 20 years.

Alternative 2 does address the existing building and utility conditions through a substantial capital investment and required that the plant operator attain a Level 1 Water Treatment for the CWS to be in compliance with state and federal regulation. This alternative will address:

1. Tununak's need and desire for a working Washeteria where the community can bathe and do their laundry safely. The alternative will restore the systems to meet building and safety regulations.
2. The failed mechanical, electrical, plumbing, and structural issues that are a health and safety issue for the community. The work will be extensive to make the necessary corrections and the building will gain some residual value. The upgrades would not make the facility as energy efficient as new construction and the work on site will have an extended timeline.

3. The water quality issues due to equipment that is non-functional or the lack of an operator qualified to run a CWS in Alaska. The system would become a CWS again and would act as a secondary source of water for Tununak in the event that the School Well and Treatment System became non-functional.

4. The issue that the Unnamed Creek Infiltration Gallery is failing and replace the current pump house on Unnamed Creek. The WST would be relined to allow it to safely store potable water. There would be a risk that the new infiltration gallery could develop the same issues seen with the current gallery.

Alternative 2's Rehabilitation of the current facilities addresses the Village of Tununak's need for a reliable, working Washeteria to serve the community for the next 20 years. It is the most expensive alternative up front and over the propose 20 year life cycle cost of the facility.

Alternative 3, the New Modular Combined Washeteria and Water Plant with other water system improvements, is the lowest capital cost alternative. This alternative offers substantially more benefit for the welfare and health for the residents of Tununak compared to the other alternatives. This alternative will give the community a new, safe, efficient building and utilize the New 2019 Deep well that is capable of producing clean, potable water that will require no treatment.

Based on these findings and conclusions as presented herein, Alternative 3 – Modular Combined Washeteria and Water Plant and other water system improvements is the recommended alternative to serve the future drinking water and laundry/hygiene needs of Tununak. The estimated capital cost for this project is $5.0 M.

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8.0 REFERENCES

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APPENDICES A-D

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Appendix A COST ESTIMATES

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A.1 ESTIMATION FOR RESERVOIR TANK RELINING

A.2 CAPITAL COST CALCULATIONS

A.2.1 ALTERNATIVE 2 CAPITAL COST

A.2.2 ALTERNTIVE 3 CAPITAL COST

A.3 O&M COST CALCULATIONS

A.3.1 ALTERNTIVE 1 O&M

A.3.2 ALTERNATIVE 2 O&M

A.3.3 ALTERANTIVE 3 O&M

A.4 LIFE CYCLE COST CALCULATIONS

A.5 INFLATION CALCUATION FOR O&M ON ALTERNATE 1

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Appendix B WATER DEMAND

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Appendix C POPULATION GROWTH

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Appendix D SUPPORTING DOCUMENTS

D.1 AGENCY ASSESSMENTS AND REPORTS

D.1.1 2012 ANTHC-DEHE Comprehensive Energy Audit For Tununak WTP

ANTHC 2012 "*Comprehensive Energy Audit for Tununak Water Treatment Plant & Well House*" Energy Audit listing energy costs, savings, and issues seen during assessment. It is reference in text as "ANTHC 2012". Length 18 Pages.

D.1.2 March 2017 Rural Alaska Village Grant (RAVG) MEMORANDUM

An assessment for ANTHC and VSW of the Tununak Washeteria, WTP, and infiltration gallery in 2017 that found several operational issues that pose a hazard. It is referenced in text as "RAVG". Length 11 Pages.

D.1.3 2018 September Best Practice Trip Report Memorandum

September 4, 2018 Memorandum "*Trip Report, Tununak-Water Treatment Plant and Washeteria Training Trip for Best Practice Scores-August 21-22, 2018*". It is referenced in text as "ANTHC 2018" Length 15 Pages.

D.1.4 October 2018 RMW Routine Trip Report

Remote Maintence Worker Report of site visit including 50,000 gallon Tank Cleaning. Length 5 Pages.

D.2 ENGINEERING ASSESSMENT REPORTS AND MEMOS

D.2.1 MWH December 2010 "Report on Site Conditions and Recommended Plan of Action For Sanitation Improvements in Tununak, Alaska"

A base assessment of the Tununak Washeteria, WTP, and infiltration gallery in 2009 and 2010. It is referenced in text as "MWH 2010". Length 74 Pages.

D.2.2 Stantec Technical Memos 2018

Technical Memorandum 1 – *Assessment of the Existing Wastewater Disposal System (Septic Tank/Drainfield)*

Technical Memorandum 2 – *Assessment of Existing Water Transmission Line*

Technical Memorandum 3 – *Structural Assessment of the Existing 50,000-Gallon Water Storage Tank*

Technical Memorandum 4 – *Task 1 – Desktop Study to Assess the Capacity of the Unnamed Creek Infiltration Gallery*

Technical Memorandum 4 – *Task 2 – Water Source Assessment Deep Water Supply Well*

Length 173 Pages.

D.2.3 Stantec Environmental Report December 2017

December 31, 2017 *"Final Environmental Report: Tununak Water Treatment Plant and Washeteria Facility"* Length 39 Pages.

D.3 AS-BUILT RECORDS

D.3.1 1980 As-builts for Tununak Sanitation Project

1980 Record Drawings, *"Construction Plans Sanitation Facilities Tununak, AK"* The signed As-Built record for the original Tununak Water, Septic, and Washeteria project completed between 1978-1980. Referenced in text as "1980 As-Builts." Length 28 Pages.

D.4 PERMITTING

D.4.1 October 2019 Engineer Report Request to ADEC for Approval of Well

Request with Engineering Report submitted by Bob Gilfillan. P.E on behalf of the Native Village of Tununak IRA Council Tununak, AK for a New Deep Water Supply Well to serve as a primary drinking water source. Length 131 Pages.

D.4.2 2019 Application for Water Right

Application Alaska Department of Natural Resource for the New Well Drilled July 13, 2019. Length 19 Pages.

D.4.3 2012 ADEC Reclassification of WTP as a Non-Public Water System

Letter for ADEC Drinking Water Program on June 14, 2012 changing the classification of the Tununak WTP to a Non-Public Water System with a Surface Source, Length 2 Pages.

D.5 COMMUNITY RECORDS

D.5.1 QUIT CLAIM DEED 8/24/2016

Quit Claim Deed of property from Tununak Traditional Council to the Native Village of Tununak IRA Council.

D.5.2 Tununak Income Records November 2009- 2016

Community Statement of Account Receivable and *"Budgeted Operating Expenditures"* Length 10 Pages.

D.5.3 Resolution 2015-02 Requesting Planning Project Funding

Resolution 2015-02 Passed January 5, 2015 to requesting funding for a plan for a New Tununak Washeteria, Water Treatment Plant, and Wastewater Disposal. Length 1 Page.

D.5.4 February 2020 Profit and Loss Statement

Combined Water, Washeteria, and Wastewater Profit and Loss Statement provided Tununak's accountant MDM Financial Management, LLC.

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Appendix E ADDITIONAL RECORD PHOTOS