



# City of Bethel, Alaska

## Public Works Committee Agenda

Wednesday, July 18, 2018 Regular Meeting 5:30PM City Hall Council Chambers

### Members

Alyssa Gustafson  
*Committee Member*  
Term Expires 12/2019

Fred Watson  
*Council Rep.*  
Term Expires 10/2018

Jeff Sanders  
*Committee Member*  
Term Expires 12/2020

Juan Delgado  
*Committee Member*  
Term Expires 12/2018

Courtney Trammell  
*Committee Member*  
Term Expires 12/2020

Ryan Butte  
*Committee Member*  
Term Expires 12/2020

Bill Arnold  
*Ex- Officio Member*

Anna Nicolai  
*Committee Recorder*

### I. Call to Order:

### II. Roll Call:

### III. People To Be Heard: (5 Minute Limit)

### IV. Approval Of Agenda:

### V. Approval Of Minutes:

### VI. SPECIAL ORDER OF BUSINESS:

### VII. UNFINISHED BUSINESS:

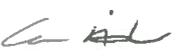
- A. Institutional Corridor Piped Water Supply Project
- B. Sewer Lagoon
- C. Clarification of BMC sections on ownership of water\sewer facilities
- D. Ordinance #18-Ordinance to adjust minimum holding tank sizes for City of Bethel hauled water & sewer services
- E. Avenues Neighborhood Water and Sewer Improvements / Preliminary Engineering Report
- F. Institutional Corridor Water and Sewer Rates

### VIII. NEW BUSINESS:

### IX. DIRECTOR'S REPORT:

### X. MEMBER COMMENTS:

### XI. ADJUOURNMENT:

Public Works Recorder/ Anna Nicolai   
Posted agenda on June 12, 2018 at City Hall, Swanson's, AC Store, QFC, AC Quick, Post Office

Introduced by:  
Introduction Date:  
Public hearing date:  
Action:  
Vote:

## *CITY OF BETHEL, ALASKA*

### **ORDINANCE #18-**

#### **AN ORDINANCE ADJUSTING MINIMUM HOLDING TANK SIZES FOR CITY OF BETHEL HAULED WATER AND SEWER SERVICES**

**WHEREAS,** The City of Bethel ("City") operates water and sewer utilities to provide water and sewer in Bethel;

**WHEREAS,** Provision of such services to Bethel is in the best interest of the public;

**WHEREAS,** The current charges for delivery of water and sewer evacuation reflect the higher cost per gallon for smaller tank sizes.

**WHEREAS,** Hauled services are set up to deliver to each neighborhood in Bethel two times a week.

**WHEREAS** A primary concern for tank sizing is for the tank to be of adequate size so that the needs of the customer can be provide by no more than 2 deliveries per week.

**WHEREAS,** Many of the strategies for reducing water and sewer costs in Bethel are based on conservation.

**WHEREAS,** The current code requires tank sizes that are larger than a residence might use in one month

**BE IT ORDAINED,** by the City Council of Bethel, Alaska; that:

**Section 1. Classification.** This ordinance is permanent and general in nature and shall be placed in the Bethel Municipal Code.

**Section 2. Repeal and Re-enactment** Section 13..04.180 of the Bethel Municipal Code is hereby repealed and re-enacted as follows:

rate charges:

**13.04.180 Holding tank service.**  SHARE

Customers to whom a water main is not available may have water delivered to their properties for discharge into holding tanks; provided, that the location, type of holding tank and access thereto is approved by the department. Quantity and frequency of delivery shall be determined by regulations or orders of the department and approved by the council, and the rate charged for such delivery shall be determined by the council by ordinance. : *It is the customers responsibility to install a tank of adequate size to meet the usage and needs of the building with no more than twice weekly deliveries.*

In new home construction, the minimum water holding tank size shall be determined by the chart below

<b>Number of Bedrooms</b>	<b>Water Tank Size</b>
Studio 300 sq ft. or less	300 gallons
Studio more than 300 sq ft.	400 gallons
One bedrooms	500 gallons
Two bedrooms	700 gallons
Three bedrooms	900 gallons
Four or more bedrooms	1000 gallons

**CITY OF BETHEL**  
**PRELIMINARY ENGINEERING REPORT**  
**AVENUES NEIGHBORHOOD WATER AND SEWER IMPROVEMENTS**

**Prepared for:**

City of Bethel  
Post Office Box 1388  
Bethel, Alaska 99559

In conjunction with:  
United States Department of Agriculture  
Rural Utilities Services

**With technical assistance from:**

DOWL  
4041 B Street  
Anchorage, Alaska 99503  
(907) 562-2000

W.O. 50118.01

June 2018

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**LIST OF ACRONYMS**

ADF&G.....	Alaska Department of Fish and Game
AHRS.....	Alaska Heritage Resources Survey
BMPs.....	best management practices
CA.....	Construction Administration
CY.....	cubic yard
DLWD.....	Alaska Department of Labor and Workforce Development
doi.....	Digital object identifier
DOT&PF.....	State of Alaska Department of Transportation and Public Facilities
DPW.....	City of Bethel Department of Public Works
FEMA.....	Federal Emergency Management Agency
FIRM.....	Flood Insurance Rate Maps
FY16.....	Fiscal Year 2016
gpd.....	gallons per day
gpm.....	gallons per minute
HMCP.....	Hazardous Materials Control Plan
HVAC.....	heating, ventilating, and air conditioning
IPaC.....	USFWS Information for Planning and Conservation system
LF.....	linear foot
LS.....	lump sum
NWI.....	USFWS National Wetlands Inventory
O&M.....	operations and maintenance
PER.....	Preliminary Engineering Report
QFC#2.....	Quick Food Center No. 2 (lift station)
ROW.....	right-of-way
rpm.....	revolutions per minute
SF.....	square foot
SHPO.....	State Historic Preservation Office
SWPPP.....	Storm Water Pollution Prevention Plan
T&E.....	threatened and endangered
USACE.....	United States Army Corps of Engineers
USDA RD.....	United States Department of Agriculture Rural Development
USDA RUS.....	United States Department of Agriculture Rural Utilities Services
USFWS.....	United States Fish and Wildlife Service

## 1.0 INTRODUCTION

The City of Bethel (City) has retained DOWL to provide engineering services related to providing water and sewer services to residents located in The Avenues, located between 3<sup>rd</sup> Avenue and 7<sup>th</sup> Avenue between Ridgecrest Drive and Main Street.

The "Avenues" neighborhood in Bethel consists of approximately 130 predominantly residential parcels. All residences in the neighborhood currently have water and sewage tanks. The City of Bethel delivers potable water and collects sewage from these tanks. This type of delivery and collection is more expensive for the homeowner than the alternative; piped water and sewer. Piped water and sewer is easier to maintain and more efficient to operate for the City of Bethel. The purpose and need to this project is to provide the "Avenues" neighborhood with a more efficient water and sewer system to reduce homeowner and City operational costs.

## 2.0 PROJECT PLANNING AREA

### 2.1 Location

The City of Bethel is a Second-Class City located in the Yukon Delta National Wildlife Refuge at the mouth of the Kuskokwim River, 40 miles inland from the Bering Sea (60.7968, -161.7714). It is the largest community in Western Alaska by population, and is approximately 44 square miles. Figure 1 shows the proposed project vicinity.

The City is located along the Kuskokwim River, in a treeless subarctic tundra floodplain terrain that is characterized as poorly drained with a shallow permafrost table. The topography is general flat, with grades ranging from zero to seven percent. Along Bethel's waterfront and townsite, the soils are poorly drained silts, with permafrost depth ranging from 30-40 feet. Further inland from the river, the ground is usually saturated or covered with surface water or sandy soils covered with silt loams and 12 inches of peaty mat. Vegetation is typically low-growing shrubs, grasses, and mats of moss and lichens. Bethel can experience flooding by the Kuskokwim River. Flooding in 1985 was 3 to 4 feet deep, which resulted in the flooding of several homes, while the flooding in 1988 was approximately 5 feet deep and flooded 600 homes. Bethel experiences constant erosion from the Kuskokwim River as it is located on the eroding bend of the river. Bethel averages 16 inches of rain and 50 inches of snow per year. The temperature ranges from 42°F to 62°F in the summer to -2°F to 19°F in the winter.

Most land around Bethel has permafrost with combinations of wet and dry tundra. The permafrost conditions, poor surface drainage, proximity to the Kuskokwim River flood impact area, wind direction, and the presence of wetlands make much of the land around Bethel undevelopable. Development in Bethel has resulted in a community with a small downtown, with a gridded road system with concentrated mixed-use development. There is a limited supply of private land, and much of the private land is Native allotments. Native allotments pose difficulties for development. It can often take the Bureau of Indian Affairs years to research title and process a land sale. Land ownership is often held by more than 20 people, which can cause coordination and agreement complications, especially if one of the co-owners moves away or passes away. Additionally, Native allotments are often exempt from local land use regulations, which can result in a lack of reserved land for utility easements.

preservation. There are no farmlands of prime, unique, or statewide importance are present in the project area. No formally classified land or federal lands exist within the municipal limits.

#### 2.2.2 Wetlands

A review of the USFWS National Wetlands Inventory showed no wetland information for the region. However, the project area is within the Subarctic Coastal Plain ecoregion (Nowicki, et al 1995), which is characterized by low relief, the predominance of wetlands and braided or meandering streams and rivers. Permafrost is widespread and vegetative cover generally consists of wet graminoid herbaceous communities. Therefore, wetlands are likely present in undeveloped areas.

#### 2.2.3 Floodplains

The Federal Management Agency (FEMA) has mapped flood hazards for Bethel related to the Kuskokwim River floodplain. According to FEMA Map Panel 0201040042C (revised 8/25/2009) the base flood elevation of the floodplain in Bethel is 17 feet above mean sea level (amsl).

#### 2.2.4 Endangered Species

There are no threatened or endangered species within the proposed project limits and the resource was not evaluated further

#### 2.2.5 Cultural Resources and Historic Sites

The Area of Potential Effect (APE) encompasses direct impact areas where ground disturbing activities may occur, staging areas temporarily disturbed during construction, and a 500-foot buffer to evaluate potential indirect impacts. A search of the Alaska Heritage Resource Survey (AHRS) was conducted April 16, 2018 to identify previously recorded sites. The review included all of the Project Location, while the APE has been determined to be the area of ground disturbance. One National Historic Register listed property is located on 3rd Avenue, south of the southernmost east-west run. Six additional buildings are recorded in the AHRS, but have not evaluated for eligibility for the National Register. Review of aerial photographs, by USDA-RD, show no structures within the APE and no predominate land features which would lend themselves to historic, cultural, or subsistence use.

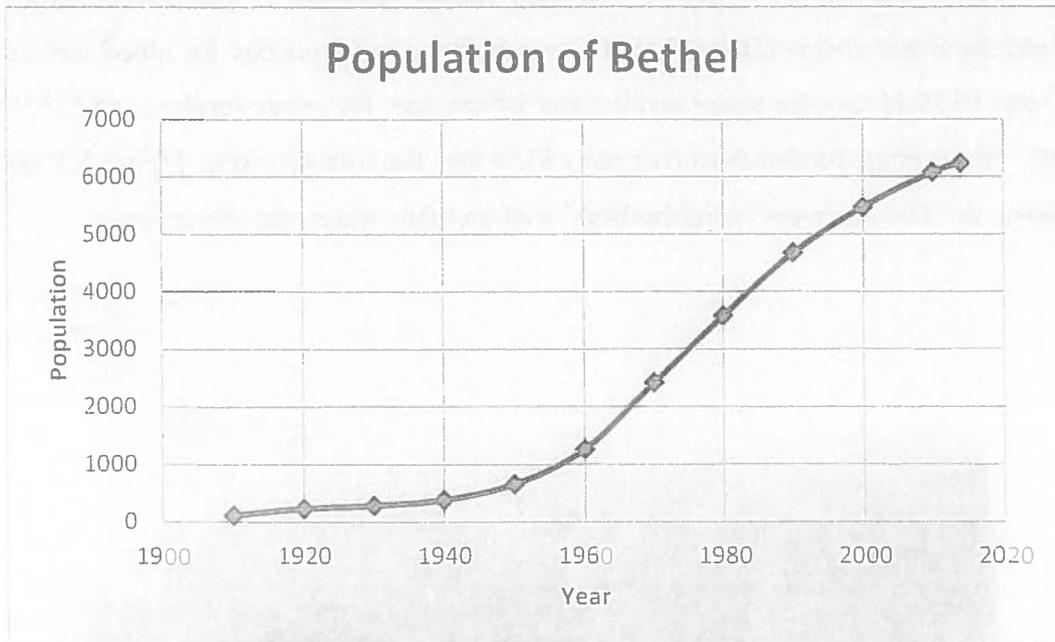


Figure 2: City of Bethel 1910-2015 Population

### 3.0 EXISTING FACILITIES

The City ruled that for health reasons, residents are no longer allowed to use honeybuckets. There are roughly 1,600 hauled water and sewer customers served by the City's hauled service fleet of water and sewer trucks. In contrast, only about 400 buildings have piped service.

#### 3.1 Location, History, and Condition of Existing Facilities

The City of Bethel serves approximately 130 residences in the Avenues by hauled water truck and hauled sewer truck. This hauled system takes two water truck drivers and two sewer truck drivers two and a half days to complete the subdivision routes each week. Each driver makes an average wage of \$19/hr. plus benefits at 116% of salary, or \$22/hr. Thus, the total amount incurred by the City per week to deliver water and evacuate sewage tanks is  $(\$19/\text{hr.} + \$22/\text{hr.}) \times 60 \text{ hrs.} \times 4 \text{ drivers} = \$9,840$ . The cost to operate the truck-haul system is directly proportional to the length of each haul. However, the rate structure is based on the number of haul trips and volume of water and wastewater. It is assumed that the lower cost of the shorter hauls balances the increased costs of the longer hauls. However, as more houses are serviced by piped water and sewer, there are fewer short hauls.

The actual City cost to produce and deliver water is more dramatic than the above rates indicate. According to the 2013 City of Bethel Rate Study (CH2M Hill), the cost to produce and deliver water via the haul system is \$62.04/1,000 gallons. The cost to collect and dispose of sewage via the haul system is \$64.05/1,000 gallons. The cost to produce and deliver piped water is \$26.18/1,000 gallons. The cost to collect and dispose of sewage via the piped system is \$9.52/1,000 gallons.

The City experiences difficulties with the occasional unwillingness for customers willing to pay, as well as issues of equity in the costs structure. Customers receiving service from the piped system have lower insurance rates due to proximity of fire hydrants. Additionally, piped service residents are un-metered, so they can use as much water volume as they desire, while the haul-system residents are charged by their volumetric water use.

The water haul trucks collect water at the City Subdivision Water Treatment Plant (CSWTP). The CSWTP wellhead has a 10-inch diameter steel casing, and was drilled to a depth of 500 feet. A Grundfos 385-S400-4 6-inch diameter 40HP submersible pump is installed at 210 feet and delivers approximately 400 GPM. The CSWTP has a storage tank of 428,000 gallons.

The Bethel Heights Water Treatment Plant (BHWTP) wellhead, has additional capacity to support the City's truck-hauling. The BHWTP wellhead is was drilled in 1969 to a depth of 420 feet, and was installed with an 8-inch diameter casing. A Grundfos 385-S400-4 6-inch diameter 40HP submersible pump is installed at 214 feet and delivers approximately 400 GPM. A secondary well located outside of the plant in 1998 with a 10-inch diameter casing and same pump was drilled in 1998 to 211.5 feet. The BHWTP has a storage tank of 505,000 gallons.

Both treatment plants are operating at approximately 1/6th of their capacity. Although capacity is sufficient for future growth, the treatment plants may need additional storage capacity to attain adequate fire flow needs of a larger water distribution network.

Each well has a filling station for water trucks. The CSWTP station has a 5HP pump, while the BHWTP has a 3HP pump.

components are protected against freezing. The trucks are stored in a 250 by 300 foot heated storage building located on the outskirts of town. It takes the City approximately six days to serve all the residents. Approximately 15 minutes are spend servicing each residence, and the tanks are pumped until overflow. Residential tank vary in size and style, which complicates the City's hauling efficiency. However, seasonal weather changes do not greatly affect service efficiency. Approximately 50 people are employed by the truck-haul system at various levels.

The City's fleet consists of a nine water trucks and nine sewer trucks. The City's fleet is approximately 20 years old, and needs replacement. A recent sewage project at the City's sewage lagoon came in under budget, and the City is able to use the budget surplus to purchase five new sewer trucks. Still though, the City needs to replace nine water trucks and four sewer trucks.

Recently the City has also been issued warnings by the State of Alaska Department of Transportation (DOT&PF) following a July 19, 2017 inspection. The City's three axle haul trucks can only weight 42,000 pounds in accordance with DOT&PF weight restrictions (17 AAC 25.100(a)). This means that most of the City's trucks despite having 3,000+ gallon capacity, can only haul 2,100 gallons at a time. The City trucks with 4,000 gallon capacity can only legally carry 3,000 gallons.

The aging fleet needs to be replaced with a newer fleet because of part's scarcity, and because operating the trucks at partial capacity is an inefficient use of resources. The fleet could be replaced with a fleet of newer models, with longer configurations, which would allow for greater total vehicle loads.

An existing sewer main goes through the Avenues that travels south between parcels between 7<sup>th</sup> Avenue and 6<sup>th</sup> Avenue. It then travels south along Ridgecrest Drive from 6<sup>th</sup> Avenue to the easement located between 6<sup>th</sup> Avenue and 5<sup>th</sup> Avenue. It travels east to cross Willow Street and continue to Main Street, at which point it turns southeast to cross 5<sup>th</sup> Avenue to Kilbuck Lift Station. This existing sewer main does provide a convenient tie in point for transitioning the neighborhood over to piped sewer.

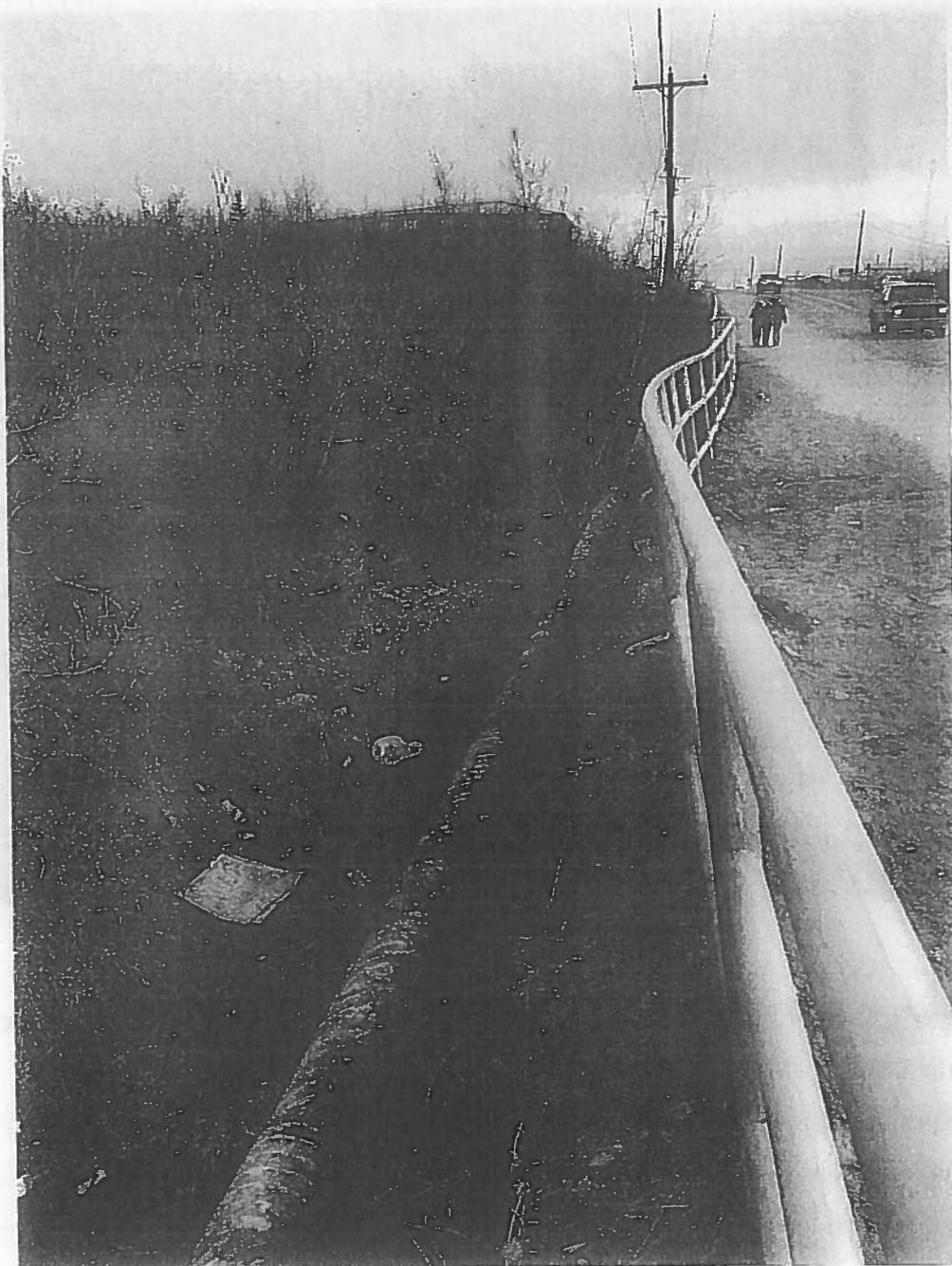


Figure 6: Existing Sewer Main Traveling South Along Ridgecrest Drive

Station is operating at capacity, and during truck discharge the operators must gradually pump in effluent to ensure there is no overflow.

The Kilbuck Lift Station discharges approximately 103 GPM at 31 feet (TDH) at peak flow, and has additional capacity of 65GPM. This is less than the 400GPM necessary for truck-haul operation.

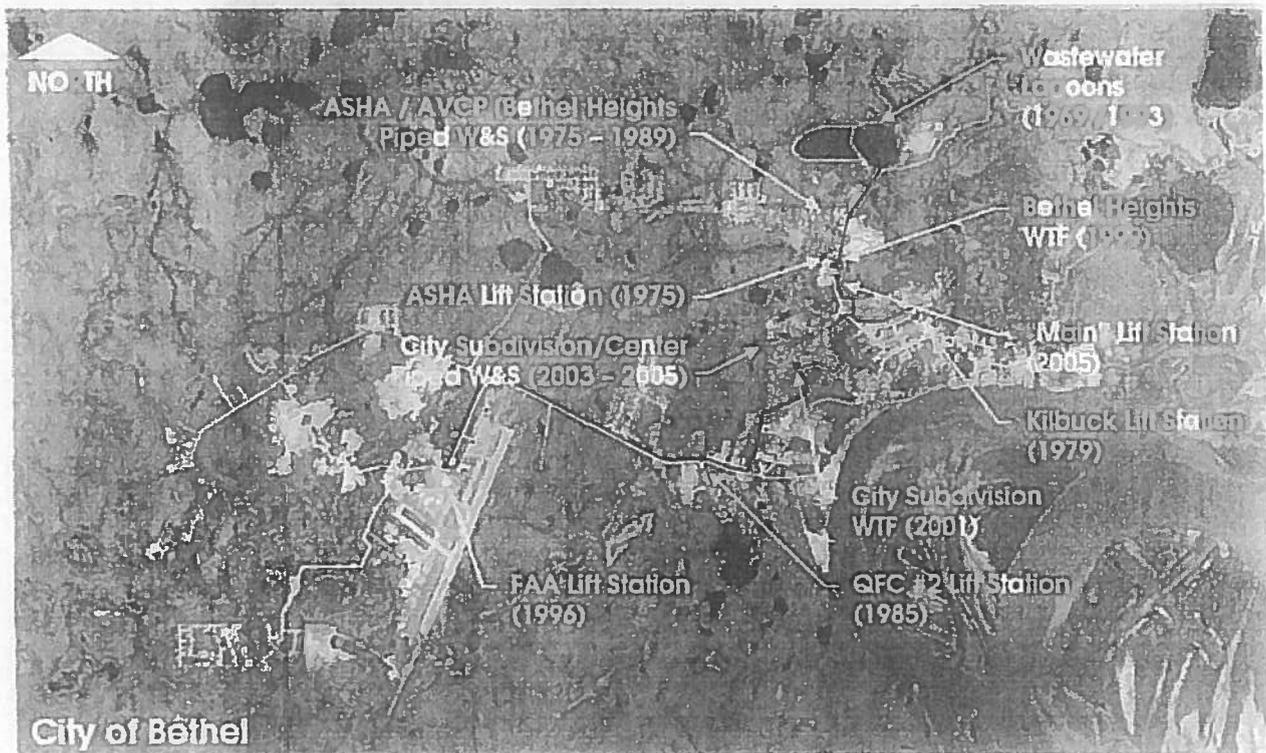


Figure 8: Existing Water and Sewer Service

## 3.2 System Operation and Maintenance

### 3.2.1 Management Adequacy

Operation and maintenance of public water and sewer systems is the responsibility of the City of Bethel Department of Public Works (DPW). The DPW manages a fleet of equipment, including work trucks, water and wastewater haul trucks, dump trucks, excavators, tractors, loaders, generators, and tools.

The advantage of a piped system over truck-haul is that O&M costs are lower, and sanitary conditions are better. The disadvantage of a piped system is the increased potential for freezing, and the higher initial capital costs.

Additionally, damage to the roads in Bethel has been caused by the heavy loads transported by the water and sewer haul trucks, which has necessitated repairs. A piped system would decrease use of haul trucks, which would decrease future road repair needs.

The 2013 utility rate study for the City of Bethel identified a path to make the whole utility financially solvent. The path is in its second year of implementation. The City does not have reserves for capital improvements. All capital improvements must be funded through grant opportunities.

According to the 2013 utility rate study, current sewer system revenues are approximately \$2.5 million annually. Hauled sewer service revenue accounts for approximately 61 percent of this total, even though hauled sewer services only account for approximately 30 percent of total wastewater volume.

In years when the sewer utility has been over-budget, the City has had to dip into City general funds. The proposed utility rate structure increase will build up reserves for future emergency repairs.

The life of water and sewer infrastructure in Bethel, and other arctic and sub-arctic communities, is short. The anticipated life of various water and sewer components is shown in the following table.

**Table 2: Projected Population for Planning Period**

Year	Projected Population
2015	(Actual) 6,241
2025	6,962
2035	7,767

3.3.2 Estimate of New Customers

The 2013 City of Bethel *Water and Sewer Cost Allocation and Rate Study* (Rate Study) prepared by CH2M HILL, Inc. assumed that new customers, both commercial and residential, would grow at an annual rate of one percent. The City currently has approximately 1,600 water and sewer customers. Approximately 70 percent of these customers are on hauled sewer systems. This percentage does not correspond proportionally to the volume of hauled wastewater, because most of the major wastewater producers in town are within the 30 percent that receive piped sewer collection. The City is pushing to transition to piped network throughout the community, but given that most new developments/subdivisions are occurring far from the piped networks, transitioning to a piped network is cost restrictive in most to the Community. In areas of high density, located in close proximity to the existing piped network, transitioning is less cost restrictive. The following table projects the growth in hauled customers.

**Table 3: Projected Hauled Services for all of Bethel**

Year	Total Projected Hauled Services
2015	(Actual) 1,125
2025	1,242
2035	1,372

Approximately half of Bethel’s services have their wastewater collected and brought to the sewage lagoon. The other half has sewage hauled to the lift station near the airport (QFC#2). This project directly impacts what is done with wastewater from approximately 660 services. The delineation between hauled and piped sewer services, in this area, is shown in Figure 4. Figure 4 does not show the areas where sewage is hauled to the QFC#2 lift station.

## 4.2 Regulatory Compliance Concerns

The need for the project is not specifically related to a regulatory compliance issue. The existing infrastructure will soon lose its intended functionality.

### 4.2.1 Flooding and Wetlands

The entire community of Bethel sits adjacent to the Kuskokwim River and within the broader context of the Yukon-Kuskokwim Delta. Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) were reviewed to determine approximate flood risks for the project area.

Much of the project area falls within the expected 100-year floodplain (1-percent annual chance of a flood), particularly the areas in proximity to the unnamed tributary that drains the project area to the Kuskokwim River. The remainder of the project area is listed as having “undetermined flood hazards, with flooding possible” (FEMA, 2011).

Due to its location and proximity to the Kuskokwim River, construction of any new structures should take into account the possibility of floods and flooding. A proposed lift station should be constructed with enough clearance above ground level to allow for floodwaters.

### 4.2.2 Alaska State Historic Preservation Office (SHPO)

A review of the Alaska Heritage Resources Survey (AHRS) list, on October 7, 2015, indicated that there are known cultural resources in the vicinity of the project and its various alternatives. However, there are no known resources in the immediate vicinity of the existing sewage lagoon and truck dump jetty. The Bethel airport has been evaluated for eligibility as a historic resource and was found to be ineligible. There are, however, a number of sites in the old town center, generally between 3rd Avenue and 6th Avenue. None of the proposed alternatives is located in this area.

### 4.2.3 Biological Resources (United States Fish and Wildlife Service)

An investigation into threatened and endangered (T&E) species and critical habitat, via the United States Fish and Wildlife Service (USFWS) Information for Planning and Conservation (IPaC) system, on July 31, 2015, indicated no T&E species or critical habitat areas in or near the project area. Migratory birds are known to nest and breed in this part of Alaska; however, it is

prevention measures that would be used during project construction to minimize impacts to surface water.

## 5.0 ALTERNATIVES CONSIDERED

### 5.1 Alternative One - No-Build

#### 5.1.1 Description

The “No-Build” alternative is to continue using the existing haul system for “The Avenues”. Residents in “The Avenue area” will see no difference in cost, quality, or quantity of water to their homes. The City would continue to replace water and sewer trucks every seven years, and continue to deliver water and sewer as they currently do. This alternative would result in minimal change to operations and practice.

#### 5.1.2 Environmental Impacts

There are no additional environmental impacts resulting from the No-Build Alternative. The City’s haul trucks would continue to have wearing impacts on the State of Alaska DOT&PF and City roads, resulting in more frequent roadway upgrades.

#### 5.1.3 Land Requirements

The No-Build alternative does not have specific land requirements, as nothing would be constructed with this option. The City’s haul trucks would be stored at the Department of Public Works shop as they currently are.

#### 5.1.4 Advantages and Disadvantages

The advantage to No-Build is low capital cost. Additionally, there will be no disturbance to daily life and commerce that would ordinarily occur during construction. Construction of other alternatives could potentially take multiple years.

The disadvantage is that No-Build results in higher Operations and Maintenance costs for the City to produce and deliver water and collect and dispose of sewage, and the recurring cost to replace trucks.

Given, The Avenues is a large neighborhood, a three-phased approach would be taken for construction of this alternative, described as follows:

Phase 1:

The proposed water main will tie in to the existing water main near the Youth Center on Osage Street. It will then follow the existing sewer main northeast and cross Ridgecrest Drive. The water main will then continue north along Ridgecrest Drive to the easement located between 6<sup>th</sup> and 7<sup>th</sup> Avenue, and follow the easement to Willow Street. The water main will then head south to cross 6<sup>th</sup> Ave to follow Willow Street until it reaches the easement between 5<sup>th</sup> Avenue and 6<sup>th</sup> Avenue. The water main then follows the easement west to Ridgecrest Drive, at which point it follows Ridgecrest Drive northwest to cross Ridgecrest Drive, and then follow the existing main path to tie in to the existing water main near the Youth Center on Osage Street.

The proposed sewer main will branch off from the existing sewer main that runs perpendicular to the easement located between 6<sup>th</sup> and 7<sup>th</sup> Avenue to extend east to Ridgecrest Drive and west to Willow Street.

Phase 2:

The water and sewer mains in the easement between 6<sup>th</sup> and 7<sup>th</sup> Avenue will cross Willow Street and continue along the easement until Main Street.

The water main will then continue southeast to cross 6<sup>th</sup> Avenue, and then run southwest along the easement between 5<sup>th</sup> and 6<sup>th</sup> Avenue to cross Willow Street and connect with the water main constructed in *Phase 1*.

The section of water main installed in *Phase 1* that runs north and south between the easement between 6<sup>th</sup> and 7<sup>th</sup> Avenue and the easement between 5<sup>th</sup> and 6<sup>th</sup> Avenue will be abandoned.

Phase 3:

The proposed water main will tie in to the main constructed in *Phase 2* at the intersection of the easement between 5<sup>th</sup> and 6<sup>th</sup> Avenue, and Main Street. The main will travel south to cross 5<sup>th</sup>

**Table 5: Capital Costs of Alternative 2**

Phase	Capital Cost	Present Value of Capital Cost
Phase 1 (Including four haul trucks, and 3 DOT&PF Highway Culverts)	\$6,771,996	\$6,771,996
Phase 2	\$3,249,716	\$3,236,769
Phase 3	\$3,394,301	\$3,367,309
	<b>Present Value of Capital Costs</b>	<b>\$13,376,075</b>

The City would continue to haul water and sewage to the neighborhood as the project is built out. Hauled water and wastewater costs were calculated into the overall O&M costs.

**Table 6: O&M Costs of Alternative 2**

O&M Cost	Total Annual Cost	Present Value of O&M Cost
Hauled Water Cost (For Three Years)	\$801,619	\$2,385,745
Hauled Sewer Cost (For Three Years)	\$827,590	\$2,463,040
Piped Water Cost (For years Four to Twenty Five)	\$338,272	\$7,025,688
Piped Sewer Cost (For years Four to Twenty Five)	\$123,008	\$2,554,796
	<b>Present Value of O&amp;M Costs</b>	<b>\$11,874,473</b>

### 5.3 Other Alternatives Considered

#### 5.3.1 Sewer Collection Systems

##### 5.3.1.1 Sewer Main Alternative 1: Individual Residential Lift Stations

This alternative would place small individual lift stations for each residential service. Individual lift stations would pump sewage from each residence to the nearest sewer main.

The advantage of this Alternative is that it is not topographically dependent. A lift station would be constructed at each residence, regardless of whether a gravity sewer system could be constructed. The City already owns and maintains many individual residence lift stations, and

the City has settled in on a standard design, which allows for easy stock-piling of spare parts. It is a simpler design that would allow for a uniform lift station design and direct return service to the main.

A disadvantage of this Alternative is that each residence would have to make space for each lift station. The lift station is owned and maintained by the City of Bethel, but each lift station is located on private property.

#### *5.3.1.2 Sewer Main Alternative 2: Multi-Residential Lift Stations*

This alternative would place larger lift stations at a low point near the residents receiving service. Sewage from multiple houses would gravity drain to the lift station, and then be pumped to the sewer mains. There are locations in the Avenues where four or five houses could be served by the same lift station.

The advantage of this Alternative is that it would require fewer lift stations with fewer moving parts for the City to maintain.

The disadvantage of this Alternative is the City has historically struggled with gravity sewer systems. Because of freeze-thaw ground movements, a gravity pipe is hard to maintain. Furthermore, combining multiple homes into one lift station does not reduce pipe requirements.

#### *5.3.1.3 Sewer Collection System Preferred Alternative*

Combining multiple residences into one lift station is appealing for a few locations throughout The Avenues, but cannot be implemented throughout the whole project area, for this reason the preferred alternative is to construct individual lift stations at each residence. A standardized design the City already uses could be used for this project. Each individual lift station can be constructed for approximately \$20,000, and this cost is included in the capital cost estimates of section 5.2.7.

**Table 8: Summary of Alternative Life Cycle Costs**

	Alternatives	
	Alt. 1 No Build	Alt. 2 Piped Water and Sewer
Capital Costs - Total	\$0	\$13,376,075
Annual O&M* Cost	\$1,802,009	\$461,280
<sup>1</sup> 25-Year Salvage/Book Value - Total	\$462,857	\$0
Present Worth of Salvage Value	\$427,339.18	\$0
<sup>2</sup> Annual O&M Present Worth	\$34,215,498	\$8,758,511
Total Present Worth Cost	\$33,788,159	\$22,134,586

\*O&M = Operations and Maintenance. For Alt 1, cost of replacement trucks is annualized. For Alt 2, this is the O&M cost for operating the system once constructed.

<sup>1</sup>Based upon straight-line depreciation and ultimate salvage value of \$0.00 at end of respective useful life. For alt 1, there is Salvage value- because trucks will only be 4 years old at end of 25 years.

See Appendices for detail of salvage book value calculations.

<sup>2</sup>Present Value of Annual O&M = Ordinary Annuity Changing At Constant Ratio;

Present Value Factor =  $[1 - (1+x)^n / (1+i)^n] / (i-x)$ ;

i = Interest Discount Rate; x = Inflation Rate; n = Number of Periods; Inflation = 2 percent; Interest = 6 percent.

## 5.5 Alternative Selection

### 5.5.1 Design Criteria

The selected alternative must be designed for the following criteria. Both alternatives can meet these criteria.

**Table 9: Design Criteria**

General	
Design Period	25 years
Parcels	118
Population Per Parcel	3
Design Population	354
*Real Interest Rate	0.4%
Environmental Conditions	
Mean Temperature	29.1°F
Design High Temperature	90°F
Design Low Temperature	-48°F
Mean Annual Precipitation	16 inches
Mean Annual Snowfall	55 inches
Ground Snow Load	40 PSF
Basic Wind Speed	120 miles per hour

## 6.0 PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)

### 6.1 Recommended Alternative Description

The recommended alternative is the piped water and sewer alternative with the pipe alignments as proposed. The City would immediately procure water and sewer haul trucks to meet the immediate need of the neighborhood, as the project progresses through design and into a multi-summer construction.

#### 6.1.1 Project Schedule

Given the immediate need for water and sewer trucks for The Avenues, it is recommended to move forward with the Piped Water and Sewer Alternative, but procurement of trucks immediately. The multi-phased construction of the preferred alternative would begin in 2020, following approximately 18 months of design and easement execution.

This PER should be used to solicit funds from the United States Department of Agriculture Rural Development (USDA RD) Fiscal Year 2019 (FY19) allocations.

#### 6.1.2 Permit Requirements

Final permit requirements will be included in the Environmental Report for this project. It is currently anticipated that permits will be minimal for the proposed action.

The State of Alaska Department of Environmental Conservation will require an Engineering Plan Set review prior to granting an approval to construct and operate the piped water and sewer systems.

**Table 11: Recommended Alternative- Piped Water and Sewer – Phase 2 Cost Estimate**

Item Description	Estimated Quantity	Unit	Unit Price	Total Price
Phase 2				
Installation of Arctic Main	3110	LF	\$250	\$777,474
Driveway Casing Crossing	1	EA	\$3,000	\$3,000
Hydrants	6	EA	\$10,000	\$60,000
Services (water and sewer)	40	EA	\$25,000	\$1,000,000
Easement Obstructions	7	EA	\$10,000	\$70,000
Construction Sub-Total				\$1,910,474
Mobilization/Demobilization (7.5% of Subtotal)	1	EA	\$298,588.90	\$143,285.56
Taxes, Bonds, Insurance (5% of Subtotal)	1	EA	\$199,059.27	\$95,523.70
Traffic Control and Public Relations (5% of Subtotal)	1	EA	\$199,059.27	\$95,523.70
Construction Surveying (3% of Subtotal)	1	EA	\$119,435.56	\$57,314.22
Preparation of SWPPP (1% of Subtotal)	1	EA	\$39,811.85	\$19,104.74
Subtotal				\$2,321,226
10% Design				\$232,123
10% Construction Administration				\$232,123
20-percent Contingency				\$464,245
<b>Total Estimated Project Capital Cost</b>				<b>\$3,249,716</b>

**Table 12: Recommended Alternative- Piped Water and Sewer – Phase 3 Cost Estimate**

Item Description	Estimated Quantity	Unit	Unit Price	Total Price
Phase 3				
Installation of Arctic Main	3110	LF	\$250	\$777,474
Highway Direct Bury Crossing	3	EA	\$70,000	\$210,000
Driveway Casing Crossing	6	EA	\$10,000	\$60,000
Hydrants	35	EA	\$25,000	\$875,000
Services (water and sewer)	1	EA	\$3,000	\$3,000
Easement Obstructions	7	EA	\$10,000	\$70,000
Construction Sub-Total				\$1,995,474
Mobilization/Demobilization (7.5% of Subtotal)	1	EA	\$149,660.56	\$149,660.56
Taxes, Bonds, Insurance (5% of Subtotal)	1	EA	\$99,773.70	\$99,773.70
Traffic Control and Public Relations (5% of Subtotal)	1	EA	\$99,773.70	\$99,773.70
Construction Surveying (3% of Subtotal)	1	EA	\$59,864.22	\$59,864.22
Preparation of SWPPP (1% of Subtotal)	1	EA	\$19,954.74	\$19,954.74
Subtotal				\$2,424,501
10% Design				\$242,450
10% Construction Administration				\$242,450
20-percent Contingency				\$484,900
<b>Total Estimated Project Capital Cost</b>				<b>\$3,394,301</b>

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