Preliminary Engineering Report

Chistochina Water and Sewer Service to 15 Homes & Washeteria Improvements

Project Number 25-CZO-TO-007

September 12, 2025

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EXECUTIVE SUMMARY

Village Safe Water (VSW) issued Task Order Number 25-CZO-TO-007 to HDR Engineering, Inc. (HDR), in January 2025 to assist the Community of Chistochina (Community) by developing a Preliminary Engineering Report (PER) to study alternatives to service water and sewer to 15 homes as well as improvements to the washeteria.

Chistochina is a community of 57 residents located at mile 32.7 on the Tok Cutoff to the Glenn Highway, 42 miles northeast of Glennallen. Sinona Creek, Boulder Creek, Chistochina River, and Copper River surround the village. Part of the Community is served by private groundwater wells and sewer system.

However, 15 homes lack access to running water and a proper wastewater disposal system. The Water Utility Building that serves the Community has deficiencies, and the water haul point is not operational.

Information used in the development of this PER includes communication with VSW and the Community of Chistochina; prior studies conducted; publicly available government data; and data collected during a site visit in April 2025. This PER examines several alternatives to address deficiencies in the Chistochina Water System(s), the alternatives were split into two categories:

Water Utility Building

- Alternative 1: Evaluate, repair and replace equipment and components
- Alternative 2: Connect clinic public water system as primary source
- Alternative 3: Re-establish individual well
- Alternative 4: No Action

15 Homes

- Alternative 5: Establish Individual Wells and Sewer Systems
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Acronyms and Abbreviations and Definitions

°F	degrees Fahrenheit
AACE	Association for the Advancement of Cost Engineering
ADF&G	Alaska Department of Fish and Game
AIS	American Iron and Steel
AHRS	Alaska Heritage Resource Survey
BABAA	Buy American Build American Act
Community	Community of Chistochina
gpd	gallons per day
gpm	gallons per minute
HDPE	high-density polyethylene
HDR	HDR Engineering, Inc.
MD	Manganese Dioxide

PER	Preliminary Engineering Report
USGS	U.S. Geological Survey
VSW	Village Safe Water

1. PROJECT PLANNING

The Community of Chistochina (Community) is looking to develop a plan to provide drinking water and sewer to 15 homes and improve the local washeteria to long-term needs of the community. This Preliminary Engineering Report (PER) outlines the existing conditions and proposes alternative solutions to identify system management deficiencies and “No Action” alternatives. This document is intended to assist the Community with identifying alternatives for pursuing future projects and funding.

1.1 Location

The Community of Chistochina is at mile 32.7 on the Tok Cut-off to the Glenn Highway, 35 miles away from the Wrangell-St. Elias National Park and Preserve. The community is surrounded by the Copper River, Sinona Creek, Boulder Creek, and Chistochina River. Chistochina is 42 miles northeast of Glennallen and 236 miles from Anchorage. Chistochina is contained within the boundaries of the Ahtna, Inc. Regional Corporation.

The Community can be accessed year-round by road, through the Glenn Highway, and by flight through Chistochina Airport – CZO.

Figure 1. Chistochina vicinity map

1.2 Environmental Resources Present

1.2.1 Climate

Chistochina is located in the Copper River Basin, with a subarctic continental climate, with large temperature variability, low humidity and relatively light and irregular precipitation. In general, summers are mild and sunny while winters are usually very cold (ACRC 2025).

Although winter conditions usually prevail between October to April or May, the region has been impacted with climate change, warming faster and affecting subsistence activities (Miller 2023). Average annual temperatures may increase by about 11°F, with spring and fall possibly transitioning from below freezing to above freezing in the future (UAF 2025).

Table 1. Historic Climate Data for the City of Chistochina

Month	Average Monthly Temperature (°F)	Average Monthly Precipitation (inches)
January	-5	0.7
February	3	0.6
March	15	0.6
April	29	0.5
May	43	0.7
June	53	1.7
July	57	2.3
August	53	1.7
September	42	1.6
October	26	1.1
November	5	0.8
December	-3	0.9

Source: (SNAP 2025).

1.2.2 Geology and Soil Conditions

Mendehall (1904) described four rock formations as the most important of the Chistochina District, the Birch Creek schist is formed by the oldest micaceous schists , while Chisna formation includes beds of quartizite, arkose, pyritiferous tuff, conglomerate, and limestone and is cut by porphyritic dikes and igneous rocks followed by the Mankomen formation that includes beds of sandstones, shale, limestone, quartizite and tuffaceous sandstones and finally Gakona formation, consisting of coarse conglomerate and soft gray or buff colored shale interbedded with gravel, sand and lignite beds (Mendenhall 1904) (Moffit 1912).

Chistochina soils consist of very deep and excessively drained soils formed in sandy glacial drift. It belongs to the taxonomic class of Sandy, mixed Typic Haplocryepts. Most areas have native vegetation of aspen and white spruce (USDA 2022).

1.2.3 Archaeological Resources

Chistochina is considered the most traditional of the Ahtna villages, being home to the Cheesh'na Tribe for thousands of years. Archeological remains could possibly be found around the area (Ahtna 2017). Archaeological observation during design and construction would be necessary to protect these sites.

1.2.4 Wetlands and Wildlife

The U.S. Fish and Wildlife Service (USFWS) Wetlands Inventory has a completed inventory for Chistochina. Chistochina is surrounded by freshwater forested/shrub wetlands, with Freshwater Emergent Wetlands to the north of the Community (USFWS 2025).

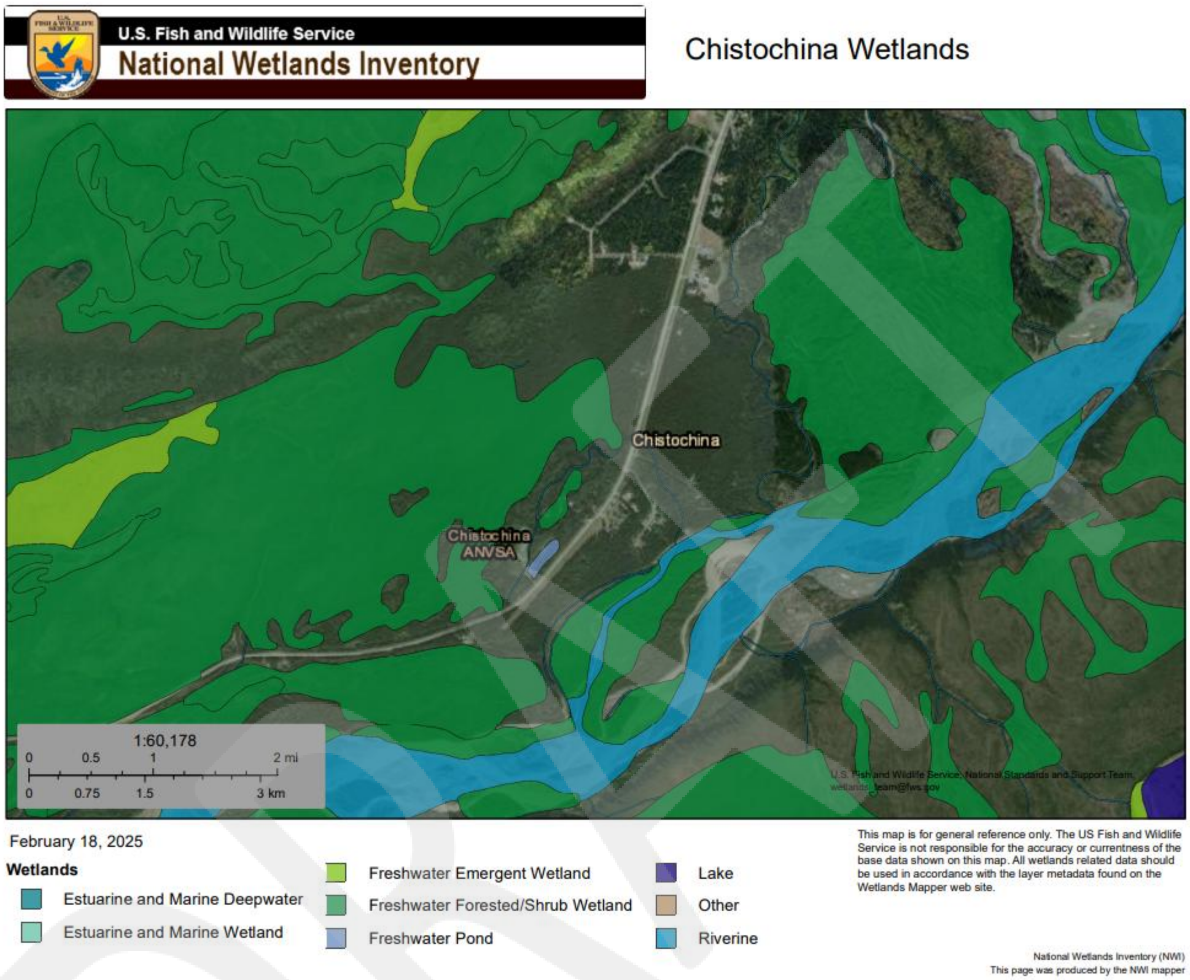

Figure 2. Wetlands in and around the Community of Chistochina (USFWS 2025)

Records from the Alaska Department of Fish and Game (ADF&G) indicate that the Community of Chistochina is surrounded by several anadromous waters such as Copper River, Chistochina River, Boulder Creek, and Sinona Creek. ADF&G has identified Chinook Salmon spawning, rearing and present in the area, as well as Sockeye Salmon spawning and rearing.

No endangered species are listed under the Endangered Species Act for Chistochina. However, nests of Bald Eagles and Golden Eagles are documented in the area, which are protected under the Bald and Golden Eagle Protection Act. Lesser Yellowlegs are also found in the area and are protected under The Migratory Bird Treaty Act (MBTA).

1.3 Population Trends

The Alaska Division of Community and Regional Affairs population data presented in Table 2 provides a historic look at the population of Chistochina. Chistochina has had some demographic fluctuations in the last 80 years, increasing significantly after the 1960's and decreasing after the 2010's (Division of Community and Regional Affairs 2024). Because the population has not undergone any increase in the last 20 years, this PER assumes that the population of Chistochina will experience no growth through the 20-year planning period.

Table 2. Chistochina, Alaska, Population History

Year	Population
1910	0
1920	0
1930	0
1940	34
1950	31
1960	28
1970	33
1980	55
1990	60
2000	93
2010	93
2020	60
2023	57

Source: (Division of Community and Regional Affairs 2024).

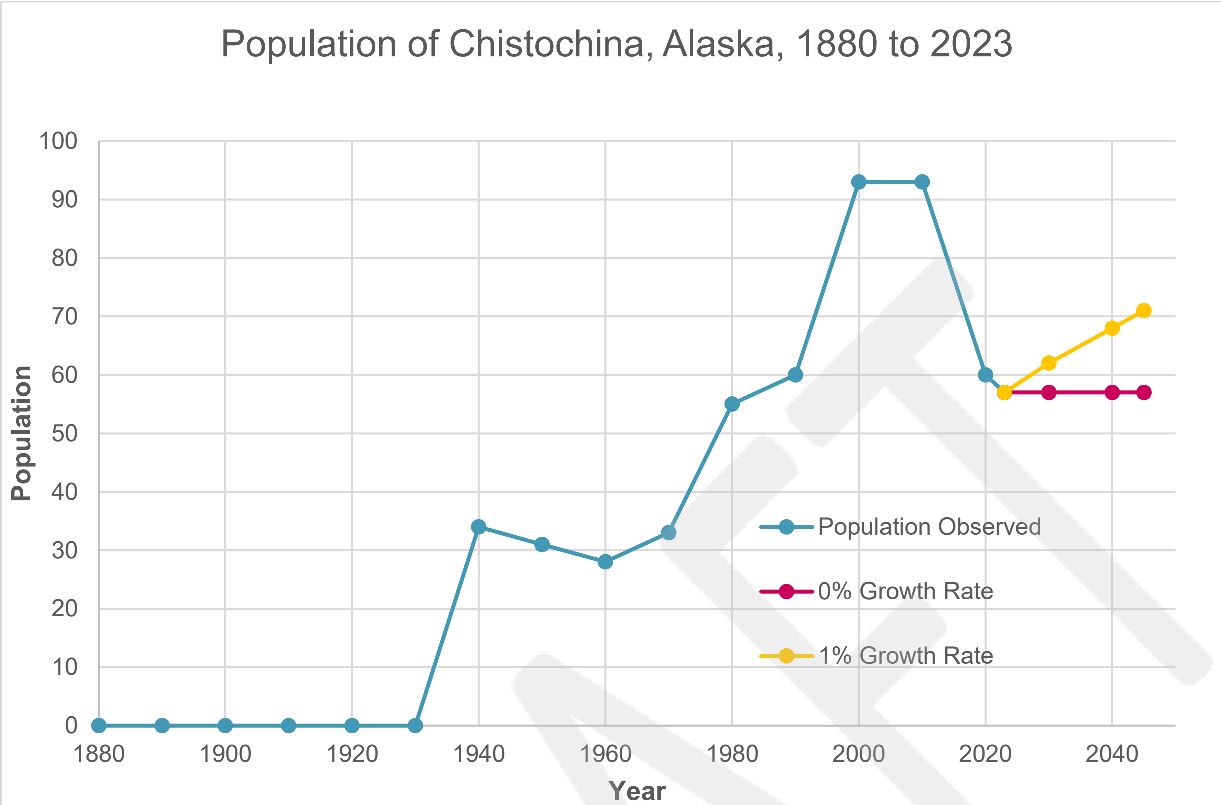

Figure 3. Future population projection in Chistochina, Alaska

An annual growth rate of 1% is shown in Figure 3 to illustrate a maximum expected growth rate. The population for design year 2045 is estimated at 57 people using a 0% annual growth rate.

It is challenging to project future growth in rural Alaska, as interrelated factors such as available land and housing, changing climate, and industry changes can greatly impact population projections.

1.4 Community Engagement

HDR Alaska, Inc. (HDR) engineers conducted a site visit to Chistochina, Alaska, to inspect the drinking water and sewer systems. HDR engineers arrived in Chistochina April 9th, 2025, at approximately 7 pm. On the morning of April 9th, 2024, HDR engineers went on a site visit to the Water Utility Building and visited several homes in Chistochina.

Jim, the local operator, led the visit to the Water Utility Building, while Danielle and Leah, representing the Cheesh'na Tribal Council, led the site visit to several homes throughout the Community and Twin Lakes. A report of the site visit is attached as Appendix A.

1.4.1 Community Preference

[To be completed in the 95% Submittal].

2. EXISTING FACILITIES

After a Village Safe Water Feasibility Study, the Cheesh-na Washeteria & Sanitation Utility Facility Study, the Community of Chistochina had decided to build a piped water and sewer system to serve the existing structures within the developed area of the Tribal Community Complex. In 2016, the new water and wastewater infrastructure was built and included:

- Two new wells (52 feet and 59 feet deep)
- 626 ft² Washeteria/Water Utility Building: process room, two public bathrooms with coin-operated showers and storage room
- 1,000 feet of 4-inch water line
- 1,000 feet of 8-inch gravity sewer main
- Sewage lift station
- Community septic tank and drain field

The Water Utility Building built in 2016 is shown in Figure 4. Figure 5 and Figure 6 show the project for piped water and sewer for Chistochina.

Figure 4. Water Utility Building in Chistochina (ANTHC 2019)

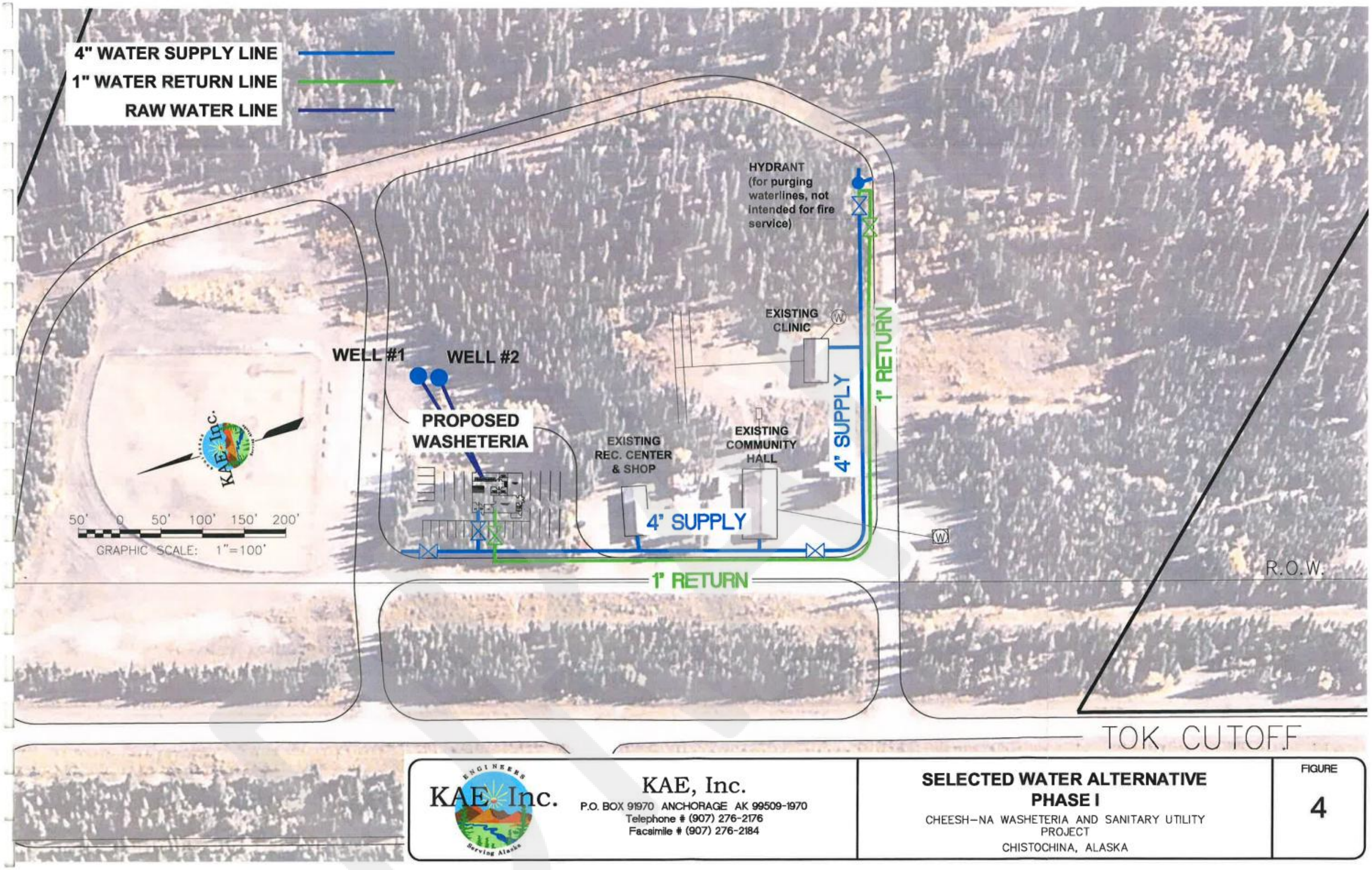

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Figure 5. Washeteria and Piped Water Project in Chistochina

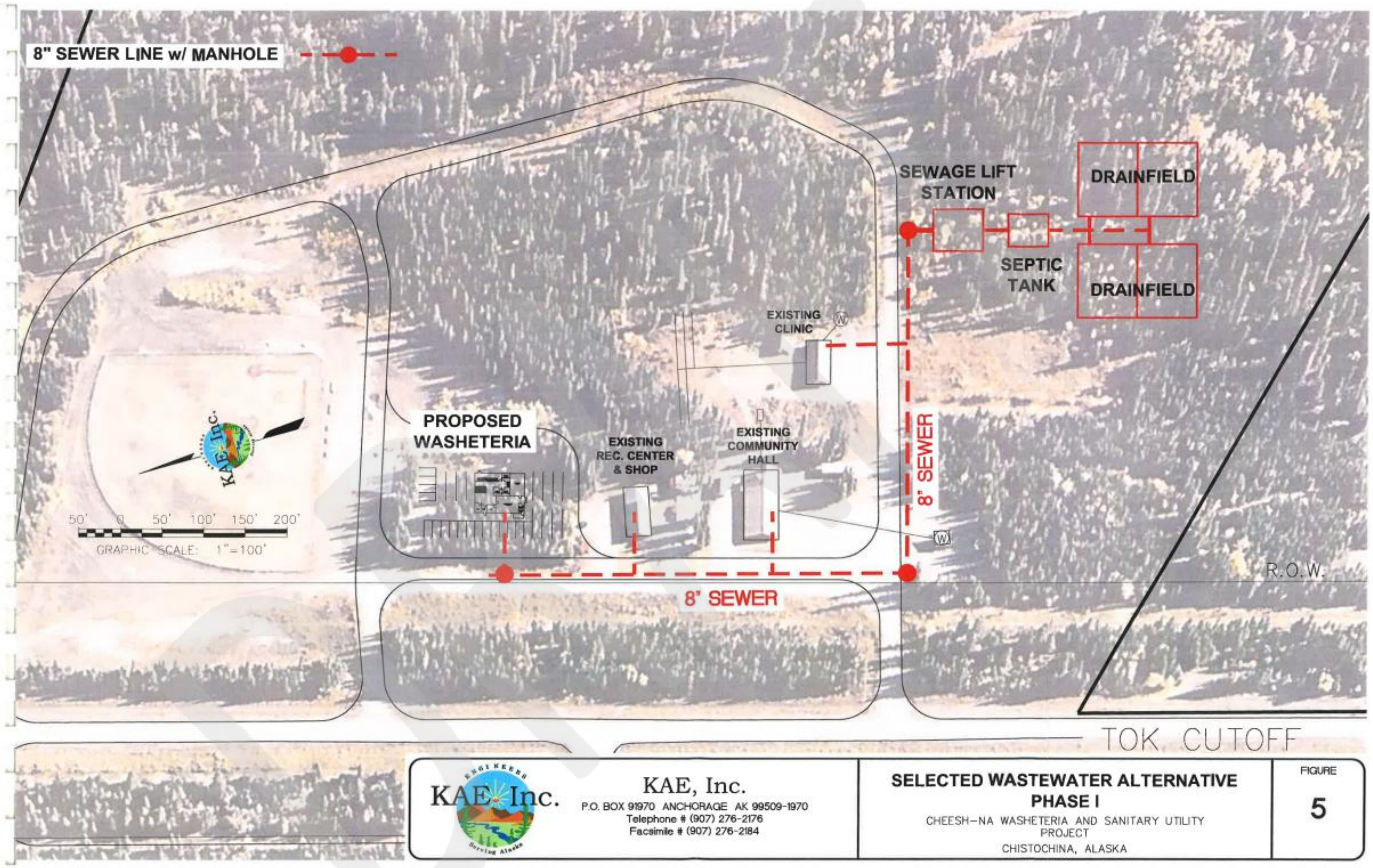


Figure 6. Washeteria and Piped Sewer Project in Chistochina

Although in the project shown above (Figure 5 and Figure 6) the Clinic would be served by the Water Utility Building, currently, the clinic has its own well and water treatment facility that is operational and has not shown any major issues since installation.

2.1 History

The Community of Chistochina was originally an Athabascan fish camp before becoming a stopover for traders and trappers. Due to the gold rush, in 1987 the Valdez-Eagle Trail was built and years later, the Chistochina Lodge was established as a roadhouse for travelers, designated a National Historic Site before burning down in 1999, replaced by the Red Eagle Lodge after that (TravelAlaska 2025). Currently, Chistochina is an Athabascan village with 57 people, where subsistence activities are crucial for the community as moose and caribou hunting, salmon fishing and berry picking.

2.1.1 Permit and Compliance

The community of Chistochina has water rights issued by Alaska Department of Natural Resources (DNR) for subsurface water. This includes 5,850 GPD for the Cheesh'Na Tribal Council, and 1,000 GPD for the Mount Sanford Tribal Consortium. For the alternatives suggested in this PER, no additional permits should be required.

2.2 Condition of Existing Facilities

2.2.1 Water Utility Building

Currently, the Water Utility Building consists of:

- Utility operation rooms (Figure 8).
- 2 (two) bathrooms with showers, that are kept locked most of the time, but are widely used during community events, along with the water hauling point (Figure 7).
- 2 (two) groundwater wells.
- Control Panels.
- 2 (two) bladder tanks (Figure 9).
- Glycol circulation system.
- Heat trace for freeze recovery.

Figure 7. Water hauling point at the Utility Building

Figure 8. Water Utility Building's operation room

Figure 9. Pressure Tank in the Water Utility Building

During the site visit, the Water Operator indicated that he believes that the current system is too complex, or overbuilt, for the community's ability to maintain and operate it, as well as expensive.

Issues with the bladder tanks were discussed as they don't seem to be functioning as intended, by not holding pressure and being placed too close to each other.

A water leak may be present in the distribution system past the Water Utility Building. When the valve is open, the well will pump for a few seconds, bringing the pressure up to 60 pounds per square inch (PSI). The pump will then shut off and within a few seconds the pressure will drop back to 0 PSI. The pressure is maintained if the valve to the distribution system is shut off. The water meter indicates an approximate 0.1 to 0.2 gallons of water flows through the water meter during these few seconds of operation. Further investigation would be necessary to determine the root cause of the system's inability to retain pressure.

The piping in the facility is uninsulated and unmarked. The purpose of the piping and their flow can be identified with some difficulty, but insulating and marking the pipes would both improve efficiency and clarify the purpose of various piping in the facility.

The heat trace for the wells was intended for freeze recovery according to the previous design plans. The heat trace is continuously on, which costs the community over $1,000 a month.

2.2.2 Community Septic System

The Community Septic System consists of three lift stations, a septic tank and a leach field. A glycol heating loop is used to prevent freezing. The system serves the Water Utility Building, the Community Building and the Tribal Office. During the site visit, it was noted that the lift stations were not insulated.

If the pumps were to freeze, the damage to the pumps would be permanent. The pumps do not appear to have been replaced since their initial installation and may have suffered freezing damage at least once.

Figure 10. Lift station near Water Utility Building, with no evidence of insulation

Figure 11. Community septic system for the Water Utility Building, Community Building and Tribal Office

2.2.3 Homes in Chistochina and Twin Lakes

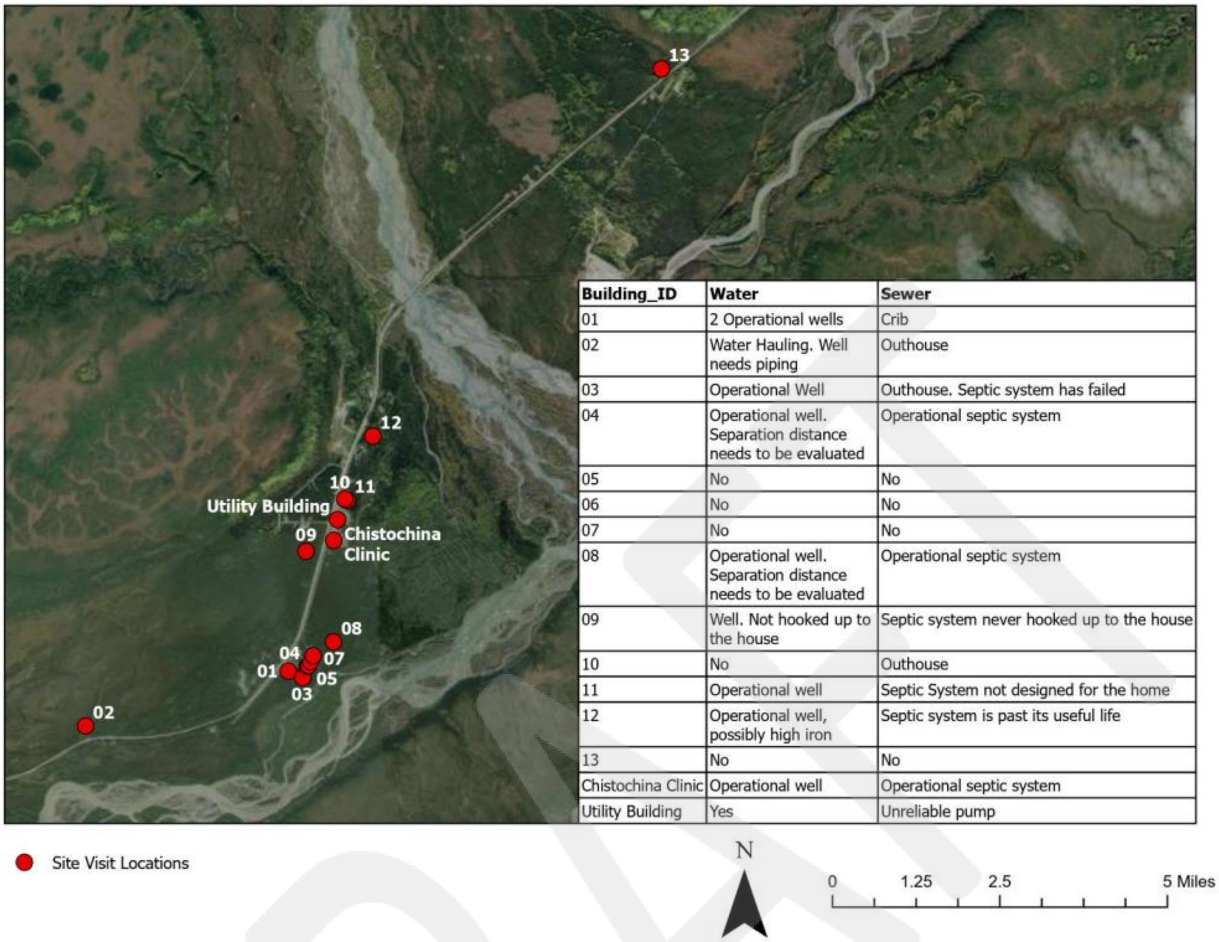
HDR engineers and a VSW engineer visited several homes in Chistochina and near Twin Lakes (Figure 12 and Figure 13). Most homes rely on individual onsite systems, such as septic tanks and leach fields, and private groundwater wells. Many homeowners indicated issues with their systems which were described in Table 3.

During the site visit, several homeowners indicated a possible high amount of iron in the water, which was confirmed with visual observation.

Table 3. Homes visited during site visit in Chistochina, AK

Building ID	Water Source	Sewer System	Does the structure have a bathroom or enough room for one?
Chistochina Clinic	Operational well	Operational septic system	Yes
Utility Building	2 Operational wells	Unreliable pump	Yes
1	2 Operational wells	Crib	Yes
2	Water Hauling. Well needs piping	Outhouse	No. But large property
3	Operational Well	Outhouse. Septic system has failed	Unclear
4	Operational well. Separation distance needs to be evaluated	Operational septic system	Yes
5	No water	No system	Yes
6	No water	No system	Yes
7	No water	No system	Yes
8	Operational well. Separation distance needs to be evaluated	Operational septic system	Yes
9	Well. Not hooked up to the house	Septic system never hooked up to the house	Yes
10	No water	Outhouse	Yes

11	Operational well	Septic System not designed for the home	Yes
12	Operational well, possibly high iron	Septic system is past its useful life	Yes
13	No water	No system	Yes
15	No water	No system	Yes
16	No water	No system	Yes
14	No water	No system	No
17	No water	No system	Yes



Building_ID	Water	Sewer
01	2 Operational wells	Crib
02	Water Hauling. Well needs piping	Outhouse
03	Operational Well	Outhouse. Septic system has failed
04	Operational well. Separation distance needs to be evaluated	Operational septic system
05	No	No
06	No	No
07	No	No
08	Operational well. Separation distance needs to be evaluated	Operational septic system
09	Well. Not hooked up to the house	Septic system never hooked up to the house
10	No	Outhouse
11	Operational well	Septic System not designed for the home
12	Operational well, possibly high iron	Septic system is past its useful life
13	No	No
Chistochina Clinic	Operational well	Operational septic system
Utility Building	Yes	Unreliable pump

Figure 12. Site visit locations in Chistochina, AK

Building_ID	Water	Sewer
14	No	No
15	No	No
16	No	No
17	No	No

Figure 13. Site visit locations near Twin Lakes, AK

2.3 Financial Status of Existing Facilities

As informed by the Cheesh'na Tribal Council and the O&M costs from July 2024 to June 2025, the operation costs of the Water Utility Building can vary from around $1,000/month during summer months to over $2,500/month in the winter. The average monthly cost of power is $1,042.64, while fuel costs are around $522.57/month. Electricity residential rate is $0.3636/kWh (DCRA 2025).

2.4 Water/Energy/Waste Audits

A Comprehensive Energy Audit was completed for Chistochina Water Utility Building on March 19, 2019 (ANTHC 2019), by the Alaska Native Tribal Health Consortium (ANTHC). HDR is not aware of any water or waste audits, and none were obtained for this project.

3. NEED FOR THE PROJECT

3.1 Health, Sanitation, and Security

The primary need for this project is to provide adequate and reliable drinking water to the Community of Chistochina, addressing existing issues with the Water Utility Building and private groundwater wells. Septic systems that are past useful life or inexistent would also be addressed, ensuring the appropriate disposal of wastewater, avoiding water/soil contamination.

3.2 Aging Infrastructure

Some of the onsite wastewater systems in Chistochina are past their useful life and are no longer operational or efficient, these systems need to be replaced. The lift station pumps have not been replaced since installation in 2016. Low maintenance and freezing temperatures indicate pumps should also be replaced.

3.3 Reasonable Growth

The population of Chistochina has been fluctuating for the past 40 years however, for this PER, only occupied residences were considered, and reasonable growth is not applicable for this project.

4. ALTERNATIVES CONSIDERED

HDR developed four alternatives (plus two No Action Alternatives) for addressing deficiencies in the Chistochina Water and Wastewater infrastructure. These alternatives were split into two separate categories; the first category considers alternatives related to the Water Utility Building and the second considers alternatives related to 15 homes. The projects can be completed independently of each other.

Water Utility Building

Alternative 1: Evaluate, repair and replace equipment and components

Alternative 2: Connect Clinic public water system as primary source

Alternative 3: Re-establish individual well

Alternative 4: No Action

15 Homes

Alternative 5: Establish individual wells and sewer systems

Alternative 6: No Action

4.1 Alternative 1: Evaluate, repair and replace equipment and components

This alternative would repair or replace several components in the Water Utility Building and provide a backup power system to prevent power surges in the facility.

4.1.1 Description

Many components in the Water Utility Building are either not operational or not functioning as intended, resulting in unreliable water supply to the Community from the facility. The sewer system is not reliable, and several components are past their useful life. For this alternative, the following components would be evaluated and repaired or replaced according to the results of the evaluation:

- Bladder tanks
- Valves
- Glycol piping configuration and pressure tanks
- Boilers and boiler controls
- Water fill point and related valves and piping

- Heat trace for freeze recovery and heat trace controls
- Lift station insulation and lift station pumps

During the site visit, it was identified that the following concerns need follow-up in-depth evaluation:

The bladder tanks are not holding pressure. They lack a sight glass that would allow an operator to identify the ratio of air to water in the tanks. The bladder tanks should be spaced further apart, because they are placed so close together that it is challenging to get access to the space behind them, although there is adequate room in the facility to space them further apart.

The operation of the glycol circulation system and its pressure tanks are needlessly complicated. The system should be thoroughly evaluated, modified and simplified if necessary, and instructions should be developed on typical day-to-day operations.

The piping in the facility is uninsulated and unmarked. The purpose of the piping and their flow can be identified with some time and effort, but insulating and marking the pipes would both improve efficiency and clarify the purpose of various piping in the facility.

The boiler controls are bypassed and one of the boilers reportedly runs continuously. Typical operations are intended to only turn the boilers on when they are needed and to cycle between them. It is unclear why the boiler controls were not functional. The boilers should be evaluated if they can be restored to full functionality, and replaced if they cannot be repaired.

The water fill point pipe should be angled downwards from inside the facility to the fill point to allow it to fully drain when the valve is closed to prevent freezing when the valve is closed. The valve is functional, but the controls for the valve are not, and the handle for the valve is broken. The valve and its controls should be replaced.

The heat trace for the wells was intended for freeze recovery according to the plans. The heat trace is continuously on, in part because the switch is ordinarily hidden from view. The switch for the heat trace should be moved or a separate indicator on the exterior of the facility to remind the operator that the heat trace is on, even if the operator is only walking around or driving by the facility.

The lift station pumps should be evaluated and replaced if necessary. The lift station themselves should be upgraded with additional insulation to mitigate the risk of freezing.

Along with the replacement of equipment, a leak detection effort would be performed in order to investigate the root cause of the system’s inability to maintain pressure. Due to the unreliability of power to the Water Utility Building, a battery energy storage system could help prevent damage caused by power surges, voltage sag, overvoltage, and similar issues, and also serve as backup power during power outages.

4.1.2 Design Criteria

The Tribal Office relies on the Water Utility Building year-round, along with two families that haul water from the fill point. Two bathrooms with showers are available for community use, and during summer, the community events in the Community Hall rely on hauling water. Water demand is shown in Table 4.

Table 4. Water Utility Building Design Criteria

Criteria	Value	Unit
Design Period	20	Years
Number of Households (4 Residents/Household)	2	Households
Estimated Water Demand – Residential	82	GPD/person
Community Hall – 200 seats*	3	GPD/seat
Tribal Office – 6 employees*	20	GPD/employee
Water Utility Building - 2 Bathrooms with a shower each*	450	GPD/shower
Estimated Peak Water Demand	2,276	GPD
Estimated Average Flow Rate During Water Demand	1.60	GPM

*Source: (KAE Inc. 2007)

All equipment should be in compliance with NSF International and ANSI (American National Standards Institute) standards. Components such as bladder tanks, valves, pressure tanks and pipes should be NSF/ANSI 61 and NSF/ANSI 372 certified, if applicable. Onsite wastewater systems should be NSF/ANSI 40 certified.

4.1.3 Environmental Impacts

4.1.3.1 Floodplains

No flooding is expected at the Water Facility Building area.

4.1.3.2 Wetlands

Not applicable. There are no wetlands near the Water Facility Building Area.

4.1.3.3 Wildlife

Not applicable. This alternative would operate within existing infrastructure boundaries.

4.1.3.4 Geotechnical Exploration

Not applicable.

4.1.3.5 Other Resources

Not applicable.

4.1.4 Land Requirements

Alternative 1 would replace existing systems on the city/tribal property. Agreements may be required.

4.1.5 Potential Construction Problems

The project will be subject to American Iron and Steel Act (AIS) and Build America, Buy America Act (BABAA) requirements. Long lead times for AIS and BABAA compliant materials, supplies, and components should be anticipated when developing project schedules. Equipment and materials should be procured well before construction so that construction is not unnecessarily delayed by the supply chain.

Phasing of construction will be important to maintain the community water supply during the construction process; temporary water storage may be necessary to ensure continuous water supply.

4.1.6 Sustainability Considerations

4.1.6.1 Water and Energy Efficiency

Not applicable.

4.1.6.2 Green Infrastructure

Not applicable.

4.1.6.3 Other

Not applicable.

4.1.7 Cost Estimate

Cost estimates are described in detail in Section 4.7 and Appendix D.Total capital and O&M costs estimates for Alternative 1 are shown in Table 5, in 2025 U.S. Dollars.

Table 5. Alternative 1 Capital and O&M Costs

Capital Costs	Capital Costs with AIS/BABAA	Annual O&M Costs
$433,154	$538,748	$24,100

4.2 Alternative 2: Connect Clinic public water system as primary source

This alternative would connect the Water Utility Building to the Clinic Public Water System, providing a reliable source of water for the community.

4.2.1 Description

The Clinic is located less than 0.5 mile from the Water Utility Building and has a reliable water system, with operational wells and efficient treatment systems. Prior to the construction of the Clinic, there were existing conceptual plans to connect the Clinic to the Water Utility Building's distribution system. The clinic was built in 2012, four years before the Water Utility Building. The Community Hall and Tribal Office would be connected to the Clinic's water system following the existing conceptual plans, and have the current water system as a backup alternative.

4.2.2 Design Criteria

The water demand for the Tribal Office and Community Hall are shown in Table 4.

4.2.3 Environmental Impacts

4.2.3.1 Floodplains

No flooding is expected near the area.

4.2.3.2 Wetlands

Not applicable.

4.2.3.3 Wildlife

Not applicable. This alternative would operate within existing infrastructure boundaries.

4.2.3.4 Geotechnical Exploration

Not applicable.

4.2.3.5 Other Resources

Not applicable.

4.2.4 Land Requirements

Alternative 2 would install a water line connecting the Water Utility Building and the Clinic. Agreements may be required.

4.2.5 Potential Construction Problems

The project will be subject to AIS and BABAA requirements. Long lead times for AIS and BABAA compliant materials, supplies, and components should be anticipated when developing project schedules. Equipment and materials should be procured well before construction so that construction is not unnecessarily delayed by the supply chain.

4.2.6 Sustainability Considerations

4.2.6.1 Water and Energy Efficiency

Not applicable.

4.2.6.2 Green Infrastructure

Not applicable.

4.2.6.3 Other

Not applicable.

4.2.7 Cost Estimates

Cost estimates are described in Section 4.7 and Appendix D. Total capital and O&M costs estimates for Alternative 2 are shown in Table 6, in 2025 U.S. Dollars.

Table 6. Alternative 2 Capital and O&M Costs

Capital Costs	Capital Costs with AIS/BABAA	Annual O&M Costs
$209,378	$257,201	$11,400

4.3 Alternative 3: Re-establish individual well

This alternative would re-establish a groundwater well for the Community Hall and Tribal Office for year-round use, while using the Water Utility Building as a back-up alternative.

4.3.1 Description

Before the Water Utility Building construction, the community buildings relied on private groundwater wells. The Water Utility Building was initially built to provide water for the community buildings in the area, including the Health Clinic and to serve as a washeteria for the community. Currently, only the Tribal Office and Community Hall (during summer, when there are community events) rely on the Water Utility Building, no washers or dryers are available to the community, and bathrooms are usually locked.

This alternative would establish a single groundwater well for the Tribal Office and Community Hall, with separate service lines, simplifying the maintenance and operation efforts for the community. The current facility would be maintained for operating the on-site wastewater system.

The wells in the region can be drilled to a depth of 40 to 50 feet, and still count as groundwater sources rather than Groundwater Under Direct Influence of surface water (GWUDI), due to the geology of the area. This has previously been established for the Clinic well, which is a public water system.

4.3.2 Design Criteria

Water demand is shown in Table 7**Error! Reference source not found.** and Table 8**Error! Reference source not found.**.

Table 7. Community Hall Design Criteria

Criteria	Value	Unit
Design Period	20	Years
Community Hall – 200 seats*	3	GPD/seat
Estimated Peak Water Demand	600	GPD
Estimated Average Flow Rate	0.42	GPM

Table 8. Tribal Office Design Criteria

Criteria	Value	Unit
Design Period	20	Years
Tribal Office – 6 employees*	20	GPD/employee
Estimated Water Demand	120	GPD
Estimated Average Flow Rate	0.08	GPM

4.3.3 Environmental Impacts

4.3.3.1 Floodplains

No flooding is expected near the area.

4.3.3.2 Wetlands

No wetlands near the area.

4.3.3.3 Wildlife

Not applicable. This alternative would operate within existing infrastructure boundaries.

4.3.3.4 Geotechnical Exploration

For a new well, a few boreholes may need to be drilled before finding the best location or depth.

4.3.3.5 Other Resources

Not applicable.

4.3.4 Land Requirements

Alternative 3 would drill a new well on the city/tribal property. Agreements may be required.

4.3.5 Potential Construction Problems

The project will be subject to AIS and BABAA requirements. Long lead times for AIS and BABAA compliant materials, supplies, and components should be anticipated when developing project schedules. Equipment and materials should be procured well before construction so that construction is not unnecessarily delayed by the supply chain.

Adequate locations for wells that consider septic system separation distance requirements should be determined in design.

4.3.6 Sustainability Considerations

4.3.6.1 Water and Energy Efficiency

Not applicable.

4.3.6.2 Green Infrastructure

Not applicable.

4.3.6.3 Other

Not applicable.

4.3.7 Cost Estimates

Cost estimates are described in Section 4.7 and Appendix D. Total capital and O&M costs estimates for Alternative 2 are shown in **Error! Reference source not found.**, in 2025 U.S. D ollars.

Table 9. Alternative 3 Capital and O&M Costs

Capital Costs	Capital Costs with AIS/BABAA	Annual O&M Costs
$251,759	$303,118	$22,050

4.4 Alternative 4 – Water Facility Building: No Action

Per the United States Department of Agriculture (USDA) Rural Development PER requirements, Alternative 4 will be No Action.

4.4.1 Description

Alternative 4 would take no action. The Water Utility Building would continue operating with the existing design, including no capital or operational improvements, except for minor repairs, as necessary.

4.4.2 Design Criteria

Not applicable.

4.4.3 Map

A location map of the existing Water Utility Building is provided in Figure 12.

4.4.4 Environmental Impacts

Not applicable.

4.4.4.1 Floodplains

Not applicable.

4.4.4.2 Wetlands

Not applicable.

4.4.4.3 Wildlife

Not applicable.

4.4.4.4 Geotechnical Exploration

Not applicable.

4.4.4.5 Other Resources

Not applicable.

4.4.5 Land Requirements

Not applicable.

4.4.6 Potential Construction Problems

Not applicable.

4.4.7 Sustainability Considerations

4.4.7.1 Water and Energy Efficiency

The current system keeps the heat trace continually on, costing the community over $1,000 per month.

4.4.7.2 Green Infrastructure

Not applicable.

4.4.7.3 Other

Not applicable.

4.4.8 Cost Estimates

Cost estimates are described in Section 4.7 and Appendix D. For the No Action alternative, no capital costs are expected and the O&M expense estimates are shown in Table 10 , in 2025 U.S. Dollars.

Table 10. Alternative 4 Capital and O&M Costs

Capital Costs	Capital Costs with AIS/BABAA	Annual O&M Costs
No Capital Costs	No Capital Costs	$23,100

4.5 Alternative 5: Establish individual wells and sewer systems

This alternative would provide new individual wells/septic systems or repair existing ones for the homes that are occupied year-round and have room for a bathroom. Water treatment systems would be provided as needed.

4.5.1 Description

This alternative proposes repairing, modifying or replacing all existing private wells and treatment systems for willing homeowners. For homes that haul water or have wells that violate the separation distance requirements, new wells would be drilled. Additionally, this alternative proposes new septic systems for the homes relying on aging leach fields and outhouses. Water sampling for new and existing wells would be performed and based on sample results. Manganese dioxide filters would be installed to address high iron content in the drinking water. All needs identified during the site visit and addressed in this alternative are described in Table 11**Error! Reference source not found.**.

Table 11. Drinking Water and Wastewater Needs

Needs	Quantity	Buildings
New private groundwater well	5	Buildings: 5, 6, 7, 10 ,13
Well decommissioning and new private well	2	Buildings: 4 and 8
New onsite septic system	7	Buildings:1, 3, 5, 6, 7,10 and 13
Septic system decommissioning and new onsite system	2	Buildings: 11 and 12
Individual Water Treatment Systems	12	This PER assumed all homes that rely on groundwater wells would need a water treatment system, this number should be

		updated, if necessary, during the design phase.

4.5.2 Design Criteria

For manganese dioxide filters, Alaska Water Technologies recommends a 1.5 cubic foot (cf) size MD (Manganese Dioxide) tank for two to three-bedroom houses. The Katalox can handle concentrations of iron, manganese, and hydrogen sulfide up to 15, 5, and 10 mg/L, respectively. The 1.5 cf system provides a standard flow rate of 4.0 gallons per minute (gpm) and a maximum flow rate of 5.5 gpm with a backwash flow rate of 9 gpm. Additionally, Katalox media also reduces heavy metals like lead and copper.

If iron concentrations are below 0.3 mg/L or above 15 mg/L, then the system should not be installed for that home. If the iron concentration is above 15 mg/L, then the well should be evaluated and re-sampled after correcting any possible deficiencies. If the iron concentration still exceeds 15 mg/L in the second sample result, then a new well is likely required.

4.5.3 Environmental Impacts

4.5.3.1 Floodplains

Not applicable.

4.5.3.2 Wetlands

Construction would proceed within the private property extent of each home.

4.5.3.3 Wildlife

Not applicable. This alternative would operate within existing infrastructure boundaries.

4.5.3.4 Geotechnical Exploration

For new wells, a few boreholes may need to be drilled before finding the best location or depth.

4.5.3.5 Other Resources

Not applicable.

4.5.4 Land Requirements

Alternative 5 would replace existing systems generally on private property, and agreements would need to be obtained from the owners.

4.5.5 Potential Construction Problems

The project will be subject to AIS and BABAA requirements. Long lead times for AIS and BABAA compliant materials, supplies, and components should be anticipated when developing project schedules. Equipment and materials should be procured well before construction so that construction is not unnecessarily delayed by the supply chain.

Adequate locations for wells that consider septic system separation distance requirements should be determined in design.

4.5.6 Sustainability Considerations

4.5.6.1 Water and Energy Efficiency

Not applicable.

4.5.6.2 Green Infrastructure

Not applicable.

4.5.6.3 Other

Soil and water contamination caused by the use of outhouses and honey buckets would be prevented with the construction of septic tanks.

4.5.7 Cost Estimates

Cost estimates are described in Section 4.7 and Appendix D. Total capital and O&M costs estimates for Alternative 5 are shown in Table 12, in 2025 U.S. Dollars.

Table 12. Alternative 5 Capital and O&M Costs

Capital Costs	Capital Costs with AIS/BABAA	Annual O&M Costs
$1,687,976	$2,004,203	$1,450

4.6 Alternative 6 – 15 Homes: No Action

Per the United States Department of Agriculture (USDA) Rural Development PER requirements, Alternative 6 will be No Action.

4.6.1 Description

Alternative 6 would take no action. The 15 homes would keep their existing water and wastewater infrastructure, and no capital or operational improvements would be included, except for minor repairs, as necessary.

4.6.2 Design Criteria

Not applicable.

4.6.3 Map

A location map of the homes is provided in Figure 12.

4.6.4 Environmental Impacts

Not applicable.

4.6.4.1 Floodplains

Not applicable.

4.6.4.2 Wetlands

Not applicable.

4.6.4.3 Wildlife

Not applicable.

4.6.4.4 Geotechnical Exploration

Not applicable.

4.6.4.5 Other Resources

Not applicable.

4.6.5 Land Requirements

Not applicable.

4.6.6 Potential Construction Problems

Not applicable.

4.6.7 Sustainability Considerations

4.6.7.1 Water and Energy Efficiency

Not applicable.

4.6.7.2 Green Infrastructure

Not applicable.

4.6.7.3 Other

Not applicable.

4.6.8 Cost Estimates

Cost estimates are described in Section 4.7 and Appendix D. For the No Action alternative, no capital costs are expected and the O&M expense estimates are shown in Table 13, in 2025 U.S. Dollars.

Table 13. Alternative 6 Capital and O&M Costs

Capital Costs	Capital Costs with AIS/BABAA	Annual O&M Costs
No Capital Costs	No Capital Costs	$1,450

4.7 Cost Estimates

All cost estimates in this PER are HDR's opinions of probable project cost and are considered approximately equivalent to Level 4 estimates as defined by the Association for the Advancement of Cost Engineering (AACE) International. These estimates represent the engineer's professional judgement based on the information available at the time of writing this PER and are based generally on process flow diagrams, major construction activities, and major equipment quotes. Per AACE guidelines, these estimates have an estimated accuracy of -15% to -30% and +20% to +50% on the low and high sides of total cost, respectively. To reflect this range of estimated accuracy and to account for cost complexities associated with remote work, a 25% contingency is added to the probable cost for each alternative, as well as a 3% uncertainty allowance and a 10% change order allowance. The 25% contingency also accounts for market volatility and inflation, and the resulting unpredictability of material and labor costs, especially for remote Alaska projects.

The AIS and the BABAA are applicable to this project. The BABAA act was enacted as part of the Infrastructure Investment and Jobs Act on November 15, 2021. The cost estimates in this PER address AIS with a 10 percent factor on applicable iron and steel components, and 15 percent factor for BABAA. The costs borne by a construction contractor to administer AIS and BABAA are accounted for with a line item that would cover the labor of an additional employee to handle the documentation. Capital costs are shown in Table 14.

Table 14. Capital Costs (in 2025 U.S. Dollars)

Alternative	Capital Costs	Capital Costs with AIS/BABAA
Alternative 1 - Evaluate, repair and replace equipment and components	$433,154	$538,748
Alternative 2 - Connect Clinic public water system as primary source	$209,378	$257,201

Alternative 3 - Re-establish individual well	$251,759	$303,118
Alternative 4 – No Action	No Capital Investment	
Alternative 5 - Establish individual wells and sewer systems	$1,687,976	$2,004,203
Alternative 6 – No Action	No Capital Investment	

The capital and O&M costs estimates present in Appendix D are based on present-day-value calculations of previous work conducted in comparable communities in Alaska, estimated quantities of raw materials, and allowances for construction contingency, logistic, permitting, legal, engineering, and VSW expenses. O&M costs are shown in Table 15.

Table 15. O&M Costs (in 2025 U.S. Dollars)

Alternative	Annual Operation and Maintenance Costs
Alternative 1 - Evaluate, repair and replace equipment and components	$24,100
Alternative 2 - Connect Clinic public water system as primary source	$11,400
Alternative 3 - Re-establish individual well	$22,050
Alternative 4 – No Action	$23,100
Alternative 5 - Establish individual wells and sewer systems	$1,450
Alternative 6 – No Action	$1,450

5. SELECTION OF AN ALTERNATIVE

5.1 Life-Cycle Cost Analysis

[To be developed in the 95% submittal with top preferred alternatives and the no action alternative]

5.2 Non-Monetary Factors

For a Non-Monetary Factor Analysis, 6 aspects were analyzed and verified accordingly:

- Operating training requirements – Alternative 1, 2 and 4 require a small untreated water system certification for the Water Utility Building and/or Clinic.
- Address Drinking Water Reliability – All alternatives, except No Action, would provide reliable drinking water to the community.
- Ease of Operation – According to information gathered during the site visit, several community members expressed concern with the operation of the Water Utility Building, being possibly too complex for the community ability to maintain. With Alternative 1 the Water Utility Building would be operational; however, it would still require a knowledgeable operator for O&M. The clinic well in Alternative 2 has proven to be reliable with the existing operator (separate from the Water Utility Building operator), although it may be just as complex to operate as the Water Utility Building. For Alternative 5, homeowners are responsible for O&M needs.
- Address Water Quality Issues – High content of iron in the water was reported by community members, this issue would be addressed by providing individual water treatment systems, as recommended by Alternative 5.
- Community Preference: To be determined.

Table 16. Non-Monetary Factor - Water Facility Building

Alternative		Operator Training Requirements	Address Drinking Water Reliability	Ease of Operation	Community Preference
1	Evaluate, repair and replace equipment and components	Intermediate	YES	Hard	Unknown
2	Connect Clinic public water system as primary source	Intermediate	YES	Intermediate	Unknown
3	Re-establish individual wells	NO	YES	Intermediate	Unknown

4	No Action	Intermediate	NO	Hard	Unknown

Table 17. Non-Monetary Factors - 15 Homes

Alternative		Address Water Quality Issues	Address Drinking Water Reliability	Ease of Operation	Community Preference
5	Establish individual wells and sewer systems	YES	YES	Intermediate	Unknown
6	No Action	NO	NO	Easy	Unknown

6. CONCLUSIONS AND RECOMMENDATIONS

[Formal Recommendation to be made during the 95% review].

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APPENDIX A

HDR Site Visit Report

Chistochina PER Site Visit Trip Report

Date:	Thursday, May 01, 2025
Project:	VSW Task Order 25-CZO-TO-007
To:	Oscar Menendez, P.E., VSW
From:	Mikkel Foltmar, P.E., Vanessa Carneiro dos Santos, E.I.T.
Subject:	Chistochina Site Visit Trip Report (4/08/25 –4/10/25) – Rev 2.0

On Wednesday, April 8th, 2025, HDR engineers Mikkel Foltmar and Vanessa Carneiro dos Santos conducted a site visit to Chistochina, Alaska to evaluate the community's current drinking water and wastewater infrastructure, including currently operational and non-operational wells, septic systems, houses not served with water or septic systems and the water facility building. The information gleaned in this site visit will help to inform the Preliminary Engineering Report (PER), wherein improvement alternatives for ensuring water access and wastewater disposal options for several homes are introduced and assessed, along with improvements for the water facility building.

The team arrived in Chistochina Wednesday evening at 19:00 PM. On Thursday Morning, HDR engineers met with Leah Hatch, the Cheesh'na Tribal Council Office Manager, Danielle, and Jim. Jim leads the Village's efforts in maintaining and operating the water facility building that serves itself, the Community Hall and Community Office. The operator believes that the current system is too complex, or overbuilt, for the community's ability to maintain and operate it, as well as expensive. For wastewater system, the operator informed that the lift station sewer pump is unreliable and started showing issues soon after installation, possibly due to freezing, as it was noted the lift station was not insulated.

Jim led the site visit to the utility building, while Danielle and Leah led the site visit to several homes throughout the Community, shown in Figure 18 (See Figure 19 and Figure 20 for zoomed in locations) and Twin Lakes (Figure 21). Notes from each place visited are included below, the locations are numbered in the order in which they were visited.

Location 1: Water Facility Building and Sewer System

The water facility building was built in 2016 and was originally designed as a water facility building and washeteria. Currently, the building includes utility operation rooms, two bathrooms with showers and one exterior water hauling point (Figure 1 through Figure 4). Only two families use the water hauling point year-round. However, during summer, the bathrooms and water hauling are used during community events. The water fill point is not currently functional.

The Tribal Office was previously served with its own well which has been decommissioned, and the building is now served by the water facility building that has two wells, at least 200 ft deep, according to the operator. For heating, the water facility building uses a glycol circulation system for the sewer lines, and heat trace for freeze recovery for the wells.

With the information gathered during the site visit with community members and water operator, the water facility building seems to have issues with bladder tanks and control panels, that are not functioning as intended. A water leak may be present in the distribution system past the water facility building. When the valve is open, the well will pump for a few seconds, bringing the pressure up to 60 pounds per square inch (PSI). The pump will then shut off and within a few seconds the pressure will drop back to 0 PSI. The pressure is maintained if the valve to the distribution system is shut off. The water meter indicates an approximate 0.1 to 0.2 gallons of water flows through the water meter during these few seconds of operation. Further investigation would be necessary to determine the root cause of the system's inability to retain pressure.

The bladder tanks are not holding pressure. This may be because they have not been properly maintained. They lack a sight glass that would allow an operator to identify the ratio of air to water in the tanks. The bladder tanks are placed so close together that it is challenging to get access to the space behind them, although there is adequate room in the facility to space them further apart.

The glycol circulation system's pressure tanks are valved closed. It's unclear if this is how they are intended to be operated. Turning the valves open turns the pumps on and increases the pressure in the pressure tanks.

The glycol circulation system is needlessly complicated. The piping for the glycol system is all ultimately interconnected and unless the system is arbitrarily valved closed at various points, the thermometers should all be putting out the same temperature reading.

The piping in the facility is uninsulated and unmarked. The purpose of the piping and their flow can be identified with some difficulty, but insulating and marking the pipes would both improve efficiency and clarify the purpose of various piping in the facility.

The boiler controls are bypassed and one of the boilers reportedly runs continuously. Typical operations are intended to only turn the boilers on when they are needed and to cycle between them. It is unclear why the boiler controls were reportedly not functional.

The water fill point line is not angled downwards from inside the facility to the fill point and might not fully drain when the valve is closed, potentially allowing it to freeze near the outlet.

The bathrooms are ordinarily locked and require a key from the nearby tribal office to access.

There is a bypass for the water meter. The water meter was being bypassed during the site visit. While a bypass is useful, the water meter should ordinarily not be bypassed.

The heat trace for the wells was intended for freeze recovery according to the plans we were able to review prior to our site visit. The heat trace is continuously on, which costs the community approximately $1,100 per month. The system should be verified as to the intent of the heat trace. While the well may not be able to pump water if the system freezes between the well and the facility, it is likely designed with freezing temperatures in mind. If that is the case, the heat trace should typically be off, unless freeze recovery is required to thaw the lines and allow water to flow again. The system may not be able to recognize that the line is frozen if the pressure calls for the pumps to turn on, but water is unable to reach the system and pressurize it, which should also be evaluated to prevent the pumps from running continuously or burning out during freezing events.

Figure 1. Water facility Building

Figure 2. Water hauling point at the Utility Building

Figure 3. Water facility Building's operation room

Figure 4. Pressure Tank in the Water facility Building

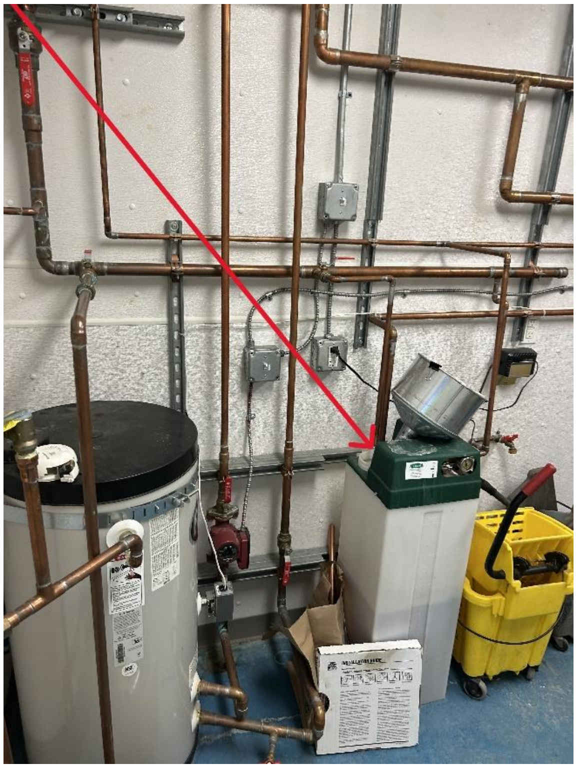


Figure 5. Cold water line to water heater. Red arrow indicates drain from cold water line into a glycol container, presenting a potential, but not immediately threatening cross-connection

Figure 6. Pink valve in bottom left corner of this figure is the non-operational valve for the water fill point

After the Utility Building, HDR engineers and the VSW Engineer visited the Chistochina Health Clinic that is located across the Tribal Office and has a similar water system, that is currently operational and has not showed any major issues since installation according to the clinic or the community. Plan drawings indicate the clinic was intended to be connected to the water facility building, however, the clinic was built in 2012 and needed water at the time. The clinic's mechanical room has well-insulated and clearly labeled pipe and equipment, and largely uses similar if not identical equipment, including identical boilers.

The sewer system includes three lift stations. The lift stations did not appear to be insulated. There is a glycol heating loop from the water facility building that's intended to keep it thawed out. Due to the depth of liquid in the lift stations, if the liquid freezes, the pumps in the lift stations would likely freeze and be damaged beyond repair as well. The pumps are not likely to have been replaced since they were first installed in 2016, and the typical useful life for a lift station pump varies based on how much maintenance they receive. As these pumps generally will not receive regular maintenance, they should be expected to last approximately five to ten years, and are likely beyond the end of their useful life. Before they are replaced with new pumps, the system should be verified as to proper insulation to ensure that it does not freeze during the winter.

Figure 7. Lift Station near tribal office, typically underneath seating

Figure 8. Lift station halfway between tribal office and water facility building

Figure 9. Lift station near water facility building, with no evidence of insulation

Figure 10. Community septic system for water facility building, community building and tribal office

Figure 11. Septic system for clinic (not evaluated as part of this PER)

Home #1

The first home to be visited was the residence of the owner of the Red Eagle Lodge. The owner stated they have two groundwater wells, with good quality water. The owner showed interest in a septic system for the on-site residence in which he and his spouse live, as the building is served by a septic crib, built by the previous owner.

Home #2

The owner of Home #2 stated that although he has a drinking water well, it is not operational as he needs help with installation of piping. Currently, he's either buying or hauling water for his home, and using an outhouse. The property is large enough for construction of a leach field and the well would probably need to be relocated, for separation distance requirements. The home likely lacks adequate space for a bathroom.

Figure 12. Groundwater Well at Home #2

Home #3

The home has an operational well drilled over 30 years ago. The septic system has failed, and an outhouse is currently being used. The home has structural concerns and may need significant repairs. It has previously been occupied year-round and may be again.

Figure 13. Groundwater well used in Home #3

Home #4

The house has a working groundwater well and a septic system, the well is very close to the residence, and meeting separation distance requirements needs to be evaluated.

Figure 14. Home #4 working groundwater well

Homes #5, #6, #7

These homes were built in the 1970's and have no water or septic systems. All homes reportedly have a bathroom, built at the time of construction.

Home #8

Home #8 has a working well, close to the house, and a septic system. The building is being remodeled currently and has enough room for a kitchen and bathroom.

Figure 15. Groundwater well and septic system

Home #9

For home #9, a septic system and groundwater well were identified in the property but were never hooked up to the house. The current condition of the systems is unclear, as the house is not occupied at the moment.

Figure 16. Home #9 working well

Home #10

Home #10 doesn't have a well or septic system and currently uses an outhouse. It was informed by the community that homes #10 and #11 are in the same property and home #11 has a working well that could potentially serve home #10.

Home #11

The home has a working well and a septic system that was designed for home #10, and is likely at the end of its useful life. The homeowner indicated interest in sharing the working well with home #10, since they're located at the same property.

Home #12

Home #12 has a working well, with potentially high iron content, based on visual observation. The septic system, although operational, is past its useful life, as it was built in the 1980's.

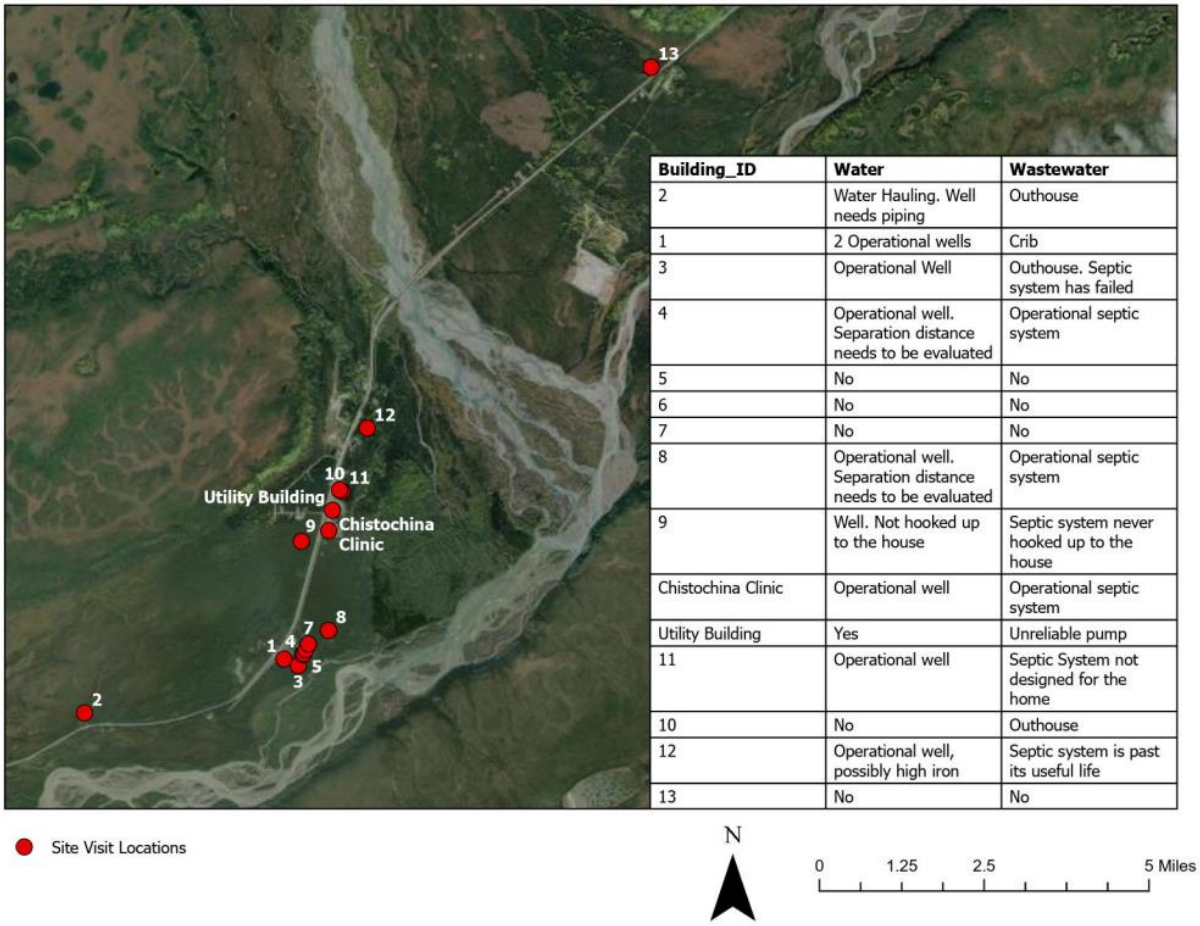
Figure 17. Home #12 groundwater well and septic system

Home #13

Home #13 has no well or septic system. The house has enough room for bathroom.

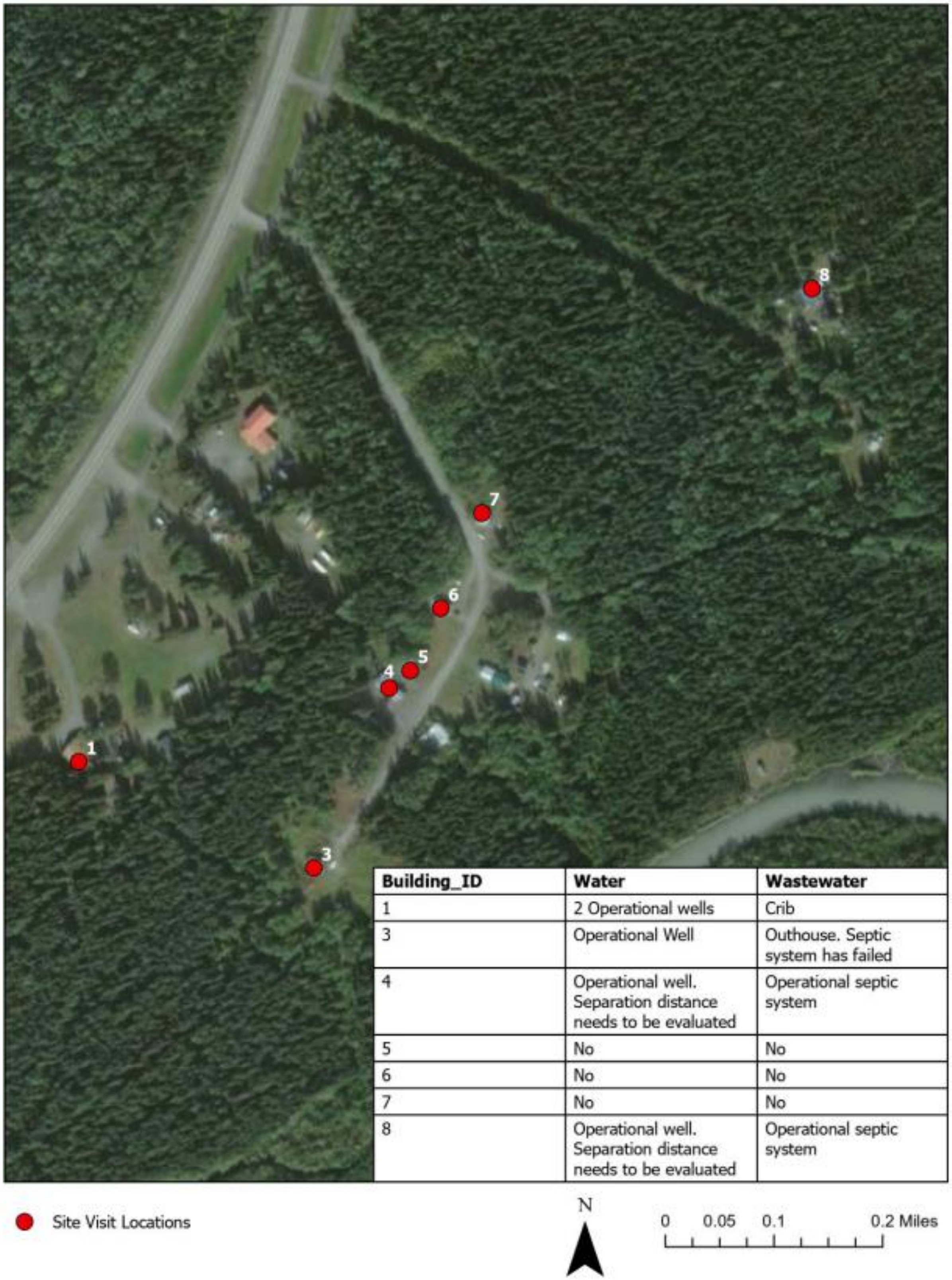
Homes #14, #15, #16 and #17

These homes are located near Twin Lakes and have no groundwater wells or septic systems. Homeowners rely on hauling water from nearby stream. Home #14 has no room for a bathroom, but it's located on a large property. While home #16 uses a windmill and solar panels for renewable energy source, the other homes rely on fuel generated power.



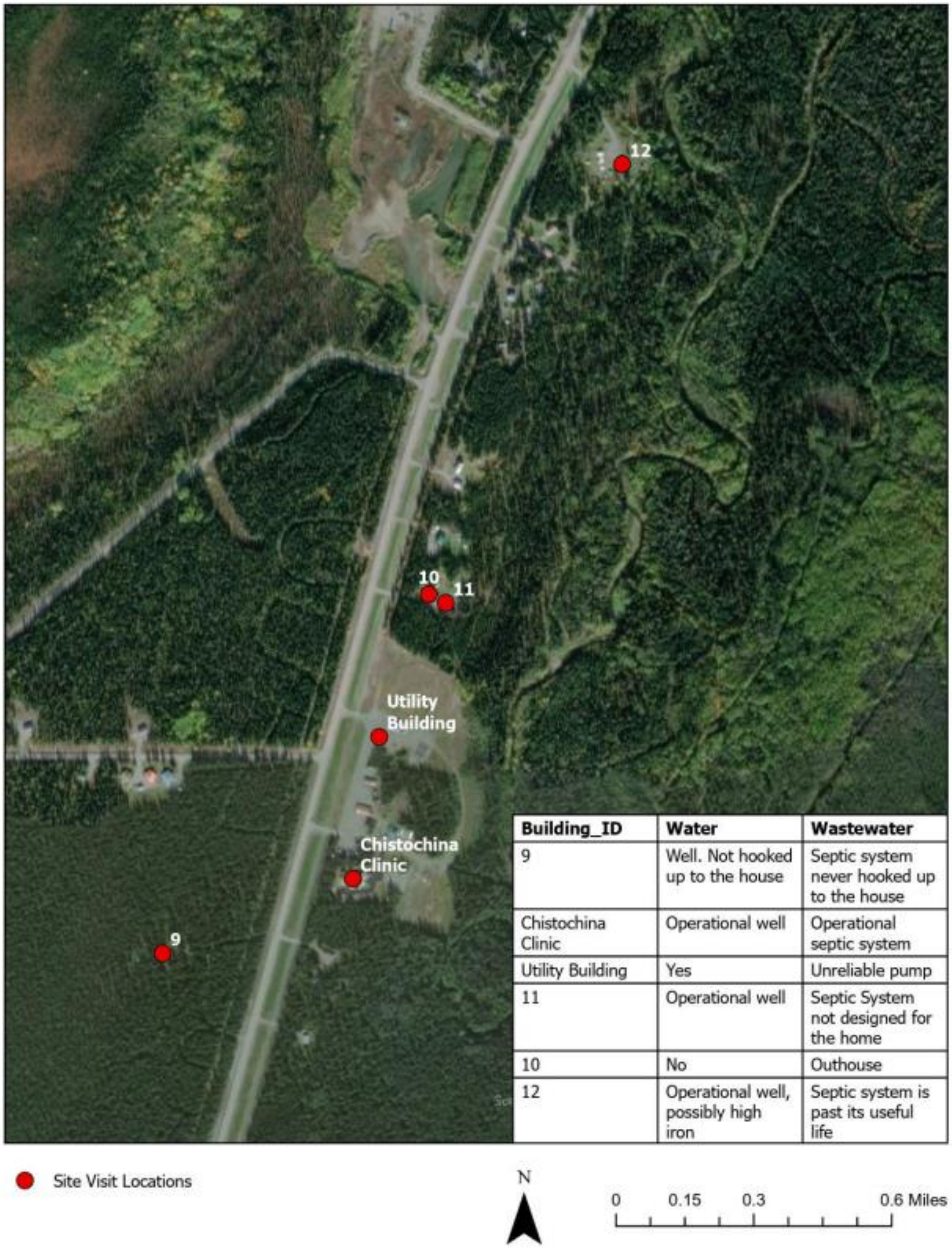
Building_ID	Water	Wastewater
2	Water Hauling. Well needs piping	Outhouse
1	2 Operational wells	Crib
3	Operational Well	Outhouse. Septic system has failed
4	Operational well. Separation distance needs to be evaluated	Operational septic system
5	No	No
6	No	No
7	No	No
8	Operational well. Separation distance needs to be evaluated	Operational septic system
9	Well. Not hooked up to the house	Septic system never hooked up to the house
Chistochina Clinic	Operational well	Operational septic system
Utility Building	Yes	Unreliable pump
11	Operational well	Septic System not designed for the home
10	No	Outhouse
12	Operational well, possibly high iron	Septic system is past its useful life
13	No	No

Figure 18. Site visit location in Chistochina, AK



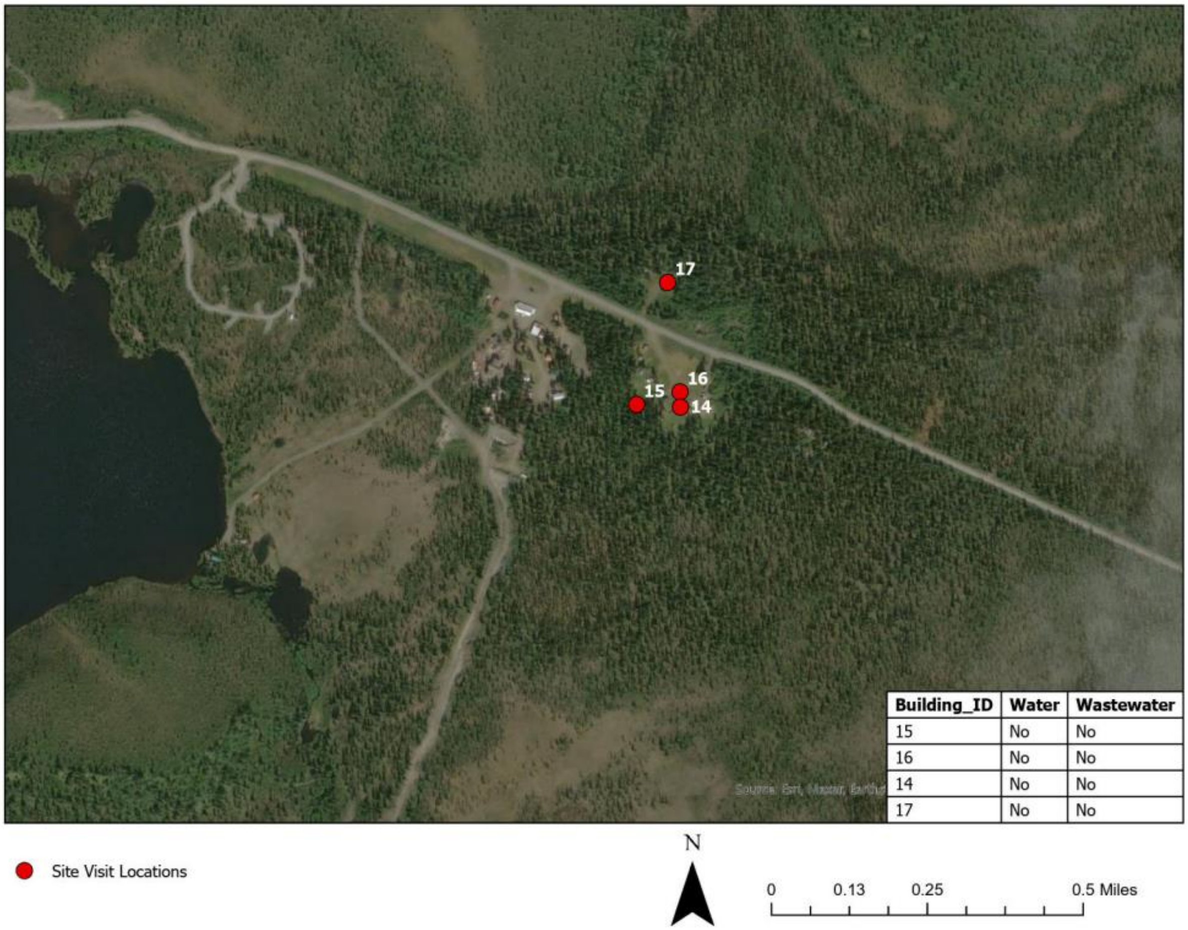
Building_ID	Water	Wastewater
1	2 Operational wells	Crib
3	Operational Well	Outhouse. Septic system has failed
4	Operational well. Separation distance needs to be evaluated	Operational septic system
5	No	No
6	No	No
7	No	No
8	Operational well. Separation distance needs to be evaluated	Operational septic system

Figure 19. Site visit locations near Chistochina School



Building_ID	Water	Wastewater
9	Well. Not hooked up to the house	Septic system never hooked up to the house
Chistochina Clinic	Operational well	Operational septic system
Utility Building	Yes	Unreliable pump
11	Operational well	Septic System not designed for the home
10	No	Outhouse
12	Operational well, possibly high iron	Septic system is past its useful life

Figure 20. Site Visit Locations near Chistochina Clinic



Building_ID	Water	Wastewater
15	No	No
16	No	No
14	No	No
17	No	No

Figure 21. Site visit location near Twin Lakes, AK

APPENDIX B

Alternatives Memo

Chistochina PER Alternatives Memo

Date:	May 5, 2025
Project:	VSW Task Order 25-CZO-TO-007
To:	Oscar Menendez, ADEC
From:	Vanessa Carneiro dos Santos EIT, Mikkel Foltmar PE, HDR
Subject:	Chistochina PER Alternatives

Introduction

HDR Alaska, Inc. (HDR), is developing the Chistochina Preliminary Engineering Report (PER) under Village Safe Water (VSW) work order 25-CZO-TO-007. The scope of the project is to evaluate and identify deficiencies related to the Water Facility Building (also known as the Water Processing Facility or Washeteria) and present alternatives to aid in resolving them, along with a no action alternative. Providing drinking water and wastewater services to up to 15 other homes is also within the scope of the PER. A site visit has been performed and the current conditions have been evaluated.

The following alternatives are split into two separate categories. The first category considers alternatives related to the Water Facility Building. The second category considers alternatives related to the up to 15 homes. These projects can be completed independently of each other.

Water Facility Building:

1. Evaluate, repair and replace equipment and components.
2. Connect clinic public water system as primary source
3. Re-establish individual wells
4. No action.

Establishing individual leach fields will not reduce the length of sewer transmission line that would need to be maintained and is therefore considered technically not feasible.

15 Homes:

5. Establish Individual Wells and Sewer Systems
6. No action.

A community drinking water system and community wastewater system was considered for the 15 homes. However, the existing wastewater system from the Water Facility Building has problems with freezing during the long cold winters, despite having a glycol heating loop system. Power in the community is expensive and unreliable. Suitable maintenance staff are difficult to find and retain. There are large distances between the homes. Piped drinking water and wastewater systems between the homes are likely to suffer from frequent failures and freezing, making these alternatives technically non-feasible. Please note that the area evaluated under Phase III of the former PER has not been developed, and this memo does not re-evaluate the technical feasibility of that alternative.

Proposed Alternatives

HDR considered a range of alternatives to address each of the issues.

WATER FACILITY BUILDING

ALTERNATIVE 1: EVALUATE, REPAIR, REPLACE AND ADD EQUIPMENT AND COMPONENTS

This alternative proposes to have several components within the water facility building professionally evaluated and either repaired or replaced. Components include:

- Bladder tanks
- Valves
- Glycol piping and pressure tanks
- Boilers and boiler controls
- Water fill point
- Heat trace and heat trace controls
- Lift stations including:
    - Lift station insulation
    - Lift station pumps

Additionally, power in the community's area is unreliable and reportedly "dirty". Some electrical components, such as the boiler controls or pumps, may have prematurely failed due to power surges and similar issues. Adding in a backup power system or equivalent system could help prevent damage caused by power surges or due to voltage sag, overvoltage, and similar issues.

ALTERNATIVE 2: CONNECT CLINIC PUBLIC WATER AS PRIMARY SOURCE

The clinic has a working public water system that has existing approval to operate from the Alaska Department of Environmental Conservation. Original plans were to connect the water facility building to the clinic to provide water to the clinic, but the clinic was built in 2012.

The clinic's water system design and setup are nearly identical to the water facility building. It is likely to be able to supply adequate water for existing demands. Rather than attempting to make the water facility building fully functional, the clinic's water system could be connected to the community buildings, and the existing water facility building wells could instead serve as potential back-up systems (or be decommissioned). If all drinking water components are decommissioned, the facility would primarily serve to keep the wastewater system operational.

The lift stations would be evaluated and repaired or replaced under this alternative, as there is no other suitable wastewater alternative for the community buildings.

ALTERNATIVE 3: RE-ESTABLISH INDIVIDUAL WELLS

The community buildings used to be served by their own wells. Putting the wells back into service or drilling new wells to provide potable water individually to the buildings that need it could keep the system simple. The existing water facility building wells could be kept seasonally operational with some or all drinking water components decommissioned. If all drinking water components are decommissioned, the facility would primarily serve to keep the wastewater system operational.

The lift stations would be evaluated and repaired or replaced under this alternative, as there is no other suitable wastewater alternative for the community buildings.

ALTERNATIVE 4: NO ACTION

Per the USDA Rural Development PER requirements, Alternative 4 will be the no action alternative for the water facility building.

15 HOMES

ALTERNATIVE 5: ESTABLISH INDIVIDUAL WELLS AND SEWER SYSTEMS

Each home was individually assessed during the site visit. Homes with permanent residents that have room for a bathroom, and existing plumbing, would be offered a regulatory compliant private drinking water well, if they do not already have one meeting those requirements. Similarly, those same homes would be offered a regulatory compliant septic system. This alternative would include the replacement or addition of water treatment systems for residences that have a working well, but contains high levels of iron in the water, as was observed in some residences during the site visit.

ALTERNATIVE 6: NO ACTION

Per the USDA Rural Development PER requirements, Alternative 6 will be the no action alternative for the drinking water and wastewater services to the up to 15 homes.

APPENDIX C

Alternatives Memo Comments

Multi-Agency Review Committee
Comments Memo

TO: Oscar Menendez
Project Engineer II, ADEC, Village Safe Water Program

FROM: Carrie Bohan, ADEC, Facilities Program Manager
On behalf of the Multi-Agency Review Committee

CC: David Landes, ADEC, Village Safe Water Program

DATE: July 2, 2025

SUBJECT: Chistochina Washeteria Improvements Alternatives Memo

The Multi-Agency Review Committee (Committee) has reviewed the Chistochina Washeteria Improvements Alternatives Memo, prepared by HDR dated May 5, 2025.

This alternatives memo is approved.

If you have any questions or would like to discuss this review in more detail, please let me know and I can put you in contact with the Committee members who can best answer your questions.

APPENDIX D

Cost Estimates: Capital and O&M

Alternative 1

Table D1. Alternative 1 Capital Cost Estimates in 2025 U.S. Dollars

Item	Quantity	Units	Unit Cost	Cost
Bladder Tanks	2	EA	$30,000	$60,000
Valves	1	LS	$2,000	$2,000
Glycol Heating System, Pressure Tanks and Boilers Configuration	1	LS	$50,000	$50,000
Water Fill Point	1	LS	$3,000	$3,000
Heat Trace Controls	1	LS	$3,000	$3,000
Lift Station Insulation and Pumps	3	EA	$25,000	$75,000
Battery Energy Storage Systems (BESS)	1	LS	$20,000	$20,000
			Construction Subtotal	**$213,000**
			Mob/Demob/Construction Logistics (10%)	$21,300
			Construction Contingency (25%)	$53,250
			Uncertainty Allowance (3%)	$6,390
			Change Order Allowance (10%)	$21,300
			Total Construction	**$315,240**
			Leak Detection Efforts	$8,000
			Permitting & Agency Consultation	$40,000
			Engineering and Design (12%)	$37,829
			Construction and Professional Services	**$401,069**
			VSW Project Management (8%)	$32,086
			Project Total	**$433,154**

Table D2. Alternative 1 Capital Cost Estimates with AIS/BABAA Requirements in 2025 U.S. Dollars

Item	Quantity	Units	Unit Cost	Cost
Bladder Tanks	2	EA	$33,000	$66,000
Valves	1	LS	$2,200	$2,200
Glycol Heating System, Pressure Tanks and Boilers Configuration	1	LS	$55,000	$55,000
Water Fill Point	1	LS	$3,450	$3,450
Heat Trace Controls	1	LS	$3,300	$3,300

Lift Station Insulation and Pumps	3	EA	$28,750	$86,250
Battery Energy Storage Systems (BESS)	1	LS	$22,000	$22,000
			Construction Subtotal	**$238,200**
			AIS/BABAA Administration	$50,000
			Mob/Demob/Construction Logistics (10%)	$23,820
			Construction Contingency (25%)	$59,550
			Uncertainty Allowance (3%)	$7,146
			Change Order Allowance (10%)	$23,820
			Total Construction	**$402,536**
			Leak Detection Efforts	$8,000
			Permitting & Agency Consultation	$40,000
			Engineering and Design (12%)	$48,304
			Construction and Professional Services	**$498,840**
			VSW Project Management (8%)	$39,907
			Project Total	**$538,747**

Table D3. Alternative 1 O&M Expenses in 2025 U.S. Dollars

Item	Quantity	Unit	Unit Price	Cost
Labor Costs	520	hrs	$40	$20,800
Power Costs	1	LS	$1,000	$1,000
Pumper Truck	1	LS	$800	$800
Yearly Well Disinfection	2	EA	$250	$500
Monitoring and Testing	1	LS	$1,000	$1,000
Total Annual Expenses				$24,100
Operating Expenses per Month				$2,008

Alternative 2

Table D4. Alternative 2 Capital Cost Estimates in 2025 U.S. Dollars

Item	Quantity	Units	Unit Cost	Cost
HDPE Service lines	1	LS	$10,000	$10,000
Water Fill Point	1	LS	$3,000	$3,000
Lift Station Insulation and Pumps	3	EA	$25,000	$75,000
			Construction Subtotal	**$88,000**
			Mob/Demob/Construction Logistics (10%)	$8,800
			Construction Contingency (25%)	$22,000
			Uncertainty Allowance (3%)	$2,640
			Change Order Allowance (10%)	$8,800
			Total Construction	**$130,240**
			Leak Detection Efforts	$8,000
			Permitting & Agency Consultation	$40,000
			Engineering and Design (12%)	$15,629
			Construction and Professional Services	**$193,869**
			VSW Project Management (8%)	$15,510
			Project Total	**$209,379**

Table D5. Alternative 2 Capital Cost Estimates with AIS/BABAA Requirements in 2025 U.S. Dollars

Item	Quantity	Units	Unit Cost	Cost
HDPE Service lines	1	LS	$11,500	$11,500
Water Fill Point	1	LS	$3,450	$3,450
Lift Station Insulation and Pumps	3	EA	$28,750	$86,250
			Construction Subtotal	**$101,200**
			AIS/BABAA Administration	$20,000
			Mob/Demob/Construction Logistics (10%)	$10,120
			Construction Contingency (25%)	$25,300
			Uncertainty Allowance (3%)	$3,036
			Change Order Allowance (10%)	$10,120
			Total Construction	**$169,776**
			Leak Detection Efforts	$8,000
			Permitting & Agency Consultation	$40,000
			Engineering and Design (12%)	$20,373
			Construction and Professional Services	**$238,149**
			VSW Project Management (8%)	$19,052
			Project Total	**$257,201**

Table D6. Alternative 2 O&M Expenses in 2025 U.S. Dollars

Item	Quantity	Unit	Unit Price	Cost
Labor Costs	260	hrs	$40	$10,400
Power Costs	1	LS	$200	$200
Pumper Truck	1	LS	$800	$800
Total Annual Expenses				$11,400
Operating Expenses per Month				$950

Alternative 3

Table D7. Alternative 3 Capital Cost Estimates in 2025 U.S. Dollars

Item	Quantity	Units	Unit Cost	Cost
Well Drilling	1	EA	$15,000	$15,000
Well Development	1	EA	$2,500	$2,500
Well Pumps and Screens	1	EA	$1,000	$1,000
Lift Station Insulation and Pumps	3	EA	$25,000	$75,000
HDPE Service lines	2	EA	$10,000	$20,000
Water Fill Point	1	LS	$3,000	$3,000
			Construction Subtotal	**$116,500**
			Mob/Demob/Construction Logistics (10%)	$11,650
			Construction Contingency (25%)	$29,125
			Uncertainty Allowance (3%)	$3,495
			Change Order Allowance (10%)	$11,650
			Total Construction	**$172,420**
			Geotechnical Investigation	$15,000
			Water/Soil Sampling	$5,000
			Permitting & Agency Consultation	$20,000
			Engineering and Design (12%)	$20,690
			Construction and Professional Services	**$233,110**
			VSW Project Management (8%)	$18,649
			Project Total	**$251,759**

Table D8. Alternative 3 Capital Cost Estimates with AIS/BABAA Requirements in 2025 U.S. Dollars

Item	Quantity	Units	Unit Cost	Cost

Well Drilling	1	EA	$15,000	$15,000
Well Development	1	EA	$2,875	$2,875
Well Pumps and Screens	1	EA	$1,100	$1,100
Lift Station Insulation and Pumps	3	EA	$28,750	$86,250
HDPE Service lines	2	EA	$11,500	$23,000
Water Fill Point	1	LS	$3,450	$3,450
			Construction Subtotal	**$131,675**
			AIS/BABAA Administration	$20,000
			Mob/Demob/Construction Logistics (10%)	$13,168
			Construction Contingency (25%)	$32,919
			Uncertainty Allowance (3%)	$3,950
			Change Order Allowance (10%)	$13,168
			Total Construction	**$214,880**
			Geotechnical Investigation	$15,000
			Water/Soil Sampling	$5,000
			Permitting & Agency Consultation	$20,000
			Engineering and Design (12%)	$25,786
			Construction and Professional Services	**$280,666**
			VSW Project Management (8%)	$22,453
			Project Total	**$303,119**

Table D9. Alternative 3 O&M Expenses in 2025 U.S. Dollars

Item	Quantity	Unit	Unit Price	Cost
Labor Costs	520	hrs	$40	$20,800
Yearly Well Disinfection	1	LS	$250	$250
Power Costs	1	LS	$200	$200
Pumper Truck	1	LS	$800	$800
Total Annual Expenses				$22,050
Operating Expenses per Month				$1,838

Alternative 4

Table D10. Alternative 4 O&M Expenses in 2025 U.S. Dollars

Item	Quantity	Unit	Unit Price	Cost

Labor Costs	520	hrs	$40	$20,800
Yearly Well Disinfection	2	EA	$250	$500
Power Costs	1	LS	$1,000	$1,000
Pumper Truck	1	LS	$800	$800
Total Annual Expenses				$23,100
Operating Expenses per Month				$1,925

Alternative 5

Table D11. Alternative 5 Capital Cost Estimates in 2025 U.S. Dollars

Item	Quantity	Units	Unit Cost	Cost
Well Decommissioning	2	EA	$8,000	$16,000
Septic Tank Decommissioning	2	EA	$10,000	$20,000
Well Drilling	7	EA	$15,000	$105,000
Well Development	7	EA	$2,500	$17,500
Well Pumps and Screens	7	EA	$1,000	$7,000
Water Treatment System	12	EA	$2,500	$30,000
On-site Wastewater System	9	EA	$75,000	$675,000
			Construction Subtotal	**$870,500**
			Mob/Demob/Construction Logistics (10%)	$87,050
			Construction Contingency (25%)	$217,625
			Uncertainty Allowance (3%)	$26,115
			Change Order Allowance (10%)	$87,050
			Total Construction	**$1,288,340**
			Geotechnical Investigation	$50,000
			Water/Soil Sampling	$30,000
			Permitting & Agency Consultation	$40,000
			Engineering and Design (12%)	$154,601
			Construction and Professional Services	**$1,562,941**
			VSW Project Management (8%)	$125,035
			Project Total	**$1,687,976**

Table D12. Alternative 5 Capital Cost Estimates with AIS/BABAA Requirements in 2025 U.S. Dollars

Item	Quantity	Units	Unit Cost	Cost
Well Decommissioning	2	EA	$8,000	$16,000

Septic Tank Decommissioning	2	EA	$10,000	$20,000
Well Drilling	7	EA	$15,000	$105,000
Well Development	7	EA	$2,875	$20,125
Well Pumps and Screens	7	EA	$1,100	$7,700
Water Treatment System	12	EA	$2,875	$34,500
On-site Wastewater System	9	EA	$86,250	$776,250
			Construction Subtotal	**$979,575**
			AIS/BABAA Administration	$100,000
			Mob/Demob/Construction Logistics (10%)	$97,958
			Construction Contingency (25%)	$244,894
			Uncertainty Allowance (3%)	$29,387
			Change Order Allowance (10%)	$97,958
			Total Construction	**$1,549,772**
			Geotechnical Investigation	$50,000
			Water/Soil Sampling	$30,000
			Permitting & Agency Consultation	$40,000
			Engineering and Design (12%)	$185,973
			Construction and Professional Services	**$1,855,745**
			VSW Project Management (8%)	$148,460
			Project Total	**$2,004,205**

Table D13. Alternative 5 O&M Expenses in 2025 U.S. Dollars

Item	Quantity	Unit	Unit Price	Cost
Yearly Well Disinfection	1	LS	$250	$250
Power Costs	1	LS	$200	$200
Filter Maintenance Cost	1	LS	$200	$200
Pumper Truck	1	LS	$800	$800
Total Annual Expenses				$1,450
Operating Expenses per Month				$121

Alternative 6

Table D14. Alternative 6 O&M Expenses in 2025 U.S. Dollars

Item	Quantity	Unit	Unit Price	Cost
Yearly Well Disinfection	1	LS	$250	$250
Power Costs	1	LS	$200	$200

Filter Maintenance Cost	1	LS	$200	$200
Pumper Truck	1	LS	$800	$800
Total Annual Expenses				$1,450
Operating Expenses per Month				$121

Community:	Chistochina	Date:	
Project:	Preliminary Engineering Report - First service to 15 homes and Washeteria Improvements 65% PER - HDR		
Reviewer Name:			
Respondent Name:	George Drinkwater - Operations Director MSTC/ Special Priojects - CTC and C/E, 360-481-1160, gdrinkwater@chistochinaenterprises.com		

Class I: Real/Potential Code or Regulation Violation - Class II: Errors or Omissions - Class III: Matters of Design Judgment - Class IV: Recommendation for better product

#	Section	Comment	Class	Designer Response	Reviewer Response
Plan Review Comments					
ALT 1		Engineering Documents from KAE are not reflective of AS-BUILT Conditions			
ALT 1		Septic Line is a 3" Pressure Line/ NOT GRAVITY			
ALT 1		Septic Design Failed because waste water flow rate too small. Freezes at all poorly insluated lift stations			
ALT 1		SEPTIC SYSTEM IS INOPERABLE AS DESIGNED			
ALT 1		Entire Septic System needs to be decommissioned and abandoned.			
ALT 1		Water Building requires refurbishment/ simplification for efficiency and maintenance			
ALT 1		Water Building - Bladder tanks repaired in Summer 2025. Water building supplies water to Tribal Offices and Hall			
ALT 1		Water Building adequately provides community water.			
ALT 1		Water Building needs a new stand - alone gravity septic system for toilets/showers/ floor drains utility sink stc.			
ALT 1		New Alternatives and cost estimastes must be created to reflect current and as-built conditions			

ALT 2		Clinic Water system not adequatly sized for community use			
ALT 3		NOT AVAILABLE- Former community well was deleted/ abandoned/ filled and buried			
ALT 4		NOT OPTIONAL			
