1. Introduction

The Akiak Native Community (ANC) is threatened by riverine erosion along approximately 2,600 feet of the Kuskokwim River. Streambank revetment projects to mitigate erosion have been found to be too expensive to be reasonable. The only viable option left is for the community to retreat from the advancing river. This involves relocating homes and other structures to new locations in the community, including the construction of a new subdivision on the western side of the village, away from the river.

The proposed location for the new subdivision is near the existing honey bucket sewage lagoon (see Figure 1), which has raised health concerns amongst the community. To alleviate these concerns, ANC would like to close the existing honey bucket sewage lagoon and provide alternate wastewater disposal methods for the limited number of residents who currently live in homes unserved by sewer service and do not have planned sewer connection.

One additional health concern for the community relates to observations of seepage adjacent to the existing wastewater lagoon. Therefore, to allow the next phase of community relocation, construction of improvements would need to be completed in the following order:
Each of the above improvements are analyzed in detail below.

2. Repair Leaking Sewage Lagoon Embankment

A trip report prepared by Alaska Native Tribal Health Consortium (ANTHC) described wastewater effluent being observed outside the northeast corner of the primary cell in the summer of 2019 (see Figure 2). The report also detailed the understanding at the time that the effluent was caused by vegetation growing in the overflow channel between the primary and facultative cells of the lagoon causing overflow over the lagoon embankment. The decision was made to remove the vegetation and monitor ponding in the future. Observation of continued ponding of effluent outside the embankment during the summer of 2020 confirmed that the vegetation was not the original cause of leakage.

Possible causes of the leakage may be due to a localized layer of permeable soil under the lagoon or damage to the geotextile wraps of the embankment caused by a driven pile baffle anchor post installed in the top of the embankment. When considering these hypotheses, it’s notable that evidence of seepage has not been observed on the embankment slope and the location of ponding effluent is limited to a small area along the embankment slope.

Alternatives for mitigating the leakage include

- Filling the Leakage Area,
- Lining the Lagoon Primary Cell,
- Filling a Portion of the Primary Cell, and
- Reconstruction of the Primary Cell within the Secondary Cell.

The options are ordered (A-D) from least to most perceived impact to lagoon operations and performance and may be implemented in succession if initial efforts do not resolve the issue. The alternatives are depicted in Figure 3 and further described below.

A. Filling the Leakage Area

This alternative includes filling the area where wastewater is being observed on the surface. The fill area would be approximately 50-feet wide by 150-feet long and 3-feet deep. The initial concept would be to install approximately 1-foot of drain rock on the ground surface and cover it with a separation geotextile and 2-feet of locally available sandy fill. Embankment slopes would be capped to mitigate liquid migration. This is currently the preferred method identified in construction cost estimate and in drawings in Appendix A.
B. Lining the Lagoon Primary Cell
This work would include pumping down the primary cell in the wastewater lagoon and removing settled sludge. Once clean, the primary cell will be lined with bentonite or a HDPE liner to prevent further effluent migration out of the cell. The total area to be lined would be approximately 400-feet long by 46-feet wide. If it becomes obvious that leakage is occurring at a specific, localized area within the cell, the extent of the lining could be limited to only that area.

C. Filling a Portion of the Primary Cell
This alternative includes pumping down and dredging the primary cell in the lagoon and then filling approximately 150-feet of the north end of the cell with 2,020 cubic yards of locally available sandy material. The intent would be for the fill to act as a plug in the area where the leakage appears to originate. This would reduce the available treatment volume in the primary cell and direct more flow to the secondary cell which currently does not appear to contain any liquid. A new transfer channel would need to be constructed to discharge wastewater from the primary cell to the secondary cell.

This alternative could be combined with Alternative B to include a liner. Reduction in the volume of the primary lagoon cell will require approval from the Alaska Department of Environmental Conservation.

D. Construction of a new Primary Cell within the Secondary Cell
As stated above, the secondary lagoon cell appears to be dry and is not pumped on a regular basis by the community. Therefore, wastewater is leaving the lagoon through percolation and/or evaporation from the primary lagoon cell. The secondary cell has approximately 12 times the volume of the primary cell and has available space within to construct a new primary cell west of the existing primary cell. Once the new cell is constructed, the old cell would be filled and abandoned. The existing force main outfall would need to be rerouted to the new discharge location.

Reduction in the volume of the secondary lagoon cell will require approval from the Alaska Department of Environmental Conservation.
3. Provide Alternate Wastewater Disposal Method

The following three alternatives were developed to analyze alternate wastewater disposal methods:

- Construct a new honey bucket lagoon east of the existing wastewater sewage lagoon.
- Construct a new honey bucket storage cell adjacent to the existing wastewater sewage lagoon.
- Construct new sewer services to unserved homes.

The options are ordered (A-C) from most to least area of impact. The alternatives are depicted in Appendix A and further described below.

A. Construct New Honey Bucket Lagoon

A new honey bucket lagoon could be constructed to provide an alternative location for disposal of hauled human waste. Akiak Native Community identified 10 people currently utilizing the existing lagoon.

Design of the honey bucket lagoon is based on the design criteria identified in the Alaska Department of Environmental Conservation’s (ADEC) Lagoon Construction Guidelines (see Table 1), including a maximum BOD loading in order to achieve treatment. A total population of 420 people was used based on 2019 information. 2019 reflects the highest recent population prior to a 6.6% decrease in population reported in 2020. The design population to be served by the proposed honey bucket lagoon was calculated by doubling the current unserved population based on community input. Demand for the honey bucket lagoon is anticipated to decrease over time as more relocated homes are connected to the expanded gravity sewer network. For the purposes of this report the population served by the honey bucket lagoon is estimated to remain constant.

The honey bucket lagoon must be designed to meet the hydraulic capacity for 20 years of use and the maximum daily biochemical oxygen demand (BOD) loading rate from the deposited waste. Climate data reflects a negligible effect of annual precipitation on hydraulic capacity. The resulting conceptual design layout from these parameters is a 105-foot-long x 105-foot-wide lagoon, with 3 feet of operable depth and 3 feet of freeboard (total 6-feet deep). Because BOD requirements are the controlling parameter, the lagoon has a large footprint but would be rarely filled.

The proposed honey bucket lagoon is larger than the existing honey bucket lagoon, constructed in 1991. The existing lagoon is a 74-foot-long x 74-foot wide septage lagoon hydraulically connected to a 54-foot x 54-foot percolation cell, both with 3 feet operable depth and 4 feet of freeboard (see Figure 7). The design of the existing facility did not consider BOD as is currently required and it sized the lagoon for pumping 43 private and community septic tanks once every two years. It had sufficient capacity for a year’s worth of treatment. Construction of the community wastewater sewage lagoon, gravity sewer mains, and force main has led to the use of the existing honey bucket lagoon for sewage self-haul. Specific design information is provided in Table 1 below.
A new honey bucket lagoon would preferably be located near the site east of the sewage lagoon, south of the area where effluent is leaking from the embankment (see Figure 1) and north of recently mapped wetlands (see Figure 4). Construction is proposed to be similar earthen embankments to the adjacent sewage lagoon as well as a bin wall dumping platform. The embankment would be constructed using locally available sandy material supported by geotextile wraps. An access road would be constructed between the proposed honey bucket lagoon and the adjacent sewage lagoon and connect to an access ramp for self-haul dumping. Repairing sewage lagoon embankment repairs prior to new construction will be important to ensure that leakage from the wastewater lagoon is not encountered during construction or operation of the proposed honey bucket lagoon.

Two geotechnical test pits were dug east of the existing sewage lagoon on August, 11, 2021. Pits found silty sands in the area and did not encounter groundwater within 10 feet of the ground surface. Based on these observations an un-lined lagoon is likely to percolate. Solids build-up at the bottom of the lagoon may decrease percolation rates over the years. Therefore, a shallow depth of liquid is anticipated and will likely require routine maintenance to distribute dumped waste away from the ramp where it may accumulate. Additionally, regular removal of plastic waste from trash bags routinely used in hauling waste will maximize the usable life of the proposed lagoon.

Drawings depicting the proposed location and dimensions of the new honey bucket lagoon can be found in Appendix A.
### Table 1: Honey Bucket Lagoon Design Criteria

<table>
<thead>
<tr>
<th><strong>POPULATION</strong></th>
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<tbody>
<tr>
<td>TOTAL POPULATION (2019)</td>
<td>420 PEOPLE</td>
<td>DCRA</td>
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<tr>
<td>EXISTING POPULATION NOT SERVED BY PROPOSED GRAVITY SEWER (2021)</td>
<td>10 PEOPLE</td>
<td>AKIAK NATIVE COMMUNITY</td>
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<tr>
<td>DESIGN POPULATION SERVED BY HONEY BUCKET SYSTEM (2021)</td>
<td>20 PEOPLE</td>
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<table>
<thead>
<tr>
<th><strong>CLIMATE DATA</strong></th>
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<tr>
<td>AVERAGE ANNUAL PRECIPITATION</td>
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<td>POTENTIAL EVAPOTRANSPIRATION AND CLIMATE IN ALASKA</td>
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<td>AVERAGE ANNUAL EVAPOTRANSPIRATION</td>
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<tr>
<td>HONEY BUCKET WASTE FLOW RATE</td>
<td>0.5 GALLONS/CAPITA-DAY</td>
<td>COLD REGIONS UTILITIES MONOGRAPH</td>
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<tr>
<td>DESIGN BOD₅ GENERATION RATE</td>
<td>0.17 LBS BOD₅/CAPITA-DAY</td>
<td>ADEC LAGOON CONSTRUCTION GUIDELINES</td>
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<table>
<thead>
<tr>
<th><strong>HONEY BUCKET LAGOON ORGANIC LOADING</strong></th>
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</thead>
<tbody>
<tr>
<td>MAX BOD₅ LOADING RATE</td>
<td>20 LB BOD₅/ACRE/DAY</td>
<td>ADEC LAGOON CONSTRUCTION GUIDELINES</td>
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</tr>
<tr>
<td>DESIGN BOD₅ GENERATION</td>
<td>3.4 LB BOD₅/DAY</td>
<td>POPULATION * BOD₅ GENERATION RATES</td>
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<tr>
<td>REQUIRED LAGOON AREA</td>
<td>0.17 ACRES</td>
<td>TOTAL BOD₅ GENERATION / MAX BOD₅ LOADING RATE</td>
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</table>

<table>
<thead>
<tr>
<th><strong>HONEY BUCKET LAGOON HYDRAULIC LOADING</strong></th>
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<th></th>
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<tbody>
<tr>
<td>ANNUAL WASTEWATER VOLUME</td>
<td>3,650 GALLONS</td>
<td>POPULATION * FLOW * DURATION</td>
<td></td>
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<tr>
<td>DESIGN LIFE WASTEWATER VOLUME (20 YEARS)</td>
<td>73,000 GALLONS</td>
<td>POPULATION * FLOW * DURATION</td>
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<thead>
<tr>
<th><strong>DESIGN HONEY BUCKET LAGOON</strong></th>
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</thead>
<tbody>
<tr>
<td>TOTAL DEPTH</td>
<td>6 FT</td>
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<td></td>
</tr>
<tr>
<td>FREEBOARD</td>
<td>3 FT</td>
<td>ADEC LAGOON CONSTRUCTION GUIDELINES</td>
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<tr>
<td>DIMENSIONS</td>
<td>105x105 FTxFT</td>
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</tr>
<tr>
<td>AREA</td>
<td>0.17 ACRES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOLUME</td>
<td>137,100 GALLONS</td>
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</table>
B. Construct New Honey Bucket Storage Cell

One alternative to a new honey bucket lagoon designed for BOD loading requirements to achieve treatment would be a new honey bucket storage cell directly adjacent to the existing sewage lagoon. Such a storage cell could be designed for regular or emergency use and liquid volume could be pumped into the primary cell after reaching a certain depth.

Design of the honey bucket storage cell is based on the design criteria identified in the Alaska Department of Environmental Conservation’s (ADEC) Lagoon Construction Guidelines (see Table 2), excluding a maximum BOD loading as the cell is not intended to achieve treatment objectives on its own. This approach was acceptable to ADEC when discussing the findings of the draft report. Similar to the honey bucket lagoon, the design population would equal double the current unserved population and would be expected to remain constant over the design life.

The honey bucket storage cell would only be designed to meet the hydraulic capacity for 20 years of use and not consider the maximum daily biochemical oxygen demand (BOD) loading rate from the deposited waste. Climate data reflects a negligible effect of annual precipitation on hydraulic capacity. The resulting conceptual design layout from these parameters is a 96-foot-long x 62-foot-wide lagoon, with 3 feet of operable depth and 3 feet of freeboard (total 6-feet deep). The honey bucket storage cell has approximately 54% the capacity of the new honey bucket lagoon. Specific design information is provided in Table 2 below.

A new honey bucket storage cell would preferably be located east of and adjacent to the sewage lagoon primary cell, south of the area where effluent is leaking from the embankment (see Figure 1) and north of recently mapped wetlands (see Figure 4). Construction is proposed to be similar earthen embankments to the adjacent sewage lagoon as well as a bin wall dumping platform. The embankment would be constructed using locally available sandy material supported by geotextile wraps. An access road would be constructed east of the proposed honey bucket storage cell and sewage lagoon embankment repairs and connect to two access ramps allowing pull-through circulation for self-haul dumping. Repairing sewage lagoon embankment repairs prior to new construction will be important to ensure that leakage from the wastewater lagoon is not encountered during construction or operation of the proposed honey bucket lagoon.

Geotechnical test pits found silty sands in the area and did not encounter groundwater within 10 feet of the ground surface. Based on these observations an un-lined lagoon is likely to percolate. Solids build-up at the bottom of the lagoon may decrease percolation rates over the years. Therefore, a shallow depth of liquid is anticipated and will likely require routine maintenance to distribute dumped waste away from the ramp where it may accumulate. Additionally, regular removal of plastic waste from trash bags routinely used in hauling waste will maximize the usable life of the proposed storage cell. The community currently has a portable pump trailer that is suitable for transfer of liquid to primary cell as needed.

Drawings depicting the proposed location and dimensions of the new honey bucket lagoon can be found in Appendix A.
### Table 2: Honey Bucket Storage Cell Design Criteria

#### POPULATION

<table>
<thead>
<tr>
<th>Description</th>
<th>Number</th>
<th>Unit</th>
<th>Source</th>
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<tbody>
<tr>
<td>Total Population (2019)</td>
<td>420</td>
<td>PEOPLE</td>
<td>DCRA</td>
</tr>
<tr>
<td>Existing Population Not Served by Proposed Gravity Sewer (2021)</td>
<td>10</td>
<td>PEOPLE</td>
<td>AKIAK NATIVE COMMUNITY</td>
</tr>
<tr>
<td>Design Population Served by Honey Bucket System (2021)</td>
<td>20</td>
<td>PEOPLE</td>
<td></td>
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#### CLIMATE DATA

<table>
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<th>Description</th>
<th>Value</th>
<th>Unit</th>
<th>Source</th>
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</thead>
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<tr>
<td>Average Annual Precipitation</td>
<td>17.55</td>
<td>INCHES</td>
<td>POTENTIAL EVAPOTRANSPIRATION AND CLIMATE IN ALASKA</td>
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<tr>
<td>Average Annual Evapotranspiration</td>
<td>14.94</td>
<td>INCHES</td>
<td></td>
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</table>

#### HONEY BUCKET WASTE GENERATION

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<tr>
<th>Description</th>
<th>Value</th>
<th>Unit</th>
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<tr>
<td>Honey Bucket Waste Flow Rate</td>
<td>0.5</td>
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<td>COLD REGIONS UTILITIES MONOGRAPH</td>
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<td>Design BOD$_5$ Generation Rate</td>
<td>0.17</td>
<td>LBS BOD$_5$/CAPITA-DAY</td>
<td>ADEC LAGOON CONSTRUCTION GUIDELINES</td>
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#### HONEY BUCKET LAGOON ORGANIC LOADING

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<th>Description</th>
<th>Value</th>
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<th>Source</th>
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<tbody>
<tr>
<td>Design BOD$_5$ Generation</td>
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<td>LB BOD$_5$/DAY</td>
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#### HONEY BUCKET LAGOON HYDRAULIC LOADING

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<th>Description</th>
<th>Value</th>
<th>Unit</th>
<th>Source</th>
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<tr>
<td>Annual Wastewater Volume</td>
<td>3,650</td>
<td>GALLONS</td>
<td>POPULATION * FLOW * DURATION</td>
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<tr>
<td>Design Life Wastewater Volume (20 Years)</td>
<td>73,000</td>
<td>GALLONS</td>
<td>POPULATION * FLOW * DURATION</td>
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</tbody>
</table>

#### DESIGN HONEY BUCKET LAGOON

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
<th>Unit</th>
<th>Source</th>
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<td>Total Depth</td>
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<td>FT</td>
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<td>Freeboard</td>
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<td>ADEC LAGOON CONSTRUCTION GUIDELINES</td>
</tr>
<tr>
<td>Dimensions</td>
<td>96x62</td>
<td>FTxFT</td>
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<tr>
<td>Area</td>
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<td>ACRES</td>
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<tr>
<td>Volume</td>
<td>73,600</td>
<td>GALLONS</td>
<td></td>
</tr>
</tbody>
</table>
C. Connect New Sewer Services to Unserved Homes

This alternative would consist of connecting sewer service to three existing homes and one planned home which are not currently served by the gravity sewer system. These existing and future homes are represented by red and orange stars respectively on Figure 6, and together comprise 10-15 residents. Connecting these homes would both constitute a health improvement for these users and replace the need for a new honey bucket lagoon or storage cell. Connecting gravity sewer services would need to be completed before the decommissioning of the existing honey bucket lagoon, but that could all take place independently of the sewage lagoon embankment repairs, which are still necessary.

The four homes requiring gravity sewer connection include three existing or recently moved homes, two of which require interior plumbing, and a new Bureau of Indian Affairs (BIA) Housing Improvement Program (HIP) home already fitted with interior plumbing. Three of the four homes are approximately 75 feet from the nearest gravity sewer main. The northernmost home is slightly farther from a recently constructed sewer main. Further analysis would be required to determine feasibility of a gravity service to this home and whether a settling tank and drainage field is a more appropriate alternative. Cost for connecting unserved homes is relatively low compared to the cost of constructing a new honey bucket lagoon and has additional public health and scheduling benefits. The existing sewer system is assumed to have adequate capacity for the additional wastewater contribution of the four homes.

4. Decommissioning the Existing Honey Bucket Lagoon

The existing lagoon is a 74-foot-long x 74-foot-wide septage lagoon hydraulically connected to a 54-foot x 54-foot percolation cell, both with 3 feet operable depth and 4 feet of freeboard (see Figure 7). As can be expected, the lagoon is associated with unpleasant odors, wastewater spills from sewage disposal, and accumulation of plastic bags and other deleterious materials. The community plans to construct
new subdivisions in the area west of the lagoon and must decommission it to create a livable and sanitary environment for relocated residents.

Per DEC, “sewage lagoon closures in which the sludge is left in place must meet the requirements for closing a sewage solids monofill under the solid waste regulations in 18 AAC 60.470.” A sewage lagoon closure plan must be submitted for approval to DEC Solid Waste Program 60 days prior to any work. Closure plans requirements are as follows:

1. A general description of the facility, including the site topography, geology, climate, and surface and groundwater hydrology.
2. A description of the anticipated post-closure use of the property.
3. A description of how public access to the lagoon will be restricted for at least three years.
4. A map of the area within 500 feet showing major topographical, geological, hydrological and biological or man-made features, including drinking water wells or intakes.
5. A site plan and cross-sectional drawing of the lagoon.
6. A description of the final cover, including installation of at least two feet of soil cover, grading for adequate drainage, and revegetation.
7. For a lined lagoon, a discussion of how the lagoon will be capped, or the liner removed and disposed, so that water does not continue to accumulate within the closed lagoon.
8. A description of how the closure demonstration requirements of 18 AAC 60.490 will be met.
9. A copy of the deed or another legal document that identifies the landowner.
10. If the operator of the lagoon is not the landowner, a signed written statement or copy of a lease agreement showing that the landowner consents to the permanent presence of the sewage solids monofill on the property and any associated conditions required by the department.
11. A post-closure monitoring plan that meets the requirements of 18 AAC 60.490 and 60.800-860. The normal post-closure monitoring period is five years. The plan will include:
   - Annual visual monitoring
   - Methane monitoring in buildings closer than 500 feet to the lagoon, if the lagoon contains more than 2,500 cubic yards of waste.
   - Surface water or groundwater monitoring if this was required during the active life of the lagoon.
12. A closure plan review fee per 18 AAC 60.700(a) Table E-3.

To decommission the lagoon, lye must first be applied over the waste and the site must be cleared. Structural components that would obstruct fill operations will be removed, and the existing berms will be graded to cover waste and fill in cells, creating a level surface. Due to the well-draining soil underlying the lagoon, residual liquid in the cells is minimal and is unlikely to prevent compaction of berms over waste. Subsequent layers of locally sourced fill will then be mounded and graded to promote drainage away from the lagoon. The site will be finished with a layer of organics and seeded to promote revegetation. The existing site fencing may inhibit closure construction activities and may be removed, but new fencing will be required by DEC to control access for the first three years. Drawings depicting a concept design for decommissioning the lagoon can be found in Appendix A.
Figure 7: Existing Honey Bucket Lagoon
5. Construction Costs

Rough Order of Magnitude (ROM) estimated construction costs were developed for each of the recommended improvements and are presented in Table 3 below. A breakdown of the estimates can be found in Appendix B.

Table 3: ROM Construction Costs

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Alt A: Honey Bucket Lagoon</th>
<th>Alt B: Honey Bucket Storage Cell</th>
<th>Alt C: Sewer Services</th>
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<tr>
<td>Sewage Lagoon Embankment Repairs Filling the Leakage Area</td>
<td>$103,000</td>
<td>$103,000</td>
<td>$103,000</td>
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<td>New Honey Bucket Lagoon Wastewater Disposal Alternative A</td>
<td>$348,000</td>
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<tr>
<td>New Honey Bucket Storage Cell Wastewater Disposal Alternative B</td>
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<td>$389,000</td>
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<tr>
<td>New Sewer Services to Unserved Homes Wastewater Disposal Alternative C</td>
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<td></td>
<td>$260,000</td>
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<tr>
<td>Decommission Existing Honey Bucket Lagoon</td>
<td>$171,000</td>
<td>$171,000</td>
<td>$171,000</td>
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Conceptual Level Estimated Construction Cost: $622,000 | $663,000 | $534,000
Construction Contingency (30%): $187,000 | $199,000 | $161,000
Total Budgetary Estimated Construction Cost: $809,000 | $862,000 | $695,000

Design (10%): $81,000 | $86,000 | $70,000
Permitting (3%): $25,000 | $26,000 | $21,000
ANC Construction Administration (8%): $65,000 | $69,000 | $56,000

Total Project Cost: $980,000 | $1,043,000 | $842,000

The table presents individual wastewater disposal methods Alternatives A-C from Section 2 along with necessary embankment repairs and decommissioning of existing honey bucket lagoon. The total project cost provides a comparison of these three different options, with Alternative C being the least expensive option. While the costs of both honey bucket alternatives are fairly similar the honey bucket storage cell is approximately $40k more expensive due to the larger quantity of bin wall facing associated with the pull-through bin wall dumping platform.

6. Recommendations

Connecting new sewer services to unserved homes is the preferred wastewater disposal method, considering the improvement of public health for users. Additionally, with only four homes currently unserved by gravity sewer, it is the least expensive wastewater disposal alternative. As such the preferred alternative is to repair sewage lagoon embankment by filling in leakage area and dispose of wastewater by connecting sewer services to unserved homes, allowing the decommissioning of the existing honey bucket lagoon to prepare for community expansion.

End Memorandum
Sanitation Improvements
Design Analysis & Recommendations

Appendix A:
Concept Drawings
SEWAGE LAGOON EMBANKMENT REPAIRS

PLAN VIEW - SEWAGE LAGOON EMBANKMENT REPAIRS

SECTION VIEW - SEWAGE LAGOON EMBANKMENT REPAIRS

Transfer Channel

Remove and reset fence over new repairs

Appropriate location of effluent leakage

New honey bucket storage cell

Alternative with associated fence and access road

New honey bucket lagoon alternative

(Not shown)

10.0' 10.0' 10.0'

46.9'

MIN. Silty Sand

MIN. Silty Rock

Sheet 01

1 of 5

AKIAK NATIVE COMMUNITY, AK
TASK 1: SANITATION IMPROVEMENTS
CONCEPT REPORT

C-101

Colin M. Singleton
CE-124820

1" = 2'

1" = 20'

C-103

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NEW HONEY BUCKET LAGOON - ALT A
AKIAK NATIVE COMMUNITY, AK

TASK 1 SANITATION IMPROVEMENTS CONCEPT REPORT

Colin M. Singleton
CE-124820

HORZ. SCALE
VERT. SCALE
SECTION VIEW - NEW HONEY BUCKET LAGOON
1” = 4'
1” = 40'

PLAN VIEW - NEW HONEY BUCKET LAGOON
SECTION VIEW - EXISTING SEWAGE LAGOON

PLAN VIEW - EXISTING SEWAGE LAGOON
HORZ. SCALE
VERT. SCALE
1” = 4'
1” = 40'

SECTION VIEW - EXISTING SEWAGE LAGOON

MAXIMUM OPERATING LEVEL = 36.0'

SEWAGE LAGOON FACULTATIVE CELL

TRANSFER CHANNEL
BURIED FORCE MAIN PIPELINE

30' RAMPS
40' DUMPING PLATFORM
ACCESS ROAD

SEWAGE LAGOON FACULTATIVE CELL

SEWAGE LAGOON FACULTATIVE CELL

20' RAMPS
50' DUMPING PLATFORM
ACCESS ROAD

30' RAMPS
100' DUMPING PLATFORM
ACCESS ROAD

SEWAGE LAGOON FACULTATIVE CELL

SEWAGE LAGOON FACULTATIVE CELL

10' RAMPS
50' DUMPING PLATFORM
ACCESS ROAD

SEWAGE LAGOON FACULTATIVE CELL

SEWAGE LAGOON FACULTATIVE CELL

20' RAMPS
50' DUMPING PLATFORM
ACCESS ROAD

SEWAGE LAGOON FACULTATIVE CELL

SEWAGE LAGOON FACULTATIVE CELL

30' RAMPS
40' DUMPING PLATFORM
ACCESS ROAD

SEWAGE LAGOON FACULTATIVE CELL

SEWAGE LAGOON FACULTATIVE CELL

20' RAMPS
50' DUMPING PLATFORM
ACCESS ROAD

SEWAGE LAGOON FACULTATIVE CELL

SEWAGE LAGOON FACULTATIVE CELL

30' RAMPS
40' DUMPING PLATFORM
ACCESS ROAD

SEWAGE LAGOON FACULTATIVE CELL

SEWAGE LAGOON FACULTATIVE CELL

20' RAMPS
50' DUMPING PLATFORM
ACCESS ROAD

SEWAGE LAGOON FACULTATIVE CELL

SEWAGE LAGOON FACULTATIVE CELL

30' RAMPS
40' DUMPING PLATFORM
ACCESS ROAD

SEWAGE LAGOON FACULTATIVE CELL

SEWAGE LAGOON FACULTATIVE CELL

20' RAMPS
50' DUMPING PLATFORM
ACCESS ROAD

SEWAGE LAGOON FACULTATIVE CELL

SEWAGE LAGOON FACULTATIVE CELL

30' RAMPS
40' DUMPING PLATFORM
ACCESS ROAD

SEWAGE LAGOON FACULTATIVE CELL

SEWAGE LAGOON FACULTATIVE CELL

20' RAMPS
50' DUMPING PLATFORM
ACCESS ROAD

SEWAGE LAGOON FACULTATIVE CELL
NEW HONEY BUCKET STORAGE CELL - ALT B

AKIAK NATIVE COMMUNITY, AK

TASK 1 SANITATION IMPROVEMENTS CONCEPT REPORT

Colin M. Singleton
CE-124820

PLAN VIEW - NEW HONEY BUCKET STORAGE CELL
GENERAL NOTES:

ALL WATER AND SEWER UTILITIES AND PROPERTY LINES ARE APPROXIMATE.

ADDITIONAL ANALYSIS IS REQUIRED TO CONFIRM FEASIBILITY OF GRAVITY SERVICE FOR HOUSE #4. EXCAVATING AND Laying OF PVC PIPING IS AN ALTERNATIVE TO GRAVITY SEWER SERVICE.

SCOPE OF WORK:

- Construct sewer services for four unserved homes consisting of buried gravity pipe.
- Two existing homes (H’s 1 & 3) require interior plumbing including one kitchen sink, one bath sink, one hot water heater and one toilet.
- A fourth home (H’s 2) is proposed and will already have interior plumbing intact.

NEW SEWER SERVICES TO UNSERVED HOMES

SCALE 1" = 100'

PLAN VIEW - NEW SEWER SERVICES TO UNSERVED HOMES

GEOID coordinate system: NAD 83 HARN

Datum: North American 1983

Projection: Albers Equal Area Conic

Standard parallel 1: 58.619° N

Standard parallel 2: 64.519° N

Central meridian: 142.5° W

False easting: 4000000

False northing: 2000000

Unit of measurement: feet

CAD Coordinate Format: AutoCAD 2009 DGN

Drawing unit: Feet

Scale: 1" = 100'

Lineweight: 10, 20, 30

Legend:

1 - Existing site
2 - New site
3 - Proposed new site

NEW SEWER SERVICES TO UNSERVED HOMES

ALT C

CE-124820
SCOPE OF WORK:
- Distribute line over existing waste
- Remove and salvage existing fencing
- Clear site of existing trees
- Remove portions of tank walls, lagoon ramp, and lagoon ramp thunders within 5 feet of finished grade and dispose in landfill
- Grade area next to using materials to cover waste with 12" to 20" of sand and fill in both cells
- Cap closed surface with 2" to 3" of local silty sand
- Place material in minimum lifts of 12" and track
- Finish surface with 6 inches of organic material over the silty surface, tracking a minimum of 2 passes with tracked equipment
- Finish the site

1. PLAN VIEW - EXISTING HONEY BUCKET LAGOON

2. SECTION VIEW - EXISTING HONEY BUCKET LAGOON

3. SECTION VIEW - DECOMMISSIONED HONEY BUCKET LAGOON
Sanitation Improvements
Design Analysis & Recommendations

Appendix B:
Conceptual Construction Estimate
# Akiak Native Community
## Sanitation Improvements Design Analysis and Recommendations
### Conceptual Construction Estimate

#### Sewage Lagoon Embankment Repairs - Filling the Leakage Area

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove &amp; Salvage Chain Link Fencing</td>
<td>150</td>
<td>LF</td>
<td>$14.00</td>
<td>$2,100</td>
</tr>
<tr>
<td>Sewer Rock</td>
<td>222</td>
<td>CY</td>
<td>$331.00</td>
<td>$73,482</td>
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<tr>
<td>Local Borrow</td>
<td>850</td>
<td>CY</td>
<td>$10.00</td>
<td>$8,500</td>
</tr>
<tr>
<td>Separation Geotextile</td>
<td>800</td>
<td>SY</td>
<td>$4.00</td>
<td>$3,200</td>
</tr>
<tr>
<td>Chain Link Fencing</td>
<td>150</td>
<td>LF</td>
<td>$100.00</td>
<td>$15,000</td>
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</table>

Subtotal: $103,000

#### New Honey Bucket Lagoon - Wastewater Disposal Alternative A

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearing and Grubbing</td>
<td>1.2</td>
<td>ACRE</td>
<td>$15,000.00</td>
<td>$18,000</td>
</tr>
<tr>
<td>Unusable Excavation</td>
<td>940</td>
<td>CY</td>
<td>$10.00</td>
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<td>Local Borrow</td>
<td>3,770</td>
<td>CY</td>
<td>$10.00</td>
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<tr>
<td>Stabilization Geotextile</td>
<td>4,205</td>
<td>SY</td>
<td>$4.00</td>
<td>$16,820</td>
</tr>
<tr>
<td>Bin Wall Facing</td>
<td>456</td>
<td>SF</td>
<td>$400.00</td>
<td>$182,400</td>
</tr>
<tr>
<td>Chain Link Fencing</td>
<td>820</td>
<td>LF</td>
<td>$100.00</td>
<td>$82,000</td>
</tr>
<tr>
<td>Standard Signs</td>
<td>4</td>
<td>EA</td>
<td>$200.00</td>
<td>$800</td>
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</table>

Subtotal: $348,000

#### New Honey Bucket Storage Cell - Wastewater Disposal Alternative B

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearing and Grubbing</td>
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<td>ACRE</td>
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<td>Unusable Excavation</td>
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<td>Local Borrow</td>
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<td>SF</td>
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<td>Chain Link Fencing</td>
<td>824</td>
<td>LF</td>
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<td>3</td>
<td>EA</td>
<td>$200.00</td>
<td>$600</td>
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Subtotal: $389,000

#### New Sewer Services to Unserved Homes - Wastewater Disposal Alternative C

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Quantity</th>
<th>Unit</th>
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<tbody>
<tr>
<td>Sewer Services</td>
<td>4</td>
<td>EA</td>
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<td>Interior Plumbing</td>
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<td>EA</td>
<td>$40,000.00</td>
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Subtotal: $260,000

#### Decommission Existing Honey Bucket Lagoon

<table>
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<tr>
<th>Item Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
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</thead>
<tbody>
<tr>
<td>Clearing</td>
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<td>SY</td>
<td>$12,000.00</td>
<td>$8,400</td>
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<td>Lye Treatment</td>
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<td>SY</td>
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<td>$6,039</td>
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<td>$8,792</td>
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<td>Remove Structures &amp; Obstructions</td>
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<td>LS</td>
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<td>$12,000</td>
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<td>Backfill Lagoon Berms</td>
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<td>LS</td>
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<td>$12,000</td>
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<tr>
<td>Local Borrow</td>
<td>3,222</td>
<td>CY</td>
<td>$10.00</td>
<td>$32,220</td>
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<tr>
<td>Local Organics</td>
<td>537</td>
<td>CY</td>
<td>$8.00</td>
<td>$4,296</td>
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<td>Seed</td>
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<td>$18,000.00</td>
<td>$12,600</td>
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<tr>
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<td>LF</td>
<td>$100.00</td>
<td>$73,000</td>
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<tr>
<td>Standard Signs</td>
<td>4</td>
<td>EA</td>
<td>$200.00</td>
<td>$800</td>
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Subtotal: $171,000
## Akiak Native Community
### Sanitation Improvements Design Analysis and Recommendations

### Conceptual Construction Estimate

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Alternatives</th>
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<tbody>
<tr>
<td></td>
<td>Alt A: Honey Bucket Lagoon</td>
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<tr>
<td>Sewage Lagoon Embankment Repairs</td>
<td>$ 103,000</td>
</tr>
<tr>
<td>Filling the Leakage Area</td>
<td>$ 348,000</td>
</tr>
<tr>
<td>New Honey Bucket Lagoon</td>
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</tr>
<tr>
<td>Wastewater Disposal Alternative A</td>
<td>$ 103,000</td>
</tr>
<tr>
<td>New Honey Bucket Storage Cell</td>
<td></td>
</tr>
<tr>
<td>Wastewater Disposal Alternative B</td>
<td>$ 103,000</td>
</tr>
<tr>
<td>New Sewer Services to Unserved Homes</td>
<td>$ 260,000</td>
</tr>
<tr>
<td>Wastewater Disposal Alternative C</td>
<td></td>
</tr>
<tr>
<td>Decommission Existing Honey Bucket Lagoon</td>
<td>$ 171,000</td>
</tr>
</tbody>
</table>

### Conceptual Level Estimated Construction Cost

- **Conceptual Level Estimated Construction Cost**: $ 622,000 | $ 663,000 | $ 534,000
- **Construction Contingency (30%)**: $ 187,000 | $ 199,000 | $ 161,000
- **Total Budgetary Estimated Construction Cost**: $ 809,000 | $ 862,000 | $ 695,000

### Design (10%): $ 81,000 | $ 86,000 | $ 70,000
### Permitting (3%): $ 25,000 | $ 26,000 | $ 21,000
### ANC Construction Administration (8%): $ 65,000 | $ 69,000 | $ 56,000

### Total Project Cost: $ 980,000 | $ 1,043,000 | $ 842,000