Akiak Sanitation Improvements Design

Date:	January 26, 2022
To:	Akiak Native Community
Thru:	Joel Neimeyer, PE - Akiak Tribal Consultant
From:	Colin Singleton, PE – CRW Engineering Group, LLC
Project:	Task 1 Sanitation Improvements
Subject:	Sanitation Improvements Design Analysis & Recommendations

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.

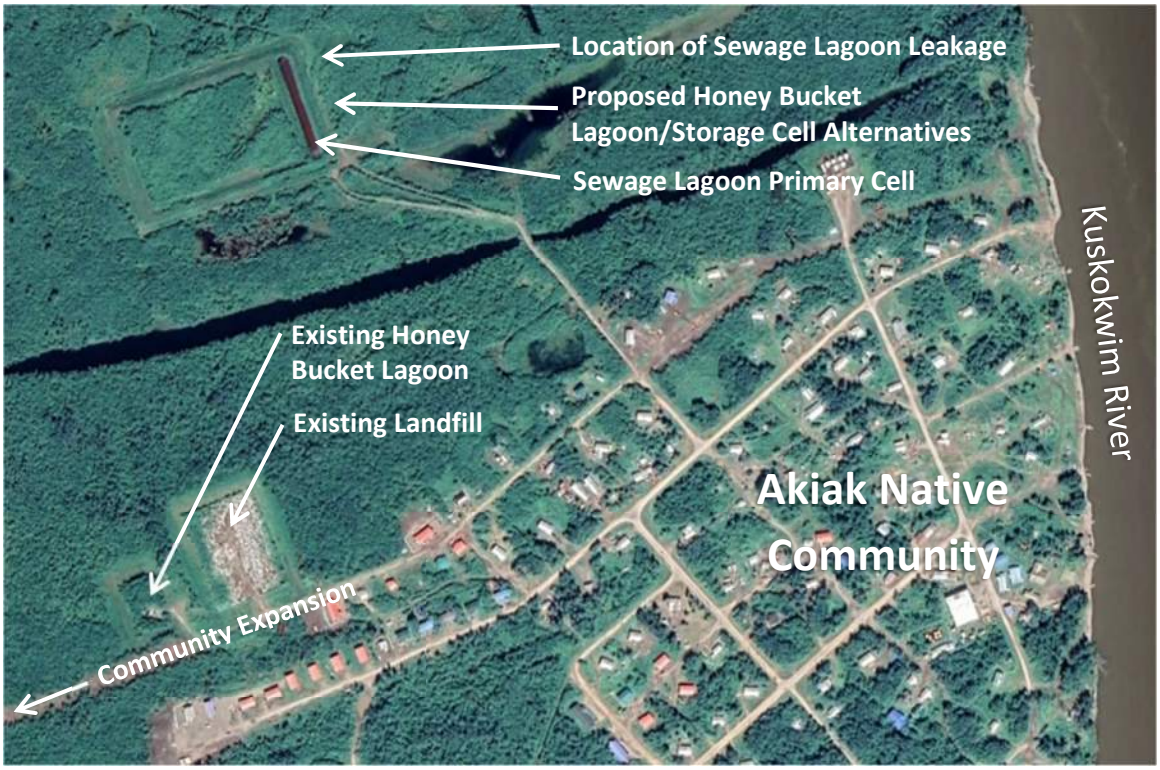
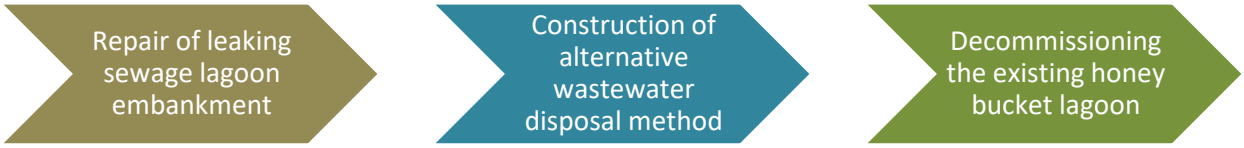


Figure 1: Location Map, Google Earth

One additional heath 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.

Figure 2: Location of Sewage Lagoon Leakage May 2021
Photo by Doug Huntman

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.

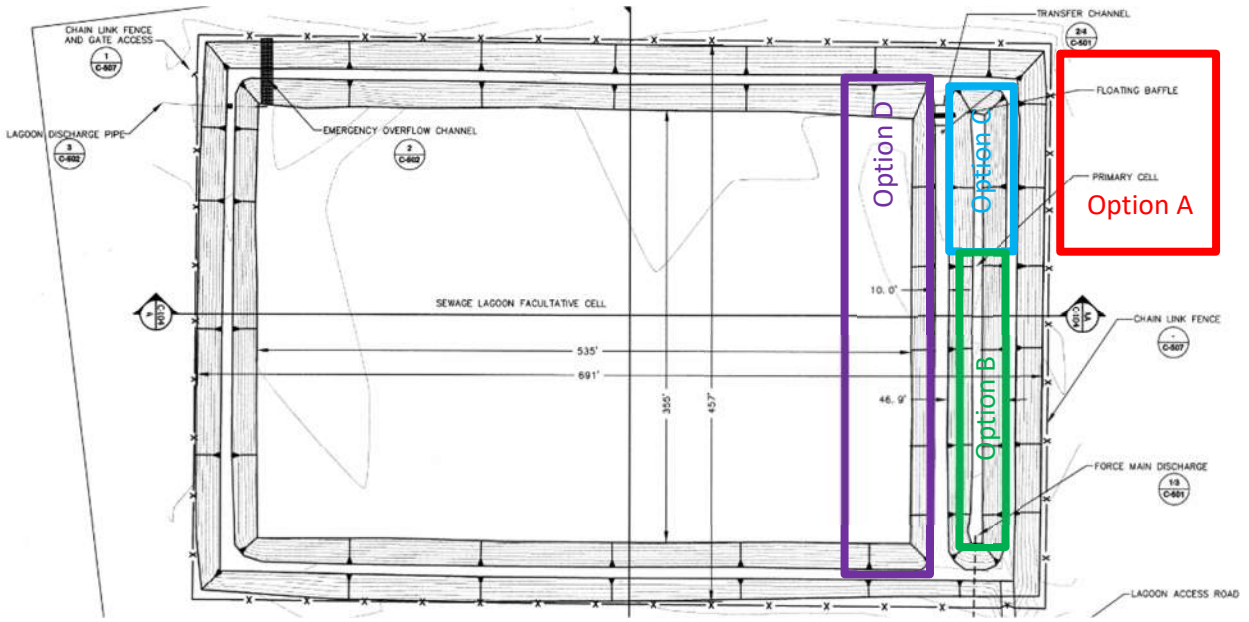


Figure 3: Sewage Lagoon Repair Site Map

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.

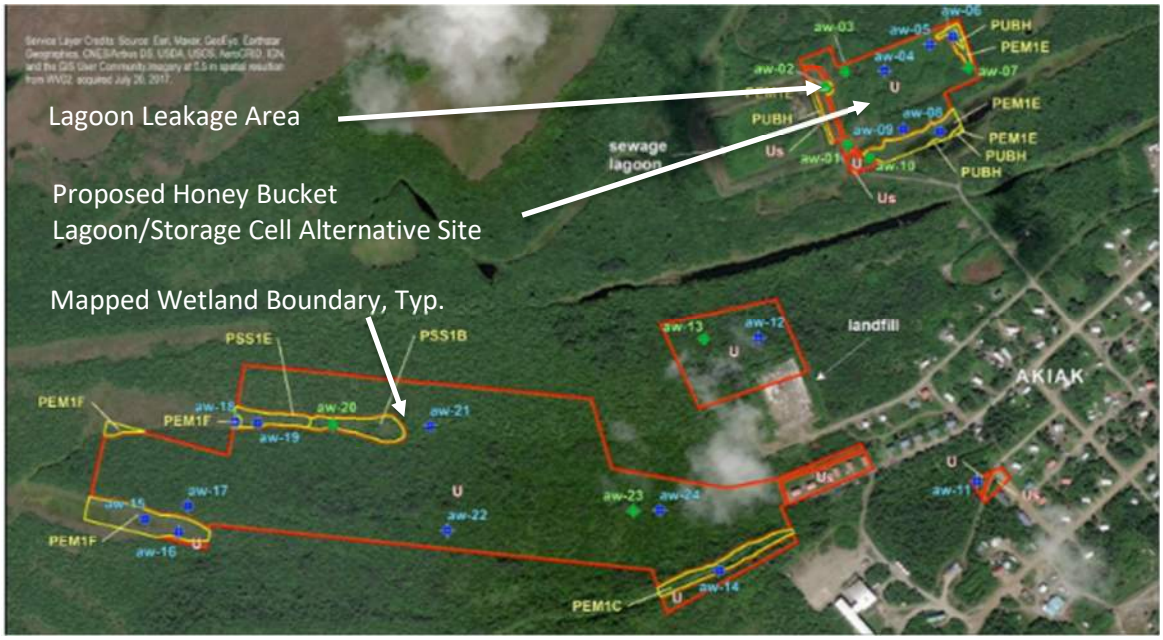


Figure 4: 2021 Wetlands Mapping (ABR, Inc)

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.

Figure 5: Proposed Location of New Honey Bucket Lagoon August 2021

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

POPULATION			
TOTAL POPULATION (2019)	420	PEOPLE	DCRA
EXISTING POPULATION NOT SERVED BY PROPOSED GRAVITY SEWER (2021)	10	PEOPLE	AKIAK NATIVE COMMUNITY
DESIGN POPULATION SERVED BY HONEY BUCKET SYSTEM (2021)	20	PEOPLE	
CLIMATE DATA			
AVERAGE ANNUAL PRECIPITATION	17.55	INCHES	POTENTIAL EVAPOTRANSPIRATION AND CLIMATE IN ALASKA
AVERAGE ANNUAL EVAPOTRANSPIRATION	14.94	INCHES	
HONEY BUCKET WASTE GENERATION			
HONEY BUCKET WASTE FLOW RATE	0.5	GALLONS/CAPITA-DAY	COLD REGIONS UTILITIES MONOGRAPH
DESIGN BOD_5 GENERATION RATE	0.17	LBS BOD_5/CAPITA-DAY	ADEC LAGOON CONSTRUCTION GUIDELINES
HONEY BUCKET LAGOON ORGANIC LOADING			
MAX BOD_5 LOADING RATE	20	LB BOD_5/ACRE/DAY	ADEC LAGOON CONSTRUCTION GUIDELINES
DESIGN BOD_5 GENERATION	3.4	LB BOD_5/DAY	POPULATION * BOD_5 GENERATION RATES
REQUIRED LAGOON AREA	0.17	ACRES	TOTAL BOD_5 GENERATION / MAX BOD_5 LOADING RATE
HONEY BUCKET LAGOON HYDRAULIC LOADING			
ANNUAL WASTEWATER VOLUME	3,650	GALLONS	POPULATION * FLOW * DURATION
DESIGN LIFE WASTEWATER VOLUME (20 YEARS)	73,000	GALLONS	POPULATION * FLOW * DURATION
DESIGN HONEY BUCKET LAGOON			
TOTAL DEPTH	6	FT	
FREEBOARD	3	FT	ADEC LAGOON CONSTRUCTION GUIDELINES
DIMENSIONS	105x105	FTxFT	
AREA	0.17	ACRES	
VOLUME	137,100	GALLONS	

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			
TOTAL POPULATION (2019)	420	PEOPLE	DCRA
EXISTING POPULATION NOT SERVED BY PROPOSED GRAVITY SEWER (2021)	10	PEOPLE	AKIAK NATIVE COMMUNITY
DESIGN POPULATION SERVED BY HONEY BUCKET SYSTEM (2021)	20	PEOPLE	
CLIMATE DATA			
AVERAGE ANNUAL PRECIPITATION	17.55	INCHES	POTENTIAL EVAPOTRANSPIRATION AND CLIMATE IN ALASKA
AVERAGE ANNUAL EVAPOTRANSPIRATION	14.94	INCHES	
HONEY BUCKET WASTE GENERATION			
HONEY BUCKET WASTE FLOW RATE	0.5	GALLONS/CAPITA-DAY	COLD REGIONS UTILITIES MONOGRAPH
DESIGN BOD_5 GENERATION RATE	0.17	LBS BOD_5/CAPITA-DAY	ADEC LAGOON CONSTRUCTION GUIDELINES
HONEY BUCKET LAGOON ORGANIC LOADING			
DESIGN BOD_5 GENERATION	3.4	LB BOD_5/DAY	POPULATION * BOD_5 GENERATION RATES
HONEY BUCKET LAGOON HYDRAULIC LOADING			
ANNUAL WASTEWATER VOLUME	3,650	GALLONS	POPULATION * FLOW * DURATION
DESIGN LIFE WASTEWATER VOLUME (20 YEARS)	73,000	GALLONS	POPULATION * FLOW * DURATION
DESIGN HONEY BUCKET LAGOON			
TOTAL DEPTH	6	FT	
FREEBOARD	3	FT	ADEC LAGOON CONSTRUCTION GUIDELINES
DIMENSIONS	96x62	FTxFT	
AREA	0.11	ACRES	
VOLUME	73,600	GALLONS	

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 10-15residents. 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.

Figure 6: Location Map, Google Earth

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.

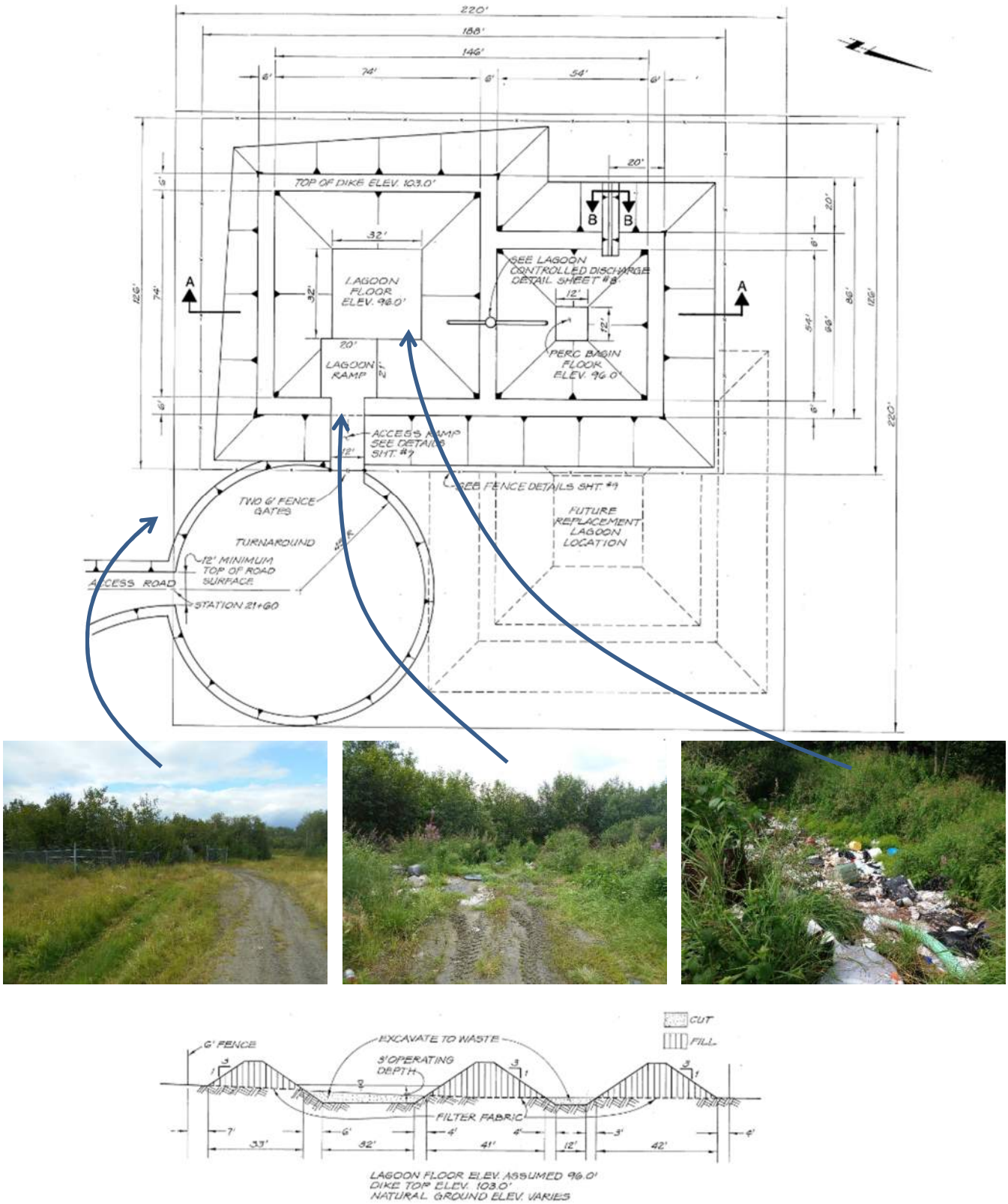


Figure 7: Existing Honey Bucket Lagoon

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

Item Description	Alternatives		
	Alt A: Honey Bucket Lagoon	Alt B: Honey Bucket Storage Cell	Alt C: Sewer Services
Sewage Lagoon Embankment Repairs Filling the Leakage Area	$ 103,000	$ 103,000	$ 103,000
New Honey Bucket Lagoon Wastewater Disposal Alternative A	$ 348,000		
New Honey Bucket Storage Cell Wastewater Disposal Alternative B		$ 389,000	
New Sewer Services to Unserved Homes Wastewater Disposal Alternative C			$ 260,000
Decommission Existing Honey Bucket Lagoon	$ 171,000	$ 171,000	$ 171,000
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

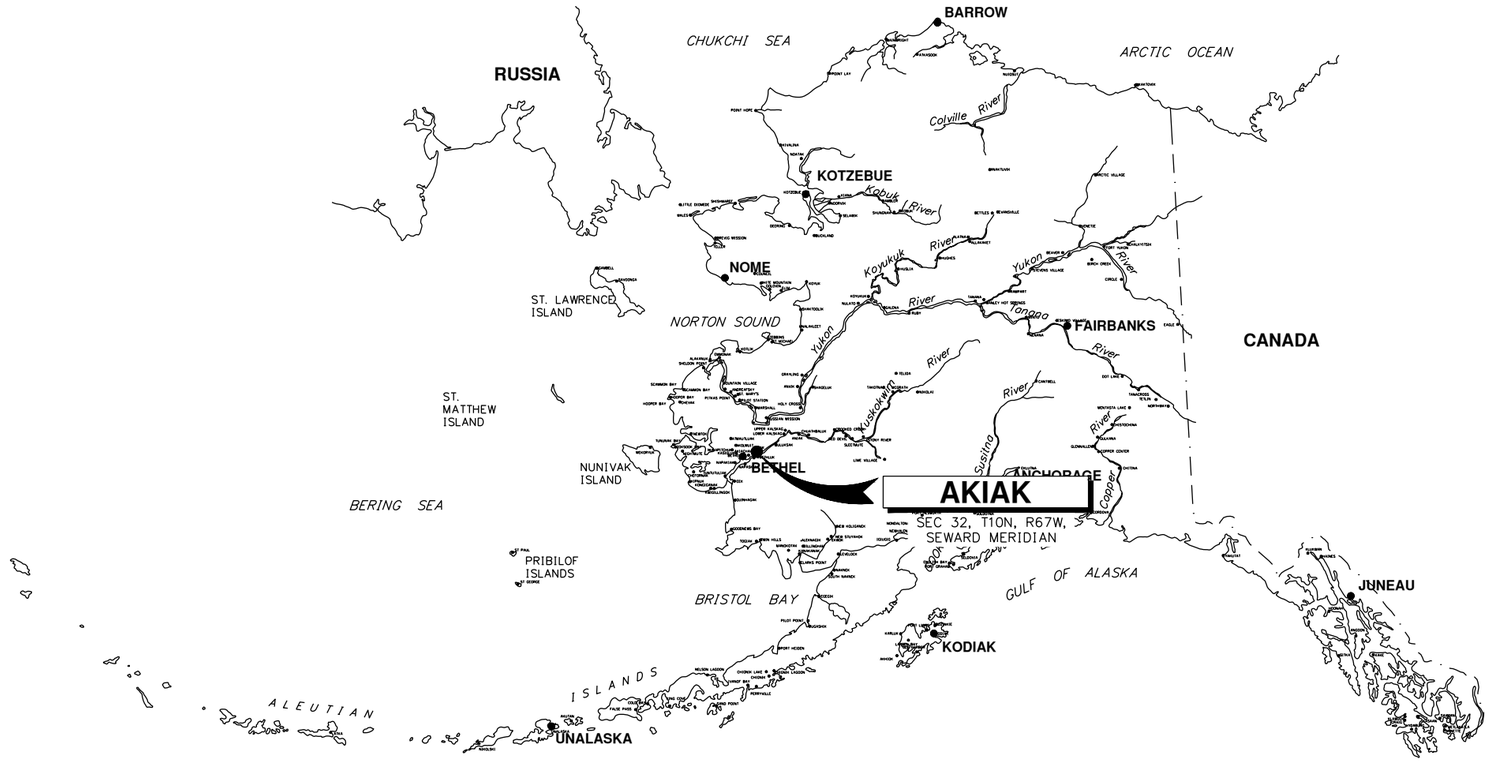
Connecting new sewer services to unserved homes is the preferred wastewater disposal method, considering the improvement of public health for users. Additionally, with only four homes currently unserved by gravity sewer, it is the least expensive wastewater disposal alternative. As such the preferred 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

AKIAK NATIVE COMMUNITY, ALASKA
TASK 1 SANITATION IMPROVEMENTS
CONCEPT REPORT



DRAWING INDEX	
SHEET ID	**SHEET TITLE**
G–001	COVER SHEET
G–101	VICINITY MAP
C–101	SEWAGE LAGOON EMBANKMENT REPAIRS
C–102	NEW HONEY BUCKET LAGOON – ALT A
C–103	NEW HONEY BUCKET STORAGE CELL – ALT B
C–104	NEW SEWER SERVICES TO UNSERVED HOMES – ALT C
C–105	LAGOON DECOMMISSIONING

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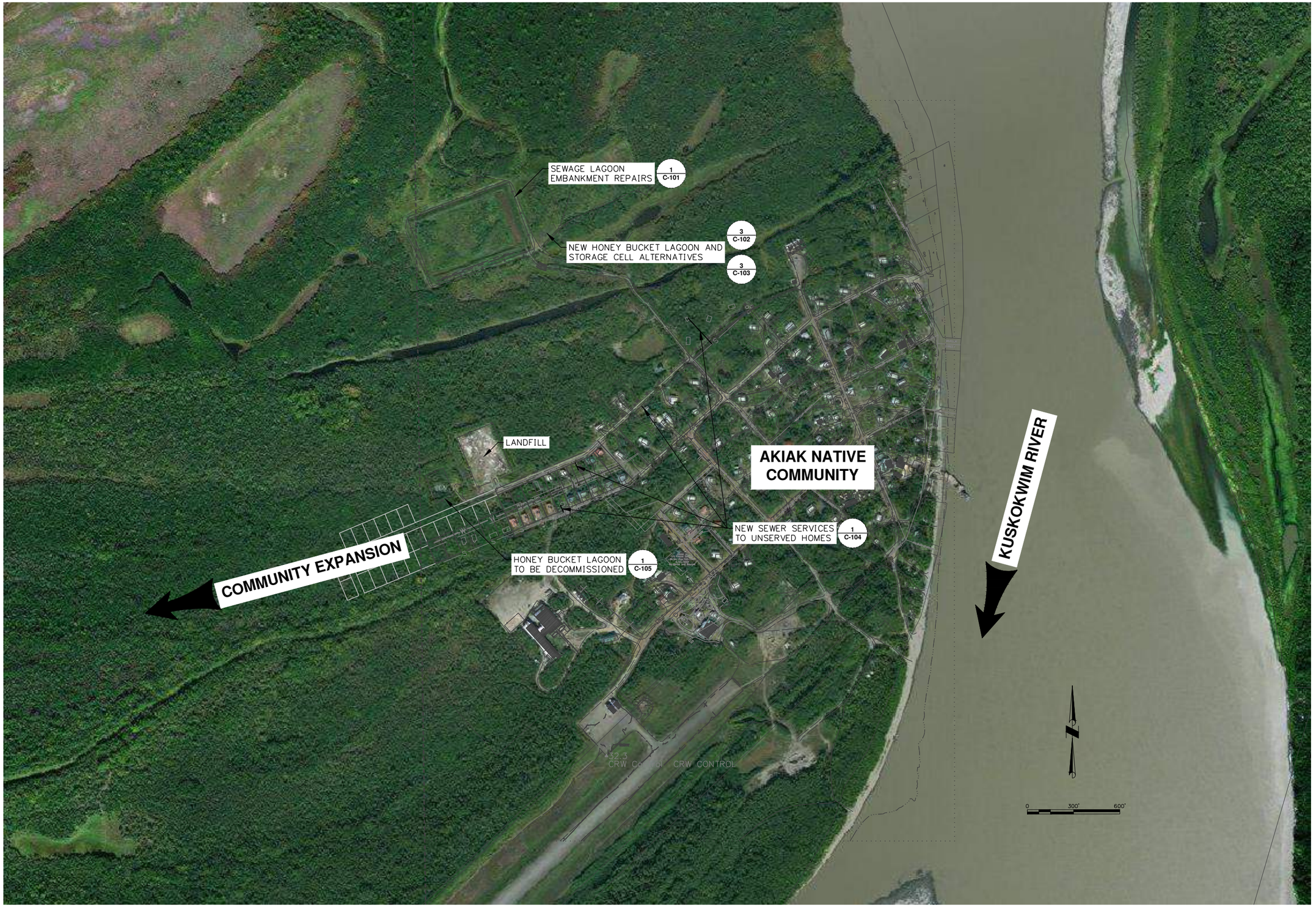
#AECL882-AK



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STATE OF ALASKA
49 TH
Colin M. Singleton
CE-124820
REGISTERED PROFESSIONAL ENGINEER

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AKIAK NATIVE COMMUNITY, AK
TASK 1 SANITATION IMPROVEMENTS
CONCEPT REPORT

MRK	DATE	DESCRIPTION	INIT

PLAN SET:	----
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DRUMS ENG:	----
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SHEET TITLE

VICINITY MAP

G-101
SHEET **2** OF **2**

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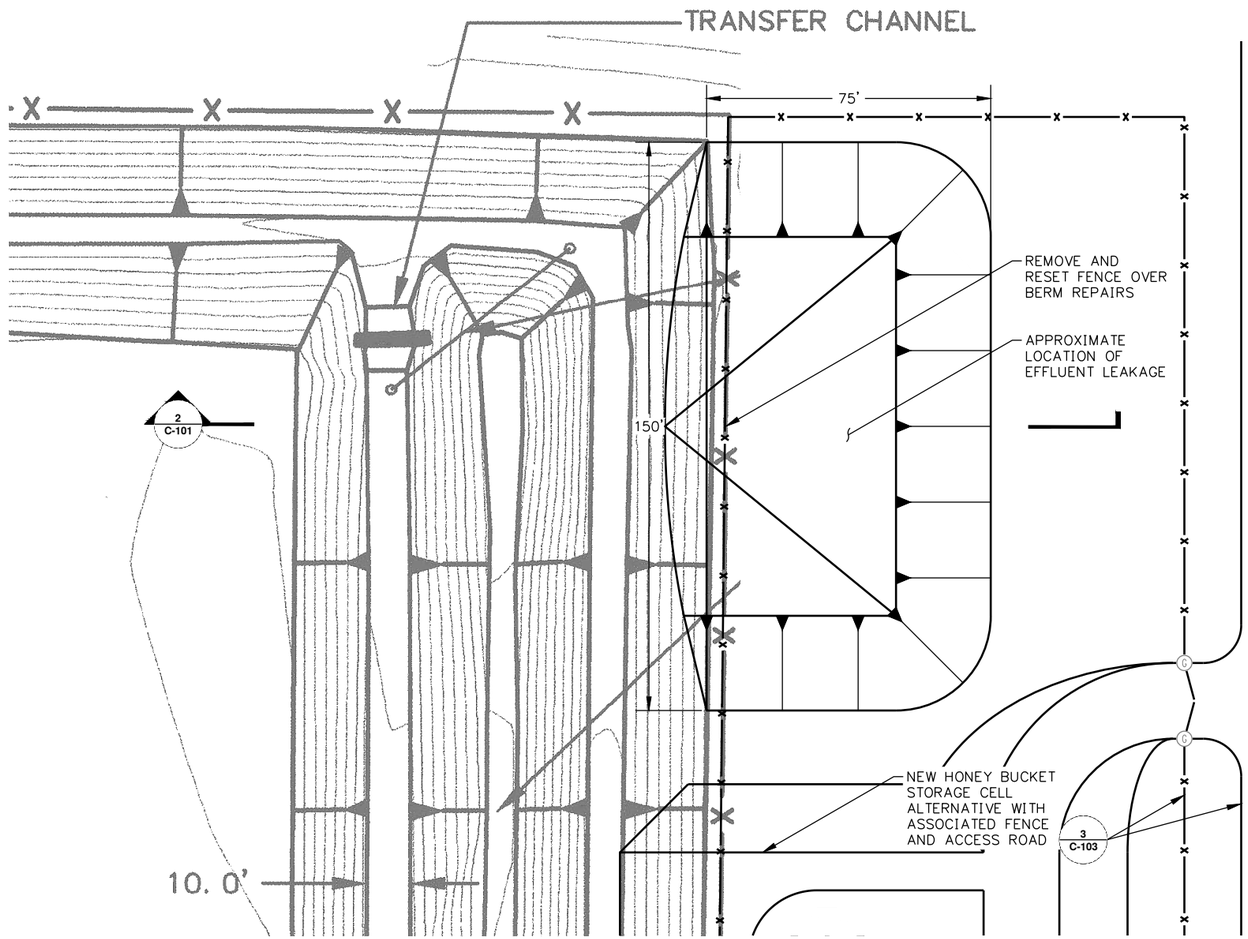
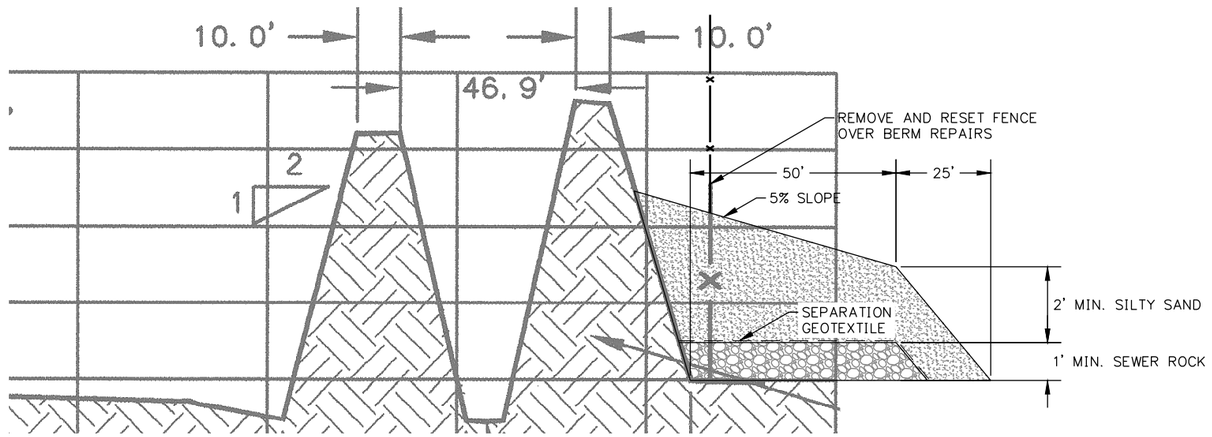


1 PLAN VIEW - SEWAGE LAGOON EMBANKMENT REPAIRS

SCALE 1" = 20'



2 SECTION VIEW - SEWAGE LAGOON EMBANKMENT REPAIRS

HORZ. SCALE 1" = 20'
VERT. SCALE 1" = 2'

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

AKIAK NATIVE COMMUNITY, AK
TASK 1 SANITATION IMPROVEMENTS
CONCEPT REPORT

MRK	DATE	DESCRIPTION	INIT

PLAN SET:	----
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PROJ ENG:	CMS
DRUMS ENG:	----
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SHEET TITLE

SEWAGE LAGOON EMBANKMENT REPAIRS

C-101

SHEET **1** OF **5**

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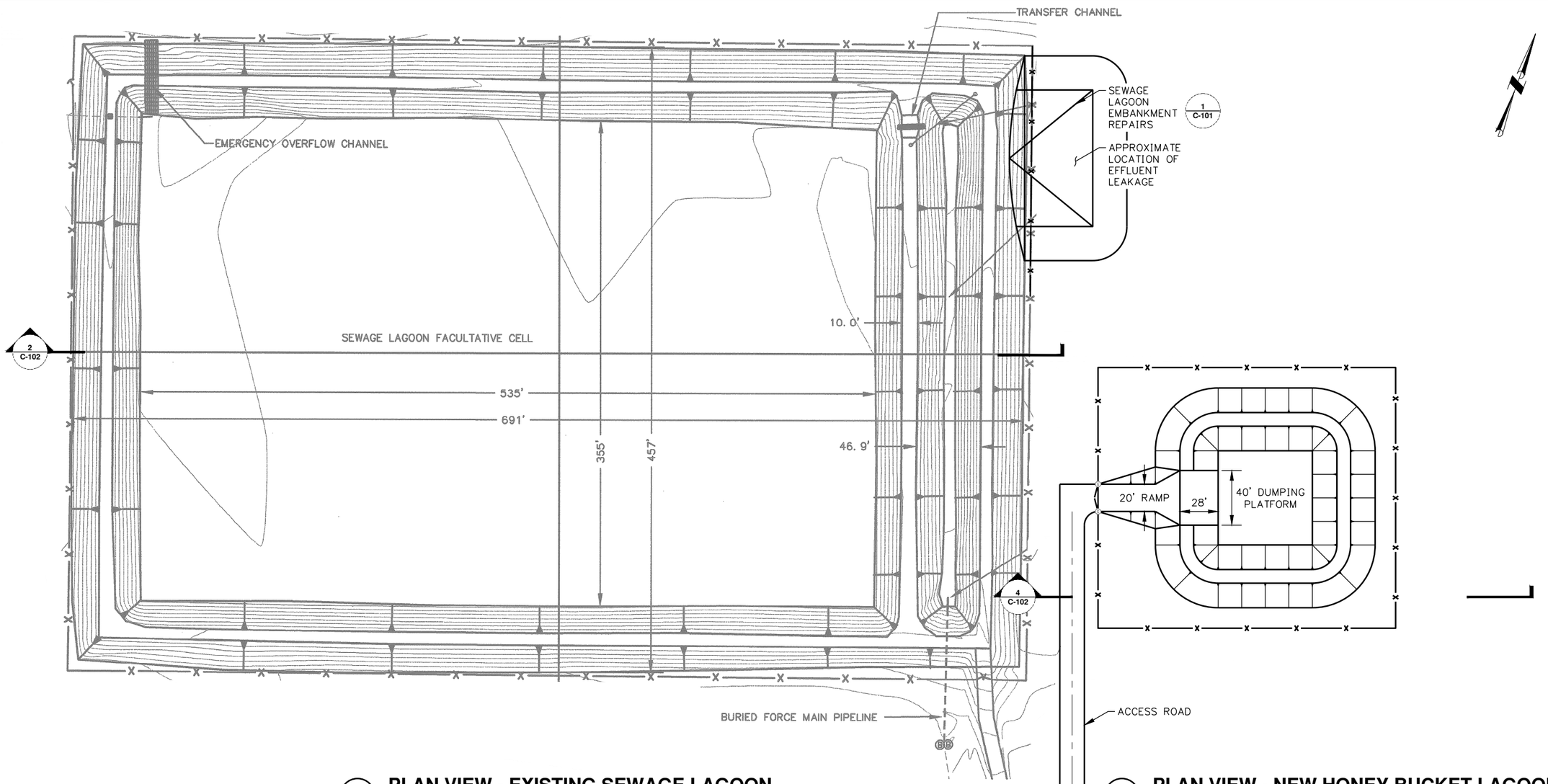


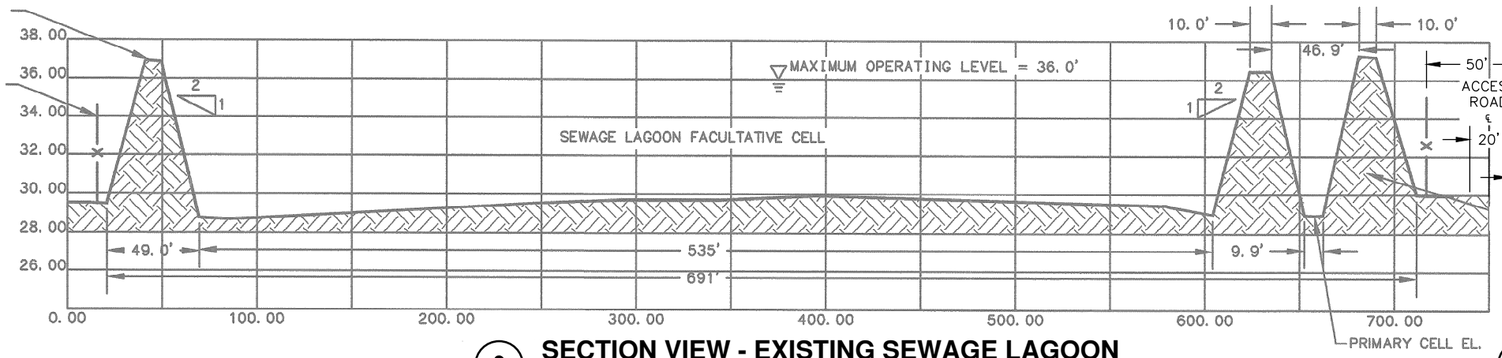
1 PLAN VIEW - EXISTING SEWAGE LAGOON

SCALE 1" = 40'

ACCESS ROAD

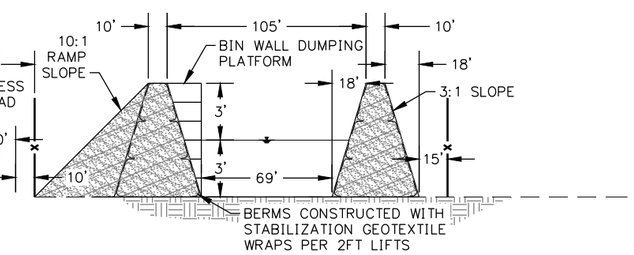
3 PLAN VIEW - NEW HONEY BUCKET LAGOON

SCALE 1" = 40'



2 SECTION VIEW - EXISTING SEWAGE LAGOON

HORZ. SCALE 1" = 40'
VERT. SCALE 1" = 4'



4 SECTION VIEW - NEW HONEY BUCKET LAGOON

HORZ. SCALE 1" = 40'
VERT. SCALE 1" = 4'

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

STATE OF ALASKA 49 TH
Colin M. Singleton
CE-124820
REGISTERED PROFESSIONAL ENGINEER

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

AKIAK NATIVE COMMUNITY, AK
TASK 1 SANITATION IMPROVEMENTS
CONCEPT REPORT

MRK	DATE	DESCRIPTION	INIT

PLAN SET:	----
PROJ MGR:	MCE
PROJ ENG:	CMS
DRUMS ENG:	----
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NEW HONEY BUCKET LAGOON - ALT A

C-102
SHEET 2 OF 5

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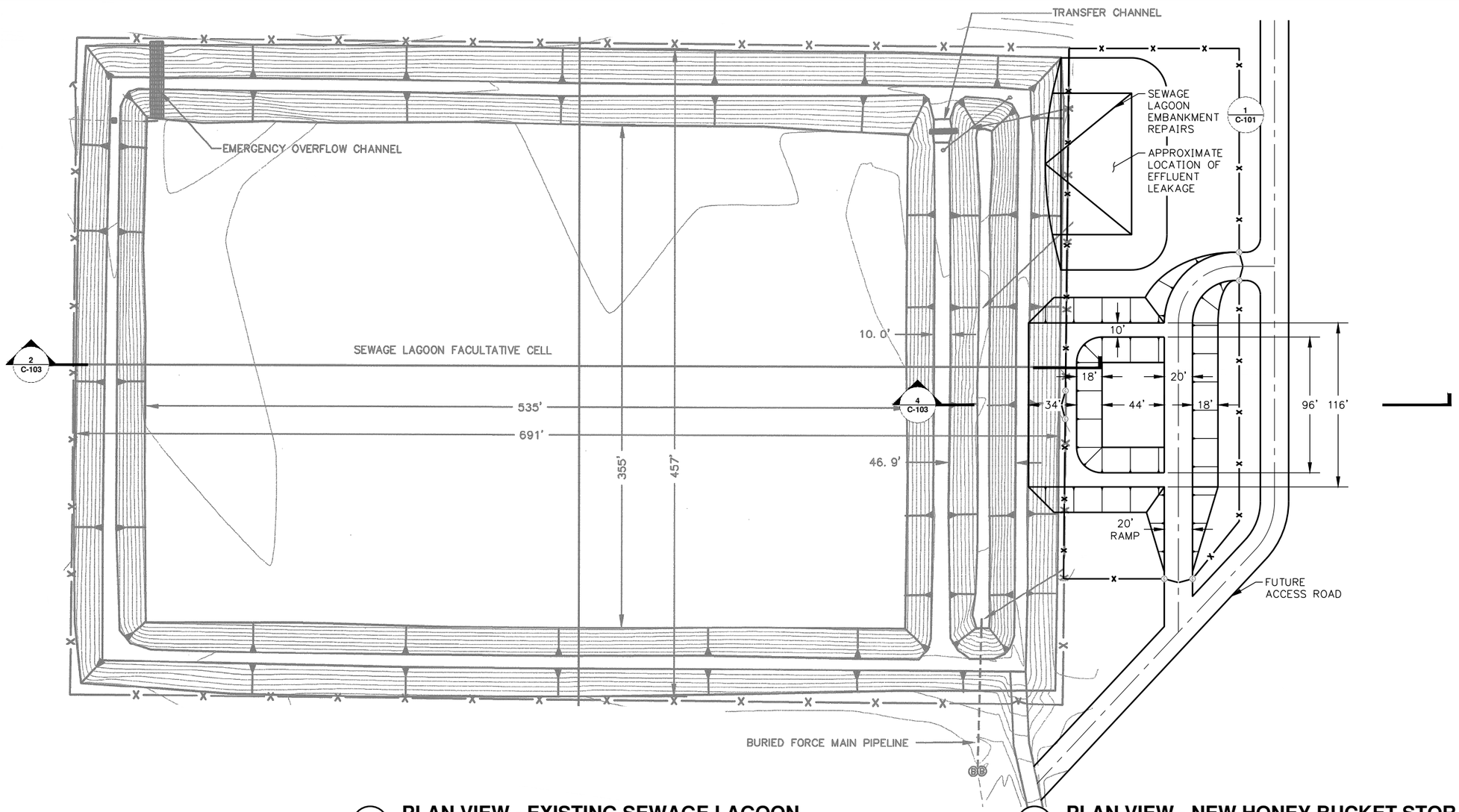
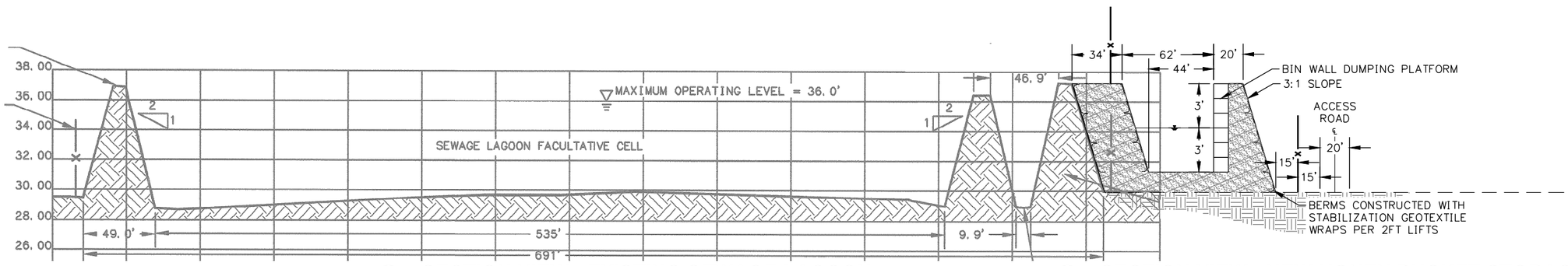


1 PLAN VIEW - EXISTING SEWAGE LAGOON

SCALE 1" = 40'

3 PLAN VIEW - NEW HONEY BUCKET STORAGE CELL

SCALE 1" = 40'



2 SECTION VIEW - EXISTING SEWAGE LAGOON

HORZ. SCALE 1" = 40'
VERT. SCALE 1" = 4'

4 SECTION VIEW - NEW HONEY BUCKET STORAGE CELL

HORZ. SCALE 1" = 40'
VERT. SCALE 1" = 4'

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SHEET TITLE

NEW HONEY BUCKET STORAGE CELL - ALT B

C-103
SHEET 3 OF 5

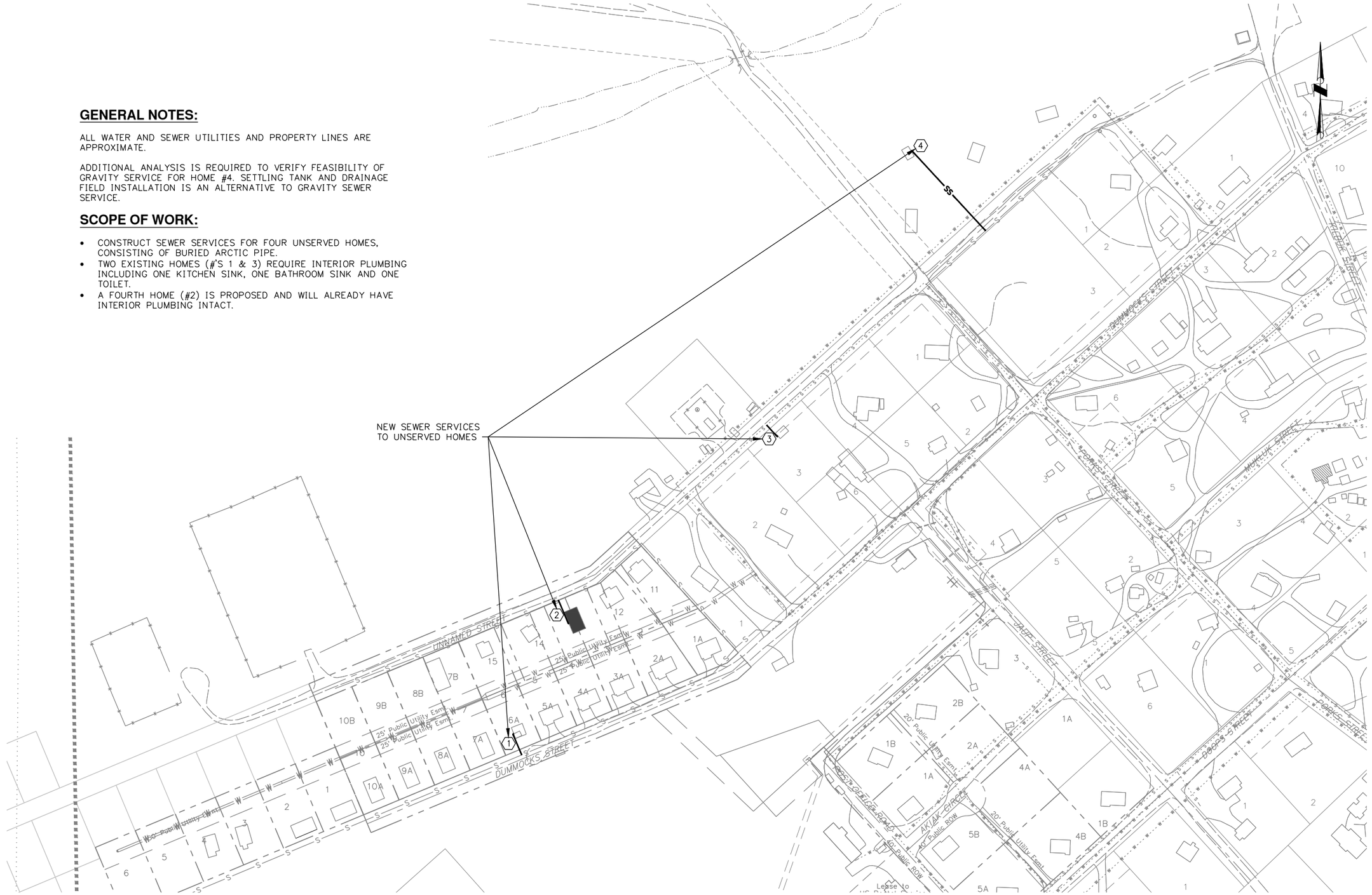
GENERAL NOTES:

ALL WATER AND SEWER UTILITIES AND PROPERTY LINES ARE APPROXIMATE.

ADDITIONAL ANALYSIS IS REQUIRED TO VERIFY FEASIBILITY OF GRAVITY SERVICE FOR HOME #4. SETTLING TANK AND DRAINAGE FIELD INSTALLATION IS AN ALTERNATIVE TO GRAVITY SEWER SERVICE.

SCOPE OF WORK:

- CONSTRUCT SEWER SERVICES FOR FOUR UNSERVED HOMES, CONSISTING OF BURIED ARCTIC PIPE.
- TWO EXISTING HOMES (#'S 1 & 3) REQUIRE INTERIOR PLUMBING INCLUDING ONE KITCHEN SINK, ONE BATHROOM SINK AND ONE TOILET.
- A FOURTH HOME (#2) IS PROPOSED AND WILL ALREADY HAVE INTERIOR PLUMBING INTACT.



1 PLAN VIEW - NEW SEWER SERVICES TO UNSERVED HOMES

SCALE 1" = 100'

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STATE OF ALASKA 49 TH
Colin M. Singleton
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0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING, IF NOT ADJUST SCALES ACCORDINGLY

AKIAK NATIVE COMMUNITY, AK
TASK 1 SANITATION IMPROVEMENTS
CONCEPT REPORT

						INIT
						DESCRIPTION
						DATE
						MRK

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PROJ ENG:	CMS
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SHEET TITLE

NEW SEWER SERVICES TO UNSERVED HOMES - ALT C

C-104

SHEET 4 OF 5

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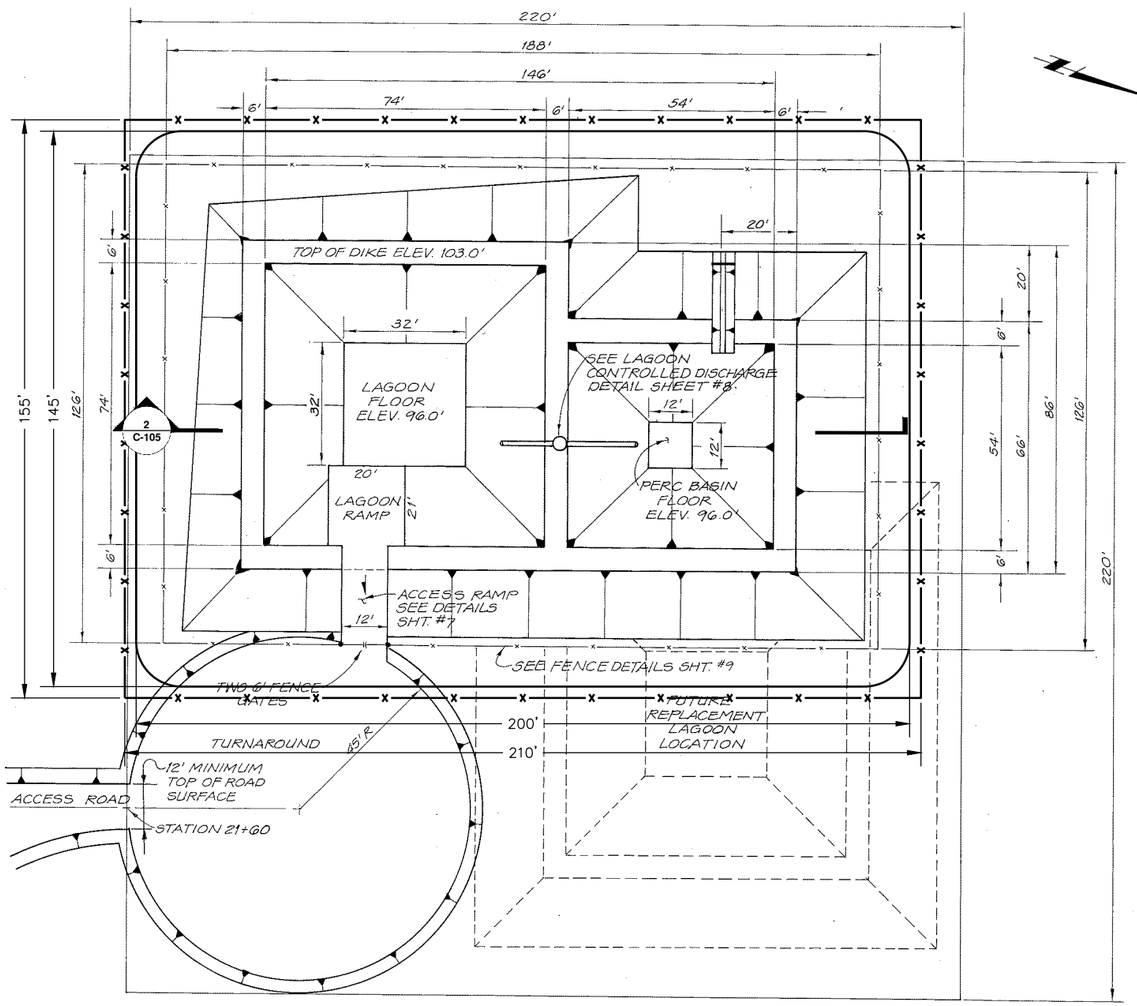
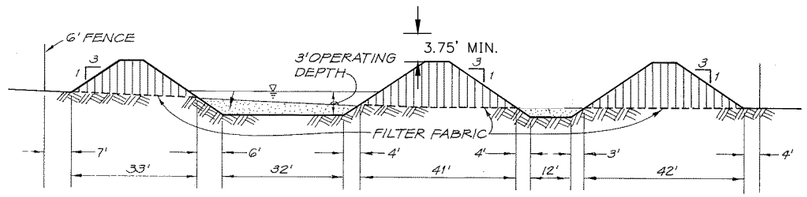


1 PLAN VIEW - EXISTING HONEY BUCKET LAGOON

SCALE 1" = 20'

SCOPE OF WORK:

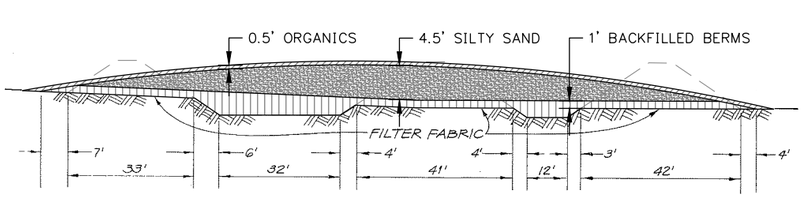
- DISTRIBUTE LYE OVER EXISTING WASTE.
- REMOVE AND SALVAGE EXISTING FENCING.
- CLEAR SITE OF EXISTING TREES.
- REMOVE PORTION OF TRANSFER MANHOLE AND LAGOON RAMP TIMBERS WITHIN 5 FEET OF FINISHED GRADE AND DISPOSE IN LANDFILL.
- GRADE BERMS FLAT, USING MATERIAL TO COVER WASTE WITH MINIMUM 1 FOOT TO AND FILL IN BOTH CELLS.
- CAP GRADED SURFACE WITH 2-4.5 FEET OF LOCAL SILTY SANDS. PLACE MATERIAL IN MAXIMUM LIFTS OF 12 INCHES, TRACKING EACH LIFT A MINIMUM OF 2 PASSES WITH TRACKED EQUIPMENT. CROWN SURFACE TO DRAIN AWAY FROM THE SITE AT APPROXIMATELY 5%.
- FINISH SURFACE WITH 6 INCHES OF ORGANIC MATERIAL OVER THE ENTIRE SURFACE, TRACKING A MINIMUM OF TWO PASSES WITH TRACKED EQUIPMENT. SEED ALL DISTURBED AREAS.
- FENCE THE SITE.



LAGOON FLOOR ELEV. ASSUMED 96.0'
DIKE TOP ELEV. 103.0'
NATURAL GROUND ELEV. VARIES

2 SECTION VIEW - EXISTING HONEY BUCKET LAGOON

HORZ. SCALE 1" = 20'
VERT. SCALE 1" = 10'



LAGOON FLOOR ELEV. ASSUMED 96.0'
DIKE TOP ELEV. 103.0'
NATURAL GROUND ELEV. VARIES

3 SECTION VIEW - DECOMMISSIONED HONEY BUCKET LAGOON

HORZ. SCALE 1" = 20'
VERT. SCALE 1" = 10'

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AKIAK NATIVE COMMUNITY, AK
TASK 1 SANITATION IMPROVEMENTS
CONCEPT REPORT

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LAGOON DECOMMISSIONING

C-105

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

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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				
Item Description	Quantity	Unit	Unit Price	Total Price
Remove & Salvage Chain Link Fencing	150	LF	$ 14.00	$ 2,100
Sewer Rock	222	CY	$ 331.00	$ 73,482
Local Borrow	850	CY	$ 10.00	$ 8,500
Separation Geotextile	800	SY	$ 4.00	$ 3,200
Chain Link Fencing	150	LF	$ 100.00	$ 15,000
			Subtotal:	**$ 103,000**

New Honey Bucket Lagoon - Wastewater Disposal Alternative A				
Item Description	Quantity	Unit	Unit Price	Total Price
Clearing and Grubbing	1.2	ACRE	$ 15,000.00	$ 18,000
Unusable Excavation	940	CY	$ 10.00	$ 9,400
Local Borrow	3,770	CY	$ 10.00	$ 37,700
Stabilization Geotextile	4,205	SY	$ 4.00	$ 16,820
Bin Wall Facing	456	SF	$ 400.00	$ 182,400
Chain Link Fencing	820	LF	$ 100.00	$ 82,000
Standard Signs	4	EA	$ 200.00	$ 800
			Subtotal:	**$ 348,000**

New Honey Bucket Storage Cell - Wastewater Disposal Alternative B				
Item Description	Quantity	Unit	Unit Price	Total Price
Clearing and Grubbing	1.4	ACRE	$ 15,000.00	$ 21,000
Unusable Excavation	760	CY	$ 10.00	$ 7,600
Local Borrow	3,568	CY	$ 10.00	$ 35,680
Stabilization Geotextile	2,645	SY	$ 4.00	$ 10,580
Bin Wall Facing	576	SF	$ 400.00	$ 230,400
Chain Link Fencing	824	LF	$ 100.00	$ 82,400
Standard Signs	3	EA	$ 200.00	$ 600
			Subtotal:	**$ 389,000**

New Sewer Services to Unserved Homes - Wastewater Disposal Alternative C				
Item Description	Quantity	Unit	Unit Price	Total Price
Sewer Services	4	EA	$ 45,000.00	$ 180,000
Interior Plumbing	2	EA	$ 40,000.00	$ 80,000
			Subtotal:	**$ 260,000**

Decommission Existing Honey Bucket Lagoon				
Item Description	Quantity	Unit	Unit Price	Total Price
Clearing	0.7	SY	$ 12,000.00	$ 8,400
Lye Treatment	1,510	SY	$ 4.00	$ 6,039
Remove & Salvage Chain Link Fencing	628	LF	$ 14.00	$ 8,792
Remove Structures & Obstructions	1	LS	$ 12,000.00	$ 12,000
Backfill Lagoon Berms	1	LS	$ 12,000.00	$ 12,000
Local Borrow	3,222	CY	$ 10.00	$ 32,220
Local Organics	537	CY	$ 8.00	$ 4,296
Seed	0.7	ACRE	$ 18,000.00	$ 12,600
Chain Link Fencing	730	LF	$ 100.00	$ 73,000
Standard Signs	4	EA	$ 200.00	$ 800
			Subtotal:	**$ 171,000**

Akiak Native Community
Sanitation Improvements Design Analysis and Recommendations

Conceptual Construction Estimate

Item Description	Alternatives		
	Alt A: Honey Bucket Lagoon	**Alt B: Honey Bucket Storage Cell**	**Alt C: Sewer Services**
Sewage Lagoon Embankment Repairs Filling the Leakage Area	$ 103,000	$ 103,000	$ 103,000
New Honey Bucket Lagoon Wastewater Disposal Alternative A	$ 348,000		
New Honey Bucket Storage Cell Wastewater Disposal Alternative B		$ 389,000	
New Sewer Services to Unserved Homes Wastewater Disposal Alternative C			$ 260,000
Decommission Existing Honey Bucket Lagoon	$ 171,000	$ 171,000	$ 171,000
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**