Preliminary Engineering Report
Final Draft

Kongiganak, Alaska

Prepared for: Indian Health Service / U.S. Environmental Protection Agency

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the Native Village of Kongiganak,
and
the Village Safe Water Program
State of Alaska, Department of Environmental Conservation

June 12, 2018

Preliminary Engineering Report
for Improvements to the
Community Sewage Lagoon,
Water Treatment Plant and
Laundry Facility

Final DRAFT

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ABBREVIATIONS

AAC - Alaska Administrative Code
ACOE – Army Corps of Engineers
ac-day - Acre-Day
ADEC - Alaska Department of Environmental Conservation
ADOL – Alaska Department of Labor
ANTHC - Alaska Native Tribal Health Consortium
ASV - All Season Vehicles
ATVs - All Terrain Vehicles
BOD - Biological Oxygen Demand
CRUM - Cold Regions Utility Manual
DAR – Design Analysis Report
DOT - Department of Transportation
DCCED – Department of Community, Commerce, and Economic Development
EMS - Emergency Medical Services
ft - feet
gpd – gallons per day
gpm – gallons per minute
KTC - Kongiganak Tribal Council
MLLW - Mean Lower Low Water
NVK – Native Village of Kongiganak
O&M - Operations and Maintenance
PER – Preliminary Engineering Report
PF - Public Facilities
PWSID – Public Water System Identification
RUS - Rural Utilities Service
SHPO - State Historic Preservation Office
SWTR – Surface Water Treatment Rule
U.S. EPA - United States Environmental Protection Agency
US - United States
USACE - United States Army Corps of Engineering
USFWS - United States Fish and Wildlife Service
USDA RD - United States Department of Agriculture Rural Development
VSW - Village Safe Water
WTP – Water Treatment Plant
WTS – Water Treatment System
WST – Water Storage Tank
YKHC - Yukon-Kuskokwim Health Corporation

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INTRODUCTION

This Preliminary Engineering Report (PER) has been written for the Village Kongiganak to evaluate alternatives to address sanitation deficiencies within the community. Analysis, alternatives, and recommendations are made within each area of concern. The three areas include repair of the existing sewage lagoon berm, repairs to the washeteria, and repairs or modifications to the water treatment plant. A second watering point under discussion has been excluded, based on the need to fund the other upgrades.

Representatives from Summit Consulting Services visited the Village of Kongiganak (March 2017) to gather information about the existing condition of the water treatment plant/washeteria, lagoon, honeybucket disposal facility, and watering point; to investigate the problems and challenges that the community had been facing with the current water and sewer facilities; and, to discuss potential solutions.

This PER has been written in accordance with U.S. Department of Agriculture, Rural Utilities Service (USDA RD/RUS) Bulletin 1780-2.

1. PROJECT PLANNING

a) Location

Kongiganak is an unincorporated traditional Yup'ik Eskimo village located two miles inland from the Kuskokwim Bay approximately 70 miles southwest of Bethel and within the Yukon Delta National Wildlife Refuge. The community was established on a shallow permafrost bluff along the Kongnignanohk River.

Further location information includes:

- Latitude 59° 57'33" North, Longitude 162° 53' 14" West (NAD 83)
- Township 2 South, Range 79 West, Section 32, Seward Meridian
- United States Geological Survey Quad Kuskokwim Bay D-3

Kongiganak was permanently settled in the late 1960's by former residents of Kwigillingok who were seeking higher ground to escape periodic flooding (DCCED)[1]. The community has a subsistence lifestyle and culture including fishing, hunting and some trapping. The local economy is based primarily on employment with the school, village services, stores, commercial fishing, seasonal construction as well as some small private enterprises in traditional arts and crafts.

b) Environmental Resources Present

Kongiganak belongs to the Yukon-Kuskokwim Delta ecoregion (ADF&G)[2]. The following are the common characteristics for this ecoregion.

i. Vegetation

Wet tundra communities consisting primarily of sedge mats, moss, and low growing shrubs predominate. Alder, willows, and scattered, stunted spruce and birch grow along major streams (USDA Forest Service)[3].

[1] *Community Database Online.* State of AK: Department of Commerce, Community, and Economic Development
[2] *Wildlife Action Plan Section IIIB: Alaska's 32 Ecoregions.* Juneau, Alaska: Alaska Department Fish & Game
[3] *Ecological Subregions of the United States*. United States Department of Agriculture, Forest Service

ii. Geology, Soil conditions, Wetlands, and Hydrology

- Geomorphology: *"The area is a lake-dotted marshy plain with many low hills of basalt and volcanic cinder cones and craters. Elevation is less than 400 ft"* (USDA Forest Service)[1].
- Lithology and Stratigraphy: *"The lowland is underlain by post-accreted Quaternary sands and silts to unknown depth. Basalt flows and cinder cones of Tertiary and Quaternary age exist. Other bedrock consists of Cenozoic sedimentary rocks with inclusions of various other assemblages"* (USDA Forest Service)[1].
- Soil Taxa: *"Dominant soils are Histic Pergelic Cryaquepts and Pergelic Cryofibrists. Soils are shallow over permafrost and consistently wet"* (USDA Forest Service)[1].
- Surface Water Characteristics *"The lowland is crossed by meandering streams of extremely low gradient. Many are tributaries or former channels of the Yukon or Kuskokwim Rivers. Wetlands occupy over 78 percent of the area"* (USDA Forest Service)[1].
- Wetlands: Kongiganak is situated within an extensive area of Freshwater Emergent Wetland. (USF&WS)[2] The necessary U.S. Army Corps of Engineers permits will be obtained depending on the selected alternative and the extent of work. It is assumed any construction outside of established facilities would impact wetlands of the US and would require a Section 404 permit from the U.S. Army Corps of Engineers (USACE). A full wetland delineation would be required if the acreage meets Section 404 thresholds for impact.

iii. Endangered Species and Critical Habitat

On April 12, 2018 the US Fish and Wildlife Service (USFWS) was contacted regarding the potential for Threatened and /or Endangered Species in the proposed area of improvements under Section 7(c) of the Endangered Species Act of 1973 as amended (16 U.S.C. 1531 et seq.). There were 12 migratory bird species and 1 critical habitat listed within the area by the USFWS (Consultation Code: 07CAAN00-2016-SLI-0171). If construction could impact migratory bird habitats, it would require further consultation with the USFWS.

iv. Fauna

"*The lakes, streams, and tidal flats interspersed with tundra and sedge flats make this Section* [area] *exceptional habitat for waterfowl, shorebirds, and furbearers. The Yukon-Kuskokwim Delta supports the highest densities of nesting tundra swans, most of the world's population of emperor swans, and one-half of the total population of black brant. All of North America's cackling Canada geese are produced in these coastal lowlands. Spectacled eiders are common north of the Kuskokwim River. The only known breeding grounds of the very rare bristle-thighed curlew extend through this Section. Although rare, white wagtails are characteristic breeders in open areas along the coast. Dovekies and McKay's buntings are limited in Alaska to off-shore islands included in this Section. River otters are abundant; short-tailed and least weasels are common. Ribbon seals are characteristic of areas off-shore. Large numbers of barren-ground caribou inhabited this Section up until the mid-1800s. Limited numbers of caribou associated with herds from other Sections now occur in this area. The musk ox was introduced to Nunivak Island in 1935 and 1936. Wood frogs have been reported from the eastern portion of this Section. All three forms of Arctic char (anadromous, resident stream, resident lake) occur here. Sheefish are associated with both the Yukon and Kuskokwim*

[1] *Ecological Subregions of the United States*. United States Department of Agriculture, Forest Service.
[2] *National Wetlands Inventory.* United States Fish & Wildlife Service.

rivers. All five species of North American Pacific salmon are indigenous to this Section; chum salmon are the most abundant" (USDA Forest Service)[1].

v. Cultural, Archeological, and Historic Sites

January 2009 State Historic Preservation Officer (SHPO) review for related projects in Kongiganak identified two sites as historic: the Russian Orthodox Church and Saint Gabriel Chapel. Both sites are outside the project area and will not be affected. All work funded by state or federal monies will be reviewed by SHPO.

vi. Formally Classified Lands / Farmlands

No important farmlands or formally classified lands are located within the proposed project area.

vii. Floodplains

Even though the village is several miles inland from the Bering Sea, the area experiences periodic wind and tide driven coastal flooding which saturates the surrounding grounds with seawater (C.Wrobel SCS)[2].

Kongiganak does not participate in the National Flood Program and floodplains with the area are not mapped. In 2005 U.S. Army Corps of Engineers estimated the 100-year flood or Base Flood Elevation to be 20.7 ft MLLW (C. Wrobel SCS, 2005)[2]. A more recent study conducted by the ACOE looked at storm damage and flooding for several western Alaskan points, including Kongiganak. The resulting 100 year surge level was 18.28 ft MLLW with a standard deviation of 1.28 ft (ACOE, 2009)[3]. Further design activities should correlate this surge elevation with a local datum in Kongiganak to determine if the design criteria of 20.7 ft MLLW should be altered.

viii. Water Quality

The existing sewage lagoon is authorized under General Permit AKG 573008 expiring August 31, 2018 for discharge of wastewater to the Kongnignanohk River. Alaska Department of Environmental Conservation (ADEC) Wastewater Program will review any proposed modifications to the sewage lagoon. Additionally, a Section 401(c) water quality certification may be required depending on the impact of recommended work.

ix. Socioeconomic/Environmental Justice Issues

The proposed improvements are not anticipated to adversely impact minority or low-income populations and communities. No socioeconomic and/or environmental justice mitigation is proposed.

x. Miscellaneous Issues

The proposed project is not anticipated to adversely affect air quality or noise levels. Impacts related to construction activity will be temporary and mitigated by communication with residents, scheduling construction activity during day hours, and controlling dust if necessary.

[1] *Ecological Subregions of the United States*. United States Department of Agriculture, Forest Service.
[2] *Environmental report for Sanitation Facilities Phase III.* Village of Kongiganak, Alaska. Summit Consulting Services, Inc.
[3] Storm-Induced Water Level Prediction Study for the Western Coast of Alaska. ERDC/CHL Letter Report. October, 2009.

c) Population Trends

US Census data reported an estimated population of 439 in 2010. Alaska Department of Labor & Workforce Development (ADOL) reported an estimated Kongiganak population of 503 in 2015 (ADOL, 2016a) and a projected population growth of 0.9% in Bethel Census Region (ADOL, 2016b)[1]. A growth rate specifically for Kongiganak has not been defined. Kongiganak City Administrator, Roland Andrew, reported an estimated population of 684 during the March 2017 site visit. Mr. Andrew's estimation is based on applications for corporation membership which he feels is a more accurate count of population and he intends to petition the ADOL for a revision of the official figure. The revised population estimates should be used if the petition is granted. In the interim, this PER assumes a 0.9% growth rate based on the population in 2015 of 503 persons. The projected 20 year design population is then 613 persons.

d) Community Engagement

Summit representatives and four representatives of the Kongiganak Tribal Council (KTC) met on March 31, 2017. The goal of the meeting was to obtain the community perspective on water and sewer issues and preferred alternatives.

The existing problems at the laundry facility were identified as the most urgent and important to the KTC. The KTC relies upon income from the washeteria to run the laundry facilities, the water plant, and the wastewater system. The state of the existing honeybucket dumping area was also a top priority and a safety concern for the community. Mr. Andrew reported that the dumpsite structure may be failing. There is concern that the structure retaining honeybucket bags will collapse and cause injury or become inaccessible.

Another concern was the placement of the honeybucket dumpsite. The Council would prefer to see honeybucket disposal moved away from the community. Other topics of discussion included the Council's support for a second watering point; reluctance to provide a water haul service; improvements and repairs that are required in the water plant; and the sewer gas odors in the washeteria/water plant. Refer to attached trip report for further information.

[1] *Alaska Population Projections 2015 to 2045*. Juneau, AK: Department of Labor and Workforce Development.

2. EXISTING FACILITIES

a) Location Map

The existing lagoon, washeteria, and water treatment plant locations that are included in this scope of work are depicted on Figure 1 of this report, Attachment B.

b) History

The Village of Kongiganak is an unincorporated community in an unorganized borough. The Kongiganak Tribal Council (KTC) is a Bureau of Indian Affairs recognized entity that currently manages the water plant, washeteria, watering point, and lagoon. Regional corporations include the Qemirtalek Corporation and the Calista Corporation. Due to climate and limited funding, infrastructure development is challenging and slow. Current infrastructure consists of a water storage tank and a water treatment facility, laundry and shower facility (washeteria), a sewage lagoon with honeybucket disposal facility, unpermitted landfill, an airstrip, boardwalks, electrical and bulk fuel services, a school, and a clinic.

Transportation to and from Kongiganak is by air carriers, or barge service from Bethel and Seattle during summer months. The State Of Alaska-DOT&PF owns a 2,400 ft. x 75 ft. gravel-dirt airstrip. Air carriers that provide passenger and freight services are Arctic Transportation, Ravn Aviation, Grant Aviation, Hageland Aviation and Yute Air.

Kongiganak is situated in an area of wetlands, dotted by multiple lakes and streams. Transportation within the village is by the system of boardwalks. The main means of transportation are ATVs year round and snow machines during winter months. The boardwalks require maintenance and repair due to constant use, winter storms, and summer flooding. Flooding generally occurs due to storm surges that back water up the river and from the coast. During storm surges, the entire low land terrain surrounding and within parts of the community are inundated with salt water. The height of the berms of the existing sewage lagoon was designed to be above the maximum expected flood surge while taking into account wave action during a storm.

Electricity is provided by Puvurnaq Power Company, which operates a diesel engine-driven power plant. Fuel storage facilities are owned by Qemirtalek Coast Corporation, Puvurnaq Power Company, and Native Village of Kongiganak.

There is currently one school in Kongiganak—the Ayagina'ar Elitnaurvik School—with 182 students and 12 teachers. The school is operated by the Lower Yukon School District.

Local health services are provided by the Yukon Kuskokwim Health Corporation (YKHC) at the Lillian E. Jimmy Memorial Health Clinic which employs a health aide. Kongiganak is classified as an isolated village; it is found in EMS Region 7A in the Yukon/Kuskokwim Region. Emergency services have coastal and air access.

Residents of Kongiganak currently do not have water and sewer service at their homes. Water is obtained from several sources, including a year-round self-haul watering point at the water treatment plant, rainwater catchment in the summer, and ice melt during the winter.

Wastewater collection consists of a limited gravity sewer system that connects the school, water plant, and washeteria waste for discharge into the sewage lagoon. Residents currently self-haul honeybuckets to a designated area at the lagoon.

Kongiganak's main supply of water is Contractor's Lake, which is a 5.1 acre tundra pond, containing approximately 7.53 MG of water. The lake is located 1.8 miles northeast of the community and is accessible by boardwalk. Raw water is pumped through an above ground HDPE transmission line into the community's 1.2 million gallon water storage tank. Construction of Contractor's Lake raw water intake, the pump float, and 10,000 ft. of raw water transmission line took place during the 1998 and 1999 construction seasons. A dike at Contractor's Lake was constructed in 2003. The 1.2 million gallon water storage tank was designed in 2005 (SCS, EEIS)[1], the foundation and thermosyphons were installed in 2006, and tank construction was completed in 2008.

The water treatment building was constructed in 1978 as a multi-purpose facility housing the water treatment equipment, sewage treatment facility (aeration chambers providing pre-treatment to the lagoon), and laundry facilities (C.Wrobel (SCS))[2]. Building renovations and water treatment equipment upgrades were described in the Sanitation Facilities Master Plan in 1993. In 1998, design and construction professionals from Montgomery Watson (Civil Engineering), Kumin Associates, Inc. (Architects) and Summit Consulting Services Inc. (Construction) made a site visit to Kongiganak to evaluate the existing conditions and determine the scope of work. The team concluded that the existing building could not be brought to code for all of its uses. During the 1998 and 1999 construction seasons the sewage treatment facility was removed and the water treatment equipment was upgraded to comply with new drinking water standards.

In 2000 the community received funding for the design and construction of a new laundry facility. Building design was developed the same year by Kumin Associates, Inc. and consists of public laundry and bathing facilities (washeteria) on the first floor and village council offices, social program offices, storage and transient quarters on the second floor (Kumin, 2000)[3]. The construction of the new building began in 2000 and was completed in 2002. The drive through watering point was designed and added to the building in 2009 (SCS, VSW)[4] along with a valve house and yard piping.

The existing 5 acre sewage lagoon, honeybucket disposal site and sewer gravity outfall were designed in 2003 by Summit Consulting Services, Inc. (SCS VSW(Lagoon))[5]. The construction started in 2004 and completed in 2008. The old sewage treatment plant was decommissioned in 2005.

Solid waste collection is not available, and there is a not permitted Class III landfill. A dumpsite is located 0.7 miles directly northwest of the community or 1.5 miles by a boardwalk.

[1] SCS, EEIS. Kongiganak Traditional Council Water and Sewer Upgrades *Phase 2-2005 1.2 MG Water Storage Tank*. Design Plans 100% Issued For Construction. Anchorage: Summit Consulting Services, Inc., 2005.
[2] (C. Wrobel SCS) *Preliminary Engineering Report*. Preliminary Engineering Report. Anchorage: Summit Consulting Services Inc., 2002.
[3] Laundry Facility for the Village of Kongiganak. Design Plans. Kumin Associates, Inc. February, 2000.
[4] SCS. *Kongiganak Traditional Council Water and Sewer Upgrades WTP Modifications.* Design Plans 95% Design for AgencyReview. Anchorage: Summit Consulting Services, Inc., 2009.
[5] SCS (Lagoon). *Kongiganak Traditional Council Sewer & Water Improvements Phase 1-2002*. Design Plans 100% Issued For Construction. Anchorage, 2003.

c) Condition of Existing Facilities

i. Lagoon Berms

The Kongiganak sewer lagoon is a 5.29 acre, single cell facultative sewage lagoon. The lagoon was designed to support a proposed piped wastewater collection system that would have served the entire village. The piped system was never built.

Currently the wastewater collection system consists of a combined pressure/gravity system that collects approximately 600,000 gallons per year (R&M, 2013)[1] from the new school, water plant, and washeteria combined.

During the March 2017 site visit, the following was observed:

- Using a grade rod and level, the elevation of the ice was measured off of a benchmark on the lagoon berm at 18.3 ft elevation MLLW.
- Six holes were drilled in the lagoon to determine the extent of erosion below the waterline. Refer to attached site plan and profiles on Figure 3, Attachment B. It appears material has sloughed off of the berm at the water surface and could be accumulating between 15 and 25 feet further down the berm. The buoyancy of the existing erosion control fabric could have influenced these measurements. This influence appears to have been in the order of inches.
- Erosion is affecting an area of at least 100 feet in length and cutting into the berm itself 1 to 3 vertical feet. The area of worst visible erosion (above the water line) has cut into the berm up to 3 feet. The damage should be verified after break-up as a precise measurement could not be taken with the presence of drifting snow.

These conditions are the result of several factors:

- The lagoon was sized for 8,212,500 gallons per year. However, Kongiganak is still a self-haul community and generates only approximately 600,000 gallons per year and 47 honeybuckets (235 gallons) per day. The size of the lagoon allows wind generated waves to hit and erode the north berm. A smaller lagoon would limit the energy waves could gain and limit erosion by wave action.
- The community has not discharged the lagoon as scheduled (every 2 years). It was last discharged in 2009 (Note: the extent of a partial discharge in 2017 could not be confirmed by the operator). Discharging over 600,000 gallons of treated sewage a year is time consuming. Depending on the water level, a discharge will take weeks to accomplish and require a couple of trips to check on the pump each day. Also, the discharge pump (Godwin DriPrime CD100M Automatic self-priming diesel pump set bought in 2004) requires repair.
- The water level in the lagoon is now at an elevation of 18.3 feet (3.0 ft above design operating level). Erosion control material was installed 10 feet on the slope, above and below the design operating level per the Superintendent who was on site during lagoon construction. It appears the erosion control material was functioning as intended to protect the earthen berm until the water level rose to its current elevation. The berm is now eroding above the erosion control material.

[1] *State of Alaska Village Safe Water, Kongiganak Feasibility Study Update*. Draft Report. R&M Consultants, Inc. May 2013.

The council reported during our site visit that they are not satisfied with the location of the lagoon and honeybucket dump facility adjacent to the community and would like to see it relocated—possibly to the landfill area. Relocating the lagoon and honeybucket dump facility are outside the scope of the current PER.

ii. Honeybucket Disposal Site

Residents self-haul honeybuckets to a designated disposal site at the lagoon 1,100 feet from the washeteria. The honeybucket disposal site consists of a fenced 50 foot radius platform, a buttress, and a fenced waste retention area (see Figure 1 and Figure 3 in Attachment B). The platform is constructed of treated lumber located 12.5 feet above the water level. The honeybucket disposal facility is connected to the existing boardwalk system and is accessible year round by ATV or snow machine. The buttress is constructed of 3"x12" treated wood planks and 4"x 8" posts, which are secured to the lagoon berm by a series of galvanized steel deadmen. Honeybucket waste and bags are accumulated in a 35 foot by 35 foot fenced retention area. During the March site visit the following was observed:

- The honeybucket waste retention area is full to the top of the retaining fencing approximately 10 to 20 feet in depth (refer to Photo Log/Trip Report in Attachment A and Figure 3) depending upon the distance from the dump chute. Note the photo in Figure 3 is from shortly after construction when water levels were low. The fence height was extended after this photo was taken. The honeybucket dump facility was intended for short term use until completion of the piped system. The structure is now completely full and in disrepair.
- The dumping structure at the top of the buttress appears to be exhibiting some wear, including loose and worn boards, especially where the buckets are pounded on the chute while dumping. The tribal administrator, Roland Andrew, reported sloughing of earth material from beneath the vertical dumping face. The area of sloughing was covered in frozen honeybucket sewage and drifting snow during the site visit and sloughing could not be confirmed.
- Lagoon gates are not aligned and have a gap big enough for children or dogs to enter the lagoon. These gates should be re-aligned as a maintenance task.

The field observations suggest approximately 680 cubic yards of waste are being held in place by the fence within the lagoon.

While Summit strongly urges that the honeybucket facility be addressed and design and repairs be proposed, due to the limits of available capital funding, this PER will not address repair of the honeybucket disposal facility.

iii. Watering Point

Residents of Kongiganak collect treated water year round from the coin operated watering point located on the outer north wall of the water treatment plant. The watering point is inside an enclosed, drive-through structure that has two opposing doors wide enough to accommodate ATVs and snow machines. This area is heated and used as a workshop for the water treatment plant and also is available for hourly rent to locals and visitors. The watering point consists of 1 inch supply piping, a solenoid valve, a vacuum breaker, and a hose that penetrates the north wall for outside water access. Minor damage to the Decktite connector was observed during the March 2017 site visit.

The water treatment plant operator reported no issues with the existing system. The community reported that this watering point is working well and is used regularly.

iv. Washeteria

The washeteria facility included six coin-operated washers, six dryers, and four bathrooms. One bathroom is considered a family bathroom and includes a toilet, a sink, and a large walk-in shower. One is a handicap access shower and restroom; one bathroom has a toilet, a sink and a regular size walk-in shower; and, one bathroom has a toilet and a sink only. A laundry attendant, a janitor and a water treatment operator are employed year around.

During the March 2017 site visit the following was observed:

- A shortage of washer capacity and availability: only three of the 6 washers are working. One of the washers does not consistently fill properly and has to be filled with water manually. The laundry attendant operates a wait list for those who want to wash clothes and a limit of two bags per person is enforced. The community has not been successful in repairing the washers, nor has it received assistance from the RMW.
- A shortage of dryer capacity and availability: Dryers #2, 5, and 6 are working. Dryers #1 and #4 are cold air, and #3 is missing the door. The coin-operation does not work reliably on all of the dryers. The community has not been successful in repairing the dryers, nor has it received assistance from the RMW.
- Deteriorating flooring throughout the first floor. The resin flooring did not adhere sufficiently at the sheathing joints and the integral cove base.
- Shower pans or surrounds were not installed. The resin flooring was carried into the shower to form a pan. This has resulted in water damage, loss of sheetrock sheathing, and mold. Only one of the three showers is in use (refer to Table 1 and Attachment B, Figure 2).
- Two of the toilets are out of operation.
- Three of the sinks are out of operation.
- Out of service showers, sinks and toilets causing p-traps to dry out potentially resulting in sewer odor within the facility, especially when the school sewer is pumping.

Table 1. Condition of Existing Bathrooms

Bathroom #	Shower	Sink	Toilet
#1	Out of service	Out of service	Out of service
#2	Out of service	Out of service	Out of service
#3	N/A	Out of service	In service
#4	Out of service	In service	In service

Table 2. Condition of Existing Dryers

Dryer #	Status	Notes
1	Partially working	Produces only cold air
2	In service	
3	Out of service	Missing door
4	Partially working	Produces only cold air
5	In service	
6	In service	

Table 3. Condition of Existing Washers

Washer Status	Number of Washers
In Service	3
Out of Service	4

v. Water Treatment Plant

The Village of Kongiganak water treatment plant does not currently meet Surface Water Treatment Rules. The NVK operates a community public water system (PWSID 271025) to supply drinking water to residents and the local school.

The surface water source is Contractor's Lake and the system operates under Surface Water Treatment Rules. The treatment system was constructed in approximately 2000 and received VSW engineer interim operational approval on May 31, 2001.

As designed, the system included pre-filtration by bag filter cartridges (8 micron followed by 5 micron), polymer addition, flocculation, 42" multi-media pressure filters, soda ash injection, and chlorine injection. An additional bag filter (U.F. Strainrite Series HPM 9700 Series) was to be used downstream of the filters to achieve log removal credit in compliance with SWTR.

None of the bag filters are in use. Contact time was originally designed to be achieved in four 5,000 gallon tanks. Further design included a treated water contact tank of approximately 200,000 gallons that was to be adjacent to the raw water storage tank. As a temporary measure, banks of 165 gallon tanks were installed over 15 years ago. A tank replacement project did not proceed, and the community is still operating with the 165 gallon tanks in the water plant basement. Refer to Attachment B, Figure 6 for water treatment schematic.

d) Financial Status of any Existing Facilities

i. Lagoon Berms

The utility provides service primarily to the LKDS School, but does not collect any direct revenue from the school for disposal of wastewater at the lagoon. The NVK does not budgetfor or performed regular maintenance at the lagoon. Estimated annual O&M costs for routine pumping and testing sampling during discharge to the environment are $7,040 per year.

ii. Washeteria

The utility charges $5 per washer load, $3 per dryer load, and $3 per shower. Approximate monthly revenues are currently $6,600. The tribal administrator reports revenues are down by up to 2/3rds due to broken washers and dryers (Andrew, 2017)[1].

Refer to Table 4 listing Fiscal Year 2016 budgeted expenses for the washeteria and water treatment plant combined (Andrew, 2017)[1].

Table 4. Fiscal Year 2016 Budgeted Expenses for Washeteria and Water Treatment Plant Facilities

Item	FY16 Estimate
Salary Expenses	$63,107
Bank Service Charge	$5,000
Payroll Taxes	$5,856
Worker's Compensation	$1,769
Administrative Fee	$2,800
Travel-Airfare	$680
Per diem	$2,880
Training, Workshop & Conference Fees	$60
Membership Dues	$1,400
Freight and Postage	$2,339
Telephone and Internet	$2,350
Equipment Repair	$200
Heating Fuel	$20,000
Janitorial Cleaning Supplies	$1,500
Gasoline and Propane	$100
Electricity	$16,800
Water Samples	$2,000
Total	**$128,841**

iii. Water Treatment Plant

The utility charges $0.10/gallon for water at the watering point and $0.10/gallon for water sold to the school.

Watering point revenue is approximately $150/week, or 214 gallons a day (Andrew, 2017)[1]. Approximately 2,000 gpd is sold to the school (Beaver, 2017)[2] which would result in $6,000 per month when school is in session. Total approximate annual revenues are then $61,800 assuming the school is purchasing water for 9 months per year.

An estimate is provided in Table 2 listing the Fiscal Year 2016 budgeted expenses for the washeteria and water plant combined (Andrew, 2017)[1]. Actual costs could not be obtained from the community, and Table 4 does not differentiate between the washeteria and the water treatment plant. A site visit to discuss financial matters is recommended if further knowledge of actual costs is required.

e) Water/Energy/Waste Audits

To our knowledge, water and waste audits have not been conducted. Several attempts to improve energy efficiency at the water treatment plant and washeteria have been made. Most notably were an inspection by R&M Consultants (R&M, 2013)[3] and an energy audit by ANTHC

[1] Telephone correspondence between Roland Andrew, Village Administrator and Julia Raymond. May 3, 2017.
[2] Telephone correspondence between Louis Beaver, Kongiganak School Principal, and Julia Raymond. May 5, 2017.
[3] *State of Alaska Village Safe Water, Kongiganak Feasibility Study Update*. Draft Report. R&M Consultants, Inc. May 2013.

(ANTHC, 2011)[1]. A follow up ANTHC trip report (RAVG, 2015)[2] documents that portions of these recommendations have been made but there is more work to do. These documents are included in Attachment F of this PER. It is recommended that the Village of Kongiganak continue working with the ANTHC-DEHE group and their RMW to further progress on energy improvements. Implementing energy improvements is not a part of this PER.

[1] *Comprehensive Energy Audit for Kongiganak Water Treatment Plant, Tribal Offices, and Hotel.* ANTHC-DEHE, Energy Projects Group. August 30, 2011.

[2] Trip Report – RAVG Operator Training. Senior Tribal Utility Support Specialist, ANTHC – DEHE. For travel occurring January 20th through 28th, 2015.

3. NEED FOR PROJECT

a) Health, Sanitation, and Security

Lagoon berm erosion which has already begun, may lead to a breach with the potential of raw sewage leakage into the nearby lakes and wetlands directly adjacent to the village. A breach of the berm would be very difficult to repair due to a lack of immediately available material and equipment. Gaps in the access gates to the lagoon present a security concern. Timely correction will reduce the risk of environmental damage and human contact with raw sewage.

Access to bathing and laundry facilities are important for cleanliness and sanitation. Current washeteria facilities present many challenges: collapsing sheetrock, broken toilets, non-operational showers and inefficient ventilation. There is a constant, strong unpleasant sewer odor. There is mold which may aggravate health conditions or cause respiratory problems. Ripped, cracked, and peeling flooring presents a potential tripping hazard. Washeteria accessibility and availability is especially crucial for families with small children and the elderly. New laundry equipment and washeteria repairs will improve access for personal and community hygiene. Safe drinking water is a requirement for health and regulatory compliance. The water treatment plant does not meet the requirements of the Surface Water Drinking Act.

b) Aging Infrastructure

i. Lagoon Berm

The north lagoon berm exhibits erosion due to high water levels and wave action. The remaining berms are in good shape. Water quality measurements during the next wastewater discharge should be compared to previous discharges to ensure the lagoon is still functioning.

ii. Washeteria

The current washeteria does not have an adequate amount of equipment to satisfy the community's demand. Existing washers are broken. Existing dryers are either broken or require repair. Current flooring is deteriorating; cracking, peeling and tearing can be observed throughout the facility. A majority of the plumbing fixtures are out of service and require either replacement or repair. Sheetrock walls within the bathroom need to be replaced or repaired and sanitized due to mold. The ventilation system needs to be re-evaluated and repaired or redesigned in accordance with ANTHC and RAVG reports.

iii. Water Treatment Plant

Equipment within the water treatment plant requires upgrades to meet Surface Water Treatment Rule requirements. The water treatment plant could also benefit from modern upgrades and more efficient technology.

c) Reasonable Growth

Kongiganak is a growing community. Expected population growth is discussed in Section 1.C. The existing laundry facility has been in daily use for the past 15 years (since the most previous rehabilitation) and exhibits significant signs of wear and tear. Broken washeteria equipment can no longer accommodate current community demands or any additional usage increase. Equipment replacement and upgrade will significantly benefit current and future residents as well as visitors. Upgrades to the water treatment facility should consider reasonable growth, especially in calculation of disinfection contact time requirements. The lagoon is sufficiently sized for a haul community.

4. ALTERNATIVES CONSIDERED

Section 4.0 describes alternatives for each of the three areas of concern. Section 4.1 will address the sewage lagoon. Section 4.2 describes the repairs and improvements that are needed at the washeteria (also known as the laundromat), and Section 4.3 discusses upgrades and investigations required at the water treatment plant.

4.1. Lagoon Berms

a) Description

As described in Sections 2.c.i and 2.c.ii of this PER, the existing sewage lagoon is exhibiting erosion of the north berm and the honeybucket disposal facility is full and in disrepair. Baffling in the lagoon may be a way of reducing the effective size and distance for waves to travel. However the size of the lagoon and annual ice cover make baffling a challenge. The following describes two alternatives for providing a reasonable repair to the sewage lagoon berms within currently available funding.

i. Alternative 1: Repair and Rebuild

Alternative 1 is to repair the lagoon berm. This alternative will involve repairing the Godwin wastewater discharge pump, completing necessary discharge permitting and Notice of Intent, and providing an initial discharge of 6.5 million gallons from the lagoon to reduce the elevation by approximately 3 feet, to an elevation of approximately 15 feet. The initial dewatering will discharge of 6.5 million gallons will take several weeks.

As the water levels drop, there is a risk of the honeybucket facility collapsing. If the honeybucket facility were to collapse into the lagoon, this would reduce the efficiency of the lagoon and pollute it with non-biodegradable items such as trash bags and buckets. Dispersing honeybucket material through the lagoon will extend the time needed to discharge it, and the plastic bags will complicate future discharges.

Note that the proposed project does not currently include funding to repair the honeybucket facility if it collapses.

After the water level has dropped to 15 ft, the condition of the existing erosion control fabric (North American Green's SC550 Turf Reinforcement Mat) and further extent of the erosion can be assessed. If conditions are found to be as expected, the construction repair can proceed. Areas of erosion will be re-shaped and leveled to the extent possible. This will be done working from the top of the berm with the locally available ASV track loader (ASV). If significant erosion extends below elevation 15 ft., this repair approach will not be possible and a new design will be required.

A new erosion control material will be installed from elevation 15 ft to approximately 22 ft. The proposed new material is a Propex Armormax product that can be keyed at the top elevation and rolled out to the water line. The Armormax can be secured with earth anchors. Refer to Attachment B, Figure 5. The slopes would then be re-vegetated.

ii. Alternative 2: Do Nothing.

Alternative 2, do nothing, would make no improvements to the sewage lagoon. If left un-repaired, erosion of the north berm will continue and could breach (either by direct erosion, or by collapse due to erosion) the north berm discharging sewage into the wetland system directly adjacent to town.

Any further increase in water levels will cause honeybucket bags to escape the dumping facility fencing, making future pumping operation more time intensive and difficult. Alternative 2 does not improve the health and welfare of the residents and is not recommended.

b) Design Criteria

Design criteria applicable to the sewage lagoon include:

Table 5. Lagoon Berms and Design Criteria

Criteria	Value
Wastewater Generation Rate	600,000 gpy
Maximum BOD_5 Loading Rate	35 lb BOD_5/ac-day
BOD_5 Generation Rate	80 g. BOD_5/person-day
100 Year Flood Elevation	20.7 ft. (C. Wrobel SCS, 2005)
Occupied Homes	94 (DCCED, 2017)
Berm Slope	2.5:1
Berm Material	Locally available Silt

c) Map

All alternatives considered in this PER for improvements to the sewage lagoon would occur within the existing footprint; refer to Attachment B, Figure 5.

d) Environmental Impact

All of the alternatives considered in this PER within the existing lagoon footprint would have no additional adverse environmental impacts.

e) Land Requirements

All of the alternatives for improvements to the lagoon and honeybucket disposal facility would occur on land managed by the Village of Kongiganak (leased to the traditional council by Qemirtalek Coast Corporation).

f) Potential Construction Problems

The only construction material available near the village is silt. Any other material required would need to be barged to the community. Construction with silt will require care to lay the material in shallow lifts, compact well, and address settling as it occurs.

g) Sustainability Considerations

i. Water and Energy Efficiency

Neither alternative impacts water or energy efficiency, nor changes the basic operation of the lagoon.

ii. Green Infrastructure

Not applicable. This project does not address storm water.

iii. Other

Not applicable.

h) Cost Estimates

i. Capital Costs

The estimated construction costs for Alternative 1 are listed in Table 6. Refer to Table 14 or Attachment D for a detailed breakdown.

Table 6. Lagoon Berms Capital Costs

Alternative	Capital Cost (2019 Dollars)
Alternative 1. Repair and Rebuild.	$354,000
Alternative 2. Do Nothing.	$0

ii. Annual O&M Costs:

Table 7. Lagoon Berms O&M Costs

Alternative	Annual O&M Cost (2017 Dollars)
Alternative 1. Repair and Rebuild.	$7,040
Alternative 2. Do Nothing. (See Note 1)	$7,040

Note 1. O&M costs for Alternative 2 are assumed to equal that of current operations—matching Alternative 1. Note that the community has not expended O&M effort on the sewage lagoon since 2009.

4.2. Washeteria Improvements

a) Description

i. Alternative 1: Repairs and Upgrades

Alternative 1 is to provide the repairs and upgrades that are necessary to washers, dryers, and showers in the washeteria. The identified issues are discussed individually.

Washers/Dryers: Kongiganak does not have piped water and sewer. Residents rely upon the washeteria to wash clothes and to shower. With only 2 of 6 washing machines in operation, the washeteria has a backlog of residents who are waiting to wash clothes and use the facilities; only 1/3 of the normal flow through the washeteria can be accommodated according to the Tribal Administrator. Also, the Tribe's income from the washeteria offsets the cost of operating the water and sewer system. Per the administrator, they are not able to generate enough income to cover all expenses with a reduced washeteria capacity. The dryers are in disrepair. Three of the six require repair (broken door, coin operation not functioning, and no heat). This PER Assumes 4 new washers and 2 new dryers are procured and installed and training on repair is provided.

The community has also expressed a desire for larger washers. In order to accommodate this request, a structural analysis of the building is needed to determine if it can support the weight of the larger machines. Photos of the foundation pile brackets were provided to VSW in March 2018 indicating possible issues with building movement or bearing capacity. The possible failure of foundation pile brackets and the potential to install larger washers was reviewed Nelson Franklin of Franklin & Associated—the firm that provided the original structural design for the washeteria. Mr. Franklin determined that larger washers could be installed if the specified units have a built-in suspension system that minimizes vibration. He has specified the Girbau EH030 or Girbau EH040. The failure of the foundation pile brackets is inconclusive without a site visit and further investigation by a structural engineer. It is the recommendation of the authors of this report that an onsite structural review of both structures is undertaken before major changes to equipment is made. Refer to Attachment F for Mr. Franklin's report.

Washeteria Finishes and Fixtures: The washeteria was completed in 2001 and has been in continuous use by the residents of Kongiganak and surrounding communities since. There are four restrooms: one with a handicap access shower and two with standard shower stalls. The showers were not constructed with bases and surrounds. The epoxy flooring with an integral cove was used as a shower base. This construction method has not held up well. The shower walls are deteriorating and the sheet rock is molded and disintegrating. Two of the four toilets are in use and one of the lavs is operational. The flooring throughout the washeteria is in disrepair. Reference photos in the attached photo log showing wear, cracking, and peeling of the epoxy.

Alternative 1 recommends the washeteria will receive new flooring; all four showers will be rebuilt with shower bases and surrounds; and, 2 toilets and 3 sinks will be replaced.

Sewer Gas Odors: Sewer gas odors within the building have been reported for several years. It is possible that the odors are due to dry p-traps (several toilets, sinks, and showers out of commission) and/or inadequate vents-thru-roof (VTRs). During our March site visit, we confirmed that the odors are not always present, but do come and go several times a day. The tenants of the building believe the odor occurs when the school's wastewater line is pumping. Presently, the school's wastewater line enters the

basement of the water plant, combines with the building sewer and exits to a lift station (that is now bypassed) to the sewage lagoon. The wastewater piping visible within the water plant basement was inspected and no signs of deterioration or damage were found.

This PER assumes that these p-traps and VTRs will be corrected at the same time as the washeteria rehab. The use of waterless p-traps and the addition of a VTR can be investigated. The community can also attempt to add propylene glycol or water to the traps for fixtures that are not in use to see if this mitigates the odors.

ii. Alternative 2: Do Nothing

If no improvements are made to the washeteria, the facility will pose safety hazards, fail to meet the sanitation need of the community, and will continue to degrade until the services can no longer be provided at all.

b) Design Criteria

Remodel work within the existing structures does not require a design. Replacement washers must include a built-in suspension.

c) Map

All alternatives for improvements to the washeteria and water treatment plant would occur within those buildings, refer to Attachment B, Figure 2.

d) Environmental Impact

None of the alternatives for improvements to the washeteria would have an adverse environmental impact.

e) Land Requirements

All of the alternatives for improvements to the washeteria would occur within the existing building or on that property. Land requirements are not applicable.

f) Potential Construction Problems

There are no known potential construction problems.

g) Sustainability Considerations

i. Water and Energy Efficiency

Not applicable. This project does not address water and energy efficiency.

ii. Green Infrastructure

Not applicable. This project does not address stormwater.

iii. Other

Not applicable.

h) Cost Estimates

i. Capital Costs

The estimated construction costs for Alternative 1 is $680,000, as listed in Table 8. Refer to Table 15 or Attachment D for a detailed breakdown. This estimate assumes washeteria improvements are a stand-alone project, and general conditions costs are not shared with water treatment or lagoon improvements.

Table 8. Washeteria Improvements Capital Costs

Alternative	Capital Cost (2018 Dollars)
• Procure and Install 6 washers and 2 dryers • Replace Laundry Facility Finishes (showers, toilets, lavs, flooring) / Sewer Gas Odors	$680,000
• Do Nothing	$0

ii. Annual O&M Costs

Implementation of Alternative 1 will not increase annual O&M costs. Refer to Table 4 in Section 2.d listing FY16 budget for the washeteria and water treatment plant utilities.

4.3. Water Treatment Plant Improvements

a) Description

i. Alternative 1: Repairs and Upgrades

Alternative 1 is to upgrade the water plant to meet the Surface Water Treatment Rule (SWTR). The identified issues are discussed individually.

Surface Water Treatment Rule Concerns: As noted in the 2010 Status Component Inspection (ADEC, 2010)[1] and as verified during Summit's March 2017 site visit, the plant is not operating as designed, and no longer meets Surface Water Treatment Rule requirements.

- Pre- and post- filtration bag filters are not being used.
- The turbidimeters are online, but neither calibrated nor recently serviced. (A calibration kit for the turbidimeters was onsite during the March site visit and the operator is waiting for an RMW to assist.)
- The contact storage differs from the design. The originally designed 5,000 gallon tanks could not be fit through the doors of the existing building.
- The constructed contact time was through 61 each 165 gallon (150 gallons useable) tanks providing a total useable storage of 9,150 gallons. These tanks are manifolded in a parallel configuration (they fill and discharge together). The fill line is through the top of one of the tanks. As constructed, the tanks receive a baffle factor of 0.

If the tanks were re-plumbed and given a baffle factor of 0.1 (and with the conditions noted in Table 9) only 24 minutes of contact time is available with a peak hourly flow of 20 gpm. Contact time to achieve 1 log Giardia removal is 117 minutes (see calculations in Attachment C). If each of the three banks is operated in turn, sufficient contact time could be achieved. This would require using one bank of tanks while treating to the other two. This solution is not ideal as it depends on the operator to follow a strict protocol to manually switch between banks of tanks.

If the tanks were re-plumbed to series operation, it would allow a baffle factor of 0.3 without a tracer study.

[1] Letter to Wayne Phillip, Tribal Administrator from State of Alaska, Department of Environmental Conservation. RE: Kongiganak Drinking Water Treatment Plant, Status Component Inspection. September 16, 2010.

Other options for increasing the baffle factor of the existing tanks can be explored. One option is the addition of packing balls to the tanks. Packing balls, a method developed by CampWater Industries, have been previously assigned a baffle factor of 0.4 by ADEC in 2014 (300 gallon Norwesco tanks filled minus 5 gallons with 2-inch packing material, 5-8 gpm) (AWWMA, 2017)[1]. Packing balls could be investigated for Kongiganak although a tracer study will be required.

A conventional solution would be the construction of a new treated water storage tank sized to provide adequate contact time for the washeteria and watering point. A tank with a minimum operating volume of 25,000 gallons would be sufficient with chlorine concentration of 0.4 mg/L and a peak hourly flow of 20 gpm (see calculations in Attachment C).

Alternate forms of disinfection, such as ultraviolet disinfection should be considered. Although a chlorine residual would still be required, the CT and dosage would decrease and could simplify the water storage situation.

Other water treatment needs include:

- The addition of a meter on the backwash line to achieve credit for a Master Meter.
- Address the filter, backwash, and filter to waste procedures. These should be clarified and a written procedure provided for the operator.
- Component upgrades if any (i.e., investigate new turbidimeters that would simplify the reporting requirements of the operator, determine if a streaming current detector is appropriate, procure a digital colorimeter for the operator).
- Investigate the reasons the soda ash system is not in use and compliance with the Lead and Copper Rule.
- Backflow prevention program review.
- Repair or replace the pressure pump.
- Treatment pump cavitation (discussed further below)
- The heat add circulation pumps should be replaced with NSF certified pumps (Grundfos UP15-29 would be a suitable choice) and installed with unions to simplify maintenance (RAVG, 2015)[2].
- One of the pressure pumps is inoperable and was valved off at the time of our site visit. If there are problems with the remaining pressure pump, the entire system would be offline until a new pump could be procured and installed.
- Low temp and no flow alarms should also be installed on the raw water line.
- The need for a utility dedicated ATV (discussed further below).

As the purpose of the March 2017 site visit did not originally include water treatment in the scope, final recommendations for design are not being made in this PER.

A follow up site visit and Conceptual Design Memorandum should be prepared to fully address achieving compliance with the SWTR. For the purposes of this PER, it is

[1] *Tracer Studies in Alaska and Chlorine Contact Tank Design*. Statewide AWWMA Conference. Dan Reichardt, PE, ADEC & Joe Hess, PE, DEHE. April 25, 2017.

[2] Trip Report – RAVG Operator Training. Senior Tribal Utility Support Specialist, ANTHC – DEHE. For travel occurring January 20th through 28th, 2015.

assumed that modifications to the existing tankage are required to provide sufficient chlorine contact time. Modifying the existing tankage will likely mean achieving a baffle factor approaching 0.5, reconciling with ADEC the peak hourly flow, and installing a flow meter on the discharge side to verify daily average flow. Also it is assumed the turbidimeters are serviced or replaced, the appropriate bag filters are installed, modifications are made to achieve credit for a master meter, and modifications are made to implement filter to waste practices.

Treatment Pump Cavitation: The treatment pump is a Goulds (3650 series) 2 hp pump in the basement of the water treatment building. The pump withdraws from the raw water storage tank and supplies the water treatment system. When the level in the raw water tank falls to 7 or 8 feet, the treatment pump cavitates, to keep running the system, the operator primes the pump with a garden hose and a plastic garbage can of potable water. It appears the existing pump has sufficient head to supply the treatment system from the raw water tank. Relocating the pump to the annex structure on the side of the raw water tank would likely eliminate the cavitation issues.

Relocating the pump will require changing the control system electrical supply (conduit run), and appurtenances. Before moving the pump, the community should verify that the annex remains heated and secure through the winter. In lieu of relocating the pump, providing necessary electrical and appurtenances, and ensuring the security of the annex, it is likely more cost effective to replace the existing pump. This PER assumes the existing treatment pump will be replaced with a pump capable of sufficient suction head.

Utility Dedicated ATV: During the March 2017 site visit, the operator and tribal administrator expressed a desire to use a portion of the grant funds to procure an ATV that would be used to transport equipment and materials to Contractor's Lake during raw water pumping. This PER assumes the cost for an ATV for this purpose.

Please note this PER addresses only items we are aware of to bring the water treatment system into compliance with SWTR. It is recommended that the CDM consider upgrading to modern standards (new turbidimeters, SCD, treatment rate controls, etc.).

ii. Alternative 2: Do Nothing

If no improvements are made to the water treatment plant, the facilities will continue to degrade until these services can no longer be provided at all. Of most importance are improvements to the treatment system to bring it into compliance with Surface Water Treatment Rules to ensure the KTC can provide safe water to all residents of the community.

b) Design Criteria

Design criteria applicable to the water treatment plant upgrades are included in the following table.

Peak Hourly Flow

The peak hourly flow used in the Status Component Inspection report is 20 gpm. Design calculations by Montgomery Watson in 2000 used 4.17 gpm for peak discharge flow for CT calculations (assuming 3,000 gal/day and a peak factor of 2.0). Per the water plant operator, they are now using between 1,000 – 2,000 gal/day but up to 3,000

gal/day when all washers are running. If a peak factor of 4.0 is applied to 3,000 gal/day, peak hourly flow would be 8.3 gpm. Detention time for each of these 3 flows is calculated in Attachment C. This criterion should be discussed with DEC before proceeding with design. For purposes of this PER, the peak hourly flow defined by DEC in the Status Component Inspection report is used.

CT Values

Assumptions for calculating CT are shown in Table 6. A chlorine concentration of 0.4 mg/L was assumed. These criteria should be verified before proceeding with design.

Table 9. Water Treatment Plant Improvements Design Criteria

Criteria	Value
Population (2016)	503 (2016 DOL Estimate)
Peak Hourly Flow	20 gpm (ADEC, 2010)
Peak Hour Flow	4.17 gpm (MW, 2000)
Existing Tank Volumes	9,150 gal (high) 4,880 gal (low)
CT Values (°C, pH, Cl mg/L)	5.0°C, 7.0 pH, 0.4 mg/L = 117.07 mg-min/L

c) Map

All alternatives for improvements to the water treatment plant would occur within those buildings, refer to Attachment B, Figure 2.

d) Environmental Impact

None of the alternatives for improvements to the water treatment plant would have an adverse environmental impact.

e) Land Requirements

All of the alternatives for improvements to the water treatment plant would occur within the existing buildings or on that property. Land requirements are not applicable.

f) Potential Construction Problems

There are no known potential construction problems.

g) Sustainability Considerations

i. Water and Energy Efficiency

Not applicable. This project does not address water and energy efficiency.

ii. Green Infrastructure

Not applicable. This project does not address stormwater.

iii. Other

Compliance with the Surface Water Treatment Rules is of high priority to ensure the community is providing safe water to residents.

h) Cost Estimates

i. Capital Costs

The estimated construction costs for Alternative 1 are listed in Table 10. Refer to Table 16 or Attachment D for a detailed breakdown. These capital costs assume a stand-alone project that is not concurrent with washeteria or lagoon work.

Table 10. Water Treatment Plant Improvements Capital Costs

Alternative	Capital Cost (2018 Dollars)
• Water Treatment System Upgrades (compliance with Surface Water Treatment Rules and other concerns). • Procure 4-Wheeler for Utility use	$665,000
• Do Nothing	$0

ii. Annual O&M Costs

Implementation of Alternative 1 will not increase annual O&M costs. Refer to Table 1 in Section 2.d listing FY16 budget for the washeteria and water treatment plant utilities.

5. SELECTION OF AN ALTERNATIVE

A present worth life cycle cost analysis has been performed using the estimated capital costs and O&M costs from Section 4.0, a real federal discount rate of 0.8% from OMB Circular A-94, updated December 2012, and an assumed life of 20 years. Salvage value is assumed to be zero after 20 years. Life cycle cost analyses for each alternative in the three areas of concern are discussed in sections 5.1 through 5.3. For each area of concern, a discussion of non-monetary factors follows.

5.1. Lagoon Berms

a) Life Cycle Cost Analysis

Table 11. Lagoon Berms Life Cycle Costs

Alternative	Capital Cost	Annual O&M Cost	Life Cycle Cost (Present Value)
Alternative 1. Repair and Rebuild.	$354,000	$7,040	$483,640
Alternative 2. Do Nothing	$0	$7,040	$129,640

b) Non-Monetary Factors

Repair of the lagoon berms is of high priority to prevent further degradation and possible breach of the berm. However, without addressing the present issues, the honeybucket disposal system will fail and this facility will become a dumping pond.

5.2. Washeteria Upgrades

a) Life Cycle Cost Analysis

Table 12. Washeteria Upgrades Life Cycle Costs

Alternative	Capital Cost	Annual O&M Cost	Life Cycle Cost (Present Value)
• Procure and Install 6 washers and 2 dryers • Laundry Facility Finishes (showers, toilets, sinks, flooring) / Sewer Gas Odors	$680,000	$54,252	$1,679,000
• Do Nothing	$0	$54,252	$999,000

b) Non-Monetary Factors

Improvements to the washeteria to upgrade washers and dryers are of high importance. Without the income from the washeteria to subsidize the water plant, the system requires subsidies.

5.3. Water Plant Upgrades

a) Life Cycle Cost Analysis

Table 13. Water Treatment Plant Upgrades Life Cycle Costs

Alternative	Capital Cost	Annual O&M Cost	Life Cycle Cost (Present Value)
• Procure 4-Wheeler for Utility use • Water Treatment System Upgrades (compliance with Surface Water Treatment Rules and other concerns)	$665,000	$74,590	$2,038,500
• Do Nothing	$0	$74,590	$1,373,500

b) Non-Monetary Factors

Improvements to the water treatment system to bring it into compliance with Surface Water Treatment Rules are very high priority. These upgrades are necessary to ensure that the Village of Kongiganak is supplying safe water to the watering point and the washeteria.

6. PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)

The following describes recommended alternatives for each of the two aspects investigated.

6.1. Lagoon Berms

a) Preliminary Project Design

The recommended alternative is to repair, to the extent possible, the erosion damage on the north berm. This alternative will involve an initial discharge of the lagoon to an elevation of approximately 15 feet. As the water levels drop, there is a risk of the honeybucket facility collapsing. Note, the project does not currently include funding for repair of the honeybucket facility if it collapses. If the honeybucket facility were to collapse into the lagoon, this would reduce the efficiency of the lagoon and pollute it with non-biodegradable items such as trash bags and buckets. Dispersing honeybucket material through the lagoon extends the time needed to discharge and complicates future discharges. Additionally, the project does not currently include funding for repair of the honeybucket facility if it collapses.

After the water level has dropped to 15 ft, the condition of the existing erosion control fabric (North American Green's SC550 Turf Reinforcement Mat) and further extent of the erosion can be assessed. Areas of erosion will be re-shaped and leveled to the extent possible. This will be done working from the top of the berm with the locally available ASV. If significant erosion extends below elevation 15 ft, this repair approach will not be possible.

A new erosion control material will be installed from elevation 15 ft to approximately 22 ft. The proposed new material is a Propex Armormax product that can be keyed at the top and rolled at the bottom. The Armormax can be secured with earth anchors. The slopes would then be re-vegetated.

b) Project Schedule

An approximate, recommended project schedule includes (assuming NTP in 2018):

- Procure berm repair materials and mobilize for barging on the August sailing
- Prepare an NOI for wastewater discharge in late spring.
- Mobilize a mechanic after break-up to repair the discharge pump and begin the lagoon discharge. The mechanic would demobe and the water/sewer operator would be responsible for maintaining the discharge.
- Approximately mid-summer, the superintendent would mobilize, commence berm repair, receive the barge materials and complete the repair.

c) Permit Requirements

ADEC would be notified of the proposed improvements and repairs. All permit requirements for discharge of the lagoon would be followed and appropriate notifications and monitoring conducted.

d) Sustainability Considerations

i. Water and Energy Efficiency

The recommended alternative does not improve water or energy efficiency.

ii. Green Infrastructure

Not applicable. This project does not address storm water.

iii. Other

Not applicable.

e) Total Project Cost Estimate (Engineer's Opinion of Probable Cost)

The estimated total project cost of Alternative 1 is $354,000.

Table 14. Lagoon Berms Capital Costs for Recommended Alternative.

Item	Description	Quantity	Unit	Unit Cost	Extended Cost
1	Lagoon Berm Repairs	4,000	Sq. Ft.	$19	$77,681
				Construction Subtotal	*$77,681*
	Other Direct Costs				
2	Construction Management & Engineering Support				$50,600
3	Engineering & Design Services				$40,000
4	Mobilization / Demobilization				$17,648
5	General Conditions				$99,429
6	Miscellaneous Utilities				$9,306
Other Direct Cost Subtotal					*$216,983*
				Project Cost Subtotal	**$294,663**
				10% VSW EMT	*$29,466*
				10% Contingency	*$29,466*
				Total Budget	**$353,596**

Notes and Assumptions:

1. *Costs are in 2019 dollars.*
2. *Eight weeks of superintendence and two round trips are required.*
3. *The lagoon will be pumped down approximately 3 feet. Superintendence is not required for the entire pumping operation.*
4. *Does not assume work is concurrent with other work in the community.*
5. *Does not include major upgrades for a project camp.*
6. *No work is to be done to the honeybucket facility.*
7. *Approximately 4,000 sq. ft. of repairs to the berm to include re-grading to the extent possible and installation of Propex Armormax erosion control fabric.*
8. *Locally available ASV is in working order. Does not assume additional heavy equipment is required.*
9. *General conditions costs include small material procurement costs, material handling and inventory, field superintendent, job clerk, project quarters rental, subsistence, office supplies, air fare, small tools and equipment, workers compensation, accounting services, etc.*

f) Annual Operating Budget

i. Income

Repairing the existing facilities will not result in income to the community.

ii. Annual O&M Costs

The annual Operations & Maintenance costs to support a sewage lagoon discharge every other year are approximately $7,040 per year.

iii. Debt Repayments

Not applicable.

iv. Reserves

Not applicable.

6.2 Washeteria

a) Preliminary Project Design

The recommended solution is Alternative 1. Alternative 1 is to upgrade the washeteria in order to provide access to washers, dryers, and showers.

Washers/Dryers: This PER Assumes 4 new washers and 2 new dryers are procured and installed and training on repair is provided. Three of the six dryers require repair (broken door, coin operation not functioning, and no heat).

Washeteria Finishes and Fixtures: Alternative 1 recommends the washeteria will receive new flooring; all four showers will be rebuilt with shower bases and surrounds; and, 2 toilets and 3 sinks will be replaced.

Sewer Gas Odors: This PER assumes that p-traps and VTRs will be inspected and replaced if necessary at the same time as the washeteria rehab. The use of waterless p-traps and the addition of a VTR can be investigated.

b) Project Schedule

An approximate, recommended project schedule includes (assuming NTP in 2018):

- Procure and mobilize washers/dryers and washeteria finish materials (flooring, etc.) for barging on the August sailing.
- Mobilize a project superintendent to set up a camp and hire a force account crew in mid-summer.
- Receive barge materials and begin washeteria repair work with anticipated completion in the fall.

c) Permit Requirements

None.

d) Sustainability Considerations

i. Water and Energy Efficiency

Not applicable. This project does not address water and energy efficiency.

ii. Green Infrastructure

Not applicable. This project does not address stormwater.

iii. Other

Not applicable.

e) Total Project Cost Estimate (Engineer's Opinion of Probable Cost)

The estimated total project cost of Alternative 1 is $680,000.

Table 15. Laundry Capital Costs for Recommended Alternative.

Item	Description	Quantity	Unit	Unit Cost	Extended Cost
1	Washers and Dryers	100	%	$747	$74,657
2	Washeteria Repairs	100	%	$1,403	$140,275
				Construction Subtotal	*$214,932*
	Other Direct Costs				
3	Construction Management & Engineering Support				$76,000
4	Engineering & Design Services				$25,000
5	Mobilization / Demobilization				$28,487
6	General Conditions				$152,175
7	Miscellaneous Utilities				$18,548
Other Direct Cost Subtotal					*$300,211*
				Project Cost Subtotal	**$515,142**
				10% VSW EMT	*$103,028*
				10% Contingency	*$61,817*
				Total Budget	**$679,987**

Assumptions and Notes:

1. *Costs are in 2018 dollars.*
2. *Does not assume work is concurrent with other work in the community.*
3. *Assumes structural work is not required.*
4. *General conditions costs include small material procurement costs, material handling and inventory, field superintendent, job clerk, project quarters rental, subsistence, office supplies, air fare, small tools and equipment, workers compensation, accounting services, etc.*

f) Annual Operating Budget

i. Income

The utility charges $5 per washer load, $3 per dryer load, and $3 per shower. Approximate monthly revenues are currently $6,600. The tribal administrator reports revenues are down by up to 2/3rds due to broken washers and dryers (Andrew, 2017). With these assumptions, revenues after improvements would increase to $20,000 monthly.

ii. Annual O&M Costs

Annual O&M costs will not increase in Alternative 1. Present O&M costs for the washeteria have been quantified to the extent provided by the KTC in Table 2.

iii. Debt Repayments

Not applicable.

iv. Reserves

Not applicable.

6.3. Water Plant Improvements

g) Preliminary Project Design

The recommended solution is Alternative 1. Alternative 1 is to provide the repairs and upgrades that are necessary to comply with the SWTR in the water treatment plant.

Surface Water Treatment Rule Concerns: To bring the treatment plant back into compliance with the SWTR, a detailed investigation of the facility should be undertaken by the design team. The deficiencies described within the PER were noted by ADEC audits and during the PER site visit in March, 2017. However, treatment plant upgrades was not initially identified as a focus of investigation for the PER. A conceptual design memo will include the following:

- Define the water usage rate with DEC given contradictions between the design and the latest Status Component Inspection.
- Identify the source of lead/copper exceedances and recommend a solution (perhaps copper piping replacement).
- Physically inspect the media in the filters and provide a recommendation on replacement.
- Determine if a SCD is appropriate.
- Define and examine DBP exceedances.
- Define and provide recommendations of improvements for backwash procedures, equipment, and controls.
- Specify master meter.
- Investigate the feasibility of replacing existing turbidimeters.
- Propose a solution to DEC for meeting CT requirements and obtain feedback.

It is anticipated that this further investigation will find the following improvements/determinations should be made:

- Pre and post filtration bag filters are not being used. The existing coagulation and filtration system should be evaluated and a determination made on the necessity of bag filters. Bag filtration adds to the complexity and cost of the system.
- Evaluate upgrading the coagulation system (i.e., addition of a streaming current detector). Cost estimate assumes a streaming current detector is added.
- Ensure turbidimeters are calibrated. Evaluate whether upgrades to the turbidimeters would be advantageous. Cost estimate assumes upgrading 4 turbidimeters.
- Define a peak water flow rate based upon records from the operator and updated calculations that reflect present population, future population, water use, and the use by the school. This criterion should be discussed with ADEC and used to define the actual CT that is required.
- With an established CT, the present contact storage can be re-evaluated. Re-plumbing or addition of a method to increase baffle factor are the likely outcomes. A tracer study may also be required. The PER cost estimate assumes re-use of the tanks.
- Install a meter on the backwash line to achieve credit for a Master Meter.
- Investigate backflow prevention measures.
- Address the filter, backwash, and filter to waste procedures. These should be clarified and a written procedure provided for the operator.

- Investigate the utilities history of reporting and recordkeeping. The operator may need assistance getting current and establishing future methods.

Other Water Treatment Plant Concerns: Other improvements included in Alternative 1 are:

- The heat add circulation pumps should be replaced with NSF certified pumps (Grundfos UP15-29 would be a suitable choice) and installed with unions to simplify maintenance.
- The in-operable pressure pump will be repaired or replaced.
- Low temp and no flow alarms will be installed on the raw water line.
- An ATV will be procured for transporting equipment and materials to Contractor's Lake during raw water pumping.
- A new treatment pump will be procured that has sufficient suction head to draw water from the raw water storage tank and supply water to the treatment system.

h) Project Schedule

An approximate, recommended project schedule includes (assuming NTP in 2018):

- Procure design services to include a Conceptual Design Memorandum and then full design of water treatment improvements. The site visit could occur in the spring or early summer of 2018 with a CDM complete by fall and design complete by mid-winter.
- Apply for an Approval to Construct from ADEC in mid-winter.
- Procure and mobilize water treatment equipment and materials from late winter to early spring 2019 with anticipated barging on the May sailing.
- Mobilize a superintendent and specialty contractors in early May 2019.
- Receive project materials and begin construction water treatment improvements with completion during the summer of 2019.
- Prepare Operations & Maintenance manuals, record drawings, and request a Final Approval to Operate by fall 2019.
- Receive final Approval to Operate the upgraded water treatment plant by fall 2020.

i) Permit Requirements

An Approval to Construct and an Approval to Operate will be required from ADEC for the watering plant upgrades.

j) Sustainability Considerations

v. Water and Energy Efficiency

Not applicable. This project does not address water and energy efficiency.

vi. Green Infrastructure

Not applicable. This project does not address stormwater.

vii. Other

Compliance with the Surface Water Treatment Rules is of high priority to ensure the community is providing safe water to residents.

k) Total Project Cost Estimate (Engineer's Opinion of Probable Cost)

The estimated total project cost of Alternative 1 is $665,000.

Table 16. Water Treatment Plant Capital Costs for Recommended Alternative.

Item	Description	Quantity	Unit	Unit Cost	Extended Cost
1	Utility 4-Wheeler	100	%	$164	$16,374
2	Water Treatment Upgrades	100	%	$1,163	$116,280
				Construction Subtotal	*$132,654*
	Other Direct Costs				
3	Construction Management & Engineering Support				$76,000
4	Engineering & Design Services				$150,000
5	Mobilization / Demobilization				$11,744
6	General Conditions				$117,549
7	Miscellaneous Utilities				$15,507
Other Direct Cost Subtotal					*$370,801*
				Project Cost Subtotal	**$503,454**
				10% VSW EMT	*$100,691*
				10% Contingency	*$60,414*
				Total Budget	**$664,559**

Assumptions and Notes:

1. *Costs are in 2018 dollars.*
2. *Does not assume work is concurrent with other work in the community.*
3. *Design costs do not include re-design of the treatment system to address DBPs, lead, or copper.*
4. *Costs do not include replacement of filter media or filters.*
5. *General conditions costs include small material procurement costs, material handling and inventory, field superintendent, job clerk, project quarters rental, subsistence, office supplies, air fare, small tools and equipment, workers compensation, accounting services, etc.*

l) Annual Operating Budget

viii. *Income*

All income for the water treatment plant comes from washeteria revenues. For information about these revenues refer to Section 6.1.f.i.

ix. *Annual O&M Costs*

Annual O&M costs will not increase in Alternative 1. Present O&M costs for the water treatment plant have been quantified to the extent provided by the KTC in Table 4.

x. *Debt Repayments*

Not applicable.

xi. *Reserves*

Not applicable.

7. CONCLUSIONS AND RECOMMENDATIONS

Water Treatment

The water treatment facility is not meeting the requirements of the Surface Water Treatment Rule and requires upgrades or modifications to instruments, equipment, and the contact tanks. Without adequate disinfection residents could be exposed to unsafe water. It is the recommendation of this PER that the community upgrade the water treatment facility.

Washeteria

The Kongiganak Tribal Council subsidizes the water treatment facility with revenue from the washeteria. To keep the water treatment facility in operation and to provide showers, toilets, and laundry facilities to the residents of Kongiganak the washeteria is in need of rehabilitation. These repairs should be completed in conjunction with the water treatment facilities as neither can function alone, however the cost estimates provided by this PER assume stand-alone projects.

Lagoon

The sewage lagoon berms must be repaired in order to ensure their structural integrity and that there is not a breach of the lagoon in the future. Given the level of funding available, Alternative 1, repairs to the extent of the existing grant, is recommended until funding for a permanent solution can be obtained.

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Attachment A

March 2017 Trip Report

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Summit Consulting Services Trip Report

DATE: 4/14/17 **REPORTER:** Heather Gross

LOCATION/PROJECT: **Kongiganak, Preliminary Engineering Report Investigation**

AIR CARRIERS/ROUTING:
3/27/17: Travel from Tok to Anchorage
3/28/17: Alaska Airlines Flight 41 ANC to BET
3/28/17: Grant Air, Flight 251 BET to KKH
3/29/17: Grant Air, Flight 253 KKH to BET
3/29/17: Alaska Airlines Flight 46 BET to ANC
3/30/17: Travel from Anchorage to Tok

PURPOSE: Preliminary Engineering Report (PER) Investigations.

ACCOMPANIED BY: Julia Raymond, SCS

CONTACTS: Roland Andrew, Tribal Administrator
John Phillip Jr., Water and Sewer Operator

MAJOR ACCOMPLISHMENTS:
- Investigation of the wastewater lagoon.
- Attend Tribal Council meeting.

FOLLOW-UP ITEMS:
- Complete PER.

DISCUSSION:
- Traveled to ANC on 3/27/17 and to Kongiganak on 3/28/17 leaving at 6:20 am and arriving at 9:00am.

Wastewater Investigations

- Obtained a power auger and proceeded to the lagoon. Using a grade rod and level, the elevation of the ice was measured off of a benchmark on the lagoon berm at 18.3 ft. Observations of the visible erosion and condition of the honeybucket dump facility were noted.
- Six holes were drilled in the lagoon to determine the extent of erosion below the waterline. Refer to attached site plan and profiles (note adjustments to the ice level

shown on the profiles will be corrected which will lessen the discrepancy between design and observed elevation by approximately 0.4 ft). It appears material has sloughed off of the berm at the water surface and could be accumulating between 15 and 25 feet further down the berm. It does not appear that erosion has occurred at depth. The area of worst visible erosion (above the water line) has cut into the berm up to 3 feet. This should be verified after break-up as a precise measurement could not be taken with the presence of drifting snow.

- The honeybucket dump facility is completely full. The dumping structure appears to be exhibiting some wear—especially where the buckets are pounded on the chute while dumping. The tribal administrator, Roland Andrew, reported sloughing of material from beneath the chute. This area was covered in frozen honeybucket material and drifting snow during the site visit and thus could not be confirmed.
- The other berms were examined and no evidence of erosion could be seen. This should be verified after break-up as drifting snow could be hiding cuts in the bank. The operator reported he believes the only area of erosion is at the north berm.

Watering Point Investigations

- John Phillip Jr. showed us several potential locations in the new housing area where an additional watering point would benefit residents. Three sites were investigated: between houses 101 and 105, west end of the subdivision (lift station site), and between houses 89 and 91.
- We visited the existing watering point and found it to be in good condition. The decktite on the exterior was slightly damaged. The community reported that this watering point is working well and is often used. They only issue is when they forget to empty the coin bin. Roland also noted that he had not observed any congestion or people having to wait their turn to get water.

Washeteria & Water Treatment Plant Investigations

- Roland gave us a tour of the washeteria. Throughout the building, the flooring is deteriorating. The showers are deteriorating and mold damage is visible. Only one of the three showers is in use. One of the toilets is out of operation.
- They have a shortage of washer capacity and are unable to meet the demand of the community. The washeteria operates a wait list for those who want to wash clothes and everyone is limited to two bags. Of the dryers, #2, 5, and 6 are working, #1 and 4 are cold air, and #3 is missing the door. The coin-operation does not work reliably on the dryers. Only two of the 6 washers are working and have to be partially filled with water manually.
- John Phillip Jr., toured the water plant with us. He reported that due to waiting for spare parts for the raw water pump, the community was only able to pump for a short time last fall. There was 3 feet of water remaining in the tank at the time of our visit and the operator thought this might last until he is able to pump again. Their general water usage is 1,000 to 2,000 gallons/day depending on how many washers are working in the washeteria. The operator has to prime the raw water pump every time he treats water.
- The bag filters are not in use and the operator reported that he is running the media filters in series instead of parallel. He is using polymer and chlorine. He has

ordered the calibration kits for the turbidimeters and they are onsite. However, he is waiting for the RMW to assist with calibrating them.

Council Meeting

- A council meeting was held at 3 pm to discuss the objectives of the PER, the results of our trip, and the next steps going forward. Notes from this meeting include:
- The consensus in the community was that a watering point at the west end of new housing would be of little benefit because of the proximity to the existing watering point. Two locations were identified at the east end of the subdivision. The benefits of this area include: this is the area with the highest number of elders, it is the furthest from the existing watering point, and the direction of community growth will be to the east and northeast. During the council meeting, one of these sites was requested by the council (between houses 89 and 91) and will be used as an alternative in the PER.
- The council did not feel that a paid water delivery service would be feasible. They have previously attempted to provide service for honeybucket pickup and for garbage collection, but both failed due to lack of interest in the fees. The council stated that these services were not used frequently enough to support the program even when fees were dropped to $5.
- The council's highest priority in the washeteria are new washers. They would prefer 3 to 4 non-programmable, large capacity washers. We discussed the sewer odor and the WTP issues identified by DEC. These issues will be discussed in the PER.
- Alternatives to address the lagoon were discussed. The council is concerned that the existing honeybucket disposal facility is collapsing and will not last long enough for a project to repair it. They would like to see the honeybucket facility moved away from the community.

- Traveled from KKH to ANC on 3/29/17 leaving at 5:00 pm and arriving at 10:00 pm.
- Traveled from ANC to Tok on 3/30/17.

Attachments: Photo Log

Cc (electronic copies): SCS Project Files - SCS Tok and Anchorage
Susan Randlett, VSW, susan.randlett@alaska.gov
Dave Cramer, scsdac@aol.com
Parke Ruesch, pruesch@scsalaska.com
Julia Raymond, jklukevich@scsalaska.com
Tok Office, summitctok@aol.com

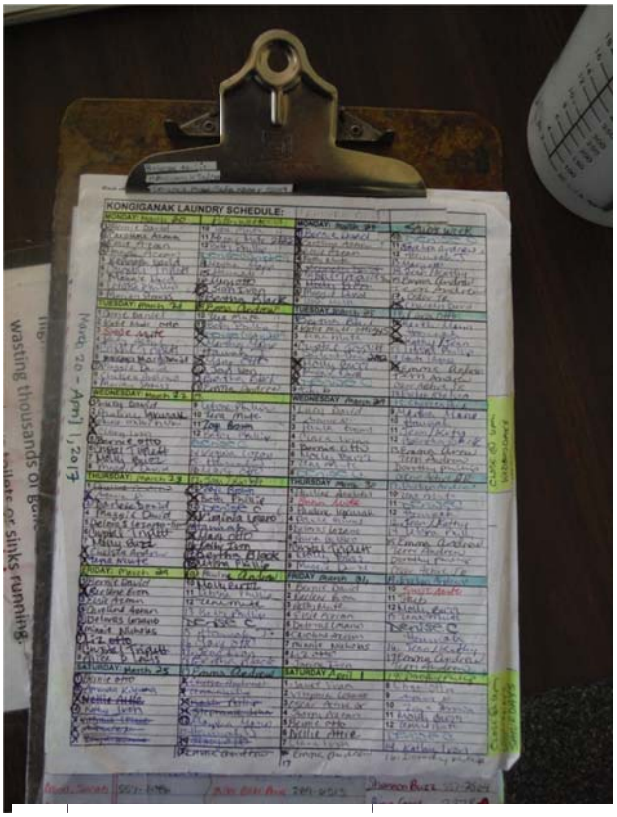
Photo Log

Photos of the existing condition of honeybucket facility (above) and during construction (below). Note that a second fence panel was added to the height of the facility from what is shown below. Accumulated waste and water level are now up to the top of the second fence panel height.

Photo of erosion during summer months. This erosion is exhibiting calving of the berms above the erosion blanket. Photo provided by Susan Randlett.

View of north berm from mid-berm at the northwest corner. The area below the figure standing on top of the berm is the area with the greatest erosion.

Measuring depth of ice, depth of water, and elevation of lagoon bottom (or berm wall).



The waiting list for the laundromat.

Washers (left picture) and dryers (right picture) in the washeteria.

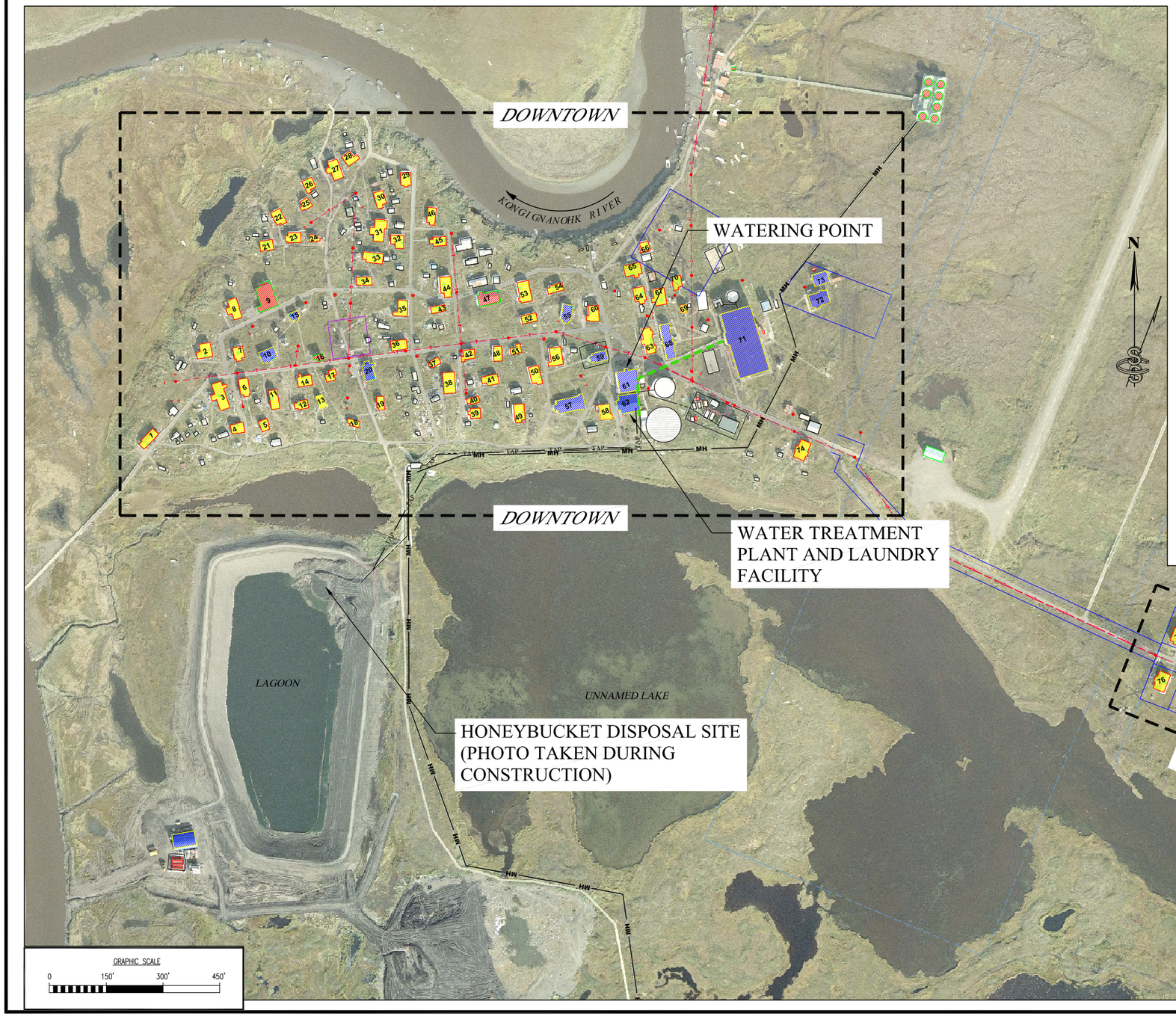
Photos on this page show toilet out of operation, disintegrating walls in showers, and deteriorated condition of flooring in the washeteria.

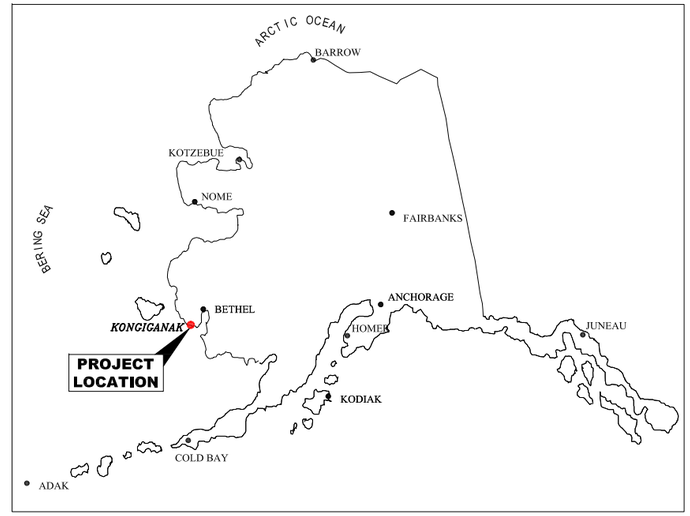
Attachment B

Figures

LEGEND

- EXISTING GRAVITY SEWER
- MH — MARINE HEADER
- TAP — TAP — EXISTING ABOVE GROUND GRAVITY SEWER: ARCTIC PIPE ON T-SUPPORTS
- ABOVE GROUND POWER LINE
- BURIED POWER LINE
- ELECTRIC POLE
- RESIDENTIAL BUILDING
- COMMERCIAL BUILDING
- PUBLIC BUILDING





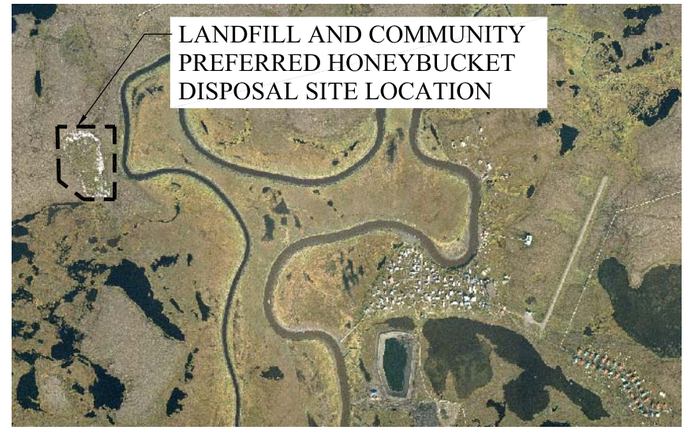


FIGURE 1

DATE: 04/16/2018
DRAWN BY: JK
CHECKED BY: HG
SCALE: AS NOTED

CITY OF KONGIGANAK
PRELIMINARY ENGINEERING REPORT
GENERAL OVERVIEW

SUMMIT CONSULTING SERVICES Inc.

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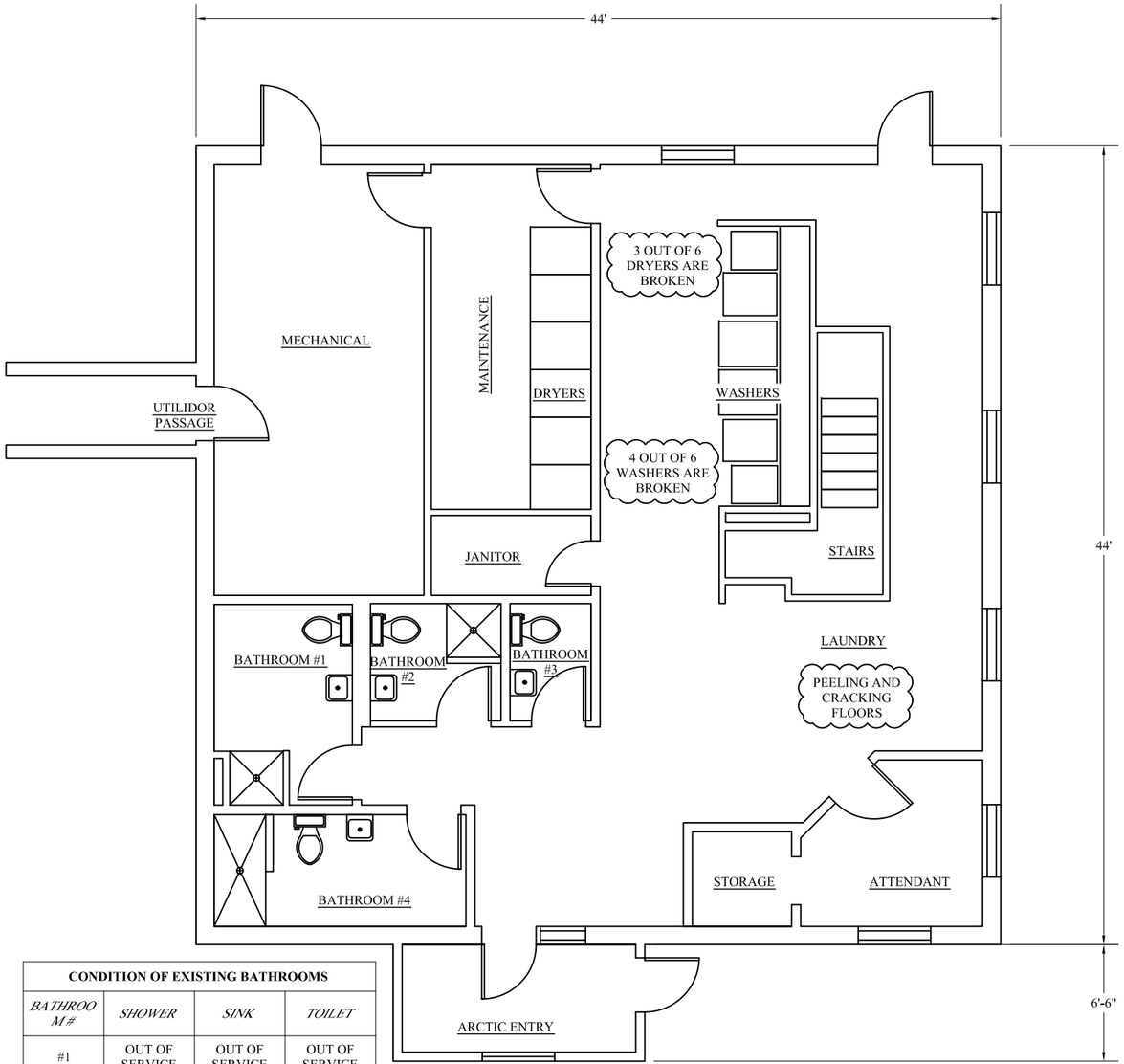
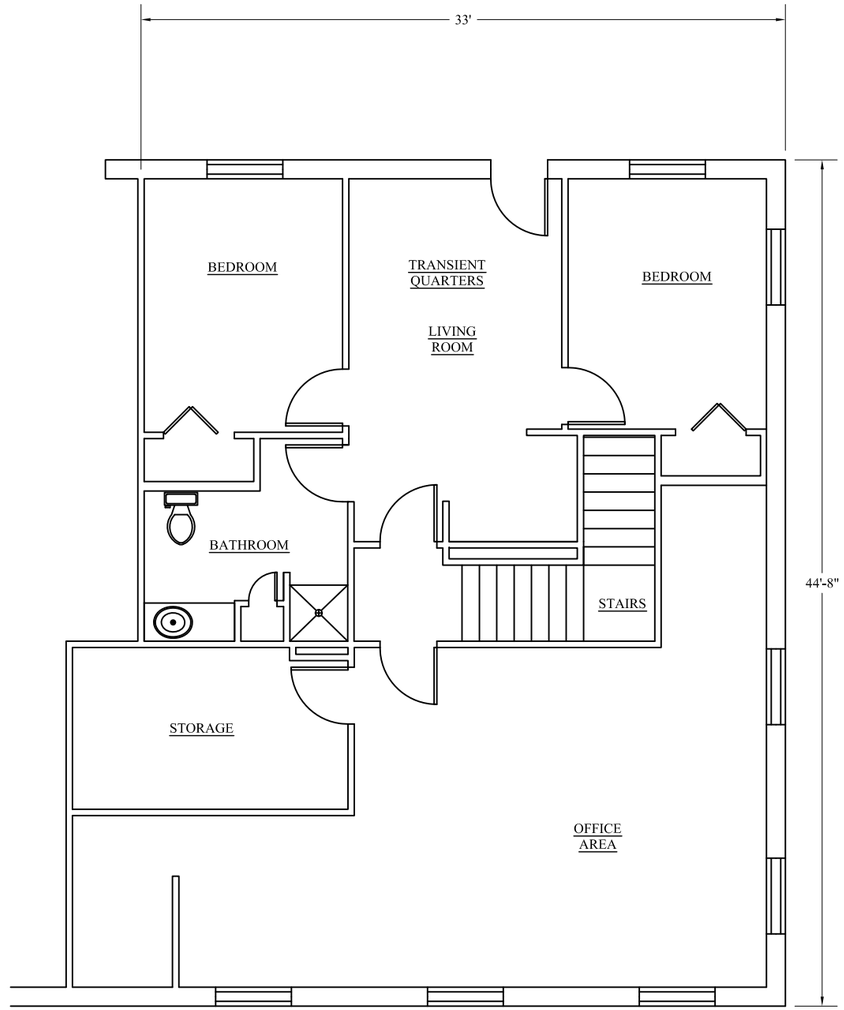


CONDITION OF EXISTING BATHROOMS			
BATHROOM #	*SHOWER*	*SINK*	*TOILET*
#1	OUT OF SERVICE	OUT OF SERVICE	OUT OF SERVICE
#2	OUT OF SERVICE	OUT OF SERVICE	OUT OF SERVICE
#3	N/A	OUT OF SERVICE	IN SERVICE
#4	OUT OF SERVICE	IN SERVICE	IN SERVICE

1 - FIRST FLOOR PLAN VIEW
SCALE:NTS



2 - SECOND FLOOR PLAN VIEW
SCALE:NTS

FIGURE 2

DATE: 04/16/2018
DRAWN BY: JK
CHECKED BY: HG
SCALE: AS NOTED

CITY OF KONGIGANAK

PRELIMINARY ENGINEERING REPORT

EXISTING LAUNDRY FACILITY

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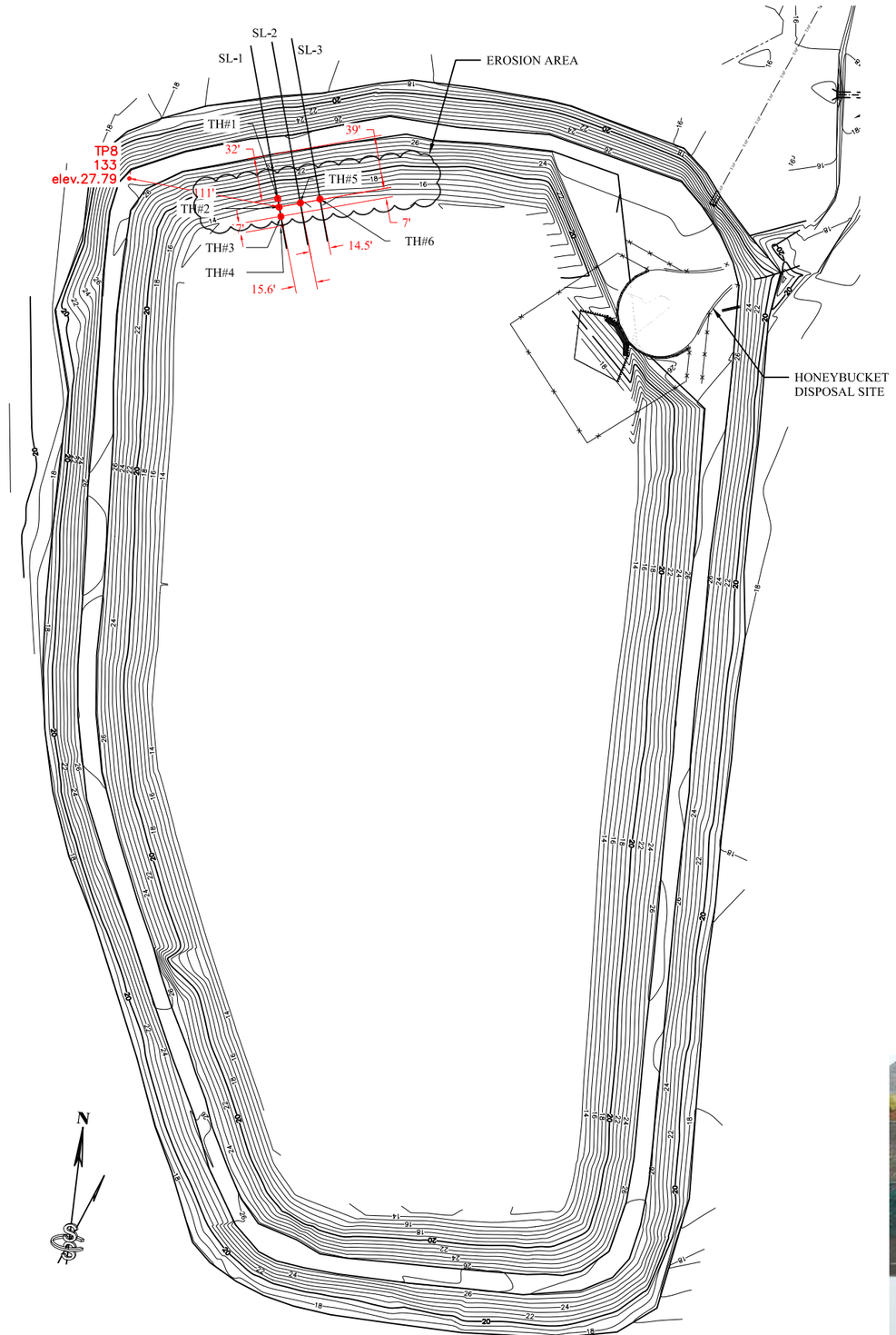
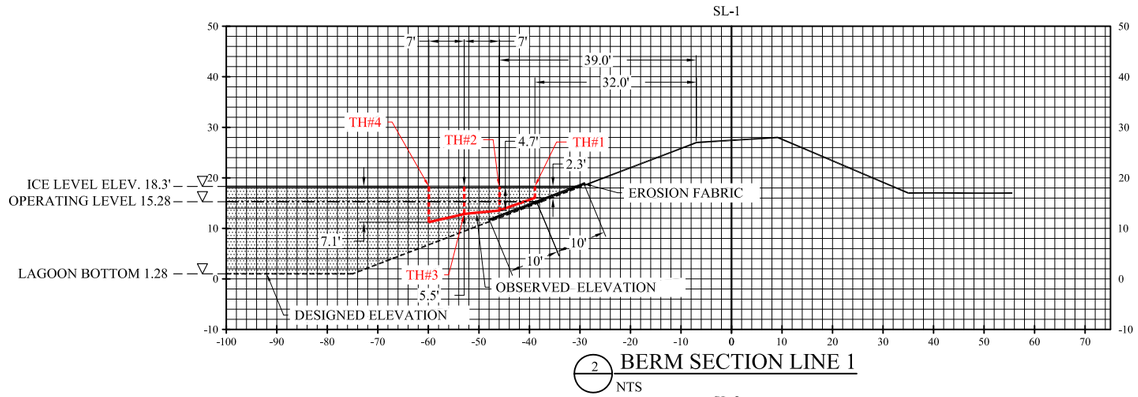


NOTE: PLAN VIEW IS BASED ON JUNE, 2007 SURVEY PERFORMED BY ALASKAN CONSULTING SURVEYORS. CONTOUR LINES ARE SHOWN DOWN TO THE WATER LEVEL AT THE TIME OF SURVEY.

1 PLAN VIEW
NTS



2 BERM SECTION LINE 1
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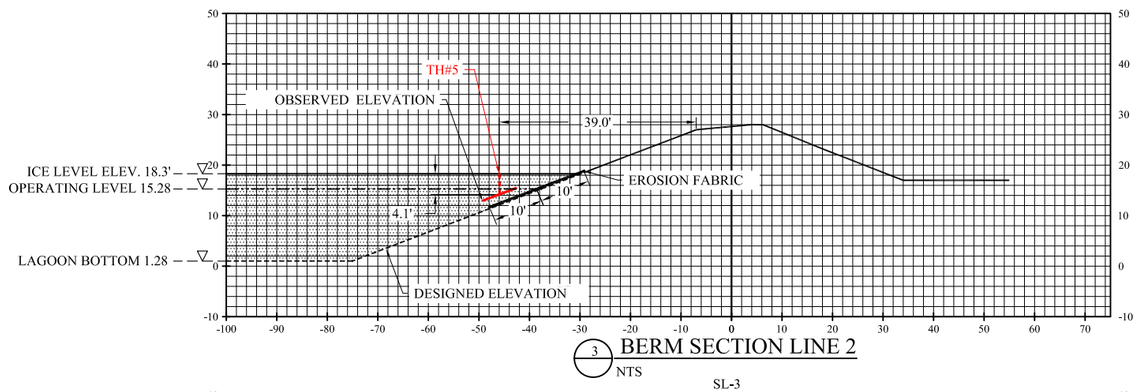

3 BERM SECTION LINE 2
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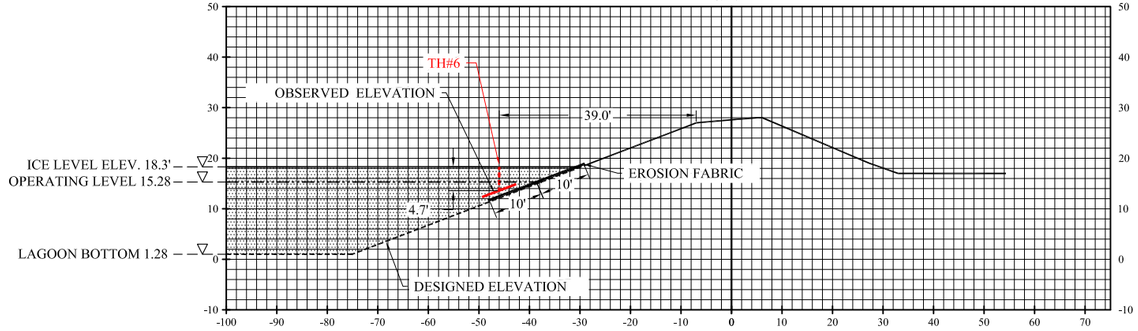

4 BERM SECTION LINE 3
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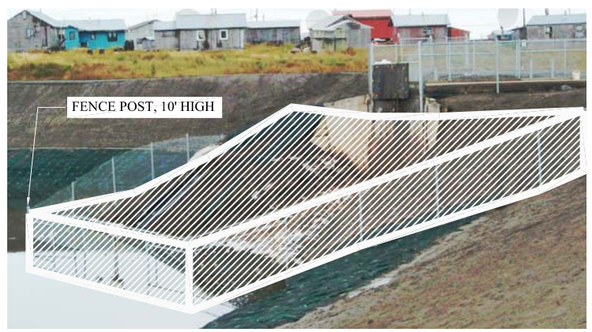
5 EXISTING HONEYBUCKET DISPOSAL AREA 9-19-2006
NTS



6 APPROXIMATE WASTE ACCUMULATION
NTS

FIGURE 3

DATE: 04/16/2018
DRAWN BY: JK
CHECKED BY: HG
SCALE: AS NOTED

CITY OF KONGIGANAK
PRELIMINARY ENGINEERING REPORT INVESTIGATION
PRELIMINARY ENGINEERING REPORT
SEWER LAGOON BANK EROSION

SUMMIT
CONSULTING SERVICES Inc.

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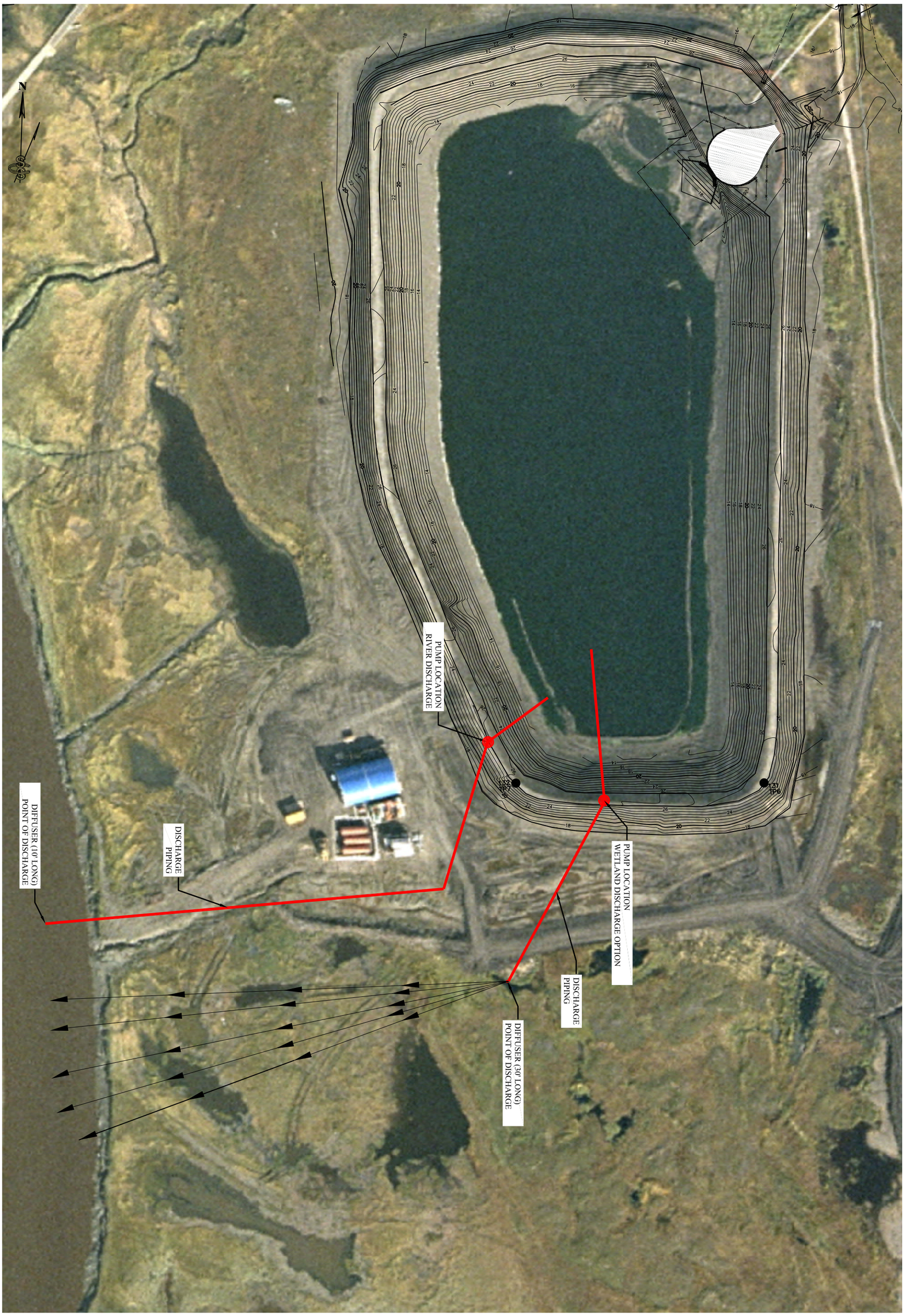

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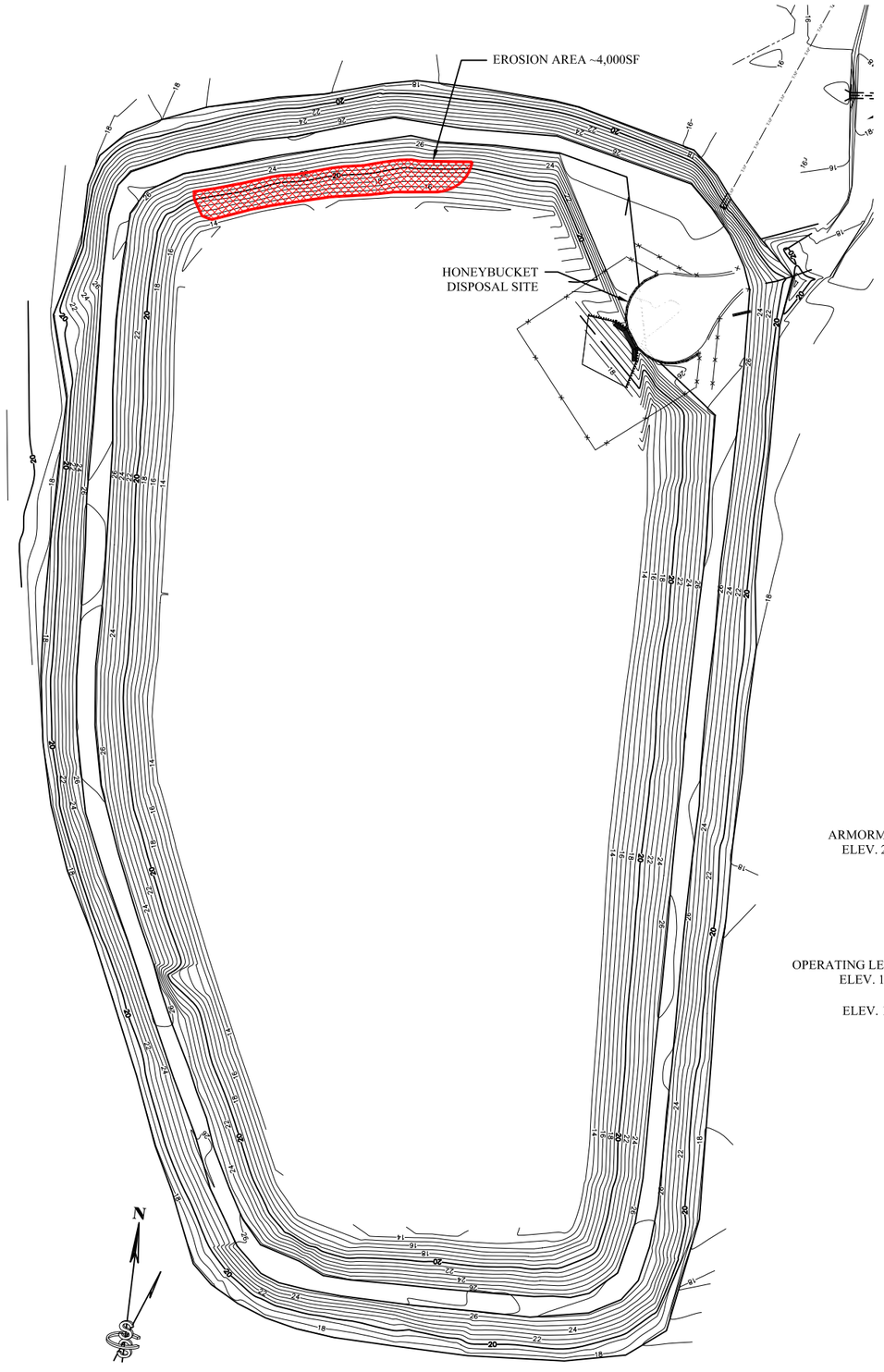
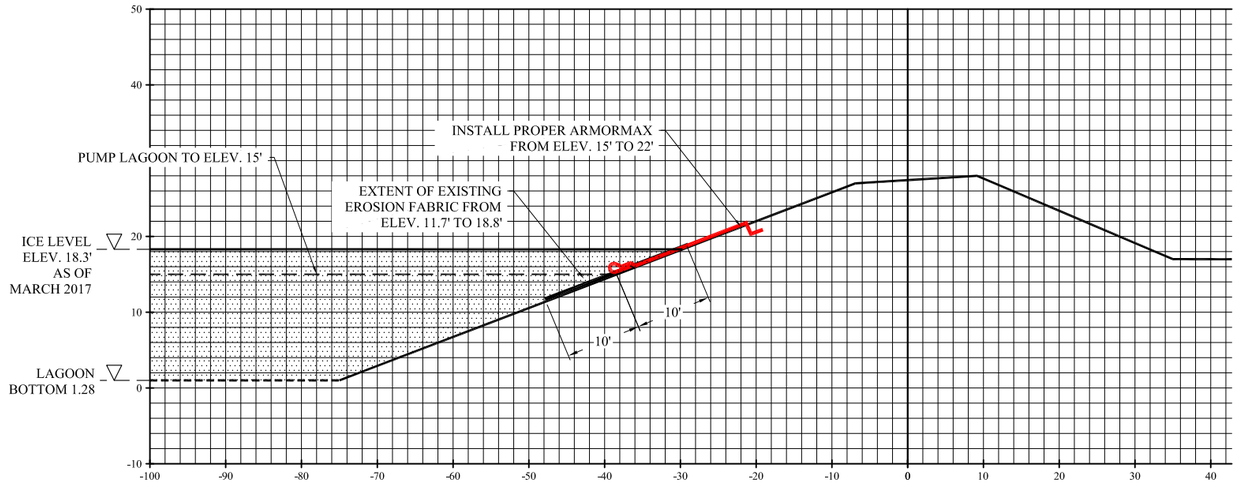
CITY OF KONGIGANAK
PRELIMINARY ENGINEERING REPORT
SEWER LAGOON DISCHARGE OPTIONS

FIGURE 4

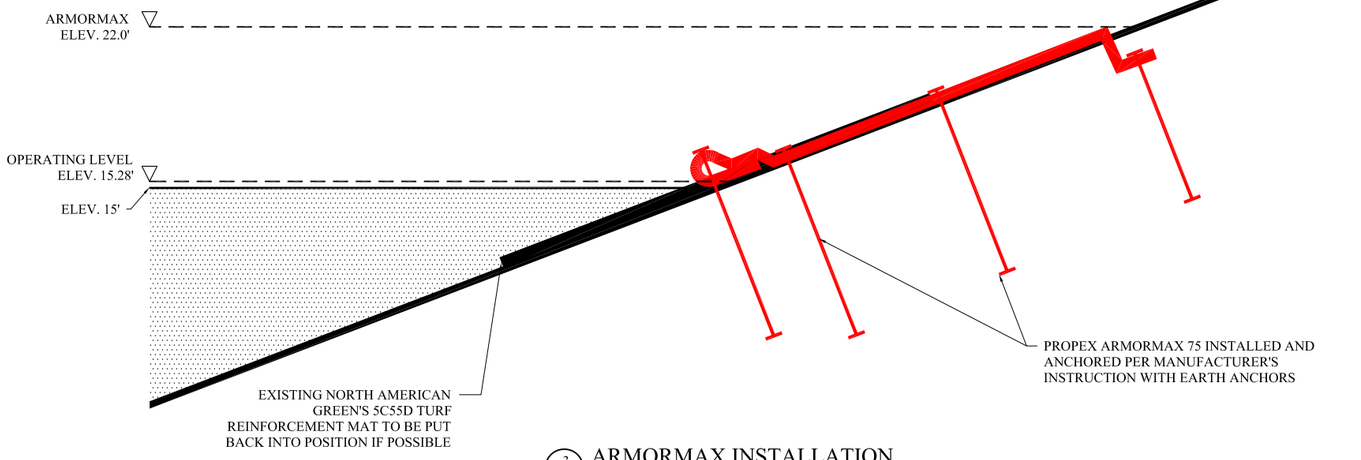
DATE: 04/16/2018
DRAWN BY: JK
CHECKED BY: HG
SCALE: AS NOTED



1 LAGOON REPAIR LOCATION PLAN
NTS



2 LAGOON BERM REPAIR SECTION
NTS



3 ARMORMAX INSTALLATION
NTS

FIGURE 5

DATE: 04/13/2018
DRAWN BY: JK
CHECKED BY: HG
SCALE: AS NOTED

CITY OF KONGIGANAK
PRELIMINARY ENGINEERING REPORT
SEWER LAGOON REPAIR ALTERNATIVE 1

SUMMIT CONSULTING SERVICES Inc.

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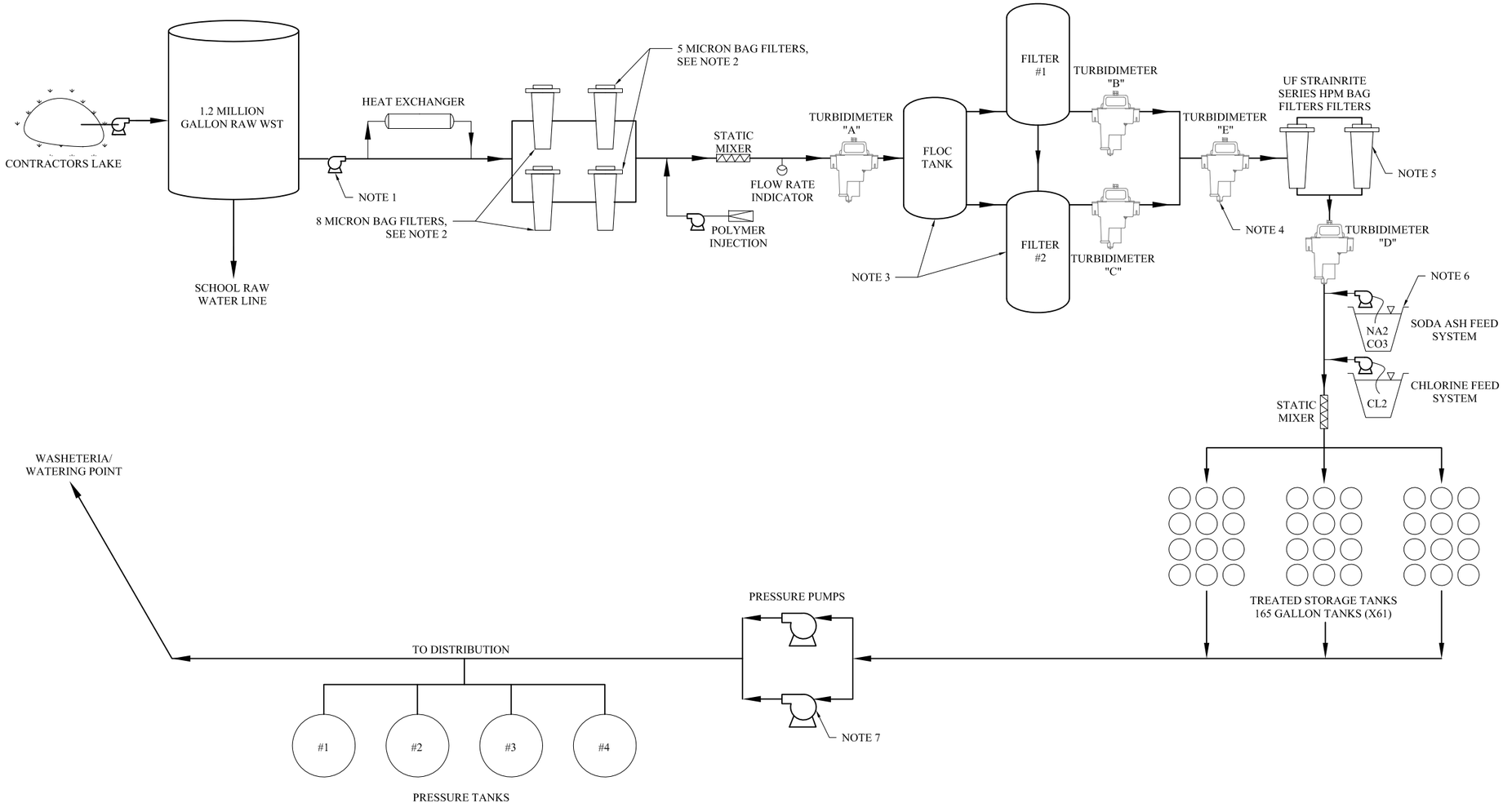

NOTES:

1. TREATMENT PUMP IS A 2HP GOULDS PLACED ON THE FIRST FLOOR. PUMP HAS INSUFFICIENT NPSH TO OPERATE CORRECTLY AT LOWER TANK LEVELS, BELOW 7-8 FT.
2. NONE OF THE BAG FILTERS ARE IN USE.
3. FILTERS WERE BEING OPERATED IN SERIES.
4. HATCH 1720E TURBIDIMETERS IN USE BUT NOT SERVICED.
5. GIARDIA FILTER NOT IN USE.
6. SODA ASH SYSTEM NOT IN USE. OPERATOR NO LONGER HAS A HAND HELD PH METER.
7. ONE OF THE PRESSURE PUMPS IN INOPERABLE.

FIGURE 6

DATE: 04/11/2018
DRAWN BY: JK
CHECKED BY: HG
SCALE: AS NOTED

CITY OF KONGIGANAK

PRELIMINARY ENGINEERING REPORT

WATER SYSTEM AK2271025 SITE SCHEMATIC

SUMMIT CONSULTING SERVICES Inc.

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Attachment C

Calculations

Honeybucket Disposal Facility Calculations

	Present Population		20-Yr Future Population	
	503		613	
Total Occupied Households (DCCED, 2017)	94	Homes	115	Homes
Honeybucket Generation Rate	0.5	Buckets/house/day	0.5	Buckets/house/day
One honeybucket =	4.5	gal	4.5	gal
One honeybucket =	0.6	ft3	0.6	ft3
Honeybucket Volume =	28.2	ft3/day	34.5	ft3/day
Honeybucket Volume =	10,293	ft3/yr	12,593	ft3/yr
HB Pit Length	50	ft	50	ft
HB Pit Width	10	ft	10	ft
HB Pit Depth (available for disposal)	17	ft	17	ft
HB Pit Volume	8,500	ft3	8,500	ft3
Days of Storage (Not including dewatering)	301	Days	246	Days

Dewatering may reduce volume by approximately 50%, prolonging life of the trench.

Days of Storage (Including dewatering)	452	Days	370	Days
	1.2	Yrs.	1.0	Yrs.

They will use approximately 8 trenches in the first 10 years, with 7 trenches remaining = 17 years.

Contact Time Calculations - Kongiganak Water Storage Tanks

Existing 150 Gallon Water Storage Tanks

Water Usage				
Qpeak		20 gpm		
Future (piped water system) peak flow (MW, 2000)				
Treated WST				
Nominal Tank Volume (165 gal tanks, 150 gal useable)		10,065 gal		
Volume @ Lowest OL (Assume low level = 80 gal)		4,880 gal		
B (baffling factor) =		0.1		
Effective Storage (B x Standby Storage)		488 gal		
Theoretical Detention Time (Contact Storage / Qpeak)		24 min		
CT Required				
Log Inactivation required by Disinfection	1			
a = (-0.0693 * T)	-0.3465			
T =		5.00 deg C		
T =	41	deg F		
b = (0.361 * pH)	2.527			
pH =	7			
c = (0.113 * cl concentration in mg/L)		0.0452 mg/L		
Cl concentration	0.4	mg/L		
CT = (Log)(5.057)(e^a)(e^b)(e^c) =		46.8 mg-min/L		
Required Contact Time (CT / Cl Residual)	117.07	min		
Theoretical Detention Time	24	is < than	CT	117.07

Water Usage				
Qpeak		4.17 gpm		
Self haul peak flow (MW, 2000)				
Treated WST				
Nominal Tank Volume (165 gal tanks, 150 gal useable)		10,065 gal		
Volume @ Lowest OL (Assume low level = 80 gal)		4,880 gal		
B (baffling factor) =		0.1		
Effective Storage (B x Standby Storage)		488 gal		
Theoretical Detention Time (Contact Storage / Qpeak)		117 min		
CT Required				
Log Inactivation required by Disinfection	1			
a = (-0.0693 * T)	-0.3465			
T =		5.00 deg C		
T =	41	deg F		
b = (0.361 * pH)	2.527			
pH =	7			
c = (0.113 * cl concentration in mg/L)		0.0452 mg/L		
Cl concentration	0.4	mg/L		
CT = (Log)(5.057)(e^a)(e^b)(e^c) =		46.8 mg-min/L		
Required Contact Time (CT / Cl Residual)	117.07	min		
Theoretical Detention Time	117	is =	CT	117.07

Water Usage					
Qpeak		8.33	gpm		
Proposed Qpeak					
Existing Avg. Daily use is 2,000 to 3,000 gal. =		3,000	gal		
Avg. Flow		2.08	gpm		
Qpeak = 4.0 x Qavg =		8.33	gpm		
Treated WST					
Nominal Tank Volume (165 gal tanks, 150 gal useable)		10,065	gal		
Volume @ Lowest OL (Assume low level = 80 gal)		4,880	gal		
B (baffling factor) =		0.1			
Effective Storage (B x Standby Storage)		488	gal		
Theoretical Detention Time (Contact Storage / Qpeak)		59	min		
CT Required					
Log Inactivation required by Disinfection		1			
a = (-0.0693 * T)		-0.3465			
T =		5.00	deg C		
T =		41	deg F		
b = (0.361 * pH)		2.527			
pH =		7			
c = (0.113 * cl concentration in mg/L)		0.0452	mg/L		
Cl concentration		0.4	mg/L		
CT = (Log)(5.057)(e^a)(e^b)(e^c) =		46.8	mg-min/L		
Required Contact Time (CT / Cl Residual)		117.07	min		
Theoretical Detention Time		59	is < than	CT	117.07

Contact Time Calculations - Kongiganak Water Storage Tanks

New 40,000 Gallon Water Storage Tank

Water Usage			
Qpeak	20	gpm	
Treated WST			
Nominal Tank Volume	40,053	gal	
Volume @ Lowest OL	25,000	gal	
B (baffling factor) =	0.1		
Effective Storage (B x Standby Storage)	2,500	gal	
Theoretical Detention Time (Contact Storage / Qpeak)	125	min	
CT Required			
Log Inactivation required by Disinfection	1		
a = (-0.0693 * T)	-0.3465		
T =	5.00	deg C	
T =	41	deg F	
b = (0.361 * pH)	2.527		
pH =	7		
c = (0.113 * cl concentration in mg/L)	0.0452	mg/L	
Cl concentration	0.4	mg/L	
CT = (Log)(5.057)(e^a)(e^b)(e^c) =	46.8	mg-min/L	
Required Contact Time (CT / Cl Residual)	117.07	min	
Theoretical Detention Time	125	is > than CT	117.07

Water Usage			
Qpeak	4.17	gpm	
Treated WST			
Nominal Tank Volume	40,053	gal	
Volume @ Lowest OL	25,000	gal	
B (baffling factor) =	0.1		
Effective Storage (B x Standby Storage)	2,500	gal	
Theoretical Detention Time (Contact Storage / Qpeak)	600	min	
CT Required			
Log Inactivation required by Disinfection	1		
a = (-0.0693 * T)	-0.3465		
T =	5.00	deg C	
T =	41	deg F	
b = (0.361 * pH)	2.527		
pH =	7		
c = (0.113 * cl concentration in mg/L)	0.0452	mg/L	
Cl concentration	0.4	mg/L	
CT = (Log)(5.057)(e^a)(e^b)(e^c) =	46.8	mg-min/L	
Required Contact Time (CT / Cl Residual)	117.07	min	
Theoretical Detention Time	600	is > than CT	117.07

Attachment D

Cost Estimates, Operation & Maintenance Costs, and Life Cycle Costs

Lagoon Berms Capital Costs for Recommended Alternative.

Item	Description	Quantity	Unit	Unit Cost	Extended Cost
1	Lagoon Berm Repairs	4,000	Sq. Ft.	$19	$77,681
Construction Subtotal					*$77,681*
	Other Direct Costs				
2	Construction Management & Engineering Support				$50,600
3	Engineering & Design Services				$40,000
4	Mobilization / Demobilization				$17,648
5	General Conditions				$99,429
6	Miscellaneous Utilities				$9,306
Other Direct Cost Subtotal					*$216,983*
Project Cost Subtotal					**$294,663**
				10% VSW EMT	*$29,466*
				10% Contingency	*$29,466*
				Total Budget	**$353,596**

Assumptions:

1. Costs are in 2019 dollars.
2. Eight weeks of superintendence and two round trips are required.
3. The lagoon will be pumped down approximately 3 feet. Superintendence is not required for the entire pumping operation.
4. Does not assume work is concurrent with other work in the community.
5. Does not include major upgrades for a project camp.
6. No work is to be done to the honeybucket facility.
7. Approximately 4,000 sq. ft. of repairs to the berm to include re-grading to the extent possible and installation of Propex Armormax erosion control fabric.
8. Locally available ASV is in working order. Does not assume additional heavy equipment is required.
9. General conditions costs include small material procurement costs, material handling and inventory, field superintendent, job clerk, project quarters rental, subsistence, office supplies, air fare, small tools and equipment, workers compensation, accounting services, etc.

Lagoon Repairs - Life Cycle Cost Analysis

Life Cycle Cost Analysis
Based on:

USDA RD Bulletin 1780-2	(for general formula)
OMB Circular a94 appendix C	(for "real" discount rate = 0.8% for 20 years)
engineering econonics reference	(for formula of USPW = (((1+i)/ notation for this factor is (P/A,i,N)

Alternative 1			**Alternative 2**		
Capital Cost =	$354,000		Capital Cost =	$0	
Annual O&M =	$7,040		Annual O&M =	$7,040	
Discount rate (i) =	0.008		Discount rate (i) =	0.008	
Planning period (n) =	20	years	Planning period (n) =	20	years

Net Present Value = Capital Cost + Uniform Series Present Worth of Annual O&M - Single Payment Present Worth of the Salvage Value
(I assume that we will consider the salvage value of the system, after 20 years, as zero)

Net Present Value =	**$483,636**	**Net Present Value =**	**$129,636**

Alternative 1: Repair erosion damage to the north berm.
Alternative 2: Do Nothing.

Operations & Maintenance Estimate
Alternative 1 - Repair Eroding Berms & Alternative 2 - No Action

Fuel Usage

Component	Gal./yr.	$/Gal	Cost ($)	
Maintenance Consumables			$200	
Fuel Usage (Godwin pump running continuously for 3 months)	500	6.00	$3,000	

Labor

Component	Hours/yr	$/hr	Cost ($)	
Assume operator discharges lagoon every two years. Each discharge requires 1 months of activity, 4 hrs/day. Assume operator spends 2 hrs/month checking the lagoon.	88	25.00	$2,200	

Permit and Sampling Expenses

Component		Cost ($)/Event	Cost ($) /yr	
Laboratory Sampling		$2,000	$1,000	
Annual Discharge Fee to ADEC		$1,280	$640	

Total Annual O&M Expenses for Lagoon **$7,040**

Alternatives 1 and 2 do not change the annual Operations & Maintenance costs of operating the lagoon.

Laundry Capital Costs for Recommended Alternative.

Item	Description	Quantity	Unit	Unit Cost	Extended Cost
1	Washers and Dryers	100	%	$747	$74,657
2	Washeteria Repairs	100	%	$1,403	$140,275
Construction Subtotal					*$214,932*
	Other Direct Costs				
3	Construction Management & Engineering Support				$76,000
4	Engineering & Design Services				$25,000
5	Mobilization / Demobilization				$28,487
6	General Conditions				$152,175
7	Miscellaneous Utilities				$18,548
Other Direct Cost Subtotal					*$300,211*
Project Cost Subtotal					**$515,142**
				10% VSW EMT	*$103,028*
				10% Contingency	*$61,817*
				Total Budget	**$679,987**

Assumptions and Notes:

1. Costs are in 2018 dollars.
2. Does not assume work is concurrent with other work in the community.
3. Assumes structural work is not required.
4. General conditions costs include small material procurement costs, material handling and inventory, field superintendent, job clerk, project quarters rental, subsistence, office supplies, air fare, small tools and equipment, workers compensation, accounting services, etc.

Washeteria - Life Cycle Cost Analysis

Life Cycle Cost Analysis
Based on:

USDA RD Bulletin 1780-2	(for general formula)
OMB Circular a94 appendix C	(for "real" discount rate = 0.8% for 20 years)
engineering econonics reference	(for formula of USPW = (((1+i)^n)-1)/((i*(1+i)^n) notation for this factor is (P/A,i,N)

Alternative 1			**Alternative 2**		
Capital Cost =	$680,000		Capital Cost =	$0	
Annual O&M =	$54,252		Annual O&M =	$54,252	
Discount rate (i) =	0.008		Discount rate (i) =	0.008	
Planning period (n) =	20	years	Planning period (n) =	20	years

Net Present Value = Capital Cost + Uniform Series Present Worth of Annual O&M - Single Payment Present Worth of the Salvage Value
(I assume that we will consider the salvage value of the system, after 20 years, as zero)

Net Present Value =	**$1,679,008**	**Net Present Value =**	**$999,008**

Alternative 1:
Procure and Install 6 washers and 2 dryers
Laundry Facility Finishes (showers, toilets, lavs, flooring) / Sewer Gas Odors

Alternative 2:
Do Nothing. This alternative would have $0 capital cost and $0 increased O&M cost.

Water Treatment Plant Capital Costs for Recommended Alternative.

Item	Description	Quantity	Unit	Unit Cost	Extended Cost
1	Utility 4-Wheeler	100	%	$164	$16,374
2	Water Treatment Upgrades	100	%	$1,163	$116,280
Construction Subtotal					*$132,654*
	Other Direct Costs				
3	Construction Management & Engineering Support				$76,000
4	Engineering & Design Services				$150,000
5	Mobilization / Demobilization				$11,744
6	General Conditions				$117,549
7	Miscellaneous Utilities				$15,507
Other Direct Cost Subtotal					*$370,801*
Project Cost Subtotal					**$503,454**
				10% VSW EMT	*$100,691*
				10% Contingency	*$60,414*
				Total Budget	**$664,559**

Assumptions and Notes:

1. Costs are in 2018 dollars.
2. Does not assume work is concurrent with other work in the community.
3. Design costs do not include re-design of the treatment system to address DBPs, lead, or copper.
4. Costs do not include replacement of filter media or filters.
5. General conditions costs include small material procurement costs, material handling and inventory, field superintendent, job clerk, project quarters rental, subsistence, office supplies, air fare, small tools and equipment, workers compensation, accounting services, etc.

Water Plant Upgrades - Life Cycle Cost Analysis

Life Cycle Cost Analysis
Based on:

USDA RD Bulletin 1780-2	(for general formula)	
OMB Circular a94 appendix C	(for "real" discount rate = 0.8% for 20 years)	
engineering econonics reference	(for formula of USPW = (((1+i)^n)-1)/((i*(1+i)^n)	notation for this factor is (P/A,i,N)

Alternative 1			**Alternative 2**		
Capital Cost =	$665,000		Capital Cost =	$0	
Annual O&M =	$74,589		Annual O&M =	$74,589	
Discount rate (i) =	0.008		Discount rate (i) =	0.008	
Planning period (n) =	20	years	Planning period (n) =	20	years

Net Present Value = Capital Cost + Uniform Series Present Worth of Annual O&M - Single Payment Present Worth of the Salvage Value
(I assume that we will consider the salvage value of the system, after 20 years, as zero)

Net Present Value =	**$2,038,495**	**Net Present Value =**	**$1,373,495**

Alternative 1:
Procure 4-Wheeler for Utility use
Water Treatment System Upgrades (compliance with Surface Water Treatment Rules and other concerns)

Alternative 2:
Do Nothing. This alternative would have $0 capital cost and $0 increased O&M cost.

Operations and Maintenance Estimated Expenses for Water Treatment Plant and Laundry Facilities.

Item	FY16 Estimate	Estimate of O&M Attributable to WTP	Estimate of O&M Attributable to Laundry
Salary Expenses	$63,107	$42,281.69	$20,825.31
Bank Service Charge	$5,000	$2,500.0	$2,500.00
Payroll Taxes	$5,856	$3,923.52	$1,932.48
Worker's Compensation	$1,769	$1,185.23	$583.77
Administrative Fee	$2,800	$1,400.0	$1,400.00
Travel-Airfare	$680	$340.0	$340.00
Perdium	$2,880	$1,440.0	$1,440.00
Training, Workshop & Conference Fees	$60	$30.0	$30.00
Membership Dues	$1,400	$700.0	$700.00
Freight and Postage	$2,339	$1,169.50	$1,169.50
Telephone and Internet	$2,350	$1,175.0	$1,175.00
Equipment Repair	$200	$100.0	$100.00
Heating Fuel	$20,000	$10,000.0	$10,000.00
Janitorial Cleaning Supplies	$1,500	$750.0	$750.00
Gasoline and Propane	$100	$50.0	$50.00
Electricity	$16,800	$5,544.0	$11,256.00
Water Samples	$2,000	$2,000	$0.00
Total	**$128,841**	**$74,588.94**	**$54,252.06**

These expenses are based on actual, budgeted expenses for Fiscal Year 2016. A portion of each line item was divided between the water plant and laundry facilities. The distribution of these expenses should be checked against the operator's knowledge and the fiscal year 2017 budget.

Attachment E

Propex Armormax Submittal

April 4, 2018

Heather Gross
Summit Consulting Services

RE: Kongiganak Lagoon Erosion Protection

Dear Heather Gross,

We want to thank you for considering the use of Propex products and solutions for erosion protection on the above referenced project. We would like to submit the following information in order to utilize ***ARMORMAX® 75*** to provide erosion protection against wind generated waves. We understand the project to consist of erosion protection around the banks of ponds at the Kongiganak Lagoon in Kongiganak, AK. We understand that the pond slopes were previously covered with North American Green's SC550 Turf Reinforcement Mat (TRM), which is failing and allowing erosion of the slope. The pond slopes have a gradient of approximately 2.6 Horizontal : 1 Vertical (2.6H:1V). We understand this to be an erosion problem and not a surficial slope instability problem.

ARMORMAX 75 consists of *PYRAMAT® 75 High Performance Turf Reinforcement Mat (HPTRM)* secured permanently with Engineered Earth Anchors. We are suggesting the installation of *ARMORMAX 75* with 3 ft long B1 anchors above the normal water level and 5 ft long B1 anchors below the normal water level. We suggest the anchors be installed with a horizontal spacing of 4 ft and a vertical spacing of 5 ft and 1.5 ft long securing pins with a horizontal spacing of 2 ft and a vertical spacing of 2.5 ft. We suggest terminating the *ARMORMAX 75* at the bottom of the slope with a burrito wrap that is detailed in the Appendix. Since vegetation establishment is unlikely below the normal water level, *ARMORMAX 75* needs to be underlain with *GEOTEX® 601* nonwoven geotextile below the normal water level and up to 1 ft above the normal water level. The nonwoven underlayment geotextile aids in retention of fine soil particles to supplement the lack of vegetation.

MANUFACTURING QUALITY AND TESTING

Over the past 20 years, Propex has utilized a Manufacturing Quality Control (MQC) program to establish internal testing frequencies, set property requirements, and rectify any deficient test results in order to successfully provide over 10 million square yards of HPTRM. Propex proudly manufactures *PYRAMAT 75* in Ringgold, GA, controlling the entire process from pellets of resin to the packaging of the HPTRM. *PYRAMAT 75* is subjected to internal and external testing per ASTM D-4355 on an annual basis for 3,000 and 6,000 hours of exposure (Table 1).

Table 1 - Independent and Internal Test Results

Property	Test Method	PYRAMAT®
Tensile Strength (Published)	ASTM D-6818	4,000 x 3,000 lb/ft
UV Resistance @ 500 Hours	ASTM D-4355	>95%
UV Resistance @ 1,000 Hours	ASTM D-4355	>95%
UV Resistance @ 3,000 Hours	ASTM D-4355	>90%
UV Resistance @ 6,000 Hours	ASTM D-4355	>90%

FIELD PERFORMANCE

In addition to laboratory testing, field samples of Propex HPTRMs are evaluated in order to correlate results from ASTM D-4355 to real world exposure for a better understanding of the material's design life. In 2015, samples of *PYRAMAT 75* were taken from the Bell Road Channel in Scottsdale, Arizona to determine the retained tensile strength after 13 years of exposure. With minimal vegetation established, the majority of the HPTRM was exposed in a severe environment having the highest solar radiation in North America of 21.70 MJ/m^2-day. The results showed an average retained tensile strength of 79% when compared to independent third party test results. Using this field retained tensile strength and both our independent and internal test results for UV resistance we can begin to anticipate the functional longevity of *PYRAMAT 75* as shown in Figure 1.

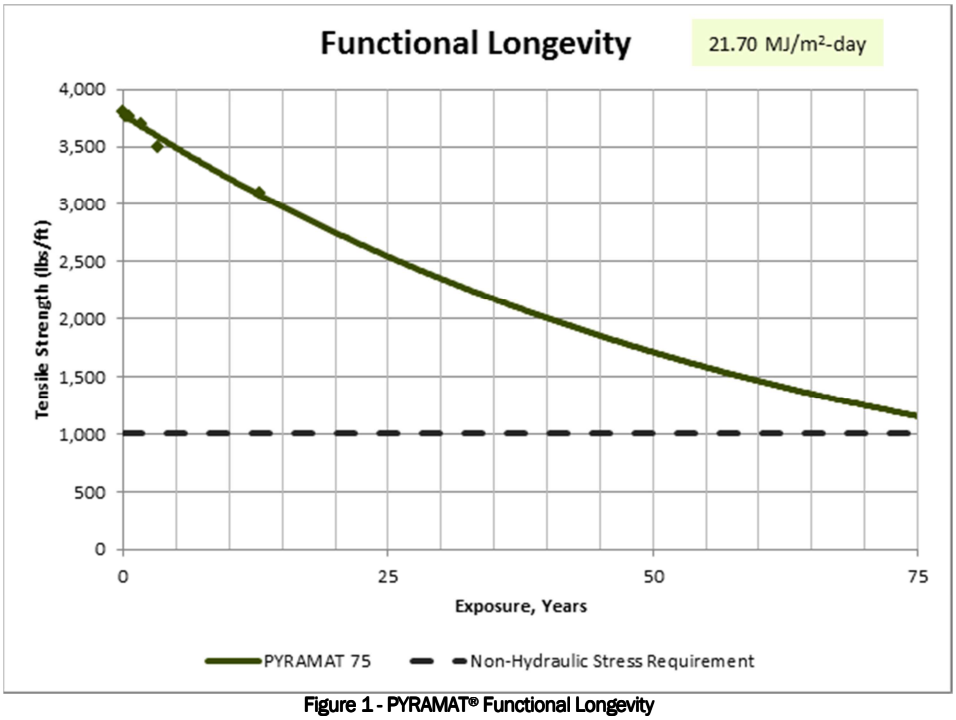


Figure 1 - PYRAMAT® Functional Longevity

PROVEN RESULTS

ARMORMAX 75 installations have totaled over 1,500,000 square yards on applications such as pond banks, levees, and channels. *ARMORMAX 75* provides excellent UV Resistance that has been both field and laboratory tested. High Performance Reinforcement Mats (HPTRMs), such as the *PYRAMAT 75* component of *ARMORMAX 75,* are set as standard best management practices (BMPs) by the EPA. In addition to environmental benefits of *ARMORMAX 75,* shipping and installation requires significantly less transportation and use of heavy machinery. While traditional hard armoring solutions, such as rock riprap or gabions require the use of heavy machinery for installation, *ARMORMAX 75* can be installed by manual labor showing an increase in productivity and a reduction in emissions.

VEGETATION ESTABLISHMENT

In order to establish an adequate stand of vegetation we suggest the existing subgrade be scarified and amended as needed prior to the placement of *ARMORMAX 75*. A site specific soil test should be performed to help determine what soil amendments, such as lime and fertilizer, need to be incorporated into the soil to promote healthy vegetation. Irrigate as necessary to establish and maintain vegetation until the vegetation has established. Frequent, light irrigation will need to be applied if natural rain events have not occurred. When watering, use a fine spray to prevent erosion of seeds or soil. Do not over irrigate.

ARMORMAX 75 provides surficial erosion control and vegetation reinforcement. ARMORMAX 75 is easy to install and is an economical, aesthetically pleasing, and effective solution for slope stabilization. The analyses presented herein are valid for Propex materials only and any alternate material should be evaluated separately.

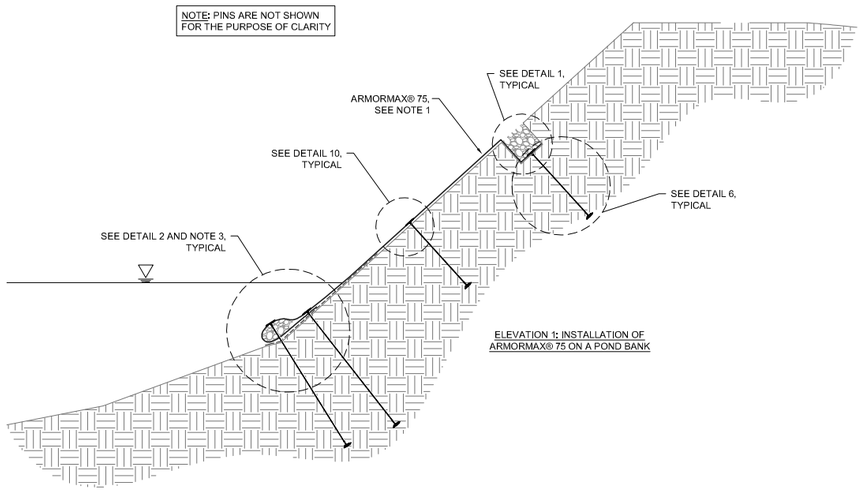
Enclosed please find product information on *ARMORMAX* 75. Should you have any questions or concerns regarding the analysis or the contents herein, please do not hesitate to contact me by phone at (423) 553-2199 or by email at jared.hill@propexglobal.com.

Sincerely,

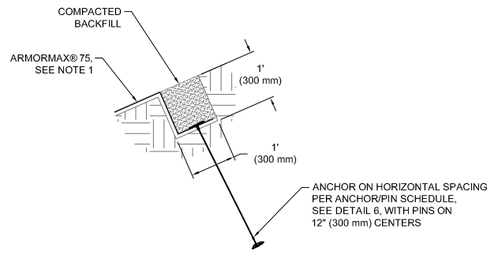
Jared Hill, EIT
Applications Engineer, GeoSolutions
Propex Operating Company, LLC

Drew Loizeaux, PE
Engineering Services Manager, GeoSolutions
Propex Operating Company, LLC

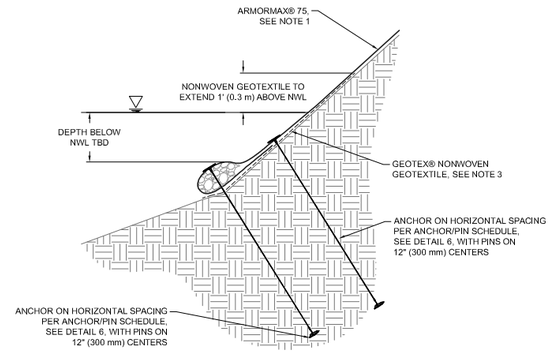
APPENDIX



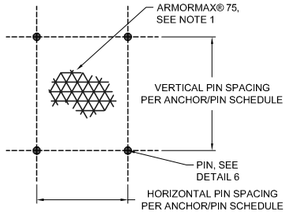
ELEVATION 1: INSTALLATION OF ARMORMAX® 75 ON A POND BANK



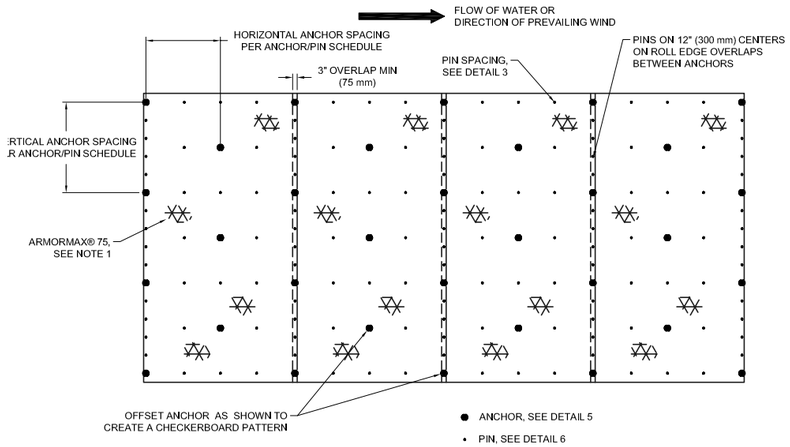
DETAIL 1: FACE OF SLOPE (FOS) TRENCH



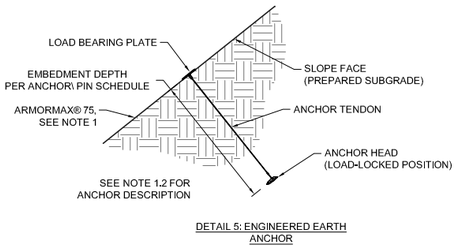
DETAIL 2: "BURRITO" TRENCH



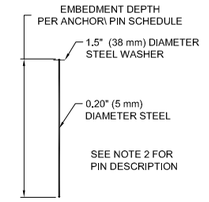
DETAIL 3: PIN PATTERN



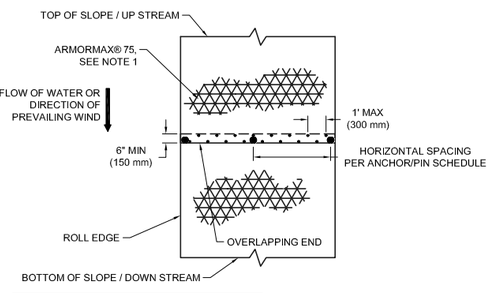
DETAIL 4: ANCHOR / PIN PATTERN



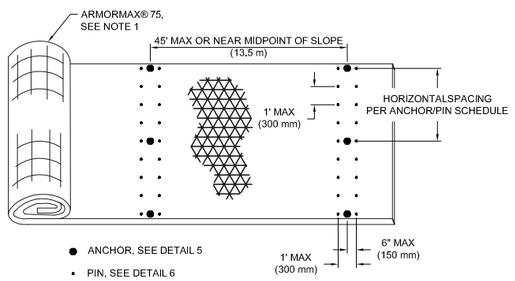
DETAIL 5: ENGINEERED EARTH ANCHOR



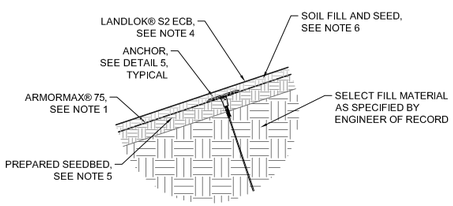
DETAIL 6: PIN



DETAIL 7: OVERLAP AT ROLL END DETAIL



DETAIL 8: SIMULATED CHECK SLOT DETAIL



DETAIL 9: VEGETATION ESTABLISHMENT

ANCHOR/PIN SCHEDULE		
SECURING DEVICE	ANCHOR	PIN
HORIZONTAL ANCHOR SPACING	4'	2'
VERTICAL ANCHOR SPACING	5'	2.5'
EMBEDMENT DEPTH	3' or 5'	1.5'

ARMORMAX® 75 ON A SLOPE FOR EROSION CONTROL (NON-STRUCTURAL APPLICATION) GENERAL INSTALLATION GUIDELINES

GENERAL NOTES

1. ARMORMAX® 75 is an engineered solution used for permanent erosion protection or surficial slope stability in vegetated and unvegetated applications. It is composed of two components: PYRAMAT® 75 High Performance Turf Reinforcement Mat (HPTRM) and Engineered Earth Anchors. The ARMORMAX® 75 is available in green or tan to provide for an aesthetically pleasing solution with proven performance.
   - 1.1. PYRAMAT® 75 HPTRM is a three-dimensional, lofty, woven polypropylene geotextile that is available in green or tan which is specially designed for erosion control applications on steep slopes and vegetated waterways. The matrix is composed of polypropylene monofilament yarns featuring X3® technology woven into a uniform configuration of resilient pyramid-like projections. The material exhibits very high interlock and reinforcement capacity with both soil and root systems, demonstrates superior UV resistance, and enhances seedling emergence.
   - 1.2. The Type B1 anchor model is used for permanent erosion protection applications and has a working load of up to 800 lbs. The Type B1 anchor consists a die cast aluminum anchor head, zinc-aluminum coated carbon steel cable, a die cast zinc load-locking mechanism with a ceramic roller, and two aluminum ferrules. The bullet nose design of the anchor head allows the anchor to penetrate HPTRM resulting in minimal installation damage. The Type B1 anchor is also designed with a recessed cavity so the top of the cable can be cut below the surface being protected.
2. The 12", 18", and 24" Securing Pins are composed of a wire, mushroomed at the top. A washer is then placed on the wire and the wire is crimped or swedged about 3-1/2" below the top so the washer will not slide off. The end of the wire is cut at a 45 degree angle for easy penetration of the soil. These Pins with washers conform to Industry standards for erosion control pins with washers.
3. GEOTEX® 601 nonwoven geotextile should be used to underlay ARMORMAX® 75 below the normal water level and 1 ft above the normal water level to assist with sediment control in conditions where poor vegetation is expected.
4. LANDLOK® S2 Erosion Control Blankets consist of 100% wheat straw mechanically bound and covered on both sides by netting. The straw is homogeneously blended and evenly distributed throughout the blanket. The netting is photodegradable polypropylene with mesh openings of approximately 3/8 in. by 3/8 in. (11 mm by 11 mm). The blanket is sewn on approximately 2 in. (51 mm) centers with photodegradable polypropylene thread. This product is NTPEP approved for AASHTO standards.

VEGETATION ESTABLISHMENT

5. Prepare seedbed by loosening 50 to 75 mm (2 to 3 in) of soil above final grade. Apply seed in an amount equivalent to 60% of the total mixture required to be installed on the soil surface, to scarified surface prior to installation of the ARMORMAX® 75. Select and apply soil amendments and fertilizer, to scarified surface prior to installation of ARMORMAX® 75. A site specific soil test should be performed to help determine what soil amendments, such as lime and fertilizer, need to be incorporated into the soil to promote healthy vegetation.
6. The installed ARMORMAX® 75 shall be soil filled and seeded with the remaining 40% of the seed mixture. Do not place excessive soil above material. Once soil fill and additional seed is in place, surficial protection should be accomplished by installing LANDLOK® S2 Erosion Control Blanket (ECB) atop the seed layer. LANDLOK® S2 ECB is to be secured using 6" U-shaped staples with a frequency of 2.0 staples per square meter (1.7 staples per square yard).
7. Irrigate as necessary to establish and maintain vegetation until 75% of vegetation has established and has reached a height of 2 inches. Frequent, light irrigation will need to be applied to seeded areas if natural rain events have not occurred within two weeks of seeding.

BEFORE INSTALLATION BEGINS

8. Coordinate with a Propex Representative: A pre-construction meeting is suggested with the construction team and a representative from Propex. This meeting should be scheduled by the contractor with at least a two week notice.
9. Gather the Tools Needed: Tools that you will need to install ARMORMAX® 75 include a pair of industrial shears to cut PYRAMAT® 75, tape measure, percussion hammer (sized appropriately for the anchors), ground rod driver compatible with the percussion hammer, drive steel compatible with the anchor, setting tool to set and load-lock the anchor, and wire cutters to cut the cable tendon of the anchor. If Anchors will be load tested during construction, additional testing equipment may be necessary. Consult the "Anchor Load Test Manual" from Propex for further guidance. Available for purchase from Propex are drive steel, setting tools, and wire cutters.
10. Determine how to Establish Vegetation: The method of vegetation establishment should be determined prior to the start of installation. Different vegetation establishment methods require different orders of installation. Refer to Establish Vegetation for further guidance.
11. Please consult the Propex Website for the most up to date installation guidelines.

EROSION CONTROL INSTALLATION DETAILS

Propex GEOSOLUTIONS

△	1 of 1			
△				
△				
Rev		Date: 04/04/2018	Drawn By: J. HILL	Scale: NTS

ARMORMAX®

ARMORMAX® 75 INSTALLATION DETAILS FOR SLOPES

*ALL DIMENSIONS ARE TO BE VERIFIED BY ENGINEER OF RECORD

ARMORMAX®

Product Data

ARMORMAX® 75

For Erosion Control

The ARMORMAX® 75 for Erosion Control is an Engineered Earth Armoring Solution™ used for permanent erosion protection in vegetated and unvegetated applications. It is composed of two components: PYRAMAT® 75 High Performance Turf Reinforcement Mat (HPTRM) and Type B1 Enginnered Earth Anchors. ARMORMAX® 75 is available in green or tan to provide for an aesthetically pleasing solution with proven performance. The anchor component is specifically designed and tested for compatibility and performance with PYRAMAT® 75 HPTRM to provide a system solution. Propex offers several anchor options to provide the ARMORMAX® 75 system designed for specific challenges and needs. The expected design life of ARMORMAX® 75 is up to 75 years because of its superior UV resistance, resistance to corrosion, strength, and durability in the most demanding environments.

The PYRAMAT® 75 HPTRM component of ARMORMAX® 75 values listed below[1] while manufactured at a Propex facility having achieved ISO 9001:2008 certification. Propex also performs internal Manufacturing Quality Control (MQC) tests that have been accredited by the Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP).

The Type B1 Anchor model is used for permanent erosion protection applications and has a working load of up to 800 lbs. The Type B1 Anchor consists a zinc-aluminum alloy anchor head, zinc-aluminum coated carbon steel cable, a zinc-aluminum alloy load-locking mechanism with a ceramic roller, and two aluminum ferrules. The bullet nose design of the anchor head allows the anchor to penetrate PYRAMAT® 75 HPTRM resulting in minimal installation damage. The Type B1 Anchor is also designed with a recessed cavity so the top of the cable can be cut below the surface being protected.

Propex GEOSOLUTIONS

ENGINEERED EARTH ARMORING SOLUTIONS™

www.propexglobal.com

Propex Operating Company, LLC · 4019 Industry Drive · Chattanooga, TN 37416 · ph 800 621 1273 · ph 423 855 1466

ARMORMAX®

Product Data

ARMORMAX® 75

For Erosion Control

PYRAMAT® 75 HPTRM PROPERTIES

PROPERTY	TEST METHOD	ENGLISH	METRIC
ORIGIN OF MATERIALS			
% U.S. Manufactured		100%	100%
PHYSICAL			
Thickness [2]	ASTM D-6525	0.40 in	10.2 mm
Light Penetration (% Passing) [3]	ASTM D-6567	10%	10%
Color	Visual	Green or Tan	
MECHANICAL			
Tensile Strength [2]	ASTM D-6818	4000 x 3000 lbs/ft	58.4 x 43.8 kN/m
Elongation [2]	ASTM D-6818	40 x 35 %	40 x 35 %
Resiliency [2]	ASTM D-6524	80%	80%
Flexibility [4]	ASTM D-6575	0.534 in-lb	616,154 mg-cm
ENDURANCE			
UV Resistance % Retained at 3,000 hrs [4]	ASTM D-4355	90%	90%
UV Resistance % Retained at 6,000 hrs [4]	ASTM D-4355	90%	90%
PERFORMANCE			
Velocity (Vegetated) [4, 5]	Large Scale	25 ft/sec	7.6 m/sec
Shear Stress (Vegetated) [4, 5]	Large Scale	16 lb/ft²	766 Pa
Manning's n (Unvegetated) [4, 6]	Calculated	0.028	0.028
USACE / CSU Wave Overtopping	Large Scale	USACE Approved	
Seedling Emergence [4]	ASTM D-7322	296%	296%
ROLL SIZES		8.5 ft x 120 ft 15.0 ft x 120 ft	2.6 m x 36.6 m 4.6 m x 36.6 m

TYPE B1 ANCHOR PROPERTIES

PHYSICAL		ENDURANCE/ COMPONENT MATERIALS	
Anchor Head Length	3.44 in	Anchor Head	Zinc-aluminum alloy
Anchor Head Width	1.22 in	Cable Tendon	Zinc-aluminum carbon steel
Anchor Head Bearing Area	3.0 in²	Load Bearing Plate	Zinc-aluminum alloy
Anchor Head Weight	0.24 lbs	Load-Lock Mechanism	Zinc-aluminum alloy w/ceramic roller
		Crimped Ferrule	Aluminum
PERFORMANCE		**MECHANICAL**	
Load Range (Cohesive through Non Cohesive Soils)	Up to 500 lbs	Ultimate Strength	1,100 lbs
Embedment Depth	Up to 5 ft	Working Load	800 lbs

NOTES:

1. The property values listed above are effective 03/09/2018 and are subject to change without notice. Values represent testing at time of manufacture.
2. Minimum average roll values (MARV) are calculated as the typical minus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any samples taken from quality assurance testing will exceed the value reported.
3. Maximum Average Roll Value (MaxARV), calculated as the typical plus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any sample taken during quality assurance testing will meet to the value reported.
4. Typical Value.
5. Maximum permissible velocity and shear stress has been obtained through vegetated testing programs featuring specific soil types, vegetation classes, flow conditions, and failure criteria. These conditions may not be relevant to every project nor are they replicated by other manufacturers. Please contact Propex for further information.
6. Calculated as typical values from large-scale flexible channel lining test programs with a flow depth of 6 to 12 inches.

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ARMORMAX®

SLOPES INSTALLATION AND MAINTENANCE GUIDELINES

Thank you for purchasing ARMORMAX® for Erosion Control or Slope Stability by Propex Operating Company, LLC (Propex). This document provides installation and maintenance guidelines for ARMORMAX used as slope armoring to improve earthen slope resiliency and slope stability. ARMORMAX provides permanent erosion protection of an earthen slope, promotes vegetation, and improves slope stability, consists of two components:

- PYRAMAT® - High Performance Turf Reinforcement Mat (HPTRM)
- Engineered Earth Anchor (Anchor)

Temporary securing pins (pins) are used during installation to hold ARMORMAX in place while installing anchors. Pins also promote vegetation establishment keeping ARMORMAX in intimate contact with the soil.

ARMORMAX is an Engineered Earth Armoring Solution ™ with a unique design for each specific project. While Propex has made every effort to ensure general validity, this information should not be used for a specific application without independent professional examination and verification of its suitability, applicability, and accuracy. The information provided herein is for general information only, and is intended to present installation guidance. Project specific contract documents take precedence when pin and anchor placements are different than what is represented in this document. Depending upon the critical nature of the structure to be armored, work restrictions may be in place such as limiting work based on growing seasons, weather patterns, etc. Work should be performed under the provisions set forth for the specific project. Propex Engineering Services is available for support during installation to consult for solving constructability issues encountered in specific applications. Please feel free to contact our Engineering Serivces team at GeoEngineering@propexglobal.com.

BEFORE INSTALLATION BEGINS

- *Coordinate with a Propex Representative:* A pre-construction meeting is suggested with the construction team and a representative from Propex. This meeting should be scheduled by the contractor with at least a two week notice.
- *Gather the Tools Needed:* Tools that you will need to install ARMORMAX include a pair of industrial shears, tape measure, percussion hammer (sized appropriately for the anchors), ground rod driver compatible with the percussion hammer, drive steel compatible with the anchor, setting tool to set and load-lock the anchor, and wire/bolt cutters to cut the cable tendon of the anchor. If anchors will be load tested during construction, additional testing equipment may be necessary. Consult the "Anchor Load Test Manual" from Propex for further guidance. Available for purchase from Propex are drive steel, JackJaw® Setting Tools, wire cutters, and a gas powered anchor driver.
- *Determine how to Establish Vegetation:* The method of vegetation establishment should be determined prior to the start of installation.
- Different vegetation establishment methods require different orders of installation. Refer to *VEGETATION ESTABLISHMENT* for further guidance.

INSTALLATION OF ARMORMAX ON SLOPES

PREPARE THE SITE

It is recommended during all stages of site preparation that disturbed soils remain unprotected for not more than a single day. Depending on project size this may require progressive site preparation during installation.

1. Grade and compact the area on the slope where ARMORMAX will be installed. The slope surface should be uniform and smooth, having all rocks, clods, vegetation or other objects removed so that during *ARMORMAX* **LAYDOWN**, ARMORMAX comes in direct, intimate contact with the slope surface.
2. Prepare the area to be armored with ARMORMAX by loosening the topsoil to promote better vegetation establishment. This may be accomplished with a rotary tiller on slopes 3:1 or flatter. For slopes greater than 3:1, prepare topsoil in a safe manner.

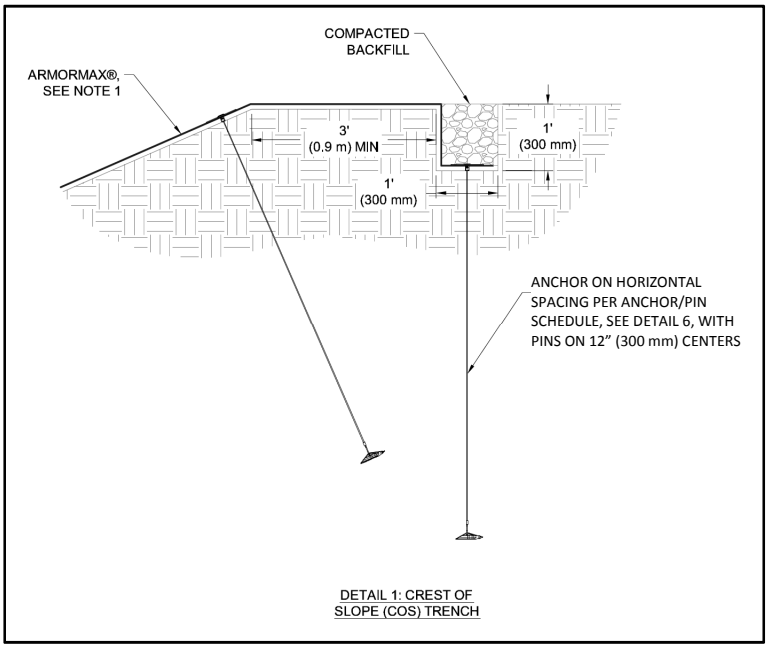


Figure 1: Crest of Slope (COS) Trench

3. Excavate a Crest of Slope (COS) trench 12 in x 12 in (300 mm x 300 mm) minimum at a distance of 3 ft (900 mm) from the crest of the slope. (Figure 1).

4. Excavate a Toe of Slope (TOS) trench 12 in x 12 in (300 mm x 300 mm) minimum at a minimum distance of 5 ft (1.5 m) from the toe of the slope. (Figure 2)

5. If seeding, refer to *VEGETATION ESTABLISHMENT* for additional considerations during site preparation.

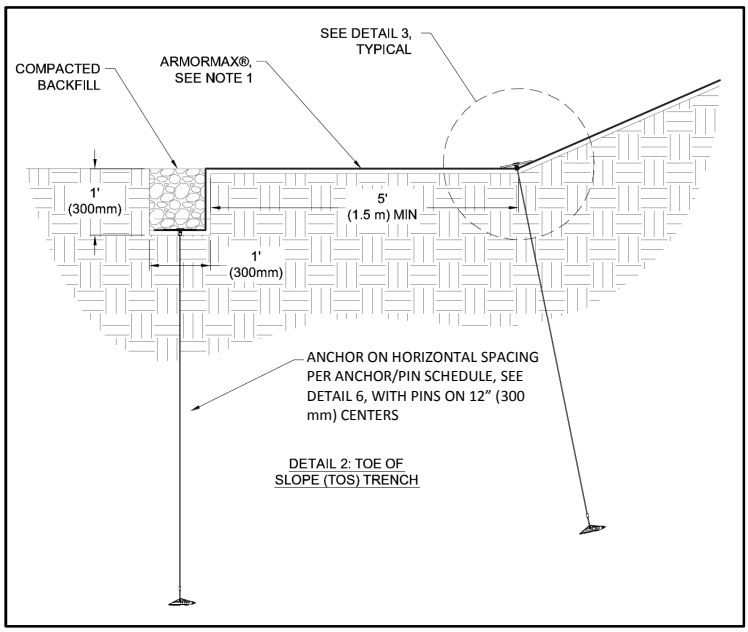


Figure 2: Toe of Slope (TOS) Trench

ARMORMAX LAYDOWN

1. Begin the *ARMORMAX* **LAYDOWN** process by starting with the downstream / downwind end of the site. To ensure proper anchoring of the overlapped areas the proceeding roll width must be laid out before the current roll width can be anchored with exception to the final roll width. For straight sections of a slope, ARMORMAX panel lengths should be long enough to construct COS and TOS trenches while also covering the surface of the slope being armored (Figure 12). Panel edges should rest approximately perpendicular to the slope center line. For best results, panels of ARMORMAX should be continuous and free from seams or roll end overlaps that are parallel to the centerline of the slope. Panel edge overlapping should follow a pattern of placing each proceeding panel's edge overtop the previous panel edge, shingling the panels in the direction of the water flow or prevailing wind.

2. Starting at the COS trench, lay ARMORMAX roll so that the roll ends points towards the crest of the slope (Figure 3), with a 3 inch (75 mm) overlap created at adjacent panel edge locations. Ensure that adjacent panel edges maintain a minimum 3 inch overlap during *ARMORMAX* **LAYDOWN** (Figure 8).

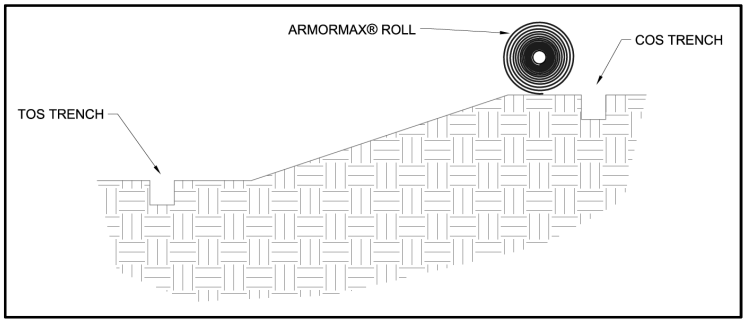


Figure 3: Crest of Slope (COS) Trench Alignment

3. Secure ARMORMAX with pins and Secondary anchors in the COS trench. Pins should be made of steel with a 0.20 in (5 mm) minimum diameter, having a 1.5 in (38mm) diameter washer at the head, and a length between 12 and 24 in (300-600 mm) with sufficient ground penetration to resist pullout (Figure 4). Longer pins may be required for looser soils. Heaver metal stakes may be required in rocky soils. Suggested placement of pins and Secondary anchors for the COS trench is along the bottom of the trench with pins on 12 in (300 mm) centers in between Secondary anchors on 4 ft (1.2 m) centers. Secondary anchors should also be installed on panel edge overlaps in the COS trench.

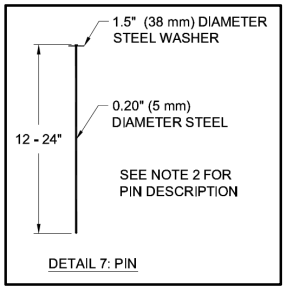


Figure 4: Securing Pin

4. Backfill and compact the COS trench in the location of the first ARMORMAX panel only (Figure 5).

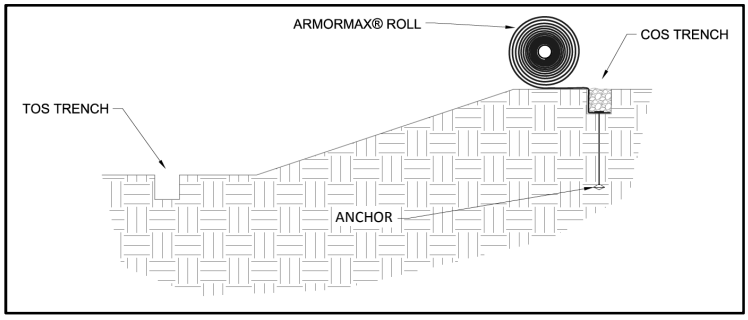


Figure 5: Crest of Slope (COS) Trench Placement

5. Unroll the ARMORMAX roll on the slope surface in the area to be armored (Figure 6). Ensure that ARMORMAX has intimate contact with the ground and all irregular surfaces beneath ARMORMAX are removed.

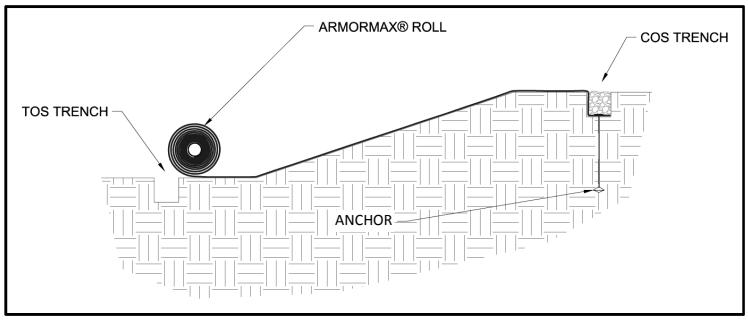


Figure 6: Placement of ARMORMAX across Slope

6. Secure ARMORMAX panels in place using pins, Primary anchors, and anchors across the slope surface according to the project's engineered design. Pin and anchor placement should reflect a staggered checkerboard pattern across the slope surface for best results (Figure 7 and Figure 8).

   - The leading edge of the first ARMORMAX panel should be secured on the Slope Armoring Edge (SAE) with pins on 12 in (300 mm) centers in between anchors on intervals based on the slope stability analysis.
   - Roll edges shall be overlapped a minimum of 3 in (75 mm) with pins placed on 12 in (300 mm) centers in between anchors on intervals based on the slope stability analysis (Figure 8).
   - Roll ends shall be overlapped a minimum of 6 in (150 mm) with upstream / upwind panel on top. Secure roll end overlaps with two rows of pins staggered 6 in (150 mm) apart on 12 in (300 mm) centers and with one row of anchors on intervals based on the slope stability analysis (Figure 9)
   - For slope lengths greater than 45 ft (13.7 m), install simulated check slots. This method includes placing two rows of pins 12 in (300 mm) apart on 12 in (300 mm) centers and one row of anchors between the rows of pins on 4 ft (1.2 m) centers at 45 ft (13.7 m) maximum intervals or across the midpoint of the slope for slope lengths less than 60 ft (18.2 m) (Figure 10).
   - At the break in slope interface towards the TOS, it is suggested that anchors be installed on intervals based on the slope stability analysis (Figure 11).

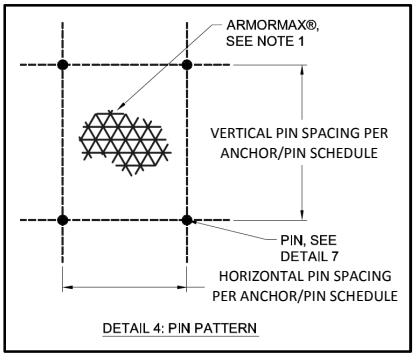


Figure 7: Example Pin Pattern

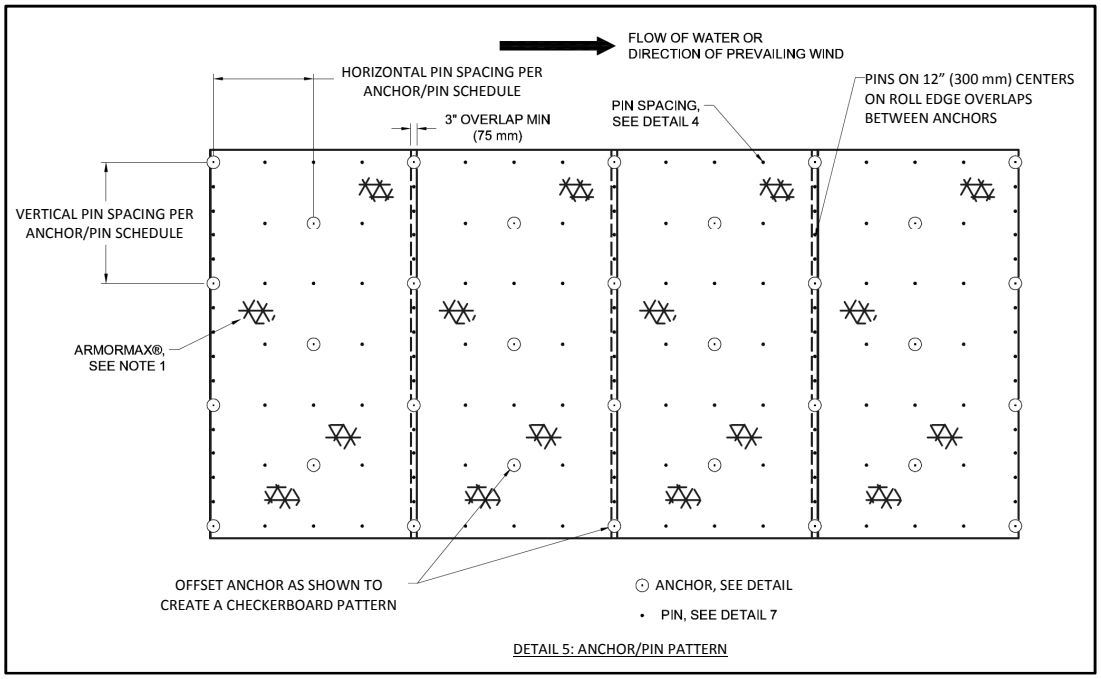


Figure 8: Example of Anchor Pattern - 0.5 Anchors/yd^2

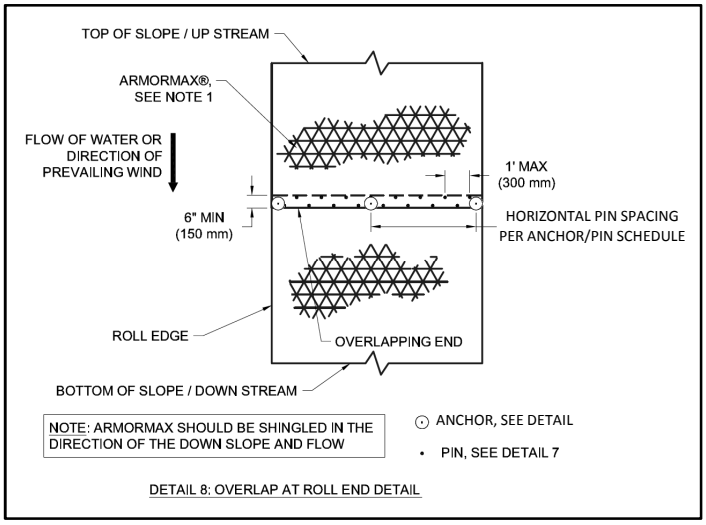


Figure 9: Roll End Overlap

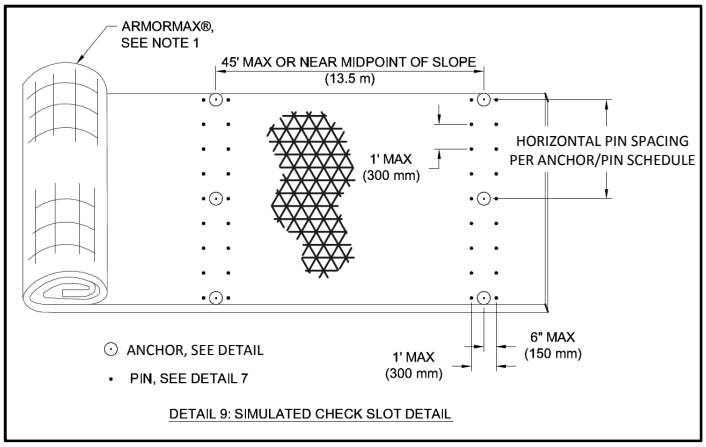


Figure 10: Simulated Check Slot

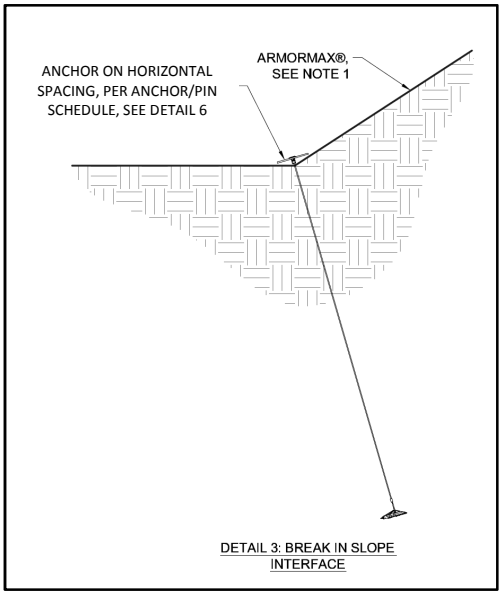


Figure 11: Break in Slope Interface

7. Secure ARMORMAX with pins and anchors in the TOS trench. Suggested placement of pins and anchors for the TOS trench is along the bottom of the trench with pins on 12 in (300 mm) centers in between anchors on 4 ft (1.2 m) centers (Figure 12).

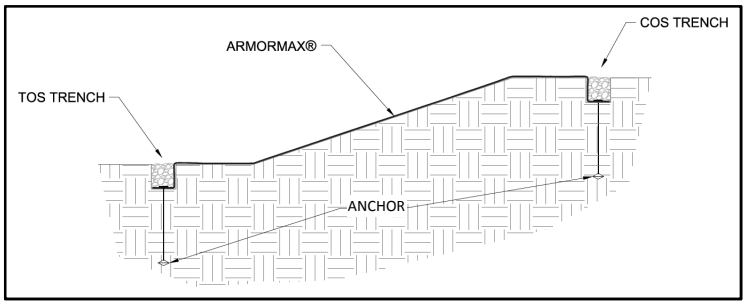


Figure 12: Crest of Slope (COS) Trench and Toe of Slope (TOS) Trench Complete

8. Backfill and compact the TOS trench. (Figure 12)

9. Continue to work down the length of the slope by repeating steps 1 through 8 overlapping each adjacent ARMORMAX panel by 3 inches (75 mm) (Figure 8). The last ARMORMAX panel should terminate on the Slope Armoring Edge (SAE) with pins on 12 in (300 mm) centers in between anchors on intervals based on the slope stability analysis. At a minimum, ARMORMAX panels should be pinned entirely across the slope surface, pins and anchors should be installed in the trenches, and the trenches should be backfilled and compacted at the end of each day to minimize rework in the case of a major rain event. Specific project conditions may warrant further evaluation of installation order for ease. An example elevation view (Figure 13) of a slope armored with ARMORMAX can be seen below for overall reference. Consult Propex Engineering Services at (800) 621-1273with any questions that you may have.

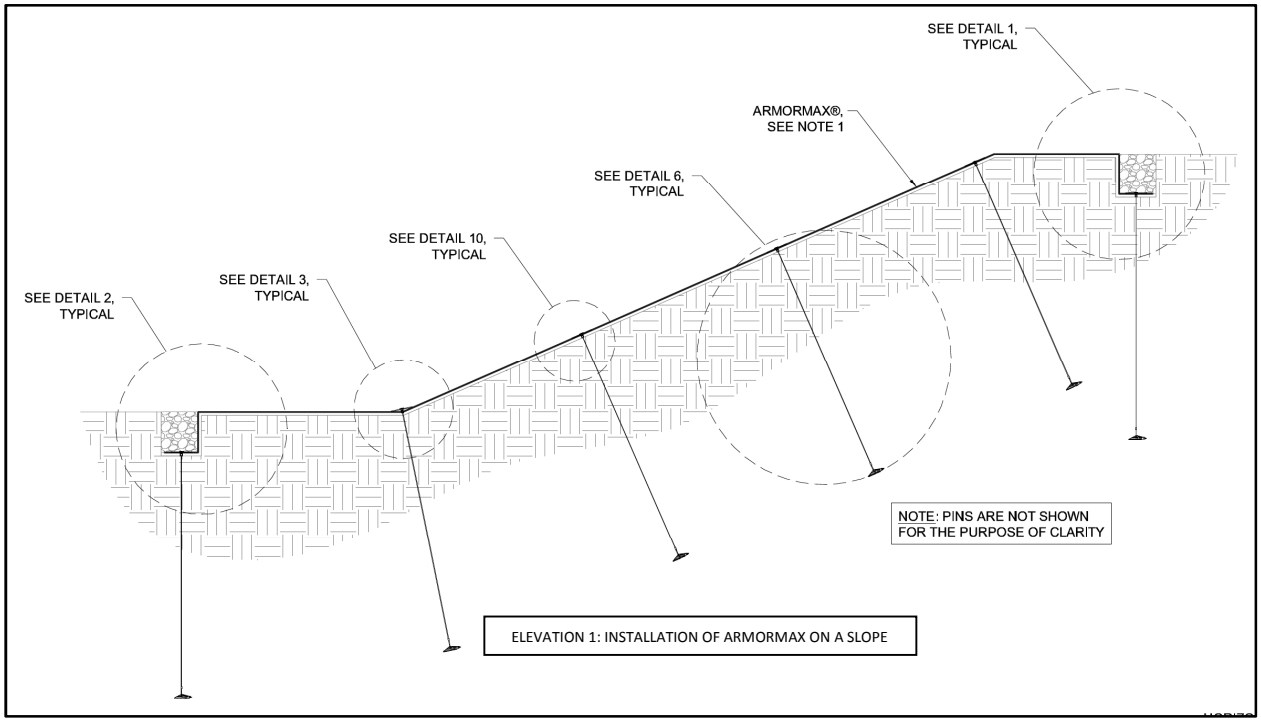


Figure 13: Completed Slope Isometric View

INSTALL ANCHORS

The ARMORMAX anchor typically consists of an anchor head, a flexible cable tendon, and a load bearing plate. For quality control purposes and warranty claims, anchors should be delivered to the jobsite fully assembled and ready for installation.

Anchors are to be installed in locations specified for the project, and are typically installed in conjunction with *ARMORMAX LAYDOWN*. There are several options available from Propex for different types of anchors. For optimal performance with the greatest risk reduction, it is important to select the proper anchor and perform the installation in accordance with the pattern designed for required resiliency and long term durability of the slope. Understanding the mechanics behind installing the anchor component of ARMORMAX will result in a quality ARMORMAX installation.

TYPE B1 & B2 ANCHOR

The installation of either Type B1 or Type B2 Anchor (Figure 14) is described below. The tools that you will need are a percussion hammer, a ground rod driver and drive steel compatible with the anchor and percussion hammer, a JackJaw setting tool, and wire cutters.

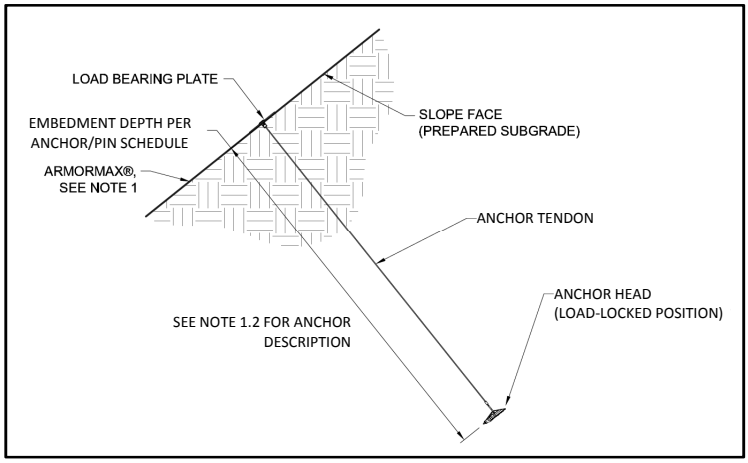


Figure 14: Anchor Detail

1. Use one piece drive steel or assemble segmental drive steel to the appropriate length in order to drive the anchor to the specified embedment depth.

2. Insert the tapered end of the drive steel into the hollow cavity of the anchor head. Position the anchor head/ drive steel tip above the ground at the drive location (Figure 15 and Figure 16).

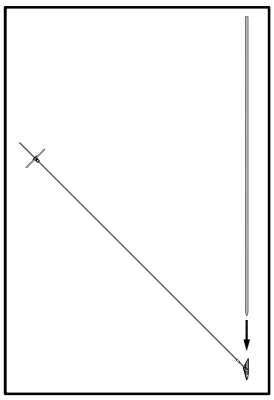


Figure 15: Insert Drive Steel into Anchor

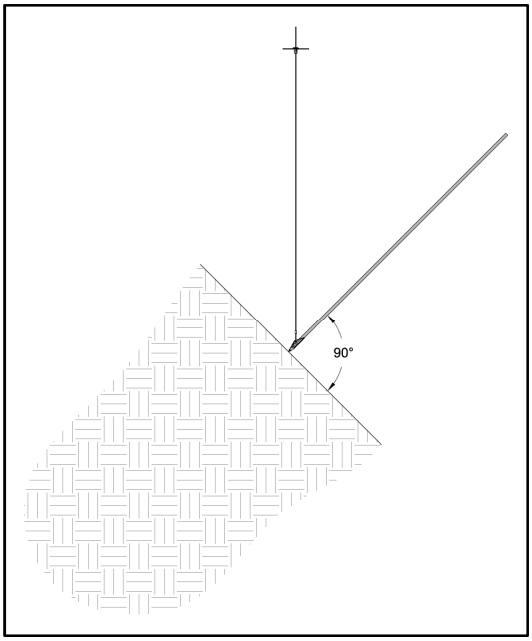


Figure 16: Position Anchor Head / Drive Steel Tip

3. Using a percussion hammer, guide the drive steel into the ground perpendicular to the slope surface at a smooth pace. Continue driving until the desired embedment depth is reached (Figure 17).

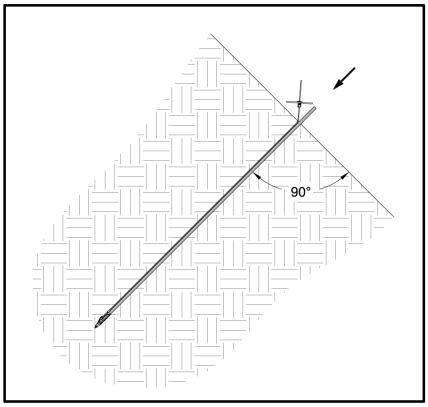


Figure 17: Drive Steel to Drive the Anchor into the Ground

4. Remove the drive steel from the ground. (Figure 18) Depending on soil conditions, this may require the use of a setting tool or leverage device.

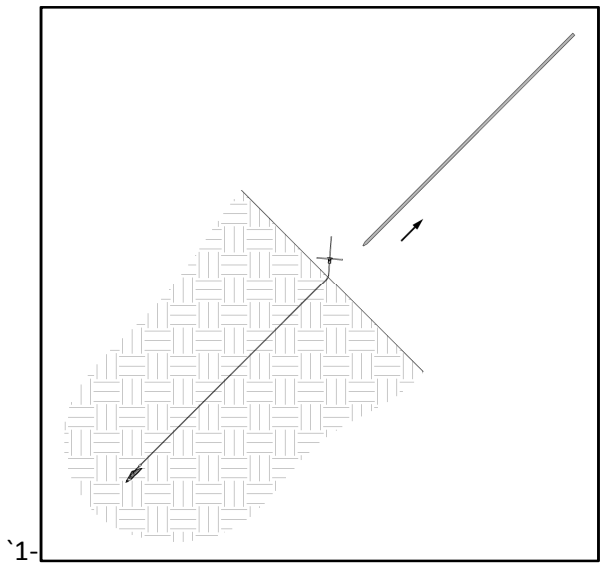


Figure 18: Remove Drive Steel from Ground

5. Slide the load bearing plate down the anchor tendon towards the slope surface using your hands (Figure 19).

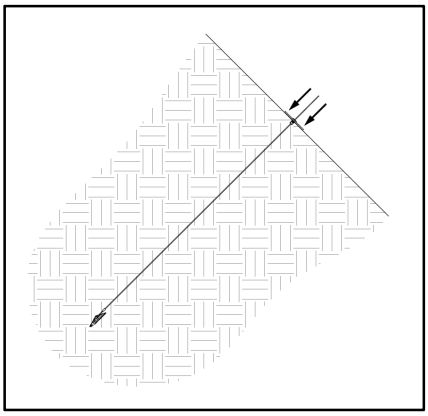


Figure 19: Slide Plate

6. Once the plate is close to the slope surface, place the JackJaw Setting Tool on the anchor plate and place the top of the anchor tendon into the grips, keeping the anchor tendon perpendicular to the slope surface (Figure 20). With gentle force, slowly start to press down on the JackJaw lever – towards the slope surface - causing the anchor tendon to start to move out of the ground (displace). During this step, the anchor head will turn in the ground – a process known as "anchor setting". The change in embedment depth to set a Type B1 Anchor can be up to 6 inches and up to 8 inches for Type B2 depending on soil conditions. When the anchor is set, there will be a noticeable change in the amount of force needed to displace the anchor any further. This is a good indication that the anchor head is now perpendicular to the anchor tendon and the anchor is ready to be load-locked.

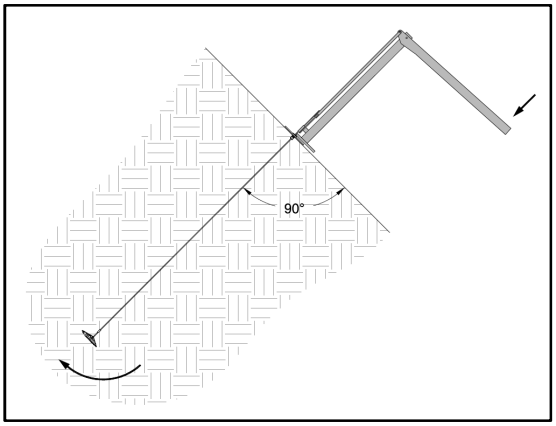


Figure 20: Use JackJaw Setting Tool to Set Anchor

7. To load-lock an anchor, continue to apply tension to the anchor tendon using the JackJaw Setting Tool creating a slight depression on the slope surface. Visually, anchors across ARMORMAX will look similar to buttons across a mattress top when anchors have been properly load-locked.

8. Conduct anchor load tests when required for quality assurance during installation. Refer to the document entitled "Anchor Load Test Manual" by Propex for further details.

9. Once anchors have been load-locked, cut off the excess anchor tendon flush to the plate at the slope surface using wire cutters (Figure 21 and Figure 22).

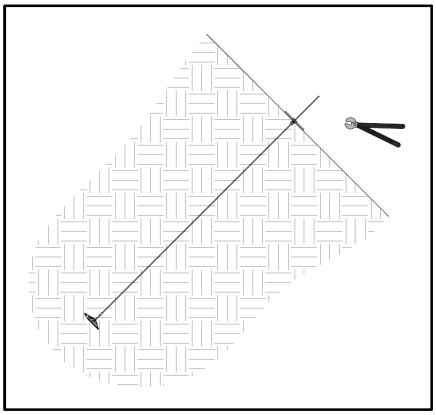


Figure 21: Trim Extra Cable Flush to Plate

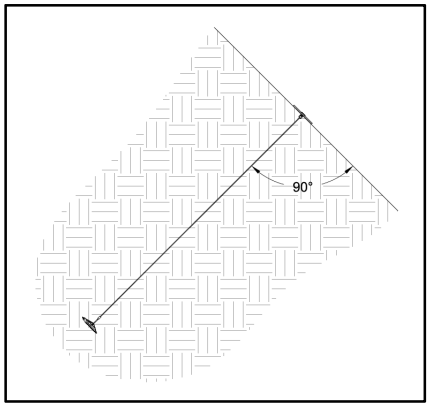


Figure 22: Complete Anchor Installation

VEGETATION ESTABLISHMENT

Vegetation can be established with ARMORMAX by broadcast seeding, hydraulic seed application (hydroseeding), or sodding. Seed application rate, seed type, sod type, and irrigation rate should be selected based on local or site specific knowledge and time of year. For best results, consider having a site specific soil test performed to help determine what soil amendments, such as lime and fertilizer, need to be incorporated into the soil to promote healthy vegetation.

Irrigate as necessary to establish and maintain vegetation until 75% of vegetation has established and has reached a height of 2 inches. Frequent, light irrigation will need to be applied to seeded areas if natural rain events have not occurred within two weeks of seeding. While watering seeded areas use a fine spray to prevent erosion of seeds or soil. Do not over irrigate. Proper irrigation guidance is provided under the Maintenance portion of this document.

PROJECT SPECIFIC CONSIDERATIONS

1. For applications that require special transitions (i.e. connections to riprap, concrete, T-walls, etc.), refer to the project specific drawings or consult with Propex Engineering Services at (800) 621-1273.

2. A deeper terminal trench and/or hard armoring may be required when slopes have severe scour potential at the toe location.

3. For installing ARMORMAX panels around curved sections of a slope, trim panels at an angle so that no more than two layers of ARMORMAX overlap at any point in time. Additional pins and anchors may be needed to secure panel edges towards the toe of the slope depending upon the radius of the curved slope. Install pins or anchors as necessary to securely fasten ARMORMAX to the ground.

4. Allowable Vehicle Traffic:

   A. If using equipment on ARMORMAX, it should be of the rubber-tired type and should avoid sharp turns. Tracked equipment is not permitted to drive over the ARMORMAX without vegetation at any time.

   B. Avoid any traffic over ARMORMAX if loose or wet soil conditions exist.

5. Disturbed areas should be reseeded. If ruts or depressions develop for any reason, rework soil until smooth and reseed such areas.

SHORT-TERM AND LONG-TERM MAINTENANCE OF ARMORMAX

The purpose of this section is to provide some general guidelines for performing short-term and long-term maintenance of ARMORMAX with respect to maintaining vegetation reinforced with ARMORMAX, and patching of ARMORMAX (in the event it needs to be removed or replaced). These procedures are to be considered minimum guidelines for proper maintenance, and further maintenance techniques may be appropriate considering local practices and procedures.

ARMORMAX PROTECTED SLOPES

For ARMORMAX to be most effective, it is important to ensure that it is properly maintained both during construction and after construction. Identifying trouble areas is easy with ARMORMAX, and it can make identifying potential threats much simpler and manageable. Look for areas with sparse, dying, or no vegetation as these are obvious signs that ARMORMAX is losing intimate contact with the slope surface. If loss of ground surface occurs, ARMORMAX will need to be removed and reinstalled as described in *PATCHING AND REPAIRS* section after the eroded area is backfilled with compacted soil that is similar to material of the slope. After ARMORMAX is reinstalled, re-establish vegetation on the newly installed ARMORMAX and disturbed areas. Monitor the sites to determine if frequent watering may be required to establish vegetation.

To minimize exposure to unwanted maintenance and repair, ARMORMAX armored slopes should be free of unauthorized vehicular traffic. Routine maintenance and slope inspections should be performed with rubber tired vehicles. Tracked equipment such as skid steers, excavators, or dozers should only be allowed to traffic over ARMORMAX in times of emergency after vegetation establishment is complete. Failure to control unauthorized traffic can result in ARMORMAX being damaged resulting in erosion below ARMORMAX during storm events. In addition, routine mowing maintenance should be used to keep the protected area free of unwanted brush, saplings, and trees. Selective herbicides that target only the unwanted plants can be used as long as the vegetation established with ARMORMAX is not impaired. Failure to control the sapling and tree growth can result in the trees being uprooted during a flood.

MAINTAINING VEGETATION

Good vegetative cover will ensure maximum performance of ARMORMAX. Vegetative cover care starts before a project is complete and is ongoing until all ARMORMAX is installed. Vegetative cover should be given every opportunity to grow and establish well. This will require that a contractor periodically fertilize, water, and mow the grasses as needed until a project is complete in the short-term, with the owner of the slope fulfilling the maintenance of the slope in a similar fashion for the long-term. For the entire lifecycle of ARMORMAX, every effort must be made to prevent unauthorized encroachments, grazing, vehicle traffic, the misuse of chemicals, or burning during inappropriate seasons.

1. After the installation of vegetation is complete, immediately water and soak the entire area using a fine spray to prevent erosion and loss of seeds. A suggested amount of water is identified below. Prior to installation if using sod, the sod pads in storage should be kept moist at all times and not stored for more than 24 hours from site arrival to installation. Warmer weather will necessitate more frequent applications than listed below.

    A. For each reach/segment of installed vegetation, watering shall be conducted immediately after each installation or the day's work.

    B. First 30 days, completed segments shall be watered daily with a minimum of 0.75 and a maximum of 1.0 inches per square foot per day (20,364 gallons minimum, 27,152 gallons maximum per acre per day).

    C. Second 30 days, the watering may be reduced to 0.50 inches per square foot per day (13,576 gallons maximum per acre per day) or as required based upon the condition of the sod.

    D. Avoid excessive application of water, so that surface runoff does not occur. Runoff should be prohibited. However, additional watering may be required for repaired or damaged areas.

Attachment F

Franklin & Associates
Structural Review Memorandum

FRANKLIN & ASSOCIATES
Consulting Engineers

225 East Fireweed Lane
Suite 202
Anchorage, Alaska 99503-2080
(907) 277-1691
(907) 277-2939 FAX

May 4, 2018

Ms. Heather Gross
Summit Consulting Services, Inc.
HC 72 Box 850
Tok, Alaska 99780

Re: Kongiganak Laundry Facility
Kongiganak, Alaska

Dear Ms. Gross:

Per our discussion I understand that the Village of Kongiganak wishes to upgrade the existing laundry facility by replacing all of the existing Speed Queen washing machines with Continental Girbau machines.

The existing laundry facility was built in 2000. It is a two-story wood frame building supported on 6-inch diameter thermal syphon piles. The subject washers are placed at the first floor level. The existing facility has six Speed Queen washing machines. The existing machines vary in size from the SC-18 to the SC-35. The maximum operating gravity load of the SC-35 is approximately 605 pounds. These machines are fixed to a floor top concrete mass to dampen the operating vibrations.

The proposed new machines are the Girbau EH030 and the EH040. The maximum operating gravity load of the EH040 machine is 1,237 pounds. I have performed a structural review of the existing floor framing and it is my opinion that the existing floor framing is adequate to support the additional loading of these machines.

I have discussed the installation of these new washers with a Girbau technical representative. He indicated that these washers have a built-in suspension system to minimize the vibration issue. He indicated that this installation into a wood frame building would not be a problem. These washers do not require a floor attachment in non-seismic areas and no additional concrete mass is required. Since the new washers are larger than the existing washers, the space provided to place them is limited. I have developed two potential placement plans. See the plan sketches and excerpts from the installation manual attached.

The original design of this building included 3" x 3" x ¼" angle bracing below the floor level. This bracing connects the floor beams to the piling at or near the finish grade. The purpose of this bracing is to limit the movement of the building due to lateral wind loading. Based on the photos you have provided, some of this bracing has failed in buckling and/or has been removed. The cause of this failure is not understood. Where the bottom of the brace was below grade, the failure may have been caused by frost heave. In other areas the bracing may have been removed to allow for installation of plumbing lines. This issue should be reviewed to determine the cause of the failure and to determine if the bracing is required and should be replaced.

I have discussed these issues with Mr. Roland Andrew, the Kongiganak Tribal Administrator. Mr. Andrew indicated the following:

- Three top loading Speed Queen washers are still in operation. These are the smaller machines. The newer and larger machines are not operating.
- The vibration/movement noted in the building was due to the operation of the larger Speed Queen washing machines and not due to wind loading. The building does not have a noticeable movement during high winds.
- The cause of the buckling failure and/or removal of the foundation bracing was not apparent.

If you have any additional questions or if I can be of additional help in this matter, please call.

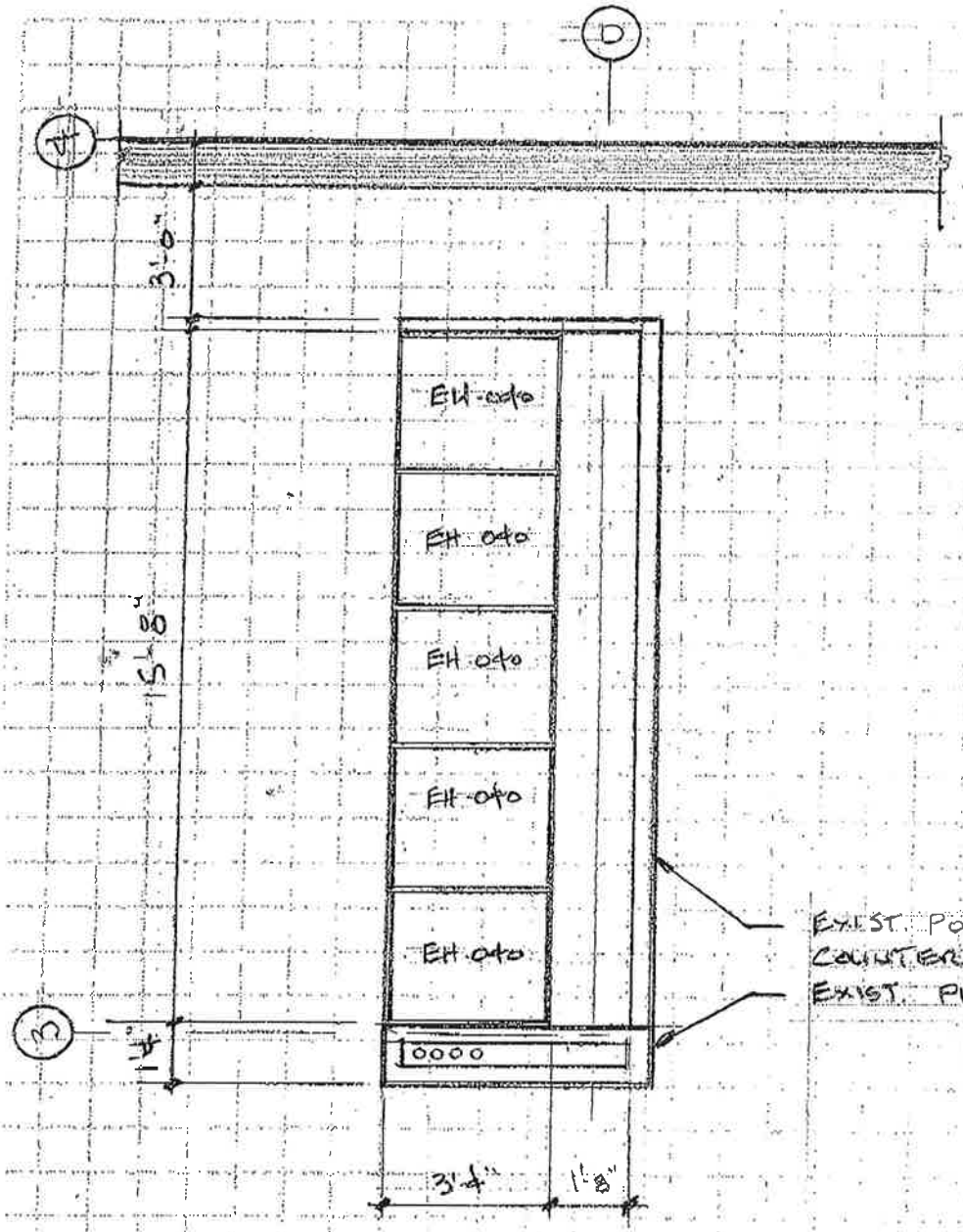
Sincerely,

Nelson M. Franklin, PE

Attachment:
Washer Placement Plan A
Washer Placement Plan B
Excerpts from the Girbau
Installation Manual, 5 pages

FRANKLIN & ASSOCIATES
Consulting Engineers

SUBJECT	KOHGIGRNAK LAUNDRY FACILITY.
PREPARED BY	[illegible]
DATE	5-4-18
SHEET	1 OF 2
JOB NO.	18-030



NOTES:

1.) THIS PLAN INDICATES PLACEMENT OF (5) GIRBAU EH-040 WASHERS.

2.) THIS PLAN ALLOWS FOR ANY COMBINATION OF THE EXISTING SPEED QUEEN OR EH-030 AND EH-040 WASHERS.

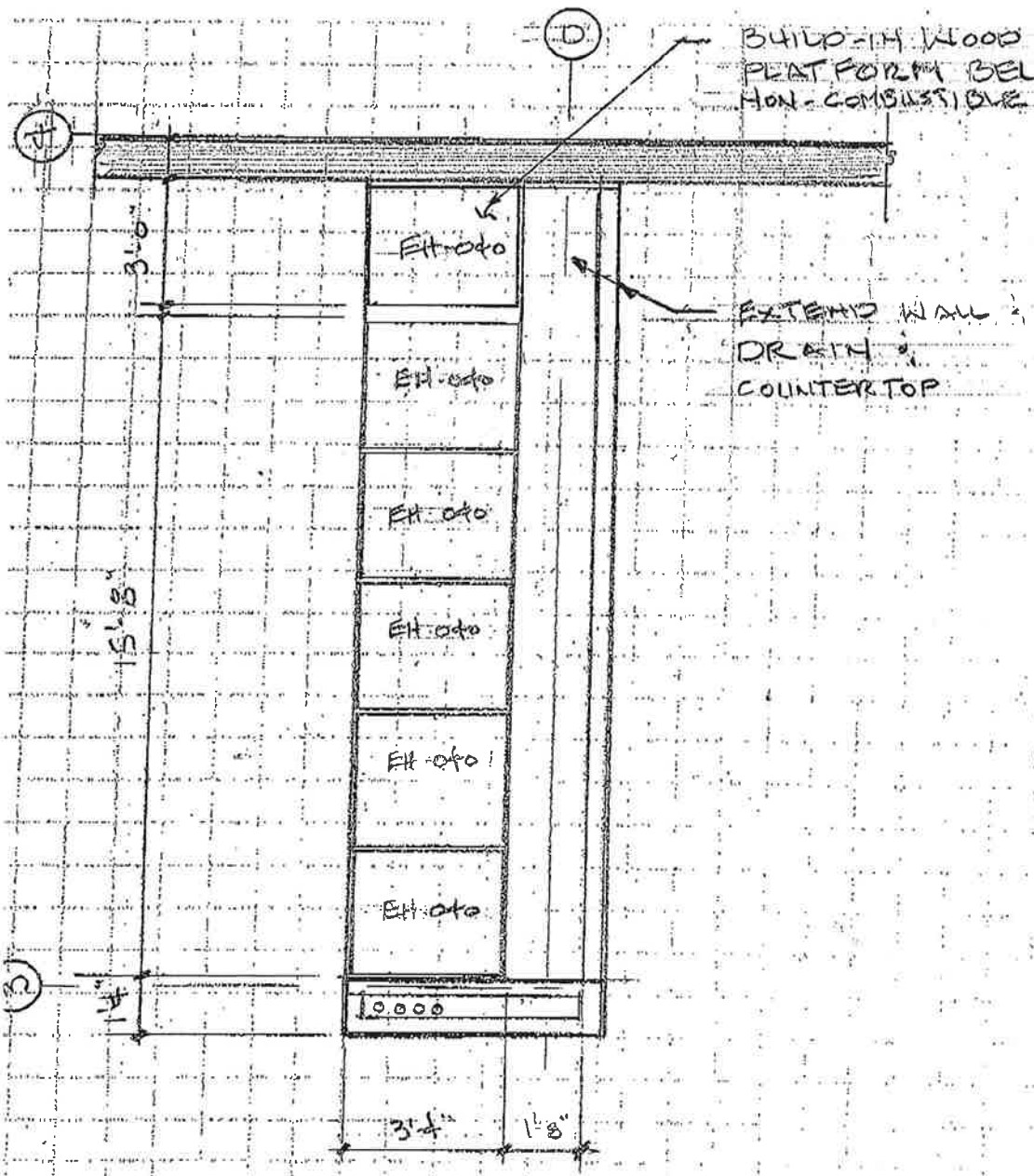
A WASHER PLACEMENT PLAN

1/4" = 1'-0"

FRANKLIN & ASSOCIATES
Consulting Engineers

SUBJECT KOBUK GRNAK LAUNDRY FACILITY.

PREPARED BY M. FRANKLIN
DATE 5-4-18
SHEET 2 OF 2
JOB NO. 18-030



B WASHER PLACEMENT PLAN

1/4" = 1'-0"

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Installation Instruction Manual for washers HS-6013/HS-6017/HS-6023/ HS-6024/HS-6032 EH030/EH040/EH055/EH060/EH080

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EN
Installation
HS-6013/17/23/24/32
EH030/040/055/060/080

Cod.nº 429043
Rev. 17/07/17

GIRBAU Technical specifications

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1.4. Installation specifications

General specifications

	UNITS	HS-6013 EH030	HS-6017 EH040	HS-6023 EH055	HS-6024 EH060	HS-6032 EH080
DRUM VOLUME	dm3 (cu.ft)	126 (4.4)	173 (6.1)	228 (8.1)	239 (8.4)	320 (11.3)
DRY LINEN CAPACITY	kg (lbs)	12.6 (28)	17,3 (38)	22.6 (50.3)	23.9 (52.7)	32.0 (70.5)
SPIN	r.p.m.	600 / 1005	550 / 950	330 / 920	350 / 966	336 / 931
	G factor	125 / 351	119 / 354	45 / 351	52 / 400	52 / 400
WASHING SPEED (max.)	r.p.m.	46.5	44	43	42	42
STATIC LOAD TRANSMITTED	kg (lbs)	409 (902)	561 (1237)	841 (1854)	693 (1528)	839 (1850)
DYNAMIC LOAD TRANSMITTED	kg (lbs)	91 (201)	96 (212)	117 (258)	132 (291)	187 (412)
FREQUENCY DYNAMIC LOAD	Hz	16.7	15.8	15.3	16.1	15.5
KINETIC ENERGY	N.m	29720	49000	66643	74789	88347
MAXIMUM THERMAL SHOCK	°C (F)	90 (162)	90 (162)	90 (162)	90 (162)	90 (162)
MAXIMUM SOUND LEVEL	dBA	< 70	< 70	< 70	< 70	< 70
PROTECTION INDEX	IP	21C	21C	21C	24	21C

Dimensions & weights

WITH CRATING	H	mm (in)	1485 (58.5)	1565 (61.6)	1650 (65.0)	1635 (64.4)	1657 (65.2)
	L	mm (in)	823 (32.4)	897 (35.3)	1025 (40.4)	1002 (39.4)	1075 (42.3)
	P	mm (in)	945 (37.2)	1017 (40)	1256 (49.4)	1260 (49.6)	1320 (52.0)
	WEIGHT	kg (lbs.)	372 (820)	495 (1091)	765 (1687)	607 (1338)	718 (1583)
WITHOUT CRATING	H	mm (in)	1325 (52.2)	1404 (55.3)	1470 (57.9)	1480 (58.3)	1500 (59.1)
	L	mm (in)	796 (31.3)	868 (34.2)	1000 (39.4)	975 (38.4)	1053 (41.5)
	P	mm (in)	887 (34.9)	962 (37.9)	1240 (48.8)	1225 (48.2)	1294 (50.9)
	M	mm (in)	509 (20)	515 (20.3)	535 (21.1)	585 (23.0)	600 (23.6)
	CdG K	mm (in)	540 (21.3)	517 (20.4)	567(22.3)	592 (23.3)	618 (24.3)
	CdG J	mm (in)	380 (15.0)	740 (29.1)	407 (16)	506 (19.9)	561 (22.1)
	WEIGHT	kg (lbs.)	344 (758)	476 (1049)	726 (1601)	584 (1289)	680 (1499)

Connections

A	CONNECTION	B.S.P.thread (NH)	2 x 3/4 (*1)	2 x 3/4 (*1)	2 x 3/4 (*1)	2 x 3/4 (*1)	2 x 3/4 (*1)
	H	mm (in)	1141 (44.9)	1232 (48.5)	1267 (49.9)	1265 (49.8)	1304 (51.3)
	MIN/MAX PRESSURE	bar (P.S.I)	0.5-6 (7-87)	0.5-6 (7-87)	0.5-6 (7-87)	0.5-6 (7-87)	0.5-6 (7-87)
	RECOMM. PRESSURE	bar (P.S.I)	2-4 (30-60)	2-4 (30-60)	2-4 (30-60)	2-4 (30-60)	2-4 (30-60)
	FLOW (4 bar)	l/min (Usgal/min)	60 (16)	60 (16)	60 (16)	60 (16)	60 (16)
	MAXIMUM TEMPERATURE	°C (°F)	80 (176)	80 (176)	80 (176)	80 (176)	80 (176)
D	OUTLET HOSE	Ø mm (in)	80 (3.15)	80 (3.15)	80 (3.15)	80 (3.15)	80 (3.15)
	H	mm (in)	125 (4.9)	125 (4.9)	175 (6.9)	145 (5.7)	149 (5.9)
	N	mm (in)	132 (5.2)	154 (6.1)	29 (1.1)	180 (7.1)	225 (8.9)
	P	mm (in)	250 (10)	250 (10)	250 (10)	250 (10)	250 (10)
	DRAIN BOX DIMENSIONS (L,P,H)	mm (in)	300x300x250(H) 12"x12"x10"(H)	300x300x250(H) 12"x12"x10"(H)	300x300x250(H) 12"x12"x10"(H)	300x300x250(H) 12"x12"x10"(H)	300x300x250(H) 12"x12"x10"(H)
	DRAIN BOX PIPE	Ø mm (in)	100 (4)	100 (4)	100 (4)	100 (4)	100 (4)
E	INLET FASTENING	Ø mm (in)	37 (1 1/2)	37 (1 1/2)	37 (1 1/2)	37 (1 1/2)	37 (1 1/2)
	H	mm (in)	1005 (39.5)	1165 (45.9)	1129 (44.4)	1160 (45.7)	1177 (46.3)
	N	mm (in)	326 (12.8)	360 (14.2)	429 (16.9)	415 (16.3)	403 (15.9)
Ed	INLET FASTENING	Ø mm (in)	16 (0.6)	16 (0.6)	16 (0.6)	16 (0.6)	16 (0.6)
	H	mm (in)	1005 (39.5)	1120 (44.1)	1129 (44.4)	1160 (45.7)	1177 (46.3)
	N	mm (in)	226 (10.5)	367 (14.5)	367 (14.5)	359 (14.1)	347 (13.7)
	MAXIMUM VOLTAGE	V	240	240	240	240	240
	MAXIMUM CURRENT	A	0.05 (*2)	0.05 (*2)	0.05 (*2)	0.05 (*2)	0.05 (*2)
d	CONNECTION	mm (in)	8 x diám,10 (3/8) 1 x diám,12 (1/2)	8 x diám,10 (3/8) 1 x diám,12 (1/2)	8 x diám,10 (3/8) 1 x diám,12 (1/2)	8 x diám,10 (3/8) 1 x diám,12 (1/2)	8 x diám,10 (3/8) 1 x diám,12 (1/2)
	H	mm (in)	1019 (40.1)	1100 (43.3)	1143 (45.0)	1155 (45.5)	1174 (46.2)
	N	mm (in)	304 (11.9)	340 (13.4)	406 (16)	393 (15.5)	412 (16.2)
V	CONNECTION	B.S.P.thread (in)	1/2	1/2	1/2	1/2	1/2
	H	mm (in)	625 (24.6)	626 (24.6)	671 (26.4)	610 (24.0)	620 (24.4)
	N	mm (in)	342 (13.4)	384 (15.1)	459 (18.1)	430 (16.9)	469 (18.5)
	PRESSURE	bar (P.S.I)	2/6 (29/87)	2/6 (29/87)	2/6 (29/87)	2/6 (29/87)	2/6 (29/87)
	FLOW	kg/h (lbs/h)	80 (176)	80 (176)	80 (176)	80 (176)	80 (176)
Vc	INLET FASTENING	Ø mm (in)	16 (0.6)	16 (0.6)	16 (0.6)	16 (0.6)	16 (0.6)
	H	mm (in)	1005 (39.5)	1120 (44.1)	1129 (44.4)	1160 (45.7)	1177 (46.3)
	N	mm (in)	226 (10.5)	367 (14.5)	337 (13.3)	311 (12.2)	299 (11.8)

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Legend

CONNECTIONS	
A	Water supply
P	Drain
E	Electrical connection inlet
Ed	Electrical connection inlet external dosing
d	Product inlets external dosing
V	Steam inlet connection
Vc	Vending connection inlet (not applicable to USA/CANADA models)
1	INTELI CONTROL: option 3 x 3/4 in
2	Origin of the external dosing signal to the washer 1A maximum current

DIMENSIONS (Figures 1, 2 & 3)	
H	Height from the machine base
N	Distance from the centre of symmetry of the unit
P	Depth
M	Height to door bottom
	Gravity centre (GC)

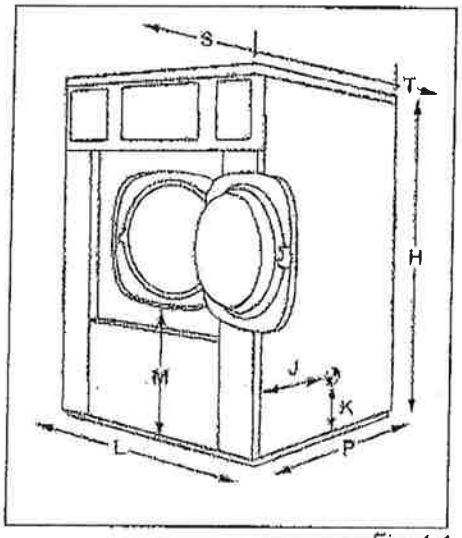

Fig. 1.1

HS-6013/17/23 / EH030/040/055

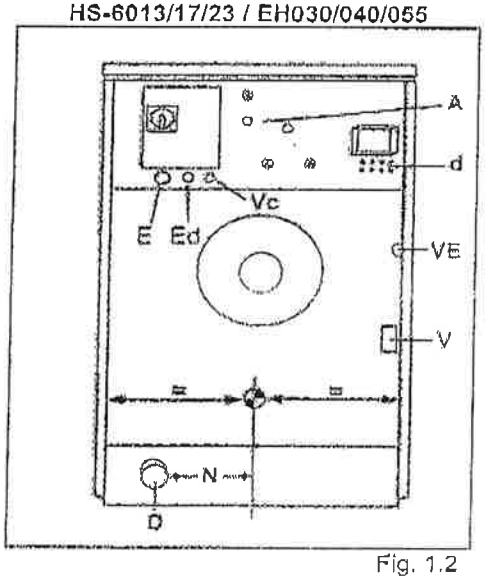

Fig. 1.2

HS-6024/32 / EH060/080

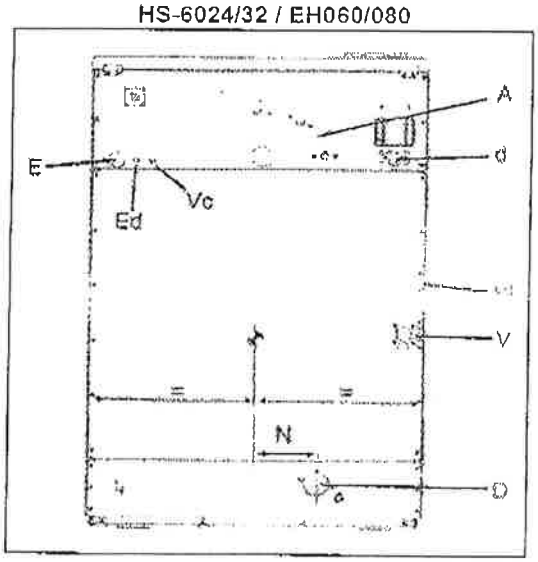

Fig. 1.3

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TO REDUCE VIBRATION AND SOUND AND TO ENSURE THAT THE MACHINE IS CORRECTLY BALANCED, IT IS ESSENTIAL THAT THE FOUR BASE LEGS OF THE WASHING MACHINE REST UNIFORMLY UPON THE FLOOR. DO NOT PLACE ANY TYPE OF ANTI-VIBRATORY DEVICE BETWEEN THE WASHER AND THE FLOOR.

NEVER INSTALL THE WASHER OVER AREAS BUILT WITH COMBUSTIBLE MATERIAL.
IF WASHERS ARE INSTALLED ON METALLIC SURFACES, AN ELECTRICAL CONDUCTOR INDEPENDENT TO THE WASHER GROUND MUST GROUND THESE SURFACES.

HS-6013, HS-6017, EH030; EH040 models.
To improve the ergonomics of loading and unloading operations, the washing machine can be installed on metal pedestals designed for this purpose (Fig. 2.3).
Check the characteristics of this product with the manufacturer or the authorized distributors.

Fig. 2.3

⚠ Specific warning for appliances installed IN THE USA /CANADA.

To reduce the risk of fire, this appliance must be fastened or otherwise secured to an uncovered concrete floor.

Alternatively the appliance should stand on a metal plate, at least the same size as the appliance and minimum thickness of 1/16 inch.

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2.5. Installing more than one washer

If the installation calls for more than one washer, align them with each other.
The minimum distance between adjacent machines and the user and maintenance areas (values I, S and T of Figure 2.4) are specified on the table below.
Check the dimensions of the drain box and the drain pipe on the table below.

[redacted]

Positioning conditions (Fig. 2.4)

I	DISTANCE BETWEEN MACHINES (RECOMMENDED) (Comunorcial and industrial laundries)	mm (in)	100 - 250 (4 - 10)
	DISTANCE BETWEEN MACHINES (MINIMUM) (Coin-op laundries)	mm (in)	10 (0.4)
S	WORKING AREA	mm (in)	1000 (39.4)
T	REAR MAINTENANCE AREA (*1)	mm (in)	500 (19.7)
A	DRAIN BOX	mm in	300 x 300 x 250 (H) 12" x 12" x 10" (H)
Ø	DRAIN PIPE (Øx1; Øx2; Øx3)	Ø mm (in)	100; 150; 180 (4; 6; 7)

*1. Double drain kit washers: figure T must measure 600 mm (23.6 inch) minimum

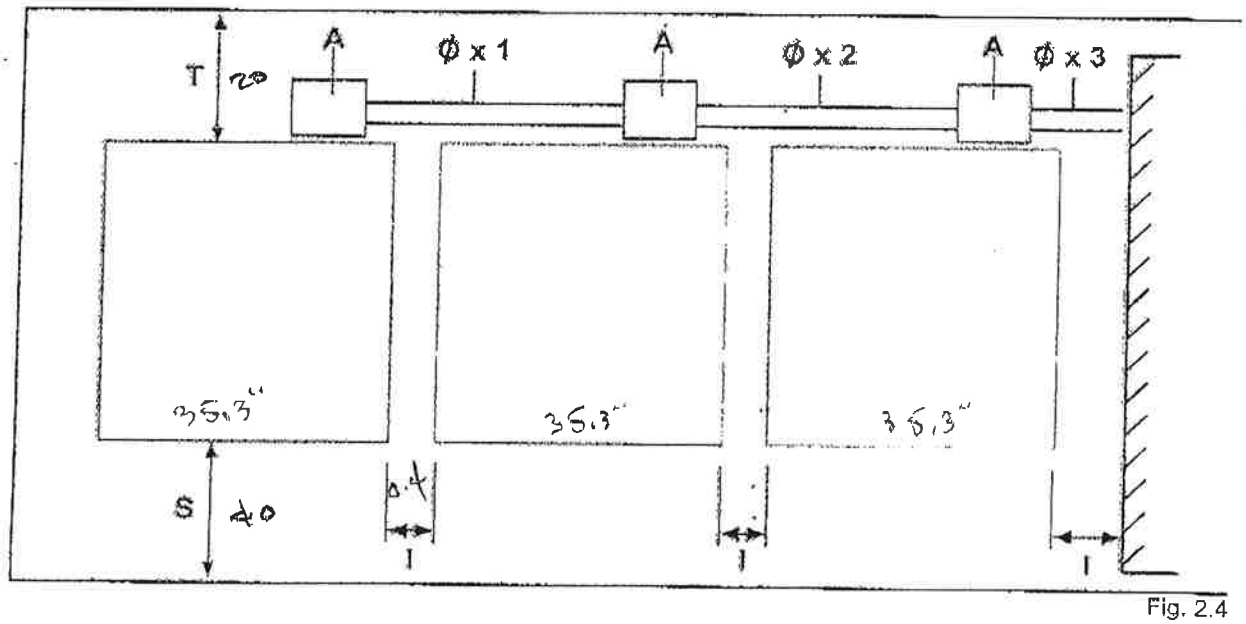

Fig. 2.4