3.3 EXISTING SITE – KIVALINA "DO NOTHING"

Evaluation of the existing village site has two alternatives: 1) the 'Do Nothing' Option, where the existing conditions are allowed to remain without alteration, and 2) a site modification program, whereby the site is raised to elevate it above the level of the storm surge, the seaward side of the spit is armored against storm wave erosion, and the lagoon side of the spit is armored against further erosion on that side.

The "Do Nothing" alternative will leave the village in the same condition it is currently in. The shoreline will continue to erode, shrinking the village until residents are forced to move or be displaced by the ocean. Residents will almost certainly be forced to abandon the village as the ocean reclaims the barrier island.

The "Do Nothing" option would leave the existing water and wastewater utilities unchanged. The ability of the residents to maintain sanitary and healthy conditions is restricted by a limited supply of water that must be individually hauled to each home. Only the school and clinic have running water and sewer systems. Furthermore, government funding agencies will not fund sanitation projects in quite justified fear that the investment will be destroyed by the village's exposure to storms, erosion, and flooding.

Clearly the "Do Nothing" option is not a viable alternative for the people of Kivalina. The imminent threat of erosion and flooding, the village's overcrowding and lack of room to expand, and the health dangers associated with the existing water and sewer systems eliminate the possibility of leaving the village in its current state. Rebuilding the existing site presents problems with funding and infrastructure development and protection. The village of Kivalina should be relocated to a new site for the health and well-being of its population.

3.4 EXISTING SITE – KIVALINA IMPROVEMENTS

3.4.1 Location and Site Description – Kivalina Improvements

See Section 2 for a description of the village location.

3.4.2 Site Development – Kivalina Improvements

Alternatives to make the Kivalina site habitable involve a program of engineered improvements to raise the elevation of the village above the storm surge, install erosion protection and armoring along the seaside of the village, and construct needed grading, sanitation, and building improvements. It should be noted that the existing Kivalina townsite has little potential for community expansion in response to community growth, compared to any of the other sites. Developable land is restricted on three sides by water, and by the airport on the north side of the townsite. There is insufficient land to meet community growth needs at this site.

The high point of the village is at a 10 ft. elevation. To be above the projected storm surge, the village would have to be raised to elevation 16.5 feet. In rough numbers, and assuming that no improvements will be made to elevate the runway, the amount of gravel needed to raise the entire village 6.5 feet would involve an area 1,800 ft long by 600 ft. wide. This includes the area from the runway to the north to Singauk Entrance, as well as filling part of the lagoon. The outside of the spit for the entire perimeter of the village would be armored for about 4,285 lf and would require over 31,000 yards of rock. Twenty-four new homes can then be added.

With the village site raised above the storm surge and the edges armored against wave

erosion, a buried utility system could be installed in the village to carry water to every building and convey sewage away to a treatment plant. Utility piping buried below the storm surge elevation would be anchored to prevent floating and constructed of a watertight material to ensure no infiltration occurs.

Placing gravel over an already developed site requires the work to be done in phases. Completing the work in a single construction season requires coordination of gravel delivery and offloading, placement and relocation of buildings. Gravel would be barged to the site, offloaded, and placed concurrently. Gravel deliveries would be spaced out to allow time for the buildings to be moved onto the newly raised gravel section.

Optimally, each building would only be moved once. Raising the village could potentially be done by placing gravel and armor rock from the north to the south in sections. As each section of gravel is installed, the nearby houses can then be moved onto the gravel pad, leaving an area with no structures for installation of the next section of gravel. At the same time, armor rock could be placed along the water edges. This "leapfrog" method of raising the finished grade elevation and moving the buildings would continue to the south end of the site.

However, some buildings in the village are not structurally sound enough to be moved and would need to be replaced. Other structures, such as the water tanks, store, school, and power plant either provide essential services or are too large to move easily. These buildings must be moved or elevated by more complicated means.

The economic implications of moving the existing water tanks must be analyzed. It may be more economically feasible to install a temporary water storage system, dismantle the existing tanks, raise the site, and erect new tanks that would be larger, better insulated and more well-protected.

The same is true for the school. The existing structure was constructed in the mid '70's, and is due for replacement. A local site raising could be performed after the existing school is torn down. The raising and armoring of the existing site should take place over the period of a single summer, so the existing school may not need to remain in service during construction. Since a new school would take more than a single year to construct, a replacement, such as modular units, would have to be installed while the new school is under construction.

It may be possible to raise the existing school and install a new foundation as described above. This would allow the existing school to remain in service while a new school is being constructed. Because of the tight space on the spit, any new school would have to be built on an area raised to the finished grade elevation of the village and extended to the west to add additional buildable land. This process would involve removing the existing teacher housing and replacing it with new, consolidated housing.

The modular units could then be moved and used for other purposes in the village, whether it is housing or public/community buildings.

Immediately after the gravel is placed and the buildings moved onto the new gravel pad, excavation for water and sewer lines in the new pad could begin. A system of water and sewer mains and services could be installed and remain unused until a water treatment system and sewer treatment system could be constructed and connected, probably in the year following the gravel/armor rock placement.

The process of raising the existing village site may require an enormous amount of

cooperation, coordination, and funding to ensure a continually efficient construction process.

3.4.3 Infrastructure Development – Kivalina Improvements

3.4.3.1 Water – Kivalina Improvements

A piped water system has been selected for any new town site, including improvements to Kivalina. Based on developing a system in Kivalina, continued use of the Wulik River is proposed as the water source. An infiltration gallery located approximately 2 miles east of Kivalina could be developed to ensure year round water. For a piped distribution system, a year around water source, with storage, treatment plant, and distribution mains are proposed per Section 3.1, Non Site Specific Alternatives. Water mains within the village site could be buried below ground, while water transmission mains from the water source would have to be constructed above ground away from any ice-rich permafrost. Circulation and the addition of heat is required to keep the water lines from freezing.

3.4.3.2 Wastewater – Kivalina Improvements

Improvements to the current site's sanitation facilities are limited by funding restrictions; the U.S. Environmental Protection Agency (EPA) and VSW will not fund any sanitation facilities that cannot be relocated to the new town site. Because piped utilities are being planned for the new town site, a flush and haul system would not be relocated; therefore the EPA and VSW have cancelled existing funds planned for upgrading the existing sewage lagoon to prepare for the installation of a flush and haul system at the existing town site.

Limited space on the island makes it difficult to place a lagoon system. In addition, flooding from storms would affect a lagoon system. Due to space constraints at the village site, this report recommends pretreatment using a package treatment plant, followed by discharged to a buried drain field. An alternative to a drain field is discharging directly to the Chukchi Sea. Sludge could be discharged to a sludge disposal pit located at the landfill. Refer to Section 3.1, Non Site Specific Alternatives for more detailed discussion of each component of the system. Discharging to a buried drain field has been a problem in the past.

The soils consist of sandy soil or beach sand typical of barrier islands in the region. Golder (1997) found the top of the permafrost approximately 12 ft below the surface. A well drilling log (1976) indicates permafrost between 18 and 58 ft. Due to the high permeability of the soil, depth of permafrost, and the failure of currently installed systems serving Kivalina, a subsurface disposal field should not be considered.

USACE (1998) discusses sizing and location of the disposal field. From EPA recommended application rate, the disposal field would be 20,000 sq. ft, or approximately one-half acre. The proposed location of the disposal field would be in the northern half of the proposed new landfill.

3.4.3.3 Solid Waste – Kivalina Improvements

Kivalina's current Class III municipal solid waste landfill does not comply with ADEC or FAA regulations. Specifically, the landfill is located approximately 1,984 feet to the north end of the Kivalina Airport runway. 18 AAC 60.305 requires a minimum 5,000 feet set back limit separating the airport runway end from a municipal solid waste landfill. This close proximity to the runway creates a hazard to aircraft when scavenging birds are attracted to the landfill. Bird strikes are extremely dangerous to aircraft and can quite easily cause an airplane to crash.

Limited space and continued erosion at the existing site makes it impossible to meet the minimum 5,000 feet set back requirement.

3.4.3.4 Fuel – Kivalina Improvements

Except for the location of marine headers and fill pipeline routings, the information in 3.2.6: Fuel applies to all potential sites equally.

3.4.3.5 Heating – Kivalina Improvements

The information in 3.2.7: Heating applies equally to all sites.

3.4.3.6 Electricity – Kivalina Improvements

3.4.3.6.1 Generation

Electricity for the community is supplied by AVEC. Electric usage (2002 statistics) for the existing community was 1.17 M kWH with peak load of 263 kW and an average load of 134 kW at any given hour. The usage numbers are based upon a community of 383 persons without plumbing. The usage numbers include the power for private buildings, community buildings, commercial buildings, school buildings, churches, the community clinic, the National Guard Amory, the community Washeteria and the AVEC station power.

Presently, AVEC serves the community with three generators: 229 kW, 203 kW, and 271 kW. The Washeteria also has its own 12 kW backup generator. A fourth 337 kW generator is currently not being used for power generation and is in need of replacement. Of the three other generators on line, the 229 kW is the newest and was installed in 1996. The 229 kW generator has clocked about 33,000 hours; typical retirement time for generator drivers has been 100,000 hours at best. Extrapolating actual usage hours from the typical retirement time, there are about eight years of life remaining on the newest of the AVEC generators.

3.4.3.6.2 Distribution

Overhead primary distribution is used throughout the community. Pole-mounted transformers convert 3-phase primary voltage to secondary 3-phase and single phase low voltage (208/120 volts 3-phase or 240/120 volts single phase) for building electrical services. All electrical services are metered, with demand type metering used for commercial and larger community buildings.

3.4.4 Access – Kivalina Improvements

The only access to the village is by boat, air, and snow machine (during the winter). There are no roads to the village. Regularly scheduled air transportation service is provided by several small air carriers local to the region.

Access by boat is from the Chukchi Sea. There are no dock facilities at the existing village site. All boats either anchor in the lagoon or the Chukchi sea, or tie up to shoreside deadmen.

3.4.4.1 Access for Subsistence Activities – Kivalina Improvements

The community has immediate access to the sea and all points inside the lagoon by boat. Singauk Inlet at the South end of the village spit affords a passage between the lagoon and the sea. Generally rougher waves on the sea side of the village make tying up in the lagoon the safer choice.

The lagoon is the main access to the Kivalina river to the north of the village and the Wulik River immediately south of the site. The lagoon itself is approximately 14 miles long and an average of 1 mile wide. Since the lagoon fronts the entire length of the existing village, direct access is available to all members of the community.

3.4.4.2 Goods & Supplies – Kivalina Improvements

All goods and supplies, including bulk fuel, are brought into the village by barge or aircraft. During the summer months when the sea is ice free, shallow draft barges can access the lagoon through Singauk Inlet and offload cargo in the relatively protected saltwater inlet. Vessels with too deep a draft to enter the inlet can tie up on the shore near the village. The seaside mooring is exposed to the wind, waves and storms off the Chukchi Sea, so delivery that must be made to this side is weather dependent. All cargo off loaded can be taken directly into the village, which fronts the barge mooring area.

Barge service for goods and bulk fuel is delivered once a year during the summer.

Small packages and mail are brought in daily by air. The airstrip also serves as a means of emergency evacuation in case of illness or injury. During periods of fuel shortages, fuel has been flown into the community.

3.4.4.3 Air Transportation – Kivalina Improvements

The village has a 3,300 ft long gravel runway, maintained by the ADOT&PF, at the immediate north end of the village. The runway's location is convenient, but it restricts expansion of the village. Currently, the runway is in violation of FAA regulations as it abuts the existing solid waste dumpsite to the north without the required 5,000 feet distance between the two facilities. There is no immediate solution to this problem.

3.4.4.4 Roads & Streets within Community – Kivalina Improvements

The road layout within the community is essentially an 'oval,' with two roads running parallel to each other at the third points of the width of the village. These roads are joined at the south end by a curved gravel trail that has become banked as years of four-wheeler traffic has pushed the loose sands and gravels to the outside of the turn. The rest of the roads have no distinct layout and were formed as residents simply took the shortest path to their destination.

3.4.4.5 Roads Outside the Community – Kivalina Improvements

There are no roads outside the community. There is a trail that is an extension of the North end of the gravel runway that provides access to the solid waste dump site. Beyond that there are primitive four-wheeler trails that allow access to the north end of the lagoon and points beyond.

3.4.5 Native Allotments

There are no Native allotments in the vicinity of the existing townsite (see Figure 2). Expansion of the existing Kivalina townsite is not constrained by Native Allotments.

3.4.6 Site Costs – Kivalina Improvements

A construction cost estimate to redevelop the existing site has been prepared. Design and construction administration are not included in the costs. The estimate includes adding fill to the entire village site, adding erosion projection, creating new fill sections for immediate growth, and adding infrastructure similar to the proposed relocation sites. The cost estimate to rebuild Kivalina within the existing site is **$196.2 million.** Detailed costs are included in Appendix A. A summary is included below:

Site work and Airport Construction	$109,600,000
Erosion Protection	$7,151,550
Construction Camp	$902,670
Power and Fuel	$5,292,000
Move Buildings	$1,125,000
New Buildings	$52,690,000
Water/Sewer System and Landfill	$19,473,814
Transportation System	N/A
Total Cost	**$196,200,000**

THE SCHOOL DRAINFIELD, CLINIC DRAINFIELD, SCHOOL RELOCATABLE AND FRANKLIN KNOX BUILDING ARE SHOWN IN APPROXIMATE LOCATION FROM DATA COLLECTED DURING JULY 23-25, 2003 SITE VISIT BY TNH. THE LOCATION OF THE HUD HOUSES WAS PROVIDED BY U.S. ARMY CORPS OF ENGINEERS. HUD HOUSE SIZE WAS MEASURED IN THE FIELD BY TNH ON 7/25/03. MAP LAST UPDATED ON 9/13/04 TO INCLUDE SITE VISIT DURING AUGUST 23-28, 2004 BY TNH.

KIVALINA VILLAGE
RELOCATION PROJECT

FIGURE 4
KIVALINA AERIAL MAP

AERIAL PHOTO TAKEN AUG. 25, 2000
KIVALINA, ALASKA

SHEET 1 of 1

FILE NAME KIVALINA AERIAL.DWG

LEGEND

001 - NOAA WEATHER STATION
002 - AIRPORT WARMUP SHACK
003 - ADOT GARAGE
004 - ADOT STORAGE/SHOP
005 - ABANDONED HOUSE
006 - LOWELL SAGE SR.
007 - ANDREW KOENIG
008 - ANITA HAWLEY
009 - BRENDA NORTON
010 - GARY SWAN
011 - AUSTIN SWAN SR.
012 - MYRA HENRY
013 - STAN HAWLEY
014 - ROY ADAMS SR.
015 - MIDAS KOENIG SR.
016 - EPISCOPAL MISSIONARY HOUSE
017 - BERTHA ADAMS
018 - LARRY ADAMS
019 - LOWELL SAGE JR.
020 - JAMES HAWLEY JR.
021 - FRIENDS CHURCH HOUSE
022 - WILLIE HAWLEY
023 - DOLLY HAWLEY
024 - MARILYN BOOTH
025 - ABNER HAWLEY
026 - ABANDONED/STORAGE
027 - SARAH HAWLEY
028 - SARAH HAWLEY
029 - ROCKY HAWLEY
030 - ROSSWELL STALKER
031 - DENNIS SWAN
032 - ALBERT KOENIG SR.
033 - ORAL HAWLEY
034 - LOUISE L. HAWLEY
035 - LOUISE L. HAWLEY
036 - BERT ADAMS
037 - WILLARD ADAMS SR.
038 - LUKE KOONOOK JR.
039 - JOY KOENIG
040 - JOY KOENIG
041 - STORAGE BUILDING
042 - WILLARD ADAMS SR.
043 - THEODORE BOOTH JR.
044 - RUTH ADAMS
045 - CITY STORAGE BUILDING
046 - CITY CONNEX
047 - CITY RESIDENCE
048 - CITY/IRA OFFICE
049 - BRUCE WESLEY JR.
050 - CHESTER BUNDE
051 - LOUIS WESLEY SR.
052 - POST OFFICE
053 - VICTOR ADAMS JR.
054 - STORAGE
055 - VICTOR ADAMS JR.
056 - ENOCH NORTON
057 - ANNA PEARL KNOX
058 - ENOCH ADAMS SR.
059 - ENOCH ADAMS JR.
060 - JANET MITCHELL
061 - JOE SWAN JR.
062 - FRANCIS SWAN
063 - FRANKLIN KNOX
064 - JOE SWAN SR.
065 - STORAGE
066 - EPISCOPAL CHURCH
067 - STORAGE
068 - JANET MITCHELL
069 - MAY ADAMS
070 - DELLA BOOTH
071 - AVEC FUEL FARM
072 - AVEC POWER PLANT
073 - AVEC STORAGE
074 - BOYS & GIRLS CLUB
075 - OLD COMMUNITY BUILDING
076 - NEW STORAGE TANK
077 - NATIONAL GUARD ARMORY
078 - AVEC POWER PLANT
079 - OLD CLINIC/CITY
080 - NEW CLINIC
081 - ALICE B. SWAN
082 - DOUGLAS SWAN
083 - OTZ TELEPHONE COOP.
084 - ORAN KNOX SR.
085 - JERRY NORTON
086 - CITY RENTAL RESIDENTAL
087 - WINONA CARTER
088 - SMALL WATER STORAGE TANK
089 - DOLLY FOSTER
090 - RUSSELL ADAMS SR.
091 - WATER PLANT STORAGE
092 - ALLEN KNOX
093 - OIL STORAGE TANK
094 - OLD FRIENDS CHURCH
095 - RUSSELL ADAMS SR.
096 - RUSSELL ADAMS JR.
097 - MARIAM NORTON
098 - RAY AND WINONA HAWLEY
099 - MARIAM NORTON
100 - RAYMOND HAWLEY
101 - RAYMOND HAWLEY
102 - WATER PLANT STORAGE
103 - CHERYL SAGE
104 - STORAGE
105 - STORAGE
106 - LOWELL SAGE JR.
107 - MCQUEEN SCHOOL
108 - CHERYL SAGE
109 - FRIENDS PASTOR CABIN
110 - SAMMY BARR
111 - CALEB WESLEY
112 - STORAGE
113 - RAYMOND HAWLEY
114 - TEACHER HOUSING
115 - CLARENCE KENNEDY
116 - CHARLES ADAMS
117 - MIDA SWAN
118 - RICHARD SAGE
119 - SCHOOL STORAGE
120 - SCHOOL SHOP
121 - NATIVE STORE CONNEX
122 - NATIVE STORE STORAGE
123 - NATIVE STORE STORAGE
124 - OLD STORE TANK FARM
125 - TEACHER HOUSING
126 - TEACHER HOUSING
127 - TEACHER HOUSING
128 - KIVALINA NATIVE STORE
129 - OLD STORE TANK FARM
130 - SCHOOL STORAGE
131 - TEACHER HOUSING
132 - TEACHER HOUSING
133 - OSCAR SWAN
134 - OSCAR SWAN
135 - TEACHER HOUSING
136 - OSCAR SWAN
137 - SCHOOL STORAGE
138 - SCHOOL FUEL TANK FARM
139 - TOMMY ADAMS SR.
140 - VILLAGE STORE FUEL DISPENSER
141 - KIVALINA NATIVE STORE TANK FARM
142 - ANDREW BALDWIN SR.
143 - SCHOOL RELOCATABLE
144 - WASHETERIA
145 - SCHOOL DRAINFIELD
146 - CLINIC/WASHETERIA DRAINFIELD
147 - EROSION PROTECTION
148 - OTZ TELEPHONE EQUIPMENT
149 - TEACHER HOUSING
150 - RAW WATER INTAKE
151 - NEW FRIENDS CHURCH

PROPERTY

- PUBLIC/COMMUNITY
- INDUSTRIAL
- COMMERCIAL
- RESIDENTIAL

GRAPHIC SCALE
100 0 50 100 200
(IN FEET)
SCALE: 1" = 100'

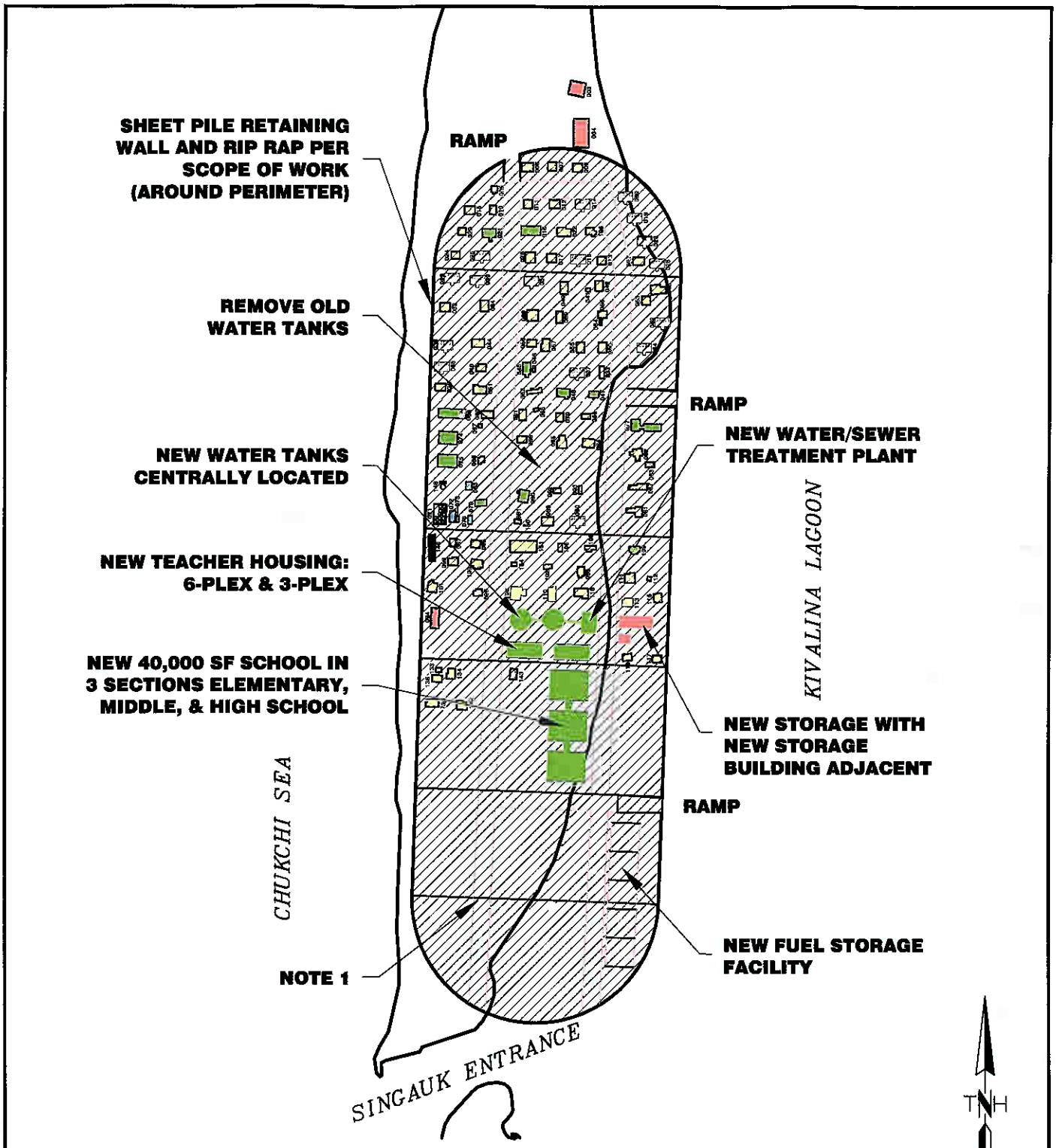
PLOT SCALE: 1:1

TRYCK NYMAN HAYES, INC.
ENGINEERS, PLANNERS, SURVEYORS
ANCHORAGE, ALASKA

DESIGNED	OFC
DRAWN	OFC
CHECKED	MEW
DATE	10/10/05
GRID	
JOB NO.	03003.007
SCALE	HOR. AS SHOWN VER.

FIELD BOOKS
DESIGN
STAKING
AS-BUILT

REV.	DATE	BY	REVISION



NOTES:

1. PHASED CONSTRUCTION TO ALLOW BUILDINGS TO BE MOVED TO NEW FILL SECTIONS.

GRAPHIC SCALE
250 0 175 250 500
(IN FEET)
SCALE: 1" = 500'

XREFs/IMAGES USED FOR THIS DWG:

PLOTTED: 06/19/06 TIME: 5:05 pm

LAYER MGR: *.lay CTB FILE: *.ctb

DRAWING NAME: KIVALINA improvements.dwg

TNH
ENGINEERING/SURVEYING & LANDSCAPE ARCHITECTURE
TRYCK NYMAN HAYES, INC.
911 W. 8TH AVENUE, SUITE 300
ANCHORAGE, AK 99501-3497
TEL: (907)279-0543 • FAX: (907)276-7679

Figure 5

KIVALINA IMPROVEMENTS

DESIGN BY: MEW	DATE: 6/16/06
DRAWN BY: RH	PROJECT No: 03003.007
SCALE: 1" = 500'	REV. –
CAD DWG FILE:	
FIELD BOOK: –	SHEET 1 OF 1
GRID: –	