Community Erosion Assessment
Akiak, Alaska
27 January 2009

1. Community: Akiak, Alaska

Figure 1: Akiak Location & Vicinity Map

2. Community Profile Summary:

Akiak, (ACK-ee-ack), is a second-class city of 367 people located on the west bank of the Kuskokwim River on the Yukon-Kuskokwim Delta. It is 42 air miles northeast of Bethel, and 377 miles west of Anchorage. Snowfall in Akiak averages 50 inches, with total precipitation of 16 inches per year. Temperatures range from -2 to 62 degrees Fahrenheit. The Kuskokwim is ice-free from mid-June through October. Akiak does not lie in an organized borough. It is located in the Bethel Recording District and Bethel Census Area. The community relies heavily on tradition and subsistence resources. Akiak is a dry community which means the sale or importation of alcohol is banned.

3. Concise Description of Erosion Problem:

Erosion at Akiak generally occurs in the spring, when snowmelt and the breakage of ice jams cause increased flow through the Kuskokwim River.

For this study the area was divided into two reaches. Reach 1 is a 2,230-foot portion of riverbank that fronts the community and is eroding at a rate of 4.1 feet per year. Reach 2 is a 3,790-foot portion of riverbank directly upstream (and north) of Reach 2 and is eroding at a rate of 6 feet per year.

An attempt was made in the past to control erosion along the upstream bank of Akiak by placing two semi submerged jetties of cylindrical pile perpendicular to the bank. These jetties proved to be problematic as they were not marked with buoys and caused some damages to boats colliding with them while they were submerged. No evidence of the jetties' impact on the bank such as accretion deposits and scour pockets associated with this kind of structure was found during the site visit.

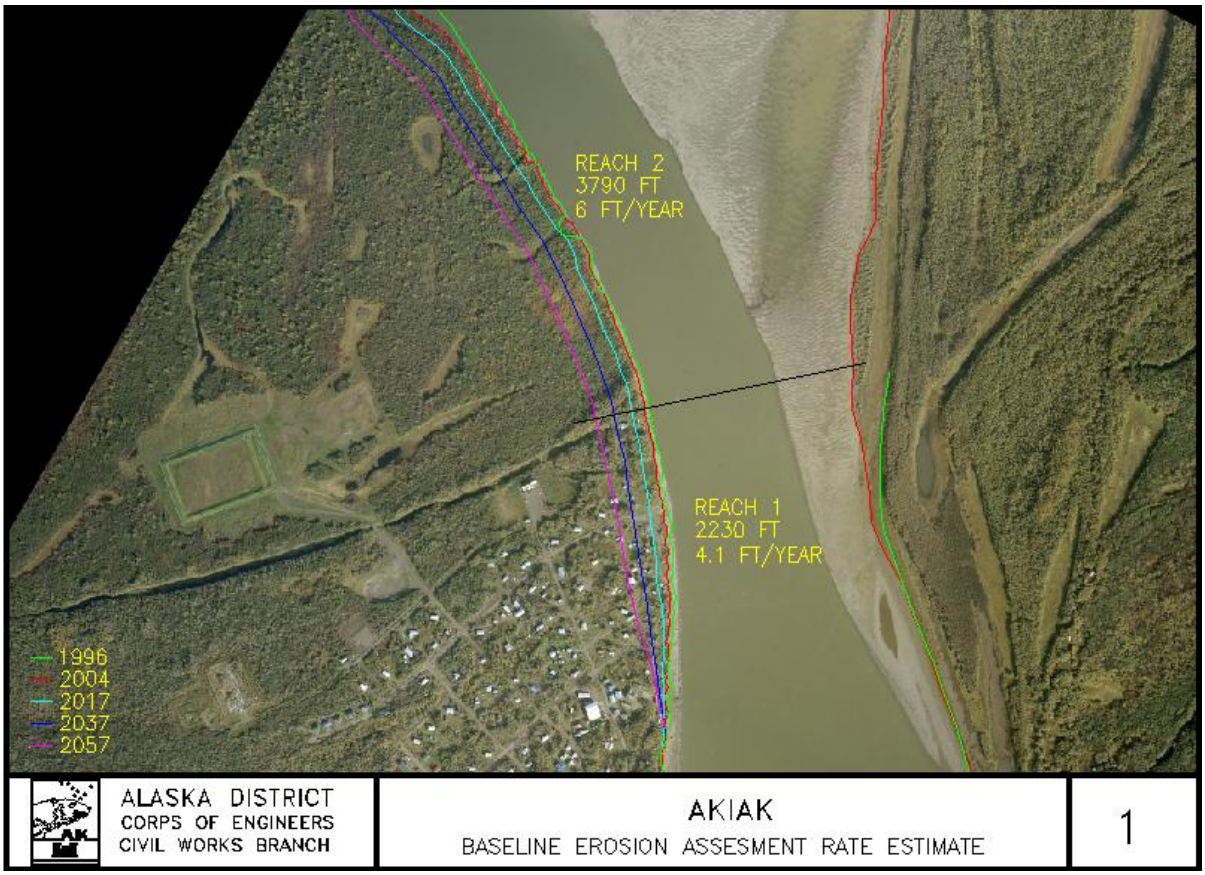

Figure 2. Akiak Erosion Map

4. Potential Erosion Damages

Using the projected erosion interval lines on the aerial photograph, the economic damages were developed for the 50 year period of analysis and broken down into the sub-intervals of 0-10 years, 11-30 years and 31-50 years. Breaking down the economic damages into these sub-intervals allows us to determine when the greatest economic impact is expected to occur. Determining when the greatest economic impact could occur is important so that timely decisions can be made when an erosion retarding measure needs to be taken. For the purposes of this report, damages were assessed by time interval rather than attempting to estimate the exact year that the damage occurs. The analysis was completed in this manner to try and account for two types of uncertainty:

1. That which is associated with predicting erosion which is progressing at varying rates over time (including episodic events); and
2. That which exists when performing a surface analysis as opposed to doing an in depth investigation such as soils exploration and expensive modeling efforts.

Damage Categories

The approach used to determine potential erosion damages is based on several assumptions as they pertain to the damage categories of residential, commercial, public infrastructure, and land values. This evaluation relies on previous reports and information gathered during site visits to determine appropriate values where data was unavailable. Assumptions used for the various damage categories are described more fully in the following discussion of future damages.

Damages caused by erosion in Akiak fall into seven damage categories: land, residential structures, commercial structures, public structures, infrastructure, cemeteries, and environmental hazards. Structures were considered a loss when the bank line encroached within ten feet of the structure's foundation. Approximately 47 percent of erosion damages in Akiak are expected to occur within the first 10 years of the examined time period.

Expected Damages

The period of analysis for this evaluation is 50 years and all damage categories have net present values calculated based on the federal fiscal year 2009 discount rate of 4 5/8 percent. The sections below detail expected losses with a summary provided in Table 1.

Akiak is losing approximately 31,900 square feet of land per year (0.73 acres). Estimated land losses for River Reach 1 are 10.70 acres with land losses for River Reach 2 expected to be 26.62 acres. It is expected that 37.33 acres will be lost over the 50-year period of analysis with a corresponding value of $373,000 and a net present value of $149,000.

Expected residential damages in Akiak are widely dispersed throughout the community. At-risk structures include 21 outbuildings (fish camps and related structures) and eight residences. Each of the outbuildings is valued at $1,000 and each residence is valued at $205,000.

Four commercial buildings are estimated to be subject to damages including the communications hub with an associated microwave tower as well as three other structures assumed to be commercial in nature based on analysis of on-site and aerial photographs.

The communications hub is expected to be lost in years 11 to 30. The three other commercial structures are expected to be lost in years 31 to 50. Our estimates likely understate the commercial damages. Were these structures to be lost, it would compromise the income earning opportunities for the businesses and the workers they employ. In addition, communications for the community would be lost and relocation efforts would impact these facilities as well.

One public building is at risk in Akiak. At this time, detailed information regarding this structure and its uses is not available. This building was assumed to be a public structure

based on analysis of on-site and aerial photographs. The building is estimated to be lost in years 31 to 50.

Building damages in Akiak are expected to total $4.5 million with a net present value of $1.4 million and an average annual cost of $73,300

Infrastructure that lies within the 50-year erosion profile includes: 23,070 feet of roads, 270 feet of sewer lines, and the old bulk fuel farm. It is likely that phone lines associated with the communications hub are also at risk during the period of analysis; however, they have been omitted from these damage calculations as the quantity threatened is unknown.

Based on engineering estimates for erosion, about 13,920 feet of roads will be affected in years 0 to 10, 8,580 feet will be affected in years 11 to 30, and 570 feet will be affected in years 31 to 50.

It is estimated that 270 feet of sewers are expected to be lost in years 31 to 50. This number is understated as there are additional sewer lines buried in areas projected to be lost to erosion. As of August 2007 these lines had been installed but not connected. Damages to sewer lines would cause sewage and related materials to enter the Kuskokwim River. While it is unknown how significant the effects will be, it is possible that these harmful contaminants could pose significant damage to local fish stocks and their related environment as well as pose a threat to human health.

As of August 2007, the fuel farm was 28 feet from the bank. It is estimated to be lost in years 0 to 10. There are environmental considerations that accompany this loss that are discussed later in this section.

In total, Akiak has $9.7 million of infrastructure at risk due to erosion. The combined net present value of these items is $6.3 million. The average annual loss of infrastructure is valued at $323,400.

The primary environmental concern in Akiak is the old fuel farm. It is unknown if the tanks are empty or still contain fuel. The surrounding soils are likely contaminated and will pose a threat to the local ecosystem and related fish stocks when they are eroded away. Decommissioning and closure of the facility is essential to avoid these harmful effects. Based on our above assumptions, this will be necessary within the 0 to 10 year time frame. This process has a cost of $512,000 with a net present value of $444,000 and an average annual cost is $22,900.

Another environmental concern is the risk associated with eroding graves. Akiak was once a regional medical hub serving patients from many of the surrounding communities. Many of the patients who died were buried on-site due to the expense of shipping the remains back home. Many of the deceased buried in the cemetery are thought to have died during a tuberculosis outbreak. The State of Alaska Department of Health and Social Services confirms that tuberculosis was a significant problem in this area during

the first half of the 1900's. Despite the passage of time, residents are concerned that they would be at risk of contracting the disease if these graves are exposed.

Akiak's cemetery was established in the early 1900's and associated with the first hospital in the area. It lies next to the river in a region where erosion is moving at an average rate of 6.0 feet per year and parts of the cemetery grounds have already been lost. While exact numbers are not known, individuals in the community indicate that between 1,000 and 1,500 graves existed in the original cemetery; we assume a total of 1,250 for this analysis. These discussions also suggested that between 50 to 75 percent of the graves have already been lost; for this analysis, we assume that 40 percent of the graves remain intact. Assuming even grave distribution and accounting for past losses, it is anticipated that 500 graves will need to be relocated over the 50-year period of analysis.

Environmental damages, as well as disaster avoidance, environmental remediation, and grave relocation costs are estimated to be in excess of $4.3 million with a net present value in excess of $3.2 million and an average annual cost in excess of $170,200.

Summary

Total erosion damages in Akiak over the 50-year period of analysis are $18.9 million with a net present value of $11.0 million and an average annual value of $574,600. Table 1 summarizes the expected damages by category.

Table 1: Total Expected Damages.

Damage category	Quantity	Time Span (years)			Total value (50 years)	Net Present Value	Average Annual Value
		0-10	11-30	31-50			
Land (acres)	37.33	$81,000	$146,000	$146,000	$373,000	$149,000	$7,700
Residential	8	11,000	827,000	825,000	1,663,000	486,000	25,100
Commercial	4	--	1,800,000	829,000	2,629,000	910,000	47,000
Public buildings	1	--	--	246,000	246,000	23,000	1,200
Infrastructure	--	5,861,000	3,521,000	315,000	9,697,000	6,263,000	323,400
Cemetery relocation	500	2,556,000	1,194,000	--	3,750,000	2,742,000	147,300
Environmental	--	512,000	--	--	512,000	444,000	22,900
Total damages	--	**$9,021,000**	**$7,488,000**	**$2,361,000**	**$18,870,000**	**$11,017,000**	**$574,600**

5. Potential Solution:

Non-structural solutions include relocating a well and abandoned storage tanks along with managing the top of the bank as a vehicle-free zone.

A riprap revetment could be constructed to protect a graveyard and fuel tanks that are currently eroding into the river. The revetment would be 275-feet long and include a 50-foot tieback key at the upstream end to prevent erosion from flanking around the structure and a tieback or thickened section at the downstream end. To accommodate erosion at the toe of the bank, a weighted toe was added to the revetment. Approximate costs are $3.4 million which is roughly $12,400 per linear foot of revetment.

6. Conclusion:

Akiak has a definite erosion problem affecting the community over the next 50 years. The community has the potential to have over $18 million in damages.

Akiak will likely require some sort of assistance to stop the erosion from causing significant future damages as they are unable to solve their own erosion problems due to limited financial resources.

7. Community Photos:

Photo 1: Looking at BM 2 from water level. Note high vertical face

Photo 2: Looking upstream at bank along central community waterfront. This area is used for launching boats.

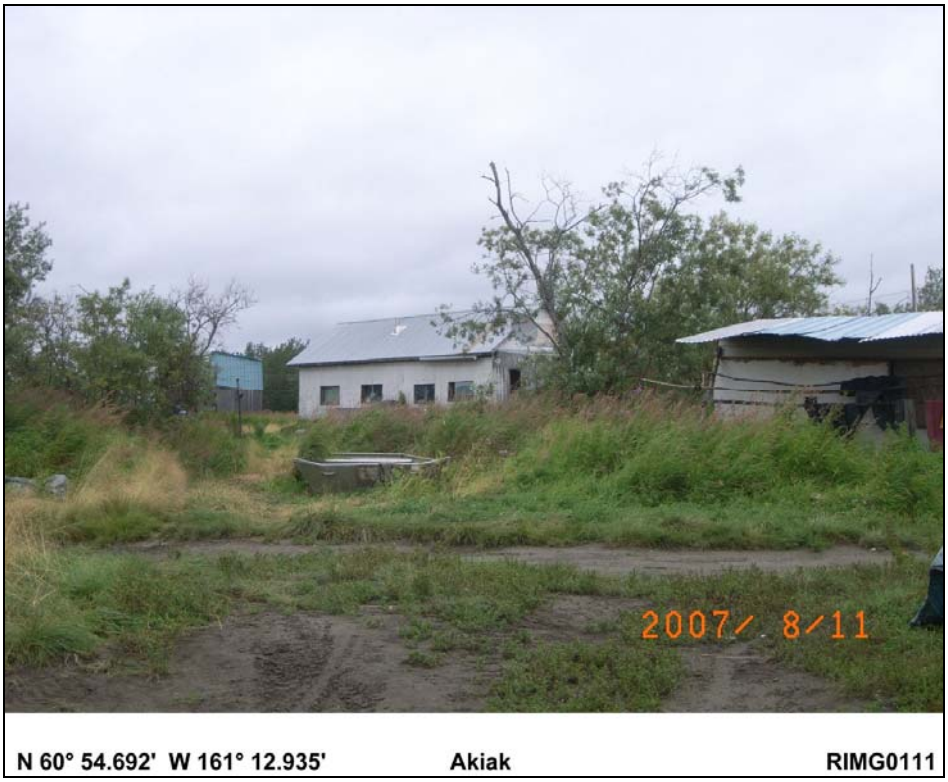

Photo 3: Near profile 2, Looking at nearest structures from top of bank along central waterfront.

Photo 4: Near BM3 Looking upstream at bank downstream from Akiak. The bank transitions from erosion to accretion in this section.

8. Additional Information:

This assessment, as well as those for other communities, can be accessed on the internet at *www.AlaskaErosion.com*. The web site also contains additional information on addressing erosion issues, educational materials, and contact information.

Kuskokwim River

Alaska District
Corps of Engineers
Civil Works Branch

Predicted and Historical Shorelines

Erosion Year

1996 2017 2057

2004 2037

AKIAK

0 250 500 750 1,000 Feet

0 100 200 300 Meters

1 inch equals 500 feet

Image dated 2004

N

Alaska Baseline Erosion

Akiak, Alaska