Community Erosion Assessment
Napaskiak, Alaska
27 January 2009

1. Community: Napaskiak, Alaska

Figure 1: Napaskiak Location & Vicinity Map

2. Community Profile Summary

Napaskiak is a second class city of 434 people located on the east bank of the Kuskokwim River, along Tupuknuk Slough, 7 miles southeast of Bethel. Napaskiak is in the Bethel Recording District of the Unorganized Borough. Napaskiak is strongly influenced by storms and patterns in the Bering Sea and also by inland continental weather. Average annual precipitation is 16 inches, with 50 inches of snowfall. Summer temperatures range from 42 to 62, winter temperatures are -2 to 19.

Napaskiak is a traditional Yup'ik Eskimo village dependent upon fishing and subsistence activities. The sale or importation of alcohol is banned in the village.

3. Concise Description of Erosion Problem

The community of Napaskiak is oriented along the south bank of Tupuknuk Slough with a large setback from the bank for most of the length of the community. For this study the community was divided into three reaches. Reach 1 is a 950-foot length of bank at the

downstream end of Tupuknuk Slough and is eroding at a rate of 1 foot per year. Reach 2 is a 1,350-foot reach of bank directly fronting the community. Tupuknuk Slough runs between the community and an island at this point. It is the preferred location for boat launchings and landings and is eroding at a rate of 2.5 feet per year. Reach 3 is a 1,900-foot reach of bank at the upstream end of the village prior to the island and is eroding at 1.8 feet per year.

While erosion is not currently a major problem at Napaskiak, the morphology of the sloughs that run past the community suggest that erosion will increase as time progresses. Northeast of Napaskiak is a small slough that feeds into Tupuknuk Slough. From aerial and surface photography, it appears that the thalweg of the Kuskokwim River is beginning to run into this slough which could explain why the depth of the slough is increasing. The initial breach reportedly occurred in 2005 and the Kuskokwim River is moving between 10 and 15 feet a year towards this slough. The Kuskokwim River is approximately 60 feet deep at the bend where the breach occurs. As the thalweg of the Kuskokwim meanders, flow through this small slough will increase causing the channel to widen and deepen.

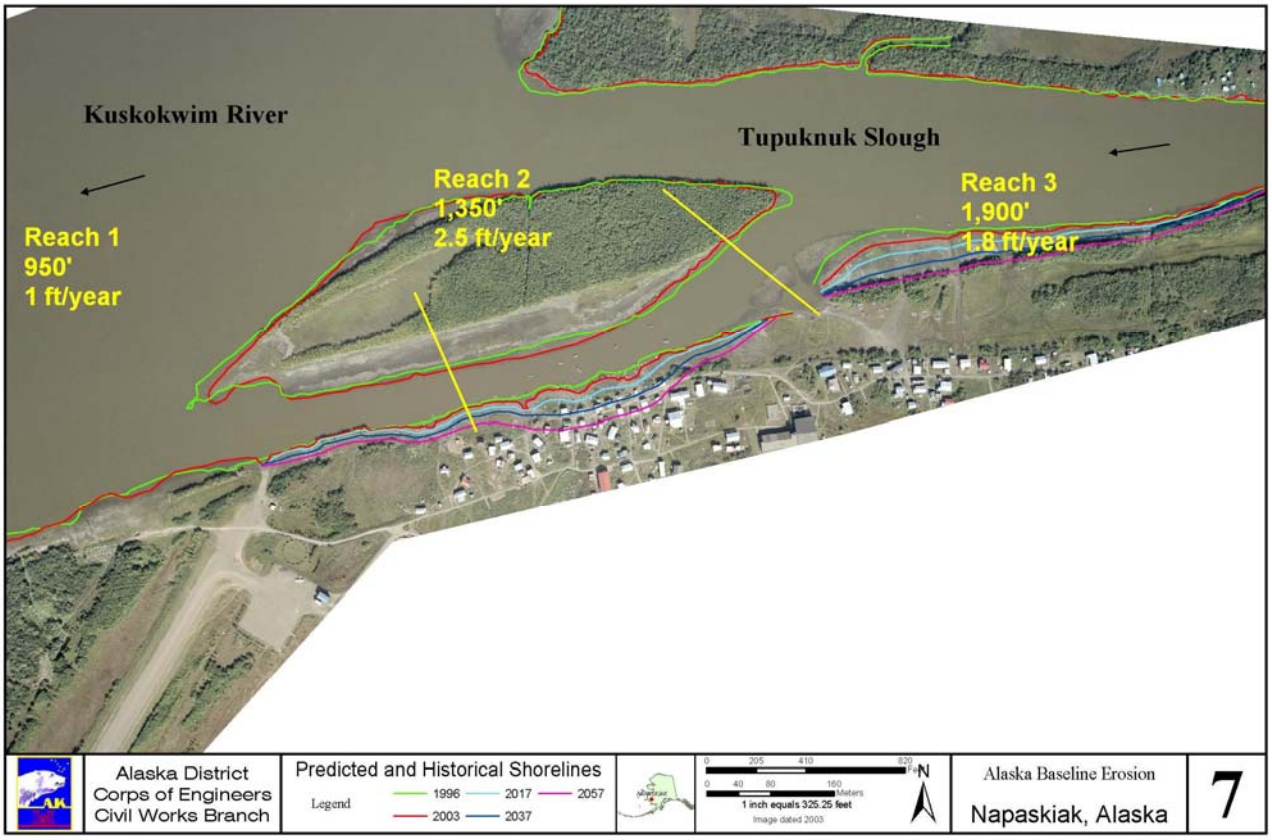


Figure 2. Napaskiak Erosion Map

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 Napaskiak fall into seven damage categories: land, residential structures, commercial structures, and infrastructure. Structures were considered a loss when the bank line encroached within ten feet of a structure's foundation.

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.

Napaskiak is losing approximately 7,745 square feet of land per year (0.18 acres). Reach 1 is expected to lose 1.11 acres with land losses for Reach 2 of 3.95 acres and losses in Reach 3 of 4.0 acres. It is expected that more than 9 acres will be lost over the 50-year period of analysis with a corresponding value of $91,000 and a net present value of $36,000.

Expected residential damages in Napaskiak are widely dispersed throughout the community. At-risk structures include 11 outbuildings (fish camps and related structures) and 13 residences. Each of the outbuildings is valued at $1,000 and each residence is valued at $205,000.

One unidentified commercial building is estimated to be subject to damages. Estimated square footage was utilized to produce a replacement value and adding an additional 20

percent of the replacement value to estimate building contents. The structure has a total estimated value of $387,000 with a net present value of $48,000 and an average annual value of $2,500.

Total expected structural damages in Napaskiak are $3.1 million with a net present value of $698,000

Infrastructure that lies within the 50-year erosion profile includes: 1,080 feet of boardwalks, and 2 utility poles. Total expected infrastructure damages are $1.0 million with a net present value of $127,000.

Summary

Total erosion damages in Napaskiak over the 50-year period of analysis are $4.2 million with a net present value of $861,000 and an average annual value of $44,500. 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)	9.07	$20,000	$36,000	$36,000	$91,000	$36,000	$1,900
Residential	13	--	1,236,000	1,442,000	2,679,000	650,000	33,500
Commercial	1	--	--	387,000	387,000	48,000	2,500
Infrastructure	--	--	4,000	1,017,000	1,021,000	127,000	6,600
Total Damages	--	**$20,000**	**$1,276,000**	**$2,882,000**	**$4,178,000**	**$861,000**	**$44,500**

5. Potential Solutions

An articulated concrete revetment could be constructed to protect the mooring area of Napaskiak. The bank would be graded to a uniform surface and a separation geotextile fabric would then be placed over the gravel fill with a nine inch articulated concrete matt placed upon this fabric. The toe of the articulated matt would be placed six feet minimum below the existing channel bed to prevent undercutting of the matt. Gravel would be backfilled over the toe of the matt to provide scour protection. Approximate cost is $4.0 million which is approximately $3,300 per linear foot of revetment.

6. Conclusion:

Napaskiak has a definite erosion problem that is affecting the community over the next 50 years. The community has the potential to have nearly $4.2 million in damages.

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

7. Community Photos:

N 60° 43.138' W 161° 44.694' Napaskiak RIMG0072

Photo 1: Reach 3.

N 60° 43.362' W 161° 43.693' Napaskiak RIMG0091

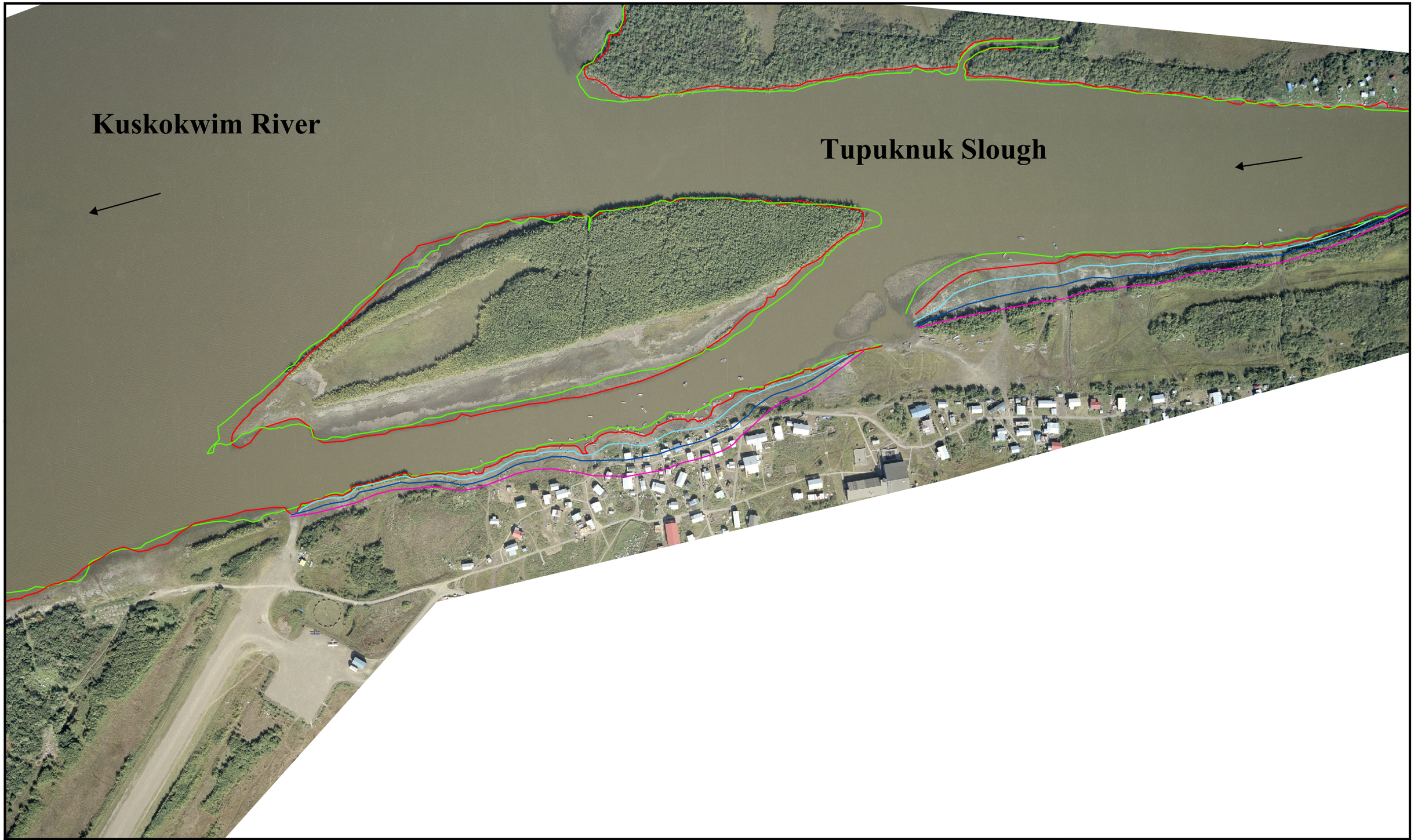
Photo 2: Looking downstream at the inlet of the slough from the Kuskokwim River. As the Kuskokwim migrates towards this slough, flow past Napaskiak is expected to increase.

N 60° 42.509' W 161° 45.959' Napaskiak RIMG0058

Photo 3: Looking at the bank from the water in Reach 2.

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.



Alaska District
Corps of Engineers
Civil Works Branch

Predicted and Historical Shorelines

Legend

1996 2017 2057
2003 2037

0 212.5 425 850 Feet
0 40 80 160 Meters
1 inch equals 325.25 feet
Image dated 2003

N

Alaska Baseline Erosion

Napaskiak, Alaska