



APPENDIX 4: FLOODING, EROSION AND RELATED HAZARDS IMPACTING ALASKA'S COMMUNITIES

IDENTIFICATION OF ISSUES

Some 6,600 miles of Alaska's coastline and many of the low-lying areas along the state's rivers are subject to severe flooding and erosion. Most of Alaska's Native villages are located on the coast or on riverbanks.

Government Accountability Office Report 04-142

In 2003, Congress directed the Government Accountability Office (GAO) to study Alaska Native Villages affected by flooding and erosion to determine the extent to which these communities were affected, what state and federal programs were available to address flooding and erosion in these communities, the status of efforts to address flooding and erosion, and what Congress might do in the future to address these issues. The report found that 184 out of 213, or 86 percent, of Alaska Native villages are affected by flooding and erosion to some extent. The report found that while many of the problems in these communities are long-standing, various studies indicate that coastal villages are becoming more susceptible to flooding and erosion due in part to rising temperatures.

In addition, the amount and accuracy of floodplain information in Alaska varies widely from place to place. Detailed floodplain studies have been completed for many of the larger communities and for the more populated areas along some rivers. For example, the Federal Emergency Management Agency (FEMA) has published Flood Insurance Rate Maps that show floodplain boundaries and flood elevations for communities that participate in the National Flood Insurance Program. However, because only a handful of Alaska Native villages participate in the program, many of the villages have not had their 100-year floodplain identified by FEMA. In addition, little or no documented floodplain information exists for most of the smaller communities. Moreover, no consolidated record has been maintained of significant floods in Alaska Native villages. The Corps' Flood Plain Management Services has an ongoing program to identify the 100-year flood elevation, or the flood of record of flood-prone communities through data research and field investigations.

Congress directed the GAO to focus on nine coastal and riverine communities affected by annual and episodic flooding and erosion: Kaktovik, Barrow, Point Hope, Kivalina, Shishmaref, Koyukuk, Unalakleet, Newtok and Bethel. Of these communities, four – Kivalina, Koyukuk, Newtok, and Shishmaref - were identified as being in imminent danger from flooding and erosion and were making plans to relocate.



GOVERNMENT ACCOUNTABILITY OFFICE REPORT 09-551

In 2009, GAO further reviewed the progress of the 31 villages threatened by flooding and/or erosion that will impact the long-term viability of the community. Twenty-eight of the 31 communities are incorporated; three are unincorporated. This list includes the following incorporated communities: Akiak, Alakanuk, Allakaket, Barrow, Chefornak, Chevak, Clark’s Point, Eyak (Cordova), Deering, Dillingham, Emmonak, Golovin, Hughes, Huslia, Kivalina Kotlik, Koyukuk, McGrath, Napakiak, Nulato, Nunapitchuk, Port Heiden, Saint Michael, Selawik, Shaktoolik, Shishmaref, Teller, and Unalakleet. The list also includes the following unincorporated villages: Kwigillingok, Lime Village, and Newtok.

The GAO divides threatened communities into three categories based on relocation actions or intentions: 1) likely to move all at once; 2) likely to gradually migrate to a new location over time; and 3) not exploring immediate relocation. The three incorporated communities identified as “likely to move all at once” include Shishmaref, Kivalina, and Shaktoolik (Table 9). These communities are under threat by coastal storm surge, which has been eroding shoreline and destroying or threatening infrastructure. Anecdotally, the winter ice pack that protected these communities has been forming later and melting earlier in recent years. This has resulted in an increase in the eroding effects of the coastal storm surges. These are the most critical of the endangered communities and are furthest along in addressing their situation.

Hughes, Unalakleet, Koyukuk, Nulato, Golovin, Allakaket, Huslia, and Teller are classified in the report as “likely to gradually migrate to new location over time” (Table 9). These are both coastal and riverine communities and are victim to either river erosion or severe coastal storm surge.

Table 11. Community Relocation Status

Status	Frequency	Percent
Likely to Move all at Once	3	2%
Likely to Gradually Migrate to New Location Over Time	8	5%
Not Exploring Immediate Relocation	17	93%
Total	28	100%



Table 12. Imminently Threatened Communities

Village	Likely to Move all at Once	Likely to Gradually Migrate to a New Location Over Time	Not Exploring Immediate Relocation	NFIP Participant
Akiak			√	
Alakanuk			√	
Allakaket		√		
Barrow			√	
Chefornak			√	
Chevak			√	
Clark's Point			√	
Eyak (Cordova)			√	√
Deering			√	
Dillingham			√	√
Emmonak			√	√
Golovin		√		
Hughes		√		
Huslia		√		
Kivalina	√			
Kotlik			√	
Koyukuk		√		√
Kwigillingok*				
Lime Village*				
McGrath			√	√
Napakiak			√	
Newtok*				
Nunapitchuk			√	
Port Heiden			√	
Saint Michael			√	
Selawik			√	
Shaktoolik	√			
Shishmaref	√			√
Teller		√		
Unalakleet		√		
Total	3	8	17	6



Incorporated communities identified by GAO as “not exploring immediate relocation” include Akiak, Alakanuk, Barrow, Chefnak, Chevak, Clark’s Point, Eyak (Cordova), Deering, Dillingham, Emmonak, Kotlik, McGrath, Napakiak, Nunapitchuk, Port Heiden, Saint Michael, and Selawik (Table 9).

Of noteworthy importance, many other communities in Alaska have flooding and erosion impacts: however, these 28 incorporated and 3 unincorporated communities are identified as the most heavily impacted by the GAO. Furthermore, only six communities are also NFIP participants including Cordova, Dillingham, Emmonak, Koyukuk, McGrath, and Shishmaref.

RECORDED FLOODS

The U. S. Army Corps of Engineers (USACE), Alaska District, Floodplain Management Services publishes flood hazard and floodplain information with the goal of reducing the threat to life from flooding in Alaska and minimizes flood-caused economic losses. This information is also intended to aid federal, state and local agencies in guiding development in the communities. Federal agencies and many state and local authorities require new buildings to be built outside the floodplain if practical, or to have the first floor elevated above the 100-year flood level if the building is located in a floodplain.

Table 13. Communities with Floods Occurring - Alaska

	Communities	Percent	Cumulative Percent
Flood in Community	83	51%	51%
No Flood in Community	69	42%	93%
NA	11	7%	100%
Total	163	100%	

The most recent floods recorded were in 2009. They were caused by ice jams during breakup on the Yukon and Kuskokwim Rivers. The earliest recorded for this database were 1913 floods caused by a storm surge in Teller, Golovin, and Koyuk in Norton Sound. The historic record data available shows that many communities in Alaska have had floods in the past. A “Most Recent Flood” event was recorded for 66 Communities, a ‘Flood of Record’ was identified for 49 communities, and 32 communities recorded a ‘Worst Flood Event on Record’. 83 communities had a flood recorded. Common causes of riverine flooding were “ice jam” or “rainfall” while for coastal areas ‘coastal storm surge’ was listed as a common cause. This is not a complete record of floods in Alaska despite the efforts of the Corps to make it so.

Unfortunately, in Alaska small populations, remote locations, and high costs make data collection in many areas of the State difficult. Recording flood information is no exception. The most



information is known about the 32 active NFIP communities (out of 163 Alaska organized communities) which represent almost 90% of Alaska’s population. Historic flood information is somewhat inconsistent as well, more is known about recent floods than past floods. Often, only the more severe floods were recorded in the past - especially in rural areas. Other data in the report included ‘Recommended Building Base Elevation’, ‘Flood Plain Report’, ‘Flood Insurance Study’ and ‘Flood Gauge’.

Table 14. Table Attributes of Flood Data Reported

Variable	Yes	No	DK	% Yes
Recommended Building Base Elevation*	40*	123	-	28%
Flood Plain Report	34	85	44	21%
Flood Insurance Study	32	114	17	17%
Flood Gauge	24	125	14	15%

*Yes means a Recommended Building Base Elevation was reported

The Recommended Building Base Elevation is the recommended elevation of the bottom of the first floor of a building. (This is a recommendation by the Alaska District, Corps of Engineers. “The Corps does not regulate the flood plain; participating communities may have different requirements”).

Flood Plain Reports are done by the U.S. Army Corps of Engineers, Alaska District, and the Federal Emergency Management Agency for various communities in Alaska to determine attributes of the flood plain situation in that area. A Flood Insurance Study is “an engineering study performed by FEMA to identify flood-prone areas, insurance risk zones, and other flood data within a community.” A Flood Gauge is a one-foot by eight-foot staff gauge typically placed in a prominent place within the community and meant to function during severe floods. It often has attached plaques that indicate the elevation of community buildings, the flood of record, and the Recommended Building Elevation”.



ALASKA VILLAGE EROSION TECHNICAL ASSISTANCE PROGRAM

The Alaska Village Erosion Technical Assistance Program (AVETA) responded to legislation that directed the U.S. Army Corps of Engineers (USACE) to investigate issues surrounding erosion at several Alaska Native villages. As part of this effort, the Corps examined erosion rates and control, potential relocation, and impacts to Alaska Native culture and tradition.

The final AVETA report documented the responses to questions raised in the Consolidated Appropriations Resolution, 2003 PL 108-7, Division D - Energy and Water Development Appropriations, 2003, Conference Report (H.R. 108-10, page 807), Senate Report (S.R. 107- 220, page 23), and HR 108-357, Section 112, page 10, Conference Report Energy and Water Development Appropriations Bill, 2004 with regards to the communities of Bethel, Dillingham, Kaktovik, Kivalina, Newtok, Shishmaref, and Unalakleet.

The questions asked were: what are the costs of ongoing erosion, what would it cost to relocate a community, and how much time do these communities have left before they are lost to erosion. The following table summarizes the answers to these questions.

Community	Costs of Future Erosion Protection	Cost to Relocate	How Long Does the Community Have*
Bethel	\$5,000,000	N/A	> 100 years
Dillingham	10,000,000	N/A	> 100 years
Kaktovik	40,000,000	\$ 20 – 40 Million	> 100 years
Kivalina	15,000,000	\$ 95 – 125 Million	10 – 15 years
Newtok	90,000,000	\$ 80 – 130 Million	10 – 15 years
Shishmaref	16,000,000	\$100 – 200 Million	10 – 15 years
Unalakleet	30,000,000	N/A	> 100 years

*These numbers assume no future erosion protection, including that listed here, is not implemented.



ALASKA BASELINE EROSION ASSESSMENT

Erosion is a major problem for many Alaska communities. In 2005, the USACE conducted a Baseline Erosion Assessment (BEA) of all communities in Alaska. The aim was to coordinate, plan, and prioritize appropriate responses to erosion throughout Alaska. The Corps identified 178 Alaska communities as having reported erosion problems. One hundred five of these were incorporated communities and are discussed here. Erosion is not to be equated with flooding. While erosion and flooding are often related issues, flooding has distinct attributes that are not related to erosion. Erosion is the subject of the Corps study.

Table 15. Erosion Assessment of Alaska Communities

Erosion for Communities Assessment	# Communities	%	% Alaska's Population
Priority Action Community	23	14%	3%
Monitor Conditions Community	41	25%	7%
Minimal Erosion Community	41	25%	56%
No Identified Erosion Issues	47	29%	(All other) 34%
Not rated	11	7%	
Total	163	100%	100%

After a research and analysis process the Corps designated three levels of community erosion status; (A) “Priority Action Communities” (N=23)—indicating a need for immediate and continuing attention to erosion issues. (B) “Monitor Conditions Communities.” (N=41) – meaning erosion problems are present but not significant enough to require immediate action and (C) “Minimal Erosion Communities.” (N=41) – In these communities erosion was identified as minor and no change was expected in the foreseeable future. Forty seven communities with no erosion history were not rated.

The Priority Action Communities represent about 2.6% of Alaska’s population while the Monitor Conditions Communities make up about 7.3% of the population with the Minimal Erosion Communities having about 56% of Alaskans.



Table 16. Declared Flood Disasters: 2000 to 2009

Year	Date	Disaster Types	Active Disaster	Number
2009	12/18	Severe Storms, Flooding, Mudslides and, Rockslides	1,865	
2009	06/11	Flooding and Ice Jams	1,843	
2008	09/26	Severe Storms, Flooding, Landslides, and Mudslides	1,796	
2006	12/08	Severe Storms, Flooding, Landslides, and Mudslides	1,669	
2006	10/16	Severe Storms, Flooding, Landslides, and Mudslides	1,663	
2006	08/04	Snow Melt and Ice Jam Flooding	1,657	
2005	12/09	Severe Fall Storm, Tidal Surges, and Flooding	1,618	
2005	03/14	Severe Winter Storm		1,584
2004	11/15	Severe Winter Storm Tidal, Surges and Flooding	1,571	
2003	04/26	Winter Storm		1,461
2002	12/04	Winter Storms		1,445
2002	06/26	Flooding		1,423
2000	02/17	Winter Storms And Avalanches	1,316	

This Table shows the number of communities experiencing a declared flooding disaster since 2000.

Table 17. Number of FEMA Declared Flood Disasters Since 2000

# Disasters in Community	# Communities	%	Cumulative %
3	27	17%	17%
2	40	24%	41%
1	28	17%	58%
0	68	42%	100%
Total	163	100%	

A federal emergency is declared when, in a formal process, it is decided that the State and local governments are unable to deal with the disaster at hand and federal assistance is warranted. FEMA coordinates this federal response. Thirteen such disasters with a flooding component have occurred since 2000. Fifty eight percent of Alaska’s organized communities experienced at least one of these emergencies. Sixteen percent or 27 organized communities experienced three emergencies.