

# Climate Change Adaptation for an At-Risk Community: Shaktoolik, Alaska



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Traditional Inupiaq village of 250 people



Shaktoolik lies near the north end of a narrow gravel and sand spit, 13 miles from high ground.



One street,  $\frac{3}{4}$  mile long, with row of houses on each side.

**It is separated from the sea by a narrow beach and from the mainland by the Tagoomenik River.**





**Moved to current site in 1975 from old village a mile south.**

In the fall the river and lagoon freeze over...

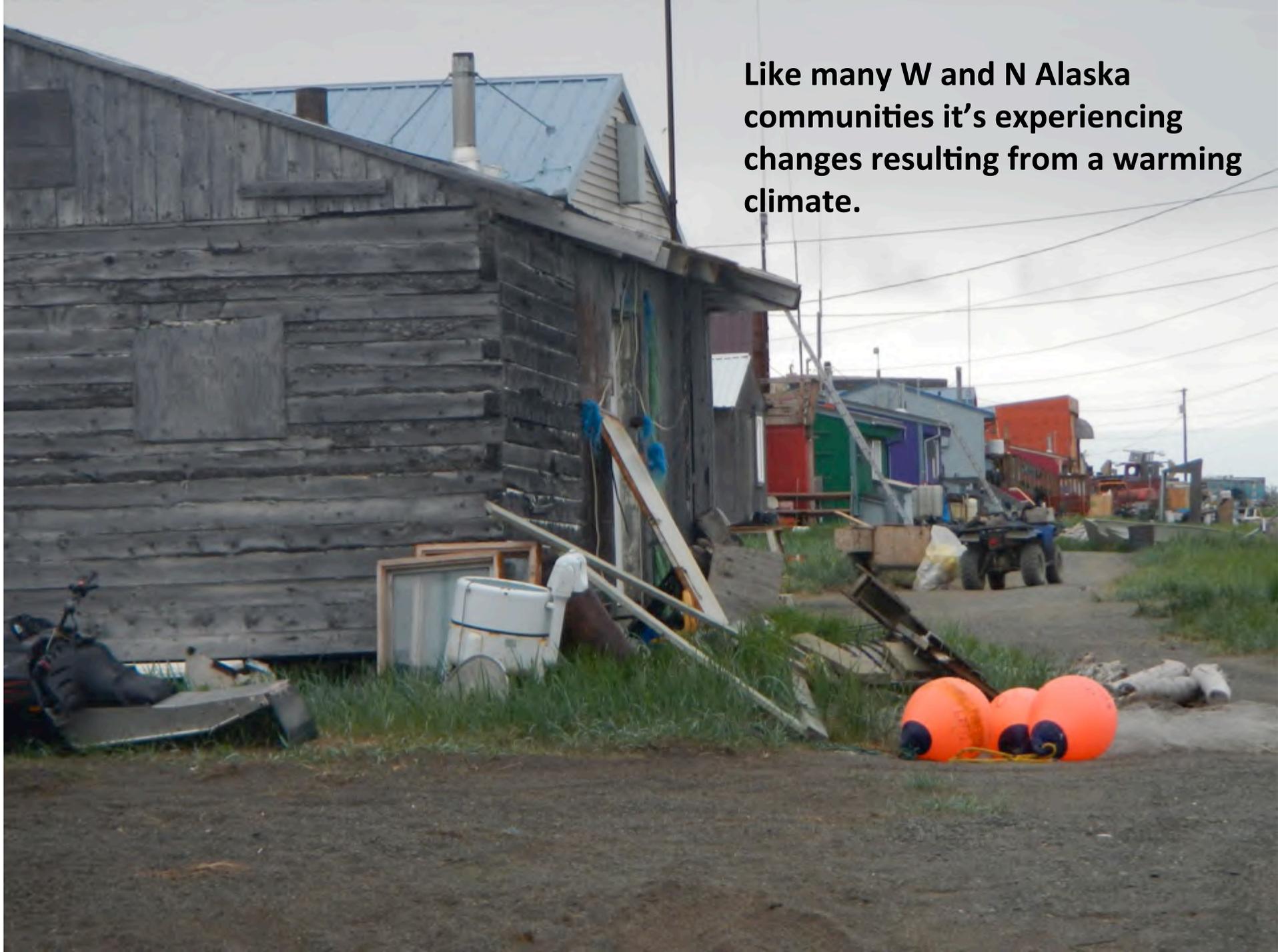
And slushy or broken ice forms along the shore on the seaward side.  
This band of broken ice breaks the big storm waves, if it is in place.

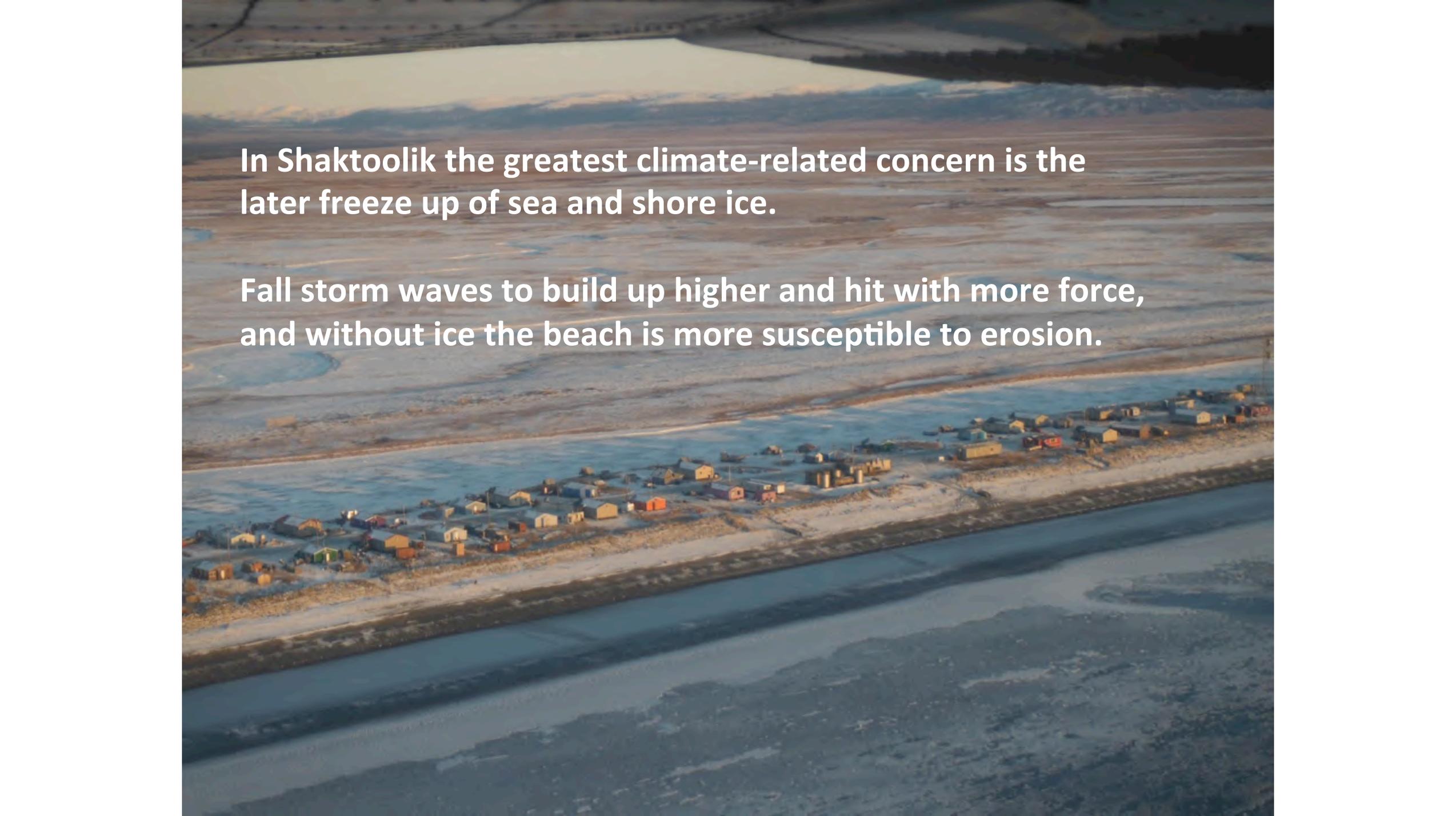




In winter Norton Sound freezes over.

**Like many W and N Alaska communities it's experiencing changes resulting from a warming climate.**



An aerial photograph of a coastal village in Shaktolik, Alaska. The village consists of numerous small, colorful houses and buildings clustered together. The surrounding landscape is a mix of snow, ice, and dark, possibly eroded soil. The foreground shows a wide, flat area that appears to be a beach or a frozen body of water, with some ice patches and shadows. The background shows a vast, flat expanse of land under a pale sky.

**In Shaktolik the greatest climate-related concern is the later freeze up of sea and shore ice.**

**Fall storm waves to build up higher and hit with more force, and without ice the beach is more susceptible to erosion.**

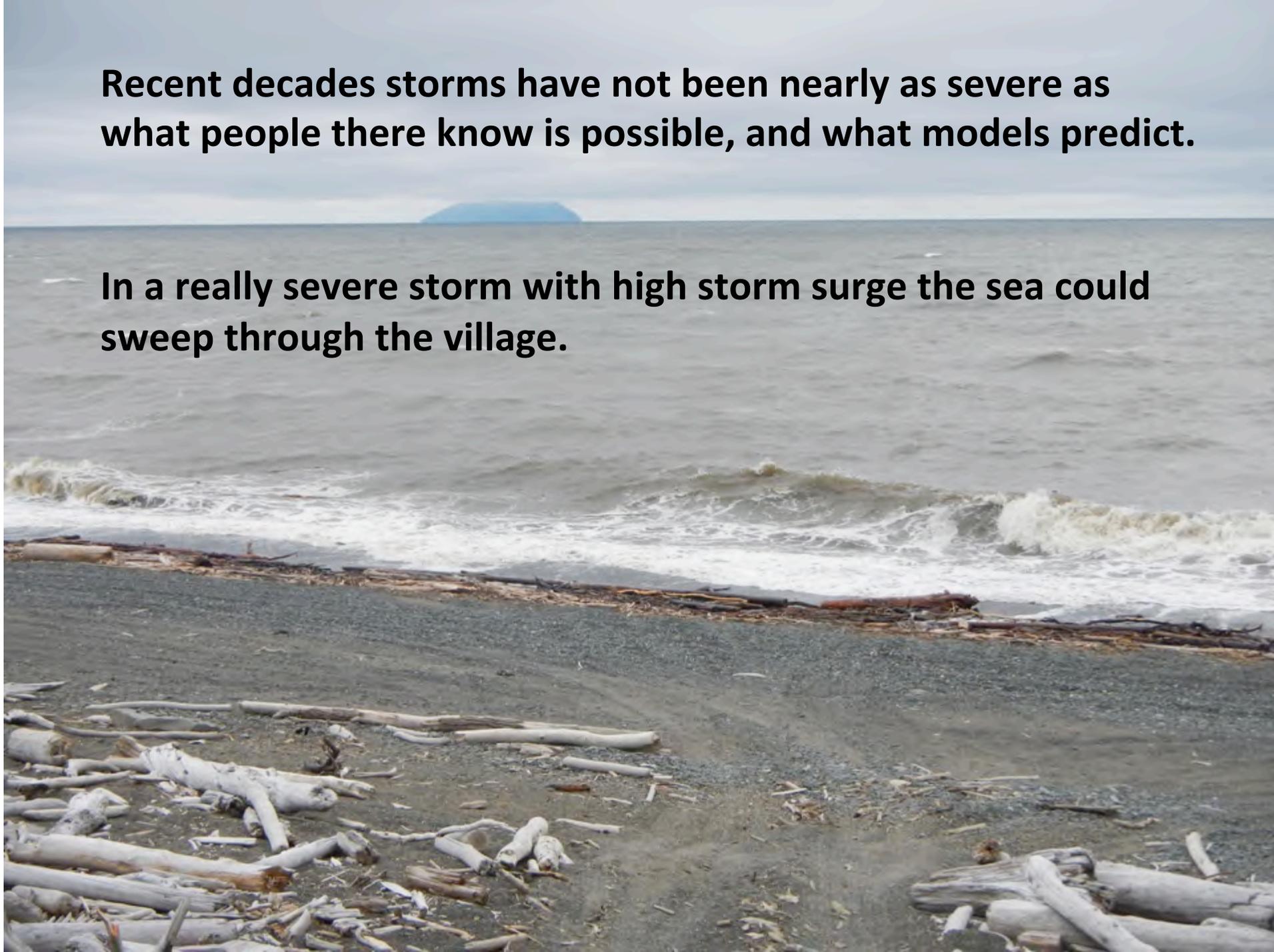
**Recent storms have flung drift logs almost into peoples' homes, damaged sewage leach fields and nearly undercut bulk fuel tanks.**

**If a storm surge temporarily raises sea level only a few more feet, this could be a deadly situation.**



**Recent decades storms have not been nearly as severe as what people there know is possible, and what models predict.**

**In a really severe storm with high storm surge the sea could sweep through the village.**





**People know it's only a matter of time.**

# Why Did the Sea Grant Marine Advisory Program get involved?

We're fish people

Thirty years ago I had a herring fishing operation in Norton Sound.

But...

We realized else that climate change was going to have big affects on Alaska.  
Responses at the time were:

- Research and monitoring
- Mitigation (working to reduce green-house gas emissions)

We said, "What can people do to adapt to the changes that are not only inevitable in the future but are already occurring?"

### Climate Change Web Resources

[Alaska Center for Wildlife Management and Policy \(ACWMP\)](#)

[Alaska Climate Change Impact Mitigation Program](#)

[Scientists Network for Alaska Planning](#)

[Center for Climate and Health, Alaska Native Tribal Health Consortium](#)

[Climate Change in Alaska \(Governor's Climate Change Sub-Cabinet\)](#)

[NOAA Climate Services](#)

[Northern Climate Exchange, Northern Research Institute of Yukon College](#)

[Climate Change Planning Tools for First Nations Communities, Centre for Indigenous Environmental Resources](#)

[NOAA Sea Grant Climate Science and Adaptation](#)

### Related publications

[Climate Change Adaptation Planning for Alaska Marine Dependent Communities](#)  
PDF of 23-slide PowerPoint presentation by Terry Johnson and Paula Cullenberg (104 KB)

[Ocean Acidification and Fisheries: Alaska Challenge and Response, Alaska Seas & Coasts Vol. 6, 2012](#)

[Responder to Coastal Erosion in Alaska in a Changing Climate: A Guide for Coastal Residents, Business and Resource Managers, Engineers, and Builders](#)

[Changing Climate—Changing Alaska's Fisheries? Alaska Seas & Coasts Vol. 5, 2008](#)

[Arctic Shift: The Alaska Problem Alaska's Native Resources October 1995, Vol. 8, No. 2](#)

[Other climate change publications at Alaska Sea Grant](#)



## Living on Alaska's Changing Coast: Adapting to Climate Change in Coastal Alaska

Coastal Alaska is changing before our eyes. Some changes are dramatic, others subtle; some are rapid and others gradual; but there is no question that our coasts and our marine-dependent communities are undergoing profound change, much of it related to temperature, weather, and climate. People who live and work on and next to the sea are reporting many observations of a changing coast.

Scientists who study the oceans and coasts see indications that even greater change is coming between now and the end of this century. Some of the anticipated changes will be harmful to coastal residents, and some may be beneficial.

With thoughtful planning we can minimize the harm to our communities, businesses and lifestyles, and in some cases we may find ways to benefit from them.

### How do we adapt?

Humans are adaptive creatures. As a species we have adapted to many kinds of change—environmental, social, economic and technological—throughout our history. We have adapted by developing technologies and by changing behaviors. Relocation to higher ground is an example of adaptation to flooding, as is construction of dikes and putting buildings on pilings.

Adaptation to future change, from sea level rise to ocean acidification and changes in the abundance and distribution of fish stocks, will take more sophisticated adaption, all set in motion by thoughtful adaptation planning.

### MAP helps Shaktoolik develop an adaptation plan

The Norton Sound village of Shaktoolik faces serious threats of erosion and flooding resulting from climate change. With a grant from the National Sea Grant Program, Marine Advisory Program agent Terry Johnson and consultant Glenn Gray [helped this community develop an adaptation plan.](#)

### How we can help

Take a look at the adaption tools, fact sheets and videos on these pages. If you have questions or would like us to meet with you or come to your community to talk about adaptation planning, contact us at [Terry.johnson@alaska.edu](mailto:Terry.johnson@alaska.edu) or 907-274-9695.

### Fact Sheets

available as free downloads from the Alaska Sea Grant Bookstore; some are also available as web pages (HTML)

- [Fisheries Adaptations to Climate Change](#)
- [Fisheries Effects](#)
- [Harmful Algal Blooms](#)
- [Species Shifts](#)
- [Ocean Acidification \(PDF\)](#)
  - [Ocean Acidification \(HTML\)](#)
- [Climate Change and Subsistence \(PDF\)](#)
  - [Climate Change and Subsistence \(HTML\)](#)
- [Sea Level Rise and Storm Surge \(PDF\)](#)
  - [Sea Level Rise and Storm Surge \(HTML\)](#)
- [Permafrost Thawing \(PDF\)](#)
  - [Permafrost Thawing \(HTML\)](#)

### Adaptation Planning Tools

available as free downloads from the Alaska Sea Grant Bookstore

- [Annotated Resources on Climate Change Adaptation for Alaska Communities](#)
- [Alaska Climate Change Adaptation Planning Tools](#) [revised 4/12/11]
  - ["Adaptation Plan for This Community" template file](#) [Microsoft Word document]
- [Climate Change Adaptation Planning Manual for Coastal Alaskans and Marine-Dependent Communities](#) [revised 4/12/11]

### PowerPoint presentation

- [Climate Change Adaptation Planning for Individuals and Communities](#) [PDF of 24-slide PowerPoint presentation; 3 MB]

### Videos

- [Faces of Climate Change](#) (three mp4 videos focusing on changes in Alaska's marine ecosystem)
- [Adaption to Climate Change](#) (video describing steps taken by Alaskan communities to adapt to these changes)



**Climate Change Adaptation Planning Manual  
For Coastal Alaskans and Marine-Dependent Communities**

**Alaska Sea Grant Marine Advisory Program  
University of Alaska Fairbanks  
2011**

Terry Johnson



In 2012 Alaska Sea Grant got funding from National Sea Grant intended to help communities address climate related problems.

Glenn Gray, an independent consultant, had been working with Shaktoolik and other Bering Sea coastal villages. Sea Grant saw an opportunity to partner and build on what he and the community had already done.



We held meetings with a six-member planning committee.  
Meetings were open to the public and other residents participated.

City  
Tribe (village or IRA)  
Corporation





With Sea Grant funding, the village (tribe) hired Thomas Sagoonik as project coordinator

Planning committee members voiced several concerns:

Breach of the spit



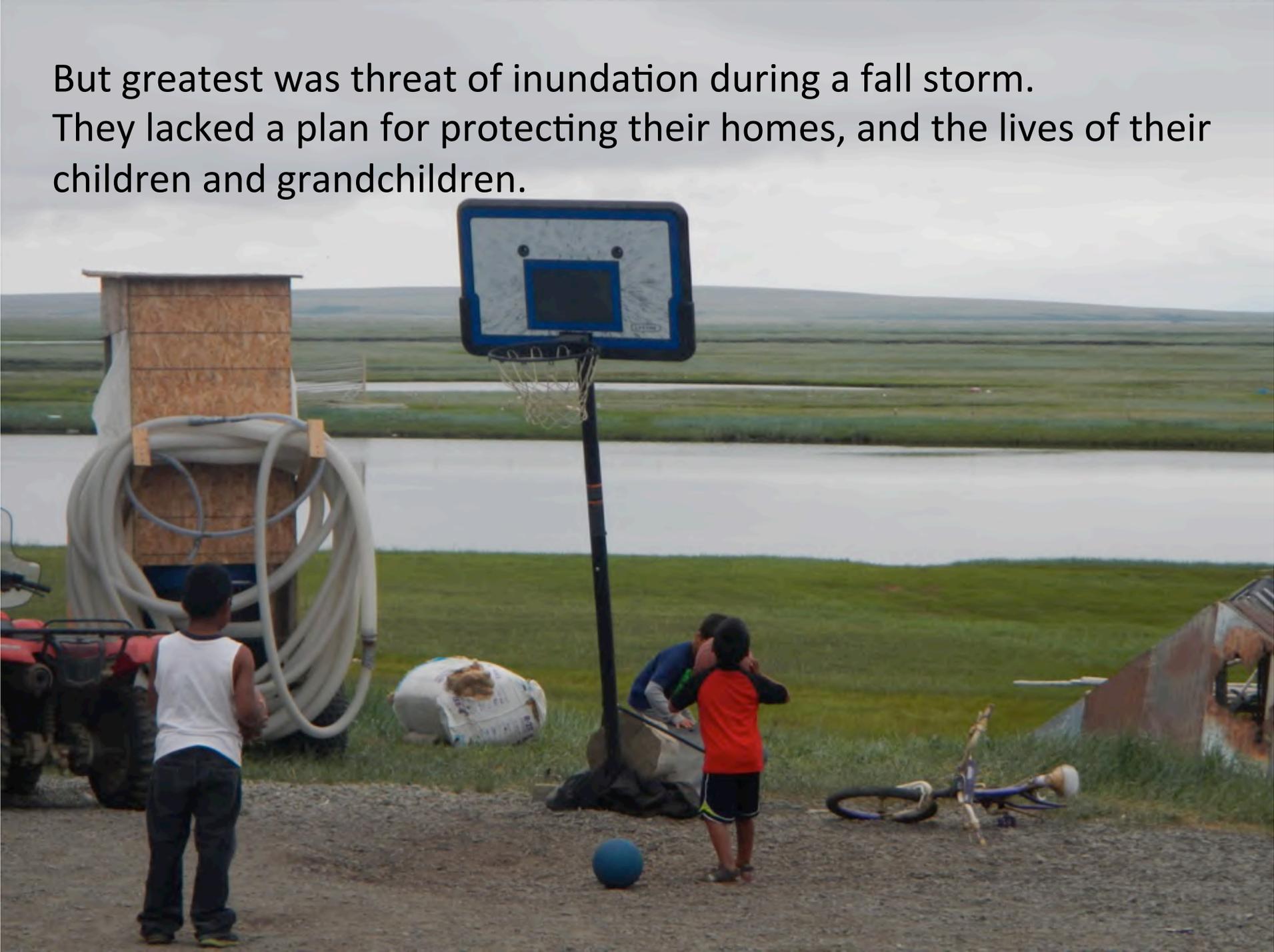


- Damage/loss of tank farm
- Water supply

Coastal (beach and bluff) erosion is concern of many residents.  
(The old village was threatened by coastal erosion.)



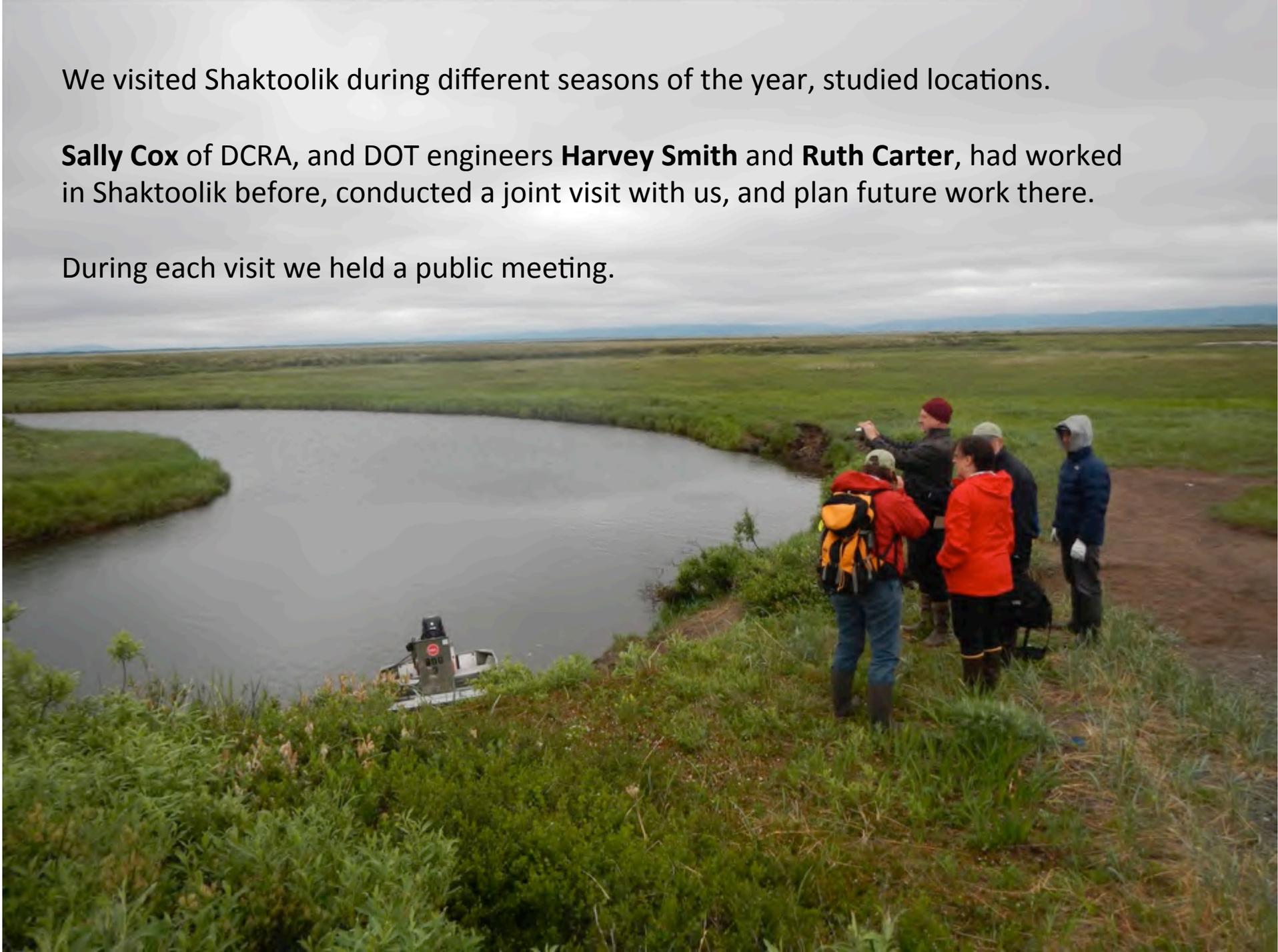
But greatest was threat of inundation during a fall storm.  
They lacked a plan for protecting their homes, and the lives of their  
children and grandchildren.



We visited Shaktoolik during different seasons of the year, studied locations.

**Sally Cox** of DCRA, and DOT engineers **Harvey Smith** and **Ruth Carter**, had worked in Shaktoolik before, conducted a joint visit with us, and plan future work there.

During each visit we held a public meeting.



We conducted extensive review of existing studies and made inquiries of our own.

We consulted with experts at:

Army Corps of Engineers

University of Alaska

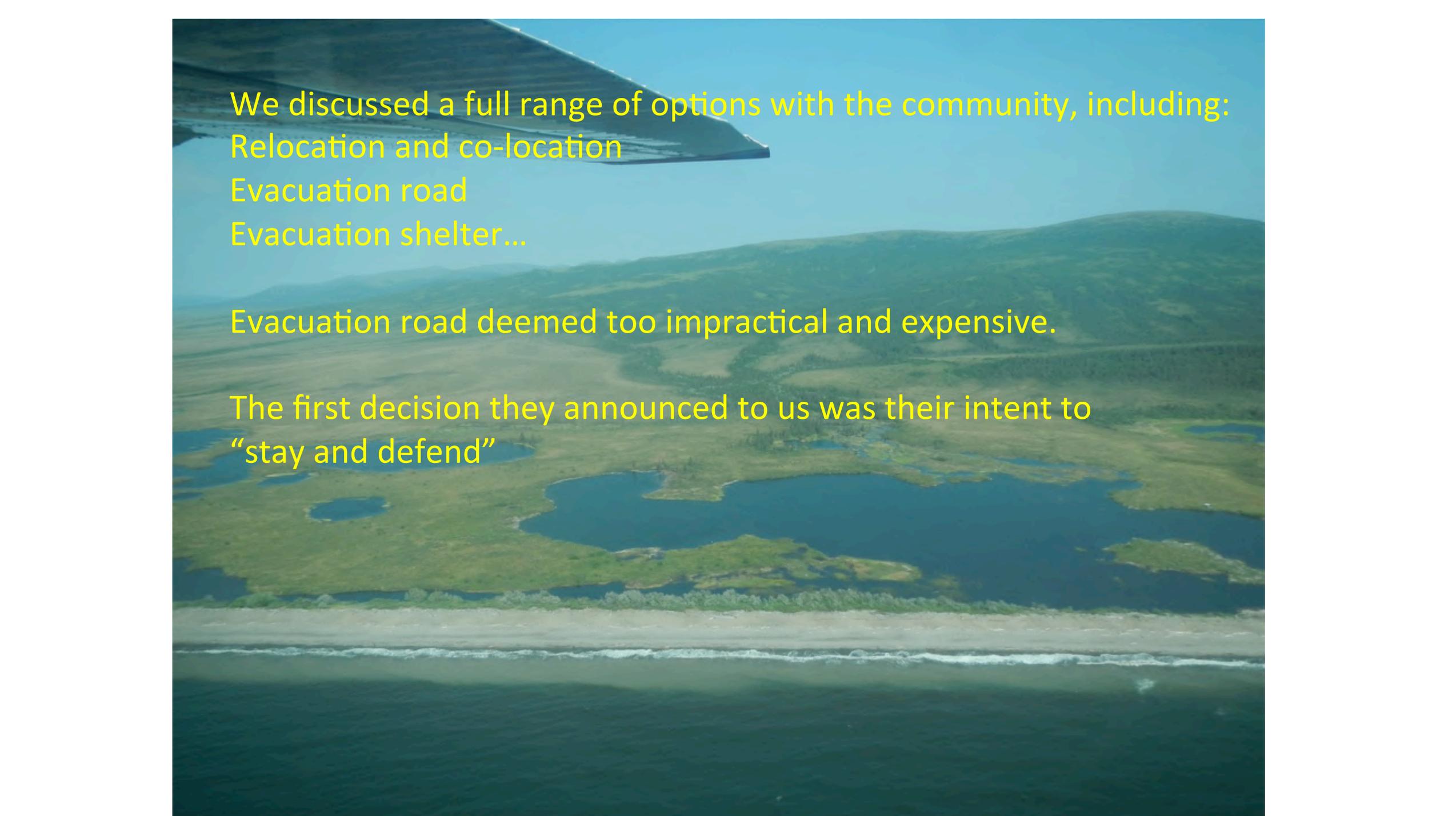
AK Division of Geol and Geoph Survey

AK Dept of Community & Reg. Affairs

Dept. Homeland Security & Em Mgt.

Dept. of Transportation and Pub. Fac.



An aerial photograph of a coastal landscape. In the foreground, there is a dark blue ocean with white waves breaking onto a sandy beach. Behind the beach is a wide, flat area of wetlands or marshland, characterized by numerous small, irregularly shaped ponds and channels of water. The wetlands are interspersed with patches of green vegetation. In the background, there are rolling green hills and mountains under a clear blue sky. The text is overlaid on the upper left portion of the image.

We discussed a full range of options with the community, including:  
Relocation and co-location  
Evacuation road  
Evacuation shelter...

Evacuation road deemed too impractical and expensive.

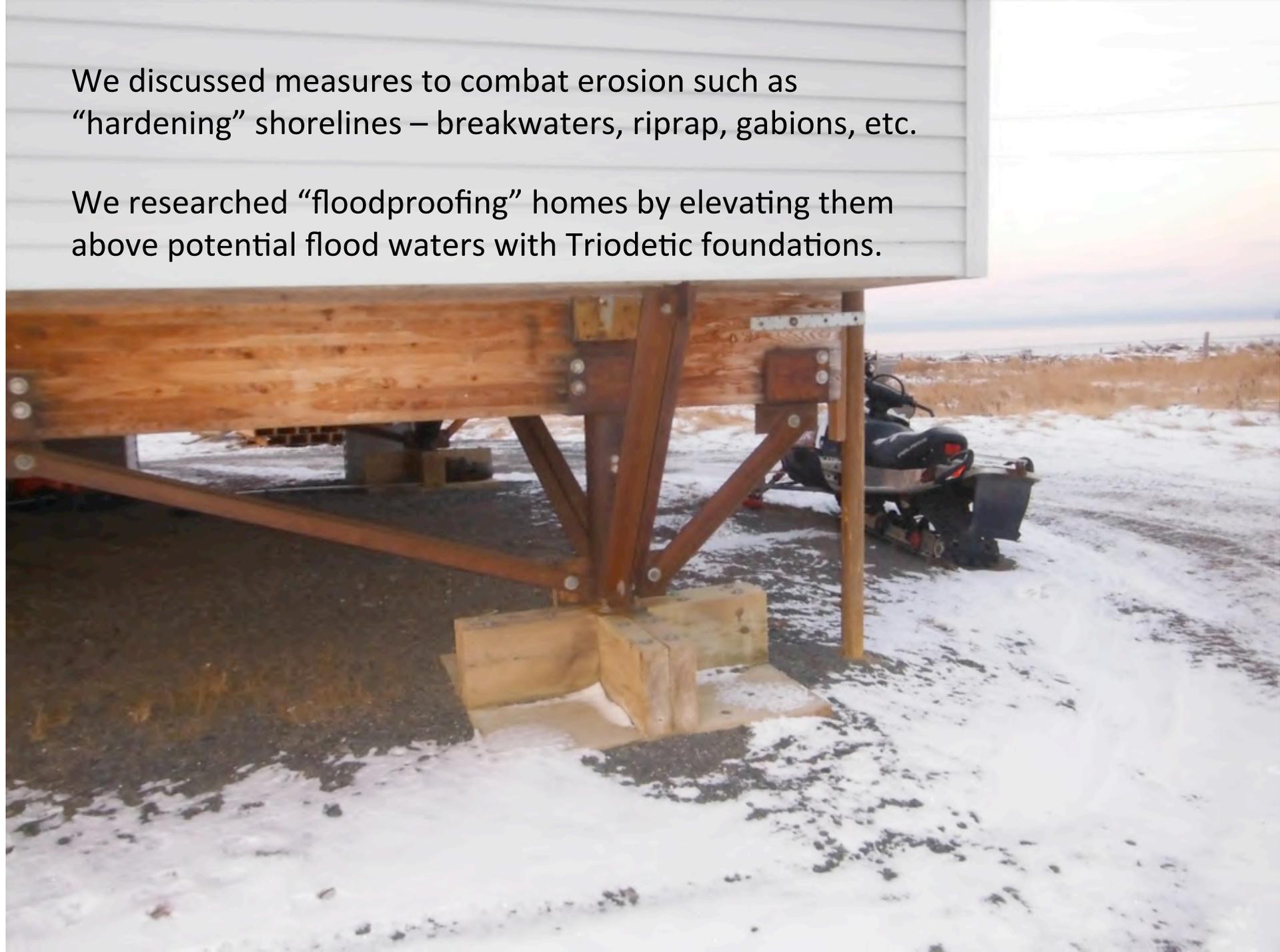
The first decision they announced to us was their intent to  
“stay and defend”

The community had previously commissioned study of a multi-purpose/evacuation building.  
Projected cost was \$10 million and climbing.



We discussed measures to combat erosion such as “hardening” shorelines – breakwaters, riprap, gabions, etc.

We researched “floodproofing” homes by elevating them above potential flood waters with Triodetic foundations.



Meanwhile, Shaktoolik got funding to expand and reinforce the school and add a multipurpose room. Designed to withstand battering by the sea, but it's neither high enough or large enough to protect all residents.





What was needed:

1. Protection of life in worst-case storm
2. Protection of property from flooding
3. Protection from erosion, if identified.

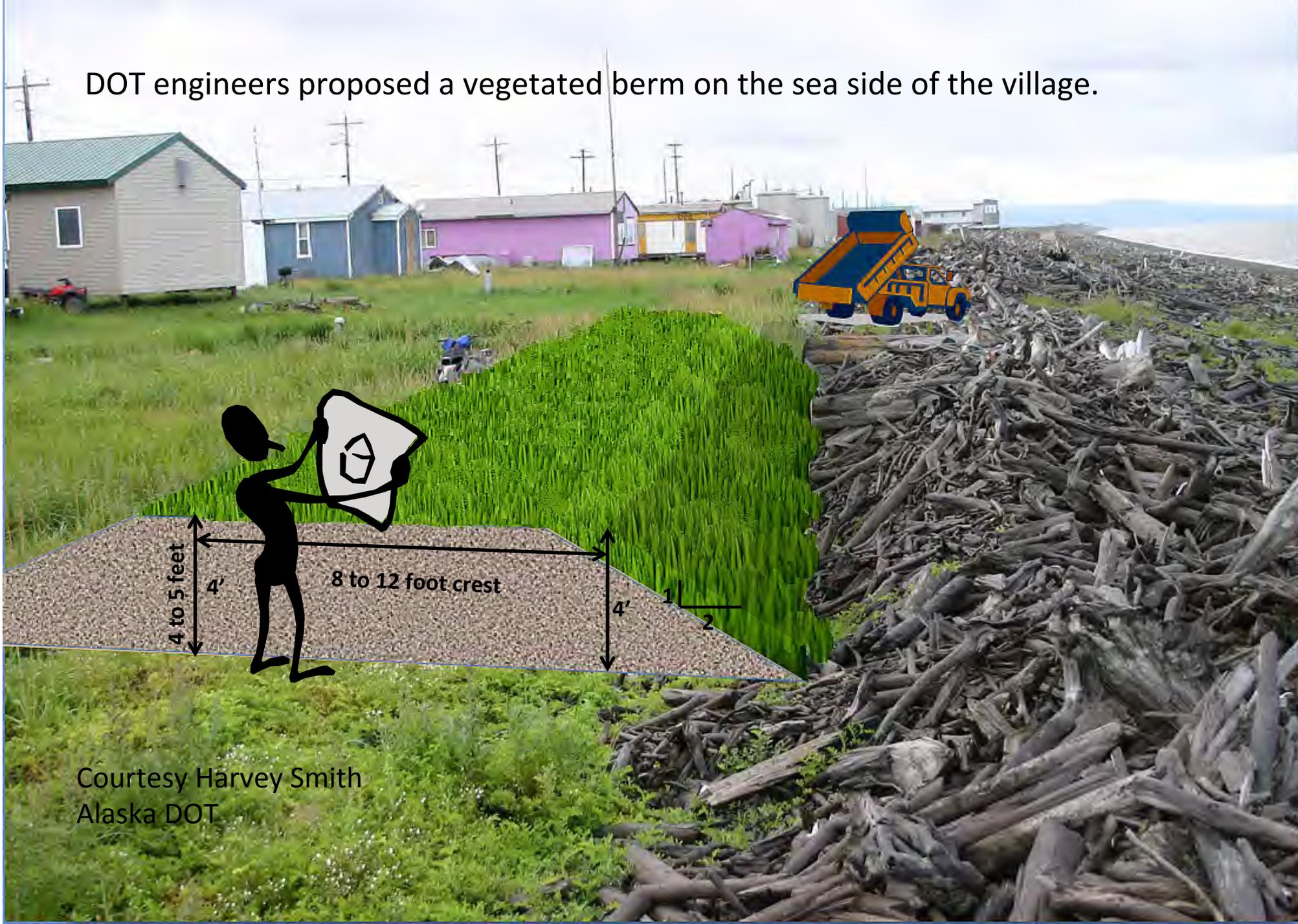
Solutions ideally would be:

Relatively low cost

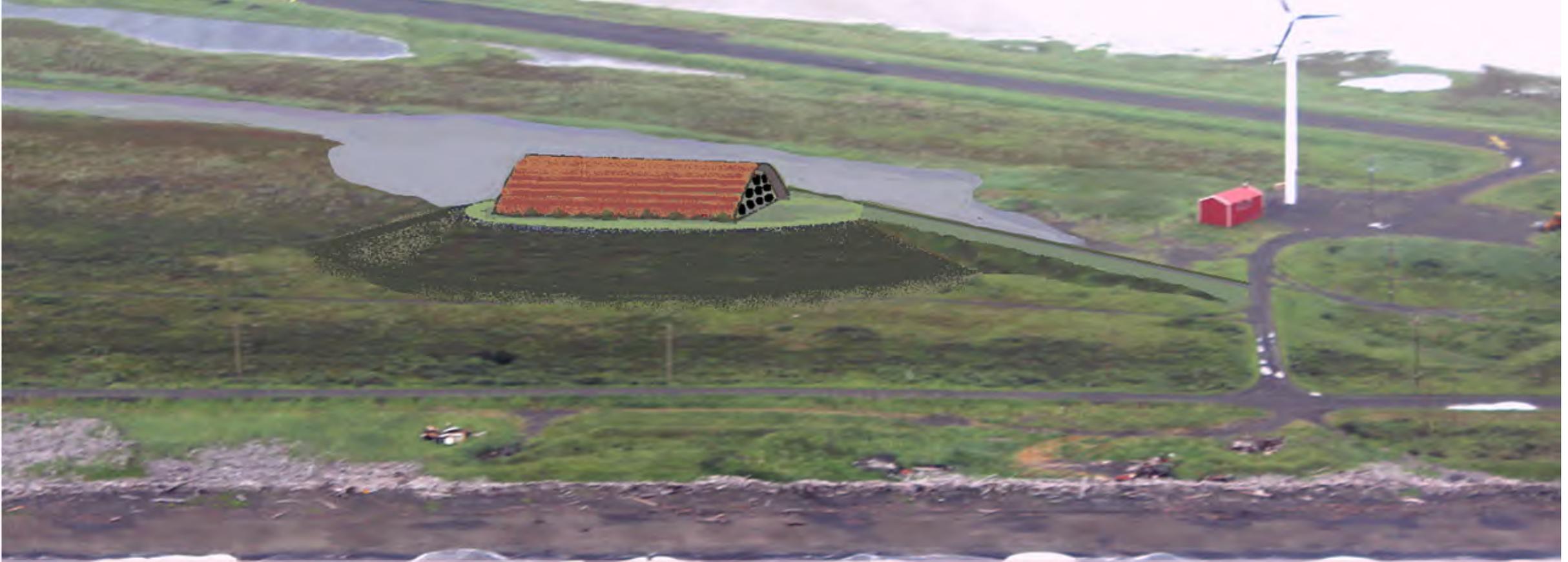
Technically simple

Done with local labor and materials.

DOT engineers proposed a vegetated berm on the sea side of the village.



Courtesy Harvey Smith  
Alaska DOT



## Criteria for Storm Surge Mound

- Quick SAFE access during storm conditions
- Above 500 year storm surge flood elevation
- Provides shelter and is close to the community
- Has multiple uses such as Community Center
- Set back from coast

*Engineering Concept and Rendering by Harvey N. Smith,  
PE, Statewide Coastal Engineer, DOT&PF 2011*



# **Shaktoolik, Alaska: Climate Change Adaptation for an At-Risk Community**

**Alaska Sea Grant Program**

## ***Adaptation Measures***

**Prepared by: Terry Johnson, Alaska Sea Grant Program &  
Glenn Gray, Glenn Gray and Associates**

**For: The Community of Shaktoolik  
November 4, 2013**

Decision  
Document

***Sources for Climate Change  
Adaptation Funding and  
Technical Assistance***

The Planning Committee held a meeting in November 2013 which produced a lot of good discussion but no decisions.

The committee met again in December and came to consensus on nine action measures.

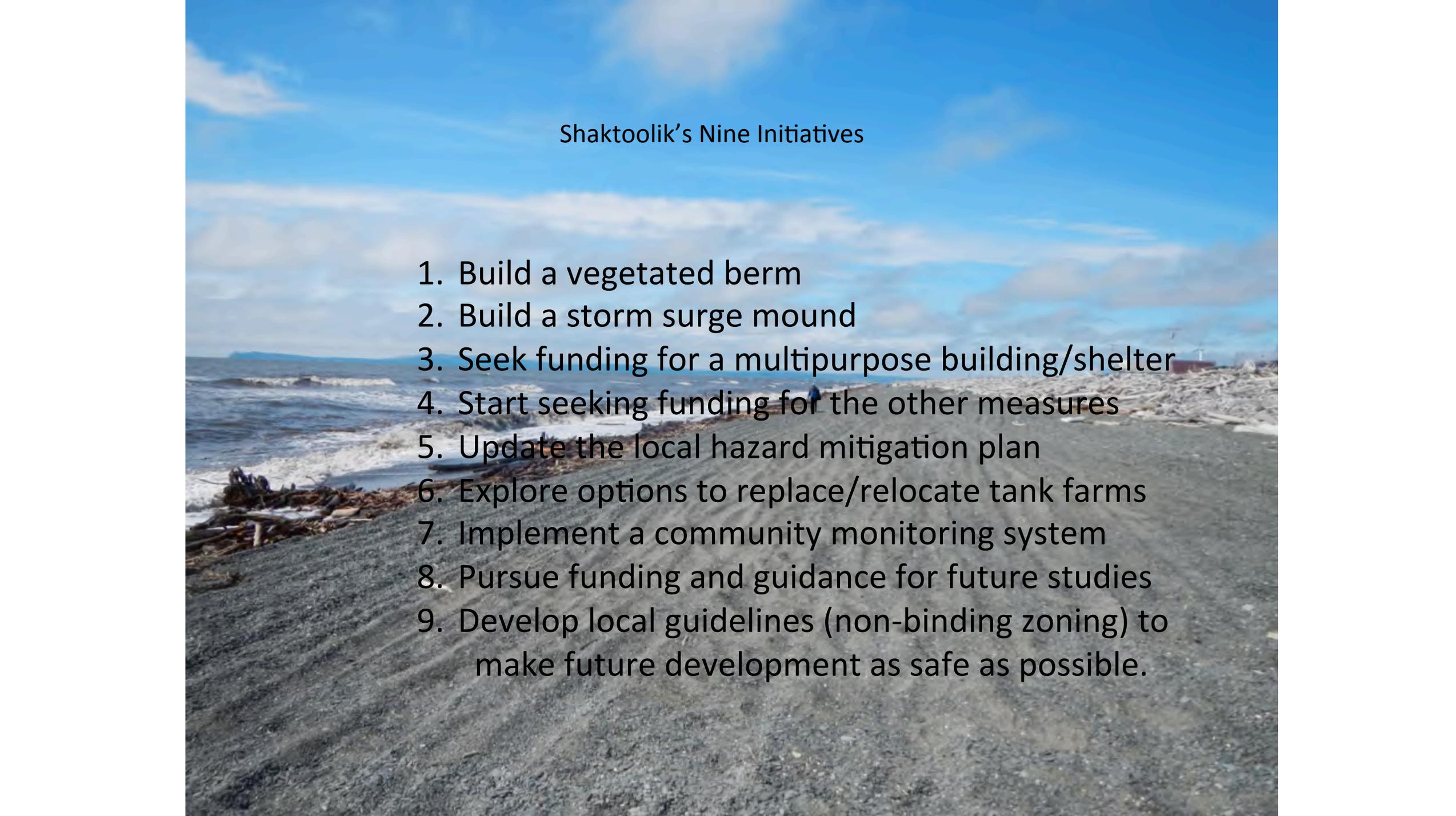


2011 storm



2013 storm





## Shaktoolik's Nine Initiatives

1. Build a vegetated berm
2. Build a storm surge mound
3. Seek funding for a multipurpose building/shelter
4. Start seeking funding for the other measures
5. Update the local hazard mitigation plan
6. Explore options to replace/relocate tank farms
7. Implement a community monitoring system
8. Pursue funding and guidance for future studies
9. Develop local guidelines (non-binding zoning) to make future development as safe as possible.



In January we presented the plan draft at a community meeting attended by 40% of Shaktoolik's entire population.

Subsequently, Mayor Asicksik got grants from NSCDC totaling \$620k.

(Also >\$1 million for repairs to leach fields, beach access, from FEMA after 2013 storm.)

Bought two army surplus dump trucks.

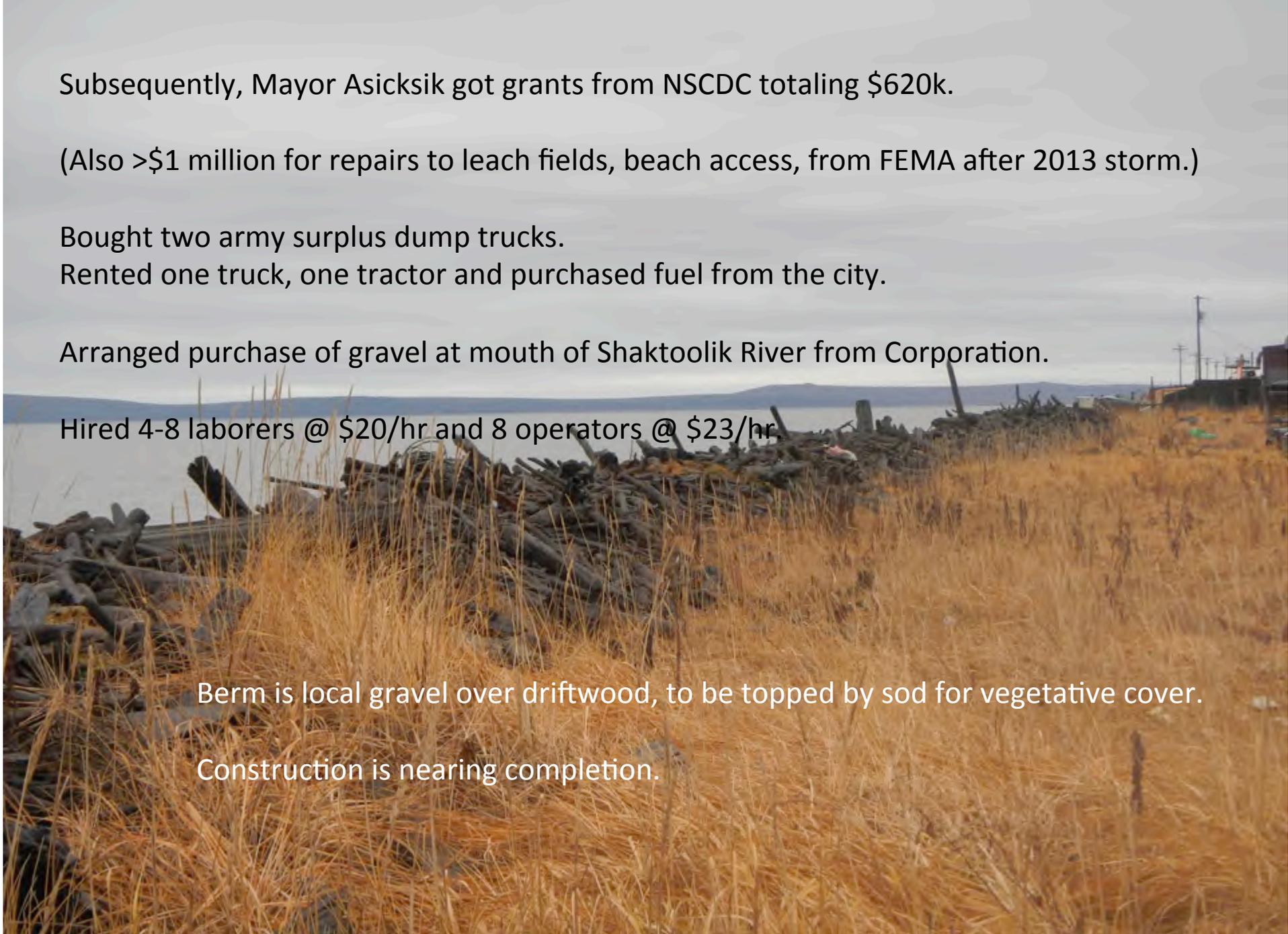
Rented one truck, one tractor and purchased fuel from the city.

Arranged purchase of gravel at mouth of Shaktoolik River from Corporation.

Hired 4-8 laborers @ \$20/hr and 8 operators @ \$23/hr.

Berm is local gravel over driftwood, to be topped by sod for vegetative cover.

Construction is nearing completion.



**Using consolidated regional (NSCDC) funding, he bought machinery, secured rights to materials, hired local workers, and has nearly completed construction of a 5' high berm on the seaward side of the village.**

“The community said ‘stay and defend’ and that’s what I’m trying to do –defend the community” – Mayor Eugene Asicksik

The IRA is considering building an evacuation mound in the future.  
Need to identify source of funds.



# What's next?

A photograph of a coastal town street. The street is unpaved and dusty. On the left, a person is riding a motorcycle. The houses are colorful, including green, blue, and red. Utility poles with many power lines run along the street. The sky is overcast.

The “Sea Grant Project” is done. The community agreed on a set of measures.

The **Alaska Community Coastal Protection Project** is about to commence. Purpose is to enhance community sustainability and resilience. RFP just out.

DCRA will hire and train a full-time Community Coordinator.  
Will organize an interagency working group to coordinate resources and technical assistance.

Will develop a Comprehensive Strategic Management Plan for next 5-10 years.

Shaktoolik's working principles:

- Low-cost measures most likely to get funded
- Low-tech measures most likely to be successful
- Use local labor, talent, and materials.
- Take the initiative, don't wait for government to do it.

“We are doing something. I tell them, let's make a start and maybe we'll get some help.” – Mayor Asicksik



## Lessons I learned:

- Actual problems may not fit the planning template.
- An “adaptation plan” has many meanings, many levels of development.
- It helps a lot if people already know that the main problem is.
- Multiple, open, discussions air all the potential solutions.
- It’s very good if the entities get along and work well together.
- People are tired of being studied, skeptical of more consultants.
- People doubt big state/federal infrastructure grants are coming soon, if at all.
- While broad agreement is necessary, a few individuals make it all happen.
- Sometimes you have to just insist that people make decisions.

Thanks for attending.

Questions or comments?



<http://seagrant.uaf.edu/map/climate/index/php>

<http://seagrant.uaf.edu/map/climate/shaktoolik.index.php>

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