EROSION EXPOSURE ASSESSMENT—EEK

Richard M. Buzard, Mark M. Turner, Katie Y. Miller, Donald C. Antrobus, and Jacquelyn R. Overbeck

EROSION EXPOSURE ASSESSMENT—EEK

Richard M. Buzard, Mark M. Turner, Katie Y. Miller, Donald C. Antrobus, and Jacquelyn R. Overbeck
Publications produced by the Division of Geological & Geophysical Surveys (DGGS) are available to download from the DGGS website (dggs.alaska.gov). Publications on hard-copy or digital media can be examined or purchased in the Fairbanks office:

Alaska Division of Geological & Geophysical Surveys
3354 College Rd., Fairbanks, Alaska 99709-3707
Phone: (907) 451-5010 Fax (907) 451-5050
dggspubs@alaska.gov | dggs.alaska.gov

DGGS publications are also available at:
Alaska State Library,
Historical Collections & Talking Book Center
395 Whittier Street
Juneau, Alaska 99811

Alaska Resource Library and Information Services (ARLIS)
3150 C Street, Suite 100
Anchorage, Alaska 99503

Suggested citation:
Contents

Eek Erosion Exposure Assessment ................................................................. 1
Acknowledgments .......................................................................................... 1
References ........................................................................................................ 4

Figures

Figure 1. Replacement cost of infrastructure in the erosion forecast area........ 3

Tables

Table 1. Quantity of infrastructure with estimated erosion exposure............... 2
Table 2. Replacement cost of infrastructure exposed to erosion......................... 2
Table 3. Cost estimate of exposed buildings and tank facilities......................... 2
EROSION EXPOSURE ASSESSMENT—EEK

Richard M. Buzard\textsuperscript{1}, Mark M. Turner\textsuperscript{1}, Katie Y. Miller\textsuperscript{1}, Donald C. Antrobus\textsuperscript{2}, and Jacquelyn R. Overbeck\textsuperscript{1}

EEK EROSION EXPOSURE ASSESSMENT

This is a summary of results from an erosion forecast near infrastructure at Eek, Alaska. We conduct a shoreline change analysis, forecast 60 years of erosion, and estimate the replacement cost of infrastructure in the forecast area. Buzard and others (2021) describe the method and guidance for interpreting tables and maps.

Source data for this summary include the following:

\begin{itemize}
  \item Delineated vegetation lines and change assessment by Buzard and others (2021) following the methods of Overbeck and others (2020).
  \item Infrastructure AutoCAD outlines and metadata from Division of Community & Regional Affairs (2004) Community Profile Map series.
  \item Added infrastructure such as roads, water and sanitation facilities, and outbuildings, delineated if visible in the most up-to-date high resolution ($\leq 0.66$ ft [20 cm] ground sample distance) aerial orthoimagery (Overbeck and others, 2016).
  \item Computed infrastructure cost of replacement based on square or linear footage from Buzard and others (2021).
\end{itemize}

Eek is located in the southeastern Yukon-Kuskokwim Delta on the Eek River that empties into Kuskokwim Bay. The community is built on a cut bank of the Eek River and consequently experiences riverine erosion. In 1984, the community built a timber retaining wall to curb erosion (U.S. Army Corps of Engineers, 2007). We did not find the exact location of the wall, but there was no major change in the long-term erosion rate at any location, so we assume the wall will not mitigate future erosion.

We forecast erosion 60 years from the most recent shoreline (2015) at 20-year intervals to identify the exposure of infrastructure to erosion. From 2015 to 2035, water lines, roads, and one building are exposed to erosion according to the erosion forecast (tables 1–3). Between 2035 and 2075, only roads remain in the erosion forecast area (table 1). The total replacement cost of infrastructure exposed to erosion is $650$ thousand ($\pm 195$ thousand) by 2075 (table 2; figs. 1 and 2).

ACKNOWLEDGMENTS

This work was funded by the Denali Commission Village Infrastructure Protection Program through the project “Systematic Approach to Assessing the Vulnerability of Alaska’s Coastal Infrastructure to Erosion.” The community of Eek was not consulted for this report.
### Table 1. Quantity of infrastructure with estimated erosion exposure by linear footage (LF), square footage (SF), or count (n).

<table>
<thead>
<tr>
<th>Erosion Forecast Date Range</th>
<th>Buildings &amp; Tank Facilities (n)</th>
<th>Power Lines (LF)</th>
<th>Fuel Lines (LF)</th>
<th>Water Lines (LF)</th>
<th>Roads</th>
<th>Airport (LF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015 to 2035</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>2035 to 2055</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>2055 to 2075</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Combined Total</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>48</td>
<td>0</td>
</tr>
</tbody>
</table>

### Table 2. Replacement cost of infrastructure exposed to erosion per 20-year interval.

<table>
<thead>
<tr>
<th>Erosion Forecast Date Range</th>
<th>Buildings &amp; Tank Facilities</th>
<th>Power Lines</th>
<th>Fuel Lines</th>
<th>Water Lines</th>
<th>Roads</th>
<th>Other</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015 to 2035</td>
<td>$400,000</td>
<td>$0</td>
<td>$0</td>
<td>$50,000</td>
<td>$200,000</td>
<td>$0</td>
<td>$650,000</td>
</tr>
<tr>
<td>2035 to 2055</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>2055 to 2075</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Combined Total</td>
<td>$400,000</td>
<td>$0</td>
<td>$0</td>
<td>$50,000</td>
<td>$200,000</td>
<td>$0</td>
<td>$650,000</td>
</tr>
</tbody>
</table>

### Table 3. Cost estimate of erosion exposure to buildings and tank facilities by 20-year interval. The count of exposed residential or unspecified buildings is denoted in parentheses.

<table>
<thead>
<tr>
<th>Erosion Forecast Date Range</th>
<th>Building Type</th>
<th>Cost of Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015 to 2035</td>
<td>Unspecified (1)</td>
<td>$400,000</td>
</tr>
<tr>
<td>2035 to 2055</td>
<td>None</td>
<td>$0</td>
</tr>
<tr>
<td>2055 to 2075</td>
<td>None</td>
<td>$0</td>
</tr>
</tbody>
</table>
Figure 1. This figure summarizes the replacement cost of all infrastructure in the erosion forecast area. Twenty-year intervals are symbolized by color: purple represents the time interval 2015 to 2035, orange represents 2035 to 2055, and yellow represents 2055 to 2075. The bulk of costs are buildings.
REFERENCES


Erosion and accretion of coasts and rivers result in shoreline change. These rates of shoreline change at Alaska communities are calculated from historical and modern shorelines (shorelines shown as lines in pink scale and labeled by year). The long-term (1953 to 2015) shoreline change rate is used to forecast where erosion could impact community infrastructure. Erosion is forecast to reach the colored areas by specified time intervals: 2015 to 2035 (purple), 2035 to 2055 (orange), and 2055 to 2075 (yellow). The area of uncertainty of the 2075 shoreline at a 90 percent confidence interval is light blue. Areas that are not colored by time interval are not forecast to erode by 2075 based on the historical shoreline change rate. For more detailed information about the impacts to infrastructure from erosion at Eek, refer to the Eek erosion exposure assessment report.
Erosion Exposure
Eek, Alaska

Infrastructure
- Power Line
- Fuel Line
- Water Line
- Road Edge
- Other

Buildings and Dates in Erosion Forecast
- 2055 to 2075
- > 2075
- 2075
- Uncertainty

Extent and Date of Erosion Forecast
- 2055 to 2075
- Uncertainty

Shorelines
- 2015
- 2004
- 1980
- 1953


The State of Alaska makes no expressed or implied warranties (including warranties for merchantability and fitness) with respect to the character, functions, or capabilities of the electronic data or products or their appropriateness for any user's purposes. In no event will the State of Alaska be liable for any incidental, indirect, special, consequential, or other damages suffered by the user or any other person or entity whether from the use of the electronic services or products or any failure thereof or otherwise. In no event will the State of Alaska's liability to the Requestor or anyone else exceed the fee paid for the electronic service or product.

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

Erosion and accretion of coasts and rivers result in shoreline change. These rates of shoreline change at Alaska communities are calculated from historical and modern shorelines (shorelines shown as lines in pink scale and labeled by year). The long-term (1953 to 2015) shoreline change rate is used to forecast where erosion could impact community infrastructure. Erosion is forecast to year 2075 (dark blue) with a 90 percent confidence interval area of uncertainty (light blue). Buildings forecast to be impacted by erosion are colored by the range of years when the impact is forecast to occur: 2015 to 2035 (purple), 2035 to 2055 (orange), 2055 to 2075 (yellow), and no impacts expected by 2075 (gray). For more detailed information about the impacts to infrastructure from erosion at Eek, refer to the Eek erosion exposure assessment report.

This work is part of the Coastal Infrastructure Erosion Vulnerability Assessment project funded by the Denali Commission Environmentally Threatened Communities Grant Program. Components of this map were prepared by the Alaska Department of Commerce, Community, and Economic Development (DCCED) using funding from multiple municipal, state, federal, and tribal partners. The original AutoCAD drawing of the infrastructure data layers was converted to ArcGIS.

Erosion Exposure Report of Investigation 2021-3 Buzard and others, 2021 Eek, Sheet 2 of 2

Eek, Alaska


Erosion and accretion of coasts and rivers result in shoreline change. These rates of shoreline change at Alaska communities are calculated from historical and modern shorelines (shorelines shown as lines in pink scale and labeled by year). The long-term (1953 to 2015) shoreline change rate is used to forecast where erosion could impact community infrastructure. Erosion is forecast to year 2075 (dark blue) with a 90 percent confidence interval area of uncertainty (light blue). Buildings forecast to be impacted by erosion are colored by the range of years when the impact is forecast to occur: 2015 to 2035 (purple), 2035 to 2055 (orange), 2055 to 2075 (yellow), and no impacts expected by 2075 (gray). For more detailed information about the impacts to infrastructure from erosion at Eek, refer to the Eek erosion exposure assessment report.

This work is part of the Coastal Infrastructure Erosion Vulnerability Assessment project funded by the Denali Commission Environmentally Threatened Communities Grant Program. Components of this map were prepared by the Alaska Department of Commerce, Community, and Economic Development (DCCED) using funding from multiple municipal, state, federal, and tribal partners. The original AutoCAD drawing of the infrastructure data layers was converted to ArcGIS.