

EROSION EXPOSURE ASSESSMENT—EEK

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Eek, Alaska, in 2015 (Overbeck and others, 2016).



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Report of Investigation 2021-3 Eek

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EROSION EXPOSURE ASSESSMENT—EEK

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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:

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

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

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Table 1. Quantity of infrastructure with estimated erosion exposure by linear footage (LF), square footage (SF), or count (n).

| Quantity of Exposed Infrastructure | | | | | | |
|------------------------------------|---------------------------------|------------------|-----------------|------------------|-------|--------------|
| Erosion Forecast Date Range | Buildings & Tank Facilities (n) | Power Lines (LF) | Fuel Lines (LF) | Water Lines (LF) | Roads | Airport (LF) |
| 2015 to 2035 | 1 | 0 | 0 | 2 | 9 | 0 |
| 2035 to 2055 | 0 | 0 | 0 | 0 | 19 | 0 |
| 2055 to 2075 | 0 | 0 | 0 | 0 | 20 | 0 |
| Combined Total | 1 | 0 | 0 | 2 | 48 | 0 |

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

| Cost to Replace Exposed Infrastructure | | | | | | | |
|--|-----------------------------|-------------|------------|-------------|-----------|-------|-----------|
| Erosion Forecast Date Range | Buildings & Tank Facilities | Power Lines | Fuel Lines | Water Lines | Roads | Other | Sum |
| 2015 to 2035 | \$400,000 | \$0 | \$0 | \$50,000 | \$200,000 | \$0 | \$650,000 |
| 2035 to 2055 | \$0 | \$0 | \$0 | \$0 | \$0 | \$0 | \$0 |
| 2055 to 2075 | \$0 | \$0 | \$0 | \$0 | \$0 | \$0 | \$0 |
| Combined Total | \$400,000 | \$0 | \$0 | \$50,000 | \$200,000 | \$0 | \$650,000 |

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.

| Cost to Replace Buildings and Tank Facilities | | |
|---|-----------------|---------------------|
| Erosion Forecast Date Range | Building Type | Cost of Replacement |
| 2015 to 2035 | Unspecified (1) | \$400,000 |
| 2035 to 2055 | None | \$0 |
| 2055 to 2075 | None | \$0 |

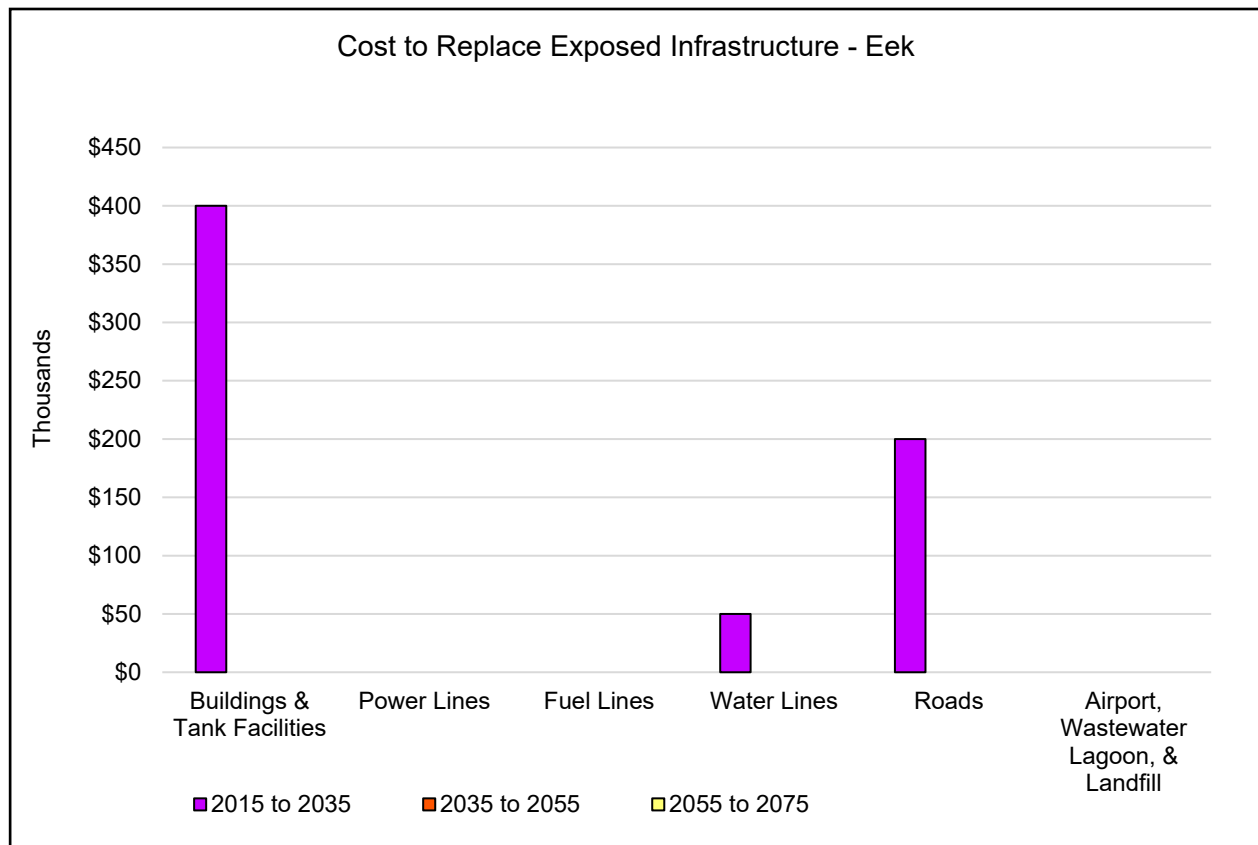


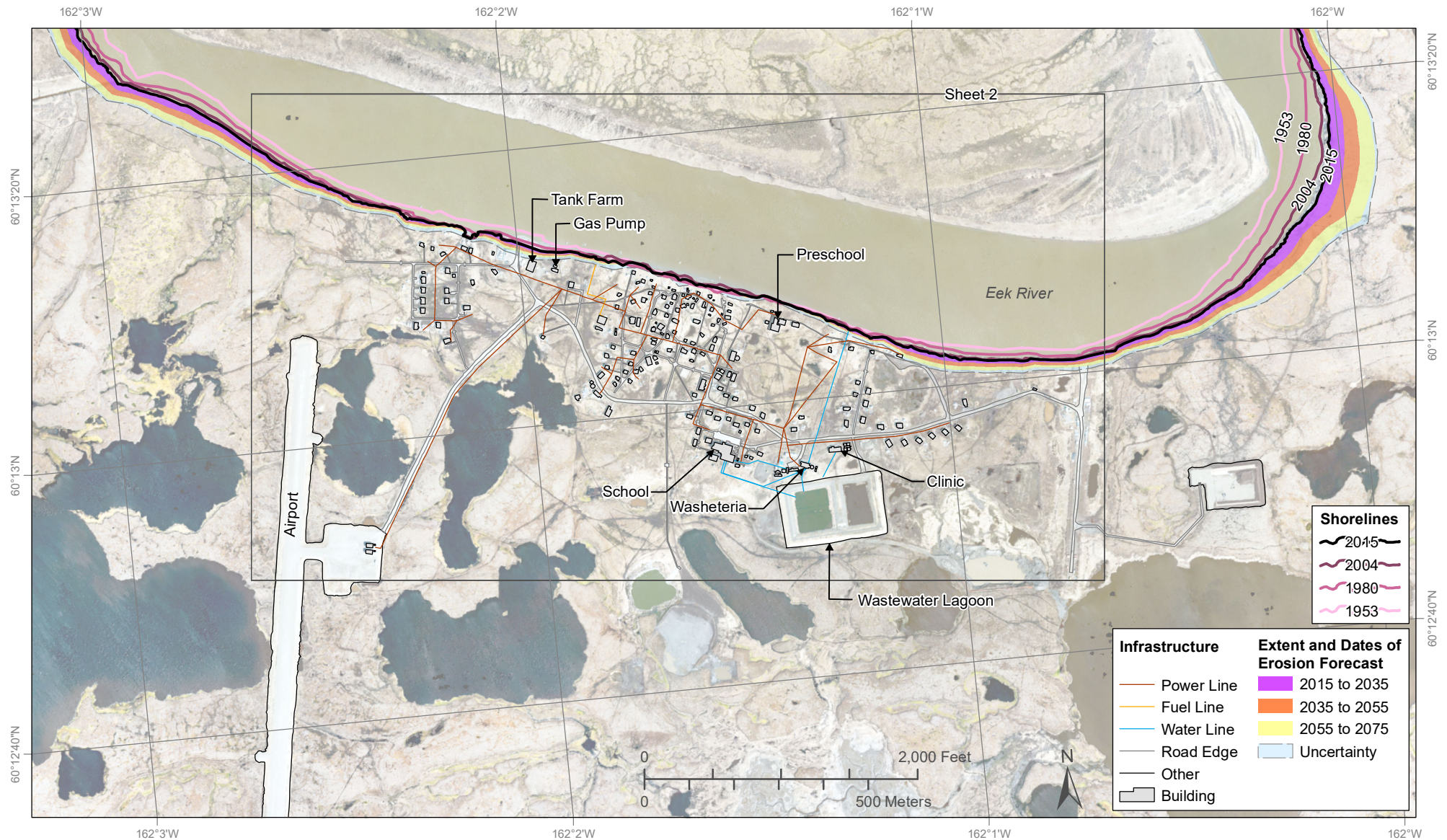
Figure 1. This figure summarizes the replacement cost of all infrastructure in the erosion forecast area. Twenty-year intervals are symbolized by color: purple represents the time interval 2015 to 2035, orange represents 2035 to 2055, and yellow represents 2055 to 2075. The bulk of costs are buildings.

REFERENCES

- Buzard, R.M., Turner, M.M., Miller, K.Y., Antrobus, D.C., and Overbeck, J.R., 2021, Erosion exposure assessment of infrastructure in Alaska coastal communities: Alaska Division of Geological & Geophysical Surveys Report of Investigation 2021-3. <https://doi.org/10.14509/30672>
- Division of Community & Regional Affairs, 2004, Community profile map, Eek: Department of Commerce, Community, and Economic Development. <https://www.commerce.alaska.gov/web/dcra/PlanningLandManagement/CommunityProfileMaps.aspx>
- Overbeck, J.R., Buzard, R.M., Turner, M.M., Miller, K.Y., and Glenn, R.J., 2020, Shoreline change at Alaska coastal communities: Alaska Division of Geological & Geophysical Surveys Report of Investigation 2020-10, 29 p., 45 sheets. <https://doi.org/10.14509/30552>
- Overbeck, J.R., Hendricks, M.D., and Kinsman, N.E.M., 2016, Photogrammetric digital surface models and orthoimagery for 26 coastal communities of western Alaska: Alaska Division of Geological & Geophysical Surveys Raw Data File 2016-1, 3 p. <https://doi.org/10.14509/29548>
- U.S. Army Corps of Engineers, 2007, Alaska baseline erosion assessment report summary—Eek: U.S. Army Corps of Engineers Alaska District, 3 p.

Erosion Forecast Eek, Alaska

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Buzard and others, 2021
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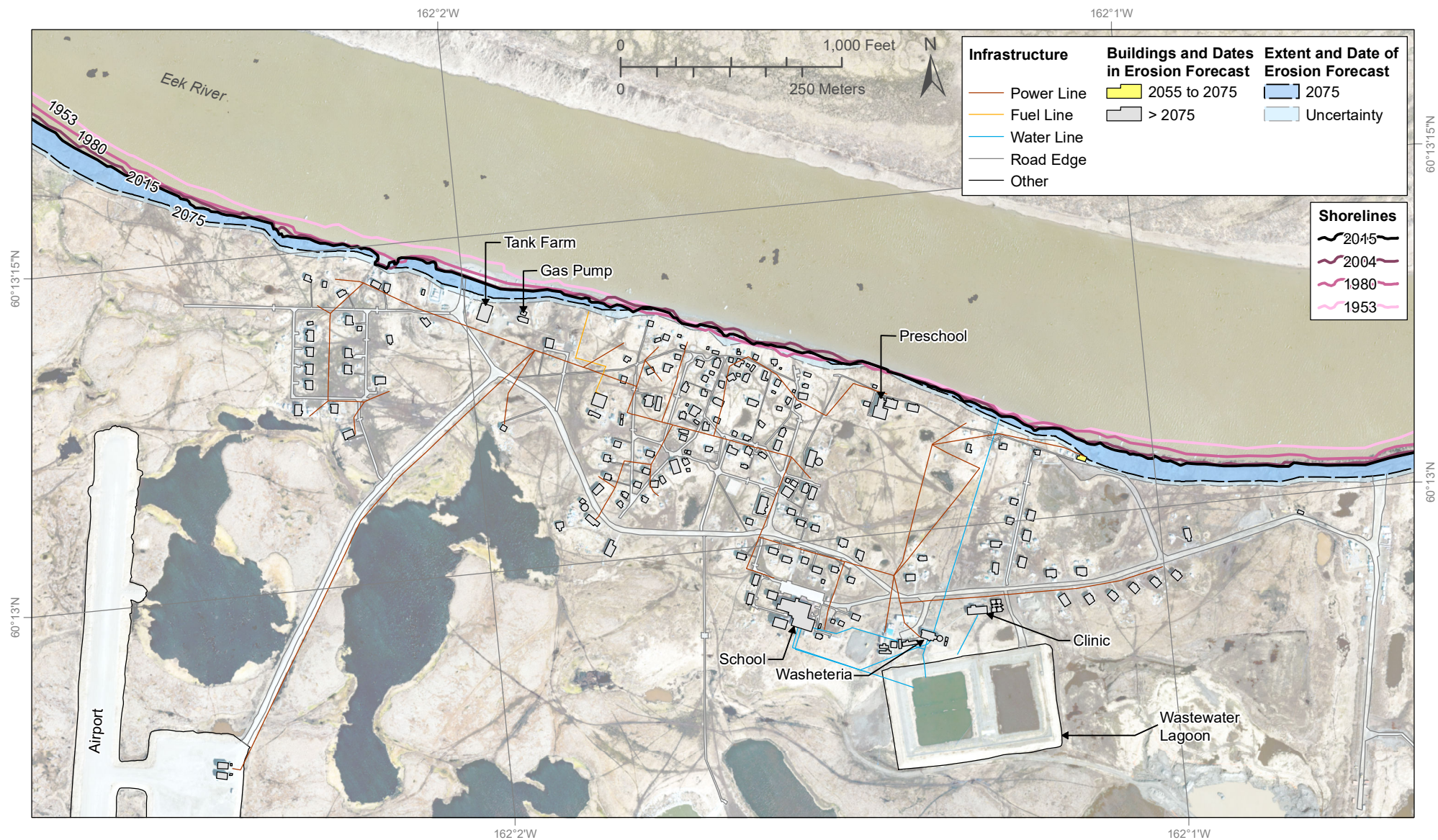
Erosion and accretion of coasts and rivers result in shoreline change. These rates of shoreline change at Alaska communities are calculated from historical and modern shorelines (shorelines shown as lines in pink scale and labeled by year). The long-term (1953 to 2015) shoreline change rate is used to 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.

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 Eek, Alaska

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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 pinkscale 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.

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