Report of Investigation 2021-3 Tununak

EROSION EXPOSURE ASSESSMENT—TUNUNAK

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Tununak, Alaska, in 2014. Shorezone, shorezone.org.

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Contents

Figures

Tables

EROSION EXPOSURE ASSESSMENT—TUNUNAK

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TUNUNAK EROSION EXPOSURE ASSESSMENT

This is a summary of results from an erosion forecast near infrastructure at Tununak, 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 the 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) and The Native Village of Tununak (2015).

Tununak is located on the northwest coastline of Nelson Island in the southwestern Yukon-Kuskokwim Delta. Infrastructure is built across a long spit that extends from the northeastern mountains to where the Tununak River exits into Tununak Bay. Erosion occurs on both sides of the spit due

to storm surge and regular riverine processes (U.S. Army Corps of Engineers [USACE], 2008). Erosion is mitigated to some degree on the coastal side with a gabion seawall built in 1984 and additional gabions and sandbags in 2004 (USACE, 2008). Erosion also occurs around the foundation of the bridge to the landfill and old airport (USACE, 2008). Large rocks were placed around the foundation to slow erosion. In 2015, a 2,500-foot boardwalk was built on the river side to improve access and prevent further erosion (Portland Bolt, 2021). We do not forecast erosion in areas with mitigation activities.

We forecast erosion 60 years from the most recent shoreline (2015) at 20-year intervals to identify the exposure of infrastructure to erosion. The erosion forecast shows most infrastructure are not exposed to erosion through 2075 (table 1). The shoreline near the tip of the spit is forecast to migrate across the road to the bridge, although the spit itself is relatively stable (Overbeck and others, 2020). The erosion may occur during a very high storm surge event that scours the roadway. Road damage is estimated using a minimum replacement cost of $200 thousand in the 2015 to 2035 period (table 2). While erosion forecasts cannot be made for the bridge itself, the nearby erosion extent implies

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Table 1. Quantity of infrastructure with estimated erosion exposure by linear footage (LF) 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**	**Bridge (n)**
2015 to 2035	0	0	0	0	213	1
2035 to 2055	0	0	0	0	26	0
2055 to 2075	0	0	0	0	66	0
Combined Total	0	0	0	0	305	1

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**	**Bridge**	**Sum**
2015 to 2035	$0	$0	$0	$0	$200,000	$300,000	$500,000
2035 to 2055	$0	$0	$0	$0	$0	$0	$0
2055 to 2075	$0	$0	$0	$0	$0	$0	$0
Combined Total	$0	$0	$0	$0	$200,000	$300,000	$500,000

the bridge is likely exposed to erosion. Given this forecast and community observations of continued bridge foundation erosion, we include the bridge replacement cost estimated by The Native Village of Tununak (2015; table 2; fig. 1). The timing of exposure is estimated to be the same as the road. The total estimated cost of infrastructure exposed to erosion is $500 thousand (± $150 thousand) by 2075 (table 2; fig. 1).

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 Tununak was not consulted for this report.

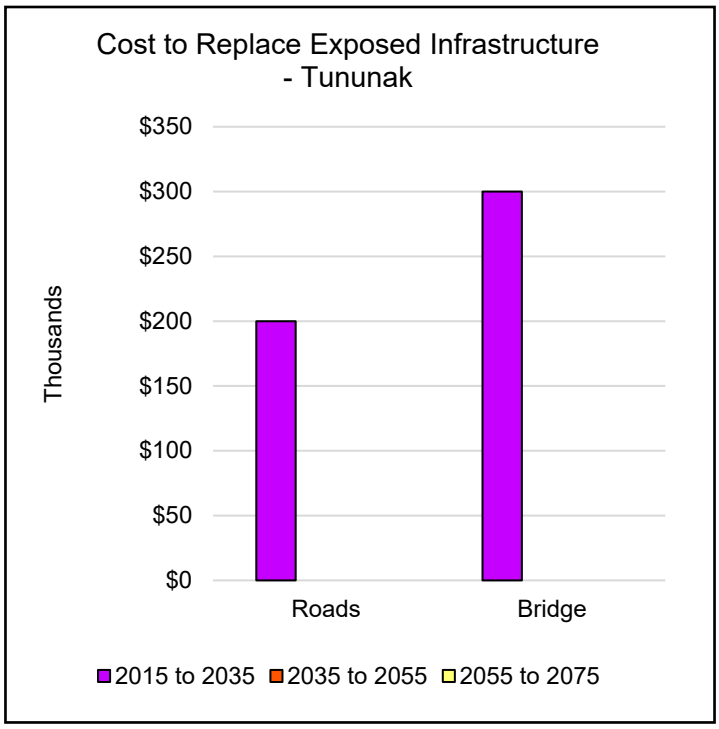

Figure 1. This figure summarizes the replacement cost of all infrastructure in the erosion forecast area. The road and bridge are both within the 2035 (purple) forecast.

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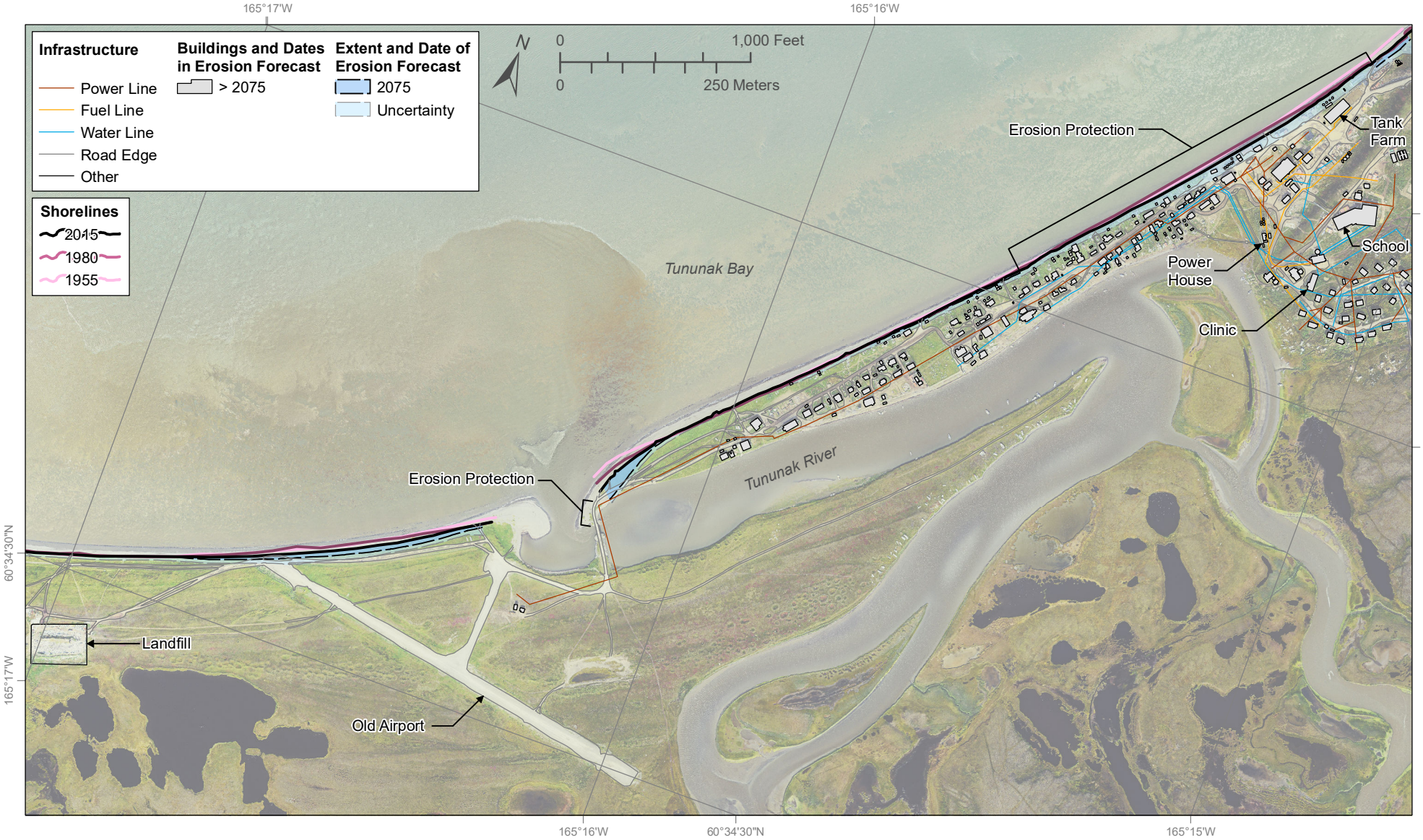
Erosion Exposure
Tununak, Alaska

Report of Investigation 2021-3
Buzard and others, 2021
Tununak, Sheet 1 of 1



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Projection: NAD83 UTM Zone 3N. Orthoimagery year: 2015. Orthoimagery available from elevation.alaska.gov

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 (1955 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 Tununak, refer to the Tununak 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.