Report of Investigation 2021-3 Stebbins

EROSION EXPOSURE ASSESSMENT—STEBBINS

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

Stebbins, Alaska, in 2015. Shorezone, shorezone.org.

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Contents

Figures

Tables

EROSION EXPOSURE ASSESSMENT—STEBBINS

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STEBBINS EROSION EXPOSURE ASSESSMENT

This is a summary of results from an erosion forecast near infrastructure at Stebbins, 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).

Stebbins is located on a small sand spit along the southern shore of Norton Sound in the lee of Stuart Island. Erosion at Stebbins is primarily from storm surge and wave action (U.S. Army Corps of Engineers [USACE], 2008). From 1951 to 2015, the shoreline was stable in front of most of the community with erosion rates reaching up

to 1.6 feet per year (Overbeck and others, 2020). Although erosion rates are relatively slow, many structures are built near the shoreline. An erosion protection berm was built from rock in front of the school. The community replaced gravel near the airport runway after a 2004 storm, resulting in a stable to accreting shoreline (U.S. Army Corps of Engineers [USACE], 2008). Erosion rates in front of the airport and the school are mostly stable. Given the mitigation activity and stable shoreline, we do not include these areas in the analysis.

We forecast erosion 60 years from the most recent shoreline (2015) at 20-year intervals to identify the exposure of infrastructure to erosion. The forecast shows 18 buildings are exposed to erosion from 2015 to 2075, nine of which are residential (tables 1–3). The total estimated cost of infrastructure exposed to erosion is $3.8 million (± $1.1 million) by 2075 (table 2; fig. 1). We did not estimate erosion exposure for fuel lines because data were not available. Sections of the shoreline that are regularly renourished may still be exposed to erosion and are not identified through this analysis. Repeat elevation surveys can be used to quantify any significant changes and evaluate the effectiveness of mitigation strategies.

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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)**	**Water Lines (LF)**	**Roads (LF)**	**Airport (LF)**
2015 to 2035	7	0	0	3	0
2035 to 2055	6	0	0	3	0
2055 to 2075	5	0	0	3	0
Combined Total	18	0	0	9	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**	**Water Lines**	**Roads**	**Sum**
2015 to 2035	$1,600,000	$0	$0	$200,000	$1,800,000
2035 to 2055	$800,000	$0	$0	$0	$800,000
2055 to 2075	$1,239,500	$0	$0	$0	$1,239,500
Combined Total	$3,639,500	$0	$0	$200,000	$3,839,500

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. NCA designated buildings with no cost assigned.

Cost to Replace Exposed Buildings and Tank Facilities		
Erosion Forecast Date Range	**Building Type**	**Cost of Replacement**
2015 to 2035	Residential (4)	$1,600,000
	Unspecified (3)	NCA
2035 to 2055	Residential (2)	$800,000
	Unspecified (4)	NCA
2055 to 2075	Residential (3)	$1,239,500
	Unspecified (2)	NCA

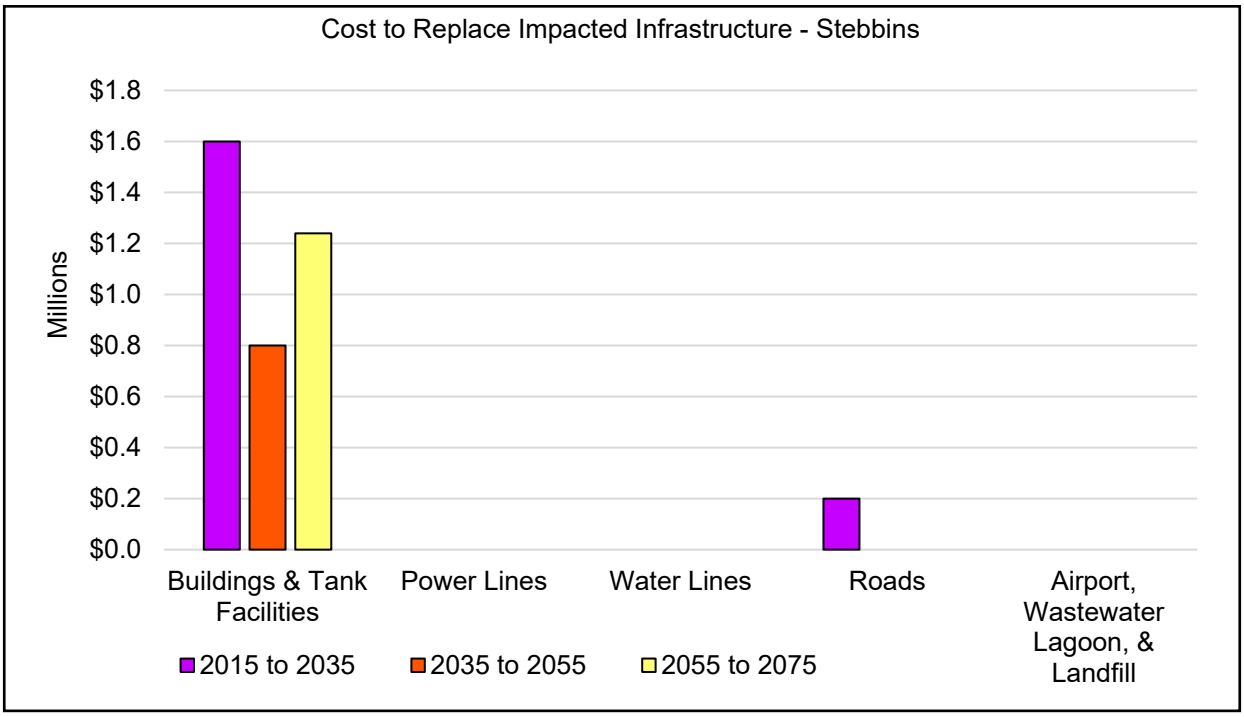

Figure 1. . This figure summarizes the replacement cost of all infrastructure in the erosion forecast area. Twenty-year intervals are symbolized by color: purple represents the time interval 2015 to 2035, orange represents 2035 to 2055, and yellow represents 2055 to 2075. The bulk of costs are buildings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

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 Stebbins was not consulted for this report.

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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

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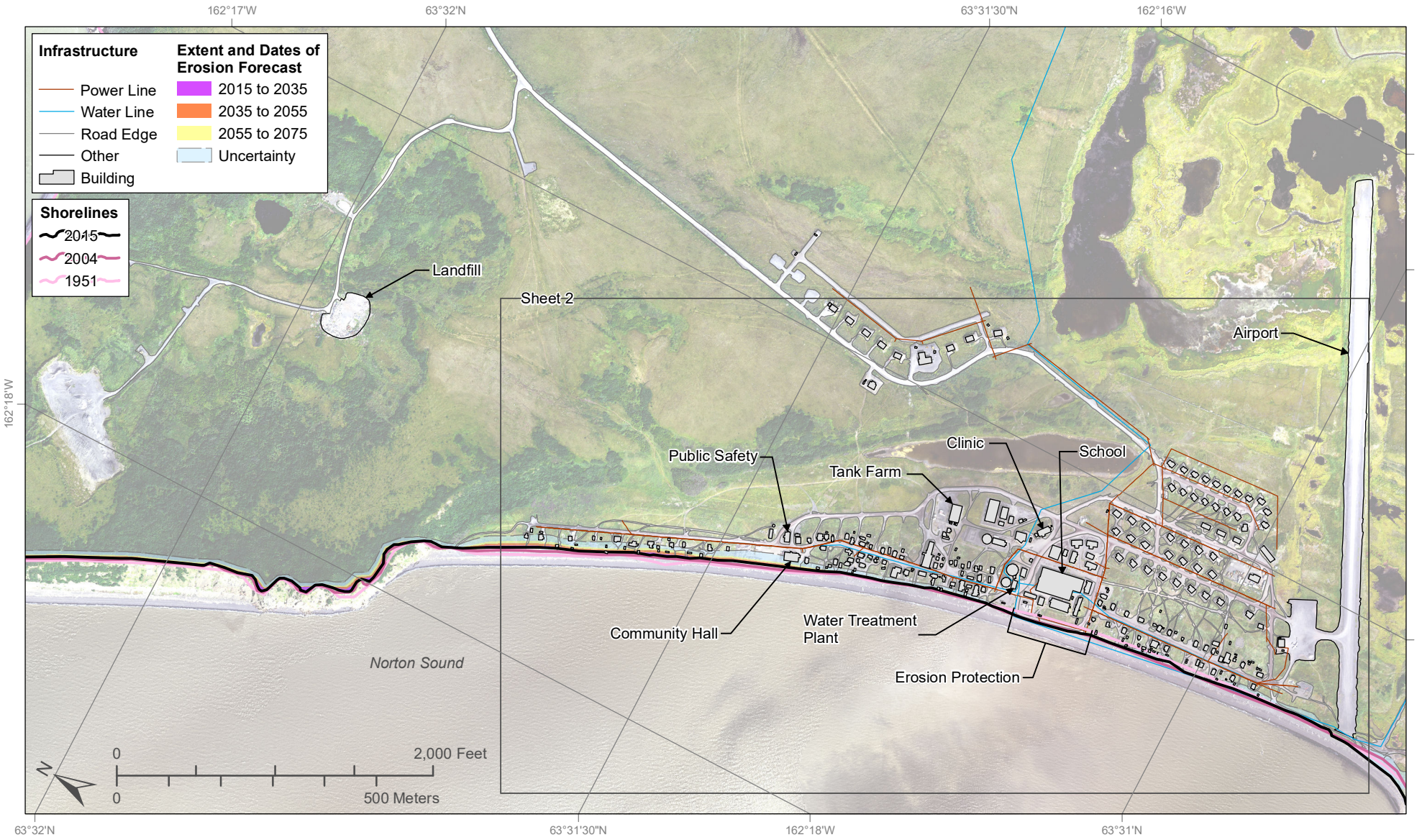
Erosion Forecast
Stebbins, Alaska

Report of Investigation 2021-3
Buzard and others, 2021
Stebbins, Sheet 1 of 2



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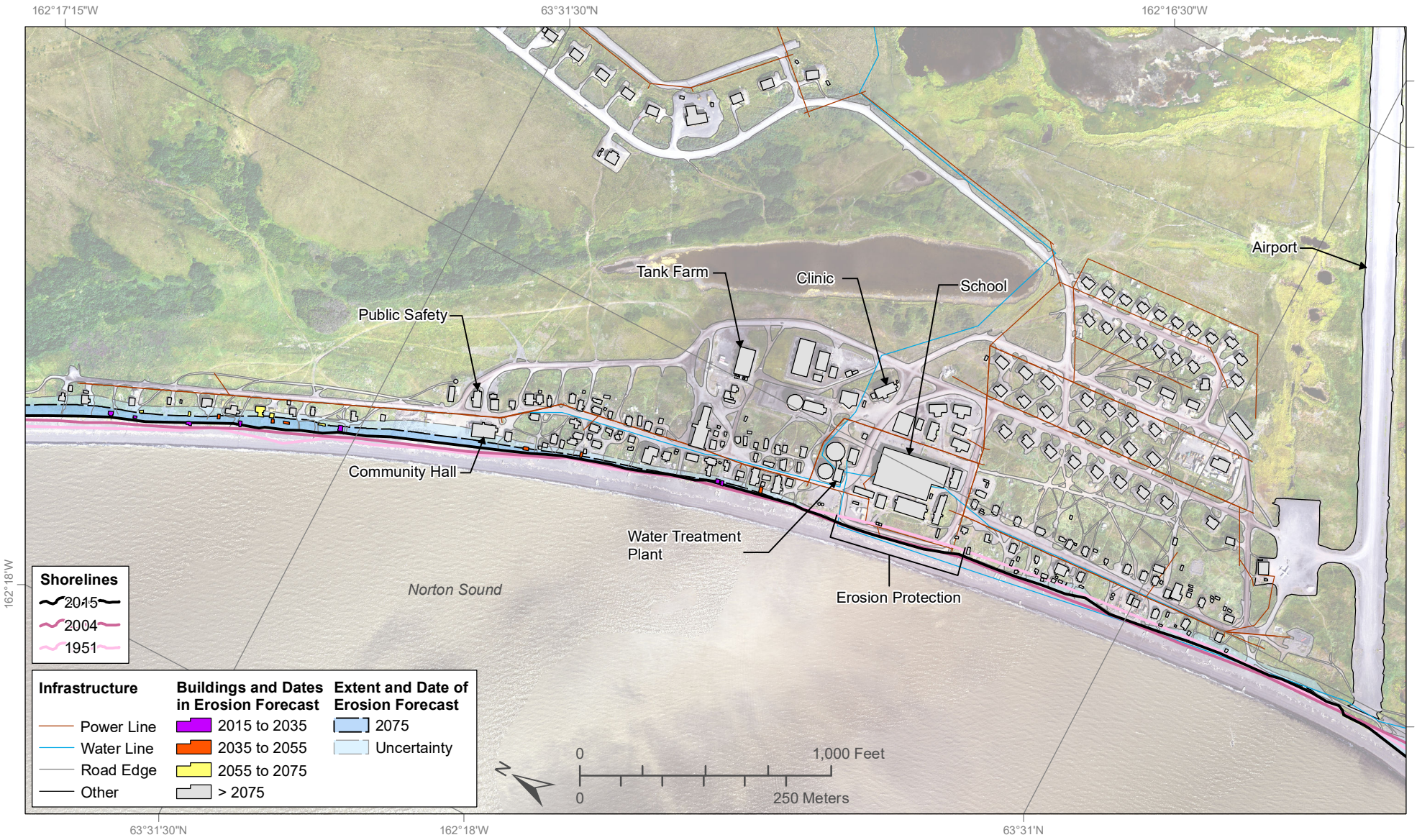
Projection: NAD83 UTM Zone 3N. Orthoimagery year: 2015. Orthoimagery available from elevation.alaska.gov

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 (1951 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 Stebbins, refer to the Stebbins 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
Stebbins, Alaska

Report of Investigation 2021-3
Buzard and others, 2021
Stebbins, Sheet 2 of 2



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