Report of Investigation 2021-3 Levelock

EROSION EXPOSURE ASSESSMENT—LEVELOCK

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

Levelock, Alaska, in 2017. Photo: Alaska Division of Geological & Geophysical Surveys.

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State of Alaska
Department of Natural Resources
Division of Geological & Geophysical Surveys

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EROSION EXPOSURE ASSESSMENT—LEVELOCK

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LEVELOCK EROSION EXPOSURE ASSESSMENT

This is a summary of erosion forecast results near infrastructure at Levelock, 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 (2002) 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 (Quantum Spatial, 2019).
- Computed infrastructure cost of replacement based on square or linear footage from Buzard and others (2021).

Levelock is located on the west side of the Kvichak River about 15 miles upstream from where the river exits into Kvichak Bay and northeast Bristol Bay. From 1951 to 2018, the river eroded between 1.0 and 3.3 feet per year at a relatively linear rate (Overbeck and others, 2020). Erosion is caused by riverine processes and fall storm surge (U.S. Army Corps of Engineers, 2007). Erosion is greatest near the boat launch on the south side of the community. Erosion rates have been near-stable

north of the dock. Other than the dock, there is no shoreline protection installed.

We forecast erosion 60 years from the most recent shoreline (2018) at 20-year intervals to identify the exposure of infrastructure to erosion. The erosion forecast shows four structures, the fuel header, power lines, and the boat launch are exposed to erosion through 2078 (tables 1–3). The greatest costs are buildings, especially in the first 20 years (table 2; fig. 1). The total replacement cost of infrastructure exposed to erosion is $1.6 million (± $0.5 million) through 2078 (table 2; fig. 1). We do not estimate erosion exposure for fuel lines because data are not available, but the fuel header is included. DGGS visited Levelock in 2021 and found that shoreline retreat at the armored dock is causing the sheet pile walls to collapse. Continued erosion monitoring can help improve near-term and long-term erosion forecasts and determine whether recent rates are outpacing the long-term average.

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 Levelock was not consulted for this report.

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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 Header (n)**	**Water Lines (LF)**	**Roads (LF)**	**Boat Launch (LF)**
2018 to 2038	3	0	0	0	0	51
2038 to 2058	1	0	1	0	0	48
2058 to 2078	0	45	0	0	0	31
Combined Total	4	45	1	0	0	130

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 Header**	**Water Lines**	**Roads**	**Boat Launch**	**Airport, Wastewater Lagoon, & Landfill**	**Sum**
2018 to 2038	$800,000	$0	$0	$0	$0	$200,000	$0	$1,000,000
2038 to 2058	$475,200	$0	$50,000	$0	$0	$0	$0	$525,200
2058 to 2078	$0	$50,000	$0	$0	$0	$0	$0	$50,000
Combined Total	$1,275,200	$50,000	$50,000	$0	$0	$200,000	$0	$1,575,200

Table 3. Cost estimate of exposed buildings and tank facilities by 20-year interval. The count of exposed unspecified buildings is denoted in parentheses.

Cost to Replace Buildings and Tank Facilities		
Erosion Forecast Date Range	**Building Type**	**Cost of Replacement**
2018 to 2038	Unspecified (3)	$800,000
2038 to 2058	Unspecified (1)	$475,200
2058 to 2078	None	$0

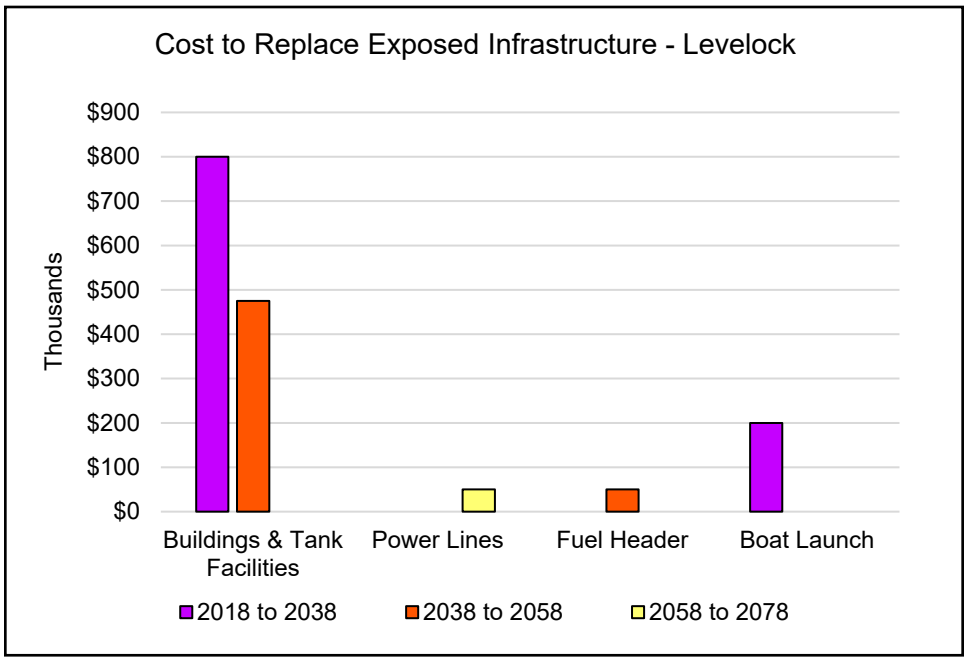

Figure 1. This figure summarizes the replacement cost of all infrastructure in the erosion forecast area. Twenty-year intervals are symbolized by color: purple represents the time interval 2018 to 2038, orange represents 2038 to 2058, and yellow represents 2058 to 2078. The bulk of costs are buildings, especially from 2018 to 2038.

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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
Levelock, Alaska

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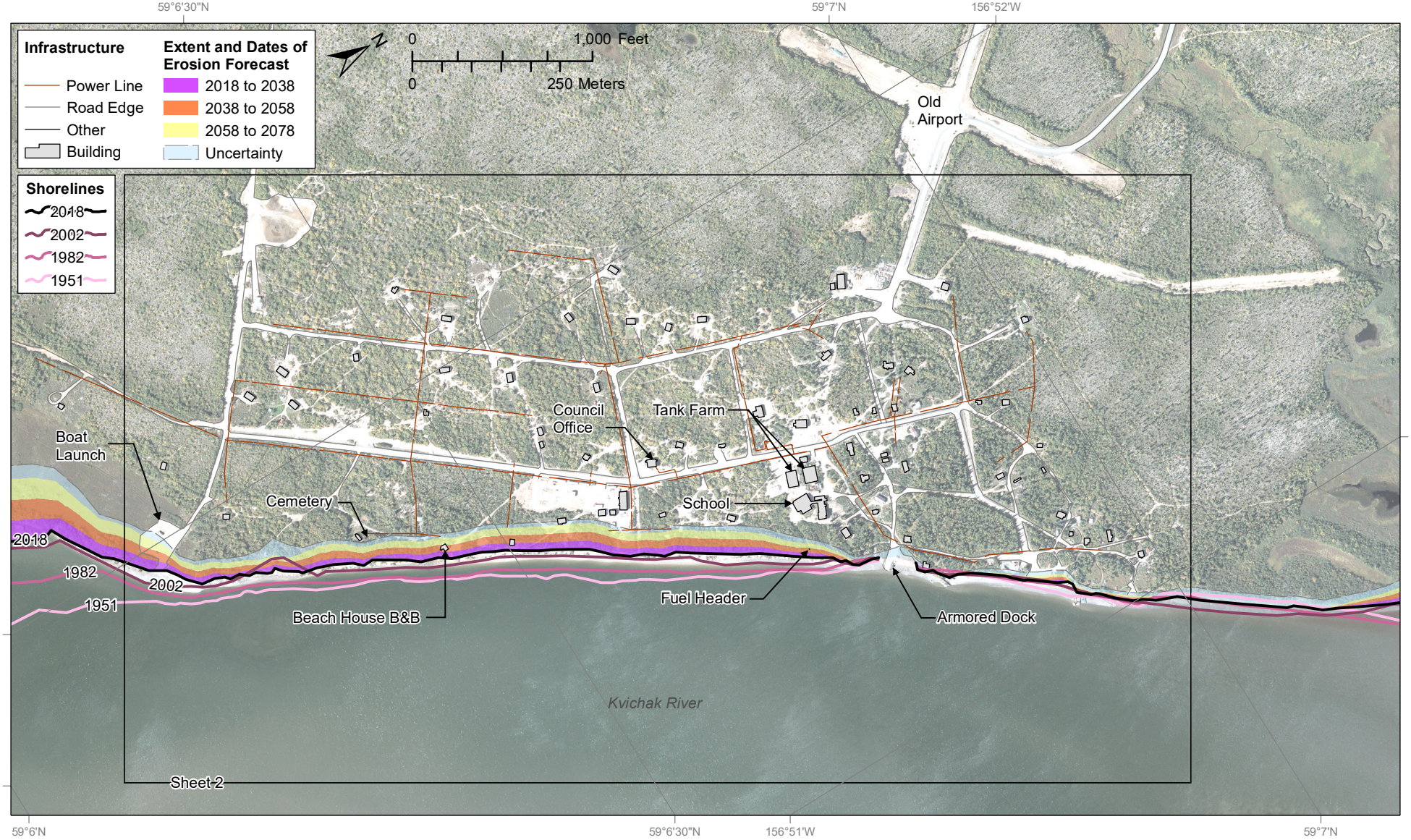
Buzard and others, 2021
Levelock, Sheet 1 of 2



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Projection: NAD83 UTM Zone 4N. Orthoimagery year: 2018. 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 2018) 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: 2018 to 2038 (purple), 2038 to 2058 (orange), and 2058 to 2078 (yellow). The area of uncertainty of the 2078 shoreline at a 90 percent confidence interval is light blue. Areas that are not colored by time interval are not forecast to erode by 2078 based on the historical shoreline change rate. For more detailed information about the impacts to infrastructure from erosion at Levelock, refer to the Levelock 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
Levelock, Alaska

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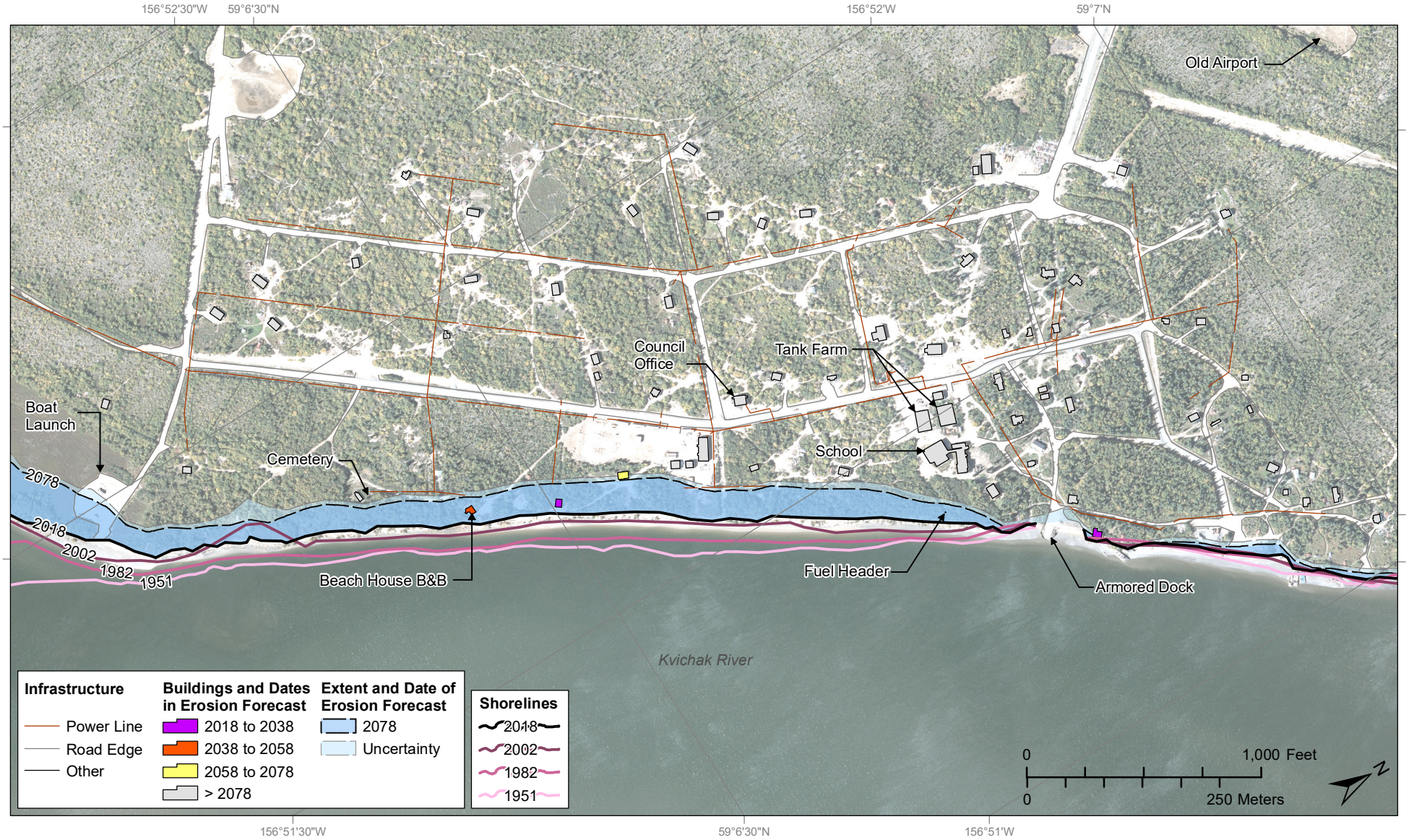
Levelock, Sheet 2 of 2



Infrastructure
- Power Line
- Road Edge
- Other

Buildings and Dates in Erosion Forecast
- 2018 to 2038
- 2038 to 2058
- 2058 to 2078
- > 2078

Extent and Date of Erosion Forecast
- 2078
- Uncertainty

Shorelines
- 2018
- 2002
- 1982
- 1951

Projection: NAD83 UTM Zone 4N. Orthoimagery year: 2018. 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 2018) shoreline change rate is used to forecast where erosion could impact community infrastructure. Erosion is forecast to year 2078 (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: 2018 to 2038 (purple), 2038 to 2058 (orange), 2058 to 2078 (yellow), and no impacts expected by 2078 (gray). For more detailed information about the impacts to infrastructure from erosion at Levelock, refer to the Levelock erosion exposure assessment report.

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