

EROSION EXPOSURE ASSESSMENT—WAINWRIGHT

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Wainwright, Alaska, in 2012. Shorezone, shorezone.org.



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Report of Investigation 2021-3 Wainwright

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EROSION EXPOSURE ASSESSMENT—WAINWRIGHT

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WAINWRIGHT EROSION EXPOSURE ASSESSMENT

This is a summary of erosion forecast results near infrastructure at Wainwright, 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 meta-data from the Division of Community & Regional Affairs (2013) 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).

Wainwright is located on the northwest coast of Alaska's North Slope. The community is built on ice-rich permafrost between the Chukchi Sea and Wainwright Inlet. The coastal bluffs are vulnerable to erosion from storm-driven waves during sea ice-free conditions (U.S. Army Corps of Engineers [USACE], 2008). From 1949 to 2019, the high



water line shoreline was mostly stable with erosion up to 2.6 feet per year (Overbeck and others, 2020). The bluff shoreline had similar erosion rates.

The community of Wainwright started replenishing the beach in 1995 with material from offshore dredge sites (USACE, 2008). In 2005, a gabion wall was installed on the south corner of town but was damaged by storms and is continually reinforced with sandbags (USACE, 2008). Erosion rates near the area where the gabion wall was built are similar to surrounding unprotected shorelines. The gabion is not visible in the 2019 aerial imagery, so we forecast erosion in this area. In 2013, a 500-foot rock revetment was constructed near the wastewater treatment plant and clinic (UMIAQ and Olgoonik Development LLC., 2014), and has since expanded to 2000 feet along the shoreline. We do not forecast erosion at the rock revetment.

We forecast erosion 60 years from the most recent shoreline (2019) at 20-year intervals to identify the exposure of infrastructure to erosion. The analysis is carried out on the Chukchi Sea shore of Wainwright. The forecast shows power lines, water lines, roads, and one residential building are exposed to erosion (tables 1–3). The total replacement cost of infrastructure exposed to erosion is \$786 thousand (\pm \$236 thousand) by 2079 (table 2; fig. 1).

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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 (LF)
2019 to 2039	0	0	0	4	13
2039 to 2059	0	24	0	118	60
2059 to 2079	1	66	0	219	238
Combined Total	1	90	0	341	311

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	Airport, Wastewater Lagoon, & Landfill	Sum
2019 to 2039	\$0	\$0	\$0	\$50,000	\$200,000	\$0	\$250,000
2039 to 2059	\$0	\$50,000	\$0	\$0	\$0	\$0	\$50,000
2059 to 2079	\$400,000	\$0	\$0	\$86,200	\$0	\$0	\$486,200
Combined Total	\$400,000	\$50,000	\$0	\$136,200	\$200,000	\$0	\$786,200

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 Exposed Buildings and Tank Facilities		
Erosion Forecast Date Range	Building Type	Cost of Replacement
2019 to 2039	None	\$0
2039 to 2059	None	\$0
2059 to 2079	Residential (1)	\$400,000

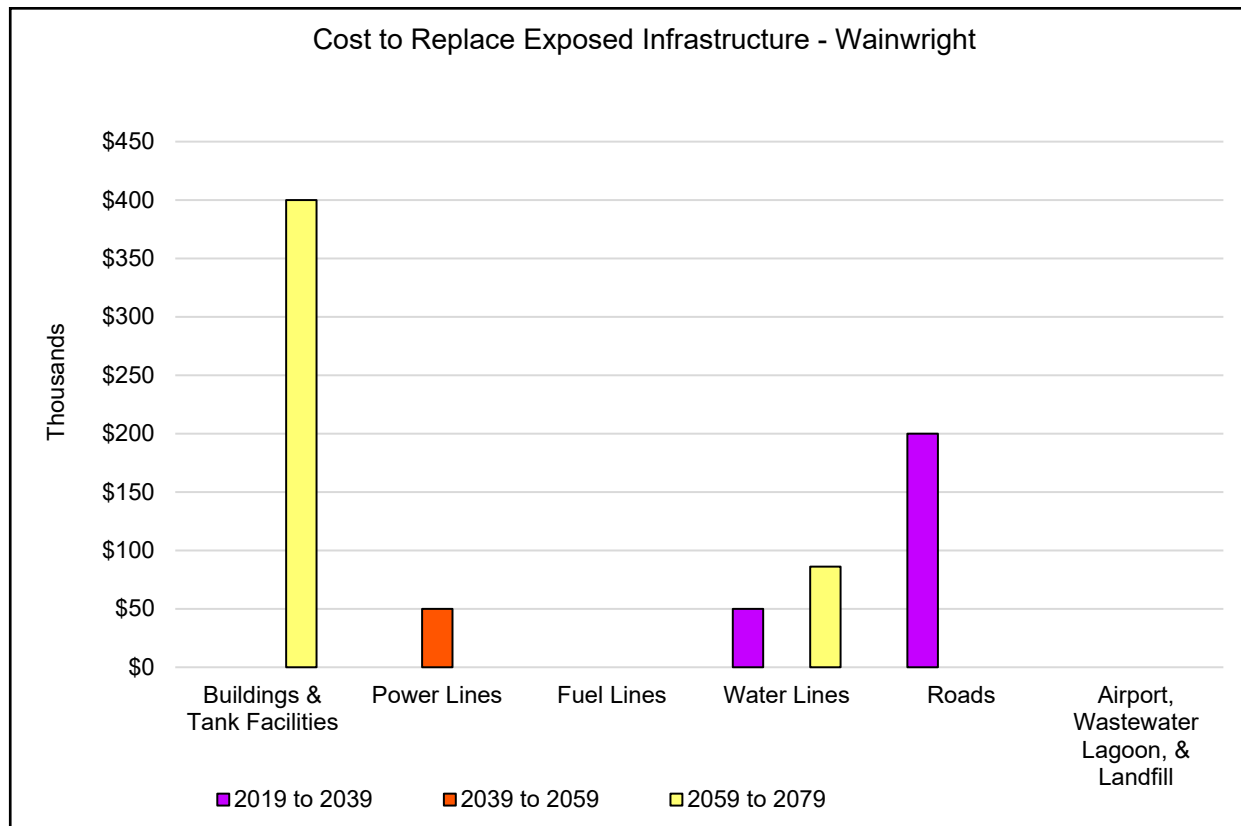


Figure 1. This figure summarizes the replacement cost of all infrastructure in the erosion forecast area. Twenty-year intervals are symbolized by color: purple represents the time interval 2019 to 2039, red represents 2039 to 2059, and yellow represents 2059 to 2079. The bulk of costs are buildings, especially from 2059 to 2079.

ACKNOWLEDGMENTS

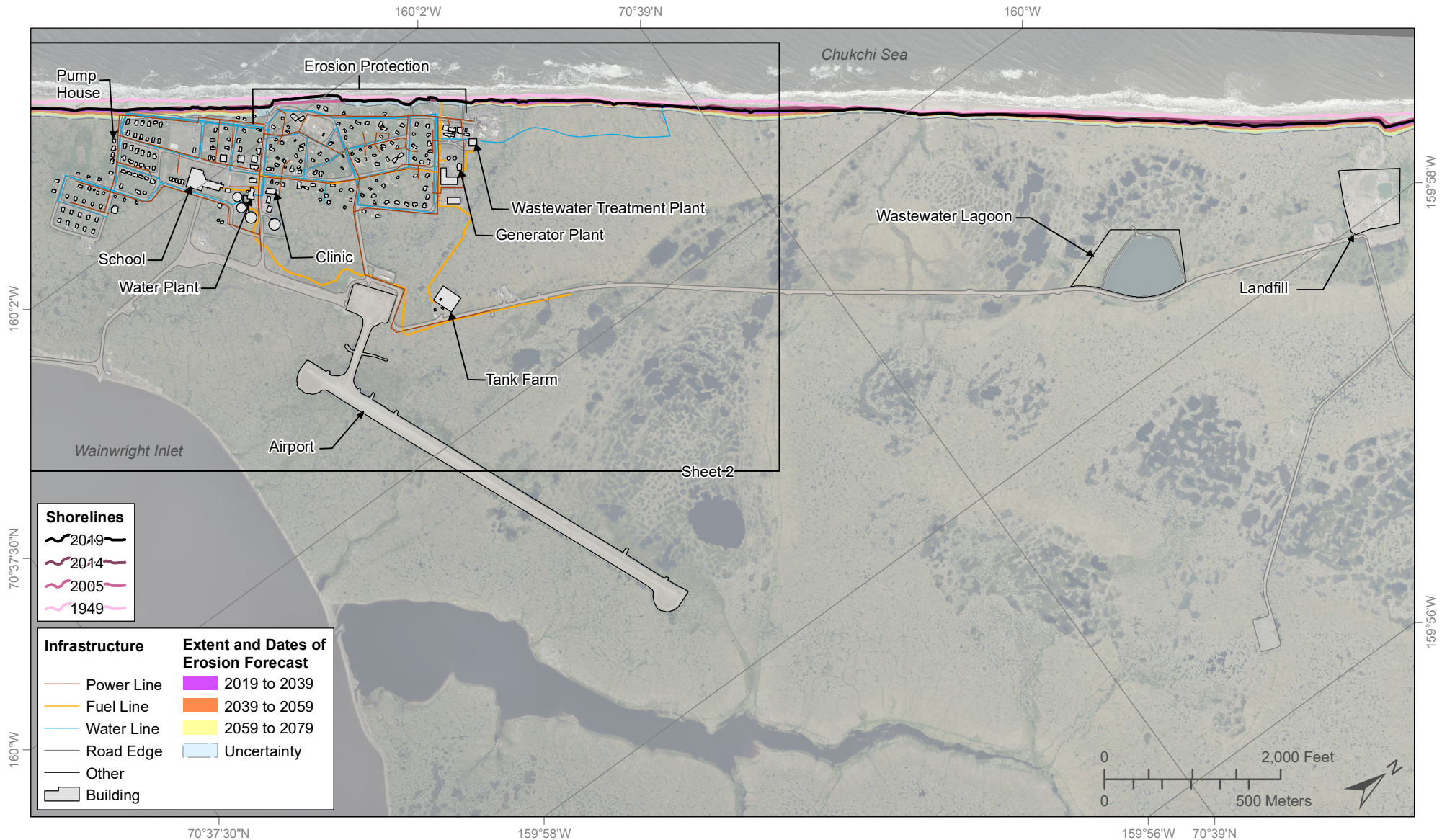
This work was funded by the Denali Commission Village Infrastructure Protection Program through the project “Systematic Approach to Assessing the Vulnerability of Alaska’s Coastal Infrastructure to Erosion.” The community of Wainwright was not consulted for this report.

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Erosion Forecast Wainwright, Alaska

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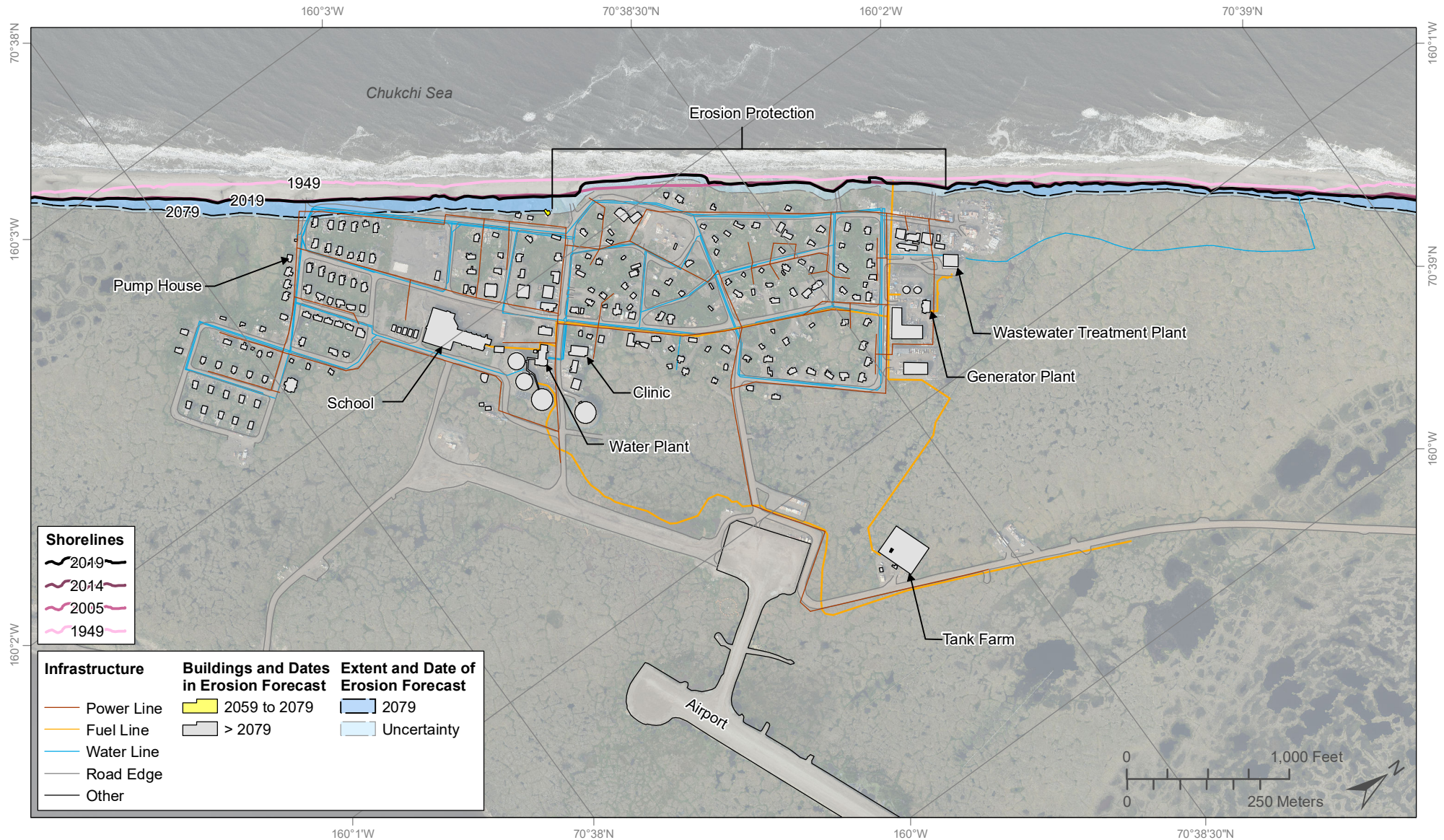
Erosion and accretion of coasts and rivers result in shoreline change. These rates of shoreline change at Alaska communities are calculated from historical and modern shorelines (shorelines shown as lines in pink scale and labeled by year). The long-term (1949 to 2019) shoreline change rate is used to forecast where erosion could impact community infrastructure. Erosion is forecast to reach the colored areas by specified time intervals: 2019 to 2039 (purple), 2039 to 2059 (orange), and 2059 to 2079 (yellow). The area of uncertainty of the 2079 shoreline at a 90 percent confidence interval is light blue. Areas that are not colored by time interval are not forecast to erode by 2079 based on the historical shoreline change rate. For more detailed information about the impacts to infrastructure from erosion at Wainwright, refer to the Wainwright 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 Wainwright, 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 (1949 to 2019) shoreline change rate is used to forecast where erosion could impact community infrastructure. Erosion is forecast to year 2079 (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: 2019 to 2039 (purple), 2039 to 2059 (orange), 2059 to 2079 (yellow), and no impacts expected by 2079 (gray). For more detailed information about the impacts to infrastructure from erosion at Wainwright, refer to the Wainwright erosion exposure assessment report.

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