

Report of Investigation 2021-1B Napakiak

COASTAL FLOOD IMPACT ASSESSMENTS FOR ALASKA COMMUNITIES—NAPAKIAK

Richard M. Buzard, Jacquelyn R. Overbeck, Katie Y. Miller, and Jessica E. Christian



Photo from airplane looking at Napakiak in August 2021. Photo: Alaska Division of Geological & Geophysical Surveys.



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OVERVIEW

This report is an assessment of the historical flood record and flood impact levels for the community of Napakiak, Alaska. Methods used to evaluate historical floods and designate flood impact elevations (minor, moderate, or major; as defined by the National Weather Service) are described in detail in an overview report (Buzard and others, 2021a). This community-specific report has three sections: data description, historical flood record, and flood impact categories. Flood and infrastructure heights are relative to North American Vertical Datum of 1988 (NAVD88). All uncertainties are reported to a 95 percent confidence interval. Quoted text from the sources used to estimate flood heights can be found in Appendix A. Appendix B has tables and figures used to determine flood category heights, including relevant results from our global navigation satellite system (GNSS) survey conducted in June 2021.

SUMMARY

Flood categories and related infrastructure heights are listed in table 1 and estimated flood heights are listed in table 2. The 2013 state hazard mitigation plan prepared by the Division of Homeland Security and Emergency Management (DHS&EM, 2013) lists four state or federal disaster declarations for flooding that apply to Napakiak (1986, 1988, 1990, 2005). From 1962 to 2021, Napakiak experienced at least 21 significant coastal flood events. Of these reported events, we estimate the peak still water elevations of 19 floods. At the time of occurrence, these floods caused two minor, eight moderate, and seven major flood events (with two below minor flooding). Homes are built higher now than in the past, and if these floods occurred



with Napakiak's current infrastructure, they would cause six minor, ten moderate, and one major floods. The highest recorded flood occurred on August 17, 1990, reaching a still water height of 17.1 ± 1.1 ft NAVD88. Ice jam floods have become far less common: of the 11 ice jam floods, 10 occurred before 1994. There is a slight increase in storm surge flood activity: of the 8 recorded storms, 3 occurred in the 1990s and 3 occurred afterwards.

DATA

Mapped data are used to interpret flood elevations from historical photographs and accounts. This section describes available data used to assess flooding for Napakiak.

Digital Elevation Models and Orthoimagery

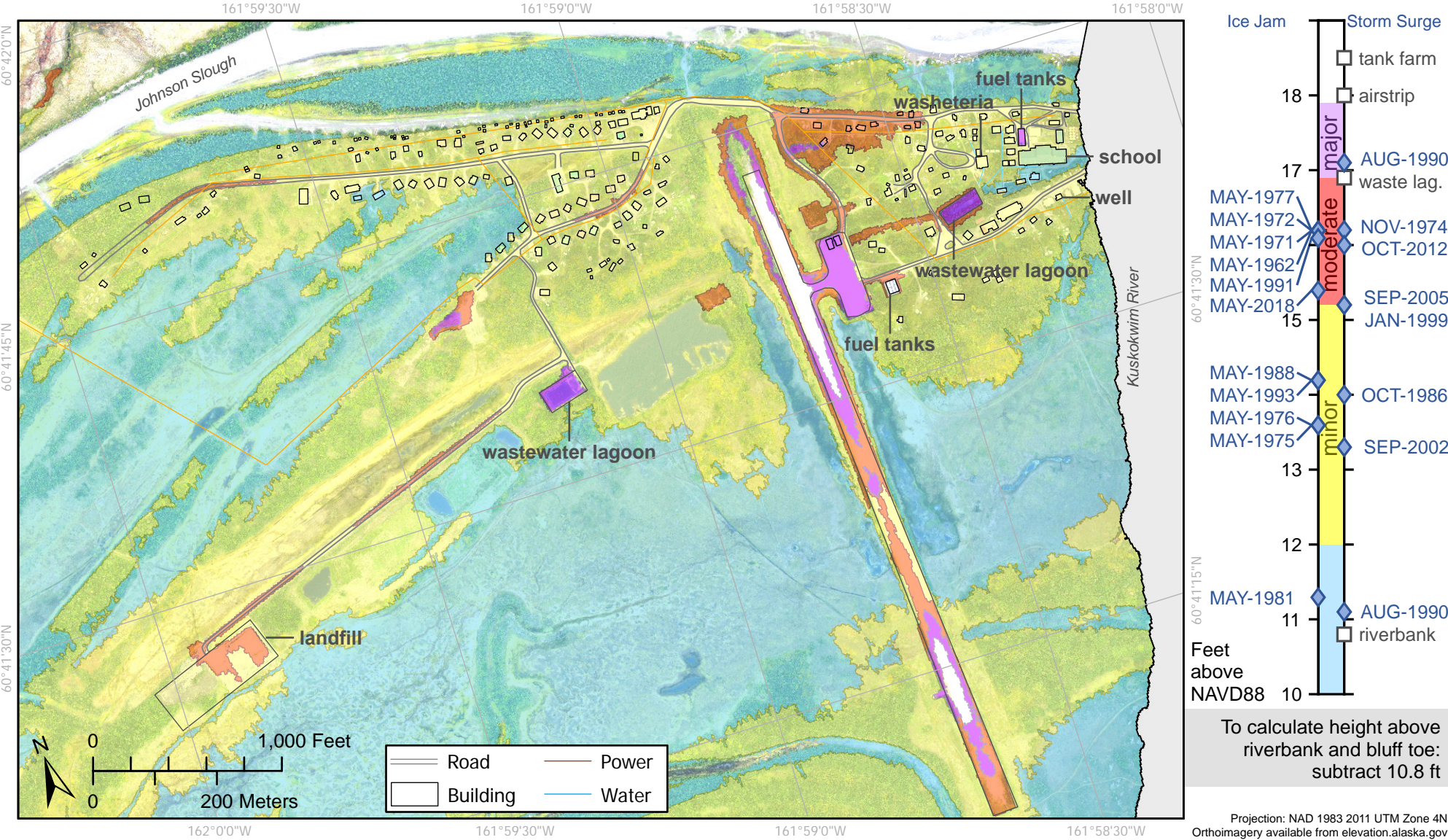
High-resolution and accuracy elevation models are required to measure flood heights. Three digital elevation models were collected at Napakiak (table 3). Digital surface models (DSMs) and orthoimagery were collected in 2015 (Overbeck and others, 2018) and 2021 (Buzard and others, 2021b; table 3). A digital terrain model (DTM) derived from lidar was collected in 2019 (DGGS, unpub. data, 2021), but was only used to create the map visualization of flood category boundaries.

¹Alaska Division of Geological & Geophysical Surveys, 3354 College Rd., Fairbanks, Alaska 99709-3707.

Coastal Flood Impact Map

Napakiak, Alaska

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Buzard and others, 2021
NAPAKIAK



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- Major Flooding** is defined to have extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations are necessary.
- Moderate Flooding** is defined to have some inundation of structures and roads near the water. Some evacuations of people and/or transfer of property to higher elevations may be necessary.
- Minor Flooding** is defined to have minimal or no property damage, but possibly some public threat.

This work was funded by Bureau of Indian Affairs Tribal Resilience Program through a collaborative project with the Native Village of Napakiak.

Table 1. Summary of infrastructure heights and flood categories. Purple = major, red = moderate, yellow = minor. Gray represents infrastructure not expected to be impacted by coastal flooding. No infrastructure is considered subject to wave runup because there is no broadly sloping beach along Napakiak.

Elevation Feature		Elevation (ft NAVD88)	Vertical Uncertainty (ft)
Other	Clinic	20.8	0.1
	School fuel tank berm	19.4	0.3
Major	Tank farm	18.5	0.3
	Airstrip covered	18.0	1.1
	Several buildings	17.9	0.6
	Washeteria	17.7	1.0
	Airstrip use or access	17.3	1.0
	Highest recorded flood	17.1	1.1
	Wastewater lagoon	16.9	0.5
	Major	16.9	0.5
Moderate	Lowest residences flooded	16.1	1.1
	Road north of airport connecting town submerged	15.2	0.3
	Moderate	15.2	0.3
Minor	Road north of airport connecting town threatened	13.8	1.3
	Low-lying property	12.0	0.2
	Minor	12.0	0.2

Table 2. Summary of estimated historical flood heights. Flood categories are included for reference: purple = major, red = moderate, yellow = minor. The categories are based on current infrastructure conditions, not the conditions when the flood occurred.

Floods Estimated			
Flood Type	Flood Date	Elevation (ft NAVD88)	Vertical Uncertainty (ft)
Storm surge	1990-AUG-17	17.1	1.1
Ice jam	1962-MAY-26	16.2	1.4
Ice jam	1971-MAY-27	16.2	1.4
Ice jam	1972-MAY-24	16.2	1.4
Storm surge	1974-NOV-11	16.2	1.4
Ice jam	1977-MAY-23	16.2	1.4
Ice jam	1991-MAY-09	16.1	1.1
Storm surge	2012-OCT-05	16.0	1.0
Ice jam	2018-MAY-08	15.4	0.8
Storm surge	1999-JAN-23	15.2	1.0
Storm surge	2005-SEP-22	15.2	1.0
Ice jam	1993-MAY-04	14.2	1.0
Ice jam	1988-MAY-24	14.2	1.0

Flood Type	Flood Date	Elevation (ft NAVD88)	Vertical Uncertainty (ft)
Storm surge	1986-OCT-13	14.0	1.1
Ice jam	1975-MAY-22	13.6	1.4
Ice jam	1976-MAY-19	13.6	1.4
Storm surge	2002-SEP-12	13.3	1.2
Ice jam	1981-MAY-12	11.3	1.3
Storm surge	1990-AUG-27	11.1	1.1
Floods Not Estimated			
Flood Type	Flood Date		
Ice jam	2009-MAY-03		
Storm surge	2005-OCT-17		

FLOOD IMPACT CATEGORIES

Flood impact categories are used by the National Weather Service to define and communicate flood risk to the public. The categories are designated as minor, moderate, and major. A

flood advisory is issued when a storm is forecast to cause minor flooding, while a flood warning is issued for moderate or major flooding. Definitions of minor, moderate, and major flooding are provided below followed by the information used

Table 3. Specifications of elevation models available for Napakiak.

	Photogrammetric DSM	Photogrammetric DSM	DTM (lidar)
Collection date	2015-AUG-12	2021-JUN-30	2019-AUG-17
Elevation type	Surface	Surface	Bare earth
Vertical datum	NAVD88 (GEOID12B)	NAVD88 (GEOID12B)	NAVD88 (GEOID12B)
Ground sample distance	0.66 ft (0.20 m)	0.23 ft (0.07)	1.64 ft (0.50 m)
Vertical accuracy	1.53 ft (0.47 m)	0.23 ft (0.07)	Unpublished

to establish the elevation thresholds for each category at Napakiak. Elevation thresholds and locations mentioned in the narrative below have been mapped using the DSM (map sheet Napakiak, previous page).

Minor Flooding: Minimal or no property damage, but possibly some public threat.

Moderate Flooding: Some inundation of structures and roads near the water. Some evacuations of people and/or transfer of property to higher elevations may be necessary.

Major Flooding: Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations are necessary.

Other Infrastructure

Clinic: 20.8 ± 0.3 ft NAVD88

The Clinic porch is 20.8 ± 0.3 ft NAVD88 (table B1; fig. B1).

School fuel tanks: 19.4 ± 0.3 ft NAVD88

The school fuel tanks were relocated further from the shoreline in 2019. There is an earthen barrier covered in tarp that measures 19.4 ± 0.3 ft NAVD88 (table B1; fig. B2).

Major flooding: 16.9 ± 0.5 ft NAVD88

Tank farm: 18.5 ± 0.3 ft NAVD88

The tank farm is built on an elevated gravel pad with cyclone fencing. The pad height is 18.5 ± 0.3 ft NAVD88 (fig. B3).

Airstrip covered: 18.0 ± 1.1 ft NAVD88

The airstrip averages 18.0 ± 1.1 ft NAVD88 (fig. B4).

Washeteria: 17.7 ± 1.0 ft NAVD88

The washeteria porch height is 17.7 ± 1.0 ft NAVD88 (measured from DSM with increased uncertainty due to error near high-angle features). The original water treatment plant, still in use, is built on the ground at 14.1 ± 0.3 ft NAVD88 (table B1; fig. B5). No sources described flood impacts to water treatment facilities (such as contaminating water or damaging vital equipment). We cannot estimate the minimum flood height required to impact water treatment. The City of Napakiak (2018b; 2020) plans to relocate the water well and treatment facility.

Airstrip use or access: 17.3 ± 1.0 ft NAVD88

Two roads lead to the airport. The north road is 15.4 ± 1.1 ft NAVD88, and the south road is 15.3 ± 0.3 ft NAVD88 (fig. B6). Two feet of water (± 1ft) covering these roads may block access to the airport, bringing the impact height to 17.3 ± 1.0 ft NAVD88.

Several buildings (flooded 1 or more ft): 17.1 ± 1.1 ft NAVD88

The August 1990 storm reached 17.1 ± 1.1 ft NAVD88 and flooded several residences.

Wastewater facility: 16.9 ± 0.5 ft NAVD88

There are two wastewater lagoons. Each is built with an earthen berm and cyclone fencing. We use an elevation fill analysis to determine the minimum height required to overtop the berm. For the school lagoon, we adjust results down by 1.5 ± 0.5 ft to account for tall grass, to estimate a height of 16.9 ± 0.5 ft NAVD88. The lowest access point into the second lagoon is the bare-earth haul path, so no adjustment is needed. The second lagoon, near the residential area, is 18.6 ± 0.2 ft NAVD88.

Moderate flooding: 15.2 ± 0.3 ft NAVD88**Lowest residences (flooded 0 to 1 ft): 16.1 ± 1.1 ft NAVD88**

The last flood to enter a residence (12 total) occurred in May 1991 when water reached 16.1 ± 1.1 ft NAVD88. The more recent events in October 2012 and May 2018 reached 16.0 ± 1.0 and 15.4 ± 0.8 ft NAVD88, respectively. We found no reports of flooded residences, although water came very close to entering at least one. We estimate a flood reaching the same height as May 1991 may begin to flood the lowest residences, but most residences are raised higher now.

Access way to larger parts of town: 15.2 ± 0.3 ft NAVD88

The road running north of the runway is the only connection between the west and east sides of town. It is 13.8 ± 1.3 ft with the lowest point at 12.7 ± 0.3 and a crest of 14.2 ± 0.3 ft NAVD88 (fig. B7). Even relatively low floods can scour the road, making it difficult and dangerous to cross. We estimate when water reaches 1 ft above the crest height, it begins significantly scouring the road and impeding travel.

Minor Flooding: 12.0 ± 0.2 ft NAVD88**Access road threatened: 13.8 ± 1.3 ft NAVD88**

Water reaching 13.8 ± 1.3 ft NAVD88 will flood half of the road connecting the west and east sides of town with up to 1 ft of water (fig. B7).

Low-lying property: 12.0 ± 0.2 ft NAVD88

The ground under the lowest 10 percent of homes is 12.0 ± 0.2 ft NAVD88. Water reaching and exceeding this height can potentially damage property on the ground.

HISTORICAL FLOOD RECORD

The historical flood record for Napakiak, Alaska, is listed here from the earliest recorded flood to the most recent (up to July 2021). The sources used in evaluating each flood are listed along with a summary of the relevant information. This historical information is used to estimate the flood height where possible. This flood record depends on information that is available to the public and shared with DGGs staff during the July 2021 survey and meetings. Relevant survey data is provided in Appendix B, table B1. It is possible that storm and flood events have occurred that are not reported here. See Appendix A for the direct quotations from each source that are used to evaluate these floods.

Due to rapid erosion, Napakiak has relocated and built new structures farther inland over time. Aerial imagery shows the oldest structures in Napakiak are from the mid-1960s to early 70s; the land on which structures from 1962 and earlier were built has eroded, including the previous school site and the structure itself. To include the older floods, we assume the ground elevation at the old community location was similar to the current location. Napakiak is built on a relatively flat, vegetated sandbar island in the Kuskokwim River. Elevation models and historical and modern aerial imagery show the island has parallel ridges and swales spanning a broad east-west arc. Modern and past structures are built on the ridges, and not in the swales.

The minimum ground elevation where structures are built as of 2019 averages 13.3 ft NAVD88 (standard deviation = 0.9 ft, $n = 88$; fig. B8). For flood estimates of past structure elevation we incorporate additional uncertainty of 1.0 ft.

In the 1950s, homes were built directly on the ground (Napakiak, oral commun., 2021). In the

1960s, residents began elevating homes, but the effort took decades (fig. 1). Multiple floods in the 1970s inundated every home and required evacuations. By the late 1980s, Napakiak had raised most homes high enough to significantly reduce evacuations and flood impacts overall. This improvement was apparent in August 1990, when the flood of record only flooded 12 homes.



Figure 1. (Left) Napakiak women begin elevating homes in the 1960s. (Right) This 1960s Napakiak house is raised above frequent flood levels. This also prevented dogs from stealing fish. Photo: Community of Napakiak.

1962-MAY-26 | 16.2 ± 1.4 ft NAVD88

Reference	Source information relevant to flood height
USACE (1979)	“20 to 25 inches of water”
USACE (2021)	None
City of Napakiak (2011)* City of Napakiak (2018a)*	Community-wide flooding. Entire population evacuated.
Napakiak, oral commun. (2021)	Almost all buildings were flooded. Buildings were built at ground level and water was about 2 ft. high. Flood water up to knees. One house was raised 4 to 5 ft off the ground and water did not get inside but insulation was destroyed. Water was inside the school.

**City of Napakiak (2011) lists a flood in “1965?”, but City of Napakiak (2018a) and other subsequent sources list the flood as “1965”, leaving out the question mark. Napakiak, oral commun. (2021) verified this is the 1962 flood and no significant flood occurred in 1965.*

The May 1962 ice jam flooded almost all buildings in Napakiak, requiring evacuation via helicopter to the nearby bluffs (City of Napakiak, 2011). Buildings were at ground level and water reached about 2 ft high (Napakiak, oral commun., 2021; USACE, 1979). One house, raised 4 to 5 ft above the ground, did not flood but water damaged insulation below the floor (Napakiak, oral commun., 2021). Flooding likely began May 26 may have lasted to the 29th (USACE, 2021).

The average ground under current residences (2021) is 13.3 ft NAVD88, and the highest is 15.2 ft NAVD88 (fig. B8). Given residences were built on the ground in 1962 and flooding was common, we assume most residences were built between these heights (14.2 ± 1.1 ft NAVD88). Flooding of 2 ft would inundate all structures with 1 to 3 feet of water. We estimate the May 1962 flood reached 16.2 ± 1.4 ft NAVD88 (table 4).

Table 4. Flood parameters used to estimate the May 26, 1962, flood. Uncertainty is calculated using the RSS error.

Feature	Flooding of residences
Feature represents	Highest water
Water level type	Still water
Ground height (ft NAVD88)	16.2
Uncertainty of DSM (ft)	0.2
Uncertainty of residences height (ft)	1.0
Uncertainty of water (ft)	1.0
Mean and uncertainty (ft NAVD88)	16.2 ± 1.4

1971-MAY-27 16.2 ± 1.4 ft NAVD88	
Reference	Source information relevant to flood height
Napakiak, oral commun. (2021)	2 ft of water in houses. Houses built 0 ft above ground. The only buildings not flooded were the Armory, BIA school, trading post and 3 to 4 houses. All ground was covered in water.
NOAA (1971)	Most residents evacuated.
USACE (2021)	Entire village except for homes on higher end of village affected by the flood. Flood waters entered most homes, but only minor damage was recorded in one home. Community watering point was not affected. No water in the BIA school.

The May 1971 ice jam flooded most homes and structures, requiring evacuation of most residents (NOAA, 1971; USACE, 2021; Napakiak, oral commun., 2021). Homes were directly on the ground at the time and had 2 ft of water inside (Napakiak, oral commun., 2021). Flooding did not reach the floor of the first elevated houses (Napakiak, oral commun., 2021). The flood height and impacts sound very similar to the 1963 flood, so we estimate the May 1971 flood reached a similar height, 16.2 ± 1.4 ft NAVD88.

1972-MAY-24 | 16.2 ± 1.4 ft NAVD88

Reference	Source information relevant to flood height
Napakiak, oral commun. (2021)	2 ft of water in homes
NOAA (1972)	None
USACE (2021)	None

The May 1972 ice jam flood was the worst in memory for many Kuskokwim and Yukon River communities (NOAA, 1972). The Yukon River flooded into the Kuskokwim via the Johnson River (Napakiak, oral commun., 2021). For Napakiak, flooding reached similar heights as in 1971 and caused similar impacts (Napakiak, oral commun., 2021). We estimate the May 1972 flood reached 16.2 ± 1.4 ft NAVD88.

1974-NOV-11 | 16.2 ± 1.4 ft NAVD88

Reference	Source information relevant to flood height
NOAA (1974)	None
Oral Commun. (2021)	Widespread flooding. Vehicles moved to the dump road to avoid being submerged. Most houses had water inside.

The November 1974 storm caused widespread coastal flooding across western Alaska (NOAA, 1974). In Napakiak, storm surge flooded all land and most houses had water inside. The community moved vehicles to the dump road, evidently the highest land, where water barely overtopped the road (Napakiak, oral commun., 2021). The dump road location is not clear in 1973 imagery, and it would likely be a different elevation today. The storm was the strongest in memory (since the 1940s), but flooding was similar to previous ice-jam events (Napakiak, oral commun., 2021). We estimate the November 1974 flood reached 16.2 ± 1.4 ft NAVD88.

1975-MAY-22 | 13.6 ± 1.4 ft NAVD88

Reference	Source information relevant to flood height
Napakiak, oral commun. (2021)	No distinct memory, likely similar flooding to previous events
NOAA (1975)	Minor flooding
USACE (2021)	"3 houses flooded, no evacuations."

The May 1975 ice jam flood only entered three homes, causing minor impacts and requiring no evacuations (USACE, 2021; NOAA, 1975). By the mid-70s, the community had moved closer to the present location and had structures that exist today. Given that almost no homes flooded, we estimate the flood reached 1.0 ± 1.0 ft above the ground height under the lowest 25 percent of structures (12.6 ± 1.0 ft NAVD88; table 5). We estimate the May 1975 flood reached 13.6 ± 1.4 ft NAVD88.

Table 5. Flood parameters used to estimate the May 22, 1975, flood. Uncertainty is calculated using the RSS error.

Feature	Flooding of residences
Feature represents	Highest water
Water level type	Still water
Estimate of height (ft NAVD88)	13.6
Uncertainty of ground (ft)	0.2
Uncertainty of residences height (ft)	1.0
Uncertainty of water (ft)	1.0
Height and uncertainty (ft NAVD88)	13.6 ± 1.4

1976-MAY-19 | 13.6 ± 1.4 ft NAVD88

Reference	Source information relevant to flood height
Napakiak, oral commun. (2021)	No distinct memory, likely similar flooding to previous events
NOAA (1976)	Flooding of some homes in Napakiak
USACE (1976)	No evacuations
USACE (2021)	None

The May 1976 ice jam flooded several communities on the Kuskokwim River and exceeded Bethel's 1941 record by 0.4 ft (NOAA, 1976). Sources list flooding of a boat house and caved in walls of homes due to flowing ice, but Napakiak (oral commun., 2021) clarified these impacts happened elsewhere and not in Napakiak. Some homes were flooded (NOAA, 1976), but there were no evacuations (USACE, 1976). We estimate the May 1976 flood reached a similar height to May 1975, 13.6 ± 1.4 ft NAVD88.

1977-MAY-23 | 16.2 ± 1.4 ft NAVD88

Reference	Source information relevant to flood height
Napakiak, oral commun. (2021)	The lowest house had 5 ft of water inside. Flooding the same as other events in the 70s. The old runway may have had 1 ft of water.
NOAA (1977a)	Evacuation of 162 women and children from Napakiak and Oscarville
NOAA (1977b)	None

The May 1977 ice jam flooded several homes and required evacuations (NOAA, 1977a). The flood was similar to the higher floods of the 1970s (Napakiak, oral commun., 2021). We estimate the 1977 flood reached 16.2 ± 1.4 ft NAVD88.

1981-MAY-12 | 11.3 ± 1.3 ft NAVD88**Reference**

USACE (2021)

Source information relevant to flood height

Low areas flooded, no homes

The May 1981 ice jam flooded low-lying areas of Napakiak and did not reach homes (USACE, 2021). No other resources mention this event, so it was likely inconsequential. We compute riverbank height using the mean height of six GNSS measurements of grass lines and bluff toes, 10.8 ± 0.7 ft NAVD88 (fig. 2). We estimate the May 1981 flood reached between the riverbank and the ground height under the lowest 25 percent of residences (table 6), 11.3 ± 1.3 ft NAVD88.

Table 6. Flood parameters used to estimate the May 12, 1981, flood. Uncertainty is calculated using the upper-lower bounds method.

Feature	Riverbank	Lowest residences
Feature represents	Lowest water	Highest water
Water level type	Still water	Still water
Estimate of height (ft NAVD88)	10.8	12.6
Estimate error (ft)	0.7	1.0
Lower bound (ft NAVD88)	10.1	11.6
Upper bound (ft NAVD88)	11.5	13.6
Mean and uncertainty (ft NAVD88)	11.3 ± 1.3	

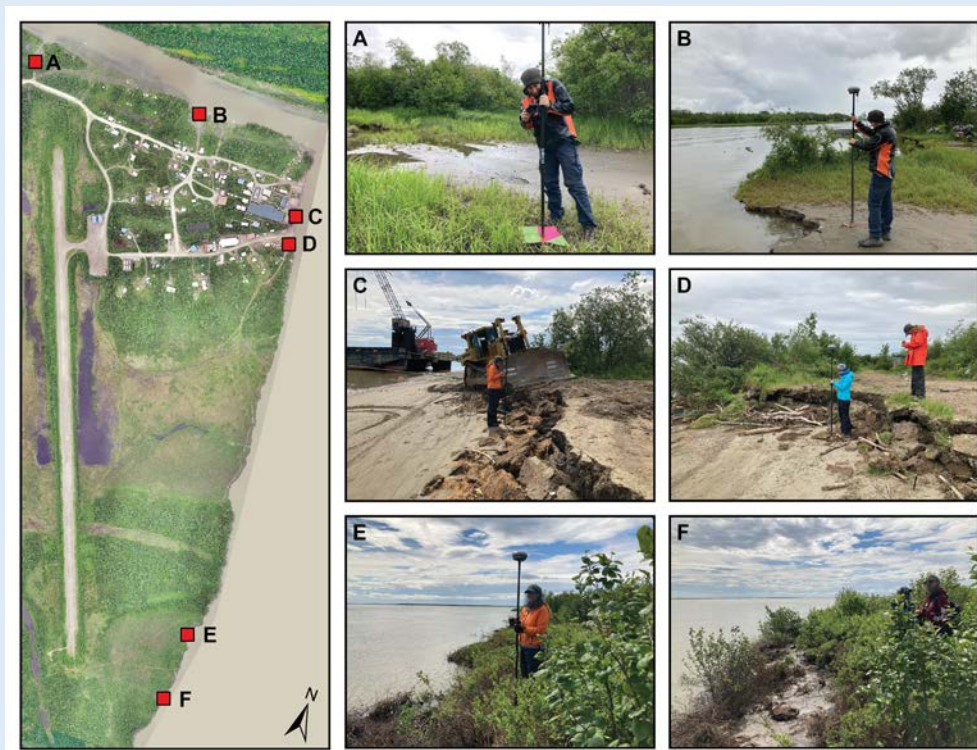


Figure 2. Riverbank height measurements from six locations around Napakiak.

1986-OCT-13 | 14.0 ± 1.1 ft NAVD88

Reference	Source information relevant to flood height
Berliner (1986)	None
City of Napakiak (2018a)	State disaster declaration. Damage to roads.
Napakiak, oral commun. (2021)	6 inches of water in building by the gas station. Building was 0 to 1 ft above the ground. Lower than the 1990 flood event.
NOAA (1986)	None

The October 1986 storm caused widespread flooding across southern Alaska, triggering a state disaster declaration (City of Napakiak, 2018a; Berliner, 1986; NOAA, 1986). In Napakiak, the flood damaged the road north of the airport connecting two parts of town (City of Napakiak, 2018a; Napakiak, oral commun., 2021). This road commonly washes out in two low sections where drainage channels from the runway flow toward the Johnson Slough. Flooding of 14.2 ± 0.3 ft NAVD88 likely is enough to begin washing out road gravel (fig. B7).

One building by the current gas station flooded with 0.5 ft of water (Napakiak, oral commun., 2021). The building was not elevated, and the floor height was up to 1 ft above ground height (0.5 ± 0.5 ft; Napakiak, oral commun., 2021). We did not find the building while surveying in Napakiak, so we compute average ground height under five buildings near the gas station: 13.0 ± 1.0 ft NAVD88. By adding the building floor height and water, we estimate the October 1986 flood reached 14.0 ± 1.1 ft NAVD88 (table 7).

Table 7. Flood parameters used to estimate the October 13, 1986, flood. Uncertainty is calculated using the RSS error.

Feature	Flooding of building
Feature represents	Highest water
Water level type	Still water
Estimate of height (ft NAVD88)	14.0
Uncertainty of ground (ft)	0.2
Uncertainty of floor height (ft)	1.0
Uncertainty of water (ft)	0.5
Height and uncertainty (ft NAVD88)	14.0 ± 1.1

1988-MAY-15 | 14.2 ± 1.0 ft NAVD88

Reference	Source information relevant to flood height
City of Napakiak (2018a) DHS&EM (2008)	State disaster declaration. Damage to roads.
NOAA (1988)	None
USACE (2021)	Damage to roads.
Napakiak, oral commun. (2021)	Low section of road between east and west side of town damaged.

The May 1988 ice jam flood damaged the lowest road connecting the east and west sides of town and caused a state disaster declaration (DHS&EM, 2008). We estimate this was a minor flood event reaching high enough to impact the lowest road, 14.2 ± 0.3 ft NAVD88. We increase uncertainty to 1.0 ft due to limited information. We estimate the May 1988 flood reached 14.2 ± 1.0 ft NAVD88.

1990-AUG-17 | 17.1 ± 1.1 ft NAVD88

Reference	Source information relevant to flood height
City of Napakiak (2018a)	Water 4 ft deep. Majority of town flooded.
City of Napakiak (2020)	Water at least 2 feet and up to 4 feet in some areas.
DCRA (2007)	Published flood height estimate in NAVD88 GEOID96.
NOAA (1990)	None
USACE (1994)	High water elevation signs placed

The first August 1990 storm flooded several communities in the Kuskokwim Delta and northern Bristol Bay (NOAA, 1990). In Napakiak, this flooded 12 homes, damaged insulation in 30, and is considered the flood of record (City of Napakiak, 2018a). Most of the city was flooded with water between 2 and 4 feet deep (City of Napakiak, 2020). USACE (1994) visited Napakiak in September 1990 to estimate the flood height and place high water elevation signs. DCRA (2007) published the flood height in NAVD88 (GEOID96). We convert this to GEOID12B using VDatum Online (found at <https://vdatum.noaa.gov/vdatumweb>). The resulting height is 16.3 ft NAVD88. However, in June 2021, DGGS measured the high water sign height is 15.6 ± 0.1 ft NAVD88. The sign height measurements disagree, and both are close to or below less severe floods. Due to this discrepancy, we examine other flood accounts to estimate the height.

The average lowest ground height under residences is 13.3 ± 0.2 ft NAVD88 (fig. B8). We add the reported water height, 3.0 ± 1.0 ft (City of Napakiak, 2020), to estimate that widespread flood levels reached 16.3 ± 1.0 ft NAVD88. In addition, one resident identified the location where flooding reached 3 to 4 ft above the ground, totaling 17.9 ± 0.5 ft NAVD88 (table B1; fig. 3). Napakiak (oral commun., 2021) identified a nearby road crown that water has never exceeded, measuring 17.9 ± 0.1 ft NAVD88 (table B1; fig. 3). We take the average of these flood observations to estimate the August 17, 1990, flood reached 17.1 ± 1.1 ft NAVD88 (table 8).

Table 8. Flood parameters used to estimate the August 17, 1990, flood. Uncertainty is calculated using the RSS error.

Feature	Water under residences	Observed flooding
Feature represents	Highest water	Highest water
Water level type	Still water	Still water
Estimate of height (ft NAVD88)	16.3	17.9
Uncertainty of water (ft)	1.0	0.5
Uncertainty of GNSS (ft)	0.1	0.1
Mean and uncertainty (ft NAVD88)	17.1 ± 1.1	



Figure 3. A. House where water reached 3 to 4 ft above ground in the August 17, 1990, flood. B. Road crown nearby that flooding has not exceeded.

1990-AUG-27 | 11.1 ± 1.1 ft NAVD88

Reference	Source information relevant to flood height
NOAA (1990)	None
Napakiak, oral commun. (2021)	Debris brought up into village

The second flood in August 1990 was caused by heavy rain (NOAA, 1990) and brought debris into Napakiak (Napakiak, oral commun., 2021). Water likely reached at least the riverbank and up to the height required to flood low-lying property (table 9). We estimate the August 27, 1990, flood reached 11.1 ± 1.1 ft NAVD88.

Table 9. Flood parameters used to estimate the August 27, 1990, flood. Uncertainty is calculated using the upper-lower bounds method.

Feature	Riverbank	Low-lying property
Feature represents	Lowest water	Highest water
Water level type	Still water	Still water
Estimate of height (ft NAVD88)	10.8	12.0
Estimate error (ft)	0.7	0.2
Lower bound (ft NAVD88)	10.1	11.8
Upper bound (ft NAVD88)	11.5	12.2
Mean and uncertainty (ft NAVD88)	11.1 ± 1.1	

1991-MAY-09 | 16.1 ± 1.1 ft NAVD88

Reference	Source information relevant to flood height
City of Napakiak (2020)	Flood levels as deep as 3 feet. 12 homes flooded.
USACE (1992)	Water 3 ft at the Napakiak Corporation Store
USACE (2021)	Roads in low lying areas flooded (no report of peak flooding)

The May 1991 ice jam flood resulted from a combination of record snowfall and sudden thaw (City of Napakiak, 2020). The same 12 homes flooded in August 1990 were flooded again, but water reached 1 ft lower (USACE, 1992; Napakiak, oral commun., 2021). We estimate the May 1991 flood reached 16.1 ± 1.1 ft NAVD88.

1993-MAY-04 | 14.2 ± 1.0 ft NAVD88

Reference	Source information relevant to flood height
USACE (2021)	"...flooding low lying area and some roads. No homes were affected."

The May 1993 ice jam flooded low-lying areas and roads in Napakiak (USACE, 2021). We estimate this was a minor flood event similar to May 1988. We estimate the May 1993 flood reached 14.2 ± 1.0 ft NAVD88.

1999-JAN-23 | 15.2 ± 1.0 ft NAVD88

Reference	Source information relevant to flood height
City of Napakiak (2020)	None
Napakiak, oral commun. (2021)	Lowest road damaged. No buildings flooded. Water too deep to drive in near riverbank
NOAA (1999)	None

The January 1999 storm caused high winds and extreme low temperatures across southwest Alaska (NOAA, 1999). The flood damaged the roading connecting the two sections of town and was too deep to drive through, but did not flood buildings (Napakiak, oral commun., 2021). To cause these impacts, we assume water reached 1.0 ± 1.0 ft higher than the lowest road. We estimate the January 1999 flood reached 15.2 ± 1.0 ft NAVD88 (table 10).

Table 10. Flood parameters used to estimate the January 23, 1999, flood. Uncertainty is calculated using the RSS error.

Feature	Water above road
Feature represents	Highest water
Water level type	Still water
Estimate of height (ft NAVD88)	15.2
Uncertainty of ground (ft)	0.3
Uncertainty of water (ft)	1.0
Height and uncertainty (ft NAVD88)	15.2 ± 1.0

2002-SEP-12 | 13.3 ± 1.2 ft NAVD88

Reference	Source information relevant to flood height
NOAA (2002)	Banks overflowed by 2 to 3 ft.
Napakiak, oral commun. (2021)	No buildings flooded. Minor event.

The September 2002 storm caused minor flooding throughout Bristol Bay and the Kuskokwim Delta (NOAA, 2002). In Napakiak, water exceeded the riverbank by 2 to 3 ft, but impacts were minor (NOAA, 2002). We add 2.5 ± 1.0 ft of water to the riverbank height of 10.8 ± 0.7 ft NAVD88 (table 11). We estimate the September 2002 flood reached 13.2 ± 1.2 ft NAVD88 (table 11).

Table 11. Flood parameters used to estimate the September 12, 2002, flood. Uncertainty is calculated using the RSS error.

Feature	Water under home
Feature represents	Highest water
Water level type	Still water
Estimate of height (ft NAVD88)	13.3
Uncertainty of riverbank (ft)	0.7
Uncertainty of water (ft)	1.0
Height and uncertainty (ft NAVD88)	13.3 ± 1.2

2005-SEPT-22 | 15.2 ± 1.0 ft NAVD88

Reference	Source information relevant to flood height
City of Napakiak (2018a) City of Napakiak (2020) DHS&EM (2008)	Widespread flooding.
Napakiak, oral commun. (2021)	Road north of airport damaged. No buildings flooded.
NOAA (2005a)	None

The September 2005 storm caused major flooding in Norton Sound and impacted several western Alaska communities (NOAA, 2005a). In Napakiak, the storm caused significant erosion, “widespread flooding” (DHS&EM, 2008), and damaged the airport road, but no buildings were flooded (Napakiak, oral commun., 2021). Given no other damages were reported, we estimate the flood reached a similar height as in January 1999. We estimate the September 2005 flood reached 15.2 ± 1.0 ft NAVD88.

2005-OCT-17 | No water level estimate

Reference	Source information relevant to flood height
DHS&EM (2008)	None
NOAA (2005b)	None

The October 2005 storm flooded communities from northern Bristol Bay to the Kuskokwim Delta (NOAA, 2005; DHS&EM, 2008). No specific impacts are described for Napakiak, so an estimate cannot be made.

2009-MAY-03 | no water level estimate

Reference	Source information relevant to flood height
DHS&EM (2013)	None
NOAA (2009)	None

The May 2009 ice jam flooded sections of the Kuskokwim River over 11 days (NOAA, 2009). Napakiak is listed in the 2013 State Hazard Mitigation Plan as being affected (DHS&EM, 2013), but we found no specific impacts so an estimate could not be made.

2012-OCT-05 | 16.0 ± 1.0 ft NAVD88

Reference	Source information relevant to flood height
Napakiak, oral commun. (2021)	Water 42 inches high from the bottom of doghouse (tape measure)
NOAA (2012)	None

The October 2012 storm caused minor flooding in western Alaska (NOAA, 2012), but widespread flooding in Napakiak (Napakiak, oral commun., 2021). Photos shared on social media show water covering the main road from the boat launch into town, which averages 14.9 ± 0.6 ft NAVD88 (fig. 4). Water reaches between halfway and the top of four-wheeler tires parked on the roadside in one photo. We estimate water is 1.0 ± 0.5 ft above the road height, reaching 15.9 ± 0.8 ft NAVD88. Water reached 42 inches above ground at a resident's doghouse, totaling 16.9 ± 0.1 ft NAVD88 (Napakiak, oral commun., 2012; table B1; fig. 5). We use the upper-lower bounds method to estimate the October 2012 flood reached 16.0 ± 1.0 ft NAVD88 (table 12).

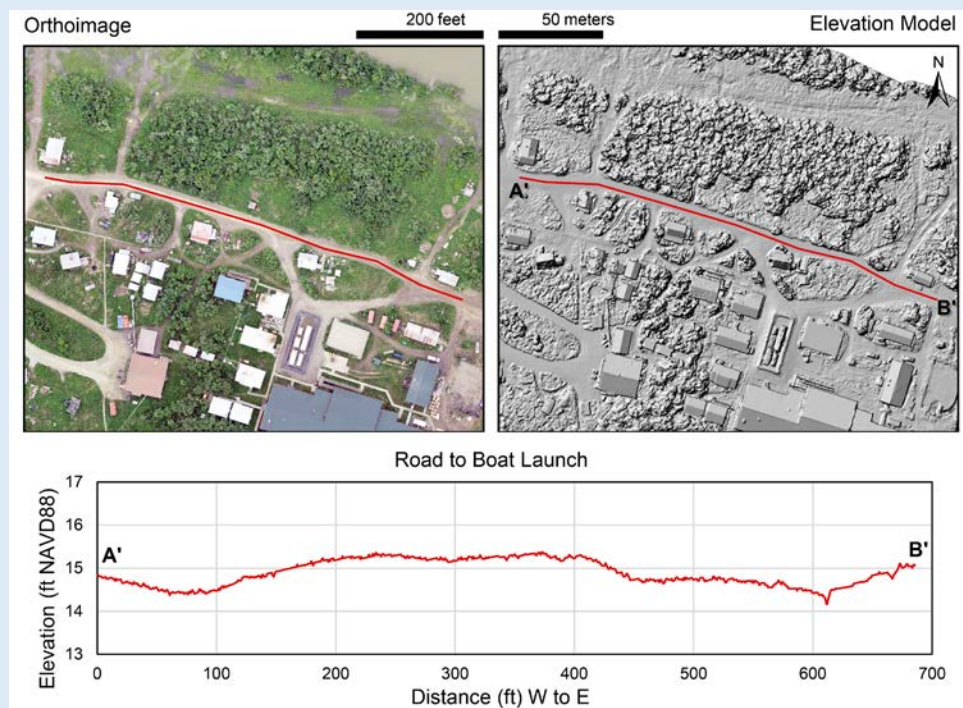


Figure 4. Elevation profile drawn on DSM show elevation of the road to the boat launch on the Kuskokwim River is mostly between 14.5 and 15.5 ft NAVD88.



Figure 5. Elevation point at house where water reached 42 inches above ground in October 2012.

Table 12. Flood parameters used to estimate the October 5, 2012, flood. Uncertainty is calculated using the upper-lower bounds method.

Feature	Flooding of doghouse	Flooding of road
Feature represents	Highest water	Lowest water
Water level type	Still water	Still water
Estimate of height (ft NAVD88)	16.9	15.9
Estimate error (ft)	0.1	0.8
Lower bound (ft NAVD88)	16.8	15.1
Upper bound (ft NAVD88)	17.0	16.7
Mean and uncertainty (ft NAVD88)	16.0 ± 1.0	

2018-MAY-08 | 15.4 ± 0.8 ft NAVD88

Reference	Source information relevant to flood height
City of Napakiak (2020)	Storm destroyed hovercraft landing and boat launch
Napakiak, oral commun. (2021)	Flooding of road to boat launch
NOAA (2018)	None

The May 2018 ice jam caused minor flooding in Napakiak and several Kuskokwim River communities (NOAA, 2018). Water flooded the road to the boat launch road but did not reach as high as the October 2012 flood (Napakiak, oral commun., 2021). We assume water was 0.5 ± 0.5 ft above the road to estimate the May 2018 flood reached 15.7 ± 1.4 ft NAVD88 (table 13). In addition, a storm on May 12 caused significant erosion in Napakiak (City of Napakiak, 2020), but no flooding (Napakiak, oral commun., 2021).

Table 13. Flood parameters used to estimate the May 8, 2018, flood. Uncertainty is calculated using the RSS error.

Feature	Flooding of road
Feature represents	Highest water
Water level type	Still water
Estimate of height (ft NAVD88)	15.4
Uncertainty of ground (ft)	0.6
Uncertainty of water (ft)	0.5
Height and uncertainty (ft NAVD88)	15.4 ± 0.8

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REFERENCES

- 2007, Community profile map, Napakiak: Department of Commerce, Community, and Economic Development.
- Berliner, Jeff, 1986, Flooding forces hundreds from homes: United Press International [website]: found at <https://www.upi.com/>
- Buzard, R.M., Overbeck, J.R., Chriest, Jonathan, Endres, K.L., and Plumb, E.W., 2021a, Coastal flood impact assessments for Alaska communities: Alaska Division of Geological & Geophysical Surveys Report of Investigation 2021-1, 16 p. <https://doi.org/10.14509/30573>
- Buzard, R.M., Christian, J.E., and Overbeck, J.R., 2021b, Photogrammetry-derived orthoimagery and elevation for Napakiak, Alaska, collected June 30, 2021: Alaska Division of Geological &

- Geophysical Surveys Raw Data File 2021-20, 4 p. <https://doi.org/10.14509/30793>
- City of Napakiak, 2011, Local hazard mitigation plan—June 2011: City of Napakiak, 122 p.
- 2018a, Local hazard mitigation plan—2018: City of Napakiak, 71 p.
- 2018b, Napakiak community plan—2018: Joint resolution of the City of Napakiak, Napakiak Corporation and Native Village of Napakiak, 51 p.
- 2020, Napakiak managed retreat plan: Summit Consulting Services Inc., 173 p.
- Division of Homeland Security & Emergency Management (DHS&EM), 2008, Alaska weather-related disasters 1978 – 2008: State of Alaska Department of Military and Veteran Affairs, 62 p.
- 2013, State of Alaska hazard mitigation plan—2013: State of Alaska Department of Military and Veteran Affairs, 569 p.
- NOAA, 1971, Climatological data—May 1971: U.S. Department of Commerce, v. 22, no. 5, 52 p.
- 1972, Climatological data—May 1972: U.S. Department of Commerce, v. 23, no. 5, 54 p.
- 1974, Storm data—November 1974: U.S. Department of Commerce, v. 16, no. 11, 7 p.
- 1975, Climatological data—May 1975: U.S. Department of Commerce, v. 26, no. 5, 49 p.
- 1976, Climatological data—May 1976: U.S. Department of Commerce, v. 27, no. 5, 45 p.
- 1977a, Climatological data—May 1977: U.S. Department of Commerce, v. 28, no. 5, 36 p.
- 1977b, Storm data—May 1977: U.S. Department of Commerce, v. 19, no. 5, 27 p.
- 1986, Storm data—October 1986: U.S. Department of Commerce, v. 28, no. 10, 44 p.
- 1988, Storm data—May 1988: U.S. Department of Commerce, v. 30, no. 5, 72 p.
- 1990, Storm data—August 1990: U.S. Department of Commerce, v. 32, no. 8, 168 p.
- 1999, Storm data—January 1999: U.S. Department of Commerce, v. 41, no. 1, 263 p.
- 2002, Storm data—September 2002: U.S. Department of Commerce, v. 44, no. 9, 154 p.
- 2005a, Storm data—September 2005: U.S. Department of Commerce, v. 47, no. 9, 208 p.
- 2005b, Storm data—October 2005: U.S. Department of Commerce, v. 47, no. 10, 132 p.
- 2009, Storm data—May 2009: U.S. Department of Commerce, v. 51, no. 5, 570 p.
- 2012, Storm data—October 2012: U.S. Department of Commerce, v. 54, no. 10, 184 p.
- 2018, Storm data—May 2018: U.S. Department of Commerce, v. 60, no. 5, 755 p.
- Overbeck, J.R., Hendricks, M.D., and Kinsman, N.E.M., 2018, Photogrammetric digital surface models and orthoimagery for the continuous coastline, Wales to Platinum, Alaska, segment M: Kongiganak to Bethel, in Overbeck, J.R., Hendricks, M.D., and Kinsman, N.E.M., Photogrammetric digital surface models and orthoimagery for the continuous coastline, Wales to Platinum, Alaska: Alaska Division of Geological & Geophysical Surveys Raw Data File 2017-8M, 3 p. <https://doi.org/10.14509/30091>
- U.S. Army Corps of Engineers (USACE), 1976, Flood data survey—Napakiak: USACE Alaska District, 4 p.
- 1979, Flood data survey—Napakiak: USACE Alaska District, 3 p.
- 1992, Flood data survey—Napakiak: USACE Alaska District, 1 p.
- 1994, High water elevation identification: Alaska District Corps of Engineers—Flood Plain Management Services, 3 p.
- 2021, Ice jam database: USACE [website]: found at <https://icejam.sec.usace.army.mil/>

APPENDIX A: STORM-RELATED ACCOUNTS

There are many written reports that contain information pertaining to storm-driven flooding in Napakiak. Reports may be difficult to find in the future as their online linked location can change. This appendix provides the exact relevant text from each source used in this report to preserve the information. Any added commentary or summary information is enclosed by brackets.

Alaska Division of Community & Regional Affairs, 1991, Community profile map, Napakiak: Department of Commerce, Community, and Economic Development.

Flood Notes - The U.S. Army Corps of Engineers (USACE) report “Alaska Communities Flood Hazard Data 1998”, has published flood of record which occurred [sic] in 1990 with a flood elevation of 0.4’ (8.54 feet based upon this maps vertical control). A flood gauge was placed on the Water Treatment Plant with the High Water Elevation at the 8.54 ft. mark.

Division of Homeland Security & Emergency Management, 2008, Alaska weather-related disasters 1978 – 2008: State of Alaska Department of Military and Veteran Affairs, 62 p.

88-77. Napakiak/Napaskiak, May 24, 1988 – Flood damage to both roads and boardwalks in Napaskiak resulted in a declaration of disaster emergency. Total State costs were \$125,292.00.

06-215. ’05 West Coast Storm, October 24, 2005... a powerful fall sea storm produced high winds combined with wind driven tidal surges resulting in severe and widespread coastal flooding and a threat to life and property... [list of areas affected by storm includes Napakiak]

City of Napakiak, 2006, Napakiak 5-year community comprehensive plan: City of Napakiak, Napakiak IRA Council and Napakiak Corporation, 28 p.

Development Projects

Road Improvements: FEMA/Disaster fund has been awarded for road repair for a small section of road near the airport that was washed away in a recent flood.

———2010, Napakiak community plan: City of Napakiak, Napakiak IRA Council and Napakiak Corporation, 28 p.

Transportation

In 2006 Napakiak was awarded enough funds by the FEMA/Disaster Fund to repair a small section of their road near the airport which was washed away in a flood.

———2011, Local hazard mitigation plan—June 2011: City of Napakiak, 122 p.

Previous [Flood] Occurrence/History – The community of Napakiak has experienced several historic flood events...

1965? – Community-wide flooding... Entire population was evacuated to bluff north of Johnson’s Slough by Army National Guard.

1973? – Community-wide flooding... Entire population was evacuated to Bethel by Army National Guard.

October 1986 – Severe flooding (State Disaster Declaration #782). Damage occurred to roads.

May 24, 1988 – Community-wide flooding. State Disaster Declaration... Damage occurred to roads.

August 17, 1990 – **Flood of Record**. A severe storm compounded by high tides caused extensive flooding in coastal communities of the Kuskokwim and Bristol Bay areas and along the lower Kuskokwim River... Community records indicate flood waters as deep as 4 feet. The flood water elevation was recorded at 8.54 feet... Damage occurred to roads. Loss of fighting gear and boats. Majority of town flooded. 12 homes were flooded... housing authoring elevated multiple units.

Sept. 22–26, 2005 – 2005 West Coast Storm. High winds combined with wind-driven tidal surges resulting in severe and widespread coastal flooding and a threat to life and property. **Federally declared disaster DR-1618...** Damage occurred to roads.

———2018a, Local hazard mitigation plan—2018: City of Napakiak, 71 p.

2.5 Coordination with Regional and Statewide Organizations

Moravian Mission... During flood events, travel is not possible between the east side and west side of the community and the church is the identified community shelter for all residents on the west side of Napakiak.

4.2 Hazard Identification and Screening

Flood – Napakiak has had several flood events, four disaster declarations as a result of flooding. Flooding can result from spring snowmelt, ice jam flooding, late-summer and fall storms and wind-drive tides.

4.3.3 Severe Weather [Quote from Walter Nelson, Napakiak resident, March 7, 2018] “During a storm from the south, the wind pushed the tides in and we all woke up to water everywhere. All of Napakiak was flooded. Many homes had an inch of water in them. We had no warning.”

Wind-drive tides: High winds, especially from southerly storms during high tides, have historically brought flooding in the form of wind-driven high tides into Napakiak. Due to the low elevation and low topographic profile of the island where Napakiak is located, this flooding can restrict travel in town, particularly between the east and west side of town and can damage property, although most buildings are elevated 2 or more feet off the ground to reduce permafrost melting. These have typically occurred with no notice or warning for potential flooding.

Bering Sea Storm: Bering Sea Storms often bring high winds, heavy rains and potentially wind-driven high tides. Southerly, storm-driven waves can reach 3-8 feet in height depending on the tide.

4.3.4 Flood

Hazard Description... Due to the low elevation of the community, flooding effects can occur throughout the community. The entire town, except for the airport runway and a few isolated high points are likely to flood.

Location – New buildings are being constructed and relocated buildings are being elevated to 5 feet or more above ground level to protect the ground from permafrost thawing and to prevent damage from floods and wind-driven high tides.

[Flood Hazards Areas Map]

Previous Occurrence/History – Napakiak has had four disaster declarations as a result of flooding: 1986, 1988, 1990, and 2005.

1965 – Community-wide flooding... Entire population was evacuated to bluff north of Johnson's Slough by Army National Guard.

1973 – Community-wide flooding... Entire population was evacuated to Bethel by Army National Guard.

October 1986 – Severe flooding (State Disaster Declaration #782)... Damage occurred to roads.

May 24, 1988 – Community-wide flooding. State Disaster Declaration... Damage occurred to roads.

August 17, 1990 – **Flood of Record**. A severe storm compounded by high tides caused extensive flooding in coastal communities of the Kuskokwim and Bristol Bay areas and along the lower Kuskokwim River... Community records indicate flood waters as deep as 4 feet. The flood water elevation was recorded at 8.54 feet... Damage occurred to roads. Loss of fighting gear and boats. Majority of town flooded. 12 homes were flooded... housing authoring elevated multiple units.

Sept. 22–26, 2005 – 2005 West Coast Storm. High winds combined with wind-driven tidal surges resulting in severe and widespread coastal flooding and a threat to life and property. **Federally declared disaster DR-1618...** Damage occurred to roads.

Vulnerability – Most flood events result in damage to the roads and boardwalks. Many of the boardwalks are subject to floating away during floods and most of the boardwalks in Napakiak are gone or damaged due to flooding. Most roads will be inundated in places during floods... The building housing the community water source wellhead is at a low elevation and is subject to contamination during flooding... Most residences and other occupied buildings are elevated above the average flood elevations; however, some outbuildings and heating oil tanks are not adequately secured to the buildings to prevent loss during flood events.

4.4.4 Exposure Analysis

Flood – Flooding is most likely to damage roads and boardwalks and impair transportation in the community... Many residences are vulnerable to water damage from flooding...

———2018b, **Napakiak community plan—2018: Joint resolution of the City of Napakiak, Napakiak Corporation and Native Village of Napakiak, 51 p.**

Transportation

In 2006 Napakiak was awarded enough funds by the FEMA/Disaster Fund to repair a small section of their road near the airport which was washed away in a flood. Unfortunately, the community and FEMA encountered unsurmountable regulatory issues with using the funds to repair road access on the State airport property. The lack of repairs and improvements in this area continues to impact drainage and water flow issues for the community.

———2020, **Napakiak managed retreat plan: Summit Consulting Services Inc., 173 p.**

Historical Erosion and Flooding

A flood event in 1965 required the entire population to be evacuated to the bluff on the other side of Johnson's Slough by the Army National Guard.

A similar event in 1973 required the entire population to be evacuated to Bethel by the Army national Guard.

An October 1986 storm caused severe flooding and damage to roads (State Disaster Declaration #782).

A May 1988 storm caused severe flooding and damage to roads and an additional State Disaster Declaration in the amount of \$200,000.

The flood of record occurred in August 1990. Most of the community was inundated with at least 2 feet of water and up to 4 feet in some areas. This event was due to a severe storm combined with high tides. Twelve homes were flooded and insulation was damaged on 30 homes.

In May 1991 record snowfalls in the interior of the State combined with sudden spring thaw event caused flood levels as deep as 3 feet and 12 homes were flooded...

In January 1999 a storm surge combined with a tide event caused \$20,000 in damage.

A fall storm occurring September 22nd through the 26th, 2005 brought high winds combined with wind driven tidal surges created widespread flooding and a loss of 75 feet of riverbank. This event was a Federally declared disaster (DR-1618).

A May 12th through the 13th, 2018 event destroyed the community's hovercraft landing and boat launch.

NOAA Climatological Data Reports

May 1971:

Major ice-jam flooding occurred in southwest Alaska towards the end of May... Most of the residents of Napakiak, Oscarville, and Napaskiak were evacuated.

May 1972:

The worst ice-jam flooding in memory of long time residents occurred on the Kuskokwim and Yukon Rivers in Alaska... The last time the Yukon and Kuskokwim Rivers "flowed as one" was about 1890.

Napakiak: flooding occurred but data not available.

May 1975:

[List of places in Alaska where minor flooding occurred in the month of May, Napakiak included] ... 112 people were evacuated from Oscarville and Napakiak...

May 1976:

This year's breakup started at Nikolai May 2, and the river was clear of ice 550 miles downstream by the 21st. Severe ice jams caused record high stages in the Kuskokwim Delta area before the ice moved out. The flood stage at Bethel reached 14.4 feet on the 19th, which exceeded the previous record of 14.0 feet set in May 1941. Flood stage at Bethel is 9 feet.

In addition to flooding, dozens of homes from Tuluksak to Napakiak were damaged by ice floes moving through the towns. Walls of houses were caved in as they were moved off their foundations. 200 people were evacuated from the villages of Tuluksak, Kwethluk, Oscarville, and Napaiskak [*sic*]. Major flooding also occurred on the Upper Kuskokwim River. At McGrath the river crested 25.7 feet on the 9th, a foot below the record. Flood stage at McGrath is 21 feet.

May 23, 1977:

...The Alaska National Guard evacuated 162 women and children from the flooded villages of Napakiak and Oscarville.

NOAA Storm Data Reports

May 1977:

Major flooding due to ice jams during spring breakup occurred on the lower Kuskokwim River during the 4th week of May. Flooding occurred at Bethel from May 23–26. The Kuskokwim River at Bethel crested about 4 feet above flood stage late on May 23. The high water and ice destroyed a bridge; there was some damage to buildings in the town due to the high water.

October 1986:

Heavy rains which fell on Southeast Alaska during the middle of the month touched off mudslides near Petersburg and in downtown Juneau. These rains came on top of three weeks of wet weather which had saturated the Southeast Alaska ground. The Mitkof Highway near Petersburg was closed while several families in Juneau were evacuated and one home there was damaged.

May 1988:

Minor flooding occurred along the Kuskokwim River below the town of Bethel due to ice melt/jamming along the river.

August 17, 1990:

Yukon-Kuskokwim Delta – A strong low moved northward across the eastern Aleutians and into the northeast Bering Sea. South winds to 50 mph and high tides caused coastal flooding along the Kuskokwim River, Kuskokwim Bay, and Bristol Bay. Communities affected included Bethel, Tuntutuliak, Napakiak, Kwigillingok, Nunapitchuk, Goodnews Bay, Eek, and Togiak. The worst damage was to private property such as subsistence food, boats, motors, fishing nets, fishing camps, and homes. Also several roads and boardwalks were washed out, and a school and clinic in Kwigillingok were damaged. Total state aid needed was estimated at \$295,000.

January 23, 1999:

[Description of regional winds but no specific flood information]

September 12, 2002:

Kuskokwim Delta – At Napakiak, one commercial fishing net was lost and the river reportedly overflowed its banks by 2–3 feet.

September 22, 2005:

[Description of flood impacts around the state, no mention of Napakiak]

May 3, 2009:

The annual spring river ice break up resulted in extensive flooding along the Kuskokwim River over the 11 days it took for the river to open up from its head waters in the Kuskokwim Valley to the mouth of the Kuskokwim River on the Bering Sea coast. Damage estimates are from the State of Alaska Disaster disaster [*sic*] declaration request to the President.

October 5, 2012:

[Minor flooding in Nome, no other impacts listed]

May 8, 2018:

The spring breakup of the river ice on the Kuskokwim River resulted in several ice jams along the river that impacted multiple communities.

U.S. Army Corps of Engineers (USACE), 1976, Flood data survey—Napakiak: USACE Alaska District, 4 p.

[Full source provided at end of document]

———1979, Flood data survey—Napakiak: USACE Alaska District, 3 p.

[Full source provided at end of document]

———1992, Flood data survey—Napakiak: USACE Alaska District, 1 p.

[Full source provided at end of document]

———1994, High water elevation identification: Alaska District Corps of Engineers—Flood Plain Management Services, 3 p.

Date of Visit: 6 September 1990

Historical Record of High Water: The highest flood of memory was caused by a combination of high tide and wind driven waves that occurred in August of 1990.

Actions Taken: High Water Elevation (HWE) signs were placed at three locations with the sign's water symbol at the level of the 1990 flood. [List of HWE sign location descriptions and photos.]

Miscellaneous: The estimated zero damage flood elevation is approximately 3 feet below the HWE signs. The recommended minimum building elevation is 2 feet above the 1990 flood elevation, or 2 feet above the HWE signs. A flood gauge was placed in the community so that flood levels can be easily monitored. The HWE signs correspond to 0.4 feet on the flood gauge.

———2021, Ice jam database: USACE [website]: found at <https://icejam.sec.usace.army.mil/>

[This resource contains flood descriptions for several communities. We provide text pertaining to Napakiak.]

[1962-MAY-26]

On May 22 the surface of the Kuskokwim was smooth with no snow on the surface.

On May 25 the surface was slushy and the shore ice was gone.

On May 26, 1962 an ice jam on the Kuskokwim River at Bethel was noted in Ice Thickness Observations, North American Arctic and Subarctic 1960–61, 1962–62.

On May 26, 27, 28 the "surface jammed ice, shore ice gone."

On May 29 the surface was free and only bank and shore ice remained.

On the Kuskokwim River at Tuluksak in May of 1962 there was an ice jam made up of large floes that affected 20 miles of the river, and was cleared within 15 minutes by bombing.

[1971-MAY-27]

On May 29 the Army Corps of Engineers dynamited a threatening ice jam some one-half mile downriver from Napakiak, Oscarville, Bethel, and Kwethluk

We surveyed Napakiak by our way of OEH Boat on June 9. Council Pres. James Willie, BIA Maintenance Man Billy McCann, and Mrs. Jung of Jung's Store were contacted. It was reported that local, extensive flooding occurred between May 27 and June 1. The entire village area, except for a number of homes on a higher end of the village, was affected by the flood. Small boats were used to evacuate people from the low [flooded] areas to the referenced unaffected area; thus, the people crowded together for lodging and safety. Flood waters entered some 60% of the approximate 45 homes, but no damages were recorded, except for minor damages in one home. The Napakiak BIA Day School [received] no extensive external or internal damages, but BIA Plant Management reported that an estimated \$960 was needed to repair the demolished boardwalks, utilidors, and floor of the quarters building. The village watering point was not affected and continues to be in good operating condition.

[Napakiak] Village population (1960) 190, on right bank of Kuskokwim River, 10 mi. SW of Bethel, Yukon-Kuskokwim Delta.

"The villages of Oscarville and [Napaskiak] were completely evacuated last night and preparations are underway for evacuation of Napakiak today."

[1972-MAY-24]

Ice jams on the Lower Kuskokwim River threatened Oscarville and [Napaskiak], which were evacuated on 5/24/72. The river flooded on 5/25. Evacuees returned 5/29.

[1975-MAY-22]

Spring Break-up Flood Reconnaissance May 20, 1975, "Jam point 1/2 mile upstream of Napaskiak on the Kuskokwim River and ends 1/2 mile downstream of Oscarville; open water upstream and solid ice downstream of Napakiak. ... Ice jam upstream of [Napaskiak] has released and end of ice is one mile upstream of [Napakiak].

1975 Ice Dusting Report: "Ice jams developed at four locations downstream of Aniak on the 15th of May and lasted until 18 May 1975. Extensive flooding was caused by the Aniak ice jams, both locally and further downstream. All villages on the Kuskokwim River downstream of Aniak experienced flooding from the combined effect of the Aniak crest and localized ice jams. ... Akiak, Kwethluk, [Napaskiak], and Oscarville were flooded on the 20th of May, and the following day the water was receding at Akiak. On 22 May, the water reached flood stage at Bethel and Napakiak, and by the 23d of May the river was ice free to approximately one mile below the confluence of the Johnson River, and the flood waters were receding at all villages on the Kuskokwim River."

Damages reported for the village of Napakiak (river mile 47) in the 1975 Ice Dusting Report: "3 houses flooded, no evacuation."

Damages reported for the village of Oscarville (river mile 54) in the 1975 Ice Dusting Report: "13 houses flooded, 32 people evacuated by ANG helicopter to Bethel."

Damages reported for the village of Bethel (river mile 58) in the 1975 Ice Dusting Report: "Estimated 60 homes and buildings flooded, no evacuations."

Damages reported for the village of [Napaskiak] (river mile 95) in the 1975 Ice Dusting Report: "38 houses flooded, 80 people evacuated by ANG helicopters to Bethel."

[1976-MAY-19]

0830 hrs May 20, 1976

“The ice on the Kuskokwim River moved last night and is now reported to be jammed one mile downstream of Napakiak. This movement caused river stages at Bethel, Oscarville and [Napaskiak] to drop about half a foot since Wednesday. The stage this morning at Bethel was 13.7 feet...flood stage at Bethel is 9 feet.”

[1979-MAY-03]

On May 3 1979, an ice jam was reported at mile 40 of the Kuskokwim River near Napakiak, at the mouth of the Johnson River.

[1981-MAY-12]

Kuskokwim River Statement, 1300 hrs May 12, 1981 [and] Alaska River Break-up Summary, 1500 hrs Tue May 12, 1981

“The Kuskokwim River reached flood stage of 9 feet at Bethel Tuesday morning due to ice jamming the river 20 miles downstream at the mouth of Johnson River. Some low area flooding was occurring from Oscarville to Napakiak, but no homes were flooded. The river level at Bethel is expected to fall some Tuesday afternoon as the tide goes out, but will not return to normal until the ice goes out below Johnson River.”

Alaska River Breakup Summary, 1545 hrs Wed May 13, 1981

“At Bethel the Kuskokwim River is running freely with less than ten percent ice. The peak stage yesterday was just below the 9 foot flood stage. The peak stage yesterday [was] just below the 9 foot flood stage. The stage today at high [tide] was 7.5 feet...down 1.5 feet since yesterdays peak. Conditions at Bethel indicate that the ice jams downstream have moved out.”

[1985-MAY-21]

5/21/85- Ice jam reported downstream of Bethel at 1050 hrs

NWS Ice Jam Flood Warning 5/25/85 1120 hrs

“An ice jam flood warning is in effect for Bethel, Oscarville and Napaskiak on the Kuskokwim River until noon Sunday. A heavy run of ice was passing Bethel Saturday night and was jamming against solid ice still in place near Napakiak downstream from Bethel. The water level has been rising steadily and is expected to go over flood stage around midnight.”

NWS River Statement 5/26/85 1045 hrs, "An ice jam flood watch continues in effect for Kwethluk and Napakiak on the Kuskokwim River through Monday noon. Ice jams have occurred and rising water levels are possible in these villages.

5/27/85 0945 hrs- Ice jam at Napaskiak is gone, open channel all the way past the Johnson River. Can drop all watches and warnings. Napaskiak water down 2'.

[1988-MAY-15]

On 5/14/88 at 1030 hrs the ice jam downstream of Akiak on the Kuskokwim River broke and moved down to Napakiak. It was reported on 5/15/88 at 1145 hrs that the ice had jammed at river mile 52 which is just upstream of Napakiak. Although Napakiak was high and dry at 1145 hrs many other upstream villages such as Bethel, Oscarville, and Napaskiak, were affected from the high water. At Bethel there was flooding around the east side. At [Napaskiak] water rose since the day before and the water was below house floor level.

5/14, 1730 hrs- "An ice jam flood warning is in effect for Bethel, Napaskiak and Oscarville on the Kuskokwim River until 2 PM Sunday. A combination of high flows, high tide, and broken ice building up against unbroken Kuskokwim River ice is causing high water upstream of Napakiak. Flooding of low areas has already been reported in [Bethel], Napaskiak and Oscarville."

5/14/88, 1745 hrs- "The National Weather Service has issued an ice jam flood watch for the village of Napakiak on the Kuskokwim River until 5 PM Sunday. Broken ice is building up against the unbroken Kuskokwim River ice above Napakiak, causing high water upstream. Flooding is presently [occurring] in Bethel, Napaskiak and Oscarville. Breakup of the ice upstream of Napakiak will result in high water at Napakiak and possible flooding."

5/15, 1045 hrs- "The ice jam flood warning for Bethel, [Napaskiak] and Oscarville remains in effect until noon Monday. An ice jam located below Napaskiak is backing up water and ice. Flooding is [occurring] in all three villages. Water levels continue to slowly rise this morning in Bethel but are reported steady in Napaskiak. Flooding in Bethel is [occurring] in low-lying areas...mainly in the east side of town near Browns slough. Water levels are expected to continue rising slowly until the ice jam breaks."

5/15, 1140- the stage at Oscarville was normal

5/15, 1200 hrs- the jam upstream of Napakiak broke and water dropped fast at [Napaskiak], Oscarville and Bethel.

5/15, 1242 hrs- the stage at Bethel was 9.92 and by 1600 hrs had dropped one foot

5/15, 1400 hrs- Napakiak began flooding

5/15, 1510 hrs- "The ice jam upstream of Napakiak broke at approximately noon Sunday, releasing a large amount of water downstream to Napakiak. Flooding has been reported...starting at approximately 2 PM Sunday. The large amount of water that was held by the jam will keep water levels rising at Napakiak for the next several hours. The possible formation of an ice jam downstream of Napakiak would increase the seriousness of flooding."

5/15, 1700 hrs- "The ice jam flood warning for Bethel, Napaskiak, and Oscarville has been reduced to a flood watch. Water began receding out of Oscarville by 330 PM Sunday and levels at Bethel dropped one foot by 4 PM. While levels are now below flood stage the Kuskokwim River is still near bankfull at [all] three locations. Renewed flooding is still possible if an ice jam forms downstream of Napakiak. This flood watch will remain in effect until noon Monday."

5/15, 1700 hrs- "The Ice Jam Flood Watch issued Saturday for Napakiak was upgraded to a flood warning at 310 PM Sunday...and is in effect until noon Monday. The ice jam which formed downstream of [Napaskiak] Saturday afternoon broke Sunday [May 15] at noon, sending high water down to Napakiak. Flooding in Napakiak was reported at approximately 2 PM Sunday."

5/16, 1200 hrs- flood watch for Bethel, Napaskiak and Oscarville cancelled, water is below bankfull

5/17, 1700 hrs- "The ice jam flood watch for Napakiak was cancelled at 5 PM Tuesday [May 17]

As reported in ADES Disaster Cost Index for Napakiak/Napaskiak, May 4, 1988

"Flood damage to roads in Napakiak and both roads and boardwalks in Napaskiak resulted in a declaration of Disaster Emergency. State disaster funds of \$200,000 were made available for public assistance." Amount of Public Assistance: \$114,310 ADES Administration costs: \$10,982 Total cost both Federal and State: \$125,292

[1989-MAY-12]

[Flooding in Bethel, Napaskiak, and Oscarville. Napakiak listed under Flood Warning, but no flood impacts observed]

[1991-MAY-09]

The waters came up over night at Napakiak, however only a few portions of road which were in low lying areas has water on them. The high water continues at Napakiak but stages are not rising and the condition in town is not expected to worsen.

[1993-MAY-04]

NWS Spring Breakup Summary 1130 am May 4, 1993, “The ice jam just upstream of [Napaskiak] broke up by 9 pm yesterday and the ice has moved downstream below Napakiak. The water level at [Napaskiak] and Napakiak rose over night, but no flooding occurred. With the ice jam release the water level at Kwethluk has dropped, but not before the road from the airport to town flooded.”

NWS Ice Jam Flood Warning for Napakiak 500 pm May 4, 1993, “The breakup front has stalled out 1.5 miles upstream of the Johnson River on the Kuskokwim River. Chunk ice is backing up behind this inplace ice and the water has risen to [bankfull] levels at Napakiak. The water level is expected to rise through the night.”

NWS Flood Statement 1100 am May 5, 1993, “The breakup front on the Kuskokwim river has moved beyond the mouth of the Johnson River. There is enough area below the Johnson River to allow water to flow around the ice. Water levels at Napakiak and [Napaskiak] have fallen more than 1 foot since yesterday evening. The river rose last night at Napakiak flooding low lying area and some roads. No homes were affected. Water levels at [Napaskiak] rose to near bankfull levels by yesterday evening. With the movement of ice downriver in the vicinity of the Johnson River water was able to get around the ice and consequentially water levels at Napakiak and [Napaskiak] have fallen.”

REFERENCES REVIEWED WITH NO FLOOD INFORMATION USED

Alaska Division of Community & Regional Affairs (DCRA), 1991, Community profile map, Napakiak: Department of Commerce, Community, and Economic Development.

City of Napakiak, 2006, Napakiak 5-year community comprehensive plan: City of Napakiak, Napakiak IRA Council and Napakiak Corporation, 28 p.

———2010, Napakiak community plan: City of Napakiak, Napakiak IRA Council and Napakiak Corporation, 28 p.

For each flood date, we reviewed the entries in the NOAA Storm Database, NOAA Climatological Database, and USACE Ice Jam database. If these sources are not referenced, we found no information pertaining to the flood.

APPENDIX B: FLOOD CATEGORY CALCULATION FIGURES

DGGS staff visited Napakiak in June 2021 and surveyed points relevant to the flood history and category study. The survey base station was installed over a temporary benchmark of unknown position. Points were surveyed with the Trimble R8s receiver. Horizontal coordinates are provided in WGS84 latitude and longitude and NAD83 (2011) UTM Zone 4N easting and northing. Elevations are provided in orthometric height (meters above NAVD88 [GEOID12B]). Average horizontal accuracy is 0.02 m (0.07 ft) and vertical accuracy is 0.03 m (0.10 ft).

Table B1. Coordinates and heights of surveyed features. Latitude and longitude are in decimal degrees WGS84. Northing and easting are in meters NAD83 (2011) UTM Zone 4N. Orthometric heights are in meters and feet above NAVD88 (GEOID12B).

Feature	Figure	Latitude	Longitude	Northing	Easting	Ortho. Height (m)	Ortho. Height (ft)
Clinic	B1	60.69599915	-161.98465636	6732628.967	337071.535	6.344	20.81
School fuel tank berm	B2	60.69461908	-161.97118998	6732442.030	337799.356	5.926	19.42
High water sign at water treatment plant	B5	60.69354688	-161.97072759	6732321.551	337819.186	4.753	15.59
water treatment plant	B5	60.69354688	-161.97072759	6732321.551	337819.186	4.298	14.10
Riverbank	2A	60.69684501	-161.98027026	6732712.239	337315.130	3.151	10.34
Riverbank	2B	60.69597804	-161.97370925	6732599.509	337668.741	3.260	10.70
Riverbank	2C	60.69408285	-161.96972188	6732378.722	337876.764	3.204	10.51
Riverbank	2D	60.69353970	-161.96994416	6732318.818	337861.900	3.346	10.98
Riverbank	2E	60.68465412	-161.97407846	6731340.056	337591.497	3.371	11.06
Riverbank	2F	60.68590870	-161.97324449	6731477.630	337643.341	3.381	11.09
House ground (1990 flood)	3	60.69514934	-161.98421200	6732533.280	337091.481	4.401	14.44
Road crown	3	60.69528103	-161.98420244	6732547.913	337092.669	5.462	17.92
Water at doghouse	5	60.69598649	-161.98439789	6732626.917	337085.574	5.149	16.89



Figure B1. Clinic porch step.



Figure B2. Height of berm surrounding school tank farm

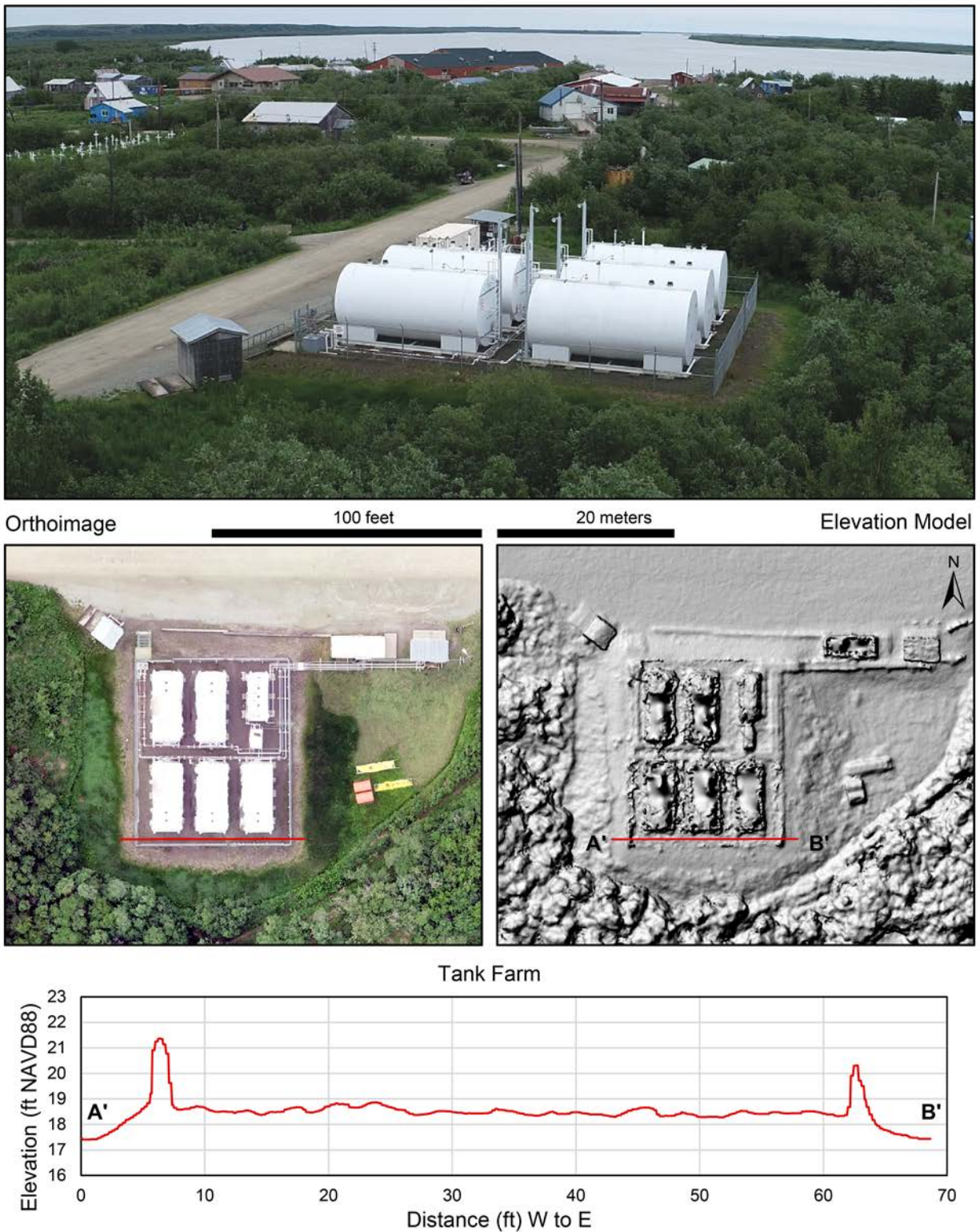


Figure B3. (Top) View looking east at tank farm, with school roof and Kuskokwim River in the background. (Center and bottom) Elevation profile drawn on DSM across south side of tank farm, showing the average ground height of the raised gravel pad between the fences is 18.5 ft NAVD88.

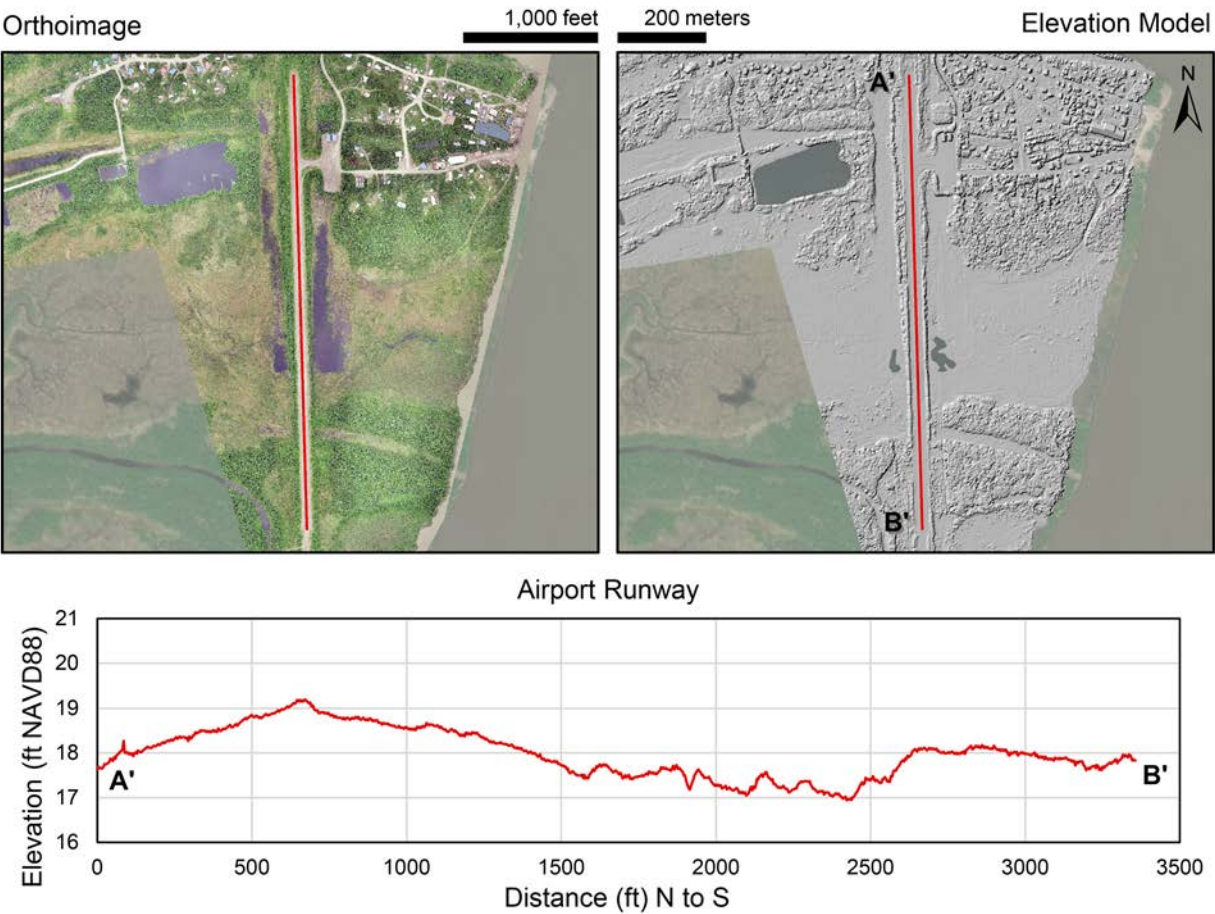


Figure B4. Elevation profile drawn on DSM across runway from north to south shows the runway is higher to the north and has a 1000-ft low section where it runs across the marsh.



Figure B5. Water treatment plant.

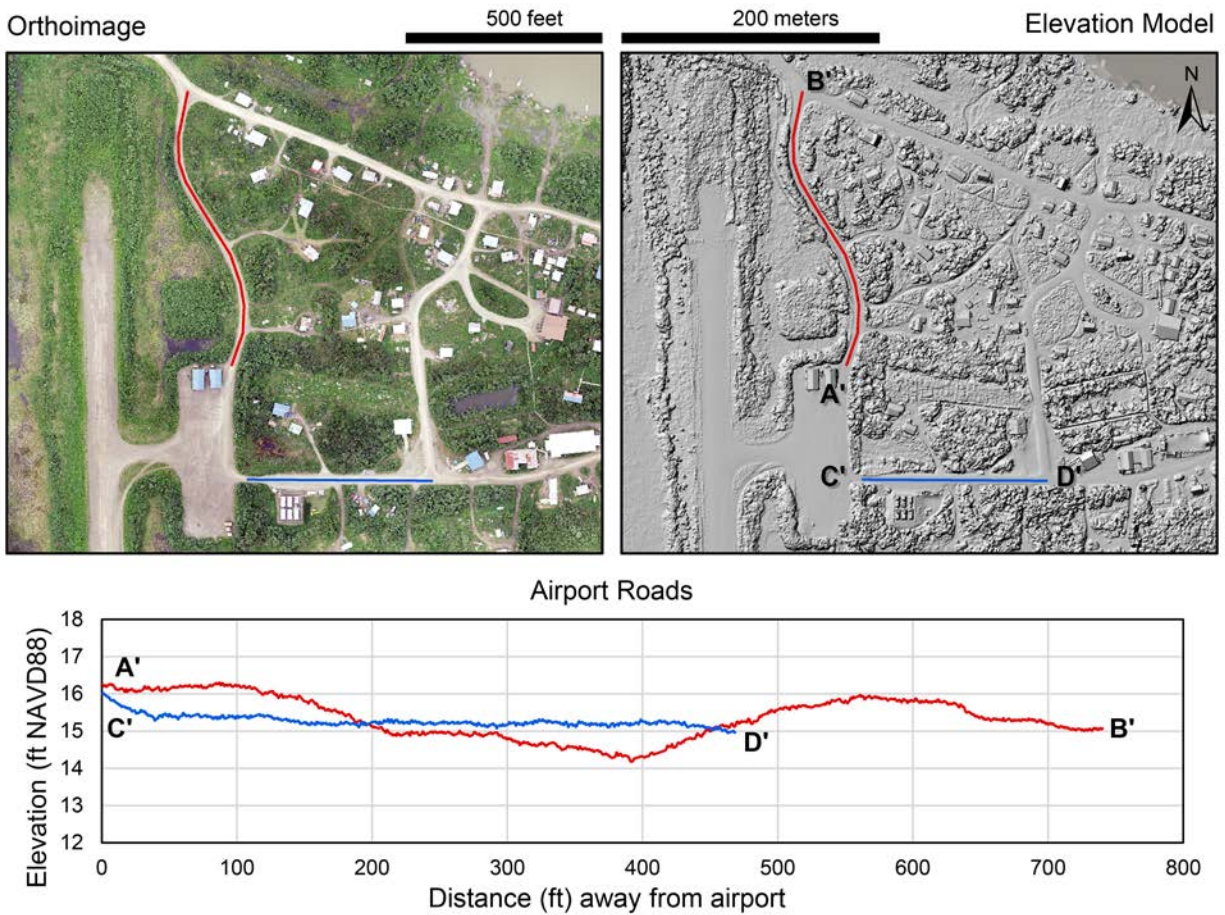


Figure B6. Elevation profiles drawn on DSM show elevation of roads leading to airport range between 14 and 16 ft NAVD88.

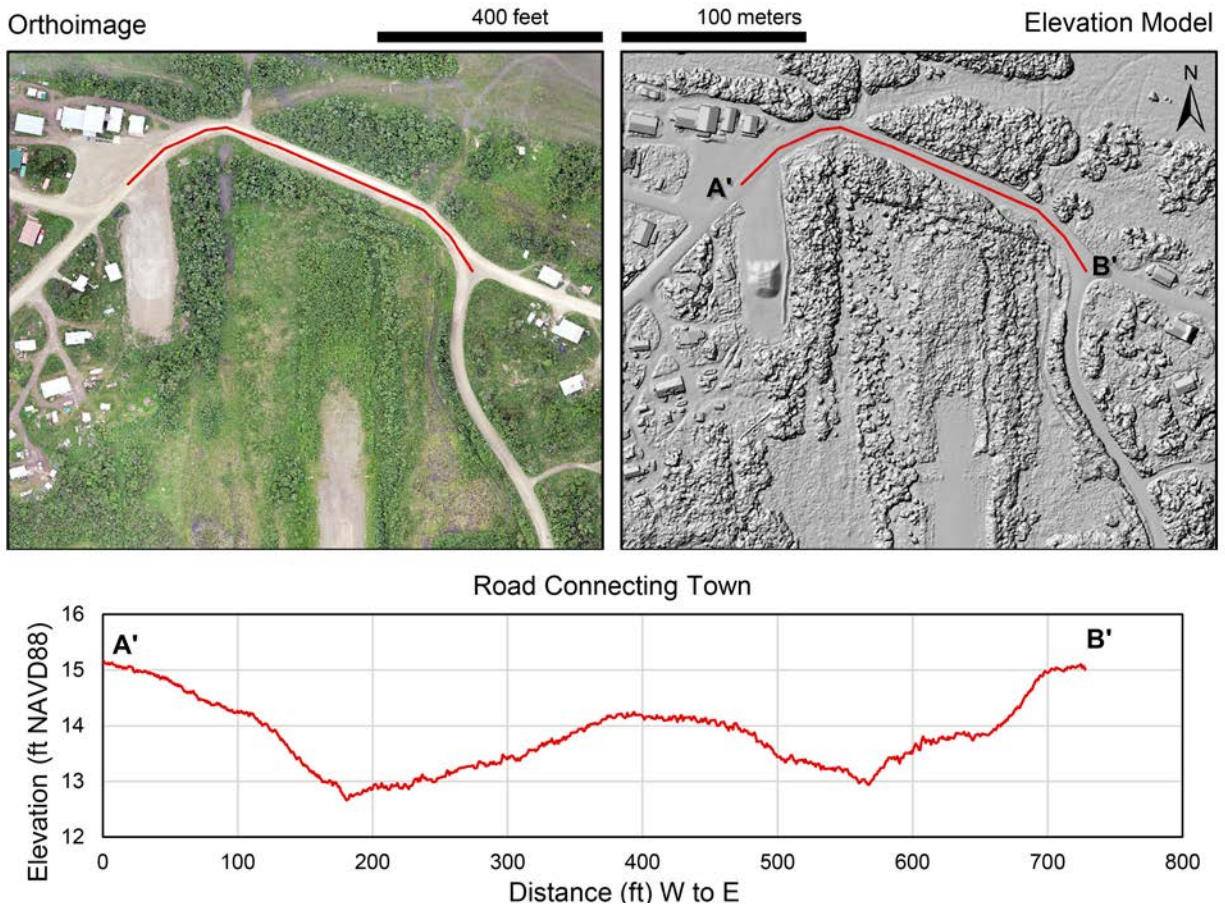


Figure B7. All roads in Napakiak have been raised except this section (Napakiak, oral commun., 2021). The lowest section of this road is 12.7 ft NAVD88 and flooding of 14.2 ft NAVD88 will cover 600 ft of road with up to 1 ft of water.

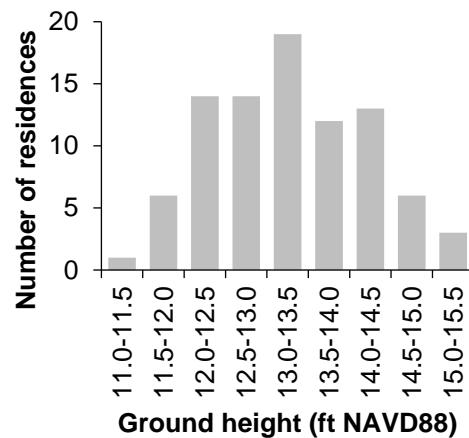


Figure B8. Histogram of the highest ground height below all residences. 90 percent of residences are on ground between 11.8 and 14.6 ft NAVD88, averaging 13.3 ft NAVD88.

DISPOSITION FORM

(AR 340-15)

OFFICE SYMBOL OR FILE REFERENCE

SUBJECT

NPAEN-A-FP

Flood Hazard Data

TO MEMO TO FILES

FROM

FPMS

DATE

13 Mar 69 MT 1

FLOOD HAZARD DATA

1. Location:

a. Subdivision

b. Longitude

161 57

Latitude

60 42

c. Name

Napaskiak

2. Information requested by:

C of E

3. Information given:

See attached

This village has a very high hazard for over 80% of the area.

4. Quality:

Good

ADO report 10/16/71, June 1965
correspondence

NAPAKIAK

Information By BLM 1976

This community slightly downstream and across the river from Napaskiak, has been seriously flooded many times. In addition, there is an extremely bad erosion problem which has been threatening the school for the past few years. There is some talk about moving the entire village or the school to a safer area.

NPA FL 14
Aug 68

DA FORM 2496
1 FEB 62

REPLACES DD FORM 96, EXISTING SUPPLIES OF WHICH WILL BE
ISSUED AND USED UNTIL 1 FEB 63 UNLESS SOONER EXHAUSTED.

U.S. GOVERNMENT PRINTING OFFICE: 1962 O-629168

MAIL TO

Alaska Disaster Office
Anchorage, Alaska

DIRECTOR, ALASKA DISASTER OFFICE
1111 East Fifth Avenue
Anchorage, Alaska 99501

Community name Kuskoquim, Alaska 1960 Census 195

Population: Average 333 Peak 220 Longitude

Geographical location: Latitude

Main occupation of residents Trading and Fishing

Normal method of communication Radio

If by radio, list normal hours of operation

Please detail: Who operates the radio (is this BIA, Bush Phone, Marine Radio, Airlines, etc.), and what are the call letters? BIA - KWP46

Is there a school? Yes Normal number of students 65 Who operates? BIA

Number and type of businesses Trading Post - 1

Is the Community on a river? Yes Name of River Kuskoquim River

Elevation of village above river

Subjected to flooding in past years? Yes

Is the Community on open water or a bay? No

Could a seismic sea wave threaten the community? Perhaps

Distance for evacuation? Yes

Name, distance, and method of transportation to nearest neighboring community: winter transportation

What medical facilities are available? Red Hospital - Bethel

Is there a fire department? Yes BIA-Mat. Guard. Kuskoquim Trading Post

Length of field 200 ft.

6/65

20. Do you have a seaplane ramp or area for sea landings? Yes - river bank
21. Do you have facilities to dock a rescue boat? ?
22. Do you have a local warning system (siren or loud horn)? No If not, what method is used to alert the Community? Church Bell
23. Are any emergency supplies stockpiled by your Community, and if so, what are they?
24. Are you served by an airline? Name Northern Consolidated Airlines and average frequency of service Three weekly mail services - also other bush planes come in
25. Do you have auxiliary or emergency power for your communications? Yes
26. Do you have Amateur (Ham) operators? No Are they members of RACES (Radio Amateur Civil Emergency Service)? No If not presently members, are they interested in joining to provide emergency communications?
27. Does your Community have an Emergency Disaster Plan? No
28. Does your Community receive Civil Defense materials and literature? Yes
29. What heavy equipment is locally available (cats, dozers, graders, cranes, etc.)?
1 small tractor

(If more space is needed to answer any question, use additional paper. Identify information by listing the question number.)

[Signature]
(Signature)

[Title]
(Title)

June 28, 1965

[Date]
(Date)

FLOOD DATA

Use back if needed

1. Village Name: NAPAKIAK

2. Population: 4350

3. Type of Hazard: Flood - ICE

4. Floods of Record and Cause:
Mo. & Year % Flooded

Maximum Depth

Cause

May 1976 100% 3.5' ICE

5. Location of high water mark and description:

Boat house in front of General
store, Road approx. 3.5'

6. Is high ground available? _____
Where? _____
How far from water? _____

7. Other information: NO EVACUATIONS

8. Coastal:
Is there offshore protection? _____
What? _____
Is Ice erosion a problem? _____
Is wave erosion a problem? _____
Details of above: _____

9. Riverine:
Is erosion a problem? _____
Is Ice a problem? _____
Details of above _____

Name C. WHEELER
Title Hydrologist
Organization NPAEN-PR-HY

Return to:
District Engineer
US Army, Corps of Engineers
Alaska District
Anchorage, Alaska 99510

ATTN: FPMS

○ Received Dec 29

City of Napakiak

VILLAGE: Napakiak, Alaska 99644

Page 1 of 3

Present Village Chief (or Mayor): James Willie

Village Status (home rule, 2nd class traditional, IRA, etc):

Worst Flood Known (cause and date): Ice jam in 1962

Depth of Flood (MAXIMUM): 20" - 25"

Highwater Marks (Describe & Locate): in. and by foot

the marker was along side the river bank.

Number of Homes Flooded: Don't Know

Number of Public Facilities and Type Flooded:

Sorry not known

Total Damage in \$ 19,000.00 to 20,000.00

Most frequent cause of flooding (ice jams, stream overflow, wind driven waves, etc.): Most frequent cause's are by ice jams,

and high wind's during fall high stream's

Other Years Flooded: in 70's and this year 1979

Publication: Number of Homes:

Public Facilities: Sorry not known.

VILLAGE: Napakiak

Page 2 of 3

Village Information (con't)

Access (air, boat, etc.): Are by boat , air & snow-go's

Economic Activity (substance hunting & fishing, mining, commercial fishing, native arts & crafts, supply point, etc.): _____

Substance hunting & Fishing, Commercial fishing, native arts & crafts supply point's Napakiak Trading Post and most people get there supply's from Bethel Store's.

Electrical Source (Owner): Napakiak Corporation

Units: (2) two Size Units: 50 kw each

Fuel (gas, diesel, nat. gas): Diesel

Type (int. comb., turbin, etc): _____

Water Supply:

How Obtained: We have only one water point and it's pump into one container and after treated its transfered to another.

Is It Treated?: Yes it's treated.

Sewer System (cesspools, privies, PHS, etc.)

In Use?: NONE*****

Planned: NOT PLANNED*****

Communications (Owner): RCA ALASCOM

Bushphone: (1) one Radio: _____ Other: _____

Village Corp (if any): Napakiak Corporation

President: Carl Motgin

VILLAGE: Napakiak

Page 3 of 3

Other Pertinent Information (erosion & other problems): _____

Here at the Village we have one major problem which is
erosion, The last 16 years approx. 950 to 1000 ft. been eroded,
also one of our problem is the roads during spring & fall
we end up walking on muddy roads we been asking for gravel, but
no one seems to care to help us on our needs.

RETURN TO:

Alaska District Engineer
Corps of Engineers
ATTN: Flood Plain Management Services
P. O. Box 7002
Anchorage, Alaska 99510

PREPARED BY:

Fritz J. Willie
Fritz J, Willie

City Manager

TITLE

updated
6/4/87

VILLAGE: Napakiaik Page 1 of 3

Present Village Chief (or Mayor): Mayor Fritz J. Willie.

Village Status (home rule, 2nd class, traditional, IRA, etc): 2nd class City

Worst Flood Known (cause and date): ~~1970's~~ 1970's

Depth of Flood (MAXIMUM):

Highwater Marks (Describe & Locate): Water entered houses measuring about 1 1/2 to 2 feet of water in houses.

The houses that were near the Huskokuin River.

Number of Homes Flooded: Four (4)

Number of Public Facilities and Type Flooded:

Total Damage in \$

Most frequent cause of flooding (ice jams, stream overflow, wind driven waves, etc.): ice jam, about 3 miles

up from Napakiaik, and about a mile down from Napakiaik.

Other Years Flooded: n/a

Publication: Number of Homes:

Public Facilities:

VILLAGE:

Napakish

Page 2 of 3

Village Information (con't)

Access (air, boat, etc.):

Economic Activity (substance hunting & fishing, mining, commercial fishing, native arts & crafts, supply point, etc.):

Substance hunting & fishing, Commercial
Fishing, and Native Arts & Crafts.

Electrical Source (Owner): Napakish Laisma Power Co.

Units:

Size Units:

Fuel (gas, diesel, nat. gas): Power from Bethel

Type (int. comb., turbin, etc): Power Plant for back-up

Water Supply:

How Obtained: Well about 1500 ft.

Is It Treated?: Hydrated Lime and other

Sewer System (cesspools, privies, PHS, etc.)

In Use?:

Planned:

Communications (Owner):

Bushphone:

Radio:

Other:

Village Corp (if any):

Napakish Corporation

President:

VILLAGE: Napavine

Page 3 of 3

Other Pertinent Information (erosion & other problems): _____

Major problem "Erosion".

RETURN TO:

U.S. Army Engineer District, Alaska
ATTN: NPAEN-PL-FP (C)
P.O. Box 898
Anchorage, Alaska 99506-0898

PREPARED BY:

Sally K. Bell
City Administrator
TITLE

Date: 01-20-92

COMMUNITY INFORMATION FORM

COMMUNITY Name: Napakiaik Mayor/Chief: James Willie Borough: na

Status (home rule/2nd class/traditional/IRA, etc.): 2nd place Population: 323 Number of Homes: 95

WATER SUPPLY: How Obtained? Well Is Water Treated? yes Electrical Source (owner): Napakiaik Trunvag Power Company
subsidiary: Napakiaik

ECONOMIC BASE: (sub. hunting, fishing/mining/comm. fishing/native arts/supply point, etc.): all except for mining

COMMUNICATIONS: Owner: United Utilities, Inc. Type of Communications Available (phone/radio, etc.): phone, VHF radio's

SEWAGE TREATMENT: What Type (cesspools/privies/public health service, etc.): privies + bog room

TRANSPORTATION: Do You Have an Air Strip? yes Can We Travel To Your Community From Anchorage By Road/Railroad? No

GENERAL FLOOD INFORMATION: How Often Is Your Community Flooded? Every year What Is The Cause Of Most Floods (ice jams, stream overflow/storm surge/heavy rains, etc.)? ice jams; storm surge How Many Homes Are Usually Flooded? 15

What Public Facilities (school, generator, airport, sewage lagoon, etc.) Are Usually Flooded? none

What Body of Water Causes Your Floods? Kuskokwim River

LAST FLOOD: When Was The Last Flood (date)? 05-91 What Caused the Last Flood? ice Break-up / jam

How Deep Did The Water Get (feet)? 3 feet Where Is A Mark Left By The High Water? Napakiaik Corporation store

How Many Homes Flooded? 12 What Public Facilities Flooded? none

WORST FLOOD: When Was the Worst Flood (date)? 08-17-90 What Caused the Worst Flood? Storm + tide surge

How Deep Did The Water Get (feet)? 4 feet Where Is A Mark Left By The High Water? Napakiaik Corporation Store

How Many Homes Flooded? 12 What Public Facilities Flooded? none

Prepared By: Minnie S. Joekay Phone Number: 589-2611

PLEASE USE THE REVERSE SIDE OF THIS FORM FOR ANY COMMENTS.