The Big Thaw – Consequences of permafrost thaw on communities of Northwestern Alaska

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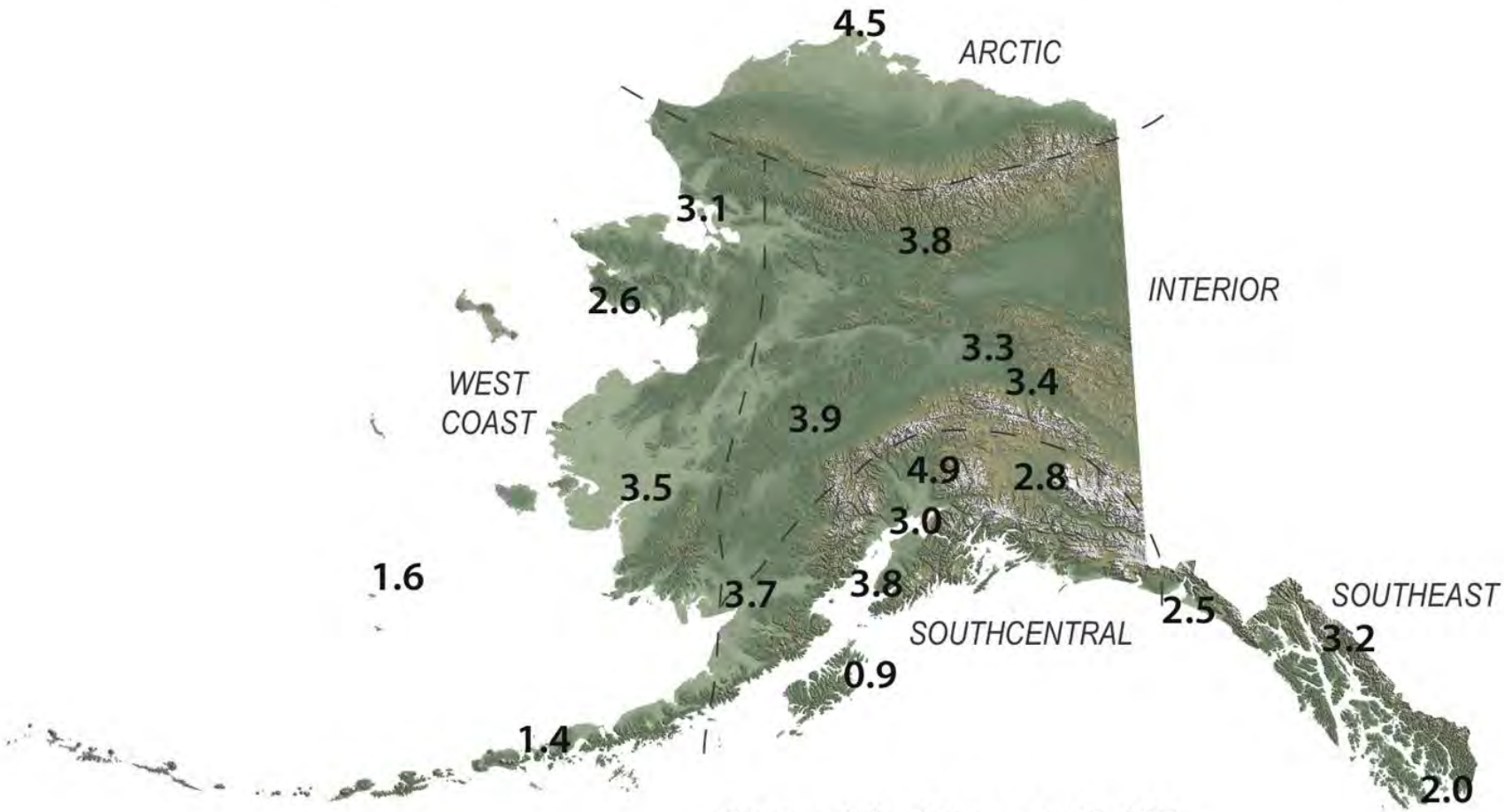
ANTHC is a statewide tribal organization providing comprehensive health care to rural Alaska residents, including clinical, public health and environmental health services.

Community Health

Clinical Services

Environmental Health & Engineering

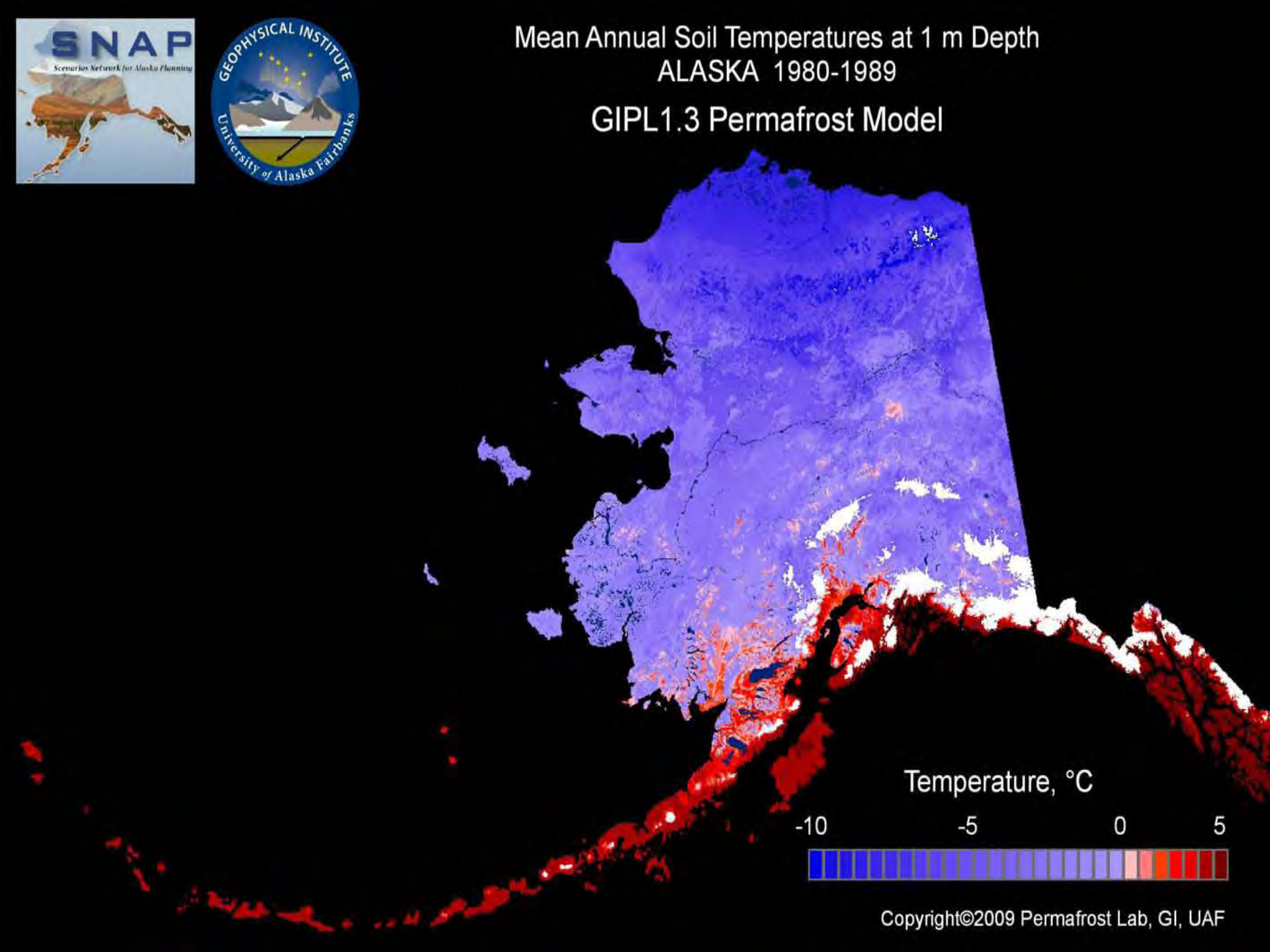
Total Change in Mean Annual Temperature (°F), 1949 - 2009



Statewide Average: 3.0°F

Alaska Climate Research Center

Geophysical Institute, University of Alaska Fairbanks


SNAP
Scenarios Network for Alaska Planning
GEOPHYSICAL INSTITUTE
University of Alaska Fairbanks
Mean Annual Soil Temperatures at 1 m Depth
ALASKA 1980-1989
GIPL1.3 Permafrost Model
Temperature, °C
-10
-5
0
5
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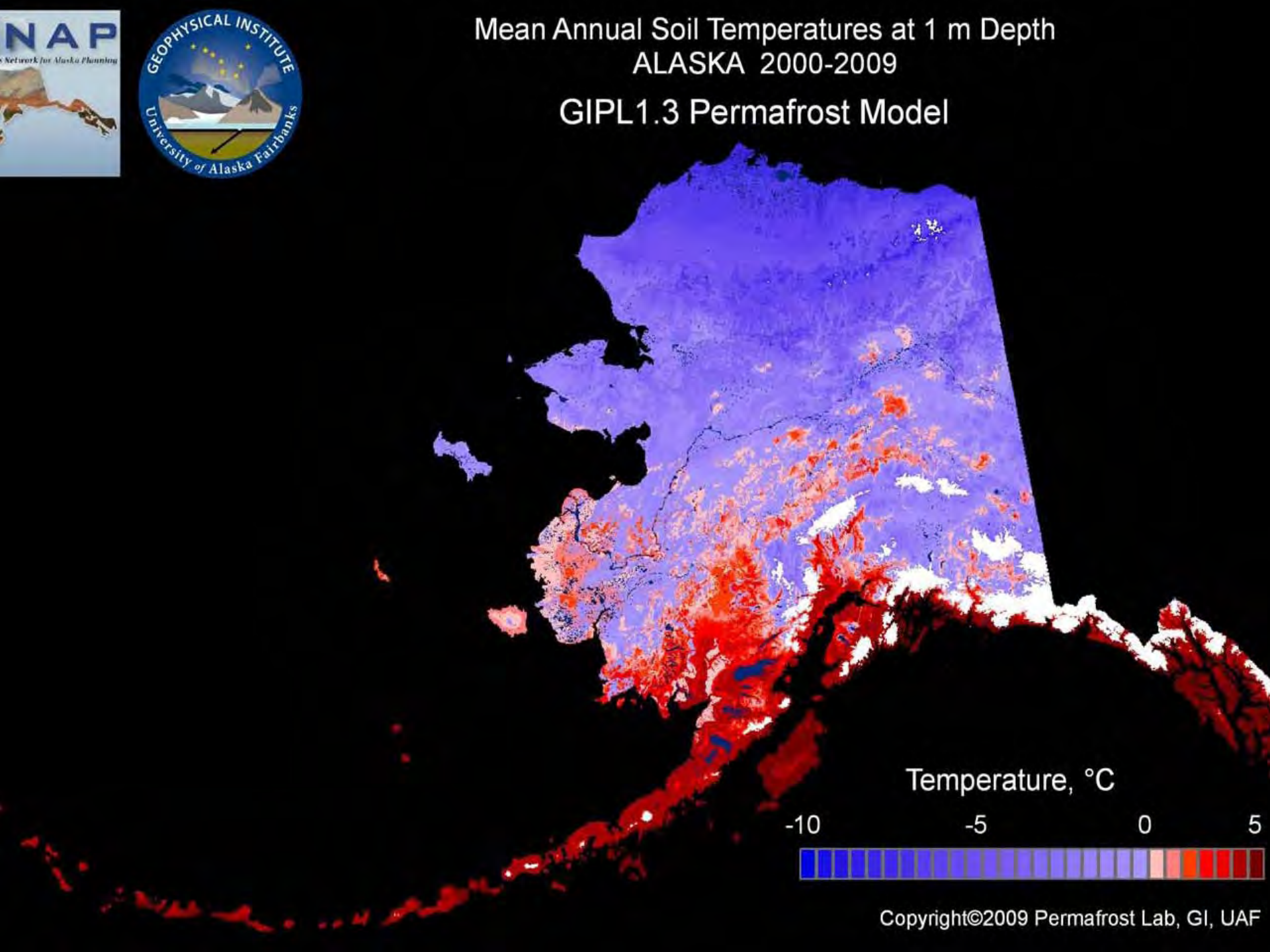
Mean Annual Soil Temperatures at 1 m Depth
ALASKA 2000-2009
GIPL1.3 Permafrost Model
Temperature, °C
-10
-5
0
5
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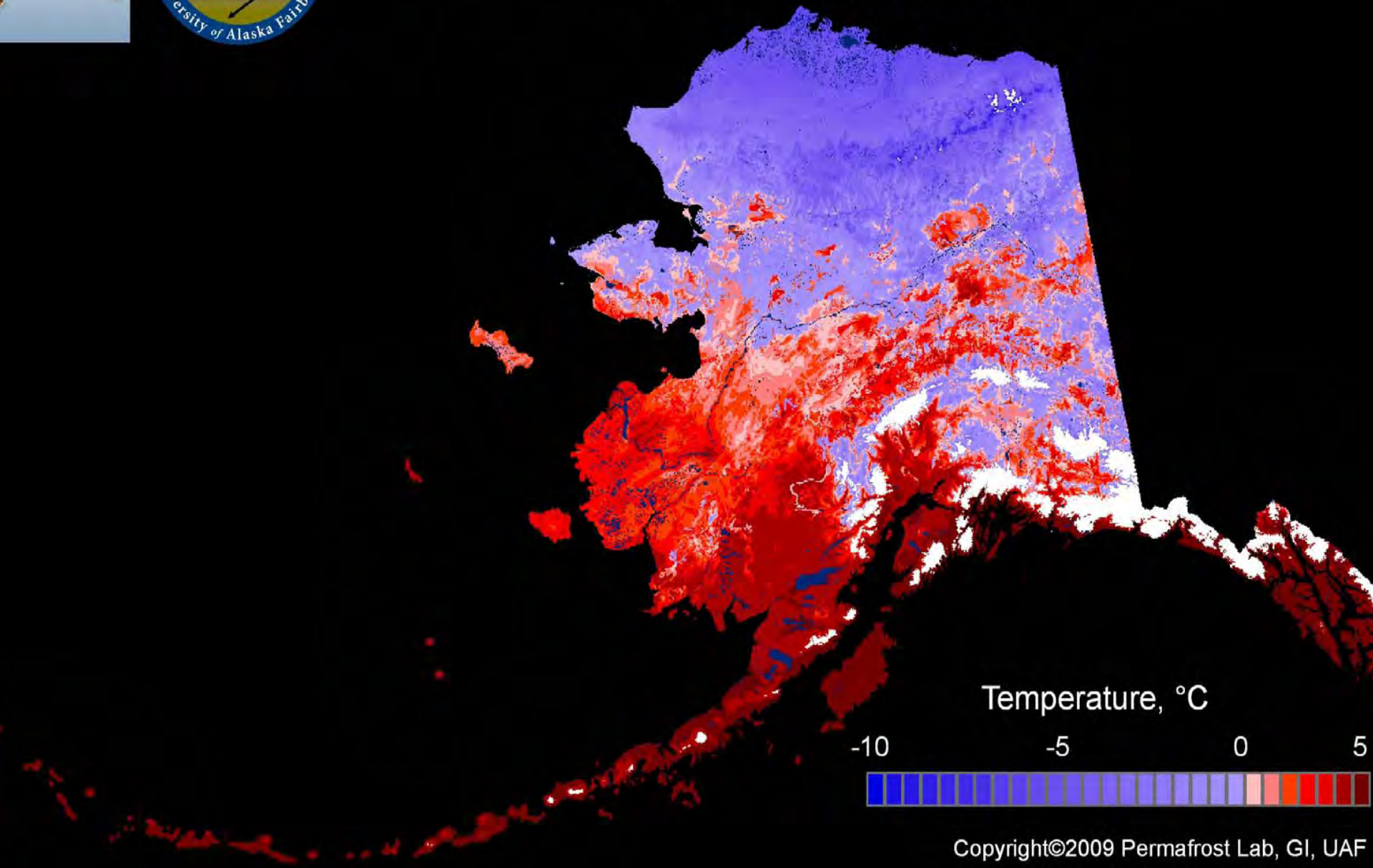
Mean Annual Soil Temperatures at 1 m Depth
ALASKA 2050-2059

GIPL1.3 Permafrost Model



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Kobuk River

Alaska

Point Hope
Kivalina
Noatak
CHUKCHI SEA
Kotzebue
Kiana
Noorvik
Selawik
Ambler
Kobuk
Shungnak
ARCTIC CIRCLE
Deering
Buckland
SCALE IN MILES
0
50
100
150
7/2004

Our infrastructure is designed for the conditions of the past, not for the present or future.

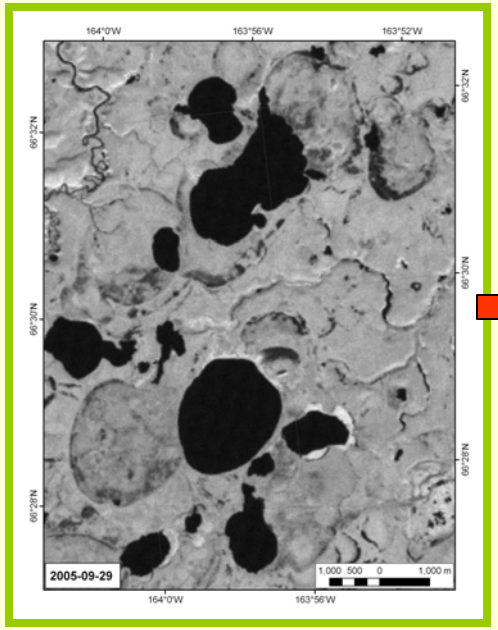
Average January Air Temperature
Point Hope, Alaska

- 1961-1990 ~ -3 degree Fahrenheit
- 2001-2010 ~ 3 degrees Fahrenheit
- 2031-2040 ~ 6 degrees Fahrenheit

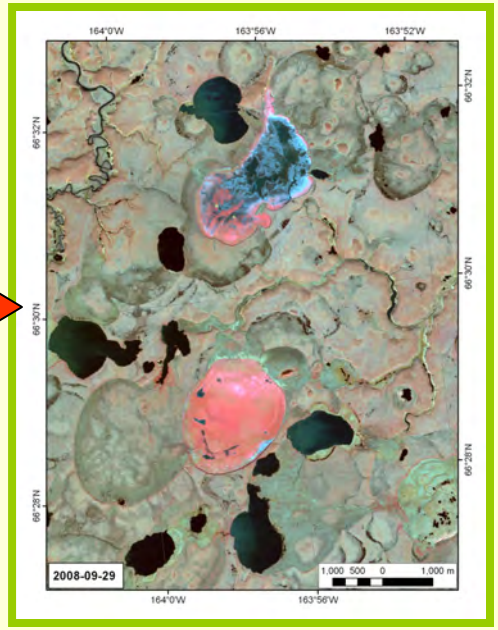
Projected change of + 9 degrees F over 89 years.

Source: Scenario Network for Alaska Planning
– Point Hope Community Charts

Photo Courtesy of Vladimir Romanovsky



09/29/2005

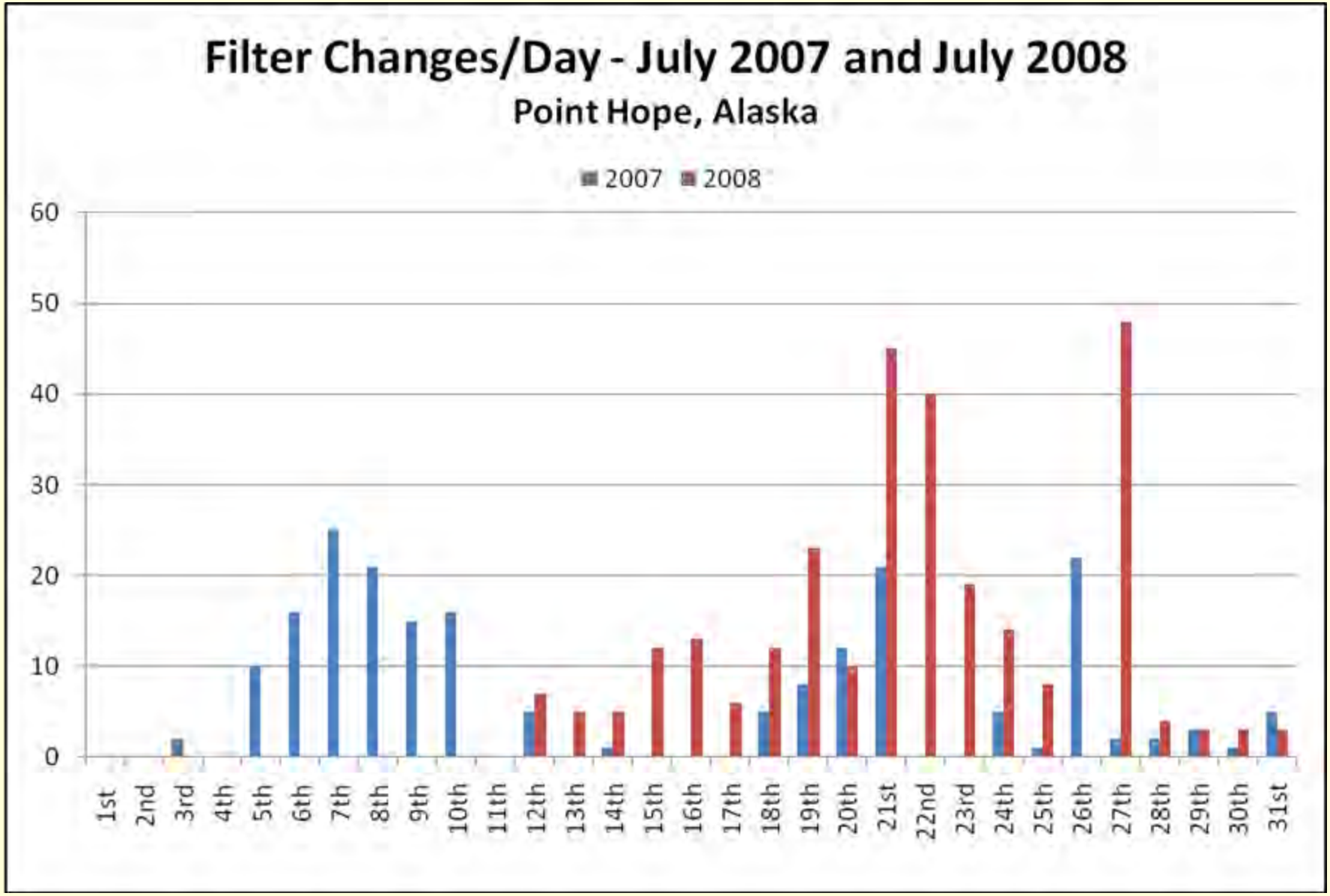


09/29/2008

September 2006 - Catastrophic drainage of two large thermokarst lakes on the Seward Peninsula, Alaska, (UAF)

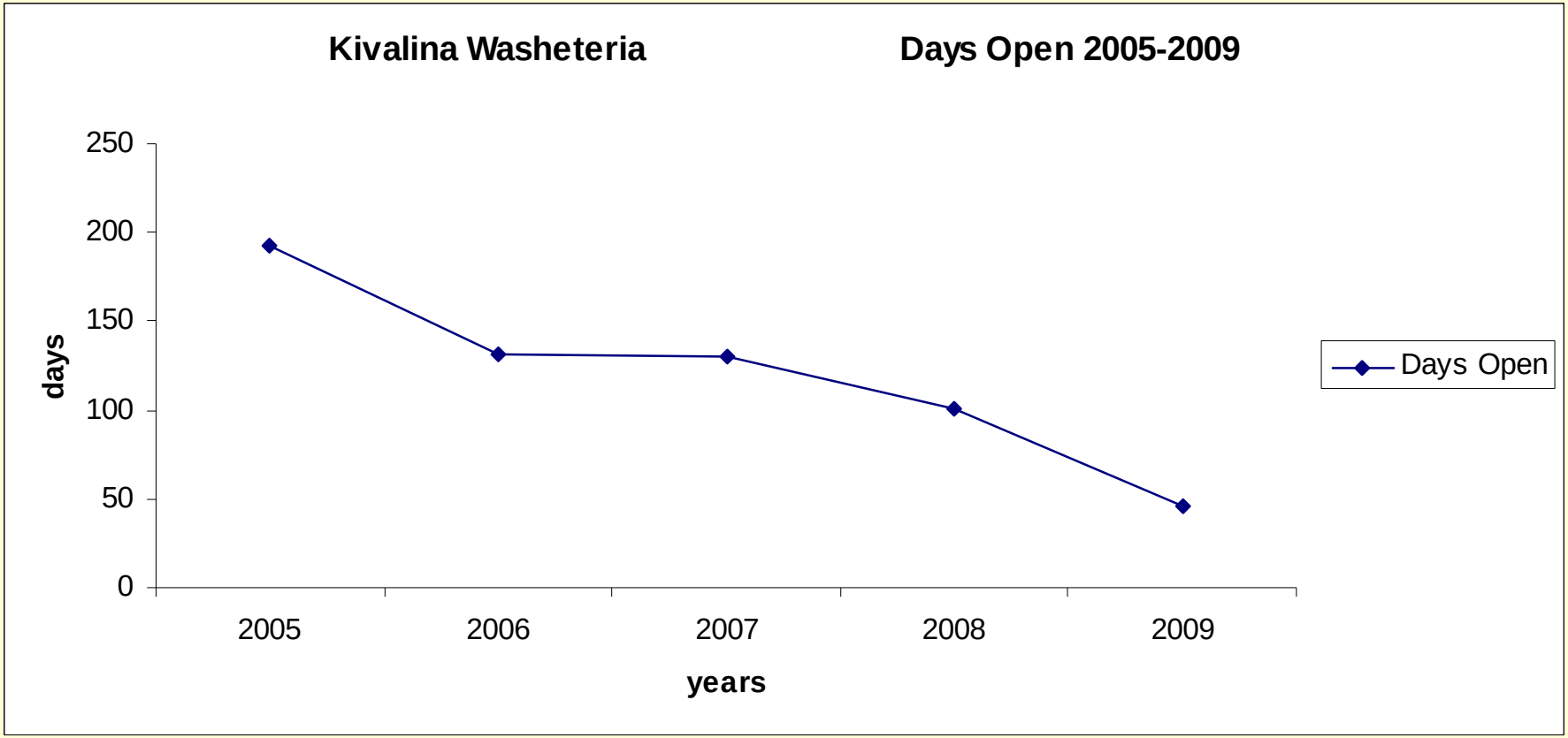
June 2005 - Community water source disappeared in Kwigillingok (ADN)

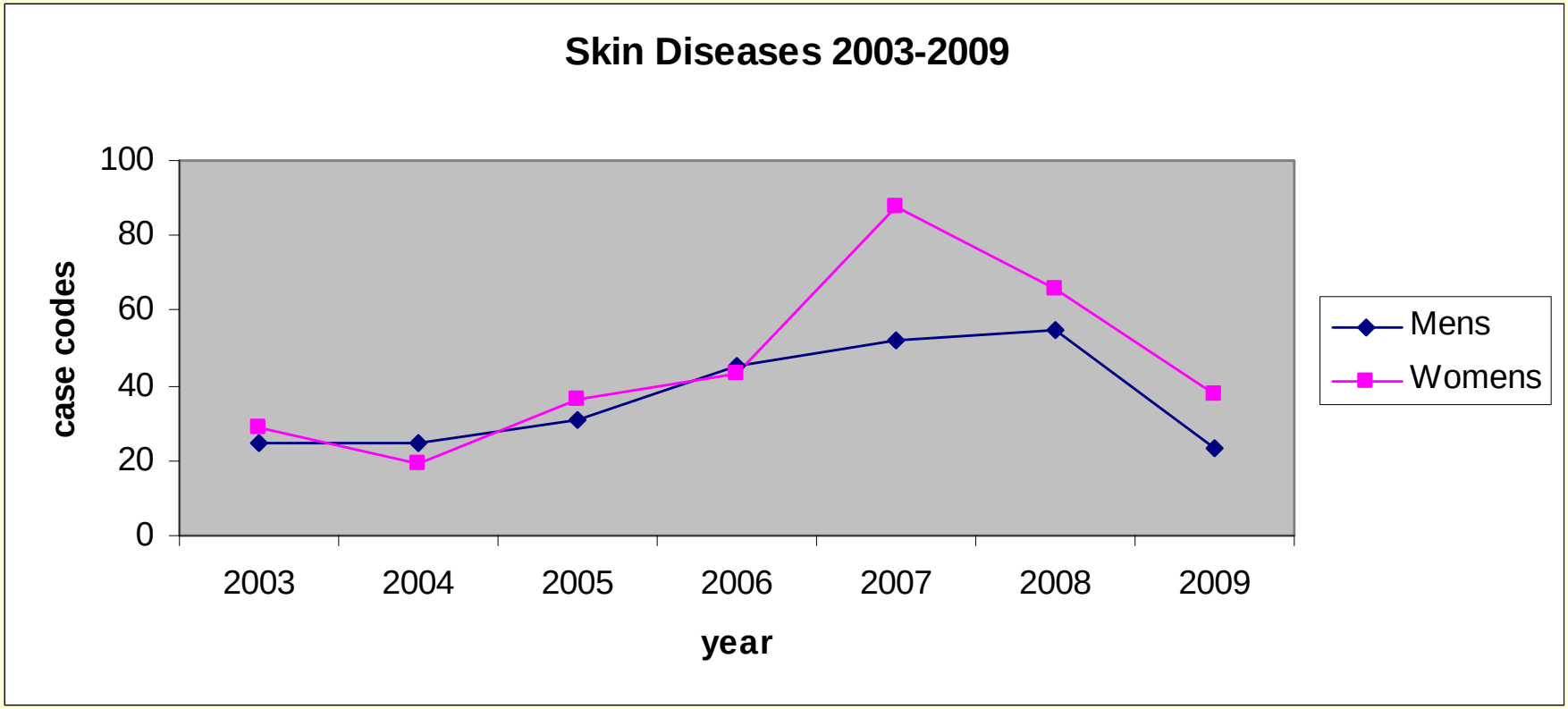
Andrew Frankson

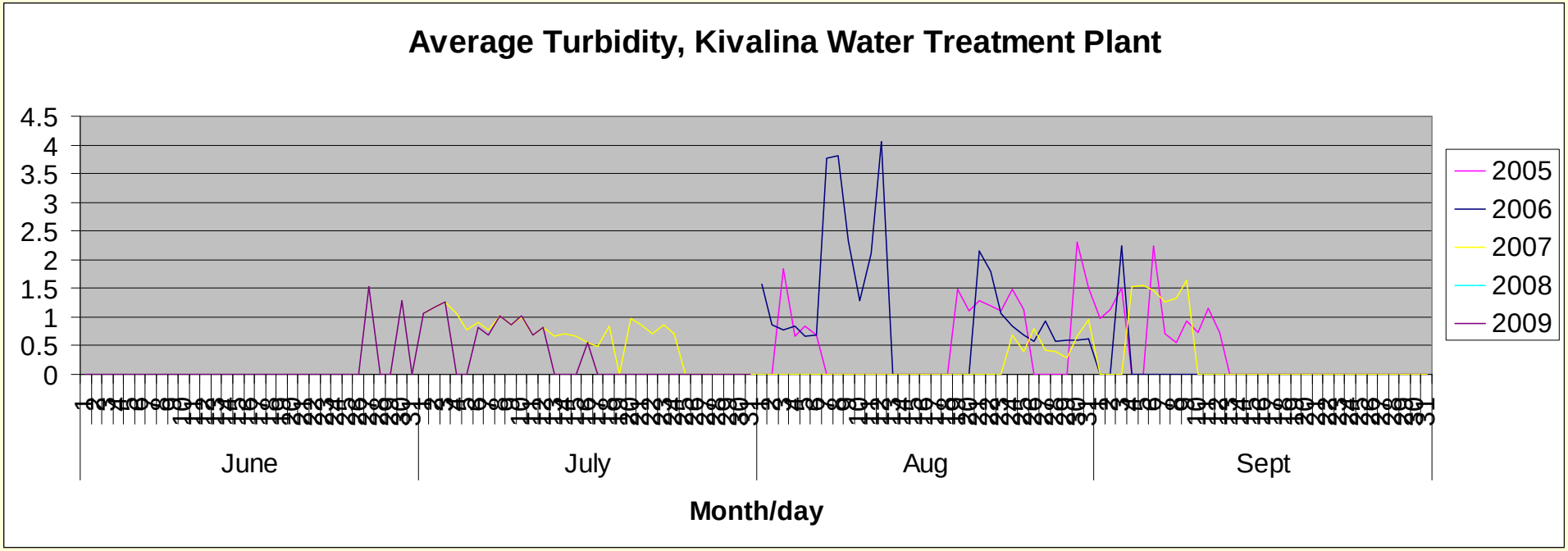

Filter Changes/Day - July 2007 and July 2008
Point Hope, Alaska
2007
2008
60
50
40
30
20
10
0
1st
2nd
3rd
4th
5th
6th
7th
8th
9th
10th
11th
12th
13th
14th
15th
16th
17th
18th
19th
20th
21st
22nd
23rd
24th
25th
26th
27th
28th
29th
30th
31st

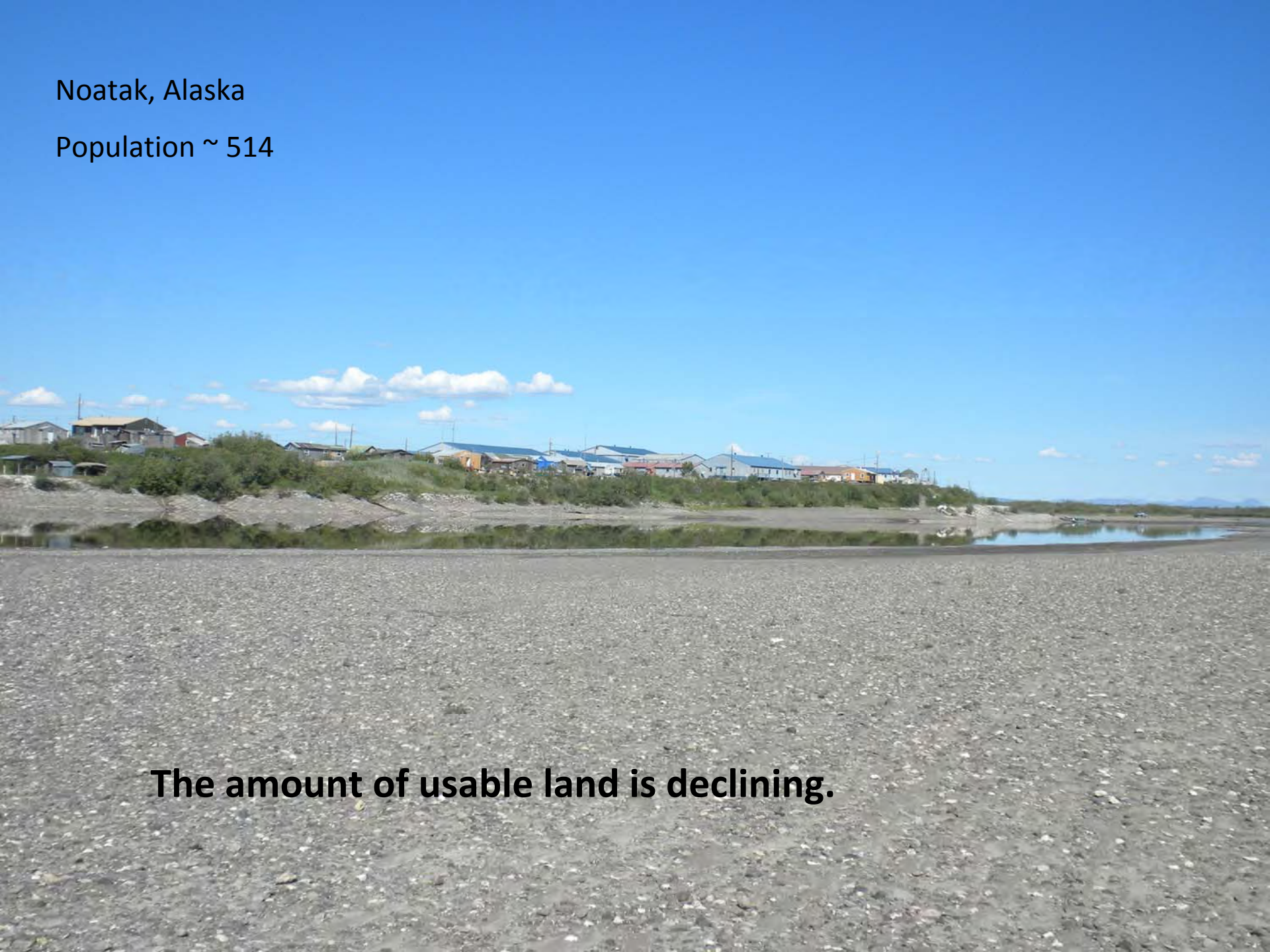
Kivalina, Alaska
Population ~374
The land is increasingly vulnerable.

Hilda Knox


Kivalina Washeteria
Days Open 2005-2009
250
200
150
100
50
0
days
2005
2006
2007
2008
2009
years
Days Open


Skin Diseases 2003-2009
100
80
60
40
20
0
case codes
2003
2004
2005
2006
2007
2008
2009
year
Mens
Womens


Average Turbidity, Kivalina Water Treatment Plant
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
June
July
Aug
Sept
Month/day
2005
2006
2007
2008
2009


Noatak, Alaska
Population ~ 514
The amount of usable land is declining.

Kiana, Alaska
Population ~ 361
The land is increasingly fragile.

Selawik, Alaska
Population ~829
Resilience requires comprehensive and coordinated planning.

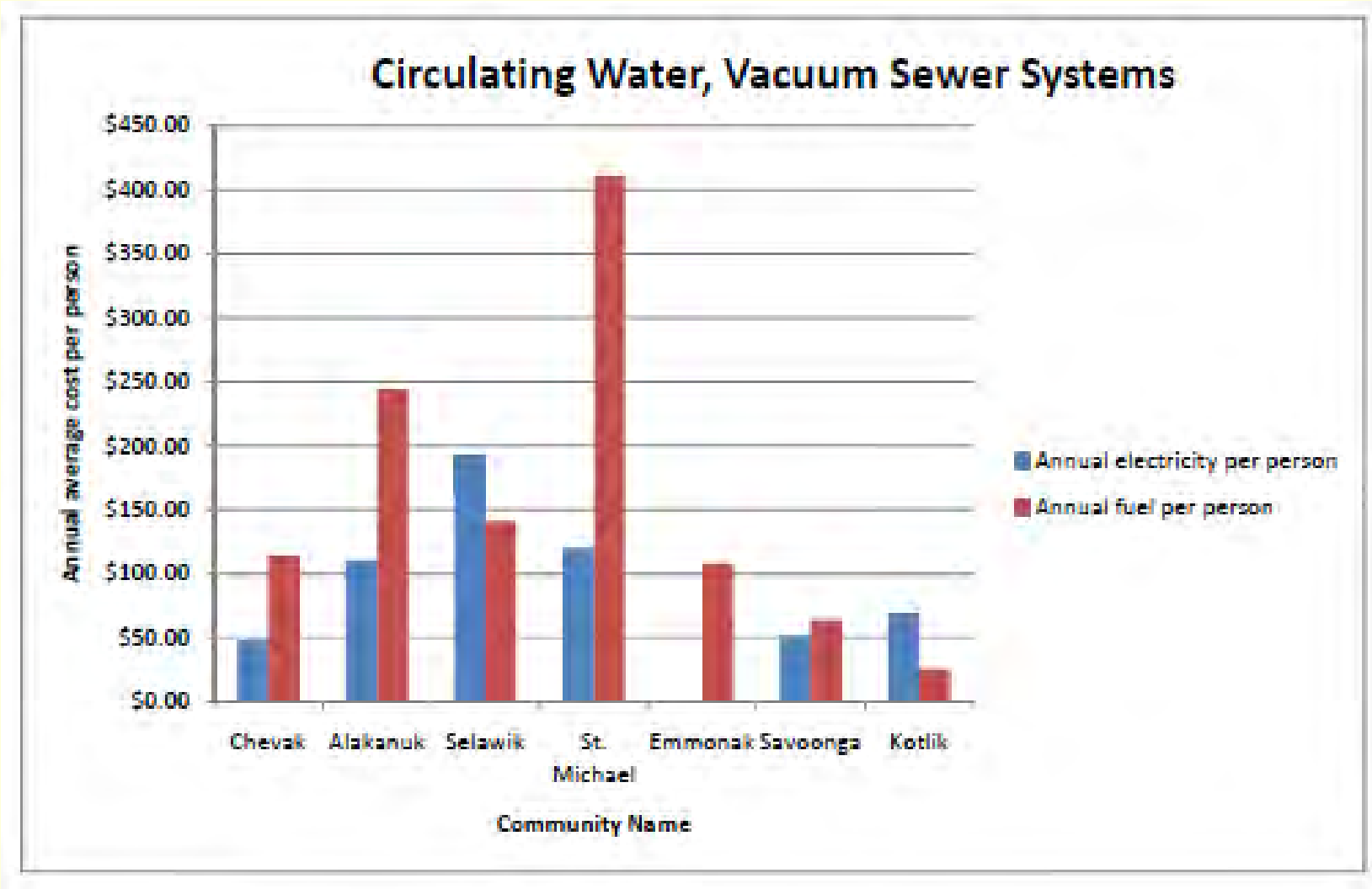
Alice Smith

Margaret McCaslin

Lawrence Larkin

~200 meters
2004
2006
2007
2008
2009

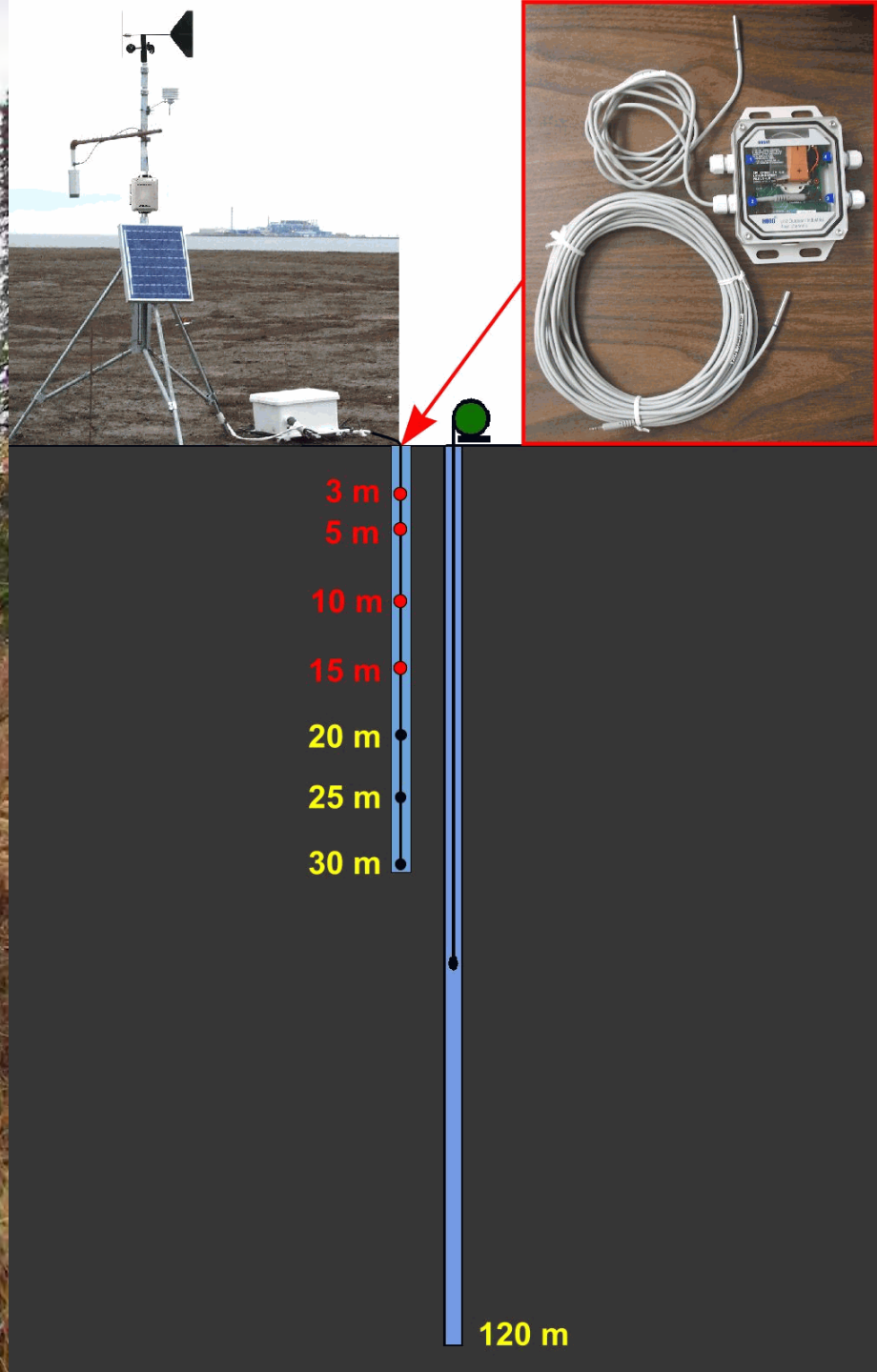
105



Bills as high as as $500 / month have been experienced by some households.

ANTHC has received funding to address glycol problems utility energy issues in Selawik.

BEAUFORT SEA
CHUKCHI SEA
Kivalina
Noatak
Norton Sound
Kiana
Selawik
Diomede
Wales
Teller
Deering
Buckland
Hughes
Brevig Mission
Huslia
Venetie
Chalkyitsik
Fort Yukon
Golovin
Kuskokwim Bay
Stebbins
Emmonak
Saint Michael
Alakanuk
McGraph
Aniak
Gulkana
Atmautluak
BERING SEA
Quinhagak
Cook Inlet
Gulf of Alaska
Bristol Bay
Nelson Lagoon
Chignik Lagoon
Vulnerable Water Systems
ADEC/Tetra Tech
ANTHC


3 m
5 m
10 m
15 m
20 m
25 m
30 m
120 m

Design Engineering Parameters: Historic and Projected due to Climate Change Impact

Name of Village	Current Population (DEC)	Location (DEC Web)		Historic Temperature (°F) (Average 1961-1990)			Projected (2031-2040) Temperature (°F) (SNAP)			Historic Precipitation (in) (SNAP: 1961-1990)	Projected (2031-2040) Precipitation (in) (SNAP)	Historic Freezing Index	Adjusted (2031-2040) Freezing Index	Historic Thawing Index	Adjusted (2031-2040) Thawing Index
		Lat (N)	Lon (W)	Min (ICCP)	Max (SNAP)	Ave (ICCP)	Min	Max	Ave						
Ambler	259	67.086110°	-157.851390°	-52.0	82.0	23.0	-48.6	83.9	24.1	22.3	25.2	5657	5463	2933	3113
Buckland	458	65.979720°	-161.123060°	-49.0	86.0	22.0	-45.8	88.0	23.1	13.2	16.1	6456	6229	2668	2842
Deering	133	66.074970°	-162.712740°	-45.0	75.0	23.0	-42.1	76.7	24.1	10.2	12.8	6826	6371	1901	1950
Kiana	383	66.975000°	-160.422780°	-52.0	77.0	23.0	-48.5	78.8	24.1	14.7	17.5	6051	5836	2753	2937
Kivalina	406	67.726940°	-164.533330°	-51.0	80.0	22.0	-47.5	81.7	23.1	8.6	10.5	6962	6516	1827	1870
Kobuk	109	66.908570°	-156.881020°	-54.0	82.0	25.0	-50.5	83.9	26.2	16.8	19.8	5657	5452	2933	3113
Kotzebue	3126	66.898280°	-162.595850°	-44.0	84.0	21.0	-41.1	85.8	22.0	9.1	11.7	6659	6198	2465	2517
Noatak	512	67.571110°	-162.965280°	-49.0	91.0	26.0	-45.6	92.8	27.3	12.4	14.9	6489	5953	3745	3917
Noorvik	642	66.838330°	-161.032780°	-52.0	77.0	23.0	-48.5	78.8	24.1	12.2	14.9	6297	6129	2753	2929
Selawik	846	66.603890°	-160.006940°	-47.0	77.0	22.5	-43.9	78.8	23.6	15.8	18.7	6487	6244	2753	2937
Shungnak	272	66.888060°	-157.136390°	-54.0	82.0	25.0	-50.5	83.9	26.2	17.1	20.0	5657	5457	2933	3113
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

The take home

1. Permafrost thaw and erosion are leading threats to infrastructure.
2. Some infrastructure is operating outside of it's design parameters.
3. New guidelines on design parameters and best practices is needed.
4. Monitoring is needed to address problems before catastrophic failures.
5. Greater capacity to ensure compatibility between systems is needed.

Thank You!

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