Alaska DOT&PF Adaptation to Climate Change
AASHTO Green Streets Conference

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Public Infrastructure and Climate Change – ADOT/PF

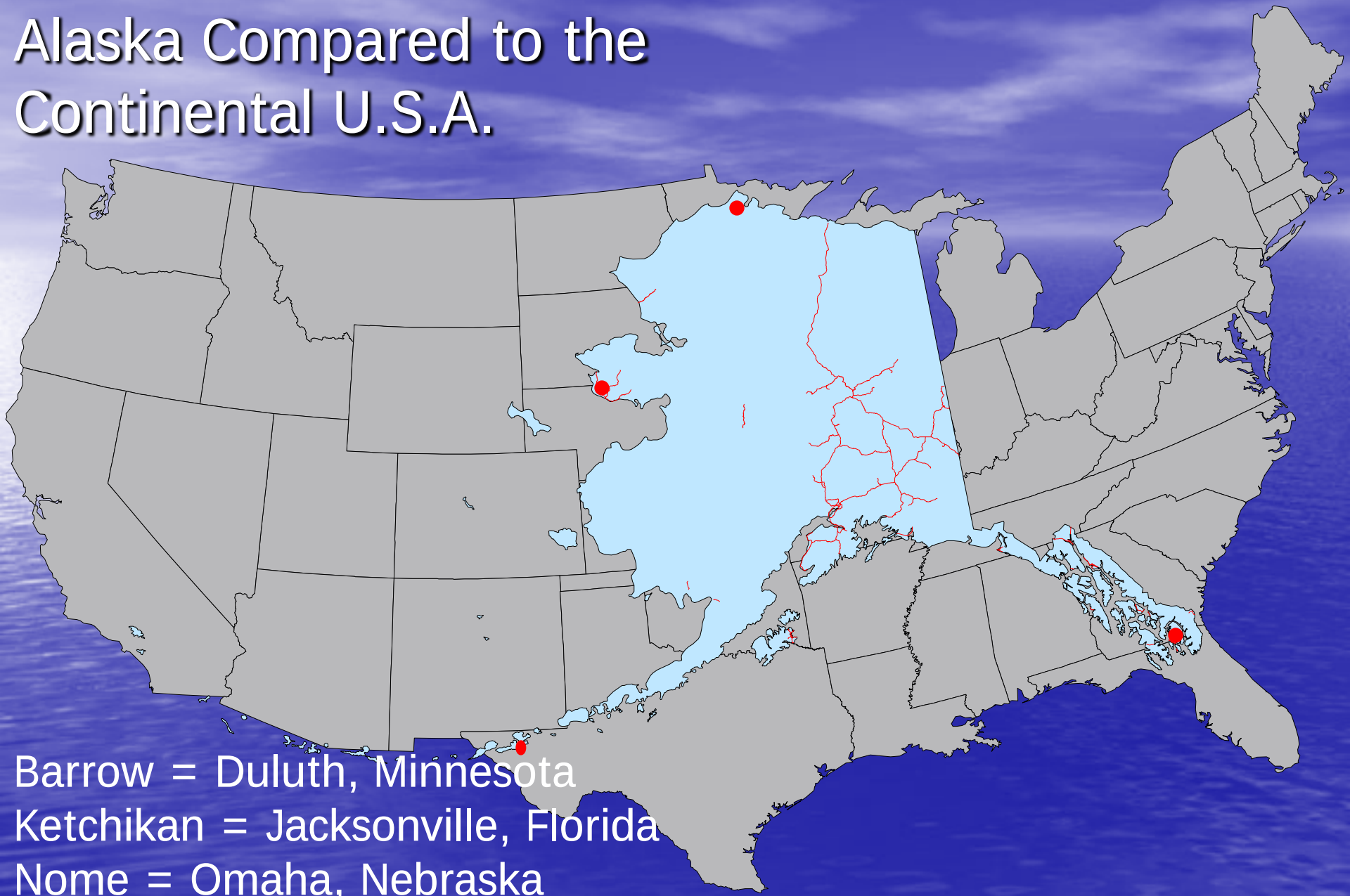
- The Department of Transportation and Public Facilities (DOT&PF) manages the State's transportation infrastructure in a very challenging environment

- Many facilities in the Alaska's interior, northern, and southwest regions are underlain by ice-rich permafrost

Alaska Department of Transportation and Public Facilities

- Over 14,000 Miles of Public Roadway
- Over 5,600 Miles of State owned road
- 845 Bridges
- 257 Rural Airports
- 28 Harbors
- 720 Buildings (DOT owned or managed)

Alaska Compared to the Continental U.S.A.



Barrow = Duluth, Minnesota
Ketchikan = Jacksonville, Florida
Nome = Omaha, Nebraska
Akutan = El Paso, Texas

Potential Climate Change Impacts

- Melting/Warming permafrost
- Increased storm frequencies and intensity
- Increased Coastal erosion due to lack of sea-ice
- Increased river and shore erosion
- Sea-level rise
- Increasing temperatures

Nome-Council Road

Copper River Highway

Climate Change Impacts

- **Loss of the subsistence way of life**

Potential Impacts to Infrastructure
Melting/Warming Permafrost

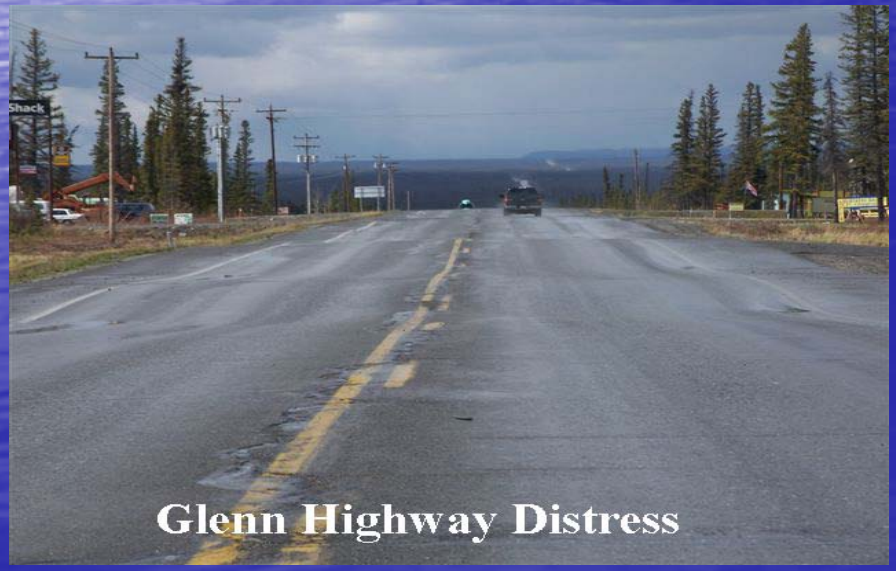
- Current estimate is the Northern Region M&O spends approximately $10+ million annually due to melting permafrost
- This represents a fraction of the need
- Costs will increase if warming trend continues

Tok Cutoff Highway

Potential Impacts to Infrastructure Melting/Warming Permafrost

- Increased highway and airport surface distress
- Increased Active Layer Detachments (slope sloughing and failures)
- Embankments built over permafrost will need to be thicker to prevent the underlying ground from thawing
- Public buildings may require relocation/ reconstruction if their foundations thaw

Permafrost Problems



Longitudinal Shoulder Cracking

Thaw Settlement

Ice-Rich Permafrost Thawing

Ice-Rich Permafrost Thawing

Potential Impacts to Infrastructure Increased Storm Frequencies and Intensities

- Changes in timing, frequency, form and/or intensity of precipitation may cause related and increasing natural processes, including:
  - Debris flows
  - Avalanches
  - Floods
- Significantly increases M&O costs

Potential Impacts to Infrastructure Increased Storm Frequencies and Intensities

- Coastal communities and their infrastructure are vulnerable to accelerated coastal erosion due to storm activity and wave action eroding shorelines once protected by shore-fast sea ice

Potential Impacts to Infrastructure
Loss of Shore-fast Sea Ice

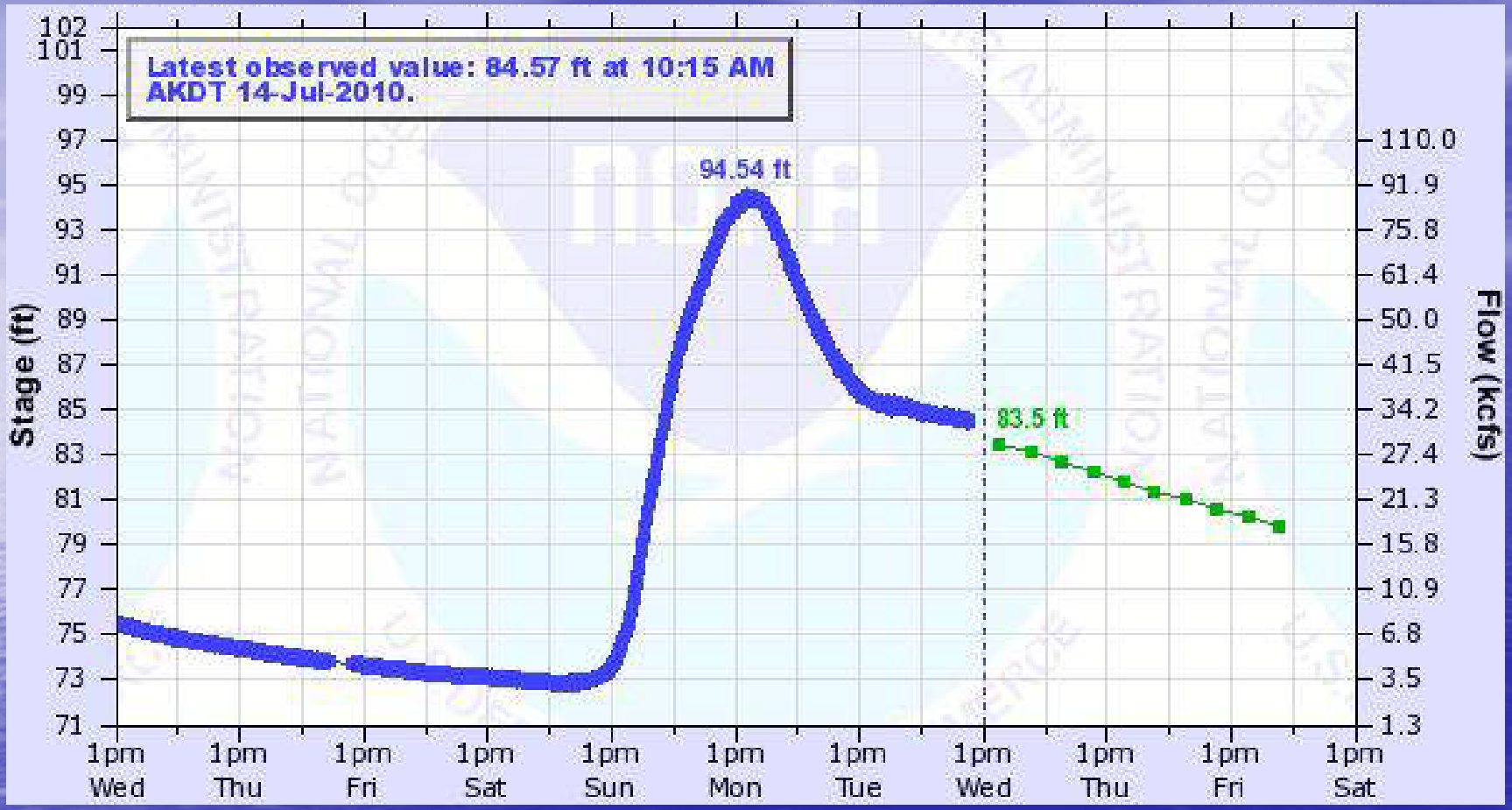
Open Water Jan 2007

Open Water Feb 2006

Potential Impacts to Infrastructure
Loss of Shore-fast Sea Ice

- Erosion rate: These two photos were taken 2 hours apart, note the ATV tracks in the road (note the 55 gallon barrel). This road no longer exists.
- In 1997, Shishmaref lost 125 feet of beach in a single storm

Flooding



Taylor Highway Flood – Forty Mile River

River stage rose 21.5 FEET in approx 30 hours – affected 100 miles of hwy.
$10M in emergency repairs.

Potential Impacts to Infrastructure

General Warming Trend

A longer seasonal transition period from fall to winter and winter to spring may require a different and potentially more costly approach to snow and ice control

Potential Impacts to Infrastructure

General Warming Trend

- Warming temperatures are altering the blend of vegetative growth on the North Slope of Alaska
- Increasing temperatures will allow a variety of invasive plants and insects to prosper in Alaska

What is ADOT & PF Doing Now

- **Shoreline Protection**
- **Relocation**
- **Evacuation Routes/Shelters**
- **Drainage Improvements**
- **Permafrost Protection**

Alaska Communities at Risk

- The USACE has identified over 180 communities that are threatened by erosion

Six Communities in Jeopardy

- Kivalina*
- Shishmaref*
- Newtok*
- Unalakleet
- Koyukuk
- Shaktoolik

* Have already begun relocation plans

Administrative Order 238

14 September 2007

Established Alaska Climate Change Sub-Cabinet

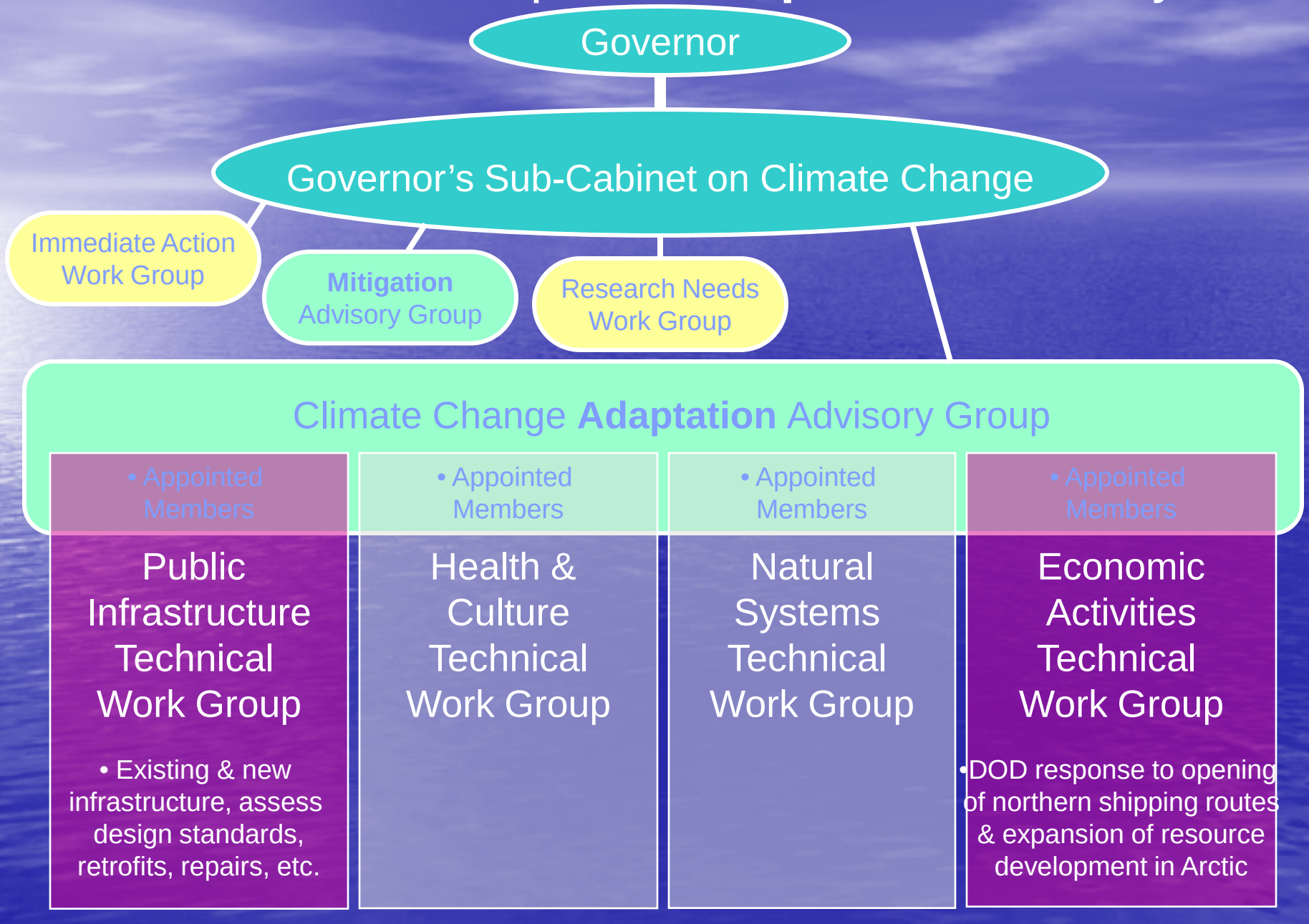
- Alaska Climate Change Strategy
  - Adaptation, Mitigation, & Research Needs
- Quick Action
  - Immediate Action Workgroup
    - A Model for Working with Communities through Interagency Partnership and Meaningful Local Involvement

Immediate Action Workgroup

IAWG Mission

To close a planning and execution gap identified by Governor Palin and the Congressional delegation by creating a unifying mechanism to assist the communities of Newtok, Shishmaref, Kivalina, Koyukuk, Unalakleet, and Shaktoolik . These communities face imminent threats of loss of life, loss of infrastructure, loss of public and private property, or health epidemics caused by coastal erosion, thawing permafrost and flooding.

Technical Work Groups for **Adaptation** Advisory Group



Components of the Alaska Climate Change Strategy

Overview of Public Infrastructure

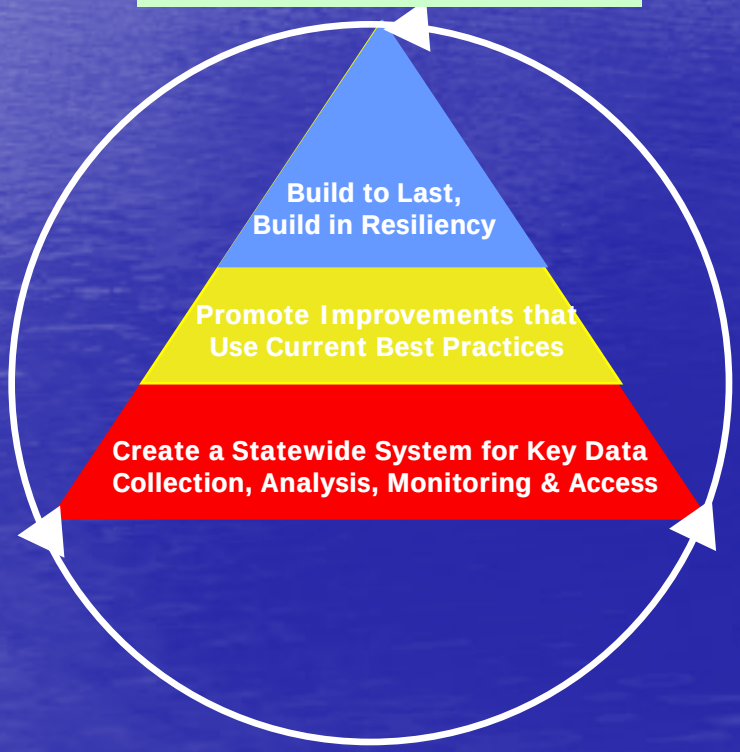
Policy Recommendations:

- Create a Coordinated and Accessible Statewide System for Key Data Collection, Analysis, and Monitoring
- Promote Improvements that Use the Current Best Practices
- Build to Last; Build Resiliency into Alaska's Public Infrastructure

Components of the Alaska Climate Change Strategy

The recommended adaptation options are designed as an integrated system. The three policies (in the triangle) build upon and support one another. Process of continued, routine communication and feedback is essential to adapt and refine actions taken over time.

Sustainable Infrastructure That supports communities In an uncertain environment



Performance Feedback

Integrated Coordinated Decision making

Updated key data analysis, aligned research and modeling outcomes

Components of the Alaska Climate Change Strategy

- **Adaptive Capacity for Existing Infrastructure is Low**

  -Public infrastructure is fixed, doesn't lend itself well to revised alignment, elevation, or structural foundation.

  -When modification is possible it is typically very expensive.

- **New Construction Provides More Opportunity to Incorporate Adaptive Techniques**

  -High potential for adaptive capacity in new infrastructure and construction through planning for projected climatic changes and updated design and siting.

  -However, these techniques increase project cost.

Thank You

Presented by Lars Gregovich, for
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Mendenhall Glacier - Juneau

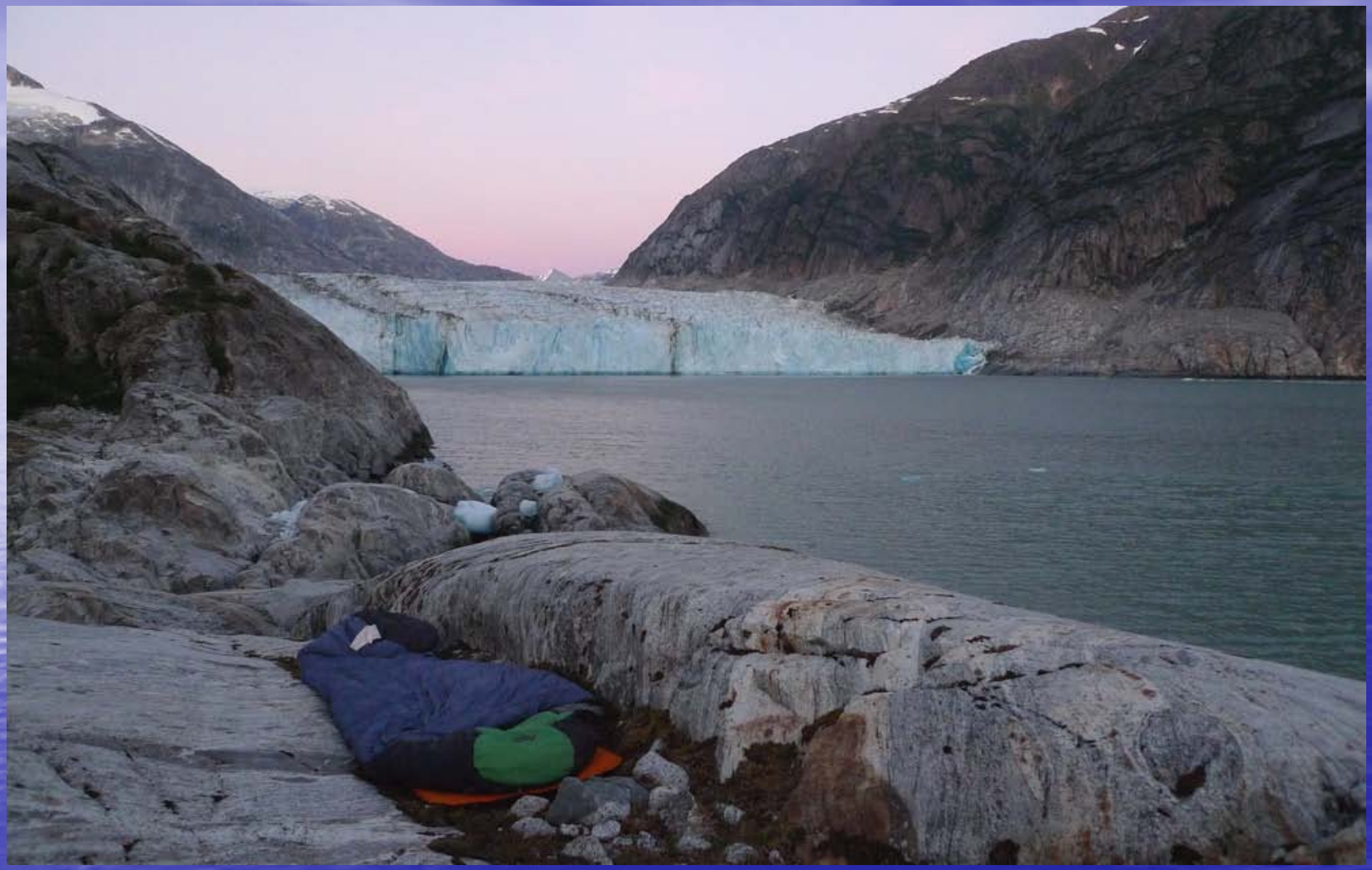
Juneau Icefield Research Station

Dawes Glacier

Endicott Arm

Face of Dawes Glacier

Endicott Arm



Camping at Dawes Glacier