Alaska's Climate Change Strategy

Public Infrastructure and Climate Change

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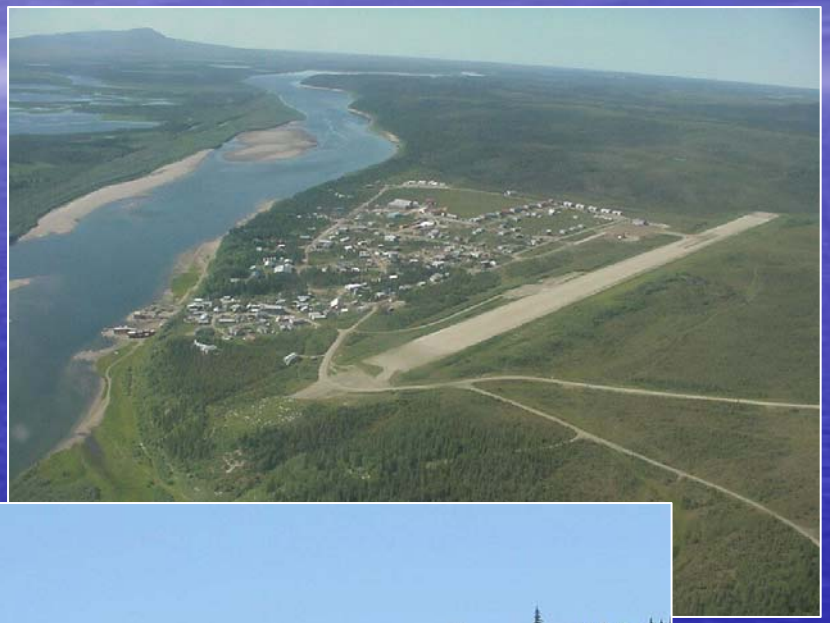
Public Infrastructure and Climate Change – ADOT/PF

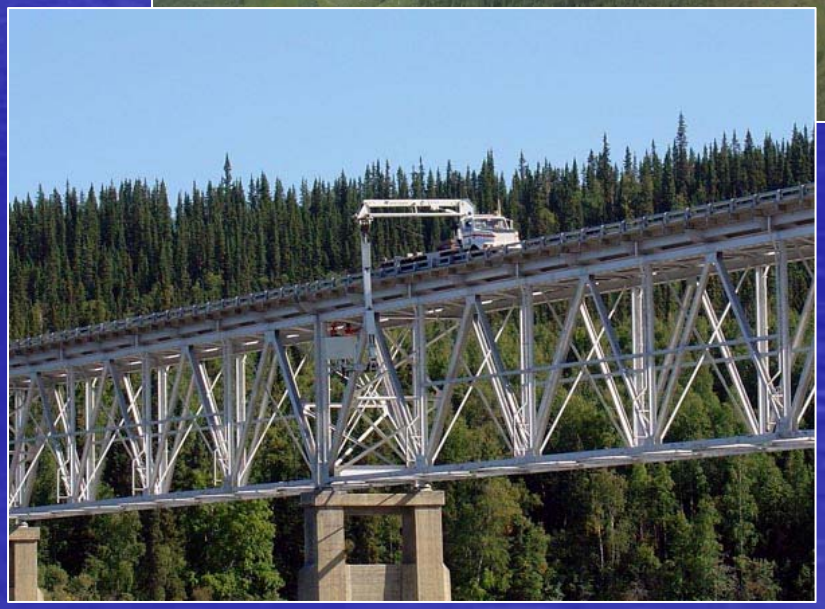
- The Department of Transportation and Public Facilities (DOT&PF) manages the State's transportation infrastructure in a very challenging environment

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

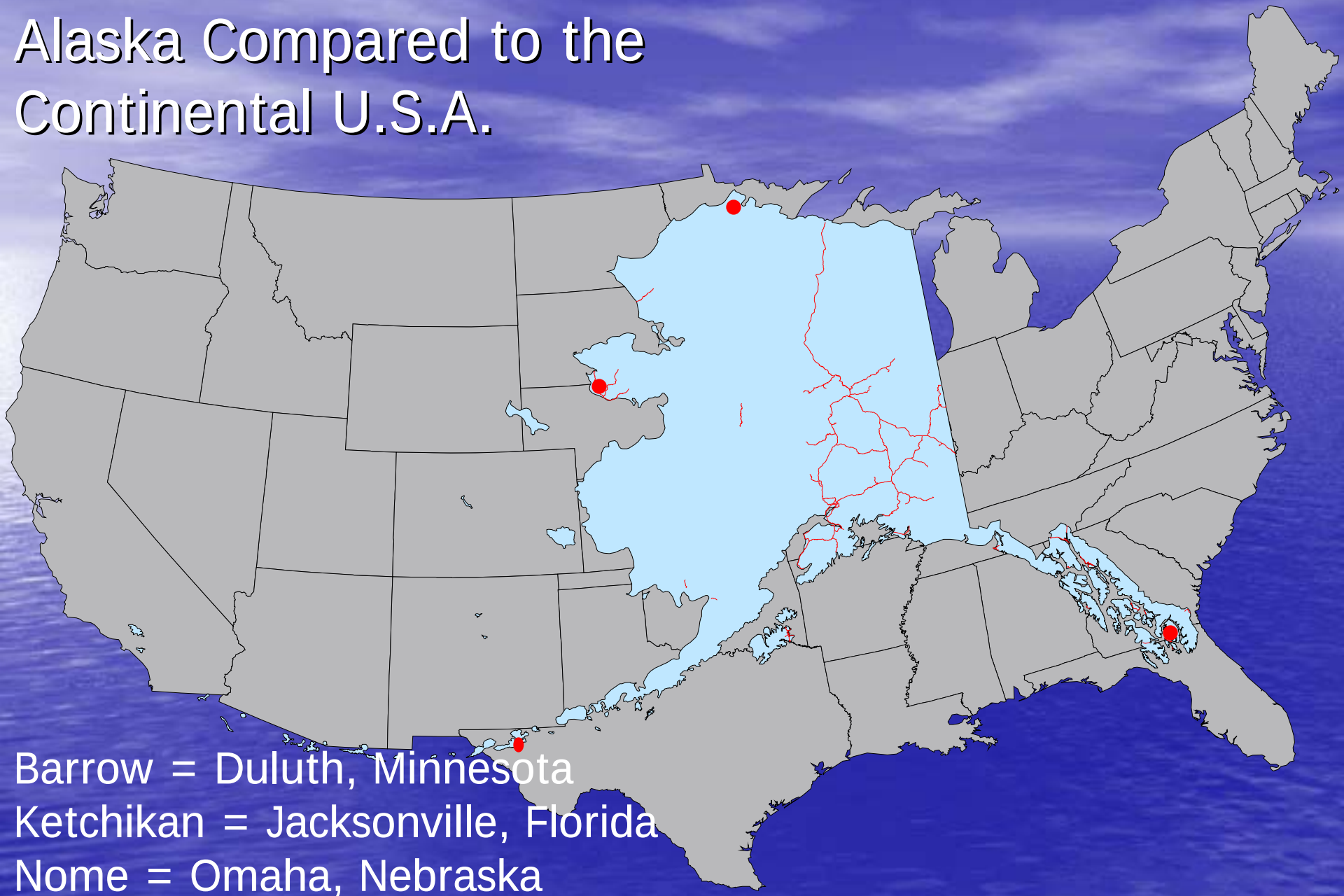
Alaska Department of Transportation and Public Facilities

- 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

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

Flooding

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

- The continued warming trend will likely result in the increase in erosion of shorelines and riverbanks which will impact any facility constructed adjacent to the waterbody
- Aufeis problems will likely increase as melt water flows out of warming zones of permafrost, requiring additional maintenance

Potential Impacts to Infrastructure

General Warming Trend -Aufeis

Potential Impacts to Infrastructure

General Warming Trend

- An increase in the frequency and severity of hot days could result in more highway and airport problems related to asphalt softening and traffic-related pavement damage and rutting
- Milder winters, with more freeze-thaw cycles, would accelerate road deterioration and increase maintenance costs

Potential Impacts to Infrastructure

General Warming Trend

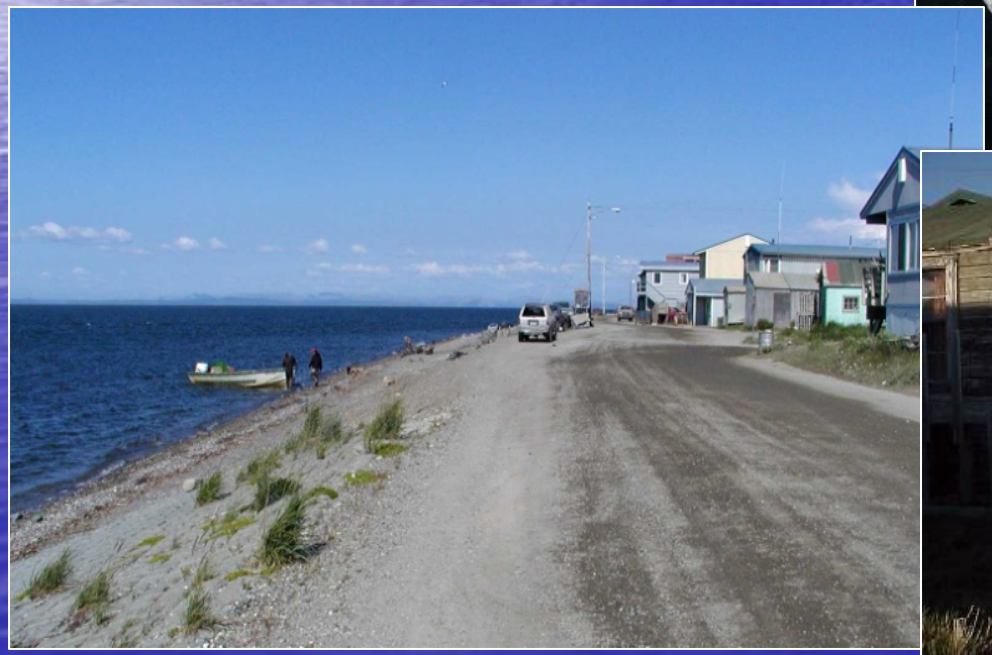
- Warming temperatures are altering the blend of vegetative growth on the North Slope of Alaska
- Increasing temperatures will allow a variety of invasive plants and insects to prosper in Alaska

What is ADOT & PF Doing Now

- Shoreline Protection
- Relocation
- Evacuation Routes/Shelters
- Flood Mitigation
- Drainage Improvements
- Permafrost Protection

Kotzebue Shore Avenue (FHWA)

- FHWA funded project to construct approximately 3400 lineal feet of sheet pile and 1000 feet of rip-rap erosion protection
- Includes Ice Protection



Kivalina

What is DOT & PF Doing Now Shoreline Protection Kivalina Airport (FEMA)

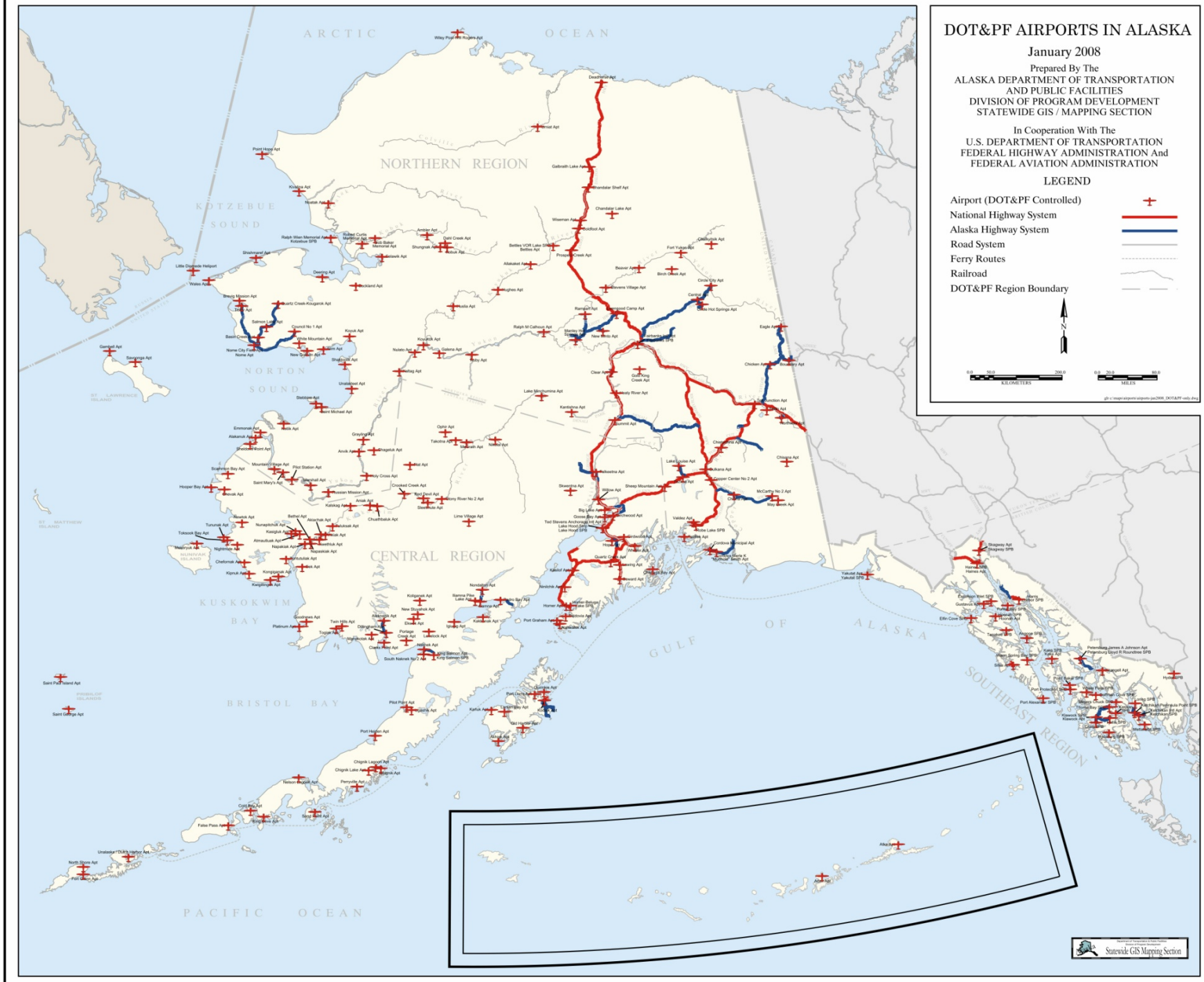
- Placed supersacks on the coastal side of airport property to protect the taxiway after sea storm
- Developing a more permanent fix that may include a dynamically stable beach

Koyukuk Airport Improvements

- Airport project completed in 2006
- Lengthened and widened runway.
- Raised grade above the 100 year flood levels
- Total Cost: $9.2 M

Alaska Communities at Risk

- The USACE has identified over 178 communities that are threatened by erosion


DOT&PF AIRPORTS IN ALASKA
January 2008
Prepared By The
ALASKA DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES
DIVISION OF PROGRAM DEVELOPMENT
STATEWIDE GIS / MAPPING SECTION
In Cooperation With The
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION And
FEDERAL AVIATION ADMINISTRATION
LEGEND
Airport (DOT&PF Controlled)
National Highway System
Alaska Highway System
Road System
Ferry Routes
Railroad
DOT&PF Region Boundary
N
KILOMETERS
MILES
ARCTIC OCEAN
NORTHERN REGION
KOTZEBUE SOUND
NORTON SOUND
CENTRAL REGION
KUSKOKWIM BAY
BRISTOL BAY
GULF OF ALASKA
SOUTHEAST REGION
PACIFIC OCEAN
Statewide GIS Mapping Section

Six Communities in Jeopardy

- Kivalina*
- Shishmaref*
- Newtok*

- Unalakleet
- Koyukuk
- Shaktoolik

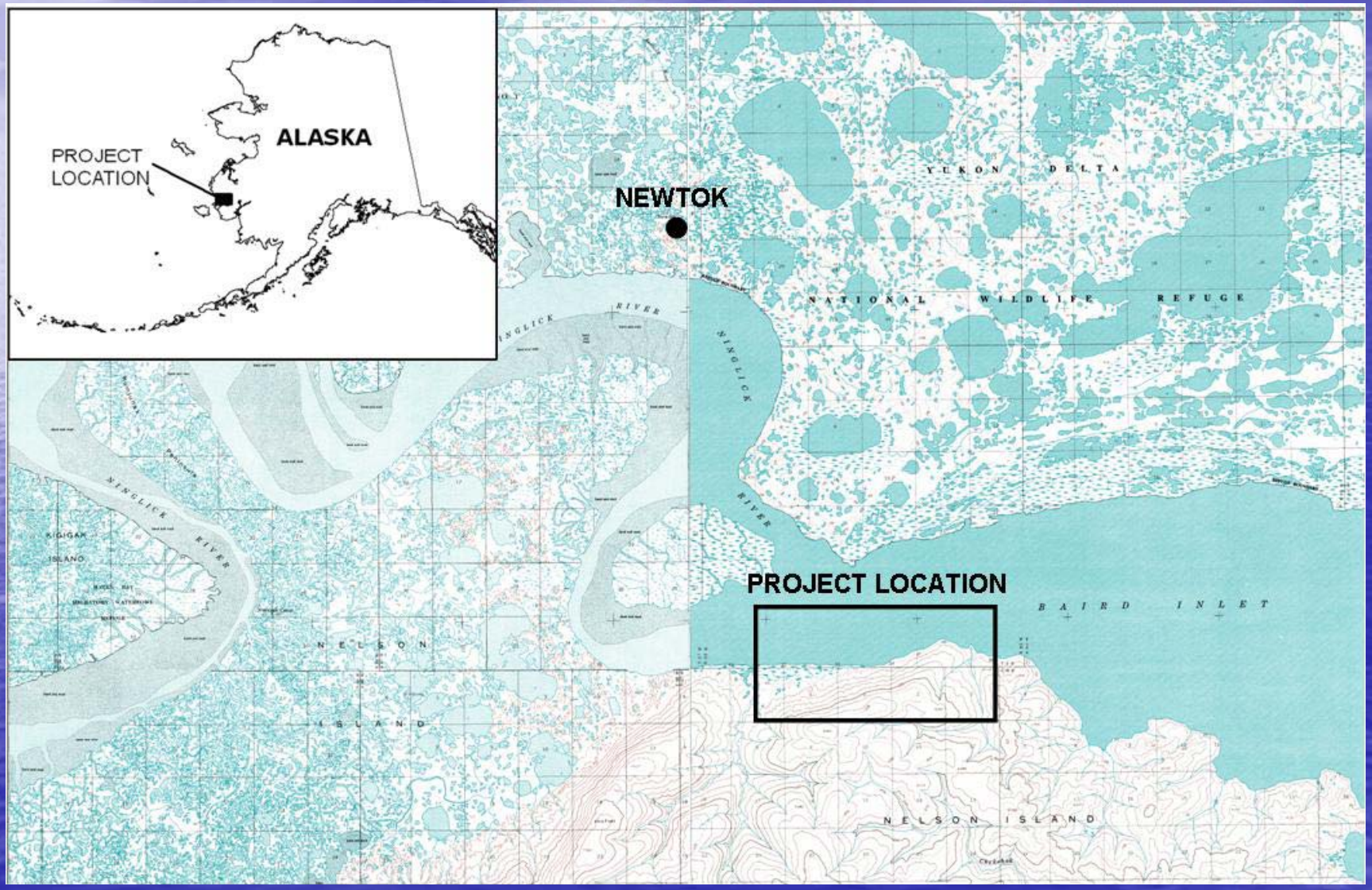
* Have already begun relocation plans

Newtok Relocation

Newtok Example

- Map Showing Erosion:
  - Shoreline in 1954
  - The dump site and the barge landing have already eroded away.
  - **First houses will be impacted by erosion between 2012 and 2017.**

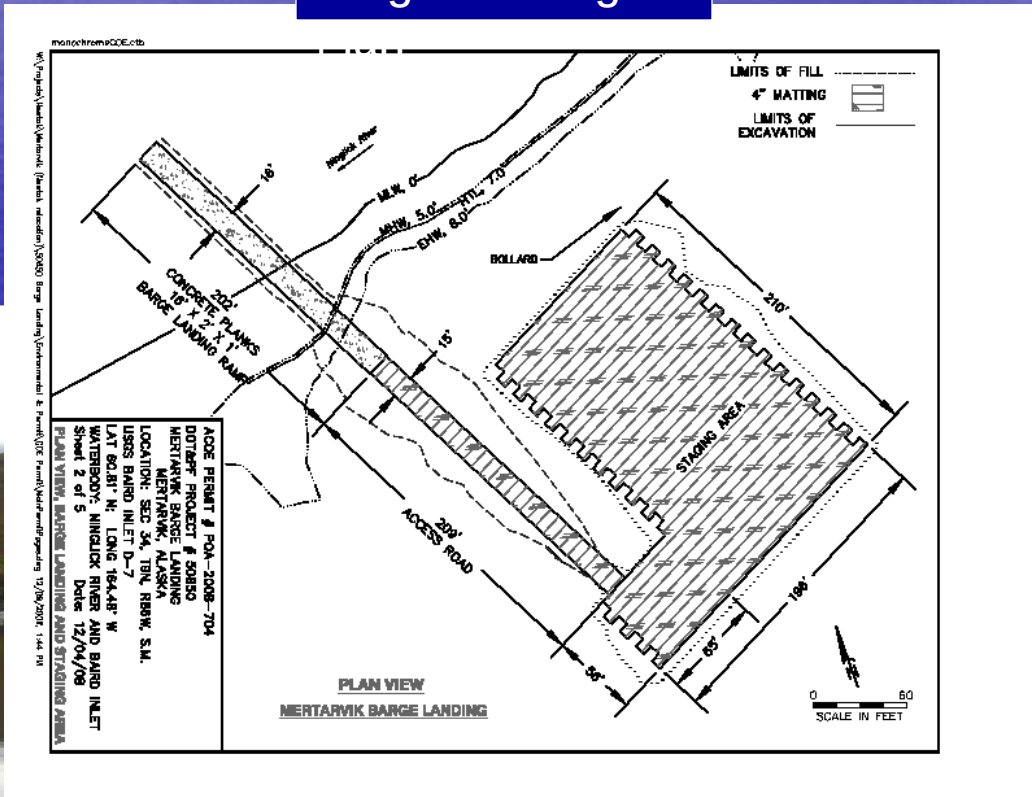
Relocation to Mertarvik



Mertarvik Barge Facility

Barge Landing Site

Barge Landing



Relocated Buildings

Potential DOT Adaptation Strategies

- Revising Design Criteria
  - Hydraulic analyses – coastal and stream
    - Re-sizing culverts, rip rap, and bridge spans
  - Embankment fills
    - Keep permafrost frozen using
      - Deeper fills
      - Creating air flow to promote heat exchange
  - Building foundations
    - More passive and active refrigeration
    - Insulation with embankment fill or thermal materials

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
    - Co-chaired by: Alaska Department of Commerce, Community and Economic Development & U.S. Army Corps of Engineers
    - Community Participation

Immediate Action Workgroup

Focusing on Alaska's most At-risk Communities

- Delivered
  - Report on Immediate Needs (12-18 months)
  - State approved $10.6M funding
  - Feds approved $40M additional funding
- Next Steps
  - Successor to the IAWG began meeting Aug '08 (Final Report just issued)
  - Continue to Leverage Funding & Resources
  - Refine needs assessments

ADAPTATION

Technical Work Groups for **Adaptation** Advisory Group

Governor Palin

Governor's Sub-Cabinet on Climate Change

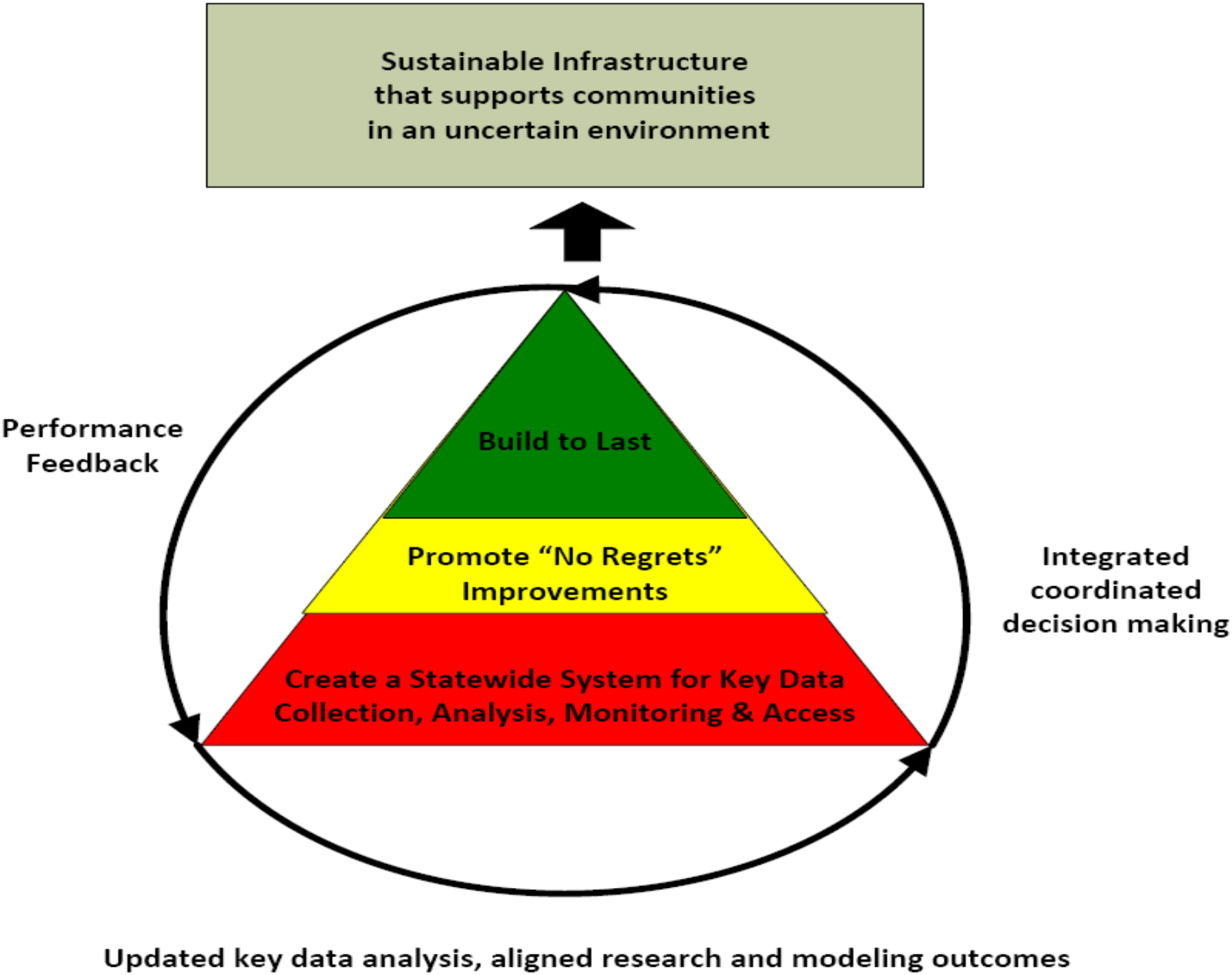
Immediate Action Work Group

Mitigation Advisory Group

Research Needs Work Group

Climate Change **Adaptation** Advisory Group

• Appointed Members	• Appointed Members	• Appointed Members	• Appointed Members
Public Infrastructure Technical Work Group • Existing & new infrastructure, assess design standards, retrofits, repairs, etc.	Health & Culture Technical Work Group	Natural Systems Technical Work Group	Economic Activities Technical Work Group •DOD response to opening of northern shipping routes & expansion of resource development in Arctic


Sustainable Infrastructure
that supports communities
in an uncertain environment
Performance
Feedback
Build to Last
Promote "No Regrets"
Improvements
Create a Statewide System for Key Data
Collection, Analysis, Monitoring & Access
Integrated
coordinated
decision making
Updated key data analysis, aligned research and modeling outcomes

Thank You

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