

## Appendix I. Common Themes Across Sectors

### Recommended Adaptation Options

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## Common Theme #1: Establish an Alaska Climate Change Knowledge Network (ACCKN)

### Recommended Option

Establish an Alaska Climate Change Knowledge Network (ACCKN) to foster coordination among the various entities with responsibilities for collecting, interpreting, and using climate change data in Alaska. The ACCKN will leverage current efforts to facilitate the following functions:

- Organize, archive when needed, and inventory data and other resources pertinent to understanding climate change and its effects in Alaska.
- Promote enhanced online access to the above data, information, and knowledge in ways that facilitate use.
- Identify and communicate (to data and information providers) the needs of communities for information to understand and plan for climate change.
- Share information on specific geographic areas of concern such as the Arctic and on specific thematic issues or trends of concern such as ocean acidification.
- Incorporate community and other entities' (e.g., the private sector, non-profit, and citizen science efforts) data, information, and knowledge about the effects of climate change and feedback on adaptation efforts.
- Integrate and analyze data and information for better understanding of climate change impacts and effects, including identifying gaps where additional data may be needed
- Provide a point of coordination with federal efforts in Alaska such as National Oceanic and Atmospheric Administration's (NOAA) activities to develop a Regional Climate Service partnership and U.S. Geological Survey (USGS) activities related to their Alaska Science Center.

### Option Description

#### Issue

Numerous activities are underway to collect data relevant to climate change in Alaska, within state agencies, among Alaskan research institutes, in the private sector, at the federal level, within not-for-profit and international organizations, and within Alaskan communities. Some of the existing data are maintained in online archives, others are stored in file cabinets or boxes. There is no easy way to access and integrate these climate-change data sets, research, and project information. Additionally, numerous forums, meetings, and events take place that generate information, knowledge, and ideas among the participants. Significant knowledge exists in these contexts, but awareness of its existence is limited and accessing and using the information is challenging and does not facilitate use. Most Alaskan communities and businesses have very little understanding of the recent and projected environmental and ecological changes they are experiencing and the approaches needed to adapt. Further, most state and federal agencies responsible for planning and managing both natural resources and built/human capital are not sufficiently informed about climate-change research and predictions to make good decisions regarding strategies to adapt to climate change. Finally, the information available is often not in a user-friendly form that meets the planning needs of communities, agencies, businesses, Non-Governmental Organizations (NGOs) and other entities.

#### Overview

There is a need to promote more effective organization of climate-change data and information and means to use the information in Alaska. This requires technology and data management approaches, as well as coordination and collaboration among agencies, organizations, and entities with data collection and management

responsibilities. Current entities with some component of climate-change data collection, data management, policy, and/or research responsibilities include:

- Alaska Marine Ecosystem Forum
- State-Federal Climate Change Executive Roundtable
- Alaska Ocean Observing System – AOOS (Alaska Marine Information System for Ocean and Coastal Information)
- Scenarios Network for Alaska Planning - SNAP
- Alaska Center for Climate Assessment and Policy - ACCAP
- Alaska Climate Research Center - ACRC
- Governor’s Sub-Cabinet on Climate Change
- North Pacific Research Board - NPRB
- National Oceanic and Atmospheric Administration - NOAA
- USGS Alaska Science Center
- Alaska SeaLife Center
- Geographic Information Network of Alaska - GINA
- Office of the State Climatologist

The ACCKN will provide this needed coordination. It will be supported by a staff that organizes and coordinates access to existing archives of data on climate change, promotes sharing of data and knowledge among experts and those in need of information, provides means to link data, identifies gaps in data and information, improves access to data that are currently difficult to locate, and provides access to tools and models that support the use of data accessible through the ACCKN. The staff will bring expertise in both technology to support the infrastructure of the ACCKN and science to analyze and understand the content.

The ACCKN will support the online, distributed management of numerous information resources via a Web portal. Resources will include archived climate data, climate projections, maps of climate and Arctic conditions and changes, research on climate-change effects, data on current environmental conditions (including data for which archives may not currently exist), policies, forums, workshops, adaptation tools, technical assistance opportunities, community knowledge, etc. The ACCKN will not be responsible for new data collection, but will organize and facilitate access to data from existing sources and assist in identifying and prioritizing gaps in data and potential sources of funding to address those gaps.

Users of and participants in ACCKN will likely include scientists, federal, state, and local government agency representatives; the private sector; academics; community members; the media; and non-governmental organizations.

## Option Design

### Structure

Central to this option is the establishment of a focal point for organizing and disseminating information relative to the various state, national, and international entities and forums on climate change. It is expected that this focal point will consist of a staff that performs a coordination function among various data collection efforts and climate change events (e.g., maintain a directory of contacts and calendar) and that develops and maintains an on-line portal to facilitate knowledge sharing. This staff, which may be established at a state-university funded site, an NGO, within an existing agency, will also assist in the analysis and use of the data. The staff, on behalf of the ACCKN, will have several responsibilities including the following:

1. Maintain a comprehensive inventory of organizations and programs collecting data relevant to climate change in Alaska. Establish means to evolve the inventory to ensure currency and the ability to integrate new efforts.
2. Provide/encourage access to information about climate change and various geographic regions that exist in current programs, offices, and databases as identified on the first page. (This will be a distributed

model, with data residing where they are collected or organized, with tools and standards to promote access.)

3. Provide access to research papers and references for better understanding impacts of and potential responses to climate change.
4. Provide access to an inventory of successful Alaska-relevant climate-change adaptation programs as well as contact information for communities, agencies, NGOs, and businesses that developed these. This will enable stakeholder groups to learn quickly from others that have developed successful climate-change adaptation plans.
5. Provide access to data about Arctic forums and individuals participating in them, results of discussions, and decisions. This will aid participants in understanding and tracking Alaska's views and positions on Arctic concerns. Similarly, support will be provided to address specific thematic issues or concern. (e.g., ocean acidification).
6. Provide a forum to bring together various entities with responsibilities for climate-change data collection to support integration and analysis of data. This includes working with NOAA as they explore development of their regional climate partnerships and Climate Services Initiative.
7. Establish means to address questions of users about climate change issues, including collecting questions and creating a Frequently Asked Questions (FAQ) and Answers file and establishing "chat" rooms/wikis for discussion.
8. Identify gaps in data and information and explore and facilitate potential funding sources to address those gaps.
9. Provide means for communities and individuals with knowledge of local conditions to contribute their data to the ACCKN.
10. Identify areas with a high degree of interest or critical topics where information is lacking and promote means among ACCKN stakeholders to interact on these topics.

#### **Targets/Goals**

A primary goal of the option is to ensure that investments in Alaska in data and information relative to climate change be leveraged to ensure they serve the communities, businesses, and people of Alaska. This includes understanding existing efforts and providing access to the data they produce.

Targets are as follows:

- Secure funding to:
  - conduct a comprehensive inventory of existing efforts, including primary points of contact
  - develop a plan for an approach to organize and coordinate access to relevant climate change data.
- Based on the plan, establish dedicated staffing (based on additional funding) for the ACCKN, as well as commitments from existing centers and data repositories to provide resources to ensure adequate engagement for Network development. Identify and secure funding for staff to support both technical and scientific aspects of managing and promoting use of climate-change data. Staff and participants in the ACCKN will undertake the following:
  - Develop a prototype of a portal/center that will support improved access to the data identified above
  - Establish a portal/center for accessing climate change and Arctic data and research
  - Use the portal to analyze data and provide technical assistance and strategies that improve the ability to respond to a changing climate and address Arctic issues
  - Establish clear measures of performance (e.g., number of users, number of contributors, relevance of information) for the portal and adapt and improve in response to those measures and potentially changing needs

#### **Timing**

**Year 1: Initiate planning and develop partnerships**

- Explore potential options/relationships with NOAA in their consideration of a Regional Climate Center in AK. Consider how the ACCKN can support and leverage current NOAA climate efforts and define the regional component of the National Climate Service (NCS).
- Complete a comprehensive inventory of existing data collection and archival efforts related to climate change and Arctic issues and sources of potential funding and technical assistance for climate-change adaptation.
- Convene groups of interested parties to outline possible approaches and develop a formal plan, identifying needed funding, technical infrastructure requirements, analytical requirements, community support, staffing, and management

**Year 2: Implement the plan**

- Secure funding for staffing
- Develop a prototype for the ACCKN, including partnerships with selected communities, businesses, and NGOs as pilot tests of ACCKN
- Begin integration and provision of data

**Year 3: Provide technical assistance in the integration and use of climate change data to a broad array of stakeholders**

**Years 4 and beyond: Continue to provide online access to and technical assistance in the use of data and information and identify data gaps and potential funding to address the gaps.**

**Parties Involved (in implementation of this option)**

Representatives of the various centers at the University of Alaska, representatives from selected state agencies who are knowledgeable about agency needs and expertise related to climate change, federal agency representatives with responsibilities for collecting data relevant to climate change and Arctic issues (e.g., NOAA, USGS), private sector representatives addressing climate change and Arctic issues, community representatives with knowledge about community needs relative to climate change, and NGOs.

**Evaluation**

Metrics must be established that document effectiveness and utilization of the network; routine user surveys could be conducted.

**Research and Data Needs**

This option suggests a portal for information and knowledge sharing, so no additional research is anticipated before implementation. The operation of ACCKN will, however, identify research gaps in its efforts to provide climate-change information to stakeholders. These research needs will be communicated to research programs and state and federal agencies.

## Implementation Mechanisms

This option can be initiated immediately through cooperative efforts among the stakeholders. Initial funding is needed for an inventory and detailed technical/institutional plan. Funding will support staff or contractor time to conduct the inventory and convene all interested parties. Funding will also support some travel costs for participants. Individuals involved in development of this option anticipate convening over the next several months to determine optimal approaches for management of initial funding (responsible entity and fund distribution). The plan developed as part of this initial phase will outline technical details and possible institutional arrangements to ensure success of the ACCKN. The plan will also identify additional staff and funding needed to support the ACCKN. A core staff of 3-5 people will likely be necessary to support ACCKN needs in the long term. Expanded functioning of the ACCKN would require additional funding support from potential stakeholders and partners, and federal agencies such as NOAA, Environmental Protection Agency (EPA), and the Departments of Energy and Interior; Federal grants, cost recovery (e.g. from industry groups wanting to know about climate factors in designing a new pipeline), and products generated (e.g. climate hazard maps for local governments). Other entities such as the Denali Commission and the North Slope Science Initiative may also play roles to support the ACCKN.

## Related Policies/Programs and Resources

### Related Policies and Programs

This program builds on and integrates the efforts of several entities that address climate change as noted in the Option Description.

### Available Resources

Many entities already have some state funding in place (direct state funding for Subcabinet activities and university funding to SNAP, AOOS, GINA, ACRC, and ACCAP). There is additional federal funding provided by NOAA to AOOS and ACCAP. These funding mechanisms have enabled these entities to develop substantial capacity and expertise but not at a scale or level of coordination sufficient to implement the proposed ACCKN. Funding to launch ACCKN could come from the federal stimulus package to Alaska.

## Feasibility

### Feasibility

This program could be implemented immediately because existing entities have the technical expertise to develop the framework. The major hurdle will be institutional - having staff to help pull together existing entities and identifying who leads, how to coordinate, who participates, how information is managed, how decisions are made, etc. An unresolved issue is how to formalize the State-University-federal and within-University partnership in a way that makes it responsive to state needs but insulates it from short-term political crises and shifts in priorities. NOAA and other federal agencies, NGO, private sector, and community representatives should also be involved.

### Constraints

The structure and function of the proposed NOAA NCS is not yet defined. ACCKN will be developing without a clear model for how it will integrate into the NCS as its Alaskan (and Arctic) regional component.

## Adaptation Benefits and Costs

### Benefits

This option provides numerous benefits for anyone dealing with climate change issues in AK. It will improve the availability of data for decision-making, will provide approaches to involve relevant stakeholders in discussions on data pertinent to climate change and Arctic issues, and could result in more fruitful and coordinated discussions occurring at the community, state, regional, and federal levels. It will also constitute the regional component of the NCS, giving the NCS an existing regional climate partnership to leverage.

### Costs

Estimated costs<sup>1</sup>:

1. Phase 1 (Inventory, Partnerships, Plan): \$150,000
2. Phase 2 (Initiate Plan Implementation): TBD based on Plan and federal agency activities (estimated \$300,000/year for state contribution to ACCKN)
3. Phase 3 (Ongoing Implementation): Estimated \$300,000/year (TBD – based on Plan)

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<sup>1</sup> These are gross estimates based on discussions within the Theme Working Group. Costs beyond initial development of the inventory and plan will be determined based on the plan.

### Status of Group Approval

Approved unanimously, with no objections.

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## Common Theme #2: Coordinate Implementation of Alaska's Efforts to Address Climate Change

This option was developed by the Cross-Cutting Technical Work Group of the Mitigation Advisory Group. The formatting and presentation are slightly different than Adaptation Advisory Group options.

### Policy Description

Responding to climate change and reducing greenhouse gas (GHG) emissions will require a dedicated and coordinated effort. Better coordination can promote efficiencies and effectiveness in the following areas:

Tracking climate change efforts across state agencies in Alaska;  
 Communicating between Alaska's efforts and other efforts (e.g., federal activities);  
 Proactively interacting with and responding to expected federal initiatives on climate change;  
 Providing access to information and education resources; and  
 Improving outreach to citizens and businesses on climate change.

To achieve the above, a coordinating entity is needed. This coordinating entity could be an Alaska Climate Change Coordinating Committee under the Sub-Cabinet or a designated person or office that brings together representatives of state agencies. It is recommended that the Sub-Cabinet ensure coordination of the work already started through the Advisory Committee process. If a committee or lead office is not identified, the Sub-Cabinet should authorize a task force to continue to identify ways to ensure coordination among state agencies, especially on policy and strategy coordination and responses to federal inquiries and reporting requirements. With a strong coordination effort, resources and funding can be identified, secured, and leveraged to further Alaska's climate change policies and goals.

### Policy Design

#### Goals:

Provide focus to state agency efforts as recommendations of the Sub-Cabinet are implemented.  
 Ensure the coordination of state agency development of position papers, guidance documents, policies, procedures, and standards to establish and implement federal and state climate change programs.  
 Provide outreach and consistent information on climate change mitigation technology and regulatory guidance to industry and the public.  
 Ensure the Sub-Cabinet's Climate Change Strategy efforts are coordinated with the Alaska Energy Plan (see CC-4), the Alaska Municipal League, industry, Western Climate Initiative (WCI), and advisory groups working on climate change efforts in Alaska.  
 Provide a primary point of contact for federal agencies addressing climate change in Alaska.

#### Activities

Support a GHG emission reporting program and associated inventories (see CC-1) as mandated by federal or state policies.  
 Develop state government partnerships with private citizens, businesses, and local governments.  
 Promote actions for state agencies to take to address climate change (see CC-3).  
 Provide outreach and access to information by continuing to support the Alaska Climate Change Strategy Web site. (Consider evolution to a portal to provide additional information and functionality as a clearinghouse of climate change information, resources, and education materials among state agencies.)

**Timing:** This coordination effort should be initiated as soon as possible after approval by the Climate Change Sub-Cabinet.

**Parties Involved:** Key to the success of the effort will be identifying and maximizing partnerships within state agencies, and with federal, private, and public programs. The Governor and the Governor's Office, the Office of Management and Budget (OMB), the Climate Change Sub-Cabinet, and representatives of key state departments, including the Alaska Department of Environmental Conservation (DEC), Alaska Department of Fish and Game (ADF&G), Alaska Department of Natural Resources (DNR), and Alaska Department of Commerce, Community, and

Economic Development (DCCED) should be involved. In 2009, the Sub-Cabinet should assess current resources and identify lead staff. Resources and staff should be committed by the end of 2009 to address the coordination goals and activities listed above.

Many groups will be partners and beneficiaries of this coordinating body, including the state legislature, Climate Change Sub-Cabinet, state and federal agencies, Alaska Municipal League, tribes, Alaska Energy Authority (AEA), University of Alaska (UA), state public elementary and secondary schools, communities and local government, and industry.

### **Implementation Mechanisms**

To establish an Alaska Climate Change Coordinating Program, the Sub-Cabinet must provide authorization to an entity to lead the effort. Additionally, funding for activities may be required. The Sub-Cabinet should submit legislative or budget documentation necessary to procure the resources and authority to charter this coordination effort. DEC will continue to have responsibilities for permitting, database, and reporting tools for administering a GHG Reporting Program (see CC-1). Appropriate tools and skills must be put in place to support coordination and outreach efforts, including technology and training as necessary.

### **Related Programs/Policies in Place**

Creating a coordinating function with the mission of tracking climate change and coordinating the state's response will help to ensure the success of the other policies in the Alaska Climate Change Strategy. Staff tasked with this effort can also serve as key liaisons and resources for the private sector if or when the state enacts regulations governing GHG emissions or reporting. A Web portal would serve as an information hub to provide outreach for preparing for and responding to climate change, and for efforts to monitor, measure, and research climate change. Many state agencies already have existing staff who deal with climate change issues and outreach. This policy would not fund these positions or create new ones within these agencies; rather, it would serve to coordinate and complement these activities.

### **Type(s) of GHG Reductions**

Not applicable.

### **Estimated GHG Reductions and Net Costs or Cost Savings**

Not applicable.

### **Key Uncertainties**

Challenges include engaging all agencies with responsibilities for addressing climate change, establishing clear responsibilities for coordinating roles, identifying needed funding to carry out the coordination, organizing information to present to the public, and identifying processes to maintain and update a Web site.

### **Additional Benefits and Costs**

#### **Benefits**

Creating a coordination function is essential to track and provide some cohesion to the state's response to the Sub-Cabinet recommendations. It will also facilitate state agencies' efforts to educate businesses, agencies, and individuals seeking knowledge about climate change programs and policies, thus improving overall understanding of climate change issues. Finally, it will provide a means for state agencies to share climate change information and coordinate interactions with the federal government.

#### **Costs**

Costs primarily entail resources for personnel to provide the point of coordination, including salaries and benefits, potentially contracting costs to develop materials and support a Web portal, and training costs to ensure staff have the skills needed to provide outreach and education.

### **Feasibility Issues**

Key feasibility issues include identifying a funding source and appropriately coordinating across existing programs. In addition, the effort needs to be flexible and generate sufficient political will to be effective and sustained.

### **Status of Group Approval**

Approved, by supermajority, with one objection. One [AAG](#) member voiced support for the option but felt it imperative that the State Coordination function expand beyond the coordination of internal state efforts to a more active and explicit role in providing communities with assistance. [The suggestion was that CT-2 and CT-3 be combined, to avoid creating a new entity.](#)

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### Common Theme #3: Community Climate Impact Assistance

This option was imported from the Health and Culture Technical Work Group under the Adaptation Advisory Group (AAG) where it originated and was fully developed. The rationale of the AAG was due to the fact that a good portion of the Option is designed to provide assistance to communities affected by climate change in areas not directly related to individuals' health or culture but to the overall well-being of the community.

#### Recommended Option

This option recommends providing tools and assistance to help communities adapt to the changing climate and its impacts on community and individual health by establishing a coordinating entity among federal, state, local, and tribal entities. Coordination at the state level should take place to ensure state agency programs and budgets are aligned. Evaluation of existing services and identification of gaps would enable the state to operate as efficiently and effectively as possible. Likewise, inter-agency coordination among multiple state and federal agencies, local governments, NGOs, and others is considered essential in supporting vulnerable communities faced with the complex issues related to climate change. Such coordination was successfully demonstrated by the Immediate Action Work Group (IAWG).

This policy option is very similar to the IAWG recommendations offered in their March 2009 report. These options should not be treated separately, but should inform one another to create the most cost effective organization to address the problems identified both here and in the IAWG recommendation. Additionally, some services outlined in these options will be implemented by entities whose mission is geared toward delivery of outreach services.

#### Option Description

##### Issue

The traditional way of life in much of Alaska is at risk. Alaska Native villagers, rural Alaskans, and other vulnerable communities are undergoing a series of challenges due to climate change, deteriorating economic circumstances, and other factors. Climate change brings a multitude of physical impacts to villages, including erosion, subsidence, floods, and storm surges. In some cases, these impacts require significant emergency response efforts, massive investments in infrastructure, or full-scale community relocation. Other climatic changes include shifts and dislocations of subsistence species, which can adversely affect traditional ways of life and subsistence diet, leading to negative social, emotional and physical health impacts in some areas. As climate change progresses, these impacts are likely to affect Alaska's major urban centers in significant ways as well. In short, Alaska's citizens and infrastructure face immediate as well as future threats from climate change. These threats are most easily recognized at the community level where vulnerability and adaptive capacity can vary widely.

##### Overview

An array of state, federal and regional entities are responsible for delivering services to Alaskan villages, rural communities, and urban centers, but specific policies and regulatory constraints produce conflicting directives that prevent the coordinated delivery of vital services that will enable endangered villages, traditional culture, and vulnerable communities to adapt in the face of climate change. Therefore, there is a need to establish a coordinating entity with the ability to navigate these multiple bureaucracies and to leverage their resources to support vulnerable communities in emergency response, relocation, subsistence concerns, and other priorities.

##### Objective

The objective of this policy is to create an integrated and coherent process to enable state, federal, regional, and local entities to provide rapid, coordinated, and effective relief to communities facing (and experiencing)

substantial cultural, health, economic, infrastructure, and subsistence impacts from climate change. Objectives of this proposed coordinating body are to navigate the complexities of requirements and mandates of multiple bureaucracies to address disaster planning and emergency response, community relocation, infrastructure development, health and cultural impacts, subsistence, and other issues. It should be noted that this policy option is very similar to the IAWG recommendations in their March 2009 report; with this option providing another perspective on the same issue. These options should not be treated separately, but should inform one another to create the most cost effective organization to address the problems identified both here and in the IAWG recommendation. Additionally, some services outlined in these options will be implemented by entities whose mission is geared toward delivery of outreach services.

### Need

Marine and terrestrial ecosystems are changing substantially with complex feedbacks that alter habitat and the mix of fish, marine mammals, terrestrial mammals, and vegetation. Sea ice, the prime habitat of walrus and seals and the hunting grounds for many coastal villagers, is forming later and at differing rates in the winter and breaking up earlier in the spring. This combined with the overall dramatic rate of sea ice loss is impacting the people with loss of traditional knowledge and extended periods without access to traditional foods. Subsistence hunters in these areas must now travel increasingly large distances to hunt marine mammals that are experiencing sharply decreasing populations (e.g., ring seal have decreased 30% in the last three years). This hunting occurs in unsafe, frigid waters in boats for which gasoline costs more than \$9/gallon, a high price to pay in communities whose per capita income is one third that of urban Anchorage. Rural villagers also confront population shifts, declines, and loss of quality in other species traditionally used for food, including fish, moose, caribou, wild berries, and other native plants.

Many aspects of the traditional ways of life are now more difficult, more dangerous, and more expensive. The cost of store bought foods, heating oil, and other daily living expenses interact with climate-related challenges to create circumstances that make survival in rural villages increasingly difficult. More than one in five individuals is below the poverty threshold, three times that of their urban counterparts. Stresses to traditional practices – including a way of life tied to being on the land and providing for one’s community – is combining with rising cost of rural living to raise the potential of serious social impacts. Other outcomes can be subtler. For example, Alex Whiting from Northwest Alaska notes that the youth and elderly depend on strong ice in fall to ice fish for saffron cod and smelt. Late freeze up and a concomitant shorter ice-fishing season lessen the opportunity for elders to pass on traditional knowledge and values.

Beyond the social and cultural impacts of climate change, many villages are now facing erosion, flooding, engulfment, and disappearance of their community infrastructure. Shismaref, a community of 150 households on the northern Bering Sea, faces relocation at a cost of \$93 - \$179 million dollars. A 2003 General Accountability Office (GAO) report found 213 predominantly Native villages, historically situated along rivers and coasts, at risk, with potential relocation costs of \$34 billion (GAO 2003). Several existing communities have begun the relocation process and others are seriously evaluating the risk to their communities and may follow suit in the near future.

Stanley Tom of Newtok stated that one of the biggest obstacles that village faces in trying to relocate is the lack of a single agency or group in charge of planning and/or response. DOT can’t build an airstrip unless there is a post office; there can’t be a post office without a school; and the school has to have 25 students. But the structures needed to house 25 students can’t be built without the airstrip. These and numerous other catch 22’s impede an integrated, flexible, and timely response. In addition, obtaining funding for relocation has been difficult and frustrating.

Congressional hearings underscore the frustration that no single agency has been designated to take the lead on erosion and climate change issues. The Alaska Climate Impact Commission established by the Alaska Legislature likewise acknowledged in its 2008 final report that there is “a greater need for interagency action among state and federal agencies, almost exclusively where threatened communities are struggling with relocation issues” (ACIC, 2008). A “key finding” from the Immediate Action Workgroup’s March 2009 report – *Recommendations to the Governor’s Subcabinet on Climate Change* – was “Replace the IAWG, which is an ad-hoc body, with a formal, standing committee or workgroup embedded in the State’s administrative operations. This will ensure continued success of leveraging the State’s resources through coordination and collaboration with other State and Federal

agencies, and with regional and community organizations.” This Community Climate Impact Assistance option recognizes the same problem as the IAWG and provides the following recommendations to move toward a constructive solution.

## Option Design

### Structure

It is recommended that a permanent, high-level state coordinating body be established within Alaska. The specific form and organization of such a coordinating body is not recommended, as those decisions require a pragmatic political perspective to ensure that an effective coordinating body is created with the authority, expertise, and community trust necessary to tackle the difficult issues currently threatening Alaskan communities. The four primary functions this coordinating body will need to tackle are described below.

#### **Function 1:** Develop a Process for Prioritizing and Addressing Climate Challenged Communities.

A deliberative process is needed to systematically and fairly address the challenges of communities that are most at risk; many of the steps are derived from recommendations of the IAWG, which build upon the work of many others, including International Arctic Research Center (IARC), University of Alaska Fairbanks (UAF), and people within federal and state agencies.

- A.** Develop scenario analysis whereby potential future climate conditions are analyzed to quantify the community impacts that might result. Using these scenarios, identify communities at risk.
- B.** Conduct meetings with leaders in at-risk communities to develop an understanding of the risks and challenges from climate change. Focus on personal safety, infrastructure, health threats and population decline. Allow the process to be driven by community leaders and landholders, with significant support from agencies.
- C.** Prioritize at risk communities and the risks within each community. Develop clear and transparent criteria for prioritization, such as: timeframe of the impact, efficacy of the solution, magnitude of the impact, financial cost, etc. Under any conceivable set of criteria, there will inevitably be losers. The clarity of the criteria and the transparency of the prioritization process will be critical in justifying the inevitably difficult tradeoffs that must be made with limited resources.
- D.** Make recommendations for addressing specific risks within communities (so communities can work themselves to reduce their vulnerability) and make recommendations on which communities should receive state and federal assistance. Revisit these recommendations annually, and revise them subject to new information.
- E.** Create strategies and measures that are tailored to the needs of the community and develop alternatives for comparison, particularly when strengthening existing community infrastructure, undertaking relocation, or making changes to community development.
- F.** Work with communities to obtain funding for these adaptation measures. In many instances, where communities lack staff or expertise to apply for and administer funding from grants, programs, or agencies, assistance with these functions can empower communities with the financial and technical resources necessary to address their community concerns on their own.

For the communities that have been identified by the State as those most at risk (Newtok, Kivalina, Shismaref, Shaktoolik, Koyukuk, and Unalakleet), develop and implement:

1. Emergency response plans, including conducting training and drills
2. Community evacuation plans

3. Community wildfire management plans
4. Geologic mapping, hazard analysis and risk mitigation plans
5. Protection and/or relocation plans

**Function 2:** Help communities adapt to flooding, erosion, and other risks either by relocation or in-place protection.

- A.** Create a mandate for climate impact assistance (especially migration and relocation) within State and Federal entities.

Oftentimes, federal or state agencies have narrowly defined directives that prevent them from proactively addressing the impacts of climate change, especially migration and/or relocation efforts. For example, the Federal Emergency Management Agency (FEMA) has a mandate to replace what has been destroyed in situ, but does not have an obligation or directive (or resources) to rebuild infrastructure in a different location. Ensuring that agencies at all levels of government incorporate options for migration and relocation as a vital element of their mission would accomplish the responsibilities of this task. While additional funding for these efforts would make a significant difference to vulnerable communities, even simply establishing the consideration of a changing climate may have many beneficial effects by freeing up funding streams currently inaccessible for these purposes and for increasing the flexibility of state and federal agencies.

Lack of agency flexibility with existing mandates and funding exacerbates the on-the-ground difficulties for communities facing climate impacts, especially relocation. For example, Newtok is trying to transition to Mertarvik, a new community several miles south with an elevation of 400 ft. above the existing community. However, because no central fund (nor several pots of money that can be combined) currently exists for a relocation effort, the movement of the community will have to be accomplished in several incremental steps using available resources, cooperative approaches like the Innovative Readiness Training and clearly justified funding requests. The 'pioneer' community in Mertarvik is being constructed with an evolutionary and modular approach designed by the Cold Climate Housing Research Center. A community plan has been developed showing the way forward leading to a barge landing, airport design and initial road and material source work. A central hub at the site will initially house construction workers. As the community transitions, this hub will be converted to administrative offices with additional "spokes" radiating from this hub to house a clinic, post office, perhaps school, maintenance facilities, and so forth. Housing will be added in clusters during this transition. Unfortunately a serious drawback to this multi-staged approach is that while agencies at various levels may have mandates to provide services and help to existing communities few, if any, incorporate mandates to aid communities in migration from disaster prone areas or full relocation efforts. The inclusion of "relocation" mandates is an integral requirement to accomplish such an approach.

- B.** Designate lead agencies at the federal and state levels and outline an overall strategy for the relocation process.

Currently there is no designated lead agency at the state or federal level to coordinate the resources (personnel, technical and funding) between agencies that have independent responsibility for community infrastructure, e.g., housing, education, health, energy, and similar needs. In addition, because different components (e.g., housing, schools, health and energy) are the responsibility of different agencies with different funding cycles, priorities, and fiscal resources, any single component of the process may be side tracked or delayed leading to significant costs overruns in other components, i.e., the communities' energy infrastructure must be in place before schools can be opened. Thirdly, a lack of a coherent and secure upfront planning/funding effort requires an enormously complicated project management approach. In fact the Division of Community and Regional Affairs using Coastal Impact Assistance monies has two grant programs offered through Department of Commerce, Community and Economic Development for two planning initiatives. One of these is Waterfront Management and All Hazards Plan (\$150k) that will result in a strategic management planning document that will provide criteria and guidelines for relocation and

community/waterfront development at Mertarvik. The potential benefits of this planning process may be considered a model for future relocation of Alaskan villages affected by flooding and coastal erosion.

A coherent relocation planning strategy should include:

- Alternatives to a preferred relocation site.
  - Evaluation of the advantages and disadvantages of each alternative.
  - Local input on community values related to alternatives.
  - Evaluation of the environmental effects of each relocation plan.
  - Estimate of costs for implementing each alternative.
  - Life-cycle costs of not relocating the community. As part of this analysis, calculate the costs associated with various scenarios, such as relocating in ten years vs. relocating in 20 years.
  - Incorporate environmental, social, and economic sustainability into community relocation plans and designs.
  - An evaluation of cross agency budgeting and regulatory challenges.
  - Selection of the plan that provides the best overall balance to meet local needs and is cost effective, sustainable, sound from an engineering standpoint, and environmentally acceptable.
- C.** Create a dedicated funding source for community climate impact assistance to the extent consistent with Federal and State law.

While the agencies involved in the coordinating entity will provide direct assistance to communities in applying and administering agency specific grant and other funding, the coordinating entity should ultimately work to identify or initiate a dedicated funding source for adaptation efforts. Because cost-effectiveness will be so important, the coordinating body should:

- a) explore opportunities for greater federal funding through state co-sponsorship of projects to attract federal match dollars;
- b) cost share with local governments and communities, including, but not limited to in-kind services such as community planning and engineering design through native corporations;
- c) encourage the identification and development of local rock and other material sources; and
- d) coordinate construction projects with others to reduce mobilization costs.

Nevertheless, the existing “patchwork” funding approach needs to be rationalized on an inter-agency, multiple entity, and multi-year basis. The current funding process is time-consuming and almost impossible to coordinate.

- D.** Create a liquid funding source to provide immediate assistance.

In addition to the dedicated funding source for relocation efforts, there needs to be a readily accessible account that provides immediate cash flow and liquidity for private households, small businesses, and other

entities (e.g., local IRA). This account will pay for immediate expenses as relocation efforts unfold. Division of Community and Regional Affairs (DCRA) stated in an October 2007 memorandum:

Communities such as Newtok are in need of “fast-tracked” funding to address critical infrastructure needs at the current village site, as well as emergency needs...at the new village site. There are few, if any, funding sources that provide for an expedited funding process. Communities experiencing erosion are not always eligible for imminent threat funding because erosion is not considered a single event disaster.

**E.** Provide assistance in compliance with the National Environmental Policy Act (NEPA) process.

Streamline the NEPA process as it applies to relocation and other climate adaptation projects by identifying a lead agency tasked with assisting community relocation efforts in compliance with the NEPA process by preparing programmatic NEPA documentation. Communities like Newtok lack the capacity, expertise, and resources to fully carry out the NEPA process, especially when they are dealing with myriad other demands, including planning for relocation, writing grants for various aspects of the relocation process, responding to inquires from numerous agencies requiring justification for their needs and at the same time trying to sustain themselves as individuals and families. Ideally, the U.S. Council on Environmental Quality (CEQ) would develop special procedures that tailor the NEPA process for relocation projects and to the scale of these communities. A permanent, high-level Alaskan government coordinating body would have the authority to bring this urgent need to CEQ's attention.

Streamlining can include appropriation of boilerplate information from existing EIS documents or a template broadly fitting the general circumstances of these riverine and coastal communities. The lead agency will require federally acknowledged leadership role in collaborating with and representing other federal agencies in the programmatic efforts in ultimately complying with the approved NEPA documentation.

**Function 3:** Develop a community-based, flexible, and responsive process to manage and promote traditional ways of life, including subsistence access under changing climatic conditions.

Climate change is clearly a factor that affects subsistence activities and traditional ways of life. Habitat, resource availability, and species composition are all changing. Many subsistence activities are more difficult, more dangerous, and/or more expensive. Factors that may restrict or impede the ability of an individual to harvest or access subsistence resources will have profound implications for the cultural fabric of rural Alaskan communities.

Typically in rural Alaska, subsistence resources provide much more than half of the local diet and in a number of places their replacement cost (at the inflated costs of local stores) can reach two thirds of a household's disposable income. However, subsistence resources and the activities associated with the harvest of these resources provide more than food and nutrition. Participation in family and community subsistence activities, whether clamming, processing fish at a fish camp, or seal hunting with a father or brother, define and establish the sense of family and community. These activities teach how a resource can be identified, methods of harvest, efficient and non-wasteful processing of the resource, and preparation of the resource as a variety of food items. They also promote most basic ethical values in Native and rural culture – generosity, respect for the knowledge and guidance of elders, self-esteem for the successful harvest of a resource, and family and public appreciation in the distribution of the harvest. No other set of activities provides a similar moral foundation for continuity between generations.

One of the impacts of climate change is that animal species that migrate into the region have been arriving up to three weeks earlier and in some cases also leaving three weeks later. These changes extend and expand the breeding season of migratory species. When coupled with other environmental factors, such as lack of snow cover, these changes affect traditional and seasonal harvest patterns. Even under conditions of profound uncertainty, there are pressing social reasons to sustain traditional subsistence practices.

To improve flexibility and dialogue, the coordinating entity should work to facilitate interactions between subsistence users and regulatory bodies (such as the Federal Subsistence Board, the Marine Mammal Commission, and the Alaska Department of Fish and Game-ADF&G), particularly where local observations may provide

important data to managers on the health and quality of subsistence species. The aim of this policy is to support the ability of these bodies to adaptively and sustainably manage species from year to year in a changing climate/environment so that healthy populations are maintained in companionship with subsistence use.

Research should be conducted that identifies dependencies on traditional food sources and impacts and constraints on those sources due to climate change. The coordinating entity should consider an approach to allow rural communities to provide input through a citizen-based reporting system to document changes observed in rivers/lakes/aquifers, fish, bird, and animal numbers, locations, and conditions as well as berry and other gathered food conditions. This could be an on-line system. Likewise, in partnership with appropriate regional and local entities, surveillance programs may be established to identify changing range, densities, and health of traditional food species, and to increase existing monitoring of fish and animal health for emerging pathogens and introduction of new species to ensure food safety and sustainability.

**Function 4:** Develop principles to guide community climate impact assistance activities. These principles should include, but are not limited to:

- A.** Provide resources to ensure cross-cultural communication and understanding within traditional languages.

Many members of some tribal communities, especially those middle aged and older speak English as a second language or not at all. Consequently, care needs to be taken to reach out to these members of the community in a manner that they can understand. Furthermore, certain media are more effective than others for outreach and communication, especially in rural Alaska. In many places radio programs or community newsletters reach a broader audience than a website ever will. Finally, communication needs to go in both directions. There is a persistent need to translate the language and traditions of native peoples into terms that technical experts and policy makers can understand. For example, the social implications of traditional knowledge and the role of subsistence in traditional culture are not easily appreciated through the simple word 'subsistence.'

- B.** Reduce community burden during sensitive times.

The community climate impact assistance activities should seek ways to streamline communication, interaction, and burden on the community, perhaps using the Newtok experience to increase efficiency on various issues. At the least, meetings and communication can be scheduled to minimize the involvement community members during high subsistence harvest seasons.

- C.** Provide for local input and community involvement.

Providing mechanisms to ensure meaningful involvement of affected parties in all phases including planning, implementation, coordination, and communication.

#### **Targets/Goals**

- Create high-level, permanent government entity to coordinate community climate impact assistance. This entity will support coordination among federal, state, local, and tribal entities with responsibilities for addressing community needs.
- Other targets can be realistically identified only by the coordinating entity itself, but may include relocating communities, creating funding streams, integrating climate into agency mandates, etc.

#### **Timing**

2010:

- Create high-level, permanent government entity to coordinate community climate impact assistance.

**Participants/Parties Involved:** The partial list below represents parties that do or will play some role in adapting their culture to the impacts of climate change, including relocation efforts, emergency response, and traditional foods and traditional knowledge networks.

### **Protection, Migration or Relocation**

#### Native Organizations:

- Native Village Traditional Councils
- ANCSA Regional and Village Native Corporations
- Other formal and informal village or Native networks

#### State of Alaska:

- Alaska Department of Commerce, Community, and Economic Development (DCCED), Division of Community & Regional Affairs (DCRA) – *group coordinator*
- Alaska Department of Environmental Conservation (DEC)/Village Safe Water Program (VSW)
- Alaska Department of Transportation and Public Facilities (DOT/PF)
- Alaska Department of Military and Veterans Affairs (DMVA)/Division of Homeland Security and Emergency Management (DHS&EM)
- Alaska Department of Natural resources (DNR), Division of Coastal and Ocean Resources (DCOM)
- Alaska Department of Education and Early Development (DEED)
- Alaska Department of Health and Social Services (DHSS)
- Alaska Industrial Development and Export Authority (AIDEA)/Alaska Energy Authority (AEA)
- Alaska State Emergency Response Commission
- Alaska Municipal League
- Alaska Governor's Office

#### Federal:

- U.S. Army Corps of Engineers (USACE), Alaska District
- U.S. Department of Commerce, Economic Development Administration (EDA)
- U.S. Department of Agriculture, Rural Development (USDA-RD)
- U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS)
- U.S. Department of Housing and Urban Development (HUD)
- U.S. Department of the Interior, Bureau of Indian Affairs (BIA) Indian Reservations Road Program
- U.S. Department of Transportation, Federal Aviation Administration (FAA).
- U.S. Environmental Protection Agency (EPA)
- Denali Commission
- Offices of Senators Lisa Murkowski and Mark Begich and Congressman Don Young

#### Regional Organizations:

- Association of Village Council Presidents Regional Housing Authority (AVCP)
- Coastal Villages Region Fund (CVRF) & Norton Sound Economic Development Corporation, Bristol Bay Economic Development Corporation, & Yukon Delta Fisheries Development Association
- Lower Kuskokwim School District (LKSD)
- Rural Alaska Community Action Program (RurAL CAP)
- Yukon-Kuskokwim Health Corporation (YKHC)
- Alaska Native Tribal Health Consortium

**Emergency response**

- DMVA, Division of Emergency Services
- DHS-FEMA
- DHS- U.S. Coast Guard Search and Rescue
- Local Emergency Planning Committees

**Traditional foods and traditional knowledge networks**

- U.S. Fish and Wildlife Federal Subsistence Management Program
- Federal Subsistence Board and Regional Advisory Councils
- Marine Mammal Commission
- International Whaling Commission?
- ADF&G Boards of Fish, Game, and the Division of Subsistence
- Alaska Native Science Commission
- Alaska Native Knowledge Network
- Alaska Native Tribal Health Consortium
- Eskimo Whaling Commission
- Aleut Marine Mammal Commission
- Alaska Native Harbor Seal Commission
- Yukon River Drainage Fisheries Association

**Evaluation**

Monitoring and evaluation of this alternative should be specific to each of the four functions identified above. While quantitative metrics may not always be available or may not tell a complete story, identification of specific objectives and progress made toward those objectives is relatively straightforward.

**Research and Data Needs:**

- Declines, increases or migratory shifts of major subsistence species and vegetation can significantly affect a wide range of cultural, community, and economic conditions. The effects of events must be assessed after an assessment is made of existing climate related socio-economic studies. Assess socio-economic impacts of existing and emergent climate change events on culture, community wellness, subsistence, and overall economics.
- Standardized ADF&G Harvest Surveys (which include considerable social, demographic, and economic information in addition to household harvest per species) need to be accomplished in each of the areas designated with emergency status.
- Standardized social network research needs to be accomplished in select communities to understand potential impacts of relocation on social, sharing, economic, and subsistence networks.
- Regional economic models to quantify climate change impacts on communities and provide input to the NEPA process.
- Regional assessments of existing social service infrastructure, staffing, budgets, and delivery need to be accomplished at regional levels as baseline to plan for increased demand.
- Social impact assessments need to be conducted at regional and community level to provide information for the NEPA process.
- Detailed interviews and oral histories need to be conducted to provide narrative information needed to assess the impacts of climate change and the potential impacts of different forms of relocation.

**Implementation Mechanisms**

Implementation requires approval by the AAG and analysis by the Subcabinet with respect to funding, possible legislation, and communication and coordination with federal entities.

## Related Policies/Programs and Resources

### Related Policies and Programs

The most pertinent related program to this option was the IAWG of the Governor's Subcabinet on Climate Change. The IAWG performed several of the functions suggested under this option but for a limited set of six communities and on a non-permanent basis. In fact, in its final report to the Governor, one of the IAWG's key findings was: Replace the IAWG, which is an ad-hoc body, with a formal, standing committee or workgroup embedded in the State's administrative operations. This will ensure continued success of leveraging the State's resources through coordination and collaboration with other State and Federal agencies, and with regional and community organizations.

### Available Resources

Although no dedicated funding exists to support these activities, a great deal of expertise has been developed by the IAWG in providing communities with climate impact assistance. Harvesting that experience can provide significant cost and time savings in developing an appropriate community climate impact assistance program. Furthermore, many of the most expensive elements of community climate impact assistance will require federal partnership. The experience of the IAWG indicates that there is a window of opportunity in the near term to garner significant federal support for assisting Alaskan communities, but that pool of money is likely to be spread thinner as more states begin to address adaptation needs.

## Feasibility

### Feasibility

The experience of the IAWG indicates that this option is quite feasible and that great advances can be made with even modest resource commitments.

### Constraints

The most significant constraint to this option is the large number of communities affected and the necessity of prioritizing them in an equitable and transparent manner. Some functions in this option require the state to interact with federal authorities such as the Federal Subsistence Board or the USACE to address current policies and mandates that impede the progress needed to accommodate community climate impacts.

## Adaptation Benefits and Costs

The coordinated delivery of services to rural communities supports every one of the TWG objectives. Currently an array of state, federal, and regional entities are responsible for delivering services to rural Alaskan villages, but specific program policies and regulatory constraints cause conflicting directives, resulting in bottlenecks in the ability to achieve a coordinated delivery of vital services and outcomes that will enable villages and traditional culture to adapt to climate change. The advent of a state coordination entity will help mitigate a number of health and cultural threats caused by climate change that are now being experienced by rural communities. For example, an integrated and coherent relocation process will:

- Decrease health risks from poor sanitation.
- Preserve community integrity and provide a basis for ongoing subsistence practices and traditional ways of knowing.

- Preserve existing cultural networks, to help communities adapt to substantial changes in wildlife and habitat.
- Lessen potentially adverse impacts on youth, by preserving opportunities to participate in traditional subsistence pursuits.
- Decrease the negative social, psychological and physical impacts associated with community dissolution.

Success in this policy option will be easily measured when a fully functioning Community Assistance Coordinating entity is up and running. Numerous benefits will accrue to agencies at the federal and state levels as they reduce their transaction costs (e.g., agency meetings) in attempting to deliver services and relief to impacted communities. A rationalized funding process will reduce cost overruns, minimize waste and duplication, and provide the community with a blue print of reasonable expectations. Processes of collaborative learning and adaptive management will allow for easy quantification of benefits over a period of decades.

Costs:

The costs of this proposal may be cut in many ways. Including community relocation costs will make the figure run into millions of dollars. However, getting started with an interagency coordinating entity could use existing personnel and existing budgets to make incremental changes with little to no additional funding. A more realistic scenario factors in some new personnel costs of several regional coordinators, dedicated support staff, travel, office space, equipment, and so forth. Savings may accrue depending upon the specific administrative and organizational form the coordinating entity takes (e.g., housed within an existing department, e.g., Division of Community & Regional Affairs, in a newly established division, or a new responsibility added to several high level agency officials).

Taking a broader view, the successful implementation of this entity is expected to result in significant avoided costs in the millions of dollars over the next 40-50 years, by facilitating cost-efficient community relocation and coordination of annual responses to floods and other impacts, rather than repeated short-term and temporary measures to shore up communities against erosion.

Ancillary Benefits and Costs:

Considerable ancillary benefits accrue across all functions of government as improved communication and coordination reduce transaction costs, improve reaction time, and streamline government response to issues and problems that may not be related to climate change. In addition, the same administrative structure put forth in this option can be utilized across a broad range of government mitigation initiatives including coordinating the many options for renewable energy, options that contain numerous costs and benefits, and options that require considerable coordination in the generation, storage, and transmission of this power.

## Status of Group Approval

Approved unanimously, with no objections.

## Common Theme #4: Promote Climate Change Science Through K-12 Education

This option was developed by the Natural Systems TWG under the AAG.

### Recommended Adaptation Option

Despite the critical and growing importance of climate change to Alaska's residents, there is a generally a poor level of public understanding of the causes and consequences of climate change. For Alaska to adapt effectively to climate change in the future, improved public understanding of climate change is needed. To address this essential need, the State of Alaska will increase emphasis, curriculum and training for delivery of climate-change science content in grades K-12 and increase coordination among existing programs and entities that address climate-change education in Alaska's schools.

### Option Description

The State of Alaska will implement steps to rapidly improve public understanding of the causes and consequences of climate change in Alaska through K-12 education programs, under the framework of the existing Alaska Science Standards. The State will provide training and curricula to teachers on climate change, provide an education specialist to focus on science and climate change education, and increase coordination among existing programs and entities that address climate-change education in Alaska's schools.

By emphasizing climate-change education, Alaska will provide adequate educational resources to its residents to enable them to make wise choices about how to minimize the costs and maximize the opportunities that result from climate change. In the absence of such education and outreach initiatives, K-12 teachers in schools will not be able to teach about climate change because of the time and subject-matter constraints in their existing curricula. Alaskans are unlikely to take climate change seriously and will not be prepared to adapt to the environmental and ecological changes that are occurring.

### Option Design

**Structure/design:** Sub-option 1 has three major components:

- The State will provide funding to the University of Alaska or other appropriate entities to develop courses for K-12 teachers so these professionals have the training necessary to teach about climate change in Alaska. These courses will involve professionals in education and extension/outreach. It would be important to determine cost effective, yet successful methods for delivery of this training to Alaska's teachers, through distance delivery, training at district in-service sessions, etc.
- The State will establish and fund a new environmental/climate change science education specialist at the Department of Education and Early Development (DEED) to provide coordination among existing programs and entities that address climate-change education in Alaska's schools, and to coordinate development and dissemination of new curriculum, materials and teacher training. (At present, DEED does not have an environmental science education specialist.)
- The State will increase coordination with and utilization of existing programs that address climate change education for Alaska's school-age children. (See Related Programs, below)

### Targets/goals

The goal of this sub-option is to include climate change as an integral component of public education in Alaska, so Alaska's youth are prepared to make wise choices about adapting to climate change. Targets will include completion of the tasks listed above.

**Timing**

Implementation for this policy can begin immediately and could be completed within three to four years.

**Participants/Parties involved**

DEED, U.S. Department of Education, University of Alaska, stakeholders, school districts, teachers, and entities listed in the Related Programs section, below.

**Evaluation**

Implementation of the adopted policy in classrooms can be monitored and evaluated through formative and summative assessments administered by classroom teachers and/or by DEED.

**Research and Data Needs**

- Research public education curricula and teacher training materials developed and implemented in other states (e.g., California).

**Implementation Mechanisms**

The primary need for implementation of these recommendations is Cabinet-level emphasis, intention, and limited strategic funding. Specific implementation steps are provided in the Option Design section, above.

**Related Policies/Programs and Resources**

Several organizations that have initiated efforts to integrate climate-change understanding into the educational program include the Center for Ocean Sciences Education, International Arctic Research Center, and the Alaska SeaLife Center. For example, the Alaska SeaLife Center in Seward is expanding its education program to include curriculum about the marine environment and climate change. This eight-unit Marine Ecosystems Curriculum will initially target students in grades 6-9 through Distance Learning. The curriculum will also form the basis for a summer camp program and can be modified for in-classroom use with grades 4-6.

The document on *Climate Literacy: Essential Principles of Climate Science* has been developed by federal science agencies including NOAA and National Science Foundation (NSF) in collaboration with many individuals and the following science and education partners: American Association for the Advancement of Science Project 2061, American Meteorological Society, Association of Science-Technology Centers, College of Exploration, Cooperative Institute for Research in Environmental Sciences, Federation of Earth Science Information Partners, Lawrence Hall of Science, University of California, Berkeley, National Environmental Education Foundation, National Geographic Education Programs, North American Association For Environmental Education, TERC, Inc., GLOBE Program, National Center for Atmospheric Research and University Corporation for Atmospheric Research. This Climate Science Literacy Guide includes science concepts aligned with the National Science Education Standards and the American Association for the Advancement of Science Benchmarks for Science, and provides a framework for understanding and communicating about climate change and climate science for individuals and communities.

## Feasibility

These recommendations could be feasibly implemented within three to four years, if targeted funding is appropriated.

## Adaptation Benefits and Costs

### Benefits

The primary and essential benefits to this option will be improving the literacy of Alaska's youth (our future adults) in basic information about climate change, mitigation and adaptation, to inform their future decisions regarding their own actions and to ensure that Alaska's population understand the importance in future State decisions and actions.

### Costs

This recommendation would involve the following general costs:

- A new statewide staff position (Education Specialist II: approximate cost \$83,000 per year, salary and benefits) to coordinate climate change education efforts for the DEED and to coordinate with other organizations involved in climate-change education.
- Development of climate change curriculum, teacher training materials and accomplishment of teacher training by the University would require contractual funding.

## Status of Group Approval

Approved unanimously, with no objection.