Climate Adaptation and Action Plan for the Norton Bay Watershed, Alaska

Norton Bay Inter-Tribal Watershed Council
Norton Bay, Alaska

Emily Murray
Project Coordinator
Norton Bay Inter-Tribal Watershed Council

Hal Shepherd, Principal
Jessica Ryan, Climate Consultant
Laoch Consulting

Prepared in cooperation with Climate Solutions University,
a program of the Model Forest Policy Program and the Cumberland River Compact

Foreword

The Norton Bay Inter-Tribal Watershed Council (NBITWC), the Model Forest Policy Program (MFPP) and the Norton Bay Alaska Native Villages (Villages) have a shared vision to enhance the resiliency of our communities and watershed. In 2013, the NBITWC, in partnership with the Villages, took the leadership role to engage in the Climate Solution's University (CSU) Plan Development Program created by the Model Forest Policy Program. The goal of CSU is to empower rural, underserved communities to become leaders in climate resilience using a cost effective distance learning program. This Climate Change Adaption Plan for the Norton Bay Watershed (CCAP) is the result of a year of community team effort, bringing in an array of stakeholders and expertise, building partnerships, extensive information gathering, critical thinking, and engaged planning. The result is a localized, actionable plan that the Norton Bay community and supporters can implement in the coming years. The outcome will be a community that has strengthened capacity to be resilient to the inevitable impacts of climate change- a community with the awareness, shared vision, and partnerships to enable it to have the capacity to withstand the impacts of climate upon the natural resources, economy, and community.

Acknowledgements

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The development of this plan was made possible by the guidance and coaching of the Climate Solutions University: Forest and Water Strategies program (CSU), created by the Model Forest Policy Program in partnership with the Cumberland River Compact and the assistance of Headwaters Economics. The team that leads the CSU program includes: Nancy Gilliam, Gwen Griffith, Todd Crossett, Toby Thaler, Margaret Hall, Jeff Morris, Alyx Perry, Ray Rasker, Vanitha Sivarajan, Mike Johnson and Josh Dye.

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Authors

Emily Murray
Project Coordinator, Norton Bay Inter-Tribal Watershed Council

Hal Shepherd, Principal
Jessica Ryan, Climate Consultant
Laoch Consulting

Editors

Gwen Griffith, Toby Thaler, Todd Crossett, and Ray Rasker

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I. EXECUTIVE SUMMARY

While many people still debate the existence of climate change and even those who have accepted that it has reality believe that climate change is a phenomenon of the future, Alaska is already feeling the effects of our rapidly changing world. During the fall of 2013, for example, the state continued to experience record high temperatures when Anchorage recorded an all-time high of 51 degrees – two degrees above the previous record of 49 degrees in 1959 and 19 degrees above what the thermometer read on the same date in 2012. In the Interior, on October 28, 2013, Delta Junction recorded 62 degrees, its warmest temperature ever and 19 degrees over the last high recorded in 1962.

The changing weather patterns in Alaska are, already, having substantial impacts on Native Alaskan village communities. Increased stream temperatures combined with other climate change related impacts of high river flows, altered ice flows and stream bank erosion, all combine with mining and related development in the Norton Bay Watershed (Watershed) to directly threaten the fishery and wildlife habitat upon which the Native Villages in the area (Villages) depend for their subsistence fishing and hunting. In addition, reduced water flows in the Watershed caused by water diversions from mining and other development activity are exacerbated by the effects of climate change. This can increase water temperatures and impair fish and wildlife habitat.

In addition, members of the local community conduct both commercial and subsistence fishing in Norton Bay, which is already impacted by the effects of climate change including coastal erosion, flooding, extreme fluctuations in hydro-geomorphology, early spring break-up and disrupted access to traditional fishing and hunting sites. In early November 2013, for example, the Norton Sound area was hit by a series of severe storms causing flooding in the streets of the communities and damage to sewer and drinking water systems.

Further, the economic welfare of the Village communities is substantially impacted by changing weather patterns, which as with elsewhere, is dependent on the cash economy to pay bills and to buy food, oil and gas and other necessities. Employment and household income, however, are generally lower than the rest of the Country on average while poverty levels are considered to be higher. Common sources of income include commercial fishing, trapping, or fish processing; public sector jobs from government grants, such as schools; and dividend payments from Alaska Native corporations.

A conventional economic structure, however, is not the whole picture for the economy of the Village communities within the Watershed. The continued pursuit of a centuries old subsistence lifestyle within in the Norton Bay Watershed is dependent on biologically rich fish and wildlife resources found there. The economic structure of the Village, therefore, can be described as

"subsistence with a cash overlay" meaning that the major portion of food and other necessities, and therefore "income", is from subsistence hunting, fishing and wild plant and berry gathering. As the impacts of climate change on fish, wildlife and plant habitat increase, the subsistence practices of the Villages will be harmed.

More importantly, because a higher percentage of their food supply comes from this subsistence lifestyle, the Villages are disproportionately impacted by the effects of climate change, which are exacerbated by mining and other industrial development activities. The result can be the release of toxic substances and lowered instream flows. In addition, income from conventional employment is usually invested in equipment to harvest wild foods. Commonly the most highly productive subsistence harvesters are from households with the largest monetary incomes. In this way, low household income and poverty indirectly impacts subsistence uses as well.

The most significant short-term risks to the forest resources in the Watershed are mining and road development. These activities exacerbate the climate change problems that the area is already facing. The Bureau of Land Management and the Alaska Department of Natural Resources can mitigate the impacts of such activities on subsistence resources through their agency role of oversight of permitting for mineral exploration and for new roads in the Watershed, In addition, the NBITWC and government entities can utilize traditional knowledge as a primary adaptation and mitigation strategy to address climate change, food security, economics, holistic wellness, and energy issues related to water quality and quantity in the Watershed.

Currently, the most substantial water resources risks from climate change in the communities are sea level rise, coastal erosion, and water temperature increase. With the already demonstrated rise in ocean levels, increased storm intensity, and continued rising of global temperatures, which will likely encourage sea level rise further, these communities can prepare by reducing building sites near bluffs and other coastal zones, anticipate community needs, and establish funding sources for movement of homes in danger.

Moreover, village communities can experience a range of far reaching effects from these physical impacts: higher prices for food and food insecurity; changes in commercial fishing, leading to lost or displaced jobs and unemployment; hunger and malnutrition caused by disruption in food and water supply; increased cost and conflict over food and water; food- and water-borne disease; emergence of new contagious and vector-borne disease; mental health disorders (e.g., depression, anxiety, Post-Traumatic Stress Disorder, substance abuse, and other conditions) caused by loss of food supply and subsistence related cultural practices; and health care impacts related to increased rates of illness and disease, emergency room use, and related costs borne by employers, health plans, and residents.

The Norton Bay Intertribal Watershed Council has developed this adaptation plan as the first step in the long range goal of addressing the many serious consequences of climate change and other non-climate stressors to the landscape and waters of the Norton Bay Watershed. Through a year-long assessment and planning process, the Council has documented the current and future risks, identified potential opportunities to adapt to climate impacts, and put forth here a plan that outlines specific goals, objectives, and action steps necessary to begin to address these urgent needs for the benefit of the four native villages living in Norton Bay and the surrounding ecosystems on which they depend. In addition, this plan can serve as a model for similar adaptation efforts needed across the Alaskan landscape.

The overarching Norton Bay Adaptation Plan goals are:

Goal 1: Obtain funding for emergency preparedness and/or relocation of native villages in the Norton Bay Watershed most critically impacted by coastal erosion and flooding.

Goal 2*:* Mitigate and/or adapt to impact of rising water temperature/stream bank erosion on aquatic habitat.

Goal 3: Increase safe access to subsistence resources watershed.

Goal 4*:* Protect subsistence resources in 100% of Watershed.

Goal 5*:* Increase education and outreach opportunities for native villagers to learn about climate change impacts with a focus on local issues and adaptation strategies.

Goal 6: Set precedent in Norton Sound Region for data collection, watershed assessment and climate change adaption planning.

Goal 7: Improve economic conditions in Norton Bay area native village communities.

By achieving these goals in coming years the Council intends to bring about outcomes that lead to more sustainable land use and watershed stewardship, protection of critical forest and water resources for both nature and human subsistence livelihoods, and long term sustainability of the healthy and economy of the native villages of the region. Implementation of the plan will be coordinated by the leadership of the Norton Bay Intertribal Watershed Council and conducted with the approval and cooperation of the four native villages on Norton Bay - Elim, Koyuk, Unalakleet, and Shaktoolik.

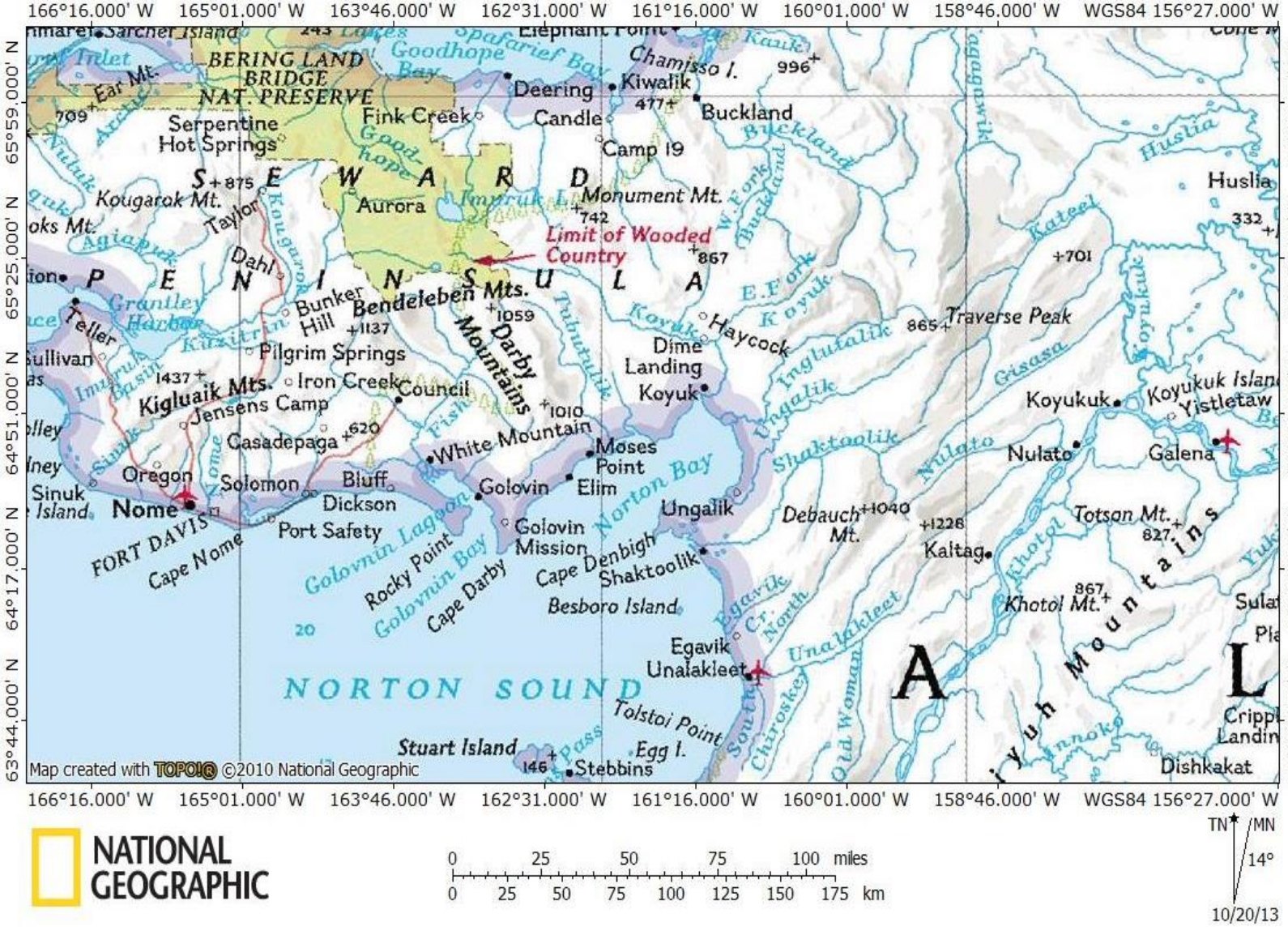

Figure 1: The Norton Bay Watershed, *Source - National Geographic, Topo! Alaska*

II. INTRODUCTION

The Norton Bay Watershed, from its headwaters to its mouth in Norton Bay, and nearby areas are home to a rich and diverse fishery including King Salmon, Pink Salmon, Chum Salmon, Silver Salmon, Arctic Grayling, whitefish, and other valuable subsistence species. The Watershed is a primary source of subsistence foods for the people of Elim, Koyuk, Unalakleet, Shaktoolik and neighboring native communities. The watershed includes traditional living places, birthplaces, burial grounds and other areas of cultural significance.

This climate adaptation plan was developed by the Norton Bay Intertribal Watershed Council (NBITWC) to address the climate stressors, risks, and adaptation opportunities related to the native villages of Norton Bay and the forest and watershed resources upon which they depend. The geographic scope of the Climate Change Adaption Plan (CCAP) is the Norton Bay watershed which includes the Norton Bay and the rivers and streams that run into the Bay, which is located on the Seward Peninsula in northwestern Alaska. The Bay and tributaries are located approximately 50 km (31 miles) from the coastal village of Elim, and 170 km (106 miles) east-northeast from the coastal city of Nome. This Watershed includes its tributaries, associated floodplain, side channels, spring systems and contributing wetlands. (See Figure 1).

Based on the fact that, a higher percentage of their food supply comes from a subsistence lifestyle, the community members of the Native Villages within the Norton Bay Watershed are disproportionately impacted by the effects of the changing climate. They are also being impacted by non-climate stressors, such as toxic substances and lowered instream flows resulting from mining and other industrial development activities taking place in the Watershed. These non-climate stressors tend to exacerbate the effects of climate change and are important to include in any stewardship planning process.

As the result of extreme weather conditions last summer, for example, Alaska Gov. Sean Parnell declared an economic disaster for residents living on St. Lawrence Island in the Bering Sea because of a historically low walrus harvest. This is causing a significant economic challenge to the residents of Gambell and Savoonga. Only 340 walrus were taken during the spring harvest, or 36 percent of the average for the last 10 years.

In addition, while the native communities in the Norton Bay area are at a higher risk from the impacts of development in the Watershed, they are at the same time the ones with the most knowledge as to what these impacts are and how to address them. The use of such Traditional Ecological Knowledge (TEK), therefore, can be applied in relation to adaptation planning to determine decline in fish population and changes in human and fish and wildlife health, aquatic and marine habitat and the environment.

Similarly, because native communities in Alaska and elsewhere in the United States have struggled against violations of the internationally recognized human rights, the experience of such communities in addressing such violations on a scientific, legal and policy level is invaluable. The research, planning and application of TEK combined with Tribal sovereign status, the federal trust relationship, and state and federal environmental justice policies, therefore, provides native villages in Alaska with the means to not only protect their own water related interests, but those of the general public in a manner that often exceeds those of the most potent environmental laws.

This Plan, therefore, focuses on restoration of traditional knowledge as a primary adaptation and mitigation strategy to address climate change, food security, economics, holistic wellness and energy issues related to water quality and quantity in the Watershed.

Figure 2: Murray's family seining, *Source: Emily Murray*

In addition to this climate adaptation plan, the NBITWC is in the process of developing a detailed Watershed Assessment of the Tubutulik River, a major river in the Norton Bay watershed. This Tubutulik River watershed plan will complement this adaptation plan for the Bay and address water quality and quantity protection activities in a synergistic way. Activities will be designed to mitigate the risk of potential contaminant sources within water protection areas and/or to decrease the vulnerability of the water sources and subsistence uses, and include establishing resolutions and ordinances, land usage agreements, water conservation efforts and educational outreach. The NBITWC will also utilize the Watershed Assessment and Management Plan to apply to the Environmental Protection Agency for Treatment as a State status, a strategy that will facilitate establishing and implementing water quality standards and criteria.

Figure 3: Caches Estuary, Norton Bay, *Source: Harold Shepherd*

a. Community Introduction

The original settlements of the Norton Bay native villages were made by the Malemute Eskimo Nevaircaq Tribe, which is a subset of the Inupiat-Yupik Eskimos. The Chief of the Tribe acted as a head of council of elders that governed the tribe. Each tribe in the area possessed a well-defined territory for harvest purposes. Alliances were sometimes made with neighboring tribes for mutual protection or to extend harvest areas. Sometime before the turn of the century, The Norton Sound region experienced an influx of Inupiat Eskimos from the North. The present populations, therefore, are descendants of both Yupik and Inupiat cultures, a fact, which is reflected in their uniquely defined Norton Bay Eskimo dialect. The Inupiat Eskimo community has lived over many centuries in the vicinity of Norton Bay. In the late 1950's, the newly established Atomic Energy Commission (AEA) set out to carve an instant harbor into the Alaskan coast of the Chukchi Sea with a massive thermonuclear explosion referred to as Project Chariot. These efforts, however, were thwarted by the Point Hope community of Inupiat along with scientists and conservationists that grew into the first stirring of the environmental movement. Then in 1992, the Inupiat revisited the Project Chariot controversy when it was discovered that before abandoning the Chariot camp, the federal government buried nuclear waste near the site and conducted experiments with radioactive tracers at the Chariot nuclear waste site. Most recently, in the summer of 2008, the Bureau of Land Management (BLM) and

State Department of Natural Resources (DNR) granted uranium exploration permits to the Companies for the Boulder Creek Uranium Mine on Alaska's Seward Peninsula.

Figure 4: Anti-Mining demonstration, *Source: Harold Shepherd*

As it relates to its sovereign authority to manage its natural and subsistence resources, the Native Village of Elim is situated in what was formerly known as the "Norton Bay Native Reservation", formed in 1911, and one of very few tribal reservations in Alaska. Because of this reservation status, the Elim Native Corporation had a choice under Section 19(b) of the Alaska Native Land Claims Settlement Act (ANCSA) of 1971 to receive title to the surface and subsurface estates in lieu of selecting other lands or receiving regional corporation stock or funds. Rather than accept title under ANCSA, the Elim Native Corporation voted to take simple title to 297,982 acres, giving the village rights to all surface and subsurface rights. As a result, the state cannot force the village to "reconvey" some of its land to the state for future development such as towns, mines, and roads. They must, however, reconvey title to any lands withdrawn for national defense purposes or lands used by the BIA for third parties (e.g., schools).

The Native Villages in the Norton Bay area pursue a centuries old subsistence lifestyle, which is dependent on fish and wildlife resources of the Norton Bay Watershed (Watershed) consisting mainly of fish, small sea mammals, and caribou from the Interior. This unique Eskimo population relies on the harvest of: seal, mukluk, salmon, flounders, whitefish, tomcod, beluga, herring, crab and smelt. The land also provided subsistence, including: squirrels, moose, caribou,

reindeer, berries, edible greens, rabbit, ptarmigan, bird eggs, and spruce hens. Certain areas were identified as hunting and harvesting grounds for their subsistence foods, according to the season.

As a means of preserving this subsistence lifestyle, the NBITWC focuses on the Tribal vision for management and oversight of the Norton Bay Watershed in Alaska's Seward Peninsula and protecting water resources of the Watershed for the benefit of the Watershed Council's members and the public. The NBITWC conducts research, education and advocacy related to its efforts to protect and restore tribal interest in water quantity, water quality, subsistence uses and water rights for the health of the watershed ecosystem, preservation of cultural identity and to benefit tribal members. Currently, the NBITWC represents the Elim, Koyuk, Unalakleet & Shaktoolik Native Village Communities. The Watershed Council is, currently, working with these and other Native Alaskan tribal governments in the drafting of the Watershed Assessment for the Tubutulik River and working to promote environmental justice policies and practices related to management of water and subsistence resources.

Figure 5: Iditarod Dog team, *Source: Harold Shepherd*

NBITWC has put much effort into working with the many agencies, villages, businesses, and organizations in the watershed. Throughout 2012 the NBITWC held meetings with local tribal, state, federal and other entities and held community meetings in the Native Villages of Elim and Koyuk. In addition, the NBWITC retains an Advisory Committee made up of state, federal and tribal entities. Current partners include: the City of Elim, the Elim School, the University of Alaska Fairbanks-Research Faculty (UAF), Kawerak Inc., Laoch Consulting, the University of Alaska Anchorage (UAA), Alaska Departments of Natural Resources and Fish and Game, hydrological, water quality and environmental education consultants, and the Model Forest Policy Program's Climate Solutions University program. NBITWC is also working to coordinate its activities with Federal, state and tribal agencies and consortiums including the WALCC, the

Norton Sound Regional Watershed Alliance, Kawerak, Inc., Nome Eskimo Community, and Norton Sound Health Corporation.

Figure 6: Elim Village, *Source: Harold Shepherd*

b. Climate Overview

Life on Earth as we know it today is made possible by relatively warm temperatures. Without gases like water vapor, carbon dioxide (CO^2) and methane in the atmosphere, the Earth would be much colder than it is now averaging 0° F instead of about 59° F, and most of the water on the planet would be frozen. At historic levels, these "greenhouse gases" make the planet livable for humans and many other kinds of plants and animals by trapping some of the heat radiating outward from the Earth, much like the walls of a greenhouse trap heated air. This process of limiting heat loss through the atmosphere is called the "greenhouse effect."

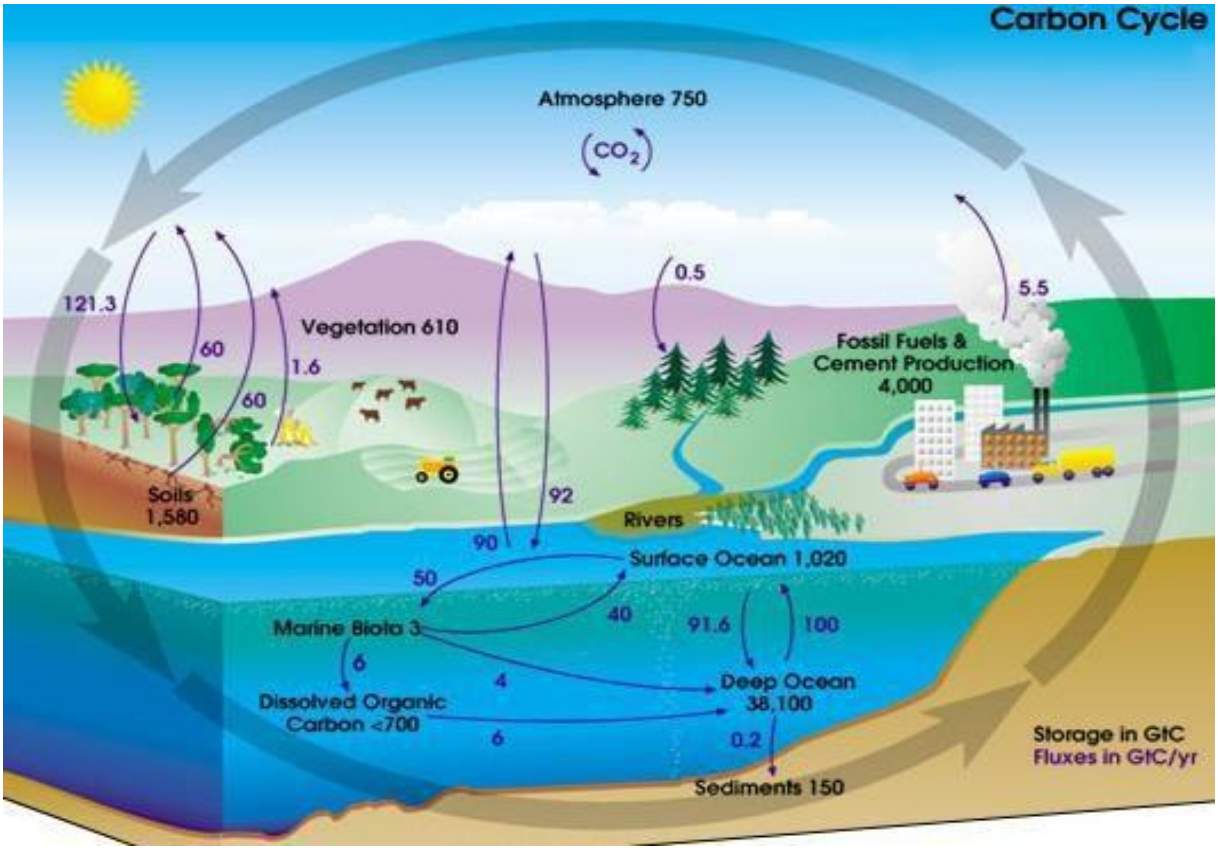

Figure 7: Carbon Cycle, *Source: https://spark.ucar.edu/imagecontent/carbon-cyclediagram-nasa*

The concentrations of carbon dioxide produced by the use of fossil fuels, along with other greenhouse gases, have rapidly increased in the Earth's atmosphere. They are the largest direct cause of global climate change and the impacts result both from the amount of emissions and the rate at which they have increased. The gases humans have added to the atmosphere have enhanced the heat trapping capacity of the blanket of greenhouse gases that naturally surround the Earth. As a result of exceeding the limits of the natural greenhouse effect, after a delay of well over a century, an energy imbalance has been created. More heat is collecting near the surface of the earth than is escaping into space. This imbalance is what is disrupting the Earth's climate system.

Alterations in the Earth's forests and landscapes are the other direct causes of global climate disruption. When we cut down forests for lumber or convert them to cities or farmland, carbon dioxide is directly released into the atmosphere. Because the cooling effect of vegetation is lost, part of the climate's self-regulating mechanism is weakened. Deforestation and other land use changes have contributed more than 20% of today's climate disruption by reducing the Earths capacity to sequester greenhouse gases.

The consequences of disruption to the Earth's climate system are already significant. The global average surface air temperatures have risen by 1° C, and might even rise as much as 6.4° C, which would be catastrophic for humans, unless atmospheric greenhouse gases are rapidly stabilized and eventually reduced to levels that existed prior the Industrial Revolution. For example, "A World Bank report imagines a world 4 degrees warmer, the temperature predicted by century's end barring changes, and says it aims to shock people into action by sharing devastating scenarios of flood, famine, drought and cyclones."[1]

More extreme weather is one of the adverse effects of rising temperatures. Warmer temperatures have increased the amount of water vapor in the air by about 4%. The added moisture is being squeezed out in concentrated outpourings, leading to more frequent and intense rains storms and catastrophic floods around the globe. The frequency and intensity of heat waves as a result of air temperature increase, is also now outstripping record highs around the world by a 2-1 ratio. In addition, the percentage of regions experiencing extreme drought has more than doubled in the past 30 years. A hotter global climate generates altered regional and local weather patterns.

Another consequence of global climate disruption is sea level rise. The oceans are absorbing much of the earth's added warmth. Warmer ocean waters expand causing some of the sea level rise. In addition, higher temperatures melt ice sheets and glaciers, which will accelerate sea-level rise. Coastal flooding and higher storm surges will damage homes, roads, and other infrastructure, and will contaminate fresh drinking water supplies and force millions of people worldwide migrate to higher ground. "A report[2] from the US National Research Council, commissioned by the US Central Intelligence Agency (CIA) and other intelligence agencies, says the consequences of climate change--rising sea levels, severe flooding, droughts, fires, and insect infestations--pose threats greater than those from terrorism ranging from massive food shortages to a rise in armed conflicts."[3]

[1] World Bank. 2012.

[2] National Research Council. 2013.

[3] Mims, C. and Buckley, S. 2012.

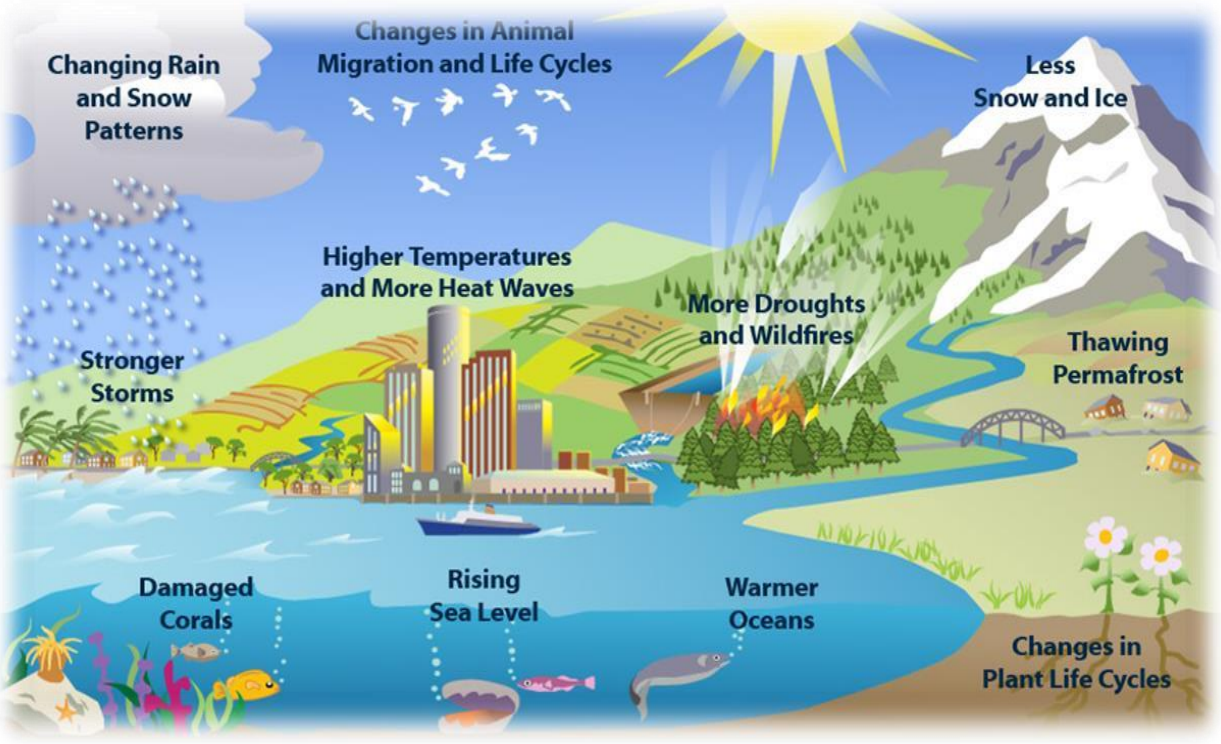

Figure 8: Impacts of Climate Change Due to More Intense Greenhouse Effect,
Source: Environmental Protection Agency

One of the best illustration of the magnitude of climate change impacts on the environment is a World Bank report showing an unusually large ice melt over a four-day period in 2012, when an estimated 97% of Greenland's surface ice sheet had thawed. In addition, there are indications that the greatest amount of melting during the past 225 years has occurred in the last decade.[4]

Global climate models predict that instances of extreme weather will increase. In many cases this means more instances of severe drought, flash floods, and extreme heat and cold weather. The Norton Bay watershed already suffers from extreme weather such as flash floods and extreme drought, and we could see these events increase in frequency and severity over time.

[4] *Ibid.*

c. Early Signs of Climate Change in Alaska

Due to the lack of specific data available for the Norton Bay Watershed, the following information and associated maps addresses Alaska in general. The Watershed is located approximately 50 km (31 miles) from the Elim Village, and 170 km (106 miles) from the coastal city of Nome and is highlighted on each map. Highlights of changing climate conditions already happening or projected for Alaska include:

1. ***Temperature increase:*** Over the past 50 years Alaska's average annual temperature has increased by about 2°F – *a rate twice as fast as that of the lower 48 states*. By 2100 Northern latitudes, including Alaska, may see an 11.5° F degree change in average annual temperature according to the EPA. And winter temperatures will increase at a higher rate than summer temperatures, creating a cascade of impacts.[5] The following figures illustrate the expected increase in temperatures throughout Alaska over the next 100 years.

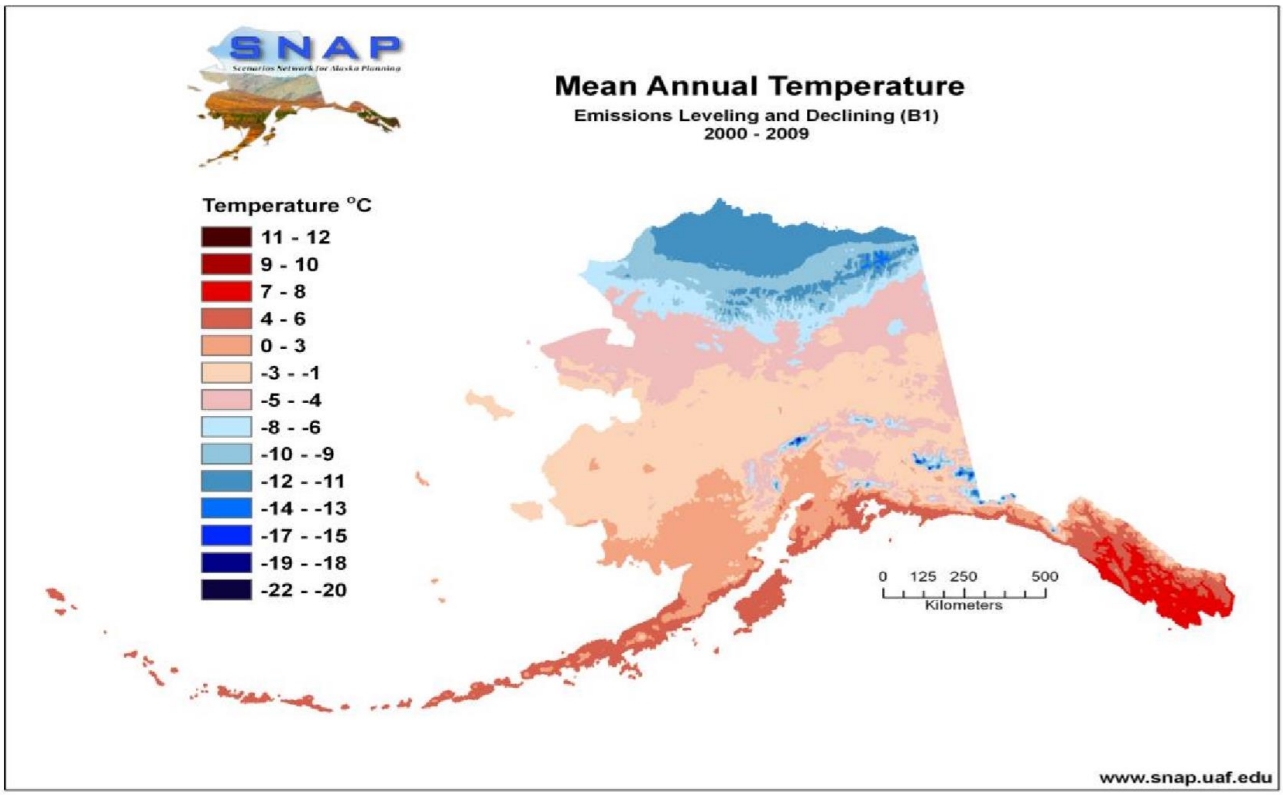

Figure 9: Temperature Change 2000-2009, *Source: Scenarios Network for Alaska and Arctic Planning*

[5] Environmental Protection Agency, http://www.epa.gov/climatechange.

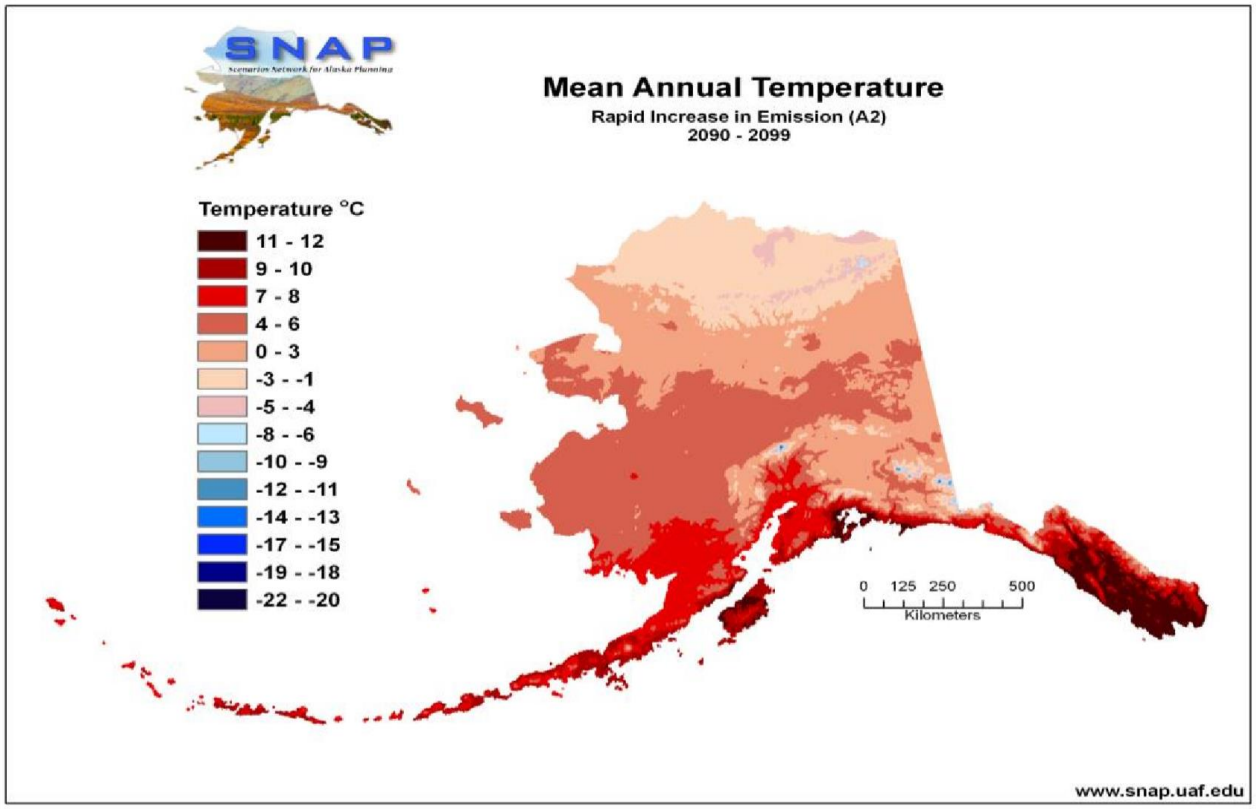

Figure 10: Temperature 2090-2099, *Source: Scenarios Network for Alaska and Arctic Planning*

2. ***Longer snow-free season*****:** Between 1970 and 2000, the snow-free season increased by about 10 days across much of Alaska, primarily due to earlier snowmelt in the spring.[6]

3. ***Reduction in lakes*****:** Across south-central Alaska, closed-basin lakes have decreased over the past 50 years due to greater evaporation and thawing of permafrost, which allows water to drain. Mud cores of these lakes indicate that they have existed in place since the last ice age, 10,000 years ago. Now willows and other pioneer plants are colonizing the empty lakebeds that remain.[7]

4. ***Spruce forests show declining growth*****:** White spruce forests in Interior Alaska are experiencing declining growth due to drought stress. At the same time, willows, dwarf birch, and other shrub species are expanding their range as permafrost melts and soils warm across regions that were previously dominated by tundra.[8]

[6] Scenarios Network for Alaska and Arctic Planning, http://www.snap.uaf.edu/data.php.
[7] Klein, Berg, and Dial. 2005.
[8] U.S. Global Change Research Program, http://nca2009.globalchange.gov/alaska.

5. ***Shifting tree line*****:** The tree line, which ends at 3,000 feet in southern Alaska and peters out altogether just beyond the 60th parallel, has begun to climb in areas where water is not limited. Pioneer shrubs and spruce trees are colonizing higher elevations on warmer, south-facing slopes as far north as the Brooks Range.[9]

6. ***Range extensions*****:** Birds and insects are extending their ranges northward in response to warmer weather and expanded shrublands. Invasive and harmful insects that are not currently found in Alaska, such as mosquitos that carry west Nile virus and ticks, are likely to expand their ranges into Alaska as well.[10]

7. ***Multi-year fires*****:** The dead-standing forests left in the wake of the spruce bark beetle infestation, coupled with warmer dryer summers have resulted in vast, sometimes multi-year fires in Alaska. The 2004 fire season burned 6.59 million acres (an area slightly larger than the state of Vermont), far surpassing any fire season on record anywhere in the United States.[11]

8. ***Permafrost changes:*** Warmer winters and longer summers have led to significant hydrological changes in regions underlain by permafrost. Much of the Alaskan interior north of Anchorage and vast swaths of land to the west along the Yukon Kuskokwim Delta have discontinuous permafrost – that is, soils just below the surface that remain frozen year-round, usually to great depths. The further north one goes, the more pervasive the permafrost soils are. These soils, provided they remain frozen, are stable and can be depended upon to support roads, pipelines, and buildings in many Alaskan communities, including Fairbanks, which is Alaska's second largest population center. But as soils warm, melting permafrost is creating significant problems with infrastructure, evidenced by homes and businesses sinking into holes opened up where ice has melted away, river banks and coastal bluffs eroding rapidly, and roads buckling as the sun warms their surfaces and melts that ground below. Numerous communities in Interior and coastal Alaska now face near annual flooding and deteriorating infrastructure.[12]

9. ***Methane release*****:** To compound the climate issue, permafrost, which is comprised of a mixture of frozen peat, glacial till, clay, and water, effectively locks up vast quantities of methane. In the ground methane is harmless, but in the atmosphere it is 20 times as effective as CO2 in trapping solar radiation. Even modest releases of methane into the atmosphere will increase the rate of global warming. There is great concern among the scientific community that wide-scale melting of permafrost will release vast stores of methane into the precarious climate change equation.[13]

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[9] Wilmking, Juday, Barber, and Zald. 2004.
[10] U.S. Fish & Wildlife Service.
[11] Shulski, M., Wendler, G., Alden, S., and Larkin, N. 2005
[12] Environmental Protection Agency, http://www.epa.gov/climatechange.
[13] *Ibid.*

10. ***Glacier melt:*** Glaciers throughout Alaska are receding rapidly. On the Kenai Peninsula, the many glaciers that spill off the 700 square mile Harding Ice Field have receded by a mile or more within the last 50 years. The Columbia Glacier, near Valdez, Alaska, began receding in 1980, and since that time it has receded over 12 miles. As it retreats, sloughing off a continual string of ice bergs, it contributes to sea level rise.[14]

Grewingk Glacier on the Kenai Peninsula has receded more than a mile since 1952. (See Figure 12.)

[14] NASA Earth Observatory.

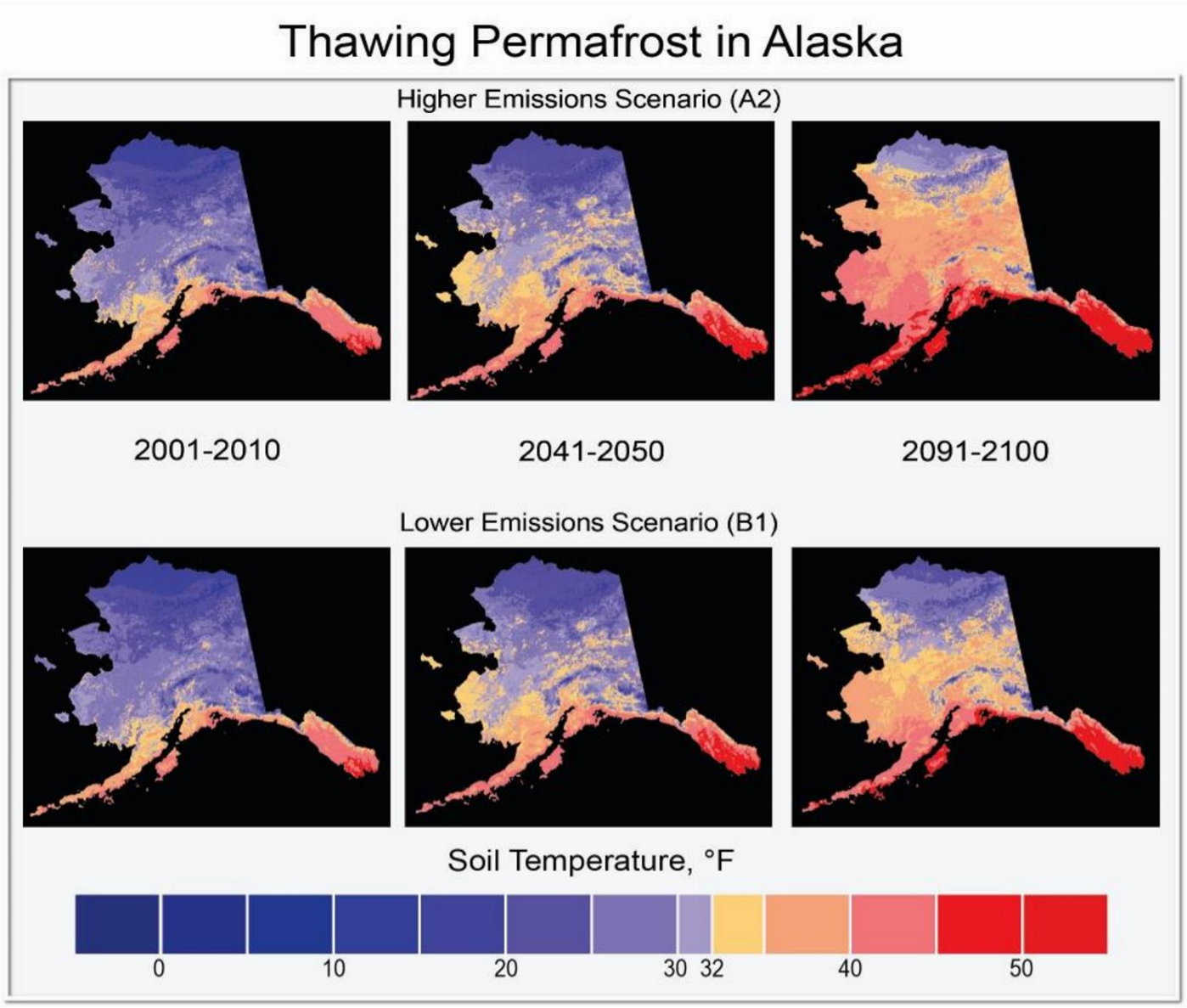

Figure 11: Thawing Permafrost timeline, *Source: U.S. Global Change Research Program*

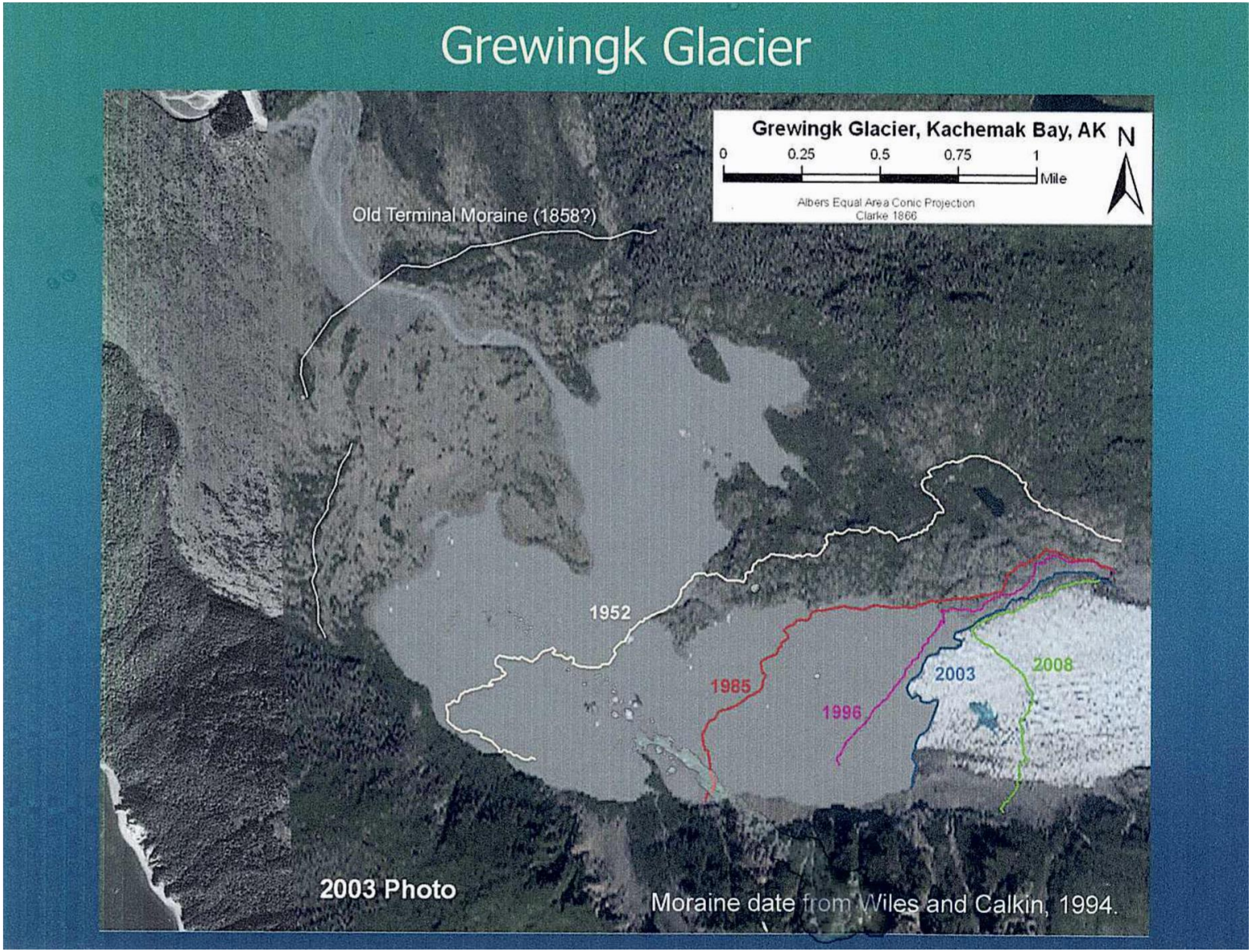

Figure 12: Glacier Recession, *Source: Wiles and Calkin*

11. ***Melting sea ice:*** While sea ice doesn't contribute to sea level rise, just as a melting ice cube doesn't increase the volume in a water glass, the loss of ice cover does lead to warmer ocean temperatures. Sea ice, being white, doesn't absorb solar radiation as effectively as the deep blue of the open ocean. This albedo effect, where oceans warm and speed climate change, is happening rapidly in the Earth's polar regions. For the first time in at least 100,000 years, since before the last ice age, a channel opened up across the Arctic Ocean during the summer of 2012, and reappeared in 2013. The 900-mile channel may soon be navigable, shortening the route between Europe and ports along the western United States and Japan, and opening the floor of the Arctic to oil exploration.[15]

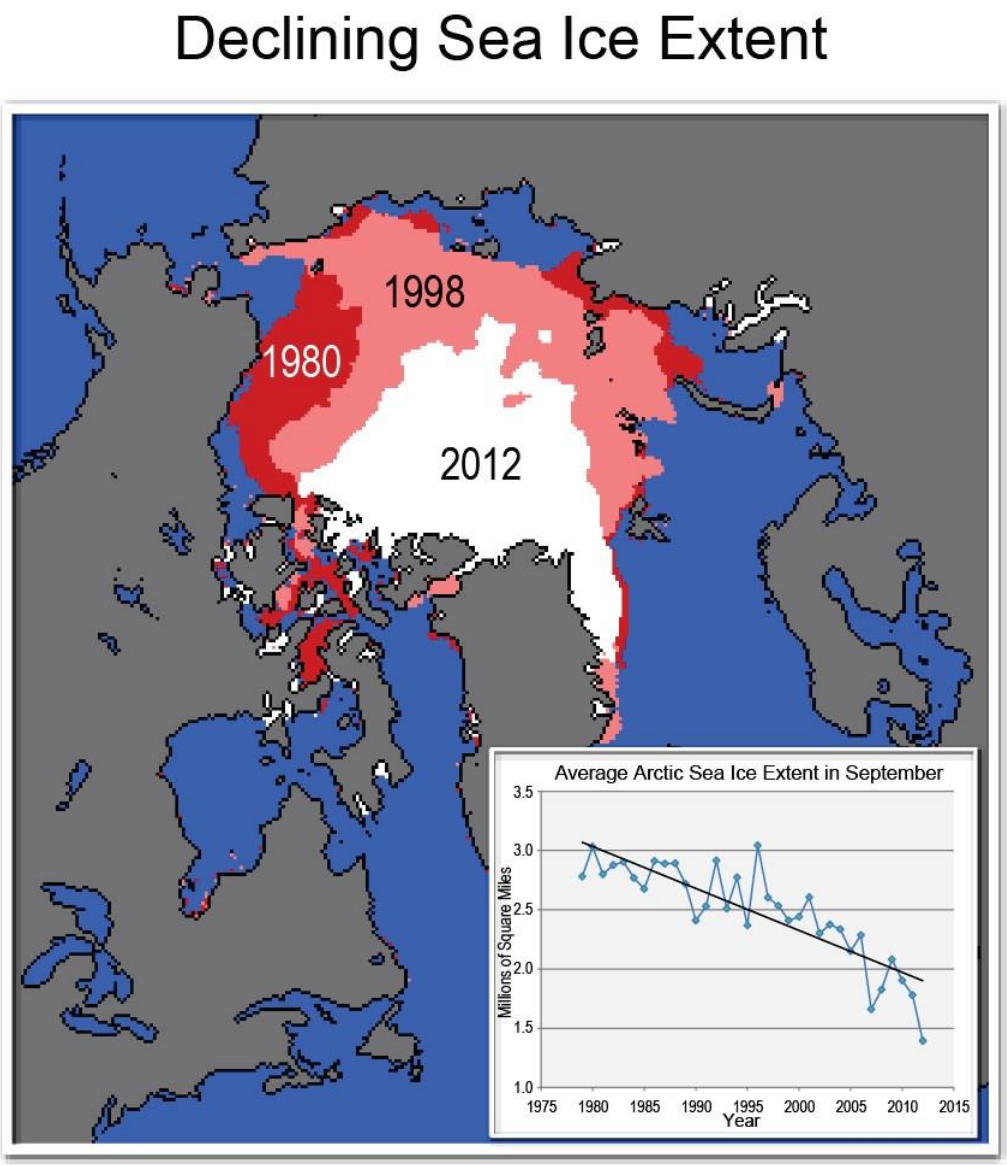

Figure 13: Sea-ice Recession, *Source: U.S. Global Change Research Program*

[15] Environmental News Network. http://www.enn.com. and Nature. http://www.nature.com.

12. ***Ocean acidification*****:** The oceans of the world act as huge carbon dioxide sinks, absorbing approximately 30% of all atmospheric CO^2 produced. The cold waters of the arctic and sub-arctic are able to absorb and retain higher concentrations of atmospheric carbon dioxide because CO^2 becomes more soluble in colder waters. The down side of this equation is that CO^2 in the water column breaks down into carbonic acid, driving up ocean acidification and lowering pH. Even a modest decrease in pH impacts the ability of organisms to form shells-organisms such as crabs, clams, and the tiny shrimp-like creatures that make up the base of the food chain. Fish species depend on these small organisms, and Alaska, in turn, depends on fish for some 78,000 jobs state-wide, or $4 billion in annual sales. Over 50% of the fish eaten in the United States come out of Alaskan waters. [16]

13. ***Sea level rise*****:** As glaciers recede, sea levels will naturally continue to rise. But sea level won't rise uniformly across the world's oceans, due to tectonic forces that result in subsiding coasts in some regions, and upwelling in other regions. In Alaska some areas that are very recently free of glaciers are rebounding as the land recoils slowly in response to the loss of millions of tons of ice. Early research suggests that these areas are currently outpacing sea level rise. Other regions of the state are not so fortunate and may experience a predicted two to six feet of sea level rise by the end of this century.[17]

In addition, when combined with extreme weather conditions, sea level rise contributes to flooding in Alaskan coastal villages which can result in damage to structures and severe health issues when sewage systems back-up or otherwise become inoperable and drinking water is impacted.

14. ***Longer growing season:*** One possible advantage that Alaska will likely see as the climate warms is an extended growing season. The growing season has already been extended up to two weeks in many regions, and climate models show that this trend will continue.

[16] Alaska Marine Conservation Council, 2012, http://www.akmarine.org/our-work/.
[17] Larsen et. al. 2005. and Alaska Sea Grant Marine Advisory Program. http://seagrant.uaf.edu/map/climate/docs/sea-level.php.

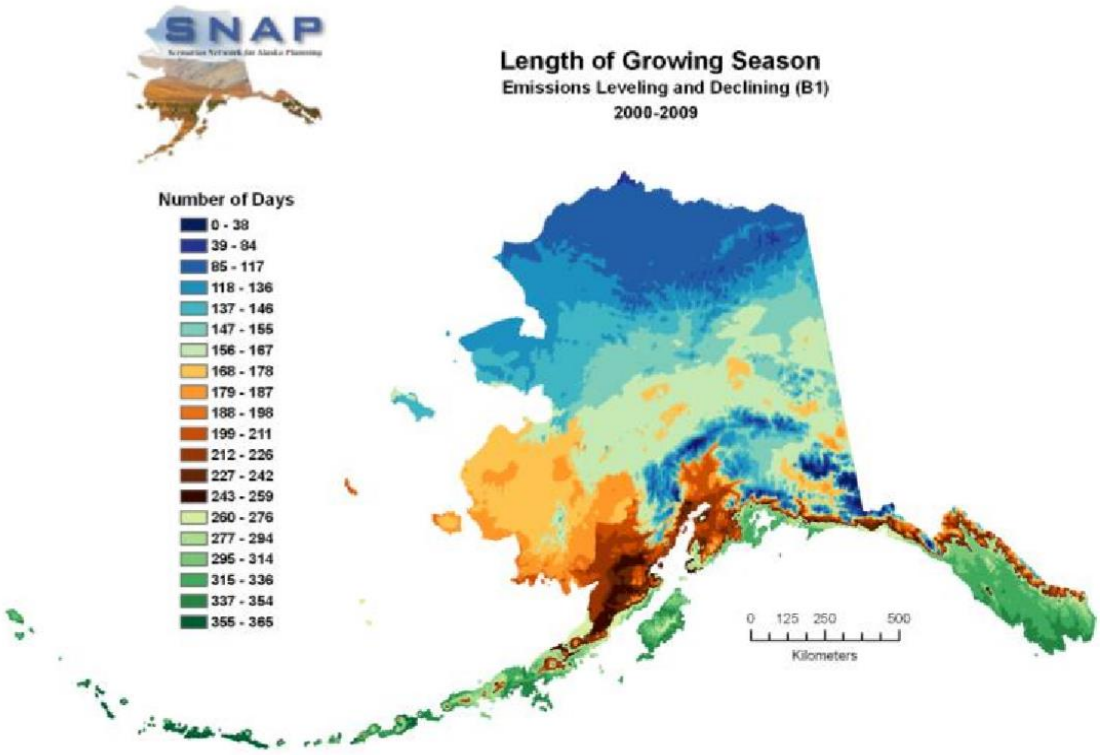

Figure 14: Current growing season, *Source: Scenarios Network for Alaska and Arctic Planning*

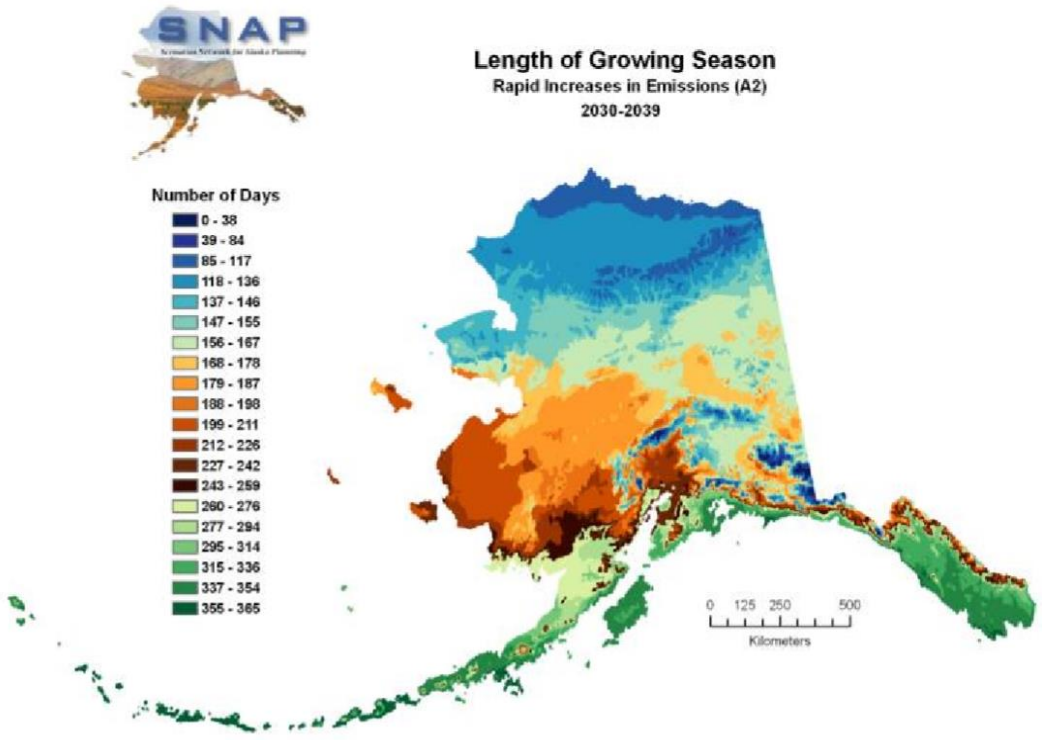

Figure 15: Projected growing season, *Source: Scenarios Network for Alaska and Arctic Planning*

d. Why Adaptation Planning is Important

It is important to understand the distinction between climate mitigation and adaptation. The goal of mitigation is to lessen the impacts of climate change by addressing the cause, reducing greenhouse gas emissions, and thus slowing or reversing climate change impacts. However, the science is clear that a certain degree of climate change is inevitable due to greenhouse gas emissions already in the atmosphere. Global atmospheric CO2 levels have now exceeded 400 ppm, up from the historic 280 ppm CO2 levels that previously gave us a stable climate for thousands of years. An increase of global greenhouse gas emissions by 25% to 90% (carbon dioxide equivalents) is projected between 2000 and 2030.[18] Currently, we are exceeding the A2 emissions scenario, which was thought to be a fairly accelerated rate of change when it was developed.[19] Therefore, climate adaptation, which means preparing for impacts that cannot be avoided, is necessary now to address the significant climate disruptions that cannot now be avoided, while simultaneously working to slow climate change with mitigation as much as possible. This plan focuses on the goal of adaptation to the climate impacts already happening and those yet to come. However, it also acknowledges the vital nature of mitigation efforts and encourages doing both to the greatest extent possible.

Goals for the Adaptation Planning Process

The impacts of climate change will seriously affect natural resources, local economies, urban development trends, and the quality of life throughout the United States and the World. The Norton Bay watershed is not immune to these impacts, and has already experienced sea level rise, flooding, and an increase in extreme weather. This adaptation plan outlines options to adapt to changes in climate and how to protect not only the Watershed's natural resources, but also how to preserve a centuries-old way of life. The Plan is designed to build on the principles already outlined in the Economic and Comprehensive Plans of the Native Villages located within the watershed, and focuses on threats due to a changing climate and a changing population. Whether or not an individual considers the scientific and academic research on climate change to be valid and relevant, community members and local officials recognize the importance of protecting the natural resources and specific threats to the water and forest resources. The strategies developed to protect and enhance forest and water resources from other impacts are similar to the strategies designed to adapt to a changing climate. By taking steps to address issues involving the Watershed's natural resources, stakeholders can significantly enhance climate change resiliency and environmental conservation at the local level. Although climate change adaptation can be seen as controversial and a political "wedge" issue, the cost of protecting natural resources and local economies required to prepare for, mitigate and adapt to climate change is much higher than the cost of doing nothing.

[18] Intergovernmental Panel on Climate Change. 2007.
[19] *Ibid.*

This document examines impacts of climate change on natural resources, the local economy, and the environment within the Watershed. This plan includes measures that will lessen the effects of climate change on the forest, water and subsistence resources. This document was drafted through a ten-month process involving the NBITWC's Climate Change Adaptation Planning group. The planning group was led through the 2013 curriculum conducted by the Model Forest Policy Program's Climate Solutions University (CSU) adaptation planning process.

The adaptation group was charged with understanding problems exacerbated by climate change as well as current and projected development practices within the watershed. The adaptation planning group represents a diverse set of opinions and perspectives involving natural resources and the community's commitment to protecting them. The planning process was led by the NBITWC, namely Emily Murray, with the technical assistance of Hal Shepherd and Jessica Ryan, and with the expert input and support of the other members of the NBITWC and its technical advisory group.

Over a 10-month period the CSU process provided learning modules and coaching to NBITWC and five other rural communities across the country. Together they went through the adaptation planning steps: 1) Form a local planning team; 2) Assess local risks and opportunities for climate, forest, water and economics; 3) Analyze the findings and identify adaptation strategies and plans; and 4) build public support to implement the plan.

In a complimentary effort, the NBITWC is conducting a watershed assessment of the watershed, which started with a thorough review of what is known about the Tubutulik River watershed fishery and wildlife and the Alaska Native cultures. NBITWC also reviewed information about uranium mining and available information outlining proposed mining operations for the Triex/Full Metal deposit that has been the focus of much exploratory study and has received much attention from various groups in and outside Alaska. Water discharge and quality data were also collected at a site 15 miles upriver.

III. ECONOMIC ANALYSIS

Economic sustainability is an important element of climate adaptation; therefore assessment and describing the socioeconomics of the communities involved is a key part of the planning process. The following provides an overview of the economic analysis findings.

a. Description of the Economy

The native villages of Norton Bay operate on a subsistence economy with a cash overlay. This means that the majority of the "economic work" activity that provides food, shelter and clothing occurs due to hunting, fishing, gathering and other natural resource activities with no direct monetary compensation. This subsistence living is then supplemented by and dependent upon a second economy of work for cash payments necessary to purchase items that must be paid for monetarily, such as gasoline, electricity, heating oil, cars, homes, etc. This type of economy is therefore difficult to account for in exact terms. Standard economic measures do not necessarily reflect the true value to the community of the waters and wildlife upon which they greatly depend for much of their family support system.

The important elements of Alaska's subsistence economy are discussed in more detail below. For an overview, the table below summarizes the highlights of the economic measures gathered for the four native villages of Norton Bay. These figures indicate several key findings:

- The villages are small populations ranging from 200-500 village members each
- The majority of any village are not considered "employed" but that does not account for their subsistence livelihood activities dependent upon local fish and wildlife
- Of those who do earn a direct salary, most at or below middle income range compared to the U.S. averages
- The distribution of incomes is unequal in all villages, with the bottom 40% of households earning a range of 13-17% of the total income in the village; while the top 20% of households earn a range of 43-58% of the total village income.
- Significantly, the percentage of individuals living below the poverty level ranges from 14 to 52% for an average of 38.5%, compared to 14.3% for the U.S. average.
- The percentage of families living below the poverty level ranges from 14 to 47% for an average of 34%, compared to 10.5% for the U.S. average.

Table 1: Norton Bay Village Economics Indicators Summary

Norton Bay Native Villages					
Economic Indicator (2007-2011)	**Elim**	**Koyuk**	**Shaktoolik**	**Unalakleet**	**U.S. Average**
Population	??	329	200	500	
% employed-full-time or part-time	40%	24%	17%	12%	55%
Highest % Income Category / Household income category	34.4% $50K-$75K	23.8% $15K-$25K	20.6% $25K-$35K	29.7% $35K-$50K	
Total income % for bottom 40% of households	13.0%	10.5%	11.5%	17.7%	
Total income % for top 20% of households	43.6%	50.5%	58.7%	49.6%	
% Individuals below poverty level	34.4%	52.6%	52.6%	14.6%	14.3%
% Families below poverty level	26.5%	47.5%	47.5%	14.7%	10.5%

Additional details of socioeconomics of these villages are provided in Appendices.

1. *Employment*

Elim: In the 2007-2011 period, the U.S. had the highest estimated percent of people that worked 50 to 52 weeks per year (55.0%), and Elim city, AK had the lowest (17.7%). In the 2007-2011 period, the U.S. had the highest estimated percent of people that worked 35 or more hours per week (58.9%), and Elim city, AK had the lowest (40.7%). (See Appendix A)

Koyuk: With a total population of 329, the employed population in 2011 was 24%. (See Appendix B).

Shaktoolik: With a total population of 200, the employed population in 2011 was 17%. (See Appendix C).

Unalakleet: With a total population of 500, the employed population in 2011 was 12%. (See Appendix D).

2. *Household Income Distribution*

Elim: In the 2007-2011 period, the largest income category in Elim was $50,000 to $74,999 (34.4% of households). The smallest income category was $150,000 to $199,999 (0.0% of households). In the 2007-2011 period, Elim had the most equal income distribution between high and low income households (Gini coeffiecient. of 0.37) in comparison to the U.S. (Gini coef. Of 0.47). In the 2007-2011 period, the bottom 40% of households in the Elim accumulated approximately 13.0% of total income, and the top 20% of households accumulated approximately 43.6% of total. (See Appendix E)

Koyuk: In the 2007-2011 period, the income category in the Koyuk with the most households was $15,000 to $24,999 (23.8% of households). The income category with the fewest households was $100,000 to $149,999 (0.0% of households). In the 2007-2011 period, the bottom 40% of households in the Koyuk city AK accumulated approximately 10.5% of total income, and the top 20% of households accumulated approximately 50.5% of total income. In the 2007-2011 period, Koyuk city, AK had the most equal income distribution between high and low income households (Gini coef. of 0.44) and the U.S. had the least equal income distribution (Gini coef. of 0.47). (See Appendix F).

Shaktoolik: In the 2007-2011 period, the income category in the Shaktoolik city AK with the most households was $25,000 to $34,999 (20.6% of households). The income category with the fewest households was $200,000 or more (0.0% of households). In the 2007-2011 period, the bottom 40% of households in the Shaktoolik city AK accumulated approximately 11.5% of total income, and the top 20% of households accumulated approximately 58.7% of total income. In the 2007-2011 period, the U.S. had the most equal income distribution between high and low income households (Gini coef. of 0.47) and Shaktoolik city, AK had the least equal income distribution (Gini coef. of 0.47). (See Appendix G)

Unalakleet: In the 2007-2011 period, the income category in the Unalakleet city AK with the most households was $35,000 to $49,999 (29.7% of households). The income category with the fewest households was $200,000 or more (1.6% of households). In the 2007-2011 period, the bottom 40% of households in the Unalakleet city AK accumulated approximately 17.7% of total income, and the top 20% of households accumulated approximately 49.6% of total income. In the 2007-2011 period, Unalakleet city, AK had the most equal income distribution between high and low income households (Gini coef. of 0.38) and the U.S. had the least equal income distribution (Gini coef. of 0.47). (See Appendix H)

3. *Poverty Levels*

Elim: In the 2007-2011 period, when the U.S. and Elim are compared, Elim city, AK had the highest estimated percent of individuals living below poverty (34.4%), and the U.S. had the lowest (14.3%). In the 2007-2011 period, Elim city, AK had 26.5% of families living below poverty (compared to 10.5% in the U.S.). In the 2007-2011 period, the highest estimated percent of public assistance in the Elim city AK was in the form of Food Stamp/SNAP (43.0%), and the lowest was in the form of Supplemental Security Income (SSI) (4.3%). (See Appendix I)

Koyuk: In the 2007-2011 period, Koyuk city, AK had the highest estimated percent of individuals living below poverty (52.6%), and the U.S. had the lowest (14.3%). In the 2007-2011 period, Koyuk city, AK had the highest estimated percent of families living below poverty (47.5%), and the U.S. had the lowest (10.5%). (See Appendix J)

Shaktoolik: In the 2007-2011 period, Koyuk city, AK had the highest estimated percent of individuals living below poverty (52.6%), and the U.S. had the lowest (14.3%). In the 2007-2011 period, Koyuk city, AK had the highest estimated percent of families living below poverty (47.5%), and the U.S. had the lowest (10.5%). (See Appendix K).

Unalakleet: In the 2007-2011 period, Unalakleet city, AK had the highest estimated percent of individuals living below poverty (14.6%), and the U.S. had the lowest (14.3%). In the 2007-2011 period, Unalakleet city, AK had the highest estimated percent of families living below poverty (14.7%), and the U.S. had the lowest (10.5%). (See Appendix L)

b. Economics Resources Law and Policy

The Alaska Native Claims Settlement Act, in 1971 resulted in recognition of Native lands, creating and funding Native corporations, and extinguishment of aboriginal hunting and fishing and opened the way for North Slope oil development and the Trans-Alaska Pipeline. Congress realized that although this right has been extinguished, both Natives and non-natives depended on wildlife foods.

Then when Congress passed the Alaska National Interests Lands Conservation Act in 1980 (ANILCA), it included a subsistence priority on federal lands and allowed subsistence on national interest lands. The laws recognized that subsistence hunting, fishing and gathering are important to Alaska and the nation, and both Alaska Natives and non-natives value the opportunity to choose a subsistence lifestyle. The Act acknowledged that without special protection for subsistence uses, commercial, agricultural, and industrial uses of the land and wildlife would eventually overwhelm subsistence uses.

ANILCA also seemed to be a comprehensive approach to the legal, political, and economic issues that plagued the state's subsistence policy. It's "Findings" provided the legal justification for federal protection of Native subsistence culture (and non-Native subsistence society). Therefore the Act: 1) Required the state to provide for the subsistence uses of rural Alaska with a priority for those uses and to establish "local advisory committees" and "regional advisory councils"; 2) Prohibited the Alaska fish and game boards from making policy contrary to the recommendations of the regional advisory councils with respect to subsistence uses; and 3) Provided for subsistence uses on federal lands.[20]

ANILCA mandated that a subsistence resources commission be appointed for each park or park monument in the state who, by mid-1982, were to "devise and recommend" a subsistence hunting program within each park or monument which after consultation and public hearing, the Interior Secretary was to "promptly implement."[21] Six months after passage of ANILCA, the National Park Service promulgated regulations further defining who would be considered a "local rural resident", and establishing procedures for setting up "resident zones" in each of the parks and monuments.[22]

Federal and state laws prohibit the sale of subsistence products at commercially significant volumes.

Alaska's overall population is still relatively small (only about 663,661 people total in 2005) and densities to the land are low. Nevertheless, commercial interests and the growing urban population create increasing pressures on Alaska's wild resource base through sport hunting and fishing and commercial enterprises like guiding, tourism, and commercial fishing. Rivalries between interest groups over fish and game have necessitated the development of laws that recognize and protect subsistence harvests.

The rural preference in federal law provides a tool for fish and game managers. Subsistence harvests by communities classified as `rural' can be recognized as distinct from the recreational harvests and commercial uses. Regulations regarding seasons, harvest methods, and bag limits can be created which provide for the customary and traditional features of the subsistence harvest pattern. Subsistence users are enabled to pursue cultural patterns without conflict with regulations from the federal and state governments. When wild resource populations cannot support all uses, customary and traditional subsistence uses are restricted last, after commercial and recreational uses. In this manner, Alaska communities with the greatest dependencies on fish

[20] Case, David S. and Voluck, David A. 2002.

[21] 16 U.S.C. Sec. 3118(a)&(b).

[22] 36 C.F.R. §13.420.

and game are provided an opportunity to continue ways of life built on mixed, subsistence-cash economies.[23]

Customary law guides local residents' access to the territory's resources, such as trapping lines, fishing camps, and common hunting areas. The customary rules exist alongside legal property systems defined by municipal, state, and federal governments. New hunters and fishers are instructed by mentors in traditional systems of knowledge, beliefs, and values regarding the natural world. In Alaska Native traditions, animals are commonly understood to have spiritual qualities and the violation of rules regarding the proper respect and treatment of animals can lead to declines in populations and poor luck in harvesting. Within the subsistence area, fishing and hunting follow a seasonal cycle linked with the migration of animals, weather, and quality of products within the local area.[24]

c. Rural Alaska

The term `rural' has come to mean a type of `rural socioeconomic system' in Alaska, rather than simply a demographic pattern. While a standard demographic definition of rural (populations less than 2,500 people) would protect most Alaska Native villages (most number less than 1,000 people), it is inappropriate because it would eliminate from subsistence protections mid-sized places dependent on wild foods like Barrow and Kotzebue (Inupiat settlements dependent on marine mammals and caribou), Bethel and Dillingham (predominately Yup'ik communities dependent on salmon and seals), and Kodiak and Sitka (predominately non-Native towns containing Alutiiq and Tlingit tribal groups dependent on salmon, halibut, and deer). The understanding of `rural' as a type of socioeconomic system was developed to conform to actual patterns of subsistence dependencies in Alaska communities.

By and large, `rural' in the subsistence statutes has come to refer to Alaska communities substantially dependent on wild foods for nutrition and other customary and traditional uses -- medicine, furs, transportation, and ceremonies. Using this rural paradigm, state and federal fish and game boards have classified Alaska places as rural or non-rural for subsistence protections. With a few exceptions, there are clear distinctions in the socioeconomic systems of Alaska communities -- communities substantially dependent on wild foods stand out from those that are not.

[23] *Ibid.*

[24] Subsistence Economics in Rural Alaska – Cultural Survival. http://www.culturalsurvival.org/ourpublications/csq/article/subsistence-economies-ruralalaska.

Based on the rural and non-rural classifications, about 20% of Alaska's population lives in rural areas and 80% in non-rural areas. The rural population is split almost evenly between Alaska Natives (49%) and non-Natives (51%). In urban areas, about 7% are Alaska Natives.

d. Wild Food Harvest Levels

Based primarily on harvest levels, where wild food harvests range from about 153 to 664 pounds per capita annually, federal and state boards have classified about 270 communities as `rural' in Alaska.[25] Significantly, wild food harvest in rural Alaska contains about 242% of the protein and about 35% of the caloric requirements[26] of the rural population. In comparison, in Alaska's non-rural areas food supplies are supported by an industrial-capital economic system, most foods are purchased, and employment is based on service support of several basic industries -- commercial extractions (oil, timber, minerals, fish), national defense, tourism, and commerce. For these non-rural areas wild food harvests range from about 16 to 40 pounds per capita annually and the urban harvest contains about 15% of the urban population's protein requirements and about 2% of the caloric requirements.[27]

e. Subsistence Economy with Cash Overlay

In addition to the subsistence sector, the rural economy also has a cash sector (also called a `commercial' or `market' sector). Commonly, the cash sector is not well-developed in rural communities. Jobs are few and seasonal. Incomes are modest and insecure from year to year. Common sources of income include commercial fishing, trapping, or fish processing, public sector jobs from government grants, such as schools, and dividend payments from Alaska Native corporations. In some rural communities, the local cash sector is more developed, such as on the arctic slope where borough revenues from oil production fund local jobs, or on the Aleutian Islands where large commercial fisheries in the Bering Sea support employment in fishing and fish processing.

[25] *Ibid.*

[26] The remaining caloric needs are made up with purchased foods that are imported from outside the Villages.

[27] Subsistence Economics in Rural Alaska – Cultural Survival. http://www.culturalsurvival.org/ourpublications/csq/article/subsistence-economies-ruralalaska.

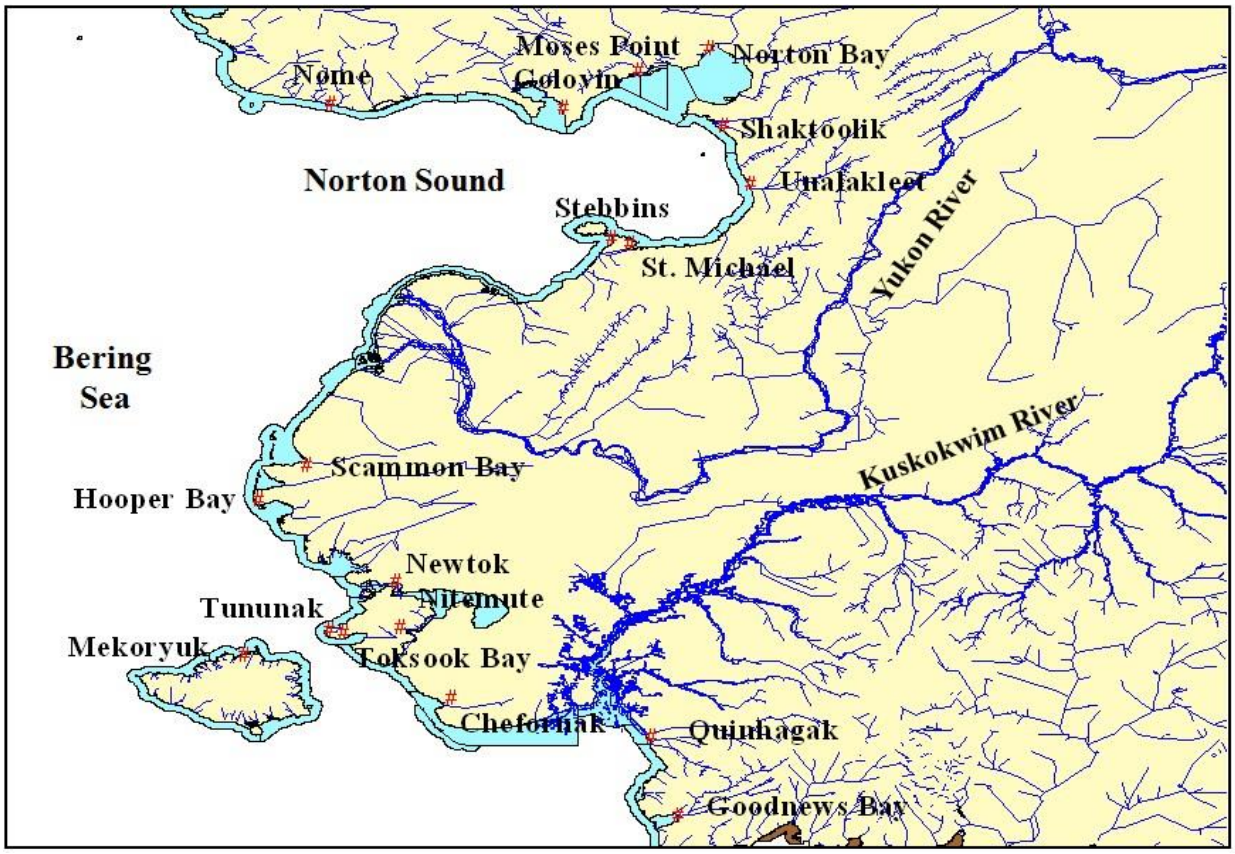

Figure 16: Location of subsistence communities in the Norton Sound Area, *Source: CityData.com*

While the subsistence sector is essential to the rural economy, so is the cash sector. The economy of the tribes within the watershed is primarily subsistence with a cash overlay. Today the community of the Villages is dependent on the cash economy to pay bills and to buy food, oil and gas. The most successful families in the rural economy combine employment income with subsistence production. Income from jobs is invested in equipment to harvest wild foods. Commonly, the most highly productive subsistence harvesters are from households with the largest monetary incomes. The socioeconomic system in rural areas is most properly understood to be a mixed, subsistence-cash system in which subsistence and cash sectors are interdependent and mutually supportive.[28]

f. The Relationship between the Economy and Climate Change

The fact that the economy of the Norton Bay village communities is substantially impacted by water temperature increases, sea level rise, melting ice flows and other effects of Climate Change, is illustrated by the Villages subsistence based economy.

[28] *Ibid.*

1. *Kinship Groups and Small-Scale Technology*

The production of wild foods in subsistence socioeconomic systems in rural Alaska communities is accomplished by family-based groups, sometimes called a `domestic mode of production.' This aspect of the subsistence sector relies on small scale, efficient methods, including traditional (fish drying racks, smokehouses, and harpoons) and modern (skiffs with outboard motors, snow machines, and rifles) technologies for harvesting and processing wild foods, Equipment is commonly purchased, which means a family must have a source of monetary income to successfully engage in subsistence production.[29]

2. *Specialization and Exchange Networks*

Specialization also occurs in subsistence based economies where about 30% of households produce 70% or more of a community's wild foods which are distributed among households primarily through non-market channels along lines of kinship and other reciprocal social obligations. In addition, producers in native villages typically share subsistence foods with family members, the elderly, single mothers, the disabled, and other segments of the community. For instance, while moose was harvested by 50% of households in Galena, 95% of households ate moose during the year. In addition to sharing, some subsistence products are bartered and exchanged through customary trade networks via small-scale transactions involving modest amounts of money.[31]

3. *Territories and Traditional Knowledge*

Another component of the rural socioeconomic system involves land and labor. Guided by customary laws, (family-based groups) and capital (small-scale technology) produce subsistence foods from traditional territories accessible from each community by boat or ground transport. A community's subsistence areas are commonly the traditional homelands of a local tribal group.[30]

[29] *Ibid.*

[30] *Ibid.*

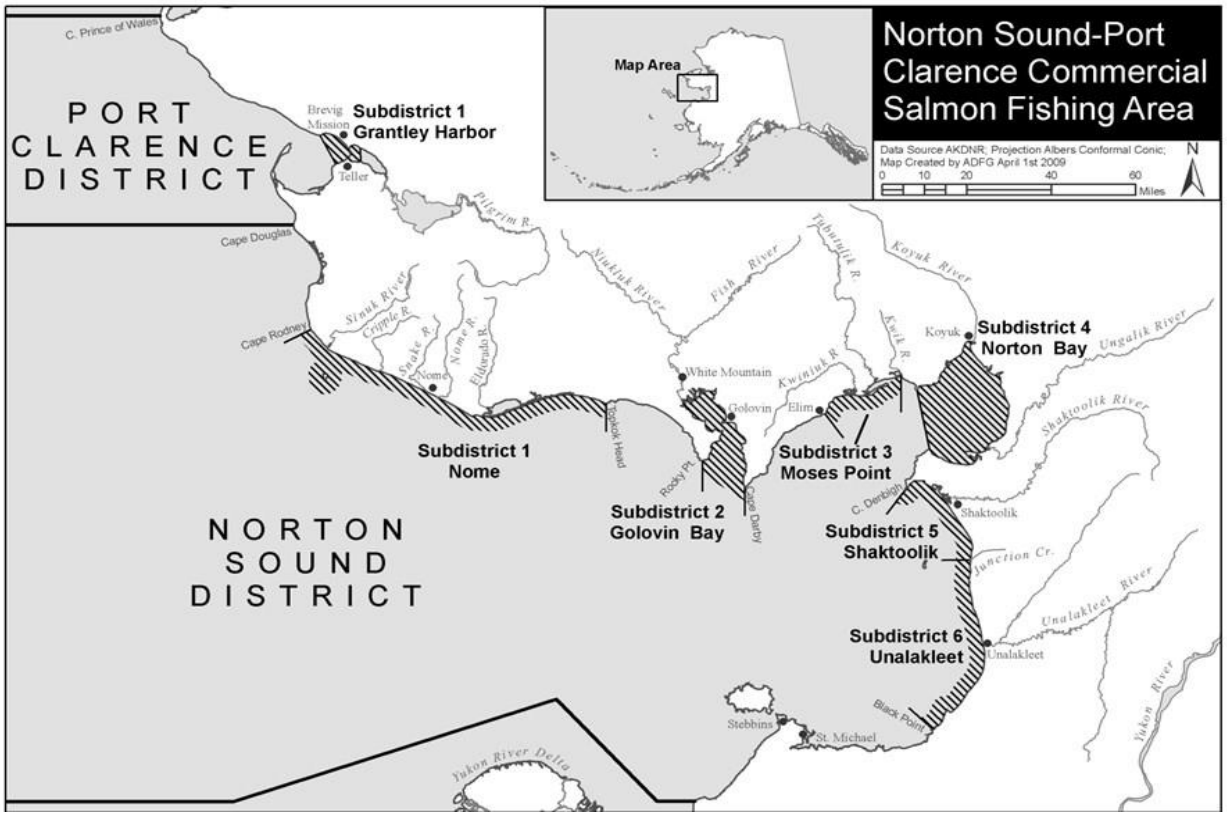

Figure 17: Commercial Fishing activity in Norton Sound, *Source: Alaska Department of Natural Resources*

g. Economics Risk Factors

Federal and state agencies and outside corporations which have engaged in practices that affect environmental justice policies and impact the Norton Bay communities; subsistence life style has resulted in financial hardship for each of its members and the ability of the Villages to protect subsistence and water resources. When considering economic production, resource extraction, subsistence uses and protection of instream flows, it is essential that federal agencies take into account the disproportionate impacts of climate change, water diversions, toxic emissions and water development on Alaska Native Villages, as well as the potential for management of water resources and participation in the decision making processes.

In addition, diminishing sea ice due to climate change and expanded natural resource extraction are causing changes in the arctic. From drilling in the Chukchi Sea, dredging for gold in Nome, to ore and gas concentrate tankers coming through the Northwest Passage from Europe, Alaska is experiencing more and more traffic past its shores. Alaska's western and northern coastline, however, is mostly shallow with very little marine infrastructure. As a result of these changes, in March 2013 the U.S. Army Corp of Engineers issued a draft report which found that:

There is a need to invest further in port development for the Alaskan Arctic to be able to respond to the changes in conditions noted below.

- Large-vessel traffic past Alaska shores is increasing and more than 60 percent of these vessels are foreign flagged.

- Increased interest in the Arctic is documented daily in the global media, and the number of international meetings focused on Arctic marine traffic and resources.

- Foreign trade and resource development in international waters highlight the need to support federal sovereignty.

- The U.S. entered into an international agreement on May 12, 2011 through the Arctic Council to support Search and Rescue in the Alaskan Arctic.

- The State of Alaska policy calls for increased development of mineral and oil and gas resources in the Arctic.

- The U.S. has expressed interest in more national sufficiency in energy resources and has selected the Arctic offshore region as one answer to this quest.

- Section 721 of the Coast Guard and Maritime Transportation Act of 2012 directs the Commandant to complete a study on the feasibility of establishing a deepwater seaport in the Arctic to protect and advance strategic United States interests within the Arctic region.[31]

- The Port System Study, however, also warned that increased arctic shipping can have significant impacts on the economic welfare of the Native Villages in Northern part of the state, by concluding that:

- Increased traffic means increased risk of incidents calling for response by the U.S. Coast Guard and other available vessels.

- Environmental protection is important as marine traffic increases and oil and gas development grows in the Chukchi and Beaufort Seas.

[31] US Army Corp of Engineers. 2013.

- Community resupply costs are high due to lightering, fuel costs, limited infrastructure and multiple handling. At the same time, rural communities are reliant on a subsistence lifestyle. Food resources could be jeopardized by increased traffic.[32]

That the communities in the Norton Sound area could be especially hard hit is illustrated by the fact that one of the most likely contenders for the new deep water ports is Nome, due to cities proximity to infrastructure, as well as to mining prospects.[33]

In summary, the socioeconomics of Norton Bay villages is a complex rural system of subsistence economy with a vital cash overlay component. It is highly dependent upon the ecosystem services of the surrounding sea and land for biological and cultural vitality of the people who live there. Given the potentially severe impacts of climate disruptions to these natural systems, it is all the more imperative that these villages take proactive measures to prepare for and adapt to these changes.

[32] *Ibid.*
[33] *Ibid.*

IV. FOREST RESOURCE ASSESSMENT

a. Contemporary Landscape – Forest History, Current Conditions and Trends

1. *History*

During the last ice age when glaciers as much as 1.5 miles thick covered much of the northern regions of North America and sea levels were 375 feet higher than today, some regions of Alaska were un-glaciated and served as refugia for pockets of plant and animal species. Evidence from pollen spores suggests that, as the climate warmed and the ice subsided, spruce trees in these isolated locations began to spread up river drainages, and as soils built up, out onto the landscape across much of central and southern Alaska. Birch, aspen, and cottonwood, as well as willows and alder may have also survived in these unglaciated regions, or may have migrated northward as the country opened up.[34] More recently, a comparison between aerial surveys conducted in the 1950s' and current satellite data indicate that tree species are moving northward into the tundra and upward in elevation, with some species migrating at very high rates.[35] The Spruce forests in the Norton Sound region grow only at very low elevations this far north, and they are discontinuous and interspersed with large tracts of tundra and wetlands. [36] There were large areas of tundra that were not covered in ice. Pollen cores indicate that some forested regions may have survived and given rise to the forests we have today.

During the late 19th and early 20th century, forests in Alaska that were accessible by boat were heavily timbered to fuel the steam ships that brought prospectors and early settlers into the state. Gold was found on the beach below Nome, Alaska in 1899, and by the end of 1900, a mining town of over 2,000 blossomed on the tundra-covered hills above the sea. Located at the north-western edge of Norton Bay, Nome has no natural forest, and there's little doubt that forests east of Nome along Norton Sound were cut to fuel the steamships, and build stores, saloons, bath houses and cabins.

[34] Bonnicksen, Thomas M. 2000.

[35] Woodall et al. 2009.

[36] Rozell, N. 2000.

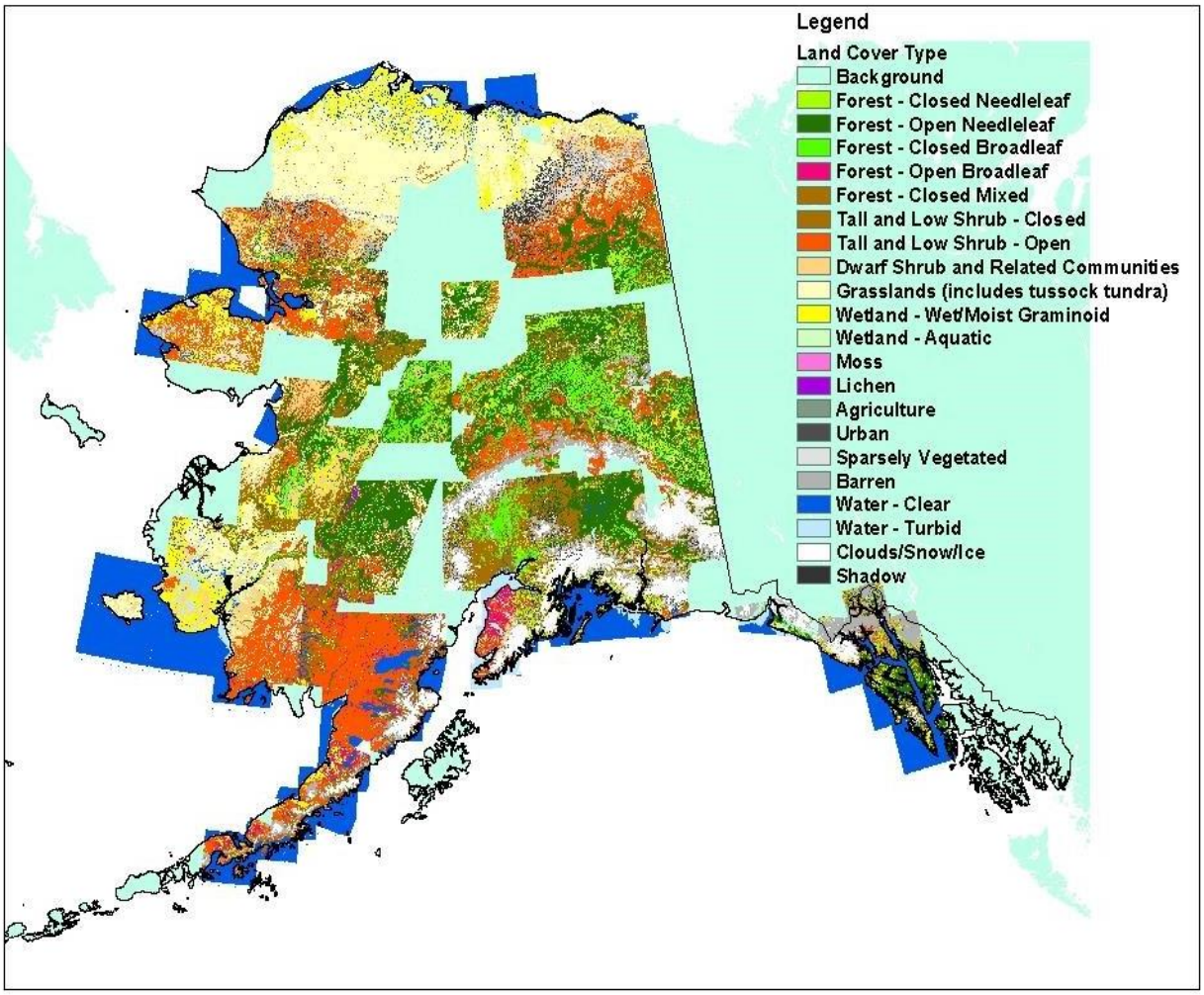

Figure 18: Data on historic land cover, *Source: http://agdc.usgs.gov/data/usgs/erosafo/ak_lcc/ak_lcc.jpg*

Warmer temperatures over the last three decades have resulted in a forest expansion into areas previously dominated by tundra, and trees found growing at higher elevations than previously recorded. This is likely to be true in the Norton Sound area, as it lies at 64.5 degrees, less than two degrees below the arctic circle. Shrub alder and willow, which grow only a few feet high on the tundra, have responded to warmer temperatures over the past 30 years with increased height, reaching heights of six feet. While Norton Bay is remote, invasive weed species are making inroads, hitch-hiking as seeds on tires, migrating animals, and clothing and boot treads. Clover, yellow toadflax, reed canarygrass, hempnettle, and dandelion have become commonplace in most of bush Alaska and can cause significant harm to local habitats.

2. *Forest Cover Conditions Today*

i. Species Diversity

Today, the forest climax species of the Norton Sound area is dominated by white and black spruce, with infrequent white birch. White spruce grows well in dryer, warmer soils, while black spruce can tolerate cold, saturated soils. Both can reach modest heights of 30 feet or more in the Norton Bay area. The spruce forest is multi-age, and despite some impact from spruce bark beetle, appears healthy. The beaches along the Sound are awash with wood that washes down the Yukon River to its mouth on the south shore of Norton Sound, and moves by tidal action northward into the Sound. The common practice among villagers is to cut and burn driftwood for home heating, rather than cutting live wood from the surrounding forest.

An understory of alder grows thickly along roadsides and other disturbed areas, and willows grow along streams and where there are wet soils. The forest floor is carpeted with blueberries, grasses, fireweed, and other low-growing vegetation. Fire is part of the natural regime in Alaska, creating a mosaic of fireweed-dominated meadows, low shrubs, thin stands of birch, early succession spruce, and mature stands of spruce. Black spruce, in particular, requires fire to melt a sticky sap around its cones before releasing its seeds for regeneration. Forest fires in Alaska are not typically suppressed unless communities are in imminent danger of property loss.

- *The relationships of hydrology of forest cover to generating healthy watershed and water resource conditions:* In forests, rain tumbles through the mature tree canopy, under story trees and shrubs, and herbaceous plants such as ferns before reaching the litter layer. Renewed by annual additions of leaves, twigs, and branches, the litter layer is: natural mulch that limits evaporation, a shock absorber that protects soil pores, an insulator that inhibits soil freezing, and a slow-release source of nutrients to foster more plant growth and site protection. The underlying organic, mixed, and mineral layers (horizons) in forest soils can store and transmit large quantities of water. This water storage capacity and permeability — exceeded only by some hurricanes and rain-on-snow events — is developed over centuries by microbes, insects, earthworms, burrowing animals, and the extensive, deep, and perennial root systems of trees and shrubs. As a result of these ecological characteristics, overland flow and soil erosion are rarely, if ever, observed in forests.

- *Contrast with the hydrology of the Current landscape:* Currently, there is very little contrast in the Watershed between the current canopy and that exhibited by healthy forest system due to the existence of little to no development with the exception of some, localized mining exploration. The images below illustrate healthy watersheds, the hydrological cycle, climate impacts to water resources, and the forest and water connections.

Figure 19: Tubutilik River & Darby mountains, *Source: Harold Shepherd*

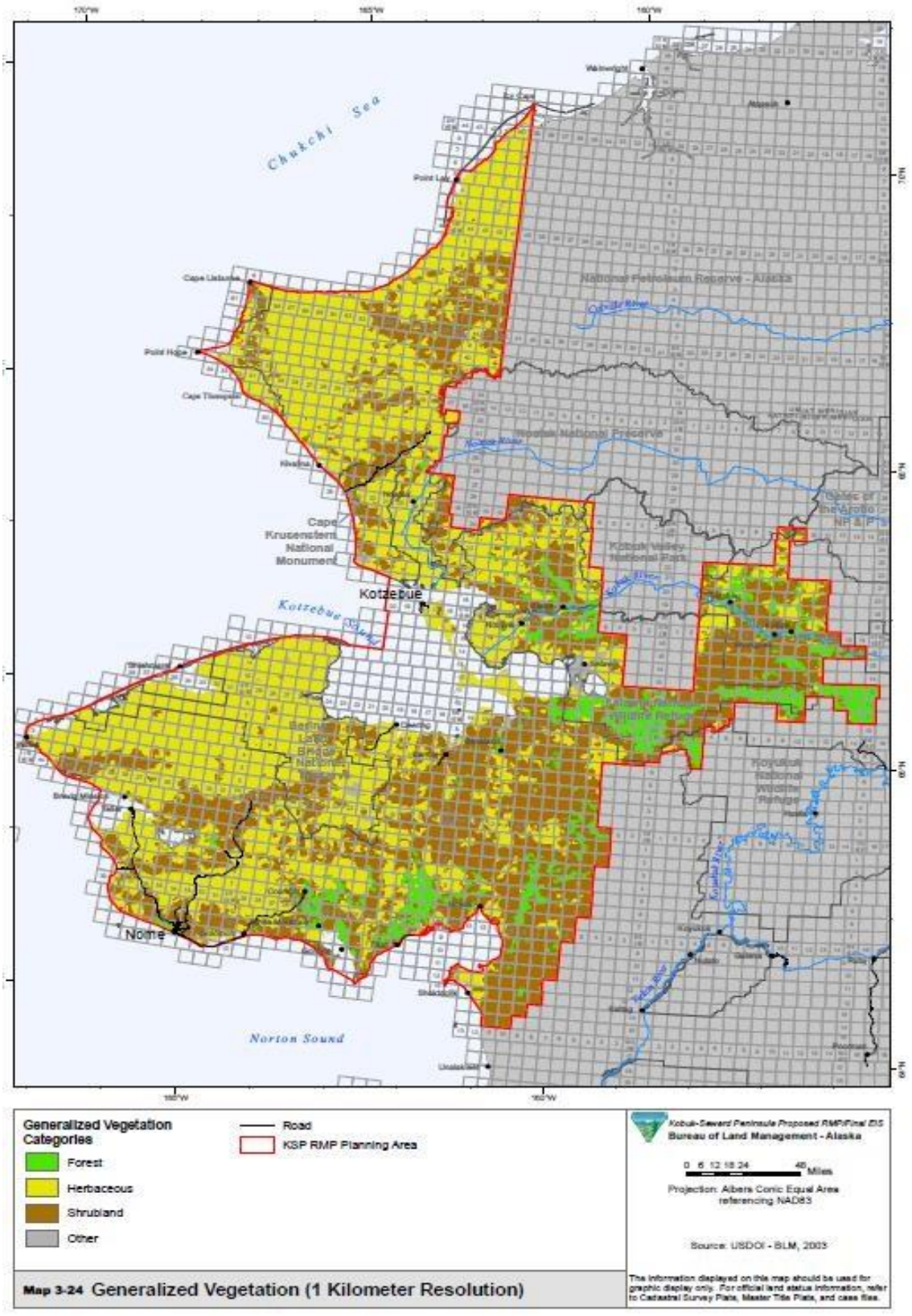

Figure 20: Vegetation Cover Seward Peninsula, *Source: BLM*

ii. Insect outbreaks

During the 1990s, the Kenai Peninsula experienced the largest outbreak of spruce bark beetles on record. The beetles, which are the size of a match tip, lay their eggs just beneath the bark of mature spruce trees. The eggs hatch out into hungry larvae that eat the green cambium layer that sustains the tree. Large numbers of larvae can girdle and kill a host tree. This was the case across the Kenai where over 80% of the forest died due to an outbreak that was exacerbated by warmer than average winters two years in a row.[37]

This infestation was not limited to the Kenai Peninsula, and has impacted large areas from the Interior of Alaska to the discontinuous forested regions along Norton Sound. These insects are not a foreign invasive - they are indigenous to spruce forests, and Alaska's cold winters usually keep their populations in check.

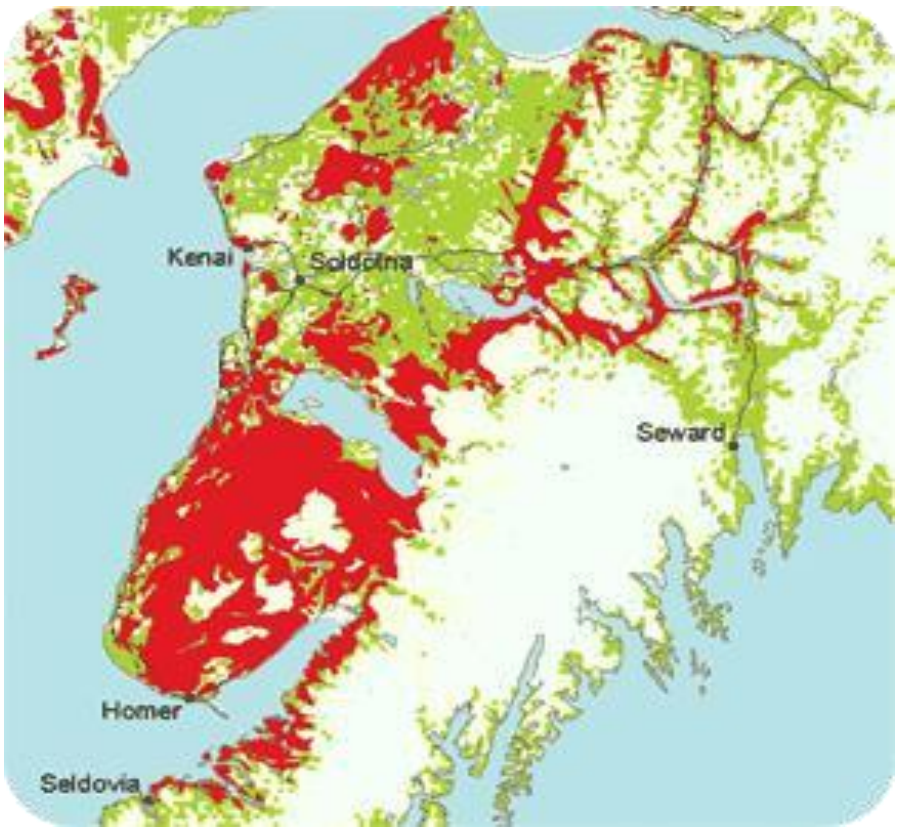

Figure 21: Insect outbreaks, *Source: Fish and Wildlife Service http://www.fws.gov/news/blog/index.cfm/2011/6/30/Alaska-Across-the-Wildest-State-*

[37]Beetle-Battle: A Threat to the World's Forests Aggravated by Climate Change. Carrillo-Rubio, L. Climate Institute. http://www.climate.org/topics/ecosystems/beetle-battle.html.

The red indicates forests that were hard hit by Spruce Bark Beetle on the Kenai Peninsula, Alaska. The white area is the Harding Ice Field.

The figure below shows the forest cover conditions of forests in the Western Alaska region. Note the small stands of forest east of Nome (dark green), and the red color which indicates spruced bark beetle mortality. The majority of the region around Norton Bay is tundra (grey) or tall shrub – predominantly alder (light green).

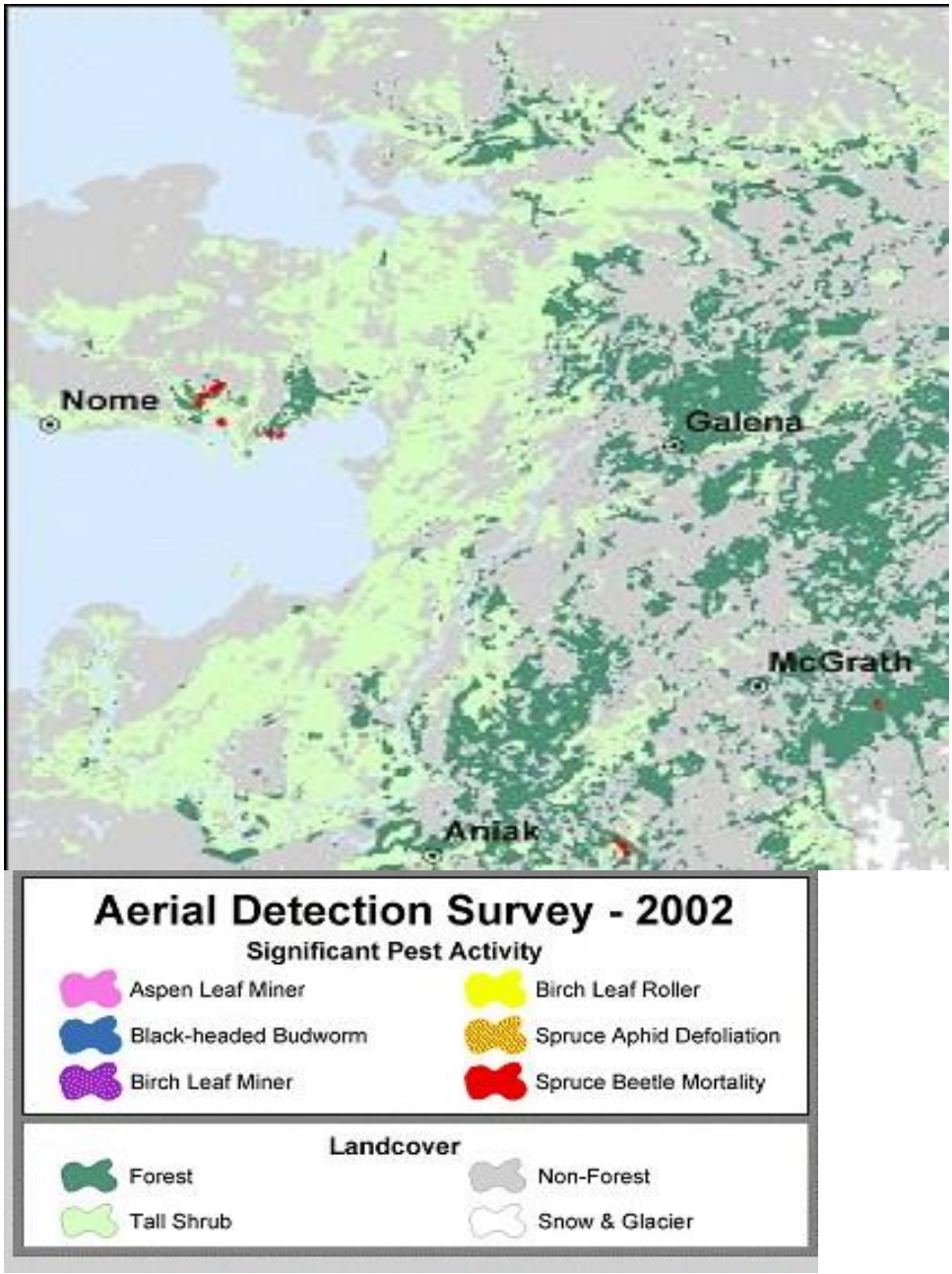

Figure 22: Forest Insect Infestations, *Source: U.S. Forest Service*

Low rainfall (~20" per year) is offset by areas of permafrost, which retains melt and rain water in ponds that can't percolate down through the frozen soils. Figure 23 illustrates rainfall for Alaska in general and Figure 24 shows permafrost for the Norton Sound region.

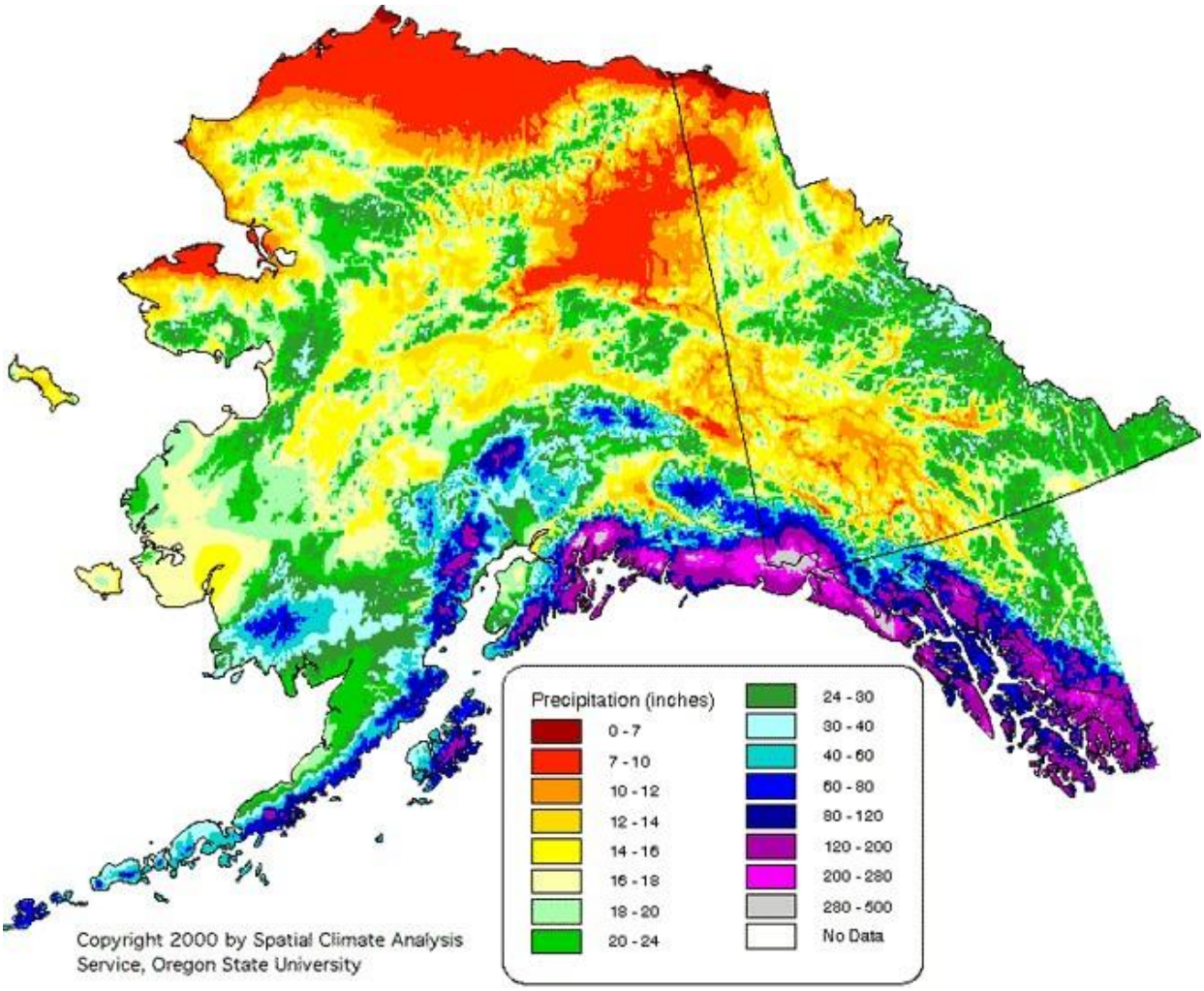

Figure 23: Alaska Average Rainfall, *Source: Spatial Climate Analysis Service*

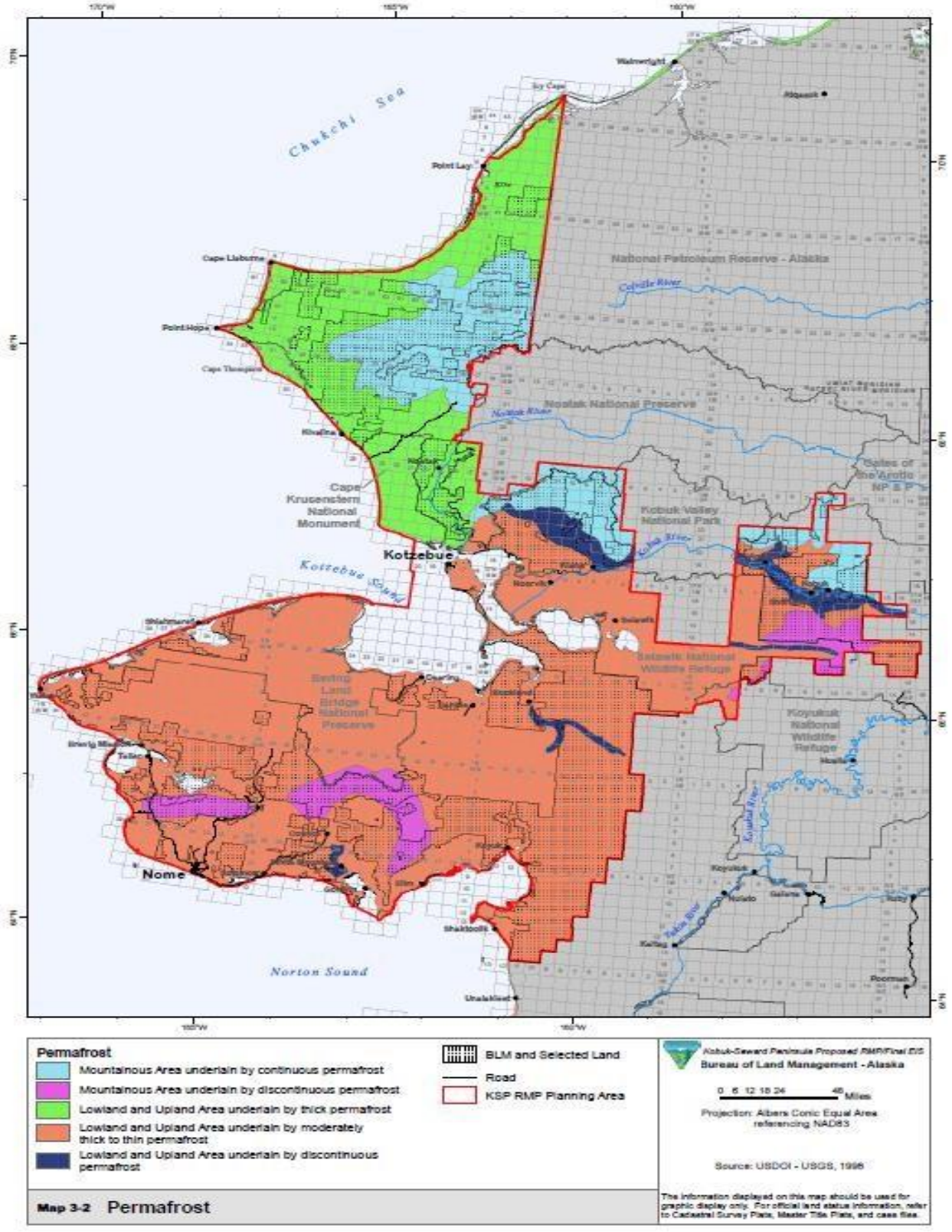

Figure 24: Permafrost in Norton Sound Region, *Source: Bureau of Land Management*

Alaska has relatively few tree species (aspen, birch, cottonwood, spruce, hemlock, and larch) and fire-driven succession is predictable, as depicted in Figure 25.

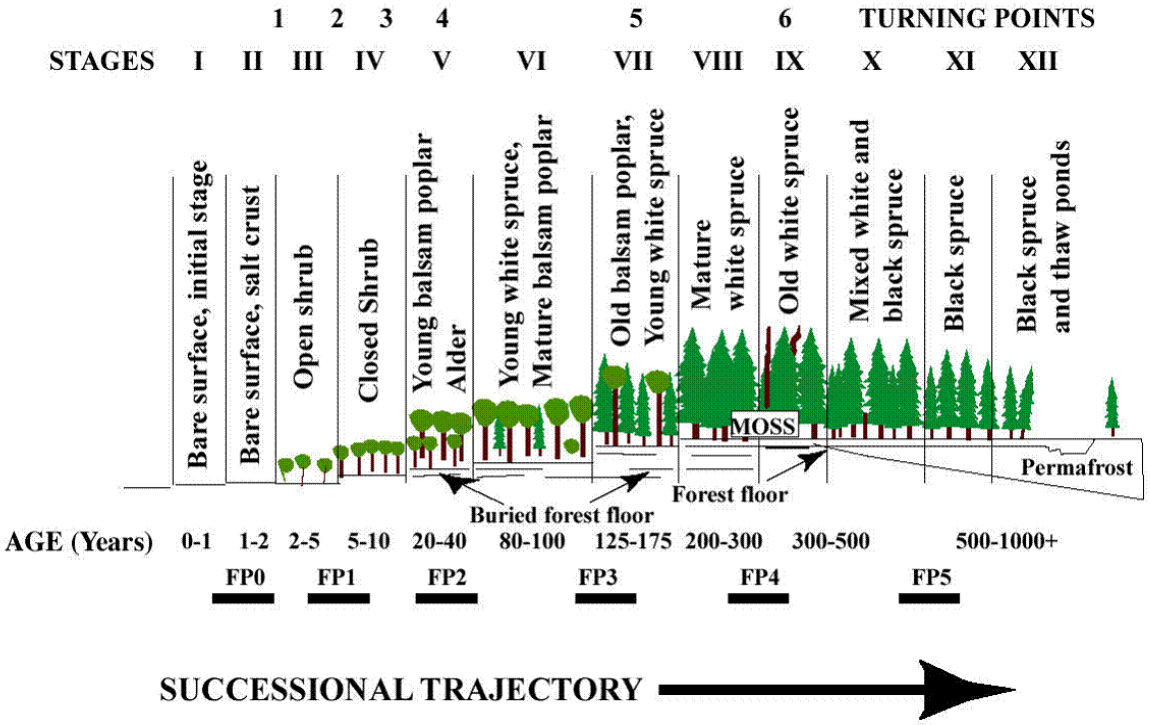

Figure 25: Succession, *Source: University of Alaska Fairbanks http://www.lter.uaf.edu/proposal2010/bnz_2010methods_text.cfm*

b. Forest Impact Findings – Current Ecological Stressors and Ecosystem Responses

1. *Forest Risk Findings*

Due to limited development and the remoteness of the area, the forests in the Norton Bay have changed little over the past few hundred years accept for a spruce beetle infestation which has impacted some locations. However, climate change will impact the forest through a change in the hydrology of the region. The Sound receives, on average, only 20 inches of precipitation per year, but because the soils are underlain with a discontinuous layer of permafrost, the rate of moisture retention is high, as water is captured in melt ponds that do not drain in the frozen soil. As the ice in these soils begins to melt with a warming climate, the forests will be impacted by increased evaporation, which can exacerbate bark beetle infestations, and increase the size and frequency of forest fires.

In addition, the changing climate conditions may affect populations of fish and wildlife upon which subsistence users have customarily relied including: 1) changes in terrestrial conditions that may influence availability of wildlife and fish species to harvest, as well as access to harvest; 2) range extensions of more temperate plants and animals that may affect subsistence resources in rural cultures; and 3) lifestyles that may be threatened due to changes in subsistence opportunities.

2. *Policy and Practices (Land Ownership, Land Use, Resource Governance)*

In the Norton Bay area, the Bureau of Land Management (BLM) manages forested and other lands under the jurisdiction of the Central Yukon Field Office and the Anchorage Field Office as presented in the Approved Resource Management Plan (RMP). This RMP was described as Alternative D in the September 2007 Kobuk-Seward Peninsula Proposed RMP and Final Environmental Impact Statement (PRMP/FEIS)(USDI-BLM 2007).

The RMP provides overall direction for management of all resources found on BLM- managed lands within the boundary of the Kobuk-Seward Peninsula planning area. Decisions in the RMP apply to all BLM-managed lands (11,913,000 acres), including selected lands (6,642,000 acres), until such time as title is transferred to the State or a Native corporation. Decisions also apply to BLM-managed subsurface mineral estates beneath private lands (approximately 80,000 acres). Acreages presented in the Record of Decision and Approved RMP are approximate because BLM continues to transfer title to lands within the planning area. Applicable laws and regulations include permitting to authorize harvest of personal use firewood and house logs and to harvest vegetative products for personal use

The Kobuk-Seward Peninsula Planning Area generally encompasses the area included in the Northwest Arctic Borough, most of the Bering Straits Region, and the western edge of the North Slope Borough. The planning area is bounded on the west and south by the Chukchi and Bering seas and on the east by the National Petroleum Reserve Alaska (NPR-A), Noatak National Preserve, Kobuk-Valley National Park and Preserve, and the Yukon River watershed (Map 1). The area is remote with no road access to interior Alaska.

Of the approximately 30 million acres within the planning area, decisions in the RMP will initially apply to 11.9 million acres of BLM-managed public lands. Lands covered by the Approved RMP include:

A) **Bureau of Land Management** – Lands that will most likely be retained in Federal ownership include those which are not selected by the State or by Native corporations. State-selected lands are public lands that were selected by the State of Alaska as part of the Alaska Statehood Act of 1958 and Alaska National Interest Lands Conservation Act (ANILCA) of 1980. Until conveyance, State-selected lands outside of National Park system lands or National Wildlife Refuges will be managed by the BLM. ANILCA allowed for over-selection by the State by up to 25% of the entitlement (sec. 906 (f)). Therefore, some State-selected lands will eventually be retained in Federal ownership.

B) **Native-Selected –** The Alaska Native Claims Settlement Act (ANCSA) of 1971 gave Alaska Natives an entitlement of 44 million acres. Some ANCSA corporations filed selections in excess of their entitlements, thus some Native-selected lands will be retained in Federal ownership.

C) **Dual-Selected –** Lands that have been selected by both the State and Alaska Natives.

D) **Mineral Estate –** All subsurface mineral estate lying beneath BLM lands is BLM-managed. On selected lands, the mineral estate goes to the State or the Native corporation upon conveyance. In addition, BLM manages an estimated 80,000 acres of subsurface mineral estate beneath private surface within the planning area.

E) **Military Lands –** Land under withdrawal to the military. If released and returned to BLM management during the life of the plan, direction contained in the Approved RMP would apply. Responses to date are in relation to forest fires and Pine Bark beetle invasions.

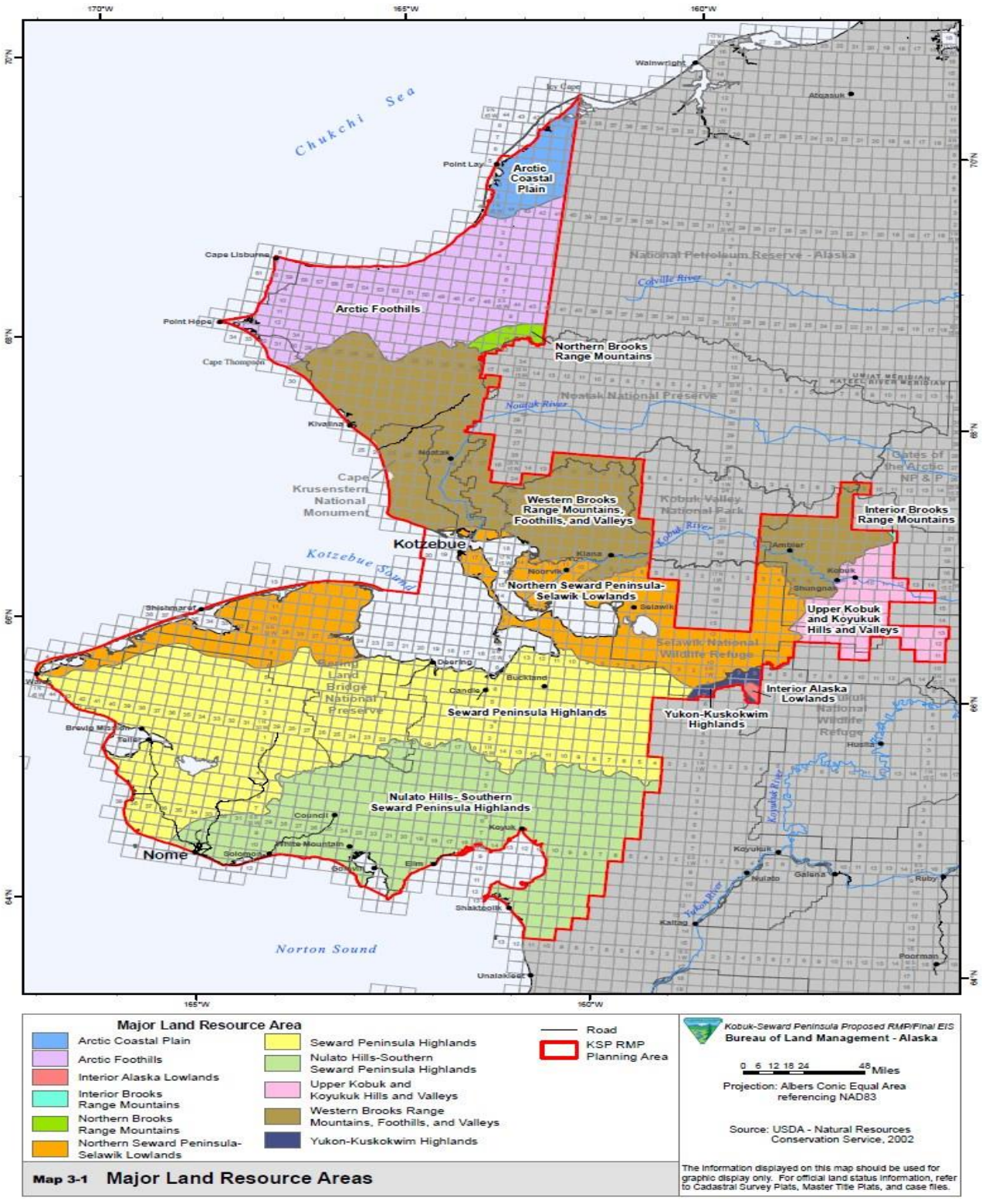

Figure 26: Land Resources, *Source: Bureau of Land Management*

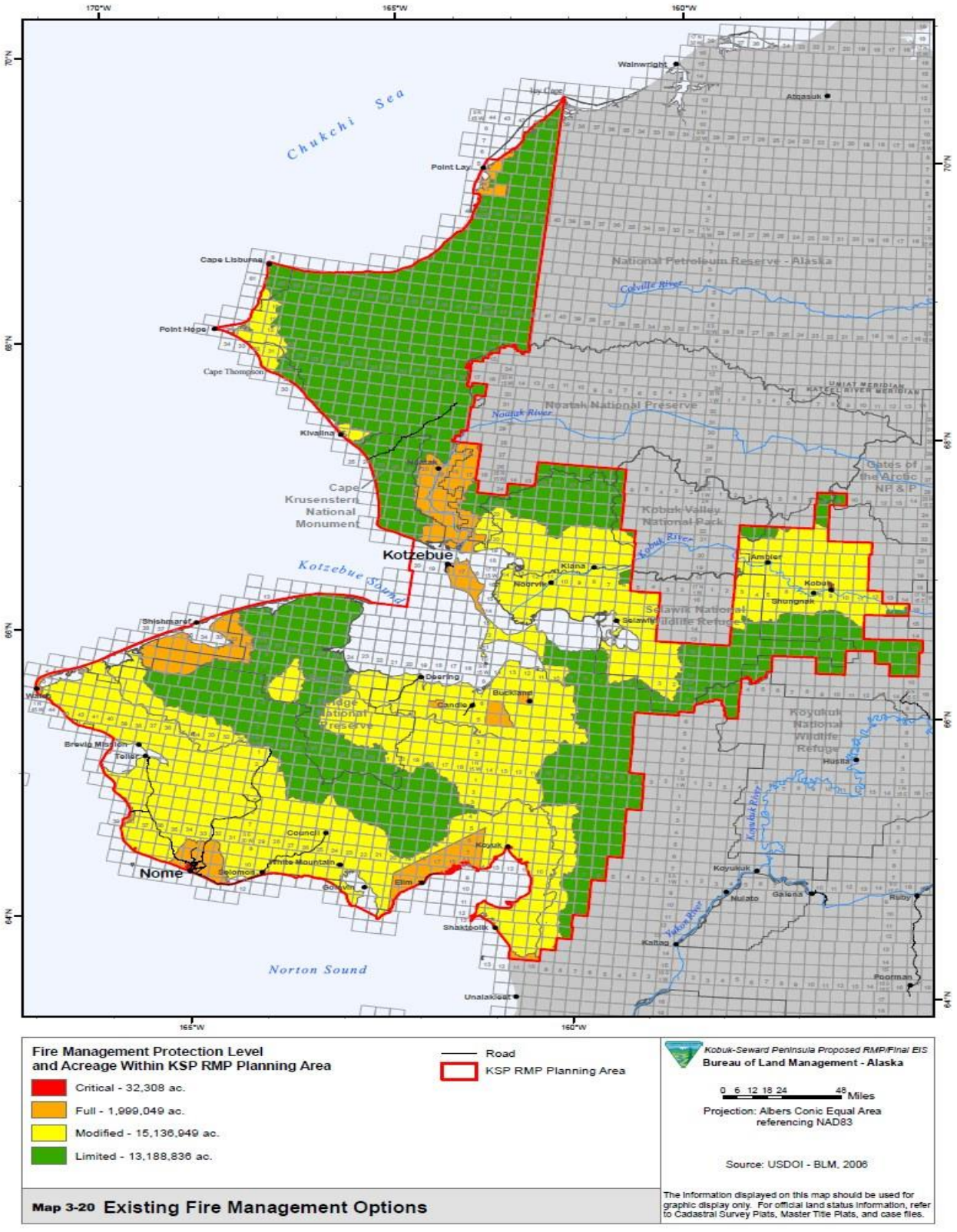

Figure 27: Fire management, *Source: Bureau of Land Management*

3. *Land Withdrawals*

Under the Alaska Native Claims Settlement Act, the Secretary of Interior withdrew 79.3 million acres under 17(d)(2) for the "national interest" and 60 million additional acres under the 17(d)(1) for possible "public interest." About 140 million acres were thus withdrawn for possible inclusion in several restrictive federal land management schemes.[38] The Secretary made his final (d)(2) recommendations in December 1973, which gave Congress until 1978 to classify the lands permanently in one of the restrictive federal and management systems. It was, however, obvious toward the end of 1978 that Congress was not going to pass the necessary legislation, so Secretary Cecil Andrus exercised his emergency withdrawal authority under the Federal Lands Policy and Management Act[39] to set aside 110 million acres in temporary three-year withdrawals. Shortly thereafter, President Carter exercised his authority under the Antiquities Act[40] to designate an additional 56 million acres as national monuments.

The practical effect of these actions was to delay, indefinitely, ANCSA's (d)(2) dealings and to preclude further development on nearly half of the lands in Alaska. This set the stage for the next two years of political debate over the fate of much of the state's public land. During the course of this debate, Alaska Natives and other Alaska subsistence advocates were able to trade their support for ANICLA's environmentally oriented land classification for environmentalist support of ANICLA's title VIII subsistence provisions.

[38] Case, David S. and Voluck, David A. 2002.

[39] Act of October 21, 1976, § 20(e), Pub. L. No. 94-579, 90 Stat. 2744, 43 U.S.C. §§ 1701, *et seq.*

[40] Act of June 8, 1906, 34 Stat. 225, 16 U.S.C. § 431.

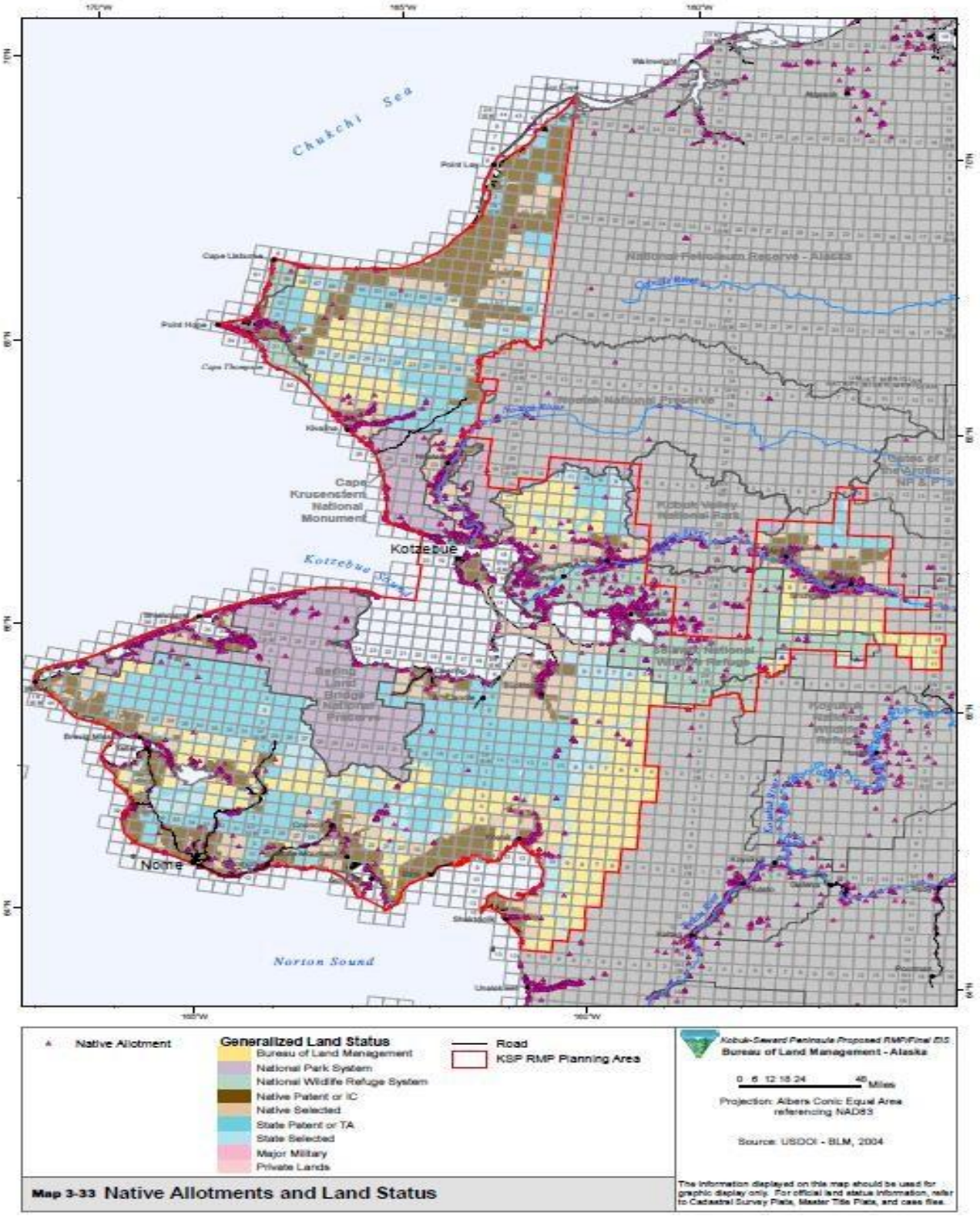

Figure 28: Land Status and Native Allotments, *Source: Bureau of Land Management*

4. *Forest Resource Stressors*

There are a number of stressors to the forested ecosystems surrounding Norton Bay. Some are directly climate related, such as shifting hydrology and bark beetles. Others are non-climate related stressors, such as development and mining, but that impacts exacerbated by climate change factors. The following table summarizes the major ecological stressors currently impacting the forest lands surrounding Norton Bay. A range of potential solutions and parties to implement them are listed briefly here and explored more fully in the adaptation plan later in this document.

Table 2: Current Forest Ecological Stressors and Ecosystem Responses

Stressor	**Potential Solutions**	**Responsible Parties**	**Comments**
Loss of forest land to potential future Mining and Associated development including road to Ambler Mining District	Urban growth boundary Land ownership; Development restrictions (tribal jurisdiction), Riparian zone requirements Inheritance programs to keep large tracts intact Ecosystem service valuations for business case for conservation	Borough; Tribes; Owners for easement purchase	Politically difficult and/or expensive; use ecosystem services to make case and possibly find ways to pay or make politically tenable
Degraded aquatic habitat	Enhanced riparian buffers Watershed clearing limitations Road management plan Stream crossing requirements Instream Flow Water Rights	Borough; State on state land; BLM on federal land; Tribes	Buffers politically difficult especially on government land; Clearing limitations, Road plans, expensive
Increased fire/Sediment & other water quality issues (WUI)	Reduce dead trees from beetle infestation Fire management / controlled burns Forest thinning programs	BLM, Borough, state agencies	Very difficult practically to control as long as climate change exists; Need good economic analysis to help "sell" the idea to Federal and state agencies and Borough; Political road blocks

5. *Mining*

The Watershed is identified as a mineral development area by the State of Alaska. In the spring of 2008, the Triex/Full Metal and Full Metal Mineral Mining Companies' (Companies) proposed uranium exploration activities within the Watershed which flows into the Elim Village's reserved lands potentially threatening human health and subsistence uses. The communities' protest of the proposed uranium exploration resulted in government-to government "consultation" meetings between the Bureau of Land Management (BLM), the Elim IRA Council, the Environmental Protection Agency (EPA) and the Alaska State Department of Natural Resources (DNR). These "consultation" meetings occurred during the spring and summer of 2008 to inform the Village fully as to planned exploration activity regarding uranium mining in the Norton Sound area.

The Triex/Full Metal deposit is the most likely site for near-term large scale mining development in the region. It is located in the Fireweed Occurrence and Boulder Creek areas of the Tubutulik River Watershed. The headwaters of the Tubutulik River originate in the Darby Mountains located to the northwest of the Triex/Full Metal deposit. The River drains the Triex/Full Metal deposit area and then passes through the lands of the Native Village of Elim before emptying into Tubutulik River at Kwiniuk Inlet near Moses Point.

In the summer of 2008, for example, the Bureau of Land Management (BLM) and State Department of Natural Resources (ADNR) granted uranium exploration permits to two Canadian Mining Companies – Triex and Full Metal Mineral for the Boulder Creek Uranium Mine on Alaska's Seward Peninsula within the Norton Bay Watershed. The 6,240 acre Boulder Creek Property hosts Alaska's largest uranium deposit discovered to-date and is approximately 50 km (31 miles) from the Elim Village, and 170 km (106 miles) from the coastal city of Nome. Toxic materials coming off of the mine site threaten to directly impact fisheries and wildlife habitat in the Fireweed, Boulder Creek and Death Valley areas, upon which the villages depend for a major portion of their subsistence fishing and hunting. Due, in part, to the threat of litigation and demonstrations held by the local native villages and other native communities, however, the Companies canceled the planned exploration activities.

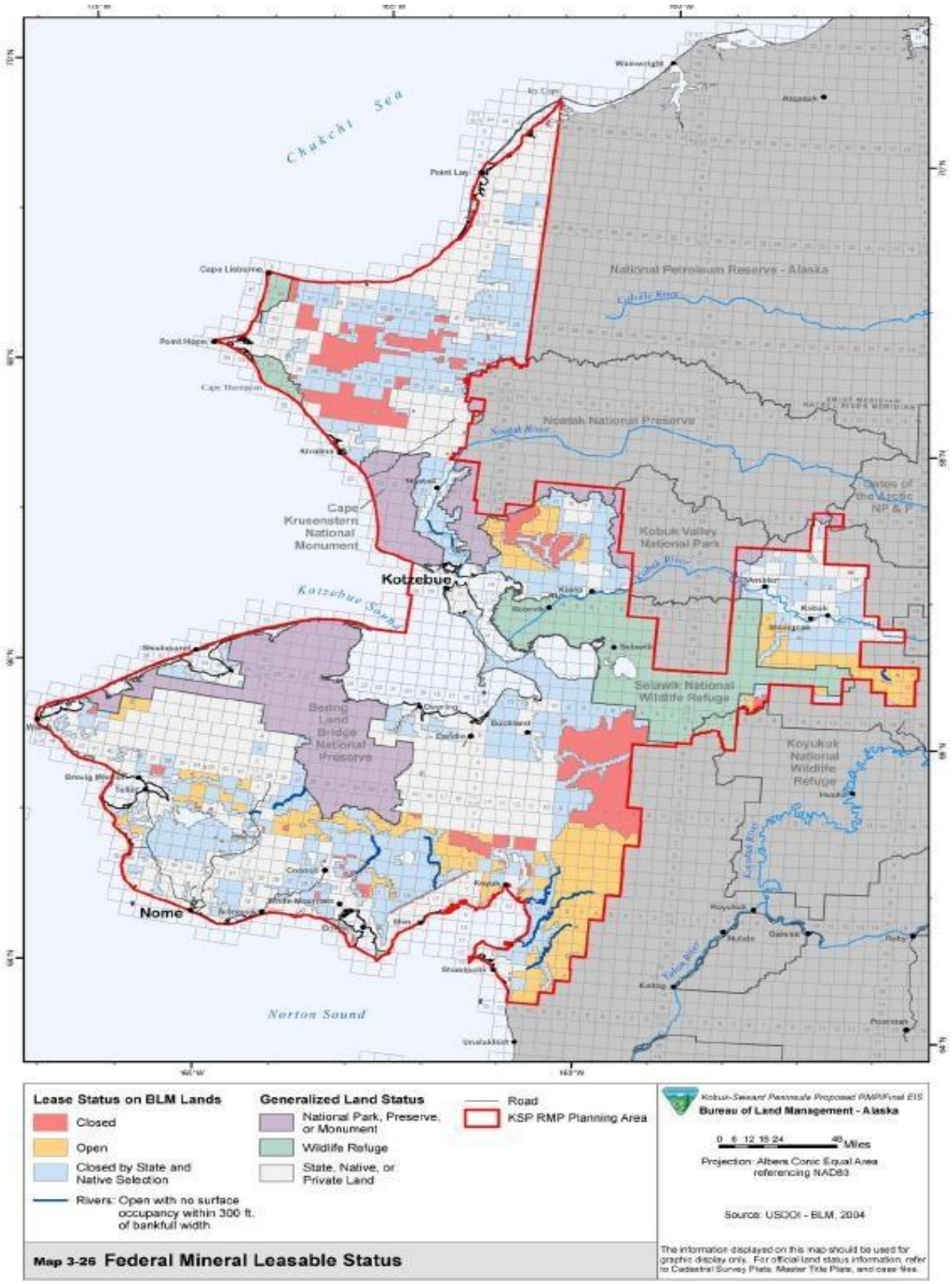

Figure 29: Mineral Lands open for mineral development, *Source: Bureau of Land Management*

Similarly, the Governor of Alaska has introduced the Road to Ambler, a new road project which is viewed as a simple budgetary item, meaning that the public will not get to vote or, possibly, even comment on it. The road could have environmental, economic and cultural impacts and over half a billion state tax dollars will be spent on its construction with no clear picture of how the costs are recouped or how the road benefits the public. The only guaranteed benefit is to foreign mining companies who may or may not decide to extract state resources.

In response to mining and road building proposals, the Native Villages in the Norton Bay area are working to influence state and federal policy decisions related to natural resource exploitation. The Villages are monitoring potential future mining and road building activity, drafting and adopting resolutions in opposition to mining and road building that would harm subsistence rights, gathering data to apply for instream flow water rights, incorporating recommendations into a Watershed Assessment for the Tubutulik River Watershed, and commenting on new mining permits and plans.

c. Forest Resources Law and Policy

1. *ANCSA*

The Alaska Native Claims Settlement Act (ANSCA) authorized a massive land withdrawal and classification for the entire state of Alaska.[414243] ANSCA directs that, beginning on December 18, 1971,1) all unreserved lands in the state would automatically be removed for 90 days; and 2) the Secretary of Interior is authorized to classify such lands for any purpose in order to protect them from development.[46] Section 17(d)(2) authorizes the Secretary to include 80 million acres of the state's lands (now referred to as "national interest lands") in national parks, forests, preserves, wildlife refuges or wild and scenic river systems.[47] ANSCA gave the federal government seven years to decide on the inclusion of up to 80 million acres of Alaska lands in traditionally restrictive public lands classifications including: providing the Secretary with nine months after adoption of the Act to conduct the Section 17(d)(2) withdrawals; two years to make recommendations to Congress for the disposition of those lands; and an additional five years to Congress to act on the Secretary's recommendations.[44]

[41] *See*, 43 U.S.C.A. § 1616(d)(1) and (2).
[42] U.S.C.A. § 1616(d)(1).
[43] U.S.C.A. § 1616(d)(2).
[44] Case, David S. and Voluck, David A. 2002.

2. *The Alaska Nation Interest Lands Conservation Act*

Congress adopted the Alaska Nation Interest Lands Conservation Act (ANILCA) [45] in order to carry out the subsistence-related policies of ANCSA. To some, extent, therefore, ANILCA was intended to settle those Alaska Native aboriginal hunting and fishing claims that ANSCA purported to extinguish. Rather than reserving off-reservation or other exclusive rights to hunt and fish because of their membership in a particular tribe, as was the case after settlement of tribes in the lower forty-eight states; instead ANILCA established subsistence protections for most rural Alaska residents – Native and non-Native.[46]

3. '*Rural' and Resource Management*

Alaska's overall population is still relatively small (only about 663,661 people total in 2005) and densities to the land are low. Nevertheless, commercial interests and the growing urban population create increasing pressures on Alaska's wild resource base through sport hunting and fishing and commercial enterprises like guiding, tourism, and commercial fishing. Rivalries between interest groups over fish and game have necessitated the development of laws that recognize and protect subsistence harvests.

i. Consultation

The Federal Trust Doctrine was developed by case law which, generally, requires the federal government to protect the interests of the Tribes in a manner that is above and beyond those of the general public. There are multiple cases which cite the "Trust Doctrine" but the first judicial recognition and best known case is *Cherokee Nations v. Georgia*.[47] The specific violations of the trust duty, however, are based in statute, including the Endangered Species Act (ESA)[48] and National Environmental Policy Act (NEPA),[49] because the Trust Duty extends to "any federal government action."[50] Also, the courts generally limit specific violations of the Trust Doctrine to the confines of the general prohibitions of each statute.

[45] Act of 2, 1980, Pub. L. No. 96-487, Title VIII, 94 Stat. 2371, 2422, 16 U.S.C.A. §§ 3111, et seq.

[46] Case, David S. and Voluck, David A. 2002; Construing section 810 of ANILCA, the Ninth Circuit Court of Appeals has held the "Congress was not passing Indian Legislation" when it enacted Title l VIII of the Act and that language in section 810 was not entitled to liberal construction to resolve doubtful expressions in favor of the Indians. *Hannah Indian Ass'n v. Morrison*, 170 F.3d 1228-1229 (9th Cir. 1999).

[47] 30 U.S. 1 (1831).

[48] 30 U.S.C. § 1251, et seq.

[49] 42 U.S.C. §4321, *et seq.*

[50] *Pyramid Lake Piaute Tribe of Indians v. United States Department of the Navy*, 898 F.2d 1410, 1413 (9th Cir. 1990).

When combined, therefore, with the statutory provisions the Trust Duty creates a strong federal obligation to protect tribal interests that goes beyond that of the obligations to the general public. This is why the proper government-to-government consultation requirement is so important.

Uranium exploration and development activities in the Norton Bay Watershed permitted by the State of Alaska, however, have been allowed to occur during the summer season, which is of critical importance to the subsistence harvesting of fish and wildlife, berries, roots, plant leaves, and a wide range of mammal and birds. Such exploration activities have resulted in discharges of contaminated waters encountered during drilling as well as the release of potential contaminants associated with drilling activity into streams. These discharges have not been quantified or evaluated by the DNR, BLM, or exploration permittees for impacts on the streams, fishery, and estuary in the Tubutulik watershed

Regardless of these impacts to the subsistence needs and traditions of the Native Communities, neither the State of Alaska DNR, the BLM, nor the exploration permittees consulted with or requested permission from the Native Village of Elim and its neighboring communities regarding the use of their traditional subsistence use areas or compiled baseline environmental data regarding water quantity, water quality, fish, mammal, bird, and plant distribution and habitat and areas of cultural or additional significance, prior to issuance of the Permits.

Consult and Coordinate with Alaska Natives – Engage in a consultation process with Alaska Natives, recognizing tribal governments' unique legal relationship with the United States and providing for meaningful and timely opportunity to inform Federal policy affecting Alaskan Native communities.

Consult and Coordinate with Alaska Natives consistent with tribal consultation policy established by Executive Order 7. This policy emphasizes trust, respect, and shared responsibility. It articulates that tribal governments have a unique legal relationship with the United States and requires Federal departments and agencies to provide for meaningful and timely input by tribal officials in development of regulatory policies that have tribal implications. This guiding principle is also consistent with the Alaska Federation of Natives Guidelines for Research.

The Executive Order seeks a collaborative and innovative approach to manage a rapidly changing region and to advance U.S. national security interests, pursue responsible stewardship, and strengthen international collaboration and cooperation, as we work to meet the challenges of rapid climate-driven environmental change. The melting of Arctic ice has the potential to transform global climate and ecosystems as well as global shipping, energy markets, and other commercial interests. To address these challenges and opportunities, the policy purports to align Federal activities in accordance with this strategy; partner with the State of Alaska, local, and

tribal entities; and work with other Arctic nations to develop complementary approaches to shared challenges. We will proactively coordinate regional development.

The Policy finds that economic development and environmental stewardship must go hand-in-hand. The unique Arctic environment will require a commitment by the United States to make judicious, coordinated infrastructure investment decisions, informed by science. To meet this challenge, we will need bold, innovative thinking that embraces and generates new and creative public-private and multinational cooperative models.[51],[52]

ii. Human Rights

Human rights, as they relate climate change to water, have been recognized in international treaties and national constitutions since 2002. However, this right is being eroded by the inclusion of water and other essential services as commodities in international trade treaties and conventions.

Similarly, The international human rights standards serve as a guide for measures to tackle climate change, underscoring the fundamental moral and legal obligations to protect and promote full enjoyment of the rights enshrined in the Universal Declaration of Human Rights[56] and in the core universal human rights treaties.[53]

Human rights laws apply to the Norton Bay village communities because like other indigenous peoples of the world many of them are struggling to maintain and preserve their own culture, but much of their land has been taken away from them, and they are highly dependent on what is left to provide them with enough food and housing. While efforts to strengthen the rights of Indigenous people in a global sense have had some positive results in recent years, including the adopting of the ILO Convention on the Rights of Tribal and Indigenous People and the UN Declaration on the Rights of Indigenous Peoples, (UNDRIP), when they are displaced and live on "welfare", their culture is undermined and the alien culture of the dominant society in which they must adapt leads to high degrees of alcoholism suicide and sometimes criminal behavior.[54]

Experts, in fact, recognize that UNDRIP guidelines require that governmental policies must recognize indigenous people's right to land and natural resources, which makes it possible for them to preserve their culture while sustaining a livelihood.[55] This relationship between native

[51] White House National Strategy for the Arctic Region, May 2013, http://www.whitehouse.gov/sites/default/files/docs/nat_arctic_strategy.pdf.
[52] U.N. Office of the High Commissioner for Human Rights, http://www.ohchr.org/EN/UDHR/Pages/Introduction.aspx.
[53] U.N. Office of the High Commissioner for Human Rights, http://www.ohchr.org/EN/ProfessionalInterest/Pages/CoreInstruments.aspx.
[54] Rehman, Javaid. 2002.
[55] *Ibid.*

people's rights to land and natural resources and economic survival has been highlighted by the Inter-American human rights bodies in a number of cases.[56] In the *Yakye Axa Indigenous Community* case, for example, the Inter-American Court of Human Rights held that Paraguay had violated the rights of the member of that community to live a dignified existence, which follow from the right to life, by delaying the restitution of their ancestral lands and thus making it difficult for them to obtain food, clean water, adequate housing, and healthcare.[57]

In fact, it can be argued that native Alaskan tribal governments, such as those in the Norton Bay watershed, retain such a property right to protect fish and wildlife upon which they rely for subsistence. This argument is based on the fact that common law recognizes a property-based sovereign trust interest in fish and wildlife populations that live within, or pass through, a government's borders.[58] Judicial recognition of the government's interest arose out of an early need to establish public rights to wildlife in a pre-possessory state,[59] and with respect to other critical natural resources such as water and air.[60] This resulted in a legal doctrine which joined the sovereign trusteeship over wildlife and the "public trust" in other natural resources.[65] These principles are fundamental to the function of governments and are manifest in the law of several other nations and trace back to ancient legal regimes predating the United States.[61] [62]

The landmark decision *Geer v. Connecticut*, which discusses the sovereign property interest in wildlife, addressed whether the State of Connecticut could forbid the entry of game that had been legally taken within the state into interstate commerce despite restriction in the Interstate Commerce Clause of the Constitution.[63] As a predicate to the constitutional issue, however, the Court Resting its conclusion on reasoning dating back through English common law to the law of Athens, the Court set forth a principle of sovereign trusteeship in wildlife that endures to this day.[64]

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[56] *See*, Case 11.140, *Mary and Carrie Dann v, United States*, IA CommHR Report NO 75/02 (27 December 2002); *Mayagna (Sumo) Awas Tingni Community v. Nicaragua*, IACtHR Series C No 79 (31 Augest 2001); *Yakye Axa Indigenous Community v, Paraguay*, IACtHR Series C No 125 (17 June 2005).

[57] *Yakye Axa Indigenous Community, ibid*, paras 164-8 and 176.

[58] *See*, 35 AM. Jur. 2D Fish and Game § 1 (1967).

[59] *See, Geer v. Connecticut*, 161 U.S. 519, 523-25 (1896) (tracing origins of governmental rights in wildlife).

[60] *See*, Ibid at 525-27 (citing treatise which grouped water, air, wildlife, the sea, and its shores to egert the as a class of property called "res communes," held in an "ancient state of negative community").

[61] *Ibid.* at 53.

[62] U.S. 519 (1896).

[63] Many courts refer to wildlife as a subset of interests protected by the public trust doctrine. See, Mary Christina Wood, The Tribal Property Right to Wildlife Capital (Part I): Applying Principles of Sovereignty to Protect Imperiled Wildlife Populations Idaho L. Rev., p. 52. Vol. 37, No.1 (2000) (Protecting Imperiled Wildlife Populations).

[64] *See*, *Ibid* at 161 U.S. at 522-27; Protecting Imperiled Wildlife Populations at 53.

The Committee on Economic, Social and Cultural Rights (CESCR) has repeatedly addressed the problems faced by indigenous peoples, including the vulnerability of such peoples whose ancestral lands may be threatened.[65] Potential future uranium mining and road building and the impacts of climate change in the Norton Bay Watershed, for example can aggravate the situation of village communities degrading their land, and cause their displacement. The CESCR has also emphasized that, as part of their obligations to protect people's resource base for food, states parties should take appropriate steps to ensure that such activities of the private business sector are in conformity with the right to food.[66]

4. *Environmental Sovereignty*

Article 1 ICCPR and ICESCR expressly recognizes the special responsibility of colonial powers in regard to the right of self-determination for indigenous populations by stating:

1. All peoples have the right of self-determination. By virtue of that right they freely determine their political status and freely pursue their economic, social and cultural development.

2. All peoples may, for their own ends, freely dispose of their natural wealth and resources without prejudice to any obligations arising out of international economic co-operation, based upon the principle of mutual benefit, and international law. In no case may a people be deprived of its own means of subsistence.

3. The States Parties to the present Covenant, including those having responsibility for the administration of Non-Self-Governing and Trust Territories, shall promote the realization of the right of self-determination, and shall respect that right, in conformity with the provisions of the Charter of the United Nations.[67]

[65] Rehman, Javaid. 2002.
[66] Rehman, Javaid. 2002- citing, CESCR General Comment 12, n 7, para 13 & 27.
[67] International Covenant on Economic, Social and Cultural Rights, Part I Article 1 (January 1976) (ICESCR).

5. *Climate Change*

The Intergovernmental Panel on Climate Change (IPCC), an international body of scientists operating under the mandate of the U.N. Environmental Program and World Meteorological Organization, called climate change "unequivocal" in their 4th Assessment Report.[68] In addition, laws exist that can force governments and other parties to reduce their Green House Gas (GHG) emissions, and litigation is an increasingly prevalent means of holding parties responsible for climate change.

However, climate change litigation raises causation and redress ability issues because any single polluter is likely to produce only a proportion of the GHGs, and thus any judicial remedy is likely to have a small impact on solving the global problem.[69] Additionally, it is difficult to connect actors and claims for forums for litigation because climate change occurs in the atmosphere without respect to national boundaries.[70]

Examples of the difficulties faced by plaintiffs in climate change cases include the recent denial by the Montana Supreme Court of a petition to declare that the atmosphere is a 'public trust' and that the state has a duty to protect and preserve the atmosphere based on the court's conclusion that it is ill-equipped to deal with the factual matters in the case.[71] In addition, in September 2007 a federal judge dismissed the State of California's lawsuit against several major automobile companies for climate change damage. California's Attorney General explained that in dismissing the case the court invoked "what is known as the 'political question' doctrine . . . agreeing with the defendants that it is for Congress and the President, not the courts, to address the injuries that California and other states experience from global warming." The case has been appealed to the Ninth Circuit."[72]

Alaskan native tribal governments have had similar problems bringing climate change related law suits. In 2008, for example, in regards to the same issues that some of the villages represented by NBITWC are currently facing, the native Inupiat village of Kivalina, Alaska brought suit against nine oil companies (including ExxonMobil Corp.), fourteen power companies, and one coal company in a lawsuit filed in federal court in San Francisco. The suit claims that the village must be relocated due to global climate change. In September 2009, the case was dismissed by the federal court on the basis that the case presents a political question and that the village lacks standing.[73]

[68] Renthal, Elizabeth and Revin, Andrew C. 2007.
[69] Mank, Bradford C. 2005.
[70] Hari M. Osofsky, 2005.
[71] Climate Justice Law: http://www.climatelaw.org/cases/country/us/atl/atlmontana/mtsct/.
[72] California Attorney General's Office, http://ag.ca.gov/globalwarming/litigation.php.
[73] Climate Justice Law: http://www.climatelaw.org/cases/country/us/kivalina/dismissed/.

In another village climate change relocation issue 7 young adults sued the state of Alaska, arguing that the state has not adequately addressed carbon emissions and global warming.[74] The Plaintiffs sued the state last year but the lower court dismissed the case, saying that policy decisions should be left to the legislative and executive branches. Kanuk and the others appealed and last October the Alaska Supreme Court took up that appeal.

Arguments before the Court are focusing on the ability and responsibility to manage a global-scale problem such as climate change, whether the atmosphere is a public trust, and whether the native villages can exercise their duty to protect it. As with some of the Norton Bay villages, the Plaintiffs argue that climate change is increasing the steadily eroding riverbank, literally from the backyards of some of the plaintiffs. The riverbank, which used to be held back by permafrost, is now receding at least several feet per year, and warmer temperatures could impact their way of life in which 90 percent of their diet comes from the tundra or the ocean.[75]

[74] College Student Sues Alaska over Climate Change. http://thinkprogress.org/climate/2013/10/04/2726421/student-sue-alaska-climate-change/

[75] *Ibid.*

V. WATER RESOURCES ASSESSMENT FINDINGS

Water Resource Stakeholders

The potential stakeholders related to management of water resources within the Norton Bay Watershed include: 1) State water department experts – water quality or watershed planning; 2) Local water utility representative; 3) Insurance companies (floods, drought, storms); 4) Storm-water coordinators for municipalities; 5) Emergency management representatives (FEMA, Local EMA, HazMit, Flood); 6) US Fish and Wildlife Service & Alaska Department of Fish and Game; 7) Natural Resource Conservation Service; 8) City Planners; 9) Local and Regional Watershed Councils; Landscape Cooperatives; 10) Native Alaskan Tribal governments consortiums and 11) Federal Land management agencies.

a. Water Quantity, Quality, and Diversity of Aquatic Habitats

Differences in hydrology, geology, and climate across the Norton Bay watershed interact to create the region's diverse hydrologic landscapes ultimately shaping the quantity, quality, diversity, and distribution of aquatic habitats throughout the watershed and determining their suitability for Pacific salmon, a keystone species that helps indicate overall health of the watershed. Healthy watersheds are characterized by cold, deep and clear streams, which provide the best habitat for Arctic aquatic species. Riparian vegetation acts as cover for rivers and streams keeping temperatures low. The photo below illustrates these undeveloped and relatively pristine features and characteristics of the Watershed. In general, conditions within the Norton Bay watershed are highly favorable for Pacific salmon. Aquatic habitats are abundant and diverse, ranging from headwater streams to braided rivers, lakes to wetlands, side channels to off-channel alcoves. The region's aquatic habitats provide a diverse assemblage of salmon spawning and rearing habitats, thereby supporting a diverse salmonid assemblage. Gravel substrates common throughout the region are essential for Pacific salmon spawning, egg incubation, and early development.

Due to increases in air temperature, changes as the result of climate change are occurring at a rapid rate to instream water temperatures, water quality, glaciation, permafrost, coastal and riparian zones, and fish and wildlife habitat. This includes altered hydrologic conditions and significant and continued changes in freshwater quantity and quality throughout Alaska, affecting numerous aquatic environments including wetlands, rivers and lakes.

Figure 30: Darby Mountains near Tubutulik River Depth Gauge Site, *Source: Harold Shepherd*

In addition, reduced water flows caused by water diversions from proposed mining and other development activity; exacerbate the effects of climate change by increasing water temperatures and reducing aquatic diversity. Further, members of the Villages conduct both commercial and subsistence fishing in marine waters, which are fed by the rivers and are already impacted by the effects such as coastal erosion, flooding, extreme fluctuations in hydro-geomorphology, early spring break-up, and access to traditional fishing and hunting sites.

Changing freshwater temperature conditions may, therefore, affect populations of fish and wildlife that Alaska Native Village communities have customarily relied on for subsistence: 1) Changes in terrestrial conditions may influence availability of wildlife and fish species to harvest, as well as access to harvest; 2) Changes in the seasonality of events such as river freeze-up and break-up may affect opportunities for customary and traditional uses of fish and wildlife; 3) Range extensions of more temperate plants and animals may affect subsistence resources; rural cultures and lifestyles may be threatened due to changes in subsistence opportunities and 4) Economic losses to local subsistence communities may occur as traditional target stocks change in their relative abundance.

b. Fishery and Wildlife Resources

1. *Fish Species and Abundance*

Closely tied to the Norton Bay Watershed's physical habitat complexity is its biological complexity, which greatly increases the region's ecological productivity and stability. This biological complexity is especially evident in the watershed's Pacific salmon populations, although other species (e.g., white fish and greyling) also show considerable biological variability. The Pacific salmon species found in the Watershed vary in many life history characteristics, allowing them to fully exploit the range of habitats available. Even within a single species, life histories can vary significantly.

This life history variability, together with the Pacific salmon's homing behavior, results in distinct populations adapted to their own specific spawning and rearing habitats.[76] Variations in temperature and stream flow associated with seasonality and groundwater-surface water interactions create a habitat mosaic supporting a range of spawning times across the watersheds.

Spawning adults return at different times, to different locations, creating and maintaining a degree of reproductive isolation and allowing development of genetically distinct stocks.[77] This stock diversity acts to stabilize salmon productivity across the watershed as a whole, as the relative contribution of Pink salmon with different life history characteristics, from different regions of the Norton Bay watershed, changes over time in response to changes in environmental conditions.[78] For example, salmon stocks that spawn in small streams may be negatively affected by low-flow conditions, whereas stocks that spawn in lakes may not be affected.[79] Thus, any population containing stocks that vary in spawning habitat is better able to persist as environmental conditions change.

[76] United States Environmental Protection Agency. 2012.
[77] *Ibid*.
[78] *Ibid*.
[79] *Ibid*.

Figure 31: Tubutulik Lower River measurements, *Source: Harold Shepherd*

Without this high level of system wide bio-complexity, annual variability in the size of Norton Bay river's Pink salmon runs would more than double and fishery closures would be more frequent.[80] In other watersheds with previously robust salmon fisheries, such as the Sacramento River's Chinook fishery, losses of bio-complexity have contributed to salmon population declines.[81] These findings suggest that even the loss of a small stock within an entire watershed's salmon population may have more significant effects than expected, due to associated decreases in bio-complexity of the population's stock complex.

According to the *Alaska Department of Fish and Game Climate Change Strategy*, "…freshwater temperature changes may affect fish and wildlife habitat in the following manner: 1) Invasive species may become established as a result of more favorable environmental conditions resulting from a changing climate having the potential to negatively affect native and endemic species; 2) Distribution of freshwater fishery resources throughout Alaska may be altered (e.g. a shift to fish species tolerant of warmer waters); 3) Distribution and run timing of targeted fish may shift, likely impacting existing regulation and management of fisheries; 4) Increases in predatory fish may affect production of targeted fish; 5) Alteration of freshwater dependent species such as salmon and trout, requiring re-evaluation of instream temperature flow water rights permitting;

[80] United States Environmental Protection Agency. 2012.
[81] *Ibid*.

6) Effects on freshwater ecosystems and the terrestrial species they support, with some species benefiting and others suffering; 7) Changes in wildlife production, distribution, and behavior; 8) Degradation of wetlands and low-lying coastal staging areas that support millions of shorebirds, geese and ducks during spring and fall staging; and 9) Warmer river basins may negatively affect dependent species (e.g. vegetation may affect moose and altered wetlands may affect waterfowl); and 10) Changes in critical winter ice flow conditions.

In addition, changing temperatures in freshwater systems may impact marine ecosystems into which these systems feed including: 1) Sea ice condition change which have the potential to affect species dependent upon sea ice for all or a part of their lives; 2) Potential shifts of marine species assemblages as waters warm; and 3) Changes in marine productivity that could negatively affect food webs important to bird species."

2. *Salmon-Derived Productivity*

Most of the nitrogen, phosphorus and other elements in adult salmon bodies are derived from the marine environment.[82] Adult salmon returning to their natal freshwater habitats import nutrients that they obtained during their ocean feeding period—that is, marine-derived nutrients (MDN)—back into those habitats. MDN from salmon accounts for a significant portion of nutrient budgets in the Norton Bay Watershed.

Returning salmon also redistribute nutrients within these systems by disturbing bottom substrates during spawning resulting in increased nutrient export downstream.[83] Productivity of the Tubutulik River region's fish and wildlife species is highly dependent on this influx of MDN into the region's freshwater habitats. When available, salmon-derived resources—in the form of live adult salmon, eggs, carcasses, and invertebrates that feed upon carcasses—are key dietary components for numerous animal species, including fish (e.g., rainbow trout, Dolly Varden, Pacific salmon, Arctic grayling), mammals (brown bear, wolves, fox, mink), and birds (bald eagle, various waterfowl). Availability and consumption of salmon-derived resources can have significant benefits for these species, including increased growth rates, energy storage, litter size, nesting success, and population density (Appendices A and C). The abundance of trophy-sized rainbow trout in the Tubutulik River system results from MDN from salmon. Terrestrial systems of the Tubutulik River watershed also benefit from these MDN. Bear, wolves, and other wildlife transport carcasses and excrete wastes throughout their ranges,[84] which provide food and nutrients for other terrestrial species.

[82] United States Environmental Protection Agency. 2012.
[83] *Ibid*.
[84] *Ibid*.

c. Ecosystem Integrity

Unlike most other areas supporting Pacific salmon populations, the Tubutulik River watershed is a nearly pristine ecosystem, undisturbed by significant human development. Large-scale, human-caused modification of the landscape—a factor contributing to extinction risk for many native salmon populations[85]—is absent, and development in the watershed consists of only a small number of fish camps used by the local native communities and some mining exploration. The primary human manipulation of the Tubutulik River ecosystem is the subsistence and commercial harvest of salmon returning to spawn.

Surface and subsurface waters are highly connected, enabling hydrologic and biochemical connectivity between wetlands, ponds, streams, and rivers, thus increasing the diversity and stability of habitats able to support fish. The high diversity of habitats, high quality of surface and subsurface waters, and relatively low development pressures all contribute to making the Norton Bay Watershed a highly productive system. This high diversity of habitats has also enabled the development of high genetic diversity of fish populations. This genetic diversity acts to reduce year-to-year variability in total production and increases the stability of the fishery. The return of salmon from the Pacific Ocean brings nutrients into the watershed and fuels terrestrial and aquatic food webs. The condition of terrestrial ecosystems in Tubutulik River, therefore, is intimately linked to the condition of salmon populations.

The Tubutulik River watershed also supports populations of resident fish that typically remain within the watershed's freshwater habitats throughout their life cycles. The region contains highly productive waters for such sport and subsistence fish species as White Fish and Arctic grayling. These fish species occupy a variety of habitats within the watershed, from headwater streams to wetlands to large rivers and lakes.

[85] United States Environmental Protection Agency. 2012.

Figure 32: Spawning sockeye salmon,
Source – Bellingham County, WA Climate Adaptation Plan (CSU 2010)

Unlike most terrestrial ecosystems, the Tubutulik River watershed has undergone little development and remains largely intact. Consequently, the watershed continues to support its historic complement of species, including large carnivores such as brown bears, bald eagles, and gray wolves; ungulates such as moose and caribou; and numerous waterfowl species. Wildlife populations tend to be relatively large in the region, due to the increased biological productivity associated with Pacific salmon runs. Brown bear and moose are abundant, with populations especially high in the Tubutulik River watershed where feltleaf willow, a preferred plant species to the moose, is abundant. The Tubutulik River watersheds are also used by caribou, primarily the Mulchatna caribou herd. This herd ranges widely through these and other watersheds.

d. Indigenous Cultures

The Alaska Native culture present in the Norton Bay watershed, the Inupiat, is one of the last intact, sustainable salmon-based cultures in the world. In contrast, other Pacific Northwest salmon-based cultures are severely threatened due to development, degraded natural resources, and declining salmon resources. Pacific salmon are no longer found in 40% of their historical breeding ranges in the western United States, and where populations remain, they tend to be significantly reduced or dominated by hatchery fish.

Salmon are integral to the entire way of life in these cultures as subsistence food and as the foundation for their language, spirituality, and social structure. The cultures have a strong connection to the landscape and its resources. In the Norton Bay area, this connection has been maintained for at least the past 4,000 years and is in part due to and responsible for the continued pristine condition of the region's landscape and biological resources. The respect and importance given salmon and other wildlife, along with the traditional knowledge of the environment, have produced a sustainable subsistence-based economy and way of life which is a key element of indigenous identity; this respect serves a wide range of economic, social, and cultural functions in Inupiat and Yu'pik societies.

The subsistence way of life in many Alaska Native villages is augmented with activities supporting cash economy transactions. Alaska Native villages, in partnership with Alaska Native corporations and other business interests, are considering a variety of economic development opportunities. Most Alaska Native villages have decided for themselves that large-scale hard rock mining is not the direction they would like to go and are, primarily, concerned with the long-term sustainability of their communities.

The NBITWC community is especially vulnerable to mining and development proposed for the Norton Sound area because they are an indigenous population highly dependent on a subsistence economy. There are 25 villages and communities within the Norton Bay watersheds, with a total population of 4,337 in 2010. Four communities have federally recognized tribal governments and a majority Alaska Native population. Many of the non-Alaska Native residents in the watersheds also have strong cultural ties to the region and practice a subsistence way of life. In the Norton Bay Watershed, salmon constitute approximately 52% of the subsistence harvest, and for some communities this proportion is substantially higher. The Norton Bay River Watershed produces a variety of important fish species in this region, including Chinook Salmon, Pink Salmon, Chum Salmon, Silver Salmon, as well as whitefish and greyling. However, the fishery is already exhibiting population pressures due to human caused impacts. Parent-year escapements for Chinook salmon, for example, were mostly poor in the 2000s, very poor for returning 5-year old chum salmon, poor to fair for coho salmon in 2003, and were poor to fair for chum in 2004.

e. Existing Conditions

1. ***Water Utilities****:* The following include narrative description of water utility entities in the Watershed and how they are owned and operated:

Elim: Water is derived from a well and is treated. Water and sewer systems built by the Public Health Service (PHS)in 1974, along with housing provided by BIA and Housing and Urban Development (HUD), have provided residents with piped water and sewer, indoor water heaters and plumbing, and in home washers and dryers. The water system is thirty years old and in great

need of repair and replacement. The City of Elim found one new water source, but water shortages still occur on occasion. They also need a new water source to prepare for future development and a source in an area far from possible contamination. There is a great need to replace cracked PVC pipes to avoid leakage from supply and sewer lines. Waste flows to a sewage treatment plant with ocean outfall. The existing water well needs to be moved north. Septic from the homes east of the well can overflow. It has the potential to contaminate the water source.

The Koyuk Washeteria and School have one primary and several back up Public Water System (PWS) wells. This assessment is exclusively limited to PWS No. 340167.001. The well has been used as a drinking water source since it was drilled in November of 1997. The well is a Class A (community and non-transient/ non-community) water system located inside the washeteria. The 2002 sanitary survey indicates that there is a storage tank with a 203,000-gallon capacity. Records also indicate that the drinking water source is untreated. This system operates year round and serves approximately 297 residents and 2 non-residents through 59 service connections.

The City of Unalakleet water system is a Class A (community) water system that obtains water from an infiltration gallery located along Powers Creek, approximately 5 miles north of the city. There are 2 wells located along the creek. One of the wells is the backup well.

The City of Shaktoolik water system is a Class A (community) water system that obtains water from two surface water intakes on the Tagoonmenik River. One intake, used in the summer, is located approximately 2-miles south of Shaktoolik. The second intake, used in the winter, is located approximately 200 yards north of the water treatment plant. Access to the intake areas is not restricted.

2. ***Source Water:*** Source water protection depends on state or local policy. The following is a list of policies and management of local source water including: the delineation of the source water areas, the primary land use/vegetation on it now, how it is protected by who, and who is in charge of managing and monitoring.

Water quality risks for drinking water sources were determined by the Alaska Department of Environment and Conservation (ADEC). The assessment included both analysis of land use in source water protection areas and direct water quality testing. For each village, potential and existing sources of the following contaminants were evaluated for the Source Water Assessment: bacteria and viruses, nitrates and/or nitrites, heavy metals, cyanide and other inorganic chemicals, synthetic organic chemicals, volatile organic chemicals, and other organic chemicals. This evaluation included all available water sampling data submitted to Alaska Department of Environmental Conservation (ADEC) by the system operator. The samples may have been

collected from either raw water or post treated water. Vulnerability ratings were determined for each potential contaminant by combining the susceptibility of the surface water source with the contaminant risks.

i. The City of Elim protection area is approximately 3.5 square miles in area and received a susceptibility rating of "very high." *A rating of high to very high is typical for all systems with surface water intakes*. ATV/dogsled trails, foot trails, and a dog tie down area were identified as potential sources of contaminants for the drinking water source.

ii. The City of Koyuk wellhead received a susceptibility rating of Very High and the aquifer received a susceptibility rating of Very High. Combining these two ratings produce a Very High rating for the natural susceptibility of the well. Identified potential and current sources of contaminants for the public drinking water source include: bulk fuel facilities, fuel tanks, airports, pipelines and power generation facilities. A detailed inventory of potential or existing contamination sources can be found in Appendix B, Table 1.

The City of Unalakleet wells received a susceptibility rating of High and the aquifer also received a susceptibility rating of High. Combining these two produces a rating of High for the natural susceptibility of the wells. Identified potential and current sources of contaminants for the well intake area include: beaver habitat, seasonal inundation, salmon spawning, heating oil tanks, and a demolition site. This assessment can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of the City of Unalakleet to protect public health.

iii. The overall protection area for the Unalakleet summer intake is approximately 8.3 square in area and received a susceptibility rating of "very high". A landing strip and all-terrain-vehicle (ATV) activity were identified as a potential source of contaminants for the drinking water source. This assessment can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of the City of Shaktoolik to protect public health.

The following table summarizes the findings from ADEC source water assessments report regarding susceptibility and vulnerability of drinking water sources to potential contamination.

Table 3: Norton Bay Native Village Water Utility System Assessments (Summarized from ADEC reports)

Water Factor Evaluated	Elim	Koyuk	Shaktoolik	Unalakleet
Drinking water source	Class A System: Wells – treated (Est. 1974)	Class A System: Wells – untreated (Est. 1997)	Two surface intakes on Tagoonmenik River	Class A System: Wells from infiltration gallery along Powers Creek
Source Water Area	3.5 square miles	??	8.3 square miles	??
Susceptibility Rating for Source Water/Wellhead	Very High	Very High	Very High	High
Susceptibility Rating for Aquifer	??	Very High	??	High
Potential contaminant sources in the area	Trails – ATV, dogsled and foot trails, dog tie down areas	Bulk fuel facilities, fuel tanks, airports, pipelines, and power generation facilities	Landing strip; and all-terrain-vehicle activity	Beaver habitat, seasonal inundation, salmon spawning, heating oil tanks, and a demolition site
Vulnerability Ratings Based on Source Susceptibility and Water Quality Testing				
Test Parameter	**Elim**	**Koyuk**	**Shaktoolik**	**Unalakleet**
Bacteria/Viruses	Medium	High	Medium	High
Nitrates/nitrites	Medium	Very High	Medium	High
Heavy metals	Medium	Very High	Medium	Very High
Cyanide and other inorganic chemicals	Medium	Very High	??	??
Synthetic organic chemicals	Medium	high	High	Low
Volatile organic chemicals	Medium	Very High	Very High	High
Other organic chemicals	Medium	Very High	High	Low
Water Supply/ Utility Needs	Address periodic water shortages; New well and system located more north of village; Repair of cracked PVC pipes	??	??	??

f. Water Risk Findings

1. *Ecological*

Issues that impact drinking water in the Norton Sound area include potential mining activity, flooding, especially from fall storms blowing in off the Bering Sea, and saltwater inundation of coastal streams that serve as water sources. Additionally, below normal temperatures in the winter can result in frozen waterlines.

Water quantity is not generally an issue in the community. Nor are groundwater aquifers at risk. Stream flows, however, are shifting in seasonal flow or volumes in late summer season due to heavy rains in recent months. Current flow risks are flooding and scouring due to heavy rain events. Future water levels needed for fish could drop due to proposed mining and related development in the Watershed. Community water supply could become contaminated from mining activity, and subsistence uses are threatened by increased sediment in rivers due to proposed road construction and use of water needed for fish flows in mining processes.

Following are excerpts from articles depicting examples of these concerns.

November 8, 2011 – Monster Storm Bears Down on Rural Western Alaska
"Big autumn sea storms are a fact of life in western Alaska. But a storm of this severity probably has not been seen since 1974, said Jeff Osiensky, regional meteorologist in Anchorage for the National Weather Service. "We really need to be careful with this storm. It is a very serious type condition," he said.

Complicating the situation, officials said, is the fact that the sea ice that often settles in along the coast by mid-autumn is not present, leaving coastal villages vulnerable not only to snow driven at hurricane force, but waves and sea surges. Sea levels are expected to rise 7 to 9 feet above normal in Norton Sound and the Bering Strait coast, federal meteorologists said. The Weather Service said "major coastal flooding" and "severe beach erosion" can be expected along many areas of the Bering Strait coast, Norton Sound, St. Lawrence Island and the Chukchi coast as far as Point Hope.[86]

Similarly, in early November 2013, storm-weary coastal communities in western Alaska, still reeling from a damaging weekend storm, were girding for a fresh round of harsh weather. A National Weather Service warning forecast high winds and freezing rain in the Yukon River Delta region. The oncoming storm was not predicted to be as powerful as the one that barreled into the area Saturday night, flooding buildings and destroying water pipelines in Kotlik and Unalakleet. Kotlik, a community of about 600 people that saw more than a dozen homes

[86] Los Angeles Times, 2011, http://latimesblogs.latimes.com/nationnow/2011/11/alaska-monster-storm-bering-sea.html.

damaged in the weekend flooding, had to send a disaster declaration to the state while officials were working with Unalakleet and Stebbins on their own declarations.

Later the same week, more weather struck in Kotlik as residents continued to work on the village's badly damaged piped vacuum sewer line, and bought bottled water from local stores. The storm wreaked havoc on water distribution lines, and local officials warned Monday that the village water tank only carried enough fresh water for five days and water purification system had to be flown in.

During the same time period, about 100 miles up the coast, in Unalakleet, crews were scrambled to repair several hundred feet of damaged water piping before the next round of bad weather. A temporary line was installed while water has continued to flow. The collapse of pipeline accentuated long-standing concerns about erosion, according to city administrators.[87]

2. *Groundwater Exchange and Flow Stability*

A key aspect of the Norton Bay Watershed's aquatic habitat is the importance of groundwater exchange. Because salmon rely on clean, cold water flowing over and through porous gravels for spawning, egg incubation, and rearing,[88] areas of groundwater upwelling create high-quality salmon habitat (Appendix M). Densities of salmon-supporting streams tend to be lower in regions with lower permeability and less extensive exchange between groundwater and surface water.[89]

Figure 33: Tubutulik River, New Channel, *Source: Judy Daniels*

[87] Anchorage Daily News. 2013. http://www.adn.com/2013/11/12/3172950/reeling-coastal-villages-prepare.html.
[88] United States Environmental Protection Agency. 2012.
[89] *Ibid.*

The tight connection between groundwater and surface waters helps to moderate water temperatures and stream flows. Groundwater contribution to stream flow also supports flows in the region's streams and rivers that are more stable than those typically observed in many other salmon streams (e.g., in the Pacific Northwest or southeastern Alaska). The lower main-stem Tubutulik and Koyuk Rivers illustrate this tendency toward moderated, consistent stream flows. Coarse-textured glacial drift in the Boulder and Volcun Creek drainages promotes high groundwater contributions to these streams, resulting in stable flows through much of the year. High base flows in the Tubutulik River also are consistent with increased interactions between surface water and groundwater, as water flows from the Darby Mountain Range and Fireweed Occurrence areas into the coarse-textured glacial drift of Tubutulik River Lowlands.

Figure 34: Coastal Erosion in the Native Village of Shishmarof,
Source: John Sutter, CNN

g. Water Law and Policies

1. *State Water Rights*

Alaska's current water law is contained primarily in the 1966 Alaska Water Use Act (AWUA) which established the appropriation system and is administered by the Department of Natural

Resources, Division of Mining, Land, and Water Management (DNR).[90] No distinction is made in the Act between surface and groundwater, they are treated as one in the Act and only "mineral and medicinal waters" are segregated and are unavailable for appropriation.[91]

In Alaska, a water rights application must be filed prior to putting the water to use, such rights may not be acquired by adverse possession, AS 46.15.040, and the right is appurtenant, or attached to, the land where it is used and will be passed with sale of land unless specifically exempted. The permit for perfection of the appropriation is issued for a fixed period of time with extensions possible.[92] Once perfected, a certificate subject to any conditions deemed necessary, will be issued for the amount of water actually used,[93] and once issued a water right is perpetual as long as the use remains unchanged. The exception to this is that instream flow reservations must be reviewed every ten years.[94]

The amount of water that can be appropriated under the Act is limited to the amount needed for the proposed use.[95] Regulations promulgated by DNR established standards for domestic and agricultural uses and if a use will require more than 100,000 gallons per day from a stream, mean annual flow data must be provided for permit issuance. Relevant to Alaskan native water interests, instream flow reservations require a more elaborate analysis, specific to each water body.[96]

The AWUA, also, allows any person to reserve "sufficient water to maintain a specified instream flow . . . at a specified reach of a stream or river" for recreation and the protection of fish and wildlife.[97] The regulations specify that the information in an application must include nine elements such as purpose, location, time, and background data.[98] If an application does not substantially comply with those requirements, it is not accepted for filing. When the DNR accepts an application, it must provide public notice and allow fifteen days for public objection.[99] Then, at some point, the DNR adjudicates the water rights pursuant to Alaska Statute section 46.15.165. This document carries the same legal weight as an out-of-stream diversion. [100]

[90] AS 46.15.010 – 46.15.270.
[91] Dugan, Kathleen Sheehan. 1999.
[92] AS 46.15.110.
[93] AS 46, 15.120.
[94] AS 46.15.145.
[95] AS 46.15.100.
[96] AS 46.15.145.
[97] AS 46.15.145;; AAC 93.142-143. see also 11 AAC 93.141.
[98] AS 46.15.145.
[99] AS 46.15.133.
[100] AS 46.15.145.

Under Alaska water law, therefore, if a party files for an instream flow reservation, that water right is superior to any proposed water uses that may come later in time. Unlike standard water right applications in Alaska, instream flow reservations must be reviewed every ten years[101] and instream flow reservations require a more elaborate analysis, specific to each water body.[102]

The instream flow water right approval process in Alaska has inherent flaws, however, primarily because the Department of Natural Resources (DNR) must adjudicate an application for an instream flow right before it can have any legal effect. In addition to the fact that the water right adjudication process can get complex and potentially injured parties can protest a water right application, the process can get political, especially when the approval of a flow application could impact resource extraction interests. As a result, recognition of water rights for Alaska Native Tribal Governments provides a more reliable means of protecting instream flows and subsistence uses.

In fact, the state has attempted to eliminate the instream flow water right reservation process, altogether, as it applies to tribes and citizens in general. Due to overwhelming public opposition, however, the vehicle for eliminating instream flow reservation in this context, HB 77, failed to gather the votes needed to pass before the end of the 2013 legislative session. However, due to substantial support from the Alaska Governor's Office, the bill will, likely, return during the 2014 legislature

2. *Prior Appropriation and Native Rights*

Arguably, Alaska Native water rights currently exist under the law of prior appropriation based on the fact that Alaska Natives have relied on a subsistence economy which relies on sufficient instream flows for fish. Under the prior appropriations system recognized in Alaska, therefore, because the priority date would extend from the time that beneficial use was first made of instream flow, Alaska Native priority would be senior to all non-Native appropriators. In fact, the AWUA provides procedures for administration and judicial determination of federal reserved water rights. The statute authorizes DNR to initiate an adjudication and serve the order on any person who owns or claims land, within the affected area, held in trust by the United States or if ownership of the land was obtained under specified Native land claim statutes.

3. *State Constitution*

Alaska Native peoples may have a protectable property interest under the Alaska Constitution, which according to the Alaska Supreme Court, can offer broader protections than corresponding provisions of the United States Constitution. This conclusion is largely based on the fact that the

[101] *Id*.
[102] *Id*.

Alaska Constitution provides that water appropriations are subject to a general reservation for fish and wildlife which are the primary source of subsistence uses.

4. *The Public Trust*

The Public Trust Doctrine provides a basis for protecting instream flows and subsistence uses for Alaskan natives. In the Seminole Public Trust case, for example, the U.S. Supreme Court concluded that "the ownership and dominion and sovereignty over lands…with…states, belong to the respective states…to use or dispose of any portion, thereof, when that can be done without substantial impairment of the interest of the public…"[103]

Although, the public trust doctrine is not explicitly stated in the Alaska Constitution, the latter expressly provides for the protection of subsistence uses by stating that "[w]herever occurring in their natural state, fish, wildlife and waters are reserved to people for common use."[104] In addition, since statehood, decisions by the Alaska Supreme Court have recognized the force of the public trust doctrine and have expanded its scope removing any question that the public trust doctrine and its role in the preservation of Alaska's natural resources is implicit in the Constitution.

Further, the Constitution has been interpreted to place access to natural resources in Alaska above private property interests. The Alaska Supreme Court, for example, concludes that the "common use" clause was unique in relation to other state constitutions and was established to avoid exclusive control over resources by the State by imposing a public trust duty to prevent such control.[105]

Moreover, in *Metlakatla Indian Cmty, Annette Island Reserve v. Egan*, the Court found that the State does not have the right to manage resources as if it were a private owner seeking to maximize income.[106] Instead, the State must manage for the benefit of the beneficiary of the trust – all people of Alaska.[107]

Moreover, in Alaska the resources protected by the public trust include those traditionally relied on by Native Alaskans for subsistence and traditional uses including: a) fish and wildlife and their habitat, navigable and non-navigable waters; b) all state land, including tidelands and uplands and all non-appropriated minerals; recreational uses of navigable or public waters or any

[103] *Illinois Cent Co v. State of Illinois City of Chicago v. Illinois Cent Co State of Illinois v. Illinois Cent*, 146 U.S. 387, 465 (1892).
[104] Article VIII, Section 3.
[105] *Owsichek v. State, Guide Licensing and Control Bd.*, 763 P.2d 488, 491 (Alaska, 1988).
[106] 362 P.2d 901, 913 (Alaska 1961).
[107] *Id*.

public purposes water that is used, or is capable of being used, consistent with the public trust, e.g., wildlife habitat, fishery habitat, scientific or educational value, or scenic beauty.[108]

Finally, the Alaska Legislature recognizes the importance of public access to waters by stating: "Ownership of land bordering navigable or public waters does not grant an exclusive right to the use of the waters and any rights of title…to use and have access to the water for recreational purposes or any other public purpose for which the water is used or capable of being used consistent with public interest".[109]

5. *Aboriginal Rights*

Some experts argue that, to the extent Alaska Native Water Rights existed via aboriginal title or treaty, these have been abrogated by the passage of the ANSCA. Alaska Native peoples, who have used and occupied traditional lands, including water rights, in Alaska since time immemorial, generally, retain aboriginal title while the Indian Nations retain equitable title (or retain possession) in the land. Aboriginal title refers to the non-treaty rights of Alaska Native and Indian Tribes, which are legally enforceable against all other entities except the United States, who as sovereign and fiduciary, is required to protect such interests. Such title, therefore, cannot be limited by the operation of state law.

In addition, based on the fact that, Alaska Native lands are not considered part of the public domain of the United States, they are not subject to the federal statutes authorizing establishment of water rights under state law on public lands. This is because a basic rule of statutory construction is that general acts of Congress do not apply to Alaska Native peoples, if their application would affect the Native peoples adversely, unless Congressional intent to include them is clear.

6. *Alaska Natives and Water Law*

Although large areas of the state are in federal reserves as a result of Alaska's recent admission into the Union, case law generally does not define the state's relationship to the federal government in terms of water rights. Similarly, water rights for the 44 million acres awarded to native regional and village corporations, however, remain undefined.[110]

Under ANILCA, however, the government did reserve "water quality and necessary water quantity" for new wildlife refuges, parks, and forests, covering approximately 104 million acres.[111] In addition, the Alaska Water Use Act provides a method of administrative adjudication

[108] Dugan, Kathleen Sheehan. 1999.
[109] Alaska Stat. 38.05.126.
[110] Dugan, Kathleen Sheehan. 1999.
[111] *Id*.

for awarding water rights and priority dates to federal reserved lands and lands received by persons under the various Indian Allotment acts or the Alaska Native Townsite Act.[112] Further, under AS 46.15.166, the Commissioner for DNR can file a complaint on behalf of the State in Superior Court to initiate a judicial adjudication. Parties are bound to the final order of the Commission under AS 46.15.165, or to the court order under AS 46.166 and AS 46.15.167.

In addition, with the exception of those necessary for state and Alaska Native Claims Settlement Act (ANCSA) corporation conveyances, Section 810 of ANILCA imposes procedural restrictions on future dispositions (i.e., leases, permits, withdrawals, etc.) of public lands if such dispositions will affect subsistence.[113] If so, the federal agency managing the lands must analyze the effect of the disposition on subsistence and consider alternatives to reduce or eliminate the need for the disposition. If the disposition would "significantly restrict subsistence uses," then it is prohibited until the agency: 1) gives notice to the state and the affected local committees and regional councils, 2) gives notice and holds a hearing near the lands being disposed of, and 3) determines that restriction of subsistence is necessary, that the least possible amount of land is affected and that reasonable steps will be taken to lessen adverse effects on subsistence.

The Katie John Cases

Federal district courts have concluded that under Title VIII of ANILCA, the United States holds title to an interest in Alaska's navigable waters as an element of the "federal navigational servitude."[114] Since the United States holds an interest in the navigable waters of Alaska, they meet ANILCA's definition of public lands and the Secretary of the Interior was charged with the management of subsistence fishing in the navigable waters of Alaska.[115]

In *Katie John II*, the Ninth Circuit concluded that public lands in Alaska included certain navigable waters, defined by the reserved water rights doctrine, which states that when the United States withdraws lands from the public domain and reserves them for a federal purpose, it implicitly reserves water then unappropriated to the "extent needed to accomplish the purpose of subsistence uses[116]

After it was confirmed by the 9th U.S. Circuit Court of Appeals, *Katie John* still acts as precedent, at least, for federal agencies who are mandated to apply the dual management scheme for subsistence to navigable waters that are reserved for the purpose of federal land withdrawals in Alaska. In Fall of 2013, the Parnell administration appealed the ruling in the case by the 9th

[112] AS 46.15.165.

[113] Case, David S. and Voluck, David A. 2002.

[114] *Katie John v. United States*, No. A90-0484-CV (HRH) 1994 WL 487830, p. 17 (D. Alaska March 30, 1994).

[115] *Id.*

[116] *Alaska v. Babbitt* (*Katie John II*), 72 F.3d 698, 703 (9th Cir. 1995).

Circuit to the U.S. Supreme Court claiming that the court improperly approved Interior Department rules enforcing federal subsistence fishing rights for rural Alaskans on navigable rivers that would otherwise be owned and managed by the state. In the appeal, the state argues that federal regulation of subsistence on navigable rivers like the Copper River "intrudes on the State of Alaska's sovereign authority to regulate fishing and hunting because the state got title to navigable rivers at statehood, and the federal government has no business managing fishery resources there.[117]

Finally, federal case law illustrates that courts will enforce the government's mandate to provide subsistence priority for Native Alaskan's on navigable waters. In *Native Village of Quinhgak v. United States,* the Plaintiffs had an established a tradition of subsistence fishing for rainbow trout in the navigable portion of rivers in the Togiak National Wildlife Refuge. Since the federal government refused to administer the ANICLA subsistence priority as required by the *Katie John* litigation, the plaintiffs were subject to state regulation which only allowed incidental take of rainbow trout when fishing under federal rather than state law and, therefore, filed suit against the United States, presumably, because the rivers are located in Togiak Nation Wildlife Refuge (Refuge). Concluding that the harm to Quinhagak cultural identity was real and provided a basis for preliminary federal regulation under ANILCA, the Ninth Circuit granted the preliminary injunctive relief. "[The Villages] needed to prove nothing more in light of the clear congressional directive to protect the cultural aspects of subsistence living."[118] ("The continuation of the opportunity for subsistence uses by rural residents of Alaska…is essential to Native physical, economic, traditional, and cultural existence"). Moreover, the subsistence priority in favor of Native Alaskan's was further strengthened by the subsequent *Katie John* decisions which confirms federal jurisdiction over the reserved waters of the Refuge.

7. *Trust Obligation*

The federal trust duty to preserve Alaska Native aboriginal lands and protect them from third-party intrusions continues under section 11 of ANCSA and ANILCA, wherein Congress withdrew Native-selected core townships and deficiency lands from the operation of the public land laws, pending final patenting. Under ANILCA, for example, the government did reserve "water quality and necessary water quantity" for new wildlife refuges, parks, and forests, covering approximately 104 million acres. With some exceptions ANILCA imposes procedural restrictions on future dispositions of public lands if such dispositions will affect subsistence. If so, the federal agency managing the lands must analyze the effect of the disposition on subsistence and consider alternatives to reduce or eliminate the need for the disposition.

[117] Anchorage Daily News. Nov. 5, 2013.
http://www.adn.com/2013/11/05/3160437/state-appeal-ofsubsistence-ruling.html.
[118] *Id*, at 394 *citing* 16 U.S.C.A. § 3111(1).

8. *Coastal Zone Management*

Pursuant to the Coastal Zone Management Act of 1972 (16 USC 1482) (CZMA), Federal agencies have a government-to-government responsibility to consult with federally recognized Indian Tribes in areas where the CZMA is in effect. Although, the CZMA facilitates consultation by State Historic Preservation Officers (SHPOs) in the exercise of their responsibilities pursuant to the National Historic Preservation Act (NHPA), and the Archaeological Resource Protection Act (ARPA) including in matters that are protective of historic properties, it does not include consultation with Tribes and their Tribal Historic Preservation Officers (THPOs) or, otherwise, provide significant protection to tribes. Although, in 1992, the NHPA was amended to include tribes, the CZMA does not address the legal rights or concerns of tribes regarding historic properties and the CZMA has not been updated to be compliant with the Presidential Memoranda and Executive Orders that mandate federal governmental agencies to conduct meaningful tribal consultation in support of the government-to-government responsibility. Federal agencies have a duty to examine the implementation of the CZMA annually.

9. *Executive Orders*

President Obama's Directive of June 12, 2009 states that "The framework should also address specific recommendations to improve coordination and collaboration among Federal, State, Tribal, and local authorities, including regional governance structures." Similarly, Executive Order 13366 Section 1B Committee on Ocean Policy (Dec. 17, 2004), requires that federal agencies "facilitate, as appropriate, coordination and consultation regarding ocean related matters among the Federal State, Tribal governments, the private sector, foreign governments and international organizations."

10. *Planning Processes*

The following table illustrates the Planning Process and relevant plans for the Norton Sound Area. Each of these planning processes represents an opportunity to engage and address climate impact issues in land use and management practice decisions by all land owners and by all levels of government for Norton Bay Watershed.

The process of the most immediate significance of those listed below is the Norton Bay Watershed Assessment and Management Plan. The leaders of the climate planning project are among those involved in this watershed monitoring and planning effort and are well positioned to bring climate change information and recommendations into the watershed planning decisions.

Table 4: Norton Sound Planning Processes

Process	Stressor or Risk or Resource Focus	Schedule	Agencies Responsible	Stakeholders
The Northwest Area Plan (NWAP).	Overall resource management direction and policy of resilience and sustainability	Adopted in 2008 – 10 year duration; Next revision 2018	Department of Natural Resources (DNR)	Everyone with an interest in long term resource management of state lands
National Petroleum Reserve - Alaska Integrated Activity Plan	Oil and Gas/Wildlife and Subsistence Resources Management	Record of Decision released Feb. 21, 2013 – 10 – 15 duration; Next revision 2023-2028	BLM	Local Subsistence Dependent Native Villages. Oil and Gas Operators. Everyone in the region with an interest in resources on or near the NPR-A
Master plan for the Iyat/Serpentine Hot Springs area	Direction for managing the hot springs area and what actions the preserve should take regarding access and facilities there.	Public meetings held – 2012; Currently accepting public comment	National Park Service	All users of the Bering Land Bridge National Park
Kobuk-Seward Peninsula Proposed RMP/Final EIS	Ecosystem services of public lands	Completed 2008 - Ten year duration ; Next revision 2018	BLM	All users of BLM land on the Seward Peninsula, all regional residents because budget relies on mining & oil and gas receipts, tribes due to federal Trust Duty
Norton Bay Watershed Assessment & Management Plan	Future management direction for the Norton Bay Watershed	Assessment initiated – 2012 – Completed in 2014; Beginning Draft Plan anticipated in 2014 - Completed in 2017	Norton Bay Inter-Tribal Watershed Council with assistance from Norton Sound Regional Watershed Alliance, Koyuk Local Watershed Committee and Advisory Council	Native Villages reliant on subsistence resources, Energy Industry, Commercial Fisherman, state and federal resource agencies, everyone else who uses Norton Bay Watershed.

VI. ADAPTATION ACTION PLAN

Team and Strategic Analysis Process

Ongoing water related planning processes for the Norton Bay area include the Tubutulik River watershed assessment which reviews, analyzes, and synthesizes available information on the potential impacts of large-scale mining development on Norton Bay fisheries and subsequent effects on the wildlife and Alaska Native cultures of the region. The primary focus of the assessment is the quality, quantity, and genetic diversity of salmon fish. Because wildlife and Alaska Native cultures in Norton Bay are intimately connected and dependent upon fish, the quantity and diversity of wildlife and the culture and human welfare of indigenous peoples, as affected by changes in the fisheries, are also addressed by the assessment.

The assessment was conducted as an ecological risk assessment. The NBITWC started with a thorough review of what is known about the Norton Bay watershed fishery and wildlife and the Alaska Native cultures. We also reviewed information about uranium mining and available information outlining proposed mining operations for the Triex deposit that has been the focus of much exploratory study and has received much attention from various groups in and outside of Alaska. We also, collected water discharge and quality data at a site 15 miles up the River.

These strategies were re-defined through interaction with regional stakeholders and the local Native Alaskan community. The assessment was then developed based on background characterization studies and conceptual models.

Assessment Findings - Summary and Recommendations

The findings of the assessment process revealed multiple stressors to the forest, water, and economic resources of the Norton Bay watershed ecosystems and people living there. Non-climate stressors were identified related to development, resource extraction, and resource management policy, each of which is exacerbated by climate change factors. A number of climate-related stressors were also identified, both current and projected, including extreme weather patterns, shifting hydrologic patterns, sea level rise, coastal erosion, degradation of both water supply and water quality, and overall risks to the health of and access to basic subsistence resources for food, shelter, and income.

Addressing these multiple stressors and adapting to changing conditions will involve a mixture of on-the-ground practices, public policy that strongly protects subsistence natural resources, fund sources to support adaptation activities, and educational programs to engage all relevant stakeholders in the adaptation process. The table below briefly summarizes the assessment findings and provides context for the major adaptation goals developed by the planning team.

Table 5: Summary of Norton Bay Watershed Assessment Findings
Risks and Potential Solutions

Planning Element	Non-climate Stressor	Climate Stressors	Risks / Impacts	Potential Solutions
Forest				
Forest Cover and Products	Mining Activity Road Construction Land Use Policy	Invasive species Insect infestations Shifting forest hydrology	Reduced habitat Forest fires Fragmentation Water quality degradation Sedimentation High water temperatures Salmon impact	Strong riparian buffers Forest BMPs Road BMPs Aerial clearing limits Tribal environmental sovereignty
Forest Health	Harvest practices	Insect infestations	Forest fires Deforestation Sedimentation and high water temperatures Salmon impact	Forest BMPs Monitor & rapid response for fire, insects and invasive species
Water				
Coastal & riparian zone management	Development in risk zones (riparian and shoreline)	Sea level rise Coastal erosion Loss of sea ice Flooding damage	Loss of coastal structures Flood damage Reduced subsistence access & food sources	Relocate coastal development Strengthen and adapt coastal access infra-structure Strong riparian zone protections
Water supply	Aging infrastructure Land use policy for source water protection areas	Shifting hydrology Declining aquifers Salt water intrusion; Seasonal low stream flows	Water shortage Degraded instream habitat Salmon impacts	Land use restrictions and pollution pre-vention in source water areas Funding to update in-nfrastructure / move wells
Water quality	Mining activity, Road construction, Poor forest harvesting practices Source water land use policy	Rising water temperatures Salt water intrusion Sedimentation	Degraded aquatic habitat Salmon decline Degraded food chain Reduced subsistence food access Reduced tourism/fishing Drinking water contamination (chemicals, pathogens) Human health impacts	Land use restrictions on polluting industrial activities; Land use restrictions in source water zones Strong riparian zone protections; Drinking water monitoring Stream water monitoring Water infrastructure upgrades

Instream Flow & Precipitation	Water diversions for industry Instream Flow Rights & Policy	Shifting hydrology Drought/low flow periods Flood events	Low flow habitat impacts Salmon decline Subsistence food decline Flood structural impacts	Establish instream flow rights Maintain optimal flow conditions Protect riparian zones
Crosscutting / Economic				
Subsistence Economy	Fishing and hunting access Shipping traffic Mining Forestry	Coastal Erosion Structural damage Changing habitats	Loss of access to hunting /fishing Loss of food Loss of income	Policy to protect subsistence access Land use practices to protect subsistence resources

Based on assessment findings and input from tribal and agency stakeholders, the adaptation planning team developed the following overarching goals to address the primary climate risks and opportunities related to climate stressors and other related non-climate stressors to Norton Bay watershed forest, water, and economic resources.

Goal 1: Obtain funding for emergency preparedness and/or relocation of native villages in the Norton Bay Watershed most critically impacted by coastal erosion and flooding.

Goal 2: Obtain stream temperature data, stream bank erosion, and other data to complement flow & water quality data currently being gathered for rivers in watershed.

Goal 3: Increase access to subsistence resources in 100% of Watershed.

Goal 4: Protect subsistence resources in 100% of Watershed.

Goal 5: Increase education and outreach opportunities for native villagers to learn about climate change impacts with a focus on local issues and adaptation strategies.

Goal 6: Set precedent in Norton Sound Region for data collection, watershed assessment and climate change adaption planning.

Goal 7: Improve economic conditions of Native Villages.

Goals, Objectives, Strategies

The following outlines the specific objectives and strategies identified as necessary and feasible to achieve each of these climate adaptation goals over the coming years.

Goal 1: **Obtain funding for emergency preparedness and/or relocation of native villages in the Norton Bay Watershed most critically impacted by coastal erosion and flooding.**

Objective 1-1: Assess extent of threat of coastal erosion to Villages.

Objective 1-2: Determine which funding entities are most appropriate.

Objective 1-3: Apply for funding (primarily FEMA at this point).

- Identify other funding sources additional to FEMA.
- Clarify which entities apply for specific grants. Certain organizations must apply for certain grants, i.e. tribal govt's.
- Obtain buy-in from Tribe in time to apply for grants. Communication gap.

Goal 2: **Obtain stream temperature data, stream bank erosion, and other data to complement flow & water quality data currently being gathered for rivers in watershed.**

Objective 2-1: Establish temperature monitoring stations in key locations on Tubutulik and other rivers.

- Obtain appropriate funding.

Objective 2-2: Obtain proper training to conduct temperature modeling.

- Locate appropriate courses or trainers.

Objective 2-3: Conduct modeling.

- Locate and Hire staffing.
- Obtain Equipment, tools, transportation, etc.
- Work with *The Alaska Department of Fish and Game to implement the agency's Climate Change Strategy* including the following recommendations: a) conduct a vulnerability assessment that considers the ecological, economic, and sociopolitical ramifications, b) work with state, federal, tribal and NGO entities to incorporate existing data and TEK into the Plan and into management plans to adaptively manage fish and wildlife; c) identify and address statutory changes needed at federal, state and local levels; d) identify or develop regional partnerships to address goals and

strategies; e) develop effective communication systems and outreach efforts for addressing common climate change goals and strategies.

- Work with the University of Anchorage Alaska (UAA) Scenarios Network for Alaska and Arctic Planning (SNAP) program, the Alaska Climate Research Center (ACRC), and Alaska Climate Science Center (ACSC) and the University of Alaska Fairbanks Alaska State Climate Center (ASCC) to develop climate change scenarios, maps, background information and research.

Goal 3: **Increase access to subsistence resources in 100% of Watershed.**

Objective 3-1: Identify sites where access is limited or potentially limited due to ice, weather, and related conditions.

- Locate proper funding.
- Apply Traditional Environment Knowledge to gain information on nature and location of limited subsistence uses.
- Develop maps and obtain equipment needed to assess issues.

Objective 3-2: Obtain emergency relief and food aid for villages that are cut off from subsistence resources.

- Obtain proper funding.
- Encourage state and federal agencies to act promptly to establish states of emergency when necessary and to promptly act on requests for emergency relief.
- Conduct public outreach to ensure understanding of extent of problem and need for emergency relief.

Goal 4: **Protect subsistence resources in 100% of Watershed.**

Objective 4-1: Identify sites where risk factors threaten fish and wildlife habitat.

- Obtain proper funding.
- Apply Traditional Environment Knowledge to identify nature and location of threatened habitat;
- Develop maps and obtain equipment, etc., needed to assess issues;
- Encourage State and federal government agencies to emphasize protection and proper management of subsistence resources over resource extraction.
- Work with the signatories to this Plan, other native villages and state governmental agencies to apply the AWRVI and other credible resources to determine the state of well-being of native communities who rely on available water and subsistence resources.

- List all ocean waters around the state as Water Quality-Limited Segments ("303 (d) List") under section 303 (d) of the CWA due to impairment for pH due to absorption of anthropogenic carbon dioxide pollution. This designation should include action to be taken by the State agencies which represents the Environmental Protection Agency as a "delegated" State, for purposes of enforcing and upholding provisions of the CWA and other Federal environmental legislation.

Objectives 4-2: Apply federal, state, tribal and international laws, policies and to protection of habitat.

- Obtain funding for research, monitoring, comments, and appeals.
- Encourage federal agencies in Alaska including BLM, BOR, BIA and USFWS to consult and partner with Native Villages in Alaska to monitor and apply for reservation of instream flows in Alaska to protect key subsistence watersheds.
- Support preservation of biodiversity and Indigenous rights in subsistence use areas.
- Be consistent with Section 1B of President Obama's Directive of June 12, 2009.
- Call on the National Oceanic and Atmospheric Administration (NOAA fisheries) and other federal fisheries agencies to establish meaningful tribal consultation as an integral component of their implementation of the CZMA and become wholly compliant with the consultation process.
- Require better consultation with tribal governmental entities in the protection of ocean and coastal resources including water rights and quality management actions, development of watershed management plans and establishment of watershed management councils.
- Adequately address compliance with watershed conservation standards including section 313 of the Clean Water Act which requires federal agencies to comply with water quality standards when they are "engaged in any activity resulting, or which may result, in the discharge or runoff of pollutants" 33 U.S.C. § 1323(a).
- Assess and combine information gathered to draft a White Paper addressing the nature and extent of the TRIBE's current water rights in the waters that flow into and through their traditional territories.
- Draft a Water Code that will provide for issuance and enforcement of water right permitting and the protection of instream flow water rights in the waters that flow into and through their traditional territories" including the Matanuska River.
- Determine and document in writing how to implement a Tribal reservation of federal instream flows, as well as state instream flow, in the Matanuska River and the impact of such reservation on any existing water right holders and the public interest; develop an assessment to determine the amount of water necessary for instream flows and Tribal needs and insure that public notice of the water right is provided.
- Bring climate change and other litigation when necessary to protect subsistence uses and health and welfare of native communities.

Goal 5: **Increase education and outreach opportunities for native villagers to learn about climate change impacts with a focus on local issues and adaptation strategies.**

Objective 5-1: Discuss climate change mitigation and adaption with each Native Village Tribal Council in Watershed.

- Obtain funding and staff resources.
- Buy-in from tribal councils and communities.

Objectives 5-2: Present power point presentation to Tribal consortiums and other watershed councils located in Norton Sound Region.

- Obtain Funding, staff and other resources.
- Buy-in from tribal councils and communities.

Objective 5-3: Present power point presentation to community meetings and gatherings and gather traditional environmental knowledge during these events.

- Obtain Funding, staff and other resources.
- Obtain buy-in from tribal councils and communities.

Objective 5-4: Publish op-eds, Letters to the Editor, and newsletters.

- Obtain funding, staff and other resources.

Goal 6: **Set precedent in Norton Sound Region for data collection, watershed assessment and climate change adaption planning.**

Objective 6-1: Incorporate water flow, quality and temperature data and TEK into Climate Change, Watershed Assessment, Watershed management and other plans.

- Obtain funding, staff and other resources.
- Obtain buy-in from federal, state and local government.
- Partner with government entities.

Objective 6-2: Distribute water flow, quality and temperature data and TEK data and Climate Change, Watershed Assessment, Watershed management and other plans throughout Norton Sound region and throughout state.

- Obtain funding, staff and other resources.
- Obtain buy-in from federal, state and local governments.
- Partner with government entities.

Objective 6-3: Apply public outreach and education to promote data, TEK and plans listed above and implementation, thereof throughout the watershed and the region.

- Obtain funding, staff and other resources.

Objective 6-4: Apply water flow, quality and temperature data and TEK data and Climate Change, Watershed Assessment, Watershed management and other plans to address risk factors and mitigate climate change impacts.

Objective 6-5: Develop and strengthen environmental sovereignty of the Native Village tribal governments.

- Implement this climate adaptation plan for Norton Bay watershed.
- Develop additional Watershed Assessments.
- Develop and adopt watershed management plans, tribal ordinances, codes and resolutions addressing the management and protection of subsistence resources.
- Consult and partner with Alaskan Villages to analyze federal and state laws that can be applied to protect tribal water rights and subsistence uses, using the Villages to identify where strengths and weaknesses exist in water management and recommend how the state instream water reservation process can be applied to protect such interests and uses.
- Encourage federal agencies to meet with the other Native Villages so that they partner with CWA and the Elim Village in this effort. Being able to see the 'big picture' of the water that communities rely on is important for the Native Villages to making good decisions and protecting subsistence uses from the negative impacts of uranium mining activity.
- Participate in tribal, regional and state water plans and urban development plans to balance growth with renewable supplies.
- Require federal agencies in Alaska including BLM, BOR, BIA and USFWS to consult and partner with Native Villages in Alaska to monitor and apply for reservation of instream flows in Alaska to protect key subsistence watersheds.
- Bring climate change and other litigation when necessary to protect subsistence uses and health and welfare of native communities.

***Goal 7*: Improve economic conditions of Native Villages.**

Objective 7-1: "Green" the federal, state and local government budgets and accounting systems so that financial planning for development can be put on a sustainable basis. Take into account all costs, including environmental costs.

- Define property rights for natural resources.
- Catalogue resource-sharing arrangements in the North.
- Report the results of the Northern Form's capital formation study to the Arctic Council.
- Catalogue best practices in sustainable development and community initiatives that balance economic development with environmental considerations.
- Set up an Arctic Council Web site of circumpolar development initiatives.
- Facilitate circumpolar information exchanges such as the University of the Arctic.
- Ensure international debt reduction programs to reduce the pressure on governments and native communities to develop water resources related to energy or other development or issue large lease holdings that will result in over allocation of water or impacts to water quality.
- Limit arctic shipping and construction of deep water ports in the Norton Sound area when it would impact subsistence uses.

VII. CLIMATE ADAPTATION AND IMPLEMENTATION PLAN

Plan Implementation

The NBITWC will be the lead implementing agency. To this end, staff of the Watershed council in coordination with the core team and advisory council will hold meetings on plan implementation with the Villages of Elim, Golovin, and others represented on the watershed council and other watershed councils and native villages in the area to obtain feedback on implementation. The staff and core team will then work collectively with stakeholders on the actions listed above to meet the goals and objectives of the plan.

Outcomes Anticipated from Implementation of the Plan

Implementation of the Plan will lead to mitigation of the risks from climate change to water source and subsistence. The following outlines the key outcomes association with taking action on this plan:

- A published climate adaptation plan, watershed assessments, management plans, and implementation work plans that incorporate collected water quality data and TEK;
- Effective communications materials and modified policy language address multi-jurisdictional challenges;
- Documented outcomes, knowledge, experiences, impacts, and best practices via reports, webinars, web, social media and presentations circulated through indigenous networks in Mexico, U.S., and Canada, the *Climate Solutions University* network, the public, partners, and agencies;
- Workshops held by Watershed Councils to exchange project outcomes among local Native Villages;
- Thousands of acres of potentially restored and/or protected watersheds within tribal, borough, city and other jurisdictions affecting subsistence resources;
- New policies, increased federal oversight and/or steps taken for environmental justice and climate adaptation.
- Further, combining the research, planning and application of Indigenous knowledge with Tribal sovereign status, the federal trust relationship, and state and federal environmental justice policies will ensure that the Plan not only assists the tribal and other local communities within the watershed to mitigate and adapt to climate change, but those of the general public in a manner that often exceeds those of even the most potent federal and state environmental laws.

Moreover, based on the fact that no watershed scale climate change adaptation/mitigation planning is currently under way for the Watershed and no effort has been made to gather existing TEK or information about the impacts of climate change on traditional subsistence based economies, the Norton Bay adaptation plan will set a precedent for incorporating such knowledge and data into a comprehensive Plan that will apply tribal expertise, knowledge and vision for mitigation and adaption.

Finally, we will utilize the Climate Solutions University's partnerships to share the information within circles throughout Alaska and the United States. We will partner with MFPP to identify existing indigenous networks that include First Nations, Native American Tribes, and Indigenous Peoples; and Document Native Villages' adaptation outcomes, knowledge, and experiences and share with the identified networks using multimedia (reports, webinars, web, presentations).

One Year Work/Implementation Plan*:* The Project will initially benefit the Inuit people who live in the Native Villages. Further, incorporating the data and information into the adaptation plan and other watershed management planning efforts addressing the impacts of mining activity and climate change on the Villages will provide precedent throughout Alaska, illustrating the ability of tribal governments to effectively manage natural resources, encouraging the federal government to recognize it's trust responsibility to the Villages and address water temperature change and protect the environment consistent with the cultural and traditional needs of such tribes and villages. The establishment of tribal environmental sovereignty and a government-to-government relationship with these federal agencies could redefine the trust relationship between native tribes and the federal government throughout the state in a manner that will, not only, strengthen tribal governments and their ability to protect subsistence resources and the health and welfare of their memberships, but will improve the integrity of tribal governing bodies and their economic, social political and jurisdictional base.

VIII. APPENDICES

APPENDIX A: Year One Activities List

The following table briefly outlines key short-term activities to take place in the first year of adaptation plan implementation.

Dates	Activities
01/15/2014	Review QAPP & conduct monitoring training
02/15/2014	Purchase equipment
03/15/2014 - 2017	Compile and Collect existing data
04/15/2014 - 2017	Integrate existing research
05/15/2014 - 2017	Conduct vulnerability assessments
03/15/2014 -2017	Gather TEK & info. & Concerns
06/15/2014 - 2017	Install gauges and conduct temp. Modeling and data collection
09/15/2014 - 2017	Address contaminants transport
10/15/2014 - 2017	Address potential to expand
11/15/2017	Incorporate TEK, Data & info. into Watershed Assessment & CCAP
12/15/2014-2017	Apply TEK, Data & info to implementation of
12/15/2014-2017	CCAP
01/15/2017	Work with Model Forest Policy Program (MFPP) to provide technical assistance; recommend how to revise the plan; and use the monitoring process as an educational tool for other communities Conduct Outreach

APPENDIX B: Native Village Employment Data

Elim Employment

Employment
What occupations and industries are present?

This page describes what people do for work in terms of the type of work (occupation) and where they work (by industry).

Employment by Occupation, 2011*

	Elim city, AK	U.S.
Civilian employed population > 16 years	˙86	141,832,499
Management, professional, & related	˙32	50,572,279
Service	˙22	24,790,091
Sales and office	˙21	35,612,518
Farming, fishing, and forestry	¨0	1,034,057
Construction, extraction, maint., & repair	¨1	12,502,151
Production, transportation, & material moving	¨10	17,321,403
Percent of Total		
Management, professional, & related	˙37.2%	35.7%
Service	˙25.6%	17.5%
Sales and office	˙24.4%	25.1%
Farming, fishing, and forestry	¨0.0%	0.7%
Construction, extraction, maint., & repair	¨1.2%	8.8%
Production, transportation, & material moving	¨11.6%	12.2%

*The data in this table are calculated by ACS using annual surveys conducted during 2007-2011 and are representative of average characteristics during this period.

Employment by Industry, 2011*

	Elim city, AK	U.S.
Civilian employed population > 16 years	˙86	141,832,499
Agriculture, forestry, fishing & hunting, mining	¨0	2,669,572
Construction	¨0	9,642,450
Manufacturing	¨0	15,281,307
Wholesale trade	¨0	4,158,689
Retail trade	¨13	16,336,915
Transportation, warehousing, and utilities	¨13	7,171,438
Information	¨0	3,256,311
Finance and insurance, and real estate	¨1	9,738,275
Prof., scientific, mgmt., admin., & waste mgmt.	¨0	14,942,494
Education, health care, & social assistance	˙54	31,927,759
Arts, entertain., rec., accommodation, & food	¨0	12,779,583
Other services, except public administration	¨1	6,960,820
Public administration	¨4	6,966,886
Percent of Total		
Agriculture, forestry, fishing & hunting, mining	¨0.0%	1.9%
Construction	¨0.0%	6.8%
Manufacturing	¨0.0%	10.8%
Wholesale trade	¨0.0%	2.9%
Retail trade	¨15.1%	11.5%
Transportation, warehousing, and utilities	¨15.1%	5.1%
Information	¨0.0%	2.3%
Finance and insurance, and real estate	¨1.2%	6.9%
Prof., scientific, mgmt., admin., & waste mgmt.	¨0.0%	10.5%
Education, health care, & social assistance	˙62.8%	22.5%
Arts, entertain., rec., accommodation, & food	¨0.0%	9.0%
Other services, except public administration	¨1.2%	4.9%
Public administration	¨4.7%	4.9%

Data Sources: U.S. Department of Commerce. 2012. Census Bureau, American Community Survey Office, Washington, D.C.

Koyuk Employment

Employment

What occupations and industries are present?

This page describes what people do for work in terms of the type of work (occupation) and where they work (by industry).

Employment by Occupation, 2011*

	Koyuk city, AK	U.S.
Civilian employed population > 16 years	˙72	141,832,499
Management, professional, & related	˙19	50,572,279
Service	˙24	24,790,091
Sales and office	¨6	35,612,518
Farming, fishing, and forestry	¨3	1,034,057
Construction, extraction, maint., & repair	¨6	12,502,151
Production, transportation, & material moving	¨14	17,321,403
Percent of Total		
Management, professional, & related	˙26.4%	35.7%
Service	˙33.3%	17.5%
Sales and office	¨8.3%	25.1%
Farming, fishing, and forestry	¨4.2%	0.7%
Construction, extraction, maint., & repair	¨8.3%	8.8%
Production, transportation, & material moving	¨19.4%	12.2%

*The data in this table are calculated by ACS using annual surveys conducted during 2007-2011 and are representative of average characteristics during this period.

Employment by Industry, 2011*

	Koyuk city, AK	U.S.
Civilian employed population > 16 years	˙72	141,832,499
Agriculture, forestry, fishing & hunting, mining	¨0	2,669,572
Construction	¨0	9,642,450
Manufacturing	¨0	15,281,307
Wholesale trade	¨0	4,158,689
Retail trade	¨2	16,336,915
Transportation, warehousing, and utilities	˙19	7,171,438
Information	¨0	3,256,311
Finance and insurance, and real estate	¨0	9,738,275
Prof., scientific, mgmt., admin., & waste mgmt.	¨0	14,942,494
Education, health care, & social assistance	¨24	31,927,759
Arts, entertain., rec., accommodation, & food	¨1	12,779,583
Other services, except public administration	¨3	6,960,820
Public administration	˙23	6,966,886
Percent of Total		
Agriculture, forestry, fishing & hunting, mining	¨0.0%	1.9%
Construction	¨0.0%	6.8%
Manufacturing	¨0.0%	10.8%
Wholesale trade	¨0.0%	2.9%
Retail trade	¨2.8%	11.5%
Transportation, warehousing, and utilities	˙26.4%	5.1%
Information	¨0.0%	2.3%
Finance and insurance, and real estate	¨0.0%	6.9%
Prof., scientific, mgmt., admin., & waste mgmt.	¨0.0%	10.5%
Education, health care, & social assistance	¨33.3%	22.5%
Arts, entertain., rec., accommodation, & food	¨1.4%	9.0%
Other services, except public administration	¨4.2%	4.9%
Public administration	˙31.9%	4.9%

Data Sources: U.S. Department of Commerce. 2012. Census Bureau, American Community Survey Office, Washington, D.C.

Shaktoolik Employment

Employment

What occupations and industries are present?

This page describes what people do for work in terms of the type of work (occupation) and where they work (by industry).

Employment by Occupation, 2011*

	Shaktoolik city, AK	U.S.
Civilian employed population > 16 years	˙87	141,832,499
Management, professional, & related	˙39	50,572,279
Service	¨9	24,790,091
Sales and office	¨15	35,612,518
Farming, fishing, and forestry	¨0	1,034,057
Construction, extraction, maint., & repair	¨14	12,502,151
Production, transportation, & material moving	¨10	17,321,403
Percent of Total		
Management, professional, & related	˙44.8%	35.7%
Service	¨10.3%	17.5%
Sales and office	¨17.2%	25.1%
Farming, fishing, and forestry	¨0.0%	0.7%
Construction, extraction, maint., & repair	¨16.1%	8.8%
Production, transportation, & material moving	¨11.5%	12.2%

*The data in this table are calculated by ACS using annual surveys conducted during 2007-2011 and are representative of average characteristics during this period.

Employment by Industry, 2011*

	Shaktoolik city, AK	U.S.
Civilian employed population > 16 years	˙87	141,832,499
Agriculture, forestry, fishing & hunting, mining	¨0	2,669,572
Construction	¨4	9,642,450
Manufacturing	¨0	15,281,307
Wholesale trade	¨0	4,158,689
Retail trade	¨12	16,336,915
Transportation, warehousing, and utilities	¨11	7,171,438
Information	¨0	3,256,311
Finance and insurance, and real estate	¨10	9,738,275
Prof., scientific, mgmt., admin., & waste mgmt.	¨2	14,942,494
Education, health care, & social assistance	˙39	31,927,759
Arts, entertain., rec., accommodation, & food	¨4	12,779,583
Other services, except public administration	¨0	6,960,820
Public administration	¨5	6,966,886
Percent of Total		
Agriculture, forestry, fishing & hunting, mining	¨0.0%	1.9%
Construction	¨4.6%	6.8%
Manufacturing	¨0.0%	10.8%
Wholesale trade	¨0.0%	2.9%
Retail trade	¨13.8%	11.5%
Transportation, warehousing, and utilities	¨12.6%	5.1%
Information	¨0.0%	2.3%
Finance and insurance, and real estate	¨11.5%	6.9%
Prof., scientific, mgmt., admin., & waste mgmt.	¨2.3%	10.5%
Education, health care, & social assistance	˙44.8%	22.5%
Arts, entertain., rec., accommodation, & food	¨4.6%	9.0%
Other services, except public administration	¨0.0%	4.9%
Public administration	¨5.7%	4.9%

Data Sources: U.S. Department of Commerce. 2012. Census Bureau, American Community Survey Office, Washington, D.C.

Unalakleet Employment

Employment

What occupations and industries are present?

This page describes what people do for work in terms of the type of work (occupation) and where they work (by industry).

Employment by Occupation, 2011*

	Unalakleet city, AK	U.S.
Civilian employed population > 16 years	˙261	141,832,499
Management, professional, & related	˙97	50,572,279
Service	˙30	24,790,091
Sales and office	˙44	35,612,518
Farming, fishing, and forestry	¨9	1,034,057
Construction, extraction, maint., & repair	¨41	12,502,151
Production, transportation, & material moving	˙40	17,321,403
Percent of Total		
Management, professional, & related	˙37.2%	35.7%
Service	˙11.5%	17.5%
Sales and office	˙16.9%	25.1%
Farming, fishing, and forestry	¨3.4%	0.7%
Construction, extraction, maint., & repair	¨15.7%	8.8%
Production, transportation, & material moving	˙15.3%	12.2%

*The data in this table are calculated by ACS using annual surveys conducted during 2007-2011 and are representative of average characteristics during this period.

Employment by Industry, 2011*

	Unalakleet city, AK	U.S.
Civilian employed population > 16 years	˙261	141,832,499
Agriculture, forestry, fishing & hunting, mining	¨16	2,669,572
Construction	˙25	9,642,450
Manufacturing	¨17	15,281,307
Wholesale trade	¨0	4,158,689
Retail trade	¨8	16,336,915
Transportation, warehousing, and utilities	˙37	7,171,438
Information	¨0	3,256,311
Finance and insurance, and real estate	¨0	9,738,275
Prof., scientific, mgmt., admin., & waste mgmt.	¨5	14,942,494
Education, health care, & social assistance	˙101	31,927,759
Arts, entertain., rec., accommodation, & food	¨16	12,779,583
Other services, except public administration	¨4	6,960,820
Public administration	˙32	6,966,886
Percent of Total		
Agriculture, forestry, fishing & hunting, mining	¨6.1%	1.9%
Construction	˙9.6%	6.8%
Manufacturing	¨6.5%	10.8%
Wholesale trade	¨0.0%	2.9%
Retail trade	¨3.1%	11.5%
Transportation, warehousing, and utilities	˙14.2%	5.1%
Information	¨0.0%	2.3%
Finance and insurance, and real estate	¨0.0%	6.9%
Prof., scientific, mgmt., admin., & waste mgmt.	¨1.9%	10.5%
Education, health care, & social assistance	˙38.7%	22.5%
Arts, entertain., rec., accommodation, & food	¨6.1%	9.0%
Other services, except public administration	¨1.5%	4.9%
Public administration	˙12.3%	4.9%

Data Sources: U.S. Department of Commerce. 2012. Census Bureau, American Community Survey Office, Washington, D.C.

APPENDIX C: Native Village Income Data and Poverty Levels

Elim Income

Income - How is income distributed?

This page describes the distribution of household income.

Household Income Distribution, 2011*

	Elim city, AK	U.S.
Per Capita Income (2011 $s)	˙$11,080	$27,915
Median Household Income^ (2011 $s)	¨$34,583	$52,762
	˙93	114,761,359
Total Households		
Less than $10,000	¨8	8,176,081
$10,000 to $14,999	¨10	6,248,397
$15,000 to $24,999	˙23	12,217,054
$25,000 to $34,999	¨6	11,944,165
$35,000 to $49,999	¨2	15,874,513
$50,000 to $74,999	˙32	21,057,656
$75,000 to $99,999	¨8	14,181,160
$100,000 to $149,999	¨4	14,551,369
$150,000 to $199,999	¨0	5,354,595
$200,000 or more	¨0	5,156,369
Gini Coefficient^	0.37	0.47
Percent of Total		
Less than $10,000	¨8.6%	7.1%
$10,000 to $14,999	¨10.8%	5.4%
$15,000 to $24,999	˙24.7%	10.6%
$25,000 to $34,999	¨6.5%	10.4%
$35,000 to $49,999	¨2.2%	13.8%
$50,000 to $74,999	˙34.4%	18.3%
$75,000 to $99,999	¨8.6%	12.4%
$100,000 to $149,999	¨4.3%	12.7%
$150,000 to $199,999	¨0.0%	4.7%
$200,000 or more	¨0.0%	4.5%

^ Median Household Income and Gini Coefficient are not available for metro/non-metro or regional aggregations.* The data in this table are calculated by ACS using annual surveys conducted during 2007-2011 and are representative of average characteristics during this period.

- In the 2007-2011 period, the income category in the Elim city AK with the most households was $50,000 to $74,999 (34.4% of households). The income category with the fewest households was $150,000 to $199,999 (0.0% of households).

- In the 2007-2011 period, the bottom 40% of households in the Elim city AK accumulated approximately 13.0% of total income, and the top 20% of households accumulated approximately 43.6% of total income.
- In the 2007-2011 period, Elim city, AK had the most equal income distribution between high and low income households (Gini coef. of 0.37) and the U.S. had the least equal income distribution (Gini coef. of 0.47).

Data Sources: U.S. Department of Commerce. 2012. Census Bureau, American Community Survey Office, Washington, D.C.

Koyuk Income

Income -How is income distributed?

This page describes the distribution of household income.

Household Income Distribution, 2011*

	Koyuk city, AK	U.S.
Per Capita Income (2011 $s)	˙$9,169	$27,915
Median Household Income^ (2011 $s)	˙$23,929	$52,762
Total Households	˙80	114,761,359
Less than $10,000	¨8	8,176,081
$10,000 to $14,999	˙16	6,248,397
$15,000 to $24,999	˙19	12,217,054
$25,000 to $34,999	¨8	11,944,165
$35,000 to $49,999	¨7	15,874,513
$50,000 to $74,999	¨7	21,057,656
$75,000 to $99,999	¨15	14,181,160
$100,000 to $149,999	¨0	14,551,369
$150,000 to $199,999	¨0	5,354,595
$200,000 or more	¨0	5,156,369
Gini Coefficient^	0.44	0.47
Percent of Total		
Less than $10,000	¨10.0%	7.1%
$10,000 to $14,999	˙20.0%	5.4%
$15,000 to $24,999	˙23.8%	10.6%
$25,000 to $34,999	¨10.0%	10.4%
$35,000 to $49,999	¨8.8%	13.8%
$50,000 to $74,999	¨8.8%	18.3%
$75,000 to $99,999	¨18.8%	12.4%
$100,000 to $149,999	¨0.0%	12.7%
$150,000 to $199,999	¨0.0%	4.7%
$200,000 or more	¨0.0%	4.5%

^ Median Household Income and Gini Coefficient are not available for metro/non-metro or regional aggregations.*The data in this table are calculated by ACS using annual surveys conducted during 2007-2011 and are representative of average characteristics during this period.

- In the 2007-2011 period, the income category in the Koyuk city AK with the most households was $15,000 to $24,999 (23.8% of households). The income category with the fewest households was $100,000 to $149,999 (0.0% of households).
- In the 2007-2011 period, the bottom 40% of households in the Koyuk city AK accumulated approximately 10.5% of total income, and the top 20% of households accumulated approximately 50.5% of total income.
- In the 2007-2011 period, Koyuk city, AK had the most equal income distribution between high and low income households (Gini coef. of 0.44) and the U.S. had the least equal income distribution (Gini coef. of 0.47).

DataSources:U.S.DepartmentofCommerce.2012.CensusBureau,AmericanCommunitySurvey Office,Washington,D.C.
0%20%40%60%80%100%0%20%40%60%80%100%% of Income % of Households Lorenz Curve, Koyuk city AK, 2011* Line of Perfect EqualityLine of Perfect InequalityLorenz Curve for Koyuk city AK10.0% 20.0%23.8% 10.0% 8.8% 8.8% 18.8% 0.0%
0.0% 0.0% 0%5%10%15%20%25%Less than $10,000$10,000 to $14,999$15,000 to $24,999$25,000 to $34,999$35,000 to $49,999$50,000 to $74,999$75,000 to $99,999$100,000 to $149,999$150,000 to $199,999$200,000 or more Household Income Distribution, Koyuk city AK, 2011*

Shaktoolik Income

Income

How is income distributed?

This page describes the distribution of household income.

Household Income Distribution, 2011*

	Shaktoolik city, AK	U.S.
Per Capita Income (2011 $s)	˙$12,803	$27,915
Median Household Income^ (2011 $s)	˙$26,667	$52,762
Total Households	˙68	114,761,359
Less than $10,000	¨8	8,176,081
$10,000 to $14,999	¨12	6,248,397
$15,000 to $24,999	¨12	12,217,054
$25,000 to $34,999	¨14	11,944,165
$35,000 to $49,999	¨4	15,874,513
$50,000 to $74,999	¨4	21,057,656
$75,000 to $99,999	¨7	14,181,160
$100,000 to $149,999	¨4	14,551,369
$150,000 to $199,999	¨3	5,354,595
$200,000 or more	¨0	5,156,369
Gini Coefficient^	0.47	0.47
Percent of Total		
Less than $10,000	¨11.8%	7.1%
$10,000 to $14,999	¨17.6%	5.4%
$15,000 to $24,999	¨17.6%	10.6%
$25,000 to $34,999	¨20.6%	10.4%
$35,000 to $49,999	¨5.9%	13.8%
$50,000 to $74,999	¨5.9%	18.3%
$75,000 to $99,999	¨10.3%	12.4%
$100,000 to $149,999	¨5.9%	12.7%
$150,000 to $199,999	¨4.4%	4.7%
$200,000 or more	¨0.0%	4.5%

^ Median Household Income and Gini Coefficient are not available for metro/non-metro or regional aggregations.*The data in this table are calculated by ACS using annual surveys conducted during 2007-2011 and are representative of average characteristics during this period.

- In the 2007-2011 period, the income category in the Shaktoolik city AK with the most households was $25,000 to $34,999 (20.6% of households). The income category with the fewest households was $200,000 or more (0.0% of households).
- In the 2007-2011 period, the bottom 40% of households in the Shaktoolik city AK accumulated approximately 11.5% of total income, and the top 20% of households accumulated approximately 58.7% of total income.
- In the 2007-2011 period, the U.S. had the most equal income distribution between high and low income households (Gini coef.

- of 0.47) and Shaktoolik city, AK had the least equal income distribution (Gini coef. of 0.47).

DataSources:U.S.DepartmentofCommerce.2012.CensusBureau,AmericanCommunitySurveyOffice,Washington,D.C.
0%20%40%60%80%100%0%20%40%60%80%100%% of Income % of Households Lorenz Curve, Shaktoolik city AK, 2011*
Line of Perfect EqualityLine of Perfect InequalityLorenz Curve for Shaktoolik city AK11.8% 17.6% 17.6%20.6% 5.9% 5.9%
10.3% 5.9% 4.4% 0.0% 0%5%10%15%20%25%Less than $10,000$10,000 to $14,999$15,000 to $24,999$25,000 to $34,999$35,000 to $49,999$50,000 to $74,999$75,000 to $99,999$100,000 to $149,999$150,000 to $199,999$200,000 or more Household Income Distribution, Shaktoolik city AK, 2011*

Unalakleet Income

Income
How is income distributed?

This page describes the distribution of household income.

Household Income Distribution, 2011*

	Unalakleet city, AK	U.S.
Per Capita Income (2011 $s)	$19,919	$27,915
Median Household Income^ (2011 $s)	$47,500	$52,762
Total Households	˙192	114,761,359
Less than $10,000	¨5	8,176,081
$10,000 to $14,999	¨8	6,248,397
$15,000 to $24,999	¨19	12,217,054
$25,000 to $34,999	¨13	11,944,165
$35,000 to $49,999	˙57	15,874,513
$50,000 to $74,999	˙29	21,057,656
$75,000 to $99,999	˙23	14,181,160
$100,000 to $149,999	¨16	14,551,369
$150,000 to $199,999	˙19	5,354,595
$200,000 or more	¨3	5,156,369
Gini Coefficient^	0.38	0.47
Percent of Total		
Less than $10,000	¨2.6%	7.1%
$10,000 to $14,999	¨4.2%	5.4%
$15,000 to $24,999	¨9.9%	10.6%
$25,000 to $34,999	¨6.8%	10.4%
$35,000 to $49,999	˙29.7%	13.8%
$50,000 to $74,999	˙15.1%	18.3%
$75,000 to $99,999	˙12.0%	12.4%
$100,000 to $149,999	¨8.3%	12.7%
$150,000 to $199,999	˙9.9%	4.7%
$200,000 or more	¨1.6%	4.5%

^ Median Household Income and Gini Coefficient are not available for metro/non-metro or regional aggregations.*The data in this table are calculated by ACS using annual surveys conducted during 2007-2011 and are representative of average characteristics during this period.

- In the 2007-2011 period, the income category in the Unalakleet city AK with the most households was $35,000 to $49,999 (29.7% of households). The income category with the fewest households was $200,000 or more (1.6% of households).
- In the 2007-2011 period, the bottom 40% of households in the Unalakleet city AK accumulated approximately 17.7% of total income, and the top 20% of households accumulated approximately 49.6% of total income.
- In the 2007-2011 period, Unalakleet city, AK had the most equal income distribution between high and low income households (Gini coef. of 0.38) and the U.S. had the least equal income distribution (Gini coef. of 0.47).

DataSources:U.S.DepartmentofCommerce.2012.CensusBureau,AmericanCommunitySurveyOffice,Washington,D.C.
0%20%40%60%80%100%0%20%40%60%80%100%% of Income % of Households Lorenz Curve, Unalakleet city AK, 2011*
Line of Perfect EqualityLine of Perfect InequalityLorenz Curve for Unalakleet city AK2.6% 4.2% 9.9% 6.8% 29.7% 15.1%
12.0% 8.3% 9.9% 1.6% 0%5%10%15%20%25%30%35%Less than $10,000$10,000 to $14,999$15,000 to $24,999$25,000 to $34,999$35,000 to $49,999$50,000 to $74,999$75,000 to $99,999$100,000 to $149,999$150,000 to $199,999$200,000 or more Household Income Distribution, Unalakleet city AK, 2011*

Elim Poverty

Income
What are poverty levels?

This page describes the number of individuals and families living below the poverty line. Poverty: Following the Office of Management and Budget's Directive 14, the Census Bureau uses a set of income thresholds that vary by family size and composition to detect who is poor. If the total income for a family or an unrelated individual falls below the relevant poverty threshold, then the family or an unrelated individual is classified as being "below the poverty level."

Poverty, 2011*

	Elim city, AK	U.S.
People	˙363	298,787,998
Families	˙68	76,507,230
People Below Poverty	˙125	42,739,924
Families below poverty	¨$18	8,000,077
Percent of Total		
People Below Poverty	˙34.4%	14.3%
Families below poverty	¨26.5%	10.5%

* The data in this table are calculated by ACS using annual surveys conducted during 2007-2011 and are representative of average characteristics during this period.

- In the 2007-2011 period, Elim city, AK had the highest estimated percent of individuals living below poverty (34.4%), and the U.S. had the lowest (14.3%).
- In the 2007-2011 period, Elim city, AK had the highest estimated percent of families living below poverty (26.5%), and the U.S. had the lowest (10.5%).

Percent Below Poverty Level by Age & Family Type~, 2011*

	Elim city, AK	U.S.
People	˙34.4%	14.3%
Under 18 years	¨40.5%	20.0%
65 years and older	¨0.0%	9.4%
Families	¨26.5%	10.5%
Families with related children < 18 years	¨28.1%	16.4%
Married couple families	¨31.0%	5.1%
with children < 18 years	¨31.0%	7.4%
Female householder, no husband present	¨18.2%	29.4%
with children < 18 years	¨0.0%	38.2%

~Percent below poverty level by age and family type is calculated by dividing the number of people by demographic in poverty by the total population of that demographic.
Data Sources: U.S. Department of Commerce. 2012. Census Bureau, American Community Survey Office, Washington, D.C.

34.4% 14.3% 26.5% 10.5% 0%5%10%15%20%25%30%35%40%Elim city, AKU.S.
Individuals and Families Below Poverty, 2011* People Below Poverty Families below poverty

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Koyuk Poverty

Income

What are poverty levels?

This page describes the number of individuals and families living below the poverty line.

Poverty: Following the Office of Management and Budget's Directive 14, the Census Bureau uses a set of income thresholds that vary by family size and composition to detect who is poor. If the total income for a family or an unrelated individual falls below the relevant poverty threshold, then the family or an unrelated individual is classified as being "below the poverty level."

Poverty, 2011*

	Koyuk city, AK	U.S.
People	˙329	298,787,998
Families	˙61	76,507,230
People Below Poverty	˙173	42,739,924
Families below poverty	˙29	8,000,077
Percent of Total		
People Below Poverty	˙52.6%	14.3%
Families below poverty	˙47.5%	10.5%

*The data in this table are calculated by ACS using annual surveys conducted during 2007-2011 and are representative of average characteristics during this period.

- In the 2007-2011 period, Koyuk city, AK had the highest estimated percent of individuals living below poverty (52.6%), and the U.S. had the lowest (14.3%).
- In the 2007-2011 period, Koyuk city, AK had the highest estimated percent of families living below poverty (47.5%), and the U.S. had the lowest (10.5%).

Percent Below Poverty Level by Age & Family Type~, 2011*

	Koyuk city, AK	U.S.
People	˙52.6%	14.3%
Under 18 years	¨68.1%	20.0%
65 years and older	¨17.4%	9.4%
Families	˙47.5%	10.5%
Families with related children < 18 years	˙58.0%	16.4%
Married couple families	¨39.3%	5.1%
with children < 18 years	¨64.7%	7.4%
Female householder, no husband present	¨56.0%	29.4%
with children < 18 years	¨56.0%	

~Percent below poverty level by age and family type is calculated by dividing the number of people by demographic in poverty by the total population of that demographic.
Data Sources: U.S. Department of Commerce. 2012. Census Bureau, American Community Survey Office, Washington, D.C.
52.6% 14.3% 47.5% 10.5% 0%10%20%30%40%50%60%Koyuk city, AKU.S. Individuals and Families Below Poverty, 2011* People Below Poverty Families below poverty

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Shaktoolik Poverty

Income

What are poverty levels?

This page describes the number of individuals and families living below the poverty line.

Poverty: Following the Office of Management and Budget's Directive 14, the Census Bureau uses a set of income thresholds that vary by family size and composition to detect who is poor. If the total income for a family or an unrelated individual falls below the relevant poverty threshold, then the family or an unrelated individual is classified as being "below the poverty level."

Poverty, 2011*

	Shaktoolik city, AK	U.S.
People	˙245	298,787,998
Families	˙52	76,507,230
People Below Poverty	˙68	42,739,924
Families below poverty	¨$14	8,000,077
Percent of Total		
People Below Poverty	˙27.8%	14.3%
Families below poverty	¨26.9%	10.5%

*The data in this table are calculated by ACS using annual surveys conducted during 2007-2011 and are representative of average characteristics during this period.

- In the 2007-2011 period, Shaktoolik city, AK had the highest estimated percent of individuals living below poverty (27.8%), and the U.S. had the lowest (14.3%).
- In the 2007-2011 period, Shaktoolik city, AK had the highest estimated percent of families living below poverty (26.9%), and the U.S. had the lowest (10.5%).

Percent Below Poverty Level by Age & Family Type~, 2011*

	Shaktoolik city, AK	U.S.
People	˙27.8%	14.3%
Under 18 years	¨44.1%	20.0%
65 years and older	¨0.0%	9.4%
Families	¨26.9%	10.5%
Families with related children < 18 years	¨35.0%	16.4%
Married couple families	¨0.0%	5.1%
with children < 18 years	¨0.0%	7.4%
Female householder, no husband present	¨8.3%	29.4%
with children < 18 years	¨11.1%	38.2%

~Percent below poverty level by age and family type is calculated by dividing the number of people by demographic in poverty by the total population of that demographic.
Data Sources: U.S. Department of Commerce. 2012. Census Bureau, American Community Survey Office, Washington, D.C. 27.8% 14.3% 26.9% 10.5% 0%5%10%15%20%25%30%Shaktoolik city, AKU.S. Individuals and Families Below Poverty, 2011* People Below Poverty Families below poverty

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Unalakleet Poverty

Income

What are poverty levels?

This page describes the number of individuals and families living below the poverty line.

Poverty: Following the Office of Management and Budget's Directive 14, the Census Bureau uses a set of income thresholds that vary by family size and composition to detect who is poor. If the total income for a family or an unrelated individual falls below the relevant poverty threshold, then the family or an unrelated individual is classified as being "below the poverty level."

Poverty, 2011*

	Unalakleet city, AK	U.S.
People	692	298,787,998
Families	˙150	76,507,230
People Below Poverty	˙101	42,739,924
Families below poverty	¨$22	8,000,077
Percent of Total		
People Below Poverty	˙14.6%	14.3%
Families below poverty	¨14.7%	10.5%

*The data in this table are calculated by ACS using annual surveys conducted during 2007-2011 and are representative of average characteristics during this period.

- In the 2007-2011 period, Unalakleet city, AK had the highest estimated percent of individuals living below poverty (14.6%), and the U.S. had the lowest (14.3%).
- In the 2007-2011 period, Unalakleet city, AK had the highest estimated percent of families living below poverty (14.7%), and the U.S. had the lowest (10.5%).

Percent Below Poverty Level by Age & Family Type~, 2011*

	Unalakleet city, AK	U.S.
People	¨14.6%	14.3%
Under 18 years	¨10.7%	20.0%
65 years and older	¨8.4%	9.4%
Families	¨14.7%	10.5%
Families with related children < 18 years	¨16.0%	16.4%
Married couple families	¨0.0%	5.1%
with children < 18 years	¨0.0%	7.4%
Female householder, no husband present	¨37.5%	29.4%
with children < 18 years	¨37.0%	38.2%

~Percent below poverty level by age and family type is calculated by dividing the number of people by demographic in poverty by the total population of that demographic.
Data Sources: U.S. Department of Commerce. 2012. Census Bureau, American Community Survey Office, Washington, D.C.
14.6% 14.3% 14.7% 10.5% 0%2%4%6%8%10%12%14%16%Unalakleet city, AKU.S.
Individuals and Families Below Poverty, 2011* People Below Poverty Families below poverty

APPENDIX D: Planning Team and Advisors

Planning Team – Members and Planning Process

Person /Group / Org / Dept. / Business	Describe interests, expertise, potential role or impact on planning or implementation process
CORE TEAM	
Emily Murray - Elim	Golovin Native Corporation board-member; involved in forming Golovin Bay Watershed Alliance (GBWA) with Council, White Mountain and Golovin to protect and monitor the Fish River and Golovin Bay. GBWA has been in existence for about five years. Secretary for the Norton Bay Inter-Tribal Bay Watershed Alliance. We are monitoring the Tubuktulik River.
Hal Shepherd – Laoch Consulting	Water Policy Consultant/Writer; Interest – Environmental Human Rights issues; Role/Duties – Research, writing and advocacy re: climate change and human rights issues.
Jessica Ryan – Owl Creek Gardens ADVISORS Kawerak, Inc.	Based in Nome, Kawerak contracts with the state and federal government to provide services to residents of the Bering Strait Region, 75% of whom are Eskimo, Aleut or American Indian, descent. With programs ranging from education to housing, and natural resource management to economic development, Kawerak seeks to improve the Region's social, economic, educational, cultural and political conditions. Kawerak Inc. is conducting a study on "Salmon, Subsistence and Identity in a Norton Sound Community" which addresses the importance of subsistence fishing and salmon to the Elim Community. We will be applying the study to explore how salmon habitat and subsistence uses might be impacted by mining and other development in the Watershed
The International Arctic Research Center & Institute of Northern Engineering in Fairbanks (IARC)	Established in 1999 as a cooperative research institute supported by both the U.S. and Japanese governments. (IARC) will store water quality data collected from the monitoring efforts.
The Norton Sound Native Health Corporation	Headquartered in Nome, Alaska, was founded in 1970 to serve the health care needs of the Inupiat, Siberian Yup'ik, and Yup'ik people of the Bering Strait region of northwest Alaska. NEC will assist in gathering data and TEK knowledge related to fish and wildlife habitat and in drafting the Watershed Assessment in relation to such data and information.

OUTSIDE ADVISORS	
Marshal Anderson - UAF	Film maker – Climate Change, Ocean Acidification
UAF/UAA Western Alaska Landscape Conservation Cooperative Overview	Generally opposed to tribal jurisdiction, land and water rights and reservation of instream flows for subsistence purposes. Proposing road through pristine watershed potentially impacting tribal lands and subsistence uses. Officially deny anthropomorphic causes of climate change.
NOAA/NMFS	Have indicated that they do not have jurisdiction over marine waters of Norton Bay; Potential source for climate and other scientific data of the region
Mining Companies	Have conducted mining exploration activities in Norton Bay Watershed. Would be in competition for water resources in watershed. Potential exacerbation of impacts of climate change.

APPENDIX E: Community Readiness SWOT Analysis

Strengths and Weaknesses = Internal Factors
Opportunities and Threats = External Factors

Strengths (Internal):
Traditional Environmental Knowledge and attachment to resource. This Community has accepted and recognizes impacts and the need to do something. State & Federal governments have recognized impacts of coastal erosion, increased pressure from shipping traffic, and changes in fish populations.

Weaknesses (Internal):
Lack of funding and prioritization by local policy makers and government entities. Lack of funding at the level required and funding prioritization necessary to properly address impacts, eg. cost of relocating Native Village of Shaktoolik could be up to $200 million but funding has still not been acquired.

Opportunities (External):
Major niche for application of TEK and management of resource using tribal vision. Opportunities to obtain funding to fill gaps in climate change adaption planning.

Threats (External):
State politics and industrial development, Extreme weather events, coastal erosion, flooding, high water temps., lack of access to subsistence, increased shipping pressure. Disconnect between larger U.S. population and local issues related to climate change. Lack of acceptance of, for example, $1 million/person relocation cost for Shaktoolik, by outside population. Lack of understanding or concern about the extent of the problem by the non-native population due to localized impacts on native village communities not experienced by vast majority of voting public, politicians, etc.

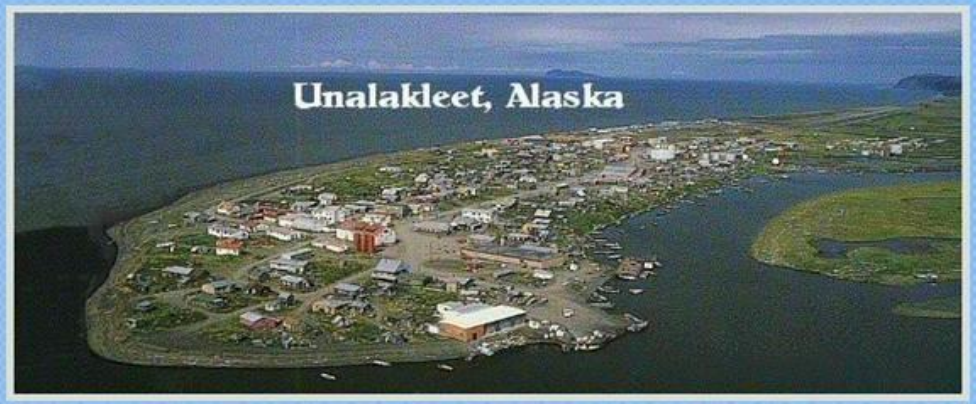
Strengths, Weaknesses, Opportunities, Treats:

Strengths: Communities accept and recognize impacts of coastal erosion and the need to do something. State & Federal governments recognize need for new emergency roads or village relocation.

Weaknesses: Lack of funding to properly address impacts. (i.e. cost of relocating Native Village of Shaktoolik could be $200 million.)

Opportunities: Obtain funding for climate change adaption planning.

Threats: State politics and industrial development, Extreme weather events, coastal erosion, flooding, high water temps., lack of access to subsistence, increased shipping pressure. Disconnect between larger U.S. population and local issues related to climate change. Lack of acceptance of price tag for village relocation by outside population.



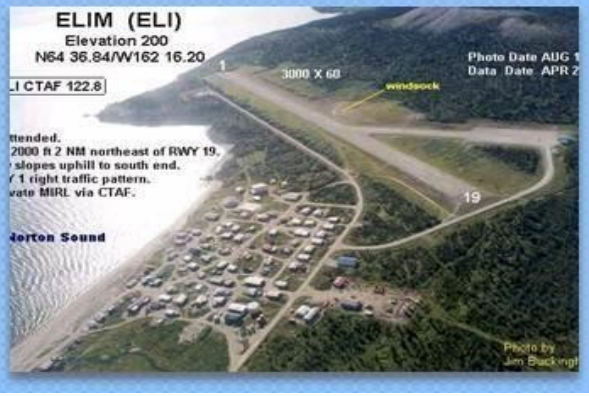


Figure 35: Community Readiness - Strengths, Weaknesses, and Opportunities

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