Chapter III: Affected Environment

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Chapter III: Affected Environment

A. Introduction

1. How to Read This Chapter

This chapter contains background information about the physical, biological, and socioeconomic resources, resource uses, and programs that exist or occur on the Bureau of Land Management (BLM) lands managed by the Anchorage Field Office (AFO) in the Bristol Bay and Goodnews Bay regions. This information is provided to establish the environmental baseline that will serve as the basis for analysis of the direct, indirect, and cumulative effects analyses presented in Chapter IV. Chapter III is organized topically; the order in which topics are addressed is not intended to imply relative importance of the topic.

Section B discusses the affected environment for resources, Section C covers the affected environment for resource uses, Section D is dedicated to special designations, Section E provides background on the social and economic environment, and Section F presents the subsistence environment.

2. Geographic Scope

The Bay planning area consists of 23 million acres, approximately 2,551,608 acres of which are administered by BLM. These lands include large blocks and a few scattered tracts of BLM unencumbered land, State-selected and Native-selected lands. BLM administers 1,197,688 acres of unencumbered land, 40,571 acres of subsurface estate (where the surface is in other ownership), and 1,313,349 acres of Native-selected and State-selected lands. Table 1.1 provides information on acreage for BLM managed lands in the planning area. The selected lands are often referred to as interim conveyed lands and will remain under the management of BLM until all land conveyances are complete by the 2009 schedule. BLM Alaska is also responsible for managing both surface and subsurface resources and uses for BLM-administered public lands. For the purposes of the following discussion, the Bay planning area is addressed in terms of two sub-regions, the Bristol Bay area and the Goodnews Bay area.

The Bay planning area is approximately an hour away by air from Anchorage. The planning area lands extend over 250 miles east-west and 150 miles north-south with virtually no road system access to Bureau administered lands. Nearly all access is accomplished using specialized aircraft supported by small tundra-tire equipped planes, float planes, ski planes, helicopters, and boats. Commercial air travel from Anchorage is required to reach hub communities served by the BLM's Anchorage Field Office (AFO).

Management of BLM-administered lands within the Bay planning area is confounded by questions of land ownership due to the ongoing land selection and conveyance process to Alaskan Native groups and the State of Alaska, as directed by Congress under the Alaska Native Claims Settlement Act (1971) and the Alaska Statehood Act. Resolution of the land ownership is moving ahead rapidly, and is expected by 2010 or earlier under a fast track land conveyance review process. However, until clear ownership of each parcel of land has been determined, BLM will continue to actively manage these selected lands under current management practices. Figures 3.1, 3.2, and 3.3 show BLM unencumbered lands in the planning area that will be the major focus of discussion in this chapter.

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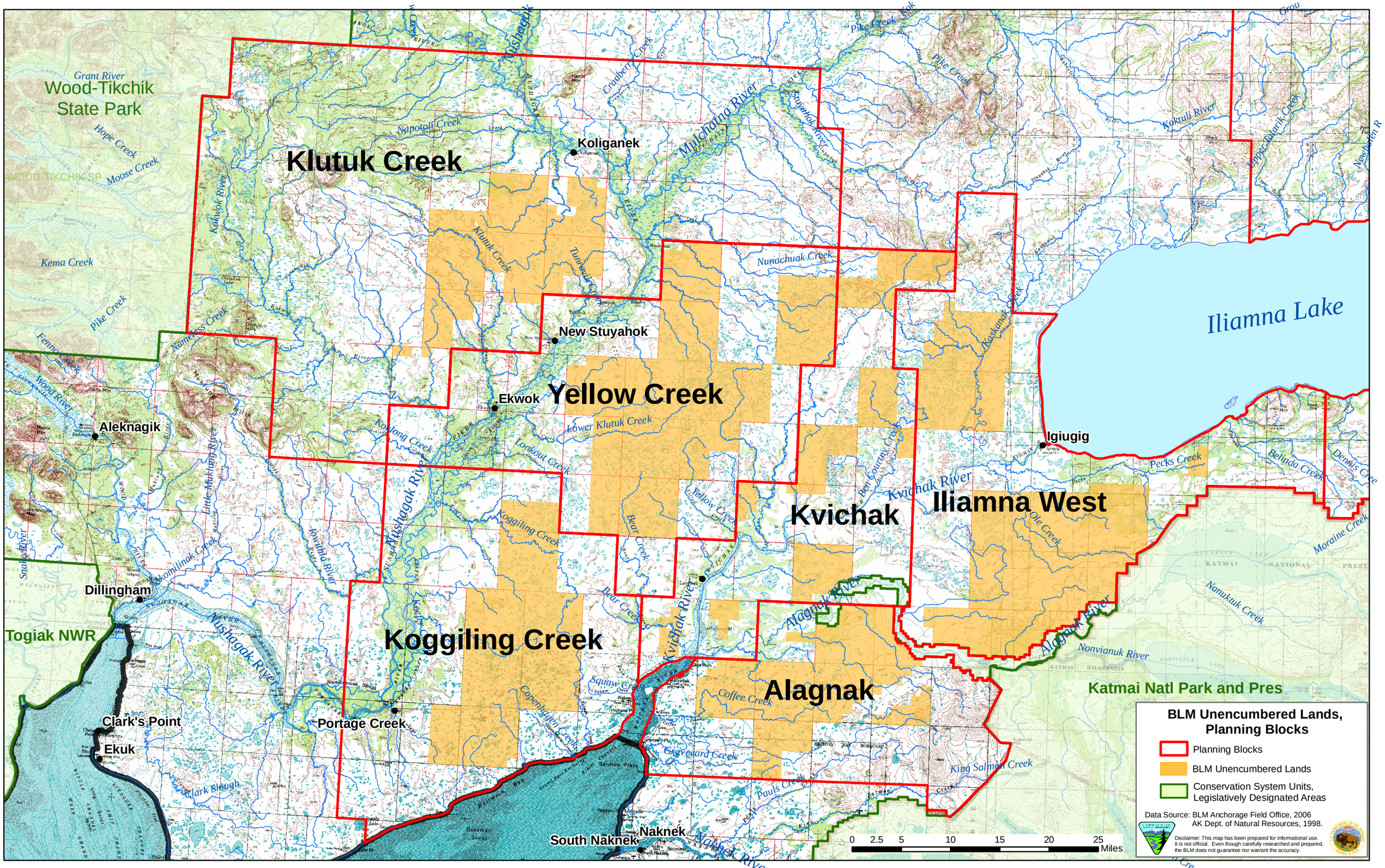

Fig. 3.1 - BLM Unencumbered Lands for Klutuk Creek, Yellow Creek, Koggiling Creek, Kvichak, Alagnak, and Iliamna West planning blocks.

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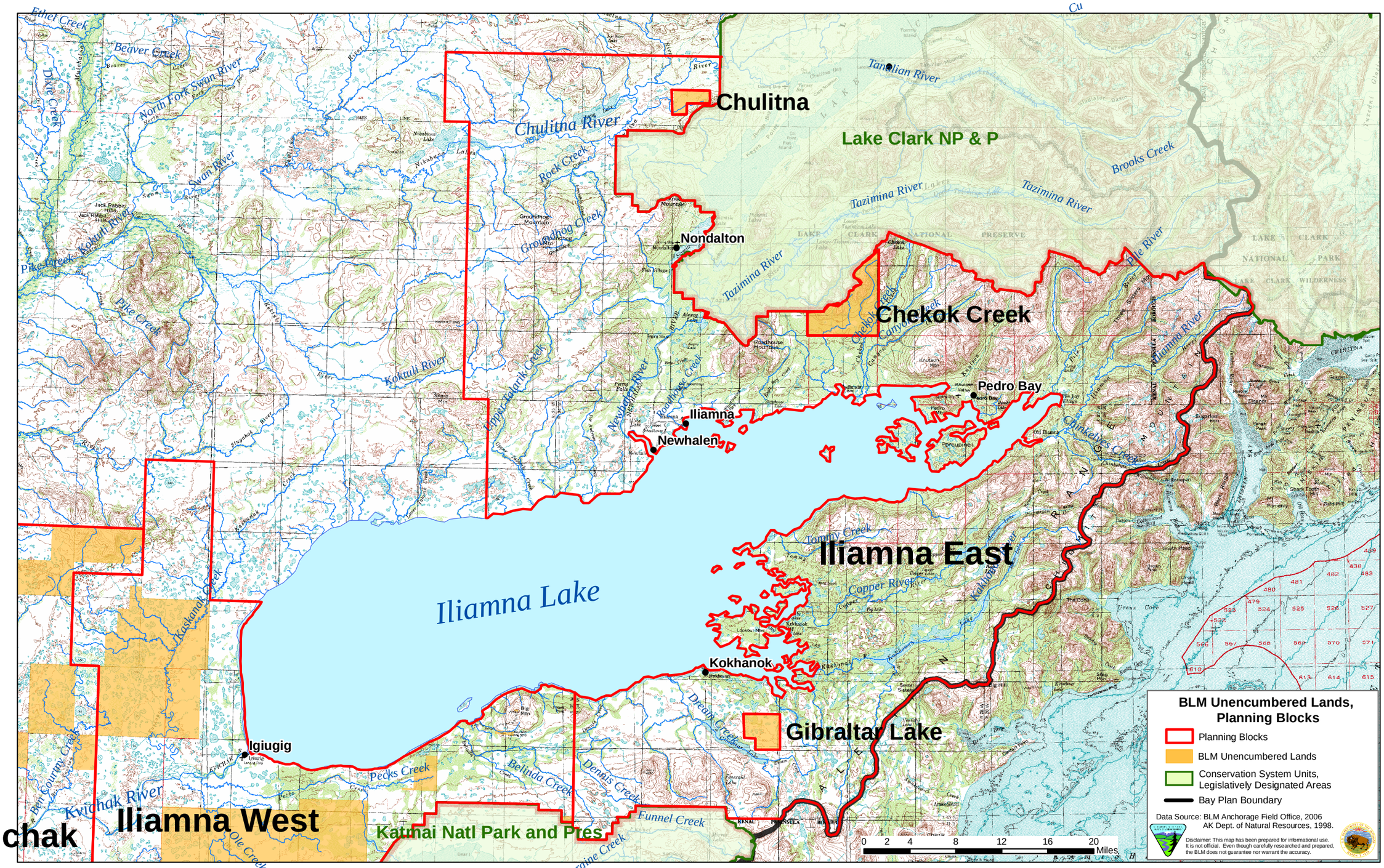

Fig. 3.2 - BLM Unencumbered Lands for Iliamna East and Iliamna West planning blocks.

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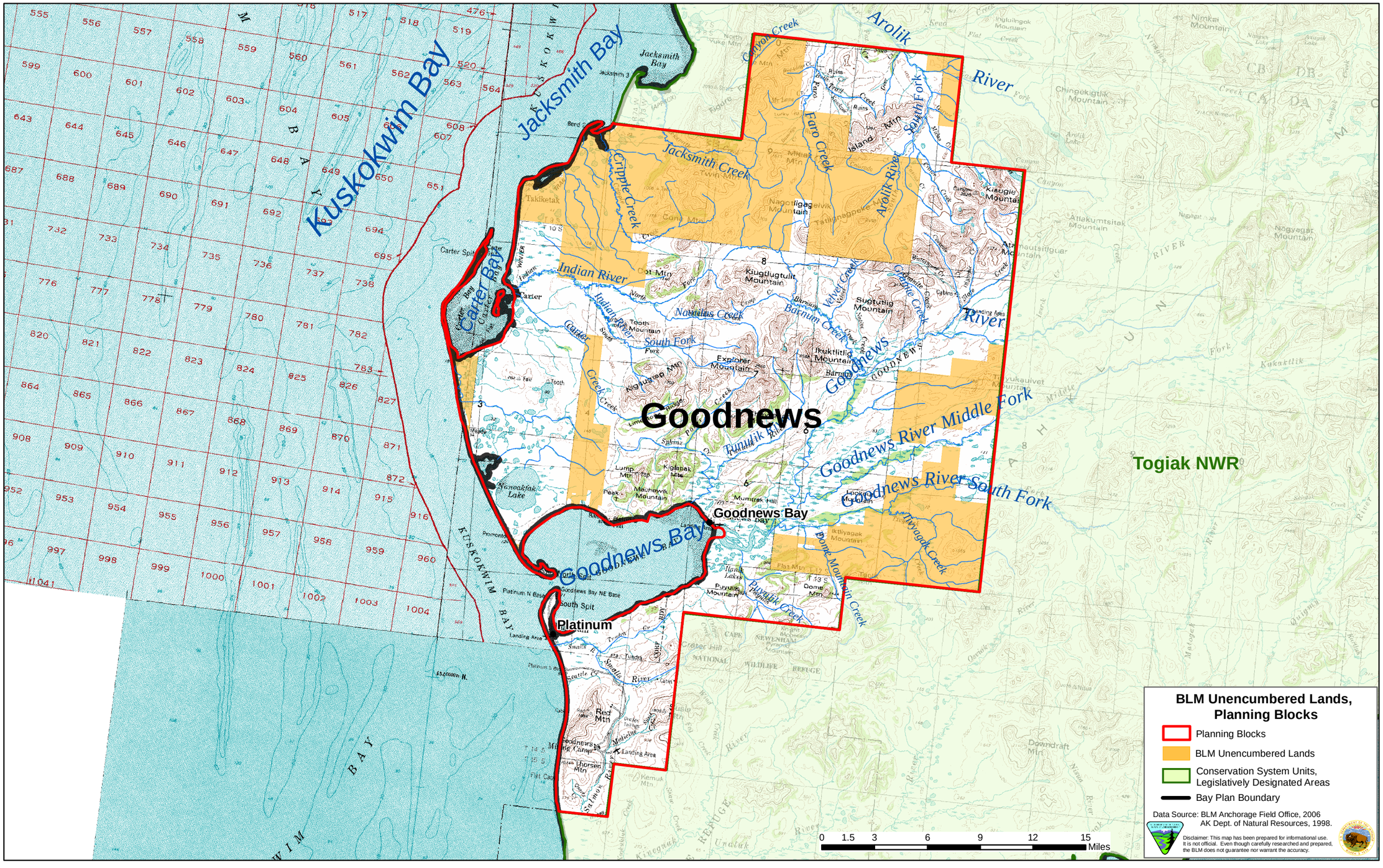

Fig. 3.3 - BLM Unencumbered Lands for Goodnews planning block.

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3. *The Planning Process and Existing Management*

a) The Planning Process and Public Participation

The Resource Management Plan (RMP) is the primary tool used by BLM to manage lands within BLM jurisdiction. Land use plans and planning decisions are the basis for every on-the-ground action the BLM undertakes. They ensure that the public lands are managed and used in accordance with the intent of Congress as stated in the Federal Land Policy and Management Act (FLPMA) (43 USC 1701 et seq.), and under the principles of multiple use and sustained yield. They also provide a process and a framework to ensure that land use plans and implementation decisions remain consistent with applicable laws, regulations, orders and policies. The RMP planning process is also integrated within the requirements of the National Environmental Policy Act (NEPA). The Environmental Impact Statement (EIS) process requires an agency to identify potential impacts that implementation of the RMP may have on the environment.

The planning process involves public participation. Public involvement entails "The opportunity for participation by affected citizens in rule making, decision making, and planning with respect to the public lands, including public meetings or hearings...or advisory mechanisms, or other such procedures as may be necessary to provide public comment in a particular instance" (FLPMA, Section 103(d)). Scoping is a collaborative public involvement process to identify planning issues to be addressed in the planning process. Planning issues are disputes or controversies about existing and potential land and resource allocations, levels of resource use, production, and related management practices. Issues include resource use, development, and protection opportunities for consideration in the preparation of the RMP. Scoping also involves the introduction of preliminary planning criteria to the public for comment.

The BLM has documented the results of scoping in a formal scoping report that was made available to the public in fall 2005. The issues and actions defined during the scoping process have been analyzed and have guided the organization of Chapter 3 with the following goals in mind:

- Identify the relevant physical, biological, social and economic resources.
- Review the literature, personal communications with resource specialists, and documentation of available information on identified resources.
- Conduct a past/present effects analysis.
- Define an environmental baseline for identified resources.

b) Existing Management

Following is a list of management decisions and their source. For the Bay planning area, the only existing plan is the Southwest Planning Area Management Framework Plan (1981) that covers the Goodnews Block only. There are no amendments to this plan. No plan has been written for the remainder of the Bay planning area. Note that in the Southwest Management Framework Plan some resources have not had any management decisions established for the Goodnews block.

Table 3.1 lists the only plan that influences current management of the Bay planning area.

Table 3.1. List of Relevant Federal Plans and Amendments for the Bay Planning Area

Document Title	Year	Other Relevant Information
Southwest Planning Area Management Framework Plan	1981	The Goodnews Block is the only relevant section to the Bay Plan.

B. Resources

1. Geography and Climate

a) Physiographic Regions

The boundaries of the Bay planning area include a varied landscape that includes portions of the Aleutian Range of mountains and two other mountain ranges, five major lake and river systems, and both coastal and interior environments. Within the area are a variety of ecosystems, largely only perturbed by natural disturbances. The planning area is part of two physiographic or geographic regions, the Pacific mountain system and the central upland and lowland region (Wahrhaftig 1965). Within this same area, a number of ecoregions have been identified. Ecoregions are based on perceived patterns of a combination of factors including land use, land surface form, potential natural vegetation, and soils (Gallant 1996). They are:

- Interior Forested Lowlands and Uplands
- Ahklun and Kilbuck Mountains
- Subarctic Coastal Plain
- Bristol Bay-Nushagak Lowlands
- Alaska Peninsula Mountains
- Alaska Range

b) Environmental Change

Climate trends over the last three decades have shown considerable warming (USDA 2004; UAF 1999; AMAP 1997). This has already led to major changes in the environment and in Alaska's ecosystems. Alaska has experienced the largest regional warming of any state in the U.S., with a rise in average temperature of about five degrees Fahrenheit since the 1960s and eight degrees Fahrenheit in winter (UAF 1999). This has led to extensive melting of glaciers, thawing of permafrost and reduction of sea ice (UAF 1999).

Alaska's warming is part of a larger warming trend throughout the Arctic. The warming has been accompanied by increases in precipitation of roughly 30 percent between 1968 and 1990 in some areas. Other areas have experienced drying (UAF 1999; McClenahan 2006, Pers. Comm.). Projections suggest that the strong warming trend will continue, particularly warming during the winter months (UAF 1999). Some anticipated changes in weather patterns include intensification in the Aleutian low-pressure system, which may shift slightly southward. Alaska would then continue to grow wetter, with annual precipitation increases of 20-25% in the north and northwest, but little change from present conditions in the southeast. Winters are anticipated to be wetter in the east and drier in the west, with summers being drier in southeast Alaska and wetter elsewhere. Winter soil moisture changes with precipitation, but summer increased evaporation from a warmed climate exceeds any projected increases in precipitation, and soils are dry everywhere (UAF 1999).

Tree growth in the boreal forest depends on temperature and precipitation. Boreal forests may be at risk from climate change associated with regional warming. Potential impacts may include decreases in effective moisture sufficient for forest growth, tree mortality from insect and disease outbreaks, probability of an increase in wildland fires, changes caused by permafrost thawing and invasion of trees, shrubs and other plant species that are adapted to the new conditions (USDA 2004; UAF 1999).

Regional environmental changes are observed to be impacting the entire Bay planning area, including coastal areas. The reduced sea ice along Alaska's coasts and rising sea level are rapidly eroding the coastal soil. Some of these locations contain archaeological and paleoontological sites. (UAF 1999; McClenahan 2006, Pers. Comm.). Coastal wetlands are being affected by rising sea level and increased storm surges as salt water and beach gravel are being moved inland (UAF 1999; McClenahan 2006,

Pers. Comm.), filling coastal ponds (J. Denton 2005, Pers. Comm.). These are natural processes, but should be monitored on BLM-administered lands for effects on a wide variety of resources.

The following impacts have been observed in Alaska in recent years:

- The warmer, drier climate has caused forest problems such as increased tree mortality, fire frequency and insect outbreaks (USDA 2004; Juday 1996; Fleming and Volney 1995).
- Spruce bark beetle outbreaks in Alaska have recently become one of the most widespread infestations observed to date, surpassed recently in Alaska by the aspen leaf miner and the birch leaf miner (USDA 2004). Such infestations of bark beetle have been observed in the forests near Iliamna and those around Dillingham and Aleknagik in the Bay planning area (McClenahan 2006, Pers. Comm.).
- A warmer climate has lengthened the growing season and growing degree days by 20% (UAF 1999).
- Boreal forests are expanding north at the rate of 60 miles for each 2 degrees Fahrenheit increase (UAF 1999).
- Shrubs and trees are expanding into arctic tundra (Starfield and Chapin 1996; UAF 1999).
- Vegetation communities are being converted to communities with taller, denser vegetation (Starfield and Chapin 1996; Rupp et al. 2000a; Rupp et al. 2000b).
- Concerns about invasion of non-native plants are increasing statewide.

The following effects are anticipated should the current trend continue:

- There is an ever increasing risk of wildland fires in areas that to date have seen few fires (USDA 2004; UAF 1999).
- One projection (Rupp et al. 1999), for example, shows a 200% increase in the total area burned per decade, leading to a deciduous forest-dominated landscape on the Seward Peninsula, presently dominated by tundra vegetation.
- Burning of the vegetative cover may increase the risk of soil erosion (McClenahan 2006, Pers. Comm.).
- Changes in temperature and precipitation will affect coastal forest hydrology and salmon spawning streams important to subsistence, commercial and sport fisheries (UAF 1999).
- Hydrologic changes in forested watersheds include warmer stream temperatures and lower summer flow from low elevation streams, higher flow from higher elevation streams (already being reported from the New Koliganek region)(BLM 2005; UAF 1999).
- There are likely to be changes in the range of vertebrate animals and changes in productivity of aquatic ecosystems (UAF 1999). As the boreal forest intrudes further north at the expense of tundra and shrub communities, there will be changes in habitats and the distribution and density of a number of wildlife species on land (UAF 1999).
- Long-term effects might include general treeline advance in elevation as well as latitude; colonization of formerly glaciated lands; and transition of tree species and ecotypes (UAF 1999).
- Regional environmental warming is affecting areas traditionally underlain by permafrost, melting frost wedges, changing drainage patterns, and drying up small lakes and wetland complexes within the Bay planning area. (UAF 1999; McClenahan 2006, Pers. Comm.; J. Denton 2005, Pers. Comm.)
- The nature and composition of soils in this region probably will be affected over time by these changes should the warming trend continue (Birkeland 1999).
- With so much melting of glaciers and permafrost, mechanisms such as slump, soil creep, and mass wasting (i.e. avalanches) can become more active (UAF 1999; McClenahan 2004).

2. Air Quality

Air is a ubiquitous resource vital to most life on earth. Air resources consist of the gaseous atmosphere. The air resources within the Bay planning area are constantly changing as winds and climatic systems move air masses across the globe.

The Air Resources Program oversees this resource according to Federal and State laws. A primary function of the Air Resources Program is to evaluate proposed actions on jurisdictional Federal lands according to the National Environmental Policy Act. There are no specific BLM-AK goals and objectives, other than compliance with Federal and State laws.

The management/enforcement of the air quality standards falls in the jurisdiction of the U.S. Environmental Protection Agency (EPA), which has the primary responsibilities under the Federal Clean Air Act (CAA). The EPA has transferred a number of responsibilities to the states and in most cases, to regional air quality management districts. The Alaska Department of Environmental Conservation, Division of Air Quality, has responsibility for air quality in Alaska. These responsibilities include monitoring, permitting, enforcement, and issuing air advisories for hazardous health conditions when necessary.

To identify an area by its air quality, all geographic areas in the state are designated by the Federal administrator as "attainment," "nonattainment," or "unclassifiable." An area is designated "attainment" for a particular contaminant if its air quality meets the ambient air quality standard for that contaminant. If there is insufficient information to classify an area as attainment or nonattainment for a particular contaminant, the area is designated "unclassifiable" for that contaminant. The Bay planning area has been designated unclassifiable/attainment. For air quality monitoring purposes, Alaska has been divided into four "air quality regions." The Bay planning area falls within the South Central Alaska Intrastate Air Quality Control Region.

The air resources within the planning area are generally considered pristine or of very good quality, except during summer when wildfires may increase the airborne particulates. This resource may be affected by other natural and human-related activities locally, regionally, or globally. Natural conditions can temporarily degrade air quality. Ash and gases from volcanic eruptions and wind blown glacial till or sand can also degrade air quality. Most of this region is very sparsely populated. Impacts to human inhabitants are generally localized and temporary.

Increasing population and development can stress air resources due to increased emissions from aircraft and vehicle internal combustion engines, burning of wood and fossil fuels, and industrial facilities that emit a broad spectrum of chemical by-products into the air. Portions of this region may continue to experience population growth and a corresponding increase in commercial, residential, and industrial development, which will exert increased demands on the regional air resources.

Primary stressors or sources of air pollution that may degrade local air resources more often will not come from BLM lands, but from surrounding lands within the Bay planning area, based on current and projected land use patterns. Except for issues of smoke from wildland fires or controlled burns, wind-blown dust from infrastructure development (for example, dust from newly developed roads with heavy traffic running at high speeds) and airborne contaminant dispersion and deposition (for example, from new or existing mining operations) there are no other known current public issues regarding air quality within the Bay planning area. The State of Alaska Department of Environmental Conservation monitors these activities for air quality violations.

a) Smoke Management

The Alaska Department of Environmental Conservation (ADEC) is responsible for declaring air episodes and for issuing air quality advisories, as appropriate, during periods of poor air quality or inadequate

dispersion conditions. ADEC is a member of the Alaska Wildland Fire Coordinating Group. During periods of wildland fire activity, the Multi-Agency Coordinating Group, a sub-group of the Alaska Wildland Fire Coordinating Group, addresses air quality and smoke management issues. As ADEC develops its State Implementation Plan for regional haze, changes may be necessary to address additional fire tracking and emission management needs based upon policies and guidelines developed by the Western Regional Air Partnership. Under State law, all agencies, corporations, and individuals that burn 40 or more acres of land require written approval from ADEC prior to burning. The Enhanced Smoke Management Plan being developed by ADEC will outline the process and items that must be addressed by land management agencies to help ensure that prescribed fire activities minimize smoke and air quality problems. The Enhanced Smoke Management Plan will also address elements required by the EPA's Interim Air Quality Policy on Wildland and Prescribed Fire (EPA 1998).

b) Critical Thresholds

During the NEPA process, air resources are evaluated for impacts. According to the Clean Air Act, each Federal agency must demonstrate that decisions or actions comply with applicable air quality requirements. Non-compliance with the Clean Air Act is a critical threshold that could stop a proposed action. State air quality regulations may also be considered a threshold. If a proposed action is expected to degrade air quality, additional information or further study may be required to quantify the amount of degradation (amount of pollutants released), to analyze the impact the action would have on the air resource (including impacts on human and ecological populations), and to evaluate the action's compliance with Federal and State regulations.

3. Soil resources

The Soil Resources Program is responsible for the protection, restoration, and enhancement of soils on BLM-administered lands. Inventory and monitoring are the typical means used to assess the condition of the resource.

a) Soils Inventory

Except for three soils studies and a number of archaeologically-related soils investigations, no detailed soil resource inventories are known to have been done in the Bay planning area, and none have taken place on BLM-administered lands. However, soils in the Bay planning area have been surveyed on a very broad scale (USDA SCS 1979) (Figures 3.4 and 3.5). This survey is best used for general land use planning and as a guide to areas for a specific purpose. Map units are very large and lacking in detail. Alaska has been divided into fifteen major land resource areas. The Bay area is comprised of portions of the Alaska Peninsula, the Kuskokwim Highlands, and the Western Alaska Coastal Plains and Deltas.

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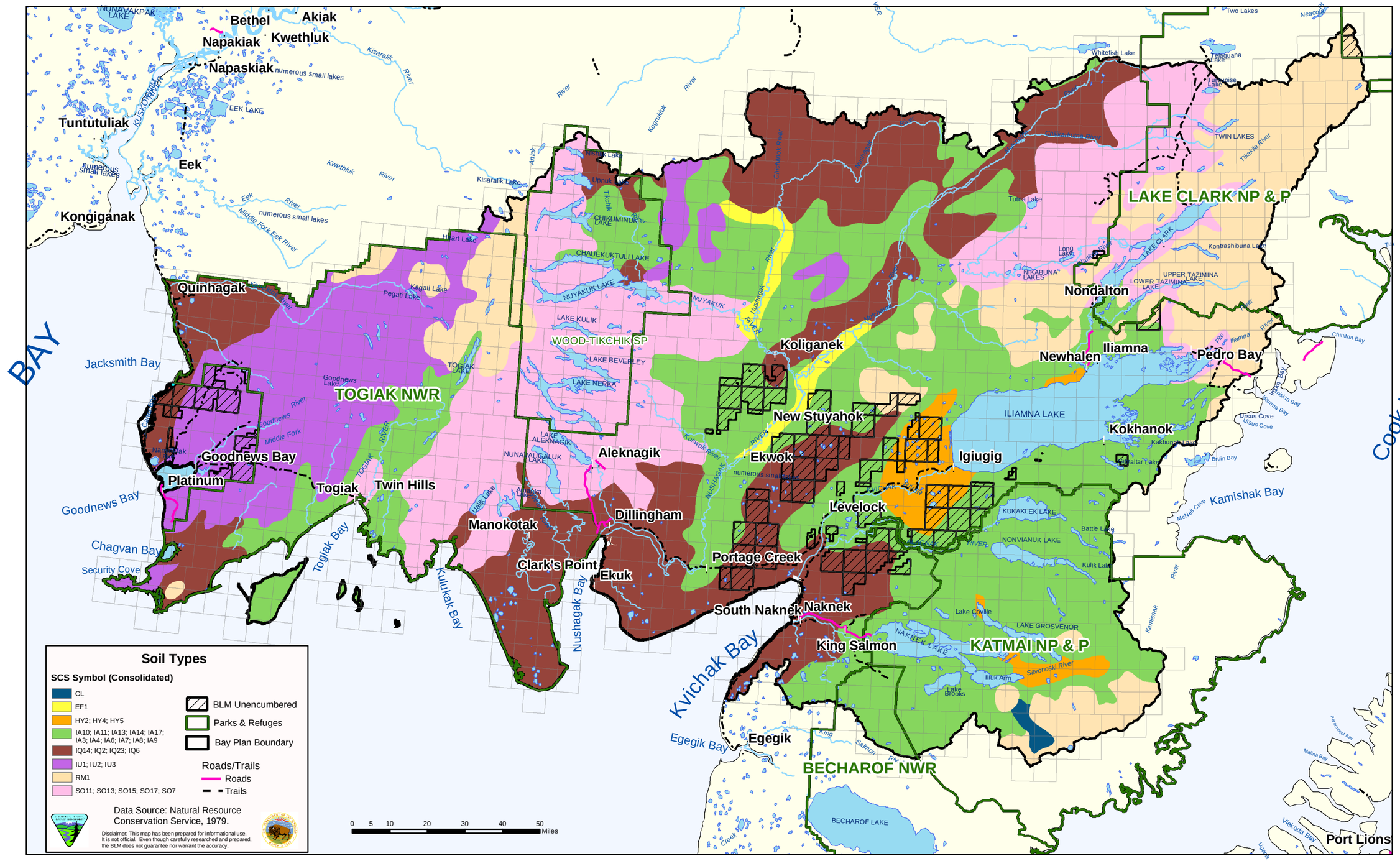

Fig. 3.4 - Soil Types Consolidated, Bay Plan.

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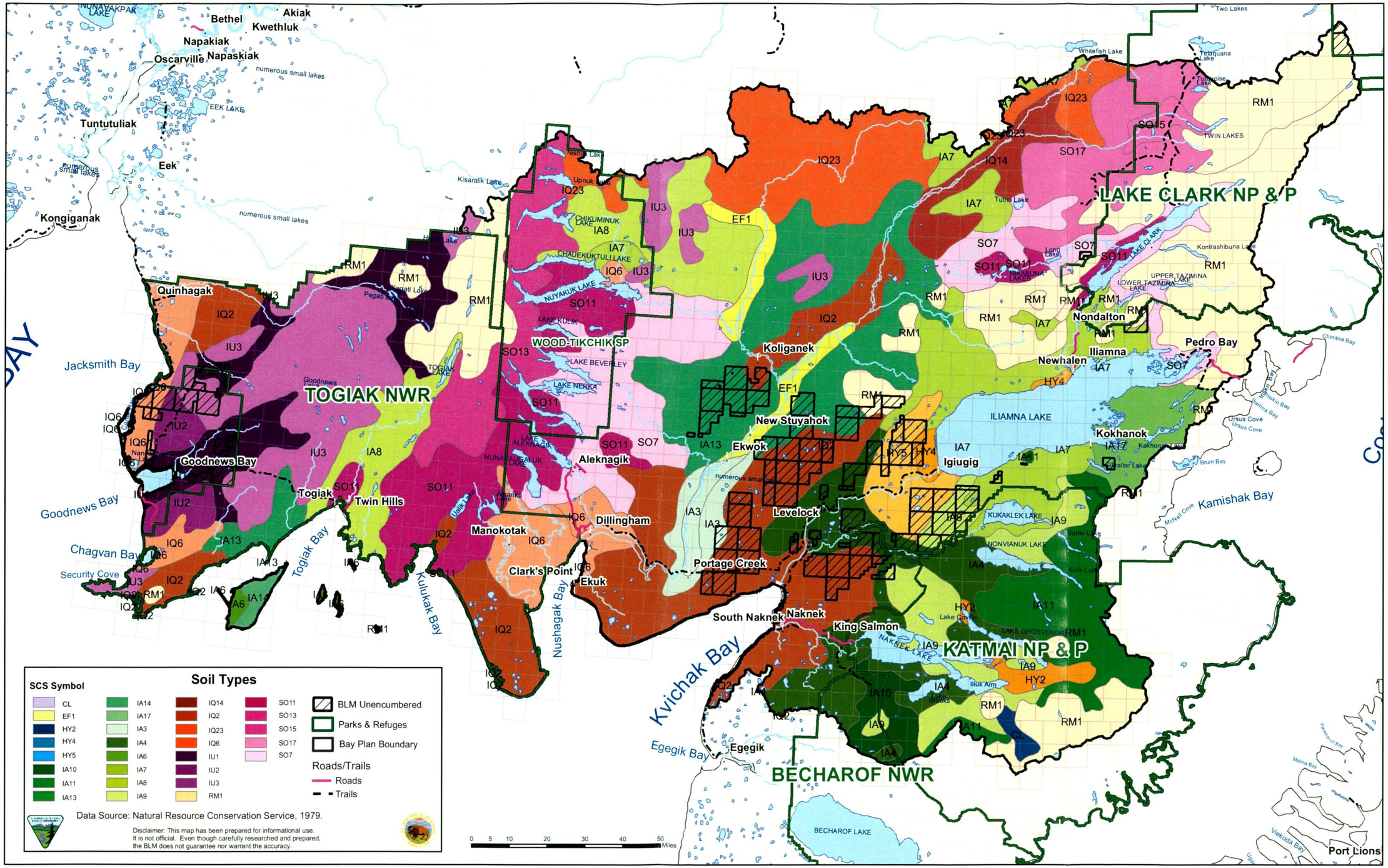

Fig. 3.5 - Soil Types, Bay Plan.

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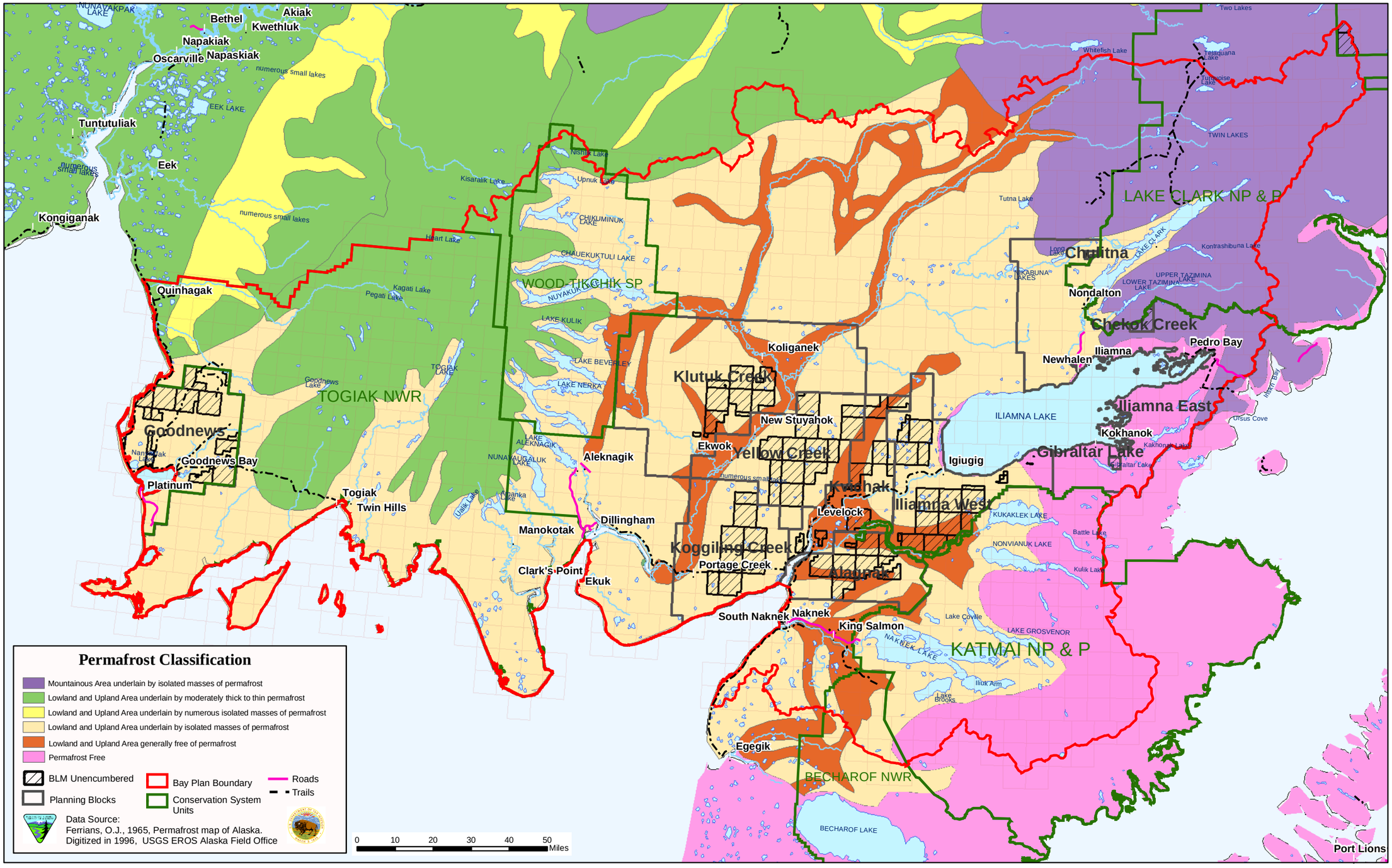

Fig. 3.6 - Permafrost Classified, Bay Plan

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Intensive soil surveys have been done on limited areas, most notably in the Nondalton area (Hinton and Neubauer 1966), the King Salmon-Naknek area (Furbush and Wiedenfeld 1970), and the Dillingham area (Rieger 1965). A brief summary of the major soil associations (USDA SCS 1979) in the Bay planning area (based on soils maps, Figures 3.5 and 3.6) are as follows:

(1) Inceptisols (Figure 3.4)

Sixty-four percent of the Bay planning area soils is Inceptisols. An Inceptisol is a type of soil in which there has been only relatively minor modification of the parent material by soil-forming processes. There has been enough modification to be able to tell an Inceptisol from an Entisol, but not intense enough to form the kinds of soil horizons (soil layers) that are required for classification in other soil orders. Generally, poorly drained soils with permafrost are considered to be Inceptisols even though they have no diagnostic horizon other than an epipedon. Most soils in Alaska are Inceptisols (USDA SCS 1979:35).

(2) Spodosols (Figure 3.4)

Nineteen percent of Bay planning area soils is Spodosols. In Spodosols organic carbon, aluminum, and in most places, iron, have been leached by percolating water from the upper part of the soil and deposited or precipitated at greater depth to form a spodic horizon. Most Spodosols in Alaska have a surface mat of organic litter, which is at least partially decomposed and a gray mineral horizon (an albic horizon) above the spodic horizon. Spodosols are dominant on uplands in areas with high precipitation, where moisture in excess of that required by the natural vegetation moves completely through the soil. Except in very coarse material and in special situations in tundra areas, Spodosols in Alaska normally occur only where mean annual precipitation exceeds 15 inches. Spodosols are most common in forested areas, but a few occur in western Alaska tundra areas (USDA SCS 1979:46).

(3) Histosols (Figure 3.4)

Only 2% of lands within the Bay planning area contain soils known as Histosols, which are made up completely or in large part of organic material. The organic material accumulates under wet conditions, in depressions or other low areas that are nearly always inundated, on slopes affected by seepage, or as a blanket on rolling hills in areas of very high rainfall. Examples of this type of soils can be found at Brooks Lake in Katmai National Park (USDA SCS 1979:30).

(4) Entisols (Figure 3.4)

Only one percent of soils within the Bay planning area are classified as Entisols. In Entisols there is little or no evidence of change as a result of soil-forming processes. Most of them have few diagnostic horizons. Wet mineral soils are classified as Entisols. In Alaska, Entisols occur most commonly on flood plains and outwash plains which receive new deposits of sediment at frequent intervals, on uplands adjacent to major rivers where new material blown from the river beds is deposited, in other young material, such as recently exposed glacial moraines, and in very cold or very steep areas where vegetation is sparse, where soils are unstable, or where parent material is exceptionally resistant to chemical weathering (USDA SCS 1979:15).

(5) Rough Mountainous Land (Figure 3.4)

Fourteen percent of the Bay planning area consists of Rough Mountainous Land (RM1) and Cinder Land (CL). Rough mountainous land is made up of steep rocky slopes, ice fields, and glaciers. Some slopes in the mountains support sparse shrubby vegetation, but most are barren. Thins soils occur in the vegetated areas on lower slopes and in valleys, but almost all are stony and shallow over bedrock or bouldery deposits (USDA SCS 1979:150-151).

Cinder lands can be found on the Alaska Peninsula and on the western Alaska coastal plains and deltas. Areas of fresh volcanic ash and cinder flows occur on slopes of active volcanoes on the Alaska Peninsula. These areas have little or no vegetation except for willows and grasses in deeply incised drainageways, such as the Valley of Ten Thousand Smokes in Katmai National Park. The loose ash is highly subject to disturbance by wind. Because of the instability of the volcanic material and the possibility of future depositions, they are poor sites for roads or buildings. The paucity of vegetation restricts their value for most wildlife (USDA SCS 1979:56). These areas are unsuitable for agriculture, forestry or building construction. A more detailed breakdown of specific soil types is provided in Figure 3.5.

Table 3.2. Soils Found in Bay Planning Area BLM Unencumbered Lands: Suitability and Limitations for Selected Uses

Planning Block, BLM Unencumbered Land	Soil Associations Present	NRCS Suitability and Limitations for Selected Uses (SCS (NRCS) 1979)
Klutuk Creek Block	IA13, IQ2	Unsuitable for livestock grazing; moderate to very severe drawbacks for locating roads, constructing low buildings, slight to very severe drawbacks for recreation and off-road trafficability. Unsuited for commercial forestry. Some areas (IA13) suitable for crops, all areas suitable for caribou.
Iliamna (West) Block	IA7, IA4, IA9, HY5, HY4	Unsuitable for crops, slight to very severe drawbacks for locating roads, constructing low buildings, recreation, and off-road trafficability. Unsuited for commercial forestry. Fair to unsuitable for domestic livestock grazing; suitable for caribou; primarily valuable for natural water storage and wildlife habitat.
Iliamna (East) Block Chekok Creek Chulitna River	RM1, IA7, SO7 SO7, RM1	Unsuitable for crops, slight to very severe drawbacks for locating roads, constructing low buildings, recreation, and off-road trafficability. Poor to unsuited for commercial forestry. Fair to unsuitable for domestic livestock grazing; suitable for caribou.
Alagnak Block	IQ2, IA4, IA9	Unsuitable for crops, domestic cattle and sheep grazing; severe to very severe drawbacks for locating roads, constructing low buildings, recreation, and off-road trafficability. Unsuited for commercial forestry. Suited for caribou and other wildlife habitat.
Kvichak Block	RM1, IQ2, IA4, HY5, IA7	Unsuitable for crops, slight to very severe drawbacks for locating roads, constructing low buildings, recreation, and off-road trafficability. Poor to unsuited for commercial forestry. Fair to unsuitable for domestic livestock grazing; suitable for caribou.
Koggiling Creek Block	IQ2, IA3	Unsuitable for crops, slight to very severe drawbacks for locating roads, constructing low buildings, recreation and off-road trafficability. Unsuited for commercial forestry. Fair to unsuitable for domestic livestock grazing; good for caribou.
Yellow Creek Block	EF1, IA13, IQ2, IA3	Exceptionally high quality of habitat for a large variety of wildlife. Unsuitable for livestock grazing; moderate to very severe drawbacks for locating roads, constructing low buildings, slight to very severe drawbacks for recreation and off-road trafficability. Unsuited for commercial forestry. Some areas suitable for crops.
Goodnews Block	IU1, IU2, IU3, IQ6	Fair to unsuited for crops, poor to unsuited for grazing domestic cattle and sheep; moderate to very severe drawbacks for locating roads, constructing low buildings, recreation, and off-road trafficability. Generally unsuited for commercial forestry. Generally good for caribou.

b) Soils Overview

The soil resources within the planning area are generally considered pristine or unaltered by human activity, except in areas adjacent to villages and urban areas. This resource may be affected by natural forces such as wind and water erosion and from human activities such as road building and mining. A primary function of the Soil Resources Program is to evaluate proposed actions on jurisdictional Federal lands according to the National Environmental Policy Act. For all authorized activities in the area, required operating procedures and stipulations mitigate to the extent possible potential sources of soil degradation.

c) Permafrost

A dominant factor in defining soils is the presence or absence of permafrost. Permafrost is defined as soil, sand, grave, or bedrock that has remained below 32 degrees Fahrenheit for two or more years (Muller 1945). Intermittent throughout the planning area, permafrost can exist as massive ice wedges and lenses in poorly drained soils or as a relatively dry matrix in well-drained gravel or bedrock. During the short arctic summer, these soils thaw, forming a shallow unfrozen zone termed the active layer. Permafrost forms a confining barrier that prevents infiltration of surface water and keeps the active layer of soils saturated. Permafrost also provides the structural integrity to hillsides and stream channel banks. Figure 3.6 shows the distribution of permafrost in the planning area.

While permafrost is an integral component of the soils in the planning area, any surface disturbance, including forest fires, that removes the overlying vegetation can initiate melting of ice-rich permafrost and result in surface subsidence (termed thermokarsting), drastically altering the surface topography, hydrological regime, and temperature of the underlying soils. As permafrost begins to thaw near the surface, it warms to greater depths, forming thaw ponds, gullies, and beaded streams. The hydrologic and thermal regime of the soil is the primary factor controlling the vegetation. These changes to the thermal regime of the soil initiate a long process of recovery with perhaps 20 to 50 years of cumulative impacts (Hinzman et al. 2000).

Soils and glacial residues in the Bay planning area contain isolated masses of intermittent permafrost. In the Bristol Bay Coastal Plain, permafrost underlies nearly all areas except the southern part of the plain. It is deep or absent in sand dunes and natural levees along streams, except in the case where tall grasses and deep sod exist (NRCS 1979; McClenahan 2006, Pers. Comm.) The region is undergoing a warming and drying trend that probably has affected the locations and depth of permafrost as well as the seasonal freeze-up of surface soils. Because no in-depth soil surveys have been accomplished for BLM lands in the Bay planning area, it is not known how future activities, for example, attempts to build ice roads to haul equipment and gravel for carrying out oil and gas exploration activities, will affect vegetation and soils (Figure 3.6).

d) Soils Demand Analysis and Forecast

Soil is an important resource in the proposed planning area in that it supports habitat important to the abundant wildlife present in the Bay planning area, promotes stream bank stability and habitat important to the myriad anadromous and freshwater fish that inhabit the region, and provides commercial resources such as timber. Subsistence, commercial, and recreational uses are all related directly or indirectly in some way to soil use.

At the present time, the activities that demand the most from the soil in the Bay planning area are subsistence and recreational in nature, particularly the use of all-terrain vehicles. Marked winter trails between villages have the potential to become summer 4-wheeler trails. A trail from Kokhanok to Katmai National Preserve that crosses BLM lands, used by 4-wheelers, has created some erosional problems. Another 4-wheeler trail has been created from a lodge on the Alagnak River in Katmai National Preserve, to Sugarloaf Mountain, with access across BLM lands. It has not yet been investigated by BLM staff. The trail that follows the Goodnews River and crosses BLM lands should be monitored for its condition.

Two types of contamination of the soil can occur with any human activities. The first is introduction of hazardous materials, for example, from a fuel spill. The second is other types of pollution, for example, silting. However, no evidence for these types of soil contamination currently exists for BLM lands within the Bay planning area.

Currently no commercial timber harvesting activities are being carried out on BLM lands in the Bay planning area, and it is anticipated that commercial timber harvesting will not be a major source of impact to soils in the future.

Soils have a role to play in wetlands, which are lands transitional between terrestrial and aquatic systems, and are generally described as lands where saturation with water is the dominant factor in determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (Cowardin 1979).

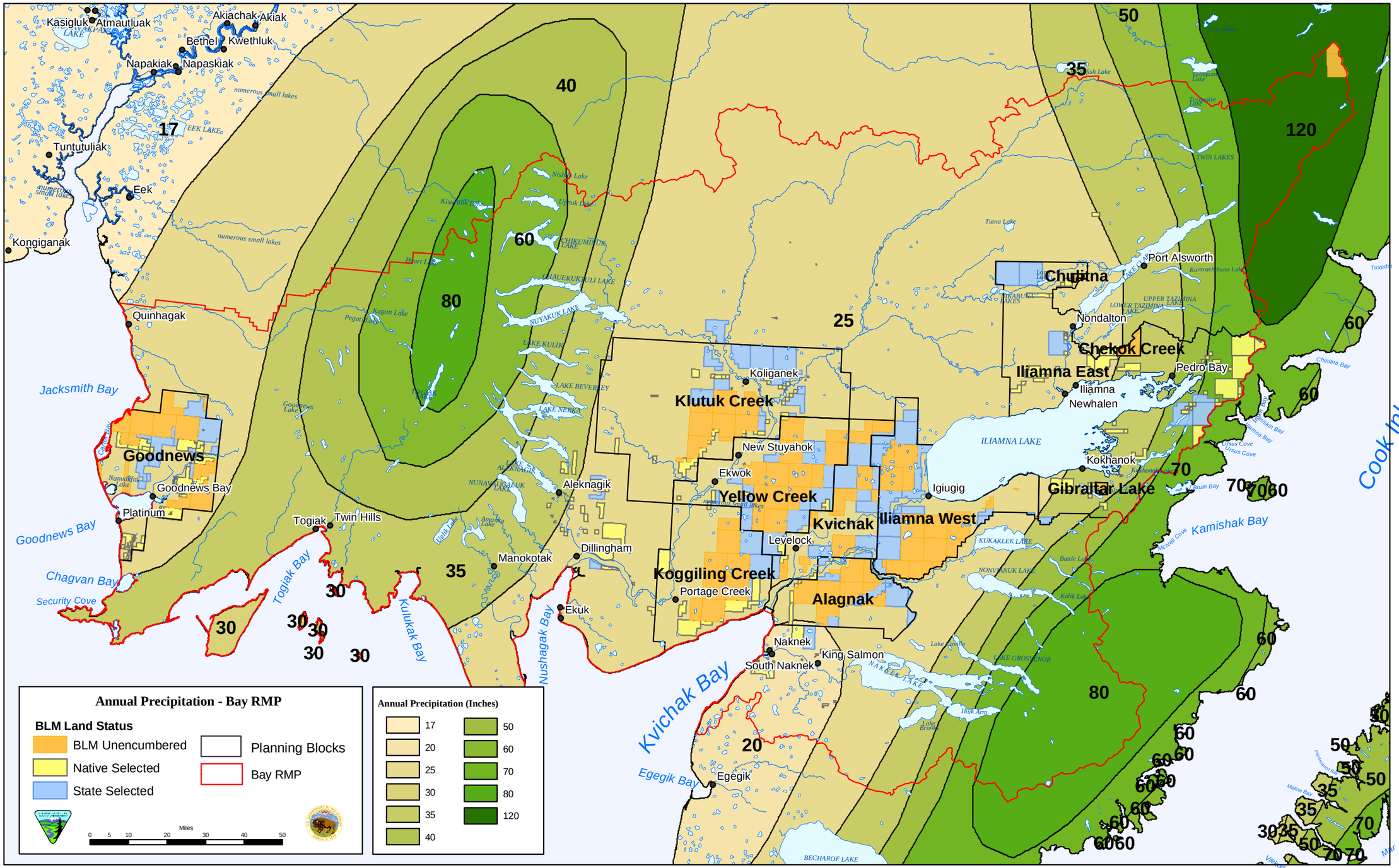
Soil resources have a role in the social and cultural aspects of rural Alaskans. The resource indirectly affects and is used for subsistence and personal use. In the past, a fine blue clay often found adjacent to the rivers in the planning area (i.e. upper Naknek River at Lake Camp) was used historically and prehistorically in the region to make bisque-fired pottery lamps and bowls (McClenahan 1994).

e) Critical Thresholds

Physical soil characteristics that may limit the degree to which reclamation may take place include sandy soils, clayey soils, soils with large coarse fragments, including glacial rubble, a shallow depth to parent material, soils with low organic matter content, and hydric soils with a shallow depth to groundwater (McClenahan 2006, Pers. Comm.).

4. Water Resources

BLM managed lands within the Bay planning area contain many hydrologic features that contribute to the area's diverse water resources. Figures 3.1, 3.2, and 3.3 provide the major water bodies in the planning area. Major watersheds throughout the United States are assigned a name and an 8-digit hydrologic unit code (HUC). Six major watersheds are incorporated within the boundary of the Bay planning area. These watersheds include: Mulchatna River (19030302); Lower Nushgak River (19030303); Wood River (19030304); Togiak (19030305); Lake Iliamna (19030306); and Kuskokwim Delta (19030502). These watersheds are composed of a complex network of streams, wetlands, and lakes that combine to support wildlife, plants, and a multitude of human activities. Subsistence, commercial, and recreational uses are all related in some way to water use. National Weather Service data suggest the variable annual precipitation amounts throughout the region range from 25-120 inches (Figure 3.7). Generally, it is believed that the surface water in these watersheds is of good quality. There are no water bodies on BLM managed lands within the Bay RMP planning area that are classified as impaired by the State of Alaska (Clean Water Act, section 303d).



Map 3.7 Annual Precipitation

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Minimal water quality information is available on most waterbodies in the planning area. Most preliminary water quality samples were gathered in conjunction with fisheries and riparian studies in the Goodnews Bay and Bristol Bay areas. For all authorized activities in the area, enforcement of State water quality standards is a required stipulation to the authorization.

No streams are monitored for water quantity within the planning area by BLM. Two stations established by the USGS are currently collecting hydrologic data within the planning area. The USGS has identified suggested locations for additional stream monitoring stations for this region, some on BLM lands. Current management practice under the Southwest Planning Area (SPA) Management Framework Plan (MFP), section W-2.1, for the Goodnews block only, identifies the need to "Perfect legal water rights to the water resource on public lands in support of Bureau programs, and in compliance with the Alaska Water Use Act" and to "Protect existing water rights of the U.S." Also, within the SPA-MFP, section W-3.1 states the need to "Identify floodplains and wetlands in the planning area."

Water resources will continue to have a significant role in the social and cultural aspects of rural Alaskans.This may become increasingly true if the State of Alaska becomes more involved with the licensing of small hydroelectric dams under 10 MW as they are in the process of doing. The resource is used extensively for subsistence and personal use. Within the planning area, major programs that can generate point or non-point water quality problems are mineral development, recreation, forest development, and fire.

a) Mineral Development

Currently, there is only one active mining operation within the Bay planning area. Hanson Industries utilizes a block of mining claims under Federal regulations located near Platinum. This placer mine operation has traditionally used the bucket-line dredge method for mineral extraction along the Salmon River. Due to decades of mining the hydrology within the Salmon River valley is extremely complex due to alterations in the geology and soils. Tailings composed of porous gravel and cobble sized material as high as 50 feet now occupy the area once filled with fine particulate material necessary to support proper river functions. During periods of low flow, the Salmon River becomes a discontinuous river in sections where the tailing porosity is too great to support the surface flow of the river. This discontinuity of river flow at times prevents access to spawning grounds for anadromous fish species. All placer and hardrock mining activities occurring on BLM managed lands are required to operate under 43 CFR 3809 regulations which require compliance with all Federal and State water quality laws. There are no active coal or oil and gas leases within the Bay planning area.

b) Recreation

The primary types of regulated recreational activities in the planning area are guided hunting, sport fishing, and float trips. All of these activities have the potential to impact water resources; however, none of these recreational activities has been determined to be detrimental to water quality in the area. During scoping the issues of garbage and human waste left on some of the rivers in the planning area and their effects on water quality were raised. No such problems are known for the streams and rivers flowing on BLM unencumbered lands in the planning area.

Recreation within the planning area covers a wide range of activities including OHV use, camping, raft and canoe float trips, and sightseeing. Many of these activities may provide short-term and localized effects to water quality through increased human occupancy on streambanks resulting in degradation of vegetation. Should OHV use increase the effects on water quality have the potential to be more widespread, primarily due to streambank and trail erosion if wetland and riparian vegetation is degraded.

c) Fire Management

Although a large portion of the area generally lacks the fuels required to support watershed damaging wildfires, some potential does exist in areas of dense spruce forests. Depending on its intensity, fire can

exert measurable effects on basic soil resources, leading to increased erosion and reduced land stability. This is manifested primarily as increased overland water flow and greater sedimentation of rivers and streams.

While wildfires have little effect on watershed values, major erosion frequently results from the use of mechanized fire equipment on ice-rich, fine-grained, permafrost soil. Complete removal of all of the vegetation and organic material during fireline construction causes much deeper permafrost melting than occurs in adjacent burned areas. Runoff channels and deep gulleys frequently form, and siltation can result.

d) Forest Products

No BLM-administered lands in the Bay planning area are known to have been disturbed by forest product harvesting. Because of the nature of the forests in the planning area, no commercial timber harvests and minimal to no non-commercial timber product usage is expected to take place on BLM lands.

5. Vegetation

This section describes the occurrence and current vegetation classes derived from satellite imagery within the planning area. Alaska Earth Cover Classification divides major vegetation types into categories derived from satellite imagery and verified by site visits to improve the accuracy of the categories. There are few detailed plant inventories for the planning area. These more intensive studies were done for limited areas, including the Goodnews Bay region and the Ahklun Mountains (Lipkin 1994, Parker 2004), and the northwestern Alaska Peninsula (Batten and Parker 2004). Most of the plant species in the planning area are widely distributed and common; however, there are some species of limited distribution and numbers, as this is typical of plant distributions. Additionally, there are likely to be some undesirable plants that are not native to the ecosystems in the planning area. These are referred to as weeds.

Forestry and fire as they relate to vegetation will be covered in separate sections.

a) Alaska Earth Cover Classification

Vegetation on most all of the BLM lands of the Bay planning area was mapped on a broad scale using satellite imagery. Four joint USDI BLM/ FWS-Ducks Unlimited, Inc. projects, Kvichak Earth Cover Classification (2002), Goodnews Bay Earth Cover Classification (2003), Naknek Military Operations Area Earth Cover Classification (2001), and Iliamna Earth Cover Classification (1994) provide a baseline inventory. This mapping generalizes vegetation and therefore is best utilized for general land use planning and as a guide to areas for further analysis. More intensive studies have been done for limited areas, including the Goodnews Bay region and the Ahklun Mountains (Lipkin 1994, Parker 2004), and the northwestern Alaska Peninsula (Batten and Parker 2004). Since the Earth Cover Classification covers most of the BLM lands covered in this plan, these classifications are used to define the vegetation within the plan boundaries.

The classification scheme consists of 10 major categories and 27 subcategories. A classification decision tree and written descriptions were developed in support of the classification. The classification was based primarily on Level III of the Viereck (and others) classification of 1992.

Classes that could not reliably be discerned from satellite imagery were merged into a more general class. Because of the importance of lichen for site characterization and wildlife forage, and because the presence of lichen can be detected by satellite imagery, shrub and forested classes with and without a component of lichen are distinguished.

A few classes from Level IV of the Viereck classification were mapped because of their identifiable satellite signature and their importance for wildlife management. These Level IV classes are tussock tundra, low shrub tussock tundra and low shrub willow/alder.

b) The Natural Vegetation Cover

Table 3.3 provides the Earth Cover Classes for vegetation for the areas that were covered in the planning area, and Table 3.4 gives the percentage of BLM unencumbered lands in the planning area in each land cover type. The vegetation in the Bay planning area is for the most part unimpacted by humans. Based on the studies cited above, the vegetation in the four vegetation study areas, Naknek, Kvichak, Iliamna, and Goodnews, comprises the following percentages of each general category (Figures 3.8 a-d, 3.9 a-d, 3.10 a-d, and 3.11 a-d). These study areas do not completely correspond to BLM lands.

Table 3.3. Earth Cover Classes for Vegetation in Portions of the Bay Planning Area.

Vegetation Type	Needleleaf	Deciduous	Mixed	Tundra	Tussock/Wet Tundra
Study Region					
Naknek	21%	14%	5%	51%	3%
Kvichak	10%	14%	5%	40%	6%
Iliamna	2%	3%	1%	20%	47%

Table 3.4 . Percentage of Planning Block in Major Land Cover Types Bay Planning Area BLM Unencumbered Lands

Planning Block	Forest	Clear Water	Grass/Forb	Riparian	Wetlands	Coastal Graminoid	Salt Water Estuary
Alagnak	19%	4%	32%	8%	33%	4%	0%
Goodnews	1%	5%	46%	22%	23%	3%	1%
Iliamna West	33%	7%	28%	14%	19%	0%	0%
Chulitna River	78%	1%	15%	3%	3%	0%	0%
Klutuk Creek**	15%	3%	47%	4%	32%	0%	0%
Koggiling Creek**	20%	10%	32%	8%	30%	0%	0%
Kvichak	20%	8%	35%	10%	26%	0%	0%
Yellow Creek	14%	10%	41%	5%	31%	0%	0%

**Portions of the western edges of these planning blocks were outside of the study area.

c) Wetlands, Herbaceous Tundra, and Forests in the Bay Planning Area

Land cover, taken with data about food sources, water, shelter, and living space, is used by biologists to model habitat for wildlife. The existing classifications, discussed above, have been utilized to produce maps of wetlands (Figure 3.10a-d), grasslands (Figure 3.8a-d), forest landcover (Figure 3.9a-d), and lichens (Figure 3.11a-d). As indicated by Table 3.4, wetlands vegetation plays a large role on BLM-administered unencumbered lands in the planning area. All of the BLM planning blocks have between 19% and 33% wetlands land cover except the Chulitna River block, which may account in part for the presence of large numbers of migratory waterfowl and other water-dependent birds there. Except for the Goodnews block, these areas are also extensively used by caribou. Wetlands vegetation decreases and

forest vegetation increases in the planning blocks to the north and east in the Kvichak study area. Riparian vegetation is more prevalent in the Goodnews block and the Iliamna West block, where it makes up from 14% to 22% of landcover; however, some riparian areas comprising up to 10% of the land cover are present in all of the planning blocks.