3.0 AFFECTED ENVIRONMENT

This chapter describes resources and values that could be affected by the no-action alternative or alternative to issue RWCAs with terms and conditions to protect the resources and maintain the access facilities.

3.1 Aquatic Resources and Fish

While generally healthy, aquatic resources within Wrangell-St. Elias National Park and Preserve are affected by a variety of natural and human influences that appear to have reduced the quality and quantity of aquatic resources in recent decades. These influences, among others, include widespread spruce bark beetle infestations, climate change, roads, trails, mining, firewood harvest (Figure 3.1), and over harvest of some fish populations. Typically streams can be considered as properly functioning if they have healthy fish populations, high levels of large woody debris, levels of fine sediment within the natural range of variation for the specific system, stable banks (non-glacial systems) and habitat not fragmented by human-caused barriers. Pool frequency ranges from low to high and is typically positively correlated with large woody debris and negatively correlated with high levels of fine sediment.

Figure 3.1 Riparian impacts from firewood harvest to a stream near the Nabesna Road.

The affected area for the analysis of potential effects to aquatic resources was divided into four areas based on watershed drainages because aquatic resources in each of these large areas are substantially different. The four areas are the Nabesna Road corridor within the Nabesna River drainage, the Nabesna Road corridor within the Copper River drainage, the McCarthy Road corridor within the Chitina River drainage, and the Chisana area within the Chisana River drainage.

3.1.1 Nabesna Road Corridor

The Nabesna Road corridor transects 2 major watersheds, the Copper River and the Nabesna River.

3.1.1.1 Nabesna River Watershed

Major streams within the Nabesna River portion of the Nabesna Road corridor include Jack Creek, Little Jack Creek and several tributaries to Jack Creek. Nearly all of these streams are low gradient (<5%) which allows them to be easily colonized by fish and to provide, in many cases, highly productive aquatic habitat. Most of the stream ecosystems are connected to lakes or ponds. Many of these aquatic systems appear to have fine sediment levels approaching the maximum level that sustains optimal spawning conditions for salmonids and other native species. Whether this condition is due to natural or human causes is unknown. Large woody debris levels appear to be substantially below natural levels in some streams due to a variety of human influences. Nabesna Road stream crossings often limit the transport of large woody debris in the stream channel even if they allow for fish passage. Fish passage is limited by inadequate stream crossing structures in some streams. Dissolved oxygen is a limiting factor in many area lakes during winter months.

Water Chemistry:

In 2006, water chemistry was sampled in streams along the Nabesna Road (table 3.1). Conductivities were fairly high at all sites, ranging from 183 µS/cm at Skookum Creek to 813 µS/cm at Little Jack Creek. This is consistent with the generally calcareous geology drained by these streams. Skookum Creek had noticeably different water chemistry than the other 4 streams in that it had relatively high dissolved phosphorous (P) and relatively low alkalinity and conductivity. Similarly, Nitrogen: Phosphorous (N:P) ratios suggest that while 4 of the 5 streams are P-limited, Skookum Creek may be N-limited. Dissolved organic carbon (DOC) concentrations were generally low at all sites. Consistent with its generally low level of solutes, Skookum Creek had the lowest DOC, although Little Jack Creek, which had the next lowest DOC concentration, also had the highest conductivity.

Table 1. Water chemistry data from Nabesna Road streams. Conductivity and pH were determined in the field.

Stream	Conductivity (uS/cm)	Alkalinity (mg/L)	pH	soluble P (mg/L)	soluble N (mg/L)	DOC (mg/L)
Chalk Creek - June	383	139	8.2	ND	ND	ND
Rock Creek - July	ND	155	ND	0.002	0.11	5.8
Chalk Creek - Sept.	477	147	7.7	0.007	0.222	2
Rock Creek - Sept.	475	170	7.3	<0.001	0.091	3.7
Jack Creek	448	146	7.6	0.004	0.148	2.2
Little Jack Creek	845	155	7.7	<0.001	0.386	1.8
Skookum Creek	182	56	7.4	0.027	0.186	1.6

Macroinvertebrates:

In 2006, macroinvertebrates were sampled in streams along the Nabesna road (table 3.2). A total of 43 macroinvertebrate taxa were collected from these 5 streams, including 3 caddisfly, 6 stonefly and 6 mayfly taxa. The majority (23) of taxa collected were Diptera (true flies), accounting for 53% of the total. Of these, 14 were chironomid midges (Chironomidae). Richness varied among the individual streams and sampling dates, ranging from 11 to 20 unique taxa (Table 2). Jack Creek had the highest richness, and furthermore had remarkably high EPT (Ephemeroptera-Plecoptera-Trichoptera) richness for an Alaskan stream. The true EPT taxa richness for Jack Creek is actually 13, because the two Isoperla species were collapsed to the generic level to increase comparability across all sites. Nemourid stoneflies were collected at all sites, though they were at low density in Jack and Skookum Creeks. *Baetis bicaudatus*, a common mayfly, was found at high densities in Rock and Chalk Creeks during the summer, but was at very low density at all 5 sites in September. The only other insect collected at all 5 sites was the chironomid midge *Diamesia*, emphasizing the biological variability found among even nearby stream ecosystems. Richness appeared to decline substantially from summer to fall at both Chalk Creek (16 to 11) and Rock Creek (18 to 12). However, the results of the replicate sampling at Chalk Creek suggest that this interpretation should be made cautiously, as richness among the 5 replicates collected on the same day in June varied from 14 to 18. In addition, the community composition changed almost completely at these sites from summer to fall, with few taxa being collected in both seasons.

Table 2. Macroinvertebrate community metrics

Stream	Taxa Richness	Non-midge Taxa Richness	EPT Taxa Richness
Chalk Creek - June	16*	11*	4.8*
Rock Creek - July	18	10	4
Chalk Creek - Sept	11	8	6
Rock Creek - Sept.	12	8	4
Jack Creek	20	17	12
Skookum Creek	17	12	8
Little Jack Creek	18	16	9

* Mean value for 5 replicate samples

Benthic diatoms:

Benthic diatoms were sampled in conjunction with the water chemistry and macro-invertebrate sampling in 2006 (table 3.3). Benthic diatom richness was substantially higher than macroinvertebrate richness. A total of 145 diatom taxa were collected from these five streams, mostly identified to the species level. Diatom richness varied from a low of 24 taxa (Little Jack Creek) to a high of 55 (Rock Creek in September), with a mean of 35.5. Diatom densities were much higher in September than in the summer. At both Chalk Creek and Rock Creek densities increased by nearly 2 orders of magnitude (40 fold at Chalk Creek, 50 fold at Rock Creek). Such an increase is probably a combination of two factors – the increase in direct sunlight available after leaf fall, and a

general increase in biomass throughout the summer in streams that are not regularly scoured by spates.

Table 3. Diatom community metrics

Stream	Taxa Richness	Density (cells/cm^2)	Dominant Taxon
Chalk Creek - June	39.6*	$8.02 \times 10^{7*}$	*Cocconeis placentula var. lineata*
Rock Creek - July	55	2.41×10^{8}	*Rhoicosphenia curvata*
Chalk Creek - Sept.	32	3.3×10^{9}	*Rhoicosphenia curvata*
Rock Creek - Sept.	45	1.2×10^{10}	*Achnanthes minutissima*
Jack Creek at Bridge	27	8.1×10^{10}	*Achnanthes minutissima*
Skookum Creek	26	3.3×10^{10}	*Meridion circulare*
Little Jack Creek	24	4.6×10^{10}	*Achnanthes minutissima*

*Mean of 5 replicates

Fish species present include Arctic grayling, slimy sculpin, burbot, longnose suckers, round whitefish and lake trout. Burbot populations in Jack Lake are reported to be well below historic levels due to over harvest. Steelhead/rainbow trout have not been documented in tributaries to the Yukon River. Yukon River tributaries within the Nabesna Road corridor do not provide habitat for salmon within the Wrangell-St. Elias National Park/Preserve boundary because stream gradient and distance from the ocean limits the ability of adult salmon to migrate into these areas.

3.1.1.2 Copper River Watershed

Major streams within the Copper River watershed portion of the Nabesna Road corridor include Caribou Creek, the Copper River, Rufus Creek, the Slana River and Tanada Creek (see Figure 3.2).

Figure 3.2 The confluence of Tanada Creek and the Copper River.

Aquatic habitat in these streams ranges from crystal clear small streams to large glacial rivers. Many of these streams are low gradient (<5%) which allows them to be easily colonized by fish and to provide, in many cases, highly productive aquatic habitat. Most of the stream ecosystems are connected to lakes or ponds. Many of these aquatic systems appear to have fine sediment levels approaching the maximum level that sustains optimal spawning conditions for salmonids and other native species. Large woody debris levels appear to be within their natural range of variation. Fish passage is not limited by inadequate stream crossing structures.

Fish populations include round and humpback whitefish, sockeye salmon, chinook salmon, slimy sculpin, arctic grayling, lake trout, burbot, longnose sucker, steelhead/rainbow trout and dolly varden. An ongoing radio telemetry study of whitefish in the Copper River may indicate that some whitefish stocks in the Copper River are anadromous. The northernmost population of steelhead in the world occurs in the Gulkana River, although anecdotal reports suggest steelhead occasionally stray upstream as far as Tanada Creek. Salmon are harvested in Tanada Creek for subsistence use and the management of this population is occasionally controversial. Copper River salmon are harvested commercially in marine waters and are internationally recognized for their superior quality.

3.1.2 McCarthy Road Corridor

The McCarthy Road corridor is contained within the Chitina River watershed. The Chitina River is the largest tributary to the Copper River. Streams in the McCarthy Road corridor range from low to high gradient, some of which are too steep to support fish populations. McCarthy Road stream crossings often limit the transport of large woody debris in the stream channel even if they allow for fish passage. Fish passage is limited by several poorly designed culverts along the McCarthy Road. Most fish bearing streams in the McCarthy Road corridor provide at least some habitat for anadromous fish as well as resident fish species. Fish populations include round whitefish, sockeye salmon, chinook salmon, coho salmon, slimy sculpin, arctic grayling, lake trout, burbot, longnose sucker, steelhead/rainbow trout and dolly varden. Long Lake along the McCarthy Road provides substantial fish habitat for unique fish populations including kokanee and a sockeye salmon stock that spawns from September through March (see figure 3.3). This spawning period is the longest of any known sockeye salmon stock.

3.1.3 Chisana Area

The analysis area for properties located in and around the community of Chisana is contained within the Chisana River watershed. Streams in the Chisana area are low gradient and display a high level of glacial influence. Relatively little is known regarding fish populations in this area. Arctic grayling, round whitefish, slimy sculpin, northern pike and burbot occupy these streams but relatively little is known regarding their life history in this especially harsh environment. The condition of spawning areas and rearing habitat is unknown.

Figure 3.3 Spawning and dead sockeye salmon at Long Lake in early March

3.2 Cultural Resources

Cultural features are scattered throughout Wrangell-St. Elias National Park and Preserve (WRST), but most are concentrated in those areas which received the most extensive and sustained use, such as along its major rivers, lakes, roads, and trails, and within its larger and more significant historic mining districts. The Copper, Chitina, Nizina, Sanford, Nabesna, Chisana, and White River corridors; Tanada, Copper, Jack, Twin, Ptarmigan, Beaver, Dadina, Tebay, Hanagita, and Long Lakes; the McCarthy, Nabesna, Kotsina, and May Creek Roads; the Batzulnetas, Suslota Lake, Trail Creek, Lost Creek, Caribou Creek, Platinum Creek, Jack Creek, Cooper Pass, Orange Hill, Beaver Creek, Bryan Creek, Horsfeld, and Bremner Trails; the Kennecott, Nabesna, Chisana, Nizina, and Kuskulana Mining Districts; and the Malaspina Forelands all hold potential for significant cultural resources (Hunt 1991). Many inholder access corridors traverse areas with such features.

A few areas within Wrangell-St. Elias National Park and Preserve have received exhaustive archeological surveys. These include the Kennecott and Bremner Mining Districts, Gold Hill, Wiki Peak, Skolai Pass, the Chisana townsite, the McCarthy Creek Road, and selected portions of the McCarthy and Nabesna Road corridors. All other archeology has been site specific.

Alaska Native people first entered this region about 8,000 years ago. Because game was not very plentiful, human numbers were low and groups remained widely dispersed and highly mobile. These early peoples typically situated their winter villages where a large tributary entered one of the major rivers, and established temporary camps whenever and wherever critical resources were available. Several villages, including Taral (on the east bank of the Copper River just south of the Chitina River), Strelna (on the McCarthy Road), and Batzulnetas (near the mouth of Tanada Creek just south of the Nabesna

Road), were particularly significant and are now especially vulnerable. Other features associated with the region's early Native inhabitants can be encountered practically anywhere and range from camp and cache sites to graves, game fences, and stone tools (Reckord 1983; USNPS 1998).

The first large influx of American immigrants arrived during the gold excitement of 1898. While this region was no Klondike, prospectors eventually made some important local discoveries. These included gold placers on tributaries of the Nizina and Chisana Rivers; gold lodes near the Nabesna and Bremner Rivers; and copper lodes near the Kennicott, Chitistone, Kuskulana, and Kotsina Rivers.

Local mining features fall into two main groups, placer and lode, and most are associated with either extraction, circulation, or processing. Those categorized as extractive include prospect and drift pits; adits and shafts; hand, hydraulic, and bulldozer cuts; hand-stacked cobble; tailings; and spoil piles. Structures related to circulation include ore car runways, aerial tramways, boardwalks, bridges, paths, and roads. Many operations also possessed dams, ponds, pipelines, ditches, and flumes to contain, divert, regulate, or supply water. Structures associated with processing include mills, power plants, crushers, and concentrators (Bleakley 2000a).

Successful prospectors established mining districts. In this region, a district typically includes a variety of utilitarian buildings and structures, locally manufactured tools, and landscape revisions consistent with mining operations. Three such districts, the Nabesna Gold Mine Historic District (Stanley 1978), the Chisana Historic Mining Landscape (Bleakley 1998; Feldman N.D.), and the Bremner Historic Mining District (Bleakley 2000b; White 2000), are presently listed on the National Register of Historic Places. A fourth, the Kennecott Mine, is a National Historic Landmark. In addition, WRST contains more than 65 additional mining-related sites which have been determined eligible for National Register listing.

Abercrombie began building the Trans-Alaska Military Road (popularly called the Valdez Trail) from Valdez to Eagle in 1899. This route was responsible for the location or expansion of many local settlements. Early entrepreneurs built roadhouses along it, often at or near existing Ahtna villages or fish camps. Many such sites, such as Copper Center, Gulkana, Gakona, Chistochina, and Slana, became substantial communities. Trail and road corridors contain the remains of sites, structures, and buildings once devoted to their construction, use, and maintenance. These include bridges, culverts, abandoned road sections, camp sites, trash scatters, and the ruins of homes, roadhouses, and support facilities. About 10 miles of the Valdez Trail situated just west of Slana parallels the northwestern boundary of Wrangell-St. Elias National Preserve (Bleakley 1997).

The Kennecott Copper Company and its successors mined on Bonanza Ridge from 1907-1938, and the Alaska Syndicate built the Copper River and Northwestern Railway to transport its ore from Kennecott to Cordova. The current McCarthy Road follows that railway's right-of-way from Chitina to McCarthy. This route retains an extensive

assemblage of associated features, including the remains of maintenance facilities, watering stations, bridges, trestles, culverts, and track, many of which have been determined eligible for National Register listing (Buzzell 2005). In addition, the community of McCarthy contains two properties, the General Store and the Mother Lode Powerhouse, which are already listed.

The Nabesna Road enjoys a similar history. Incorporating a number of prehistoric Native trail segments, it was constructed by the Alaska Road Commission in the early 1930s to facilitate development of the Nabesna Gold Mine. Like other roads and trails, its corridor contains prehistoric camp sites and stone tool scatters as well as the remains of historic cabins, shelters, camp sites, culverts, and refuse scatters (YCC 1979).

3.3 Inholder Property

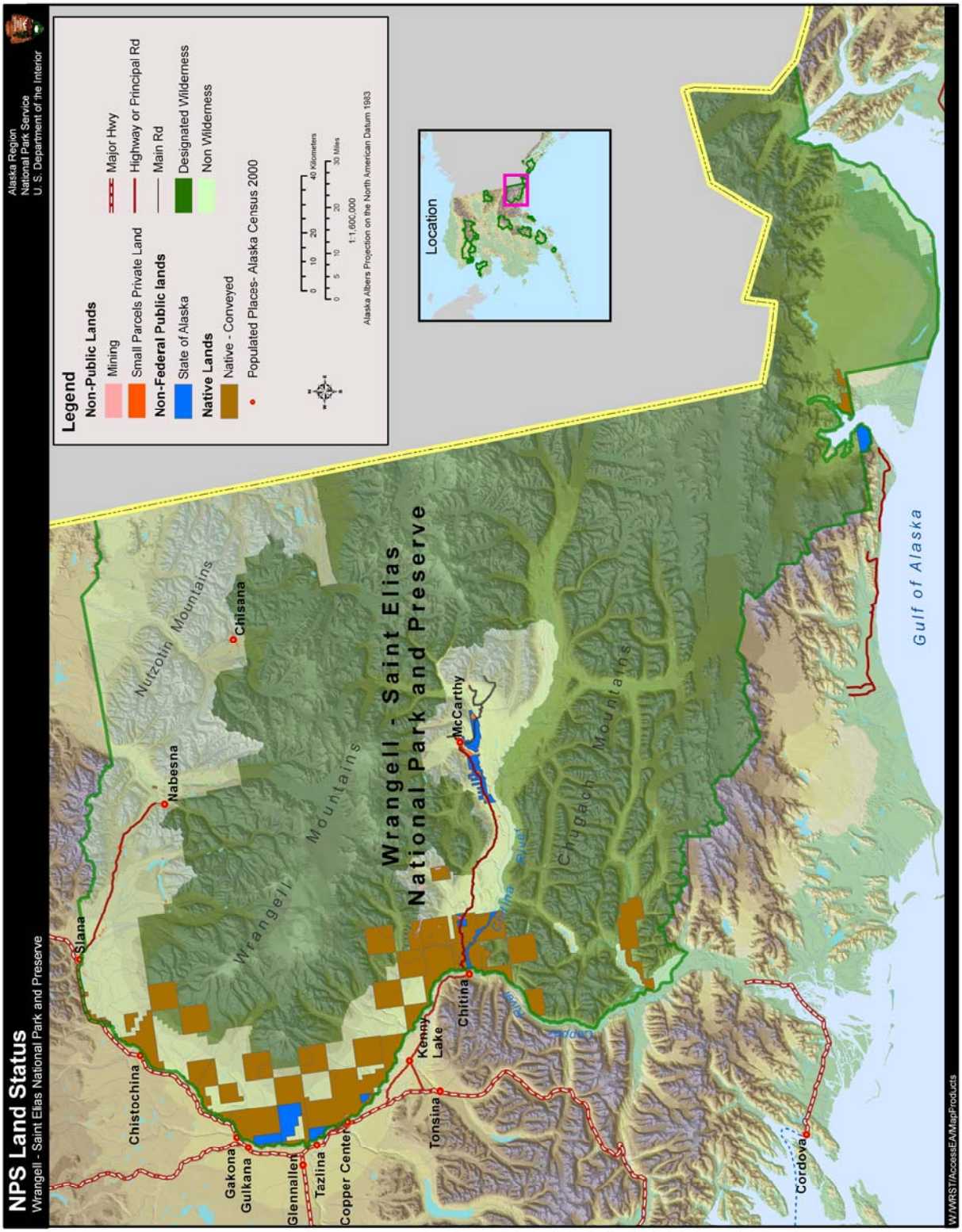
Wrangell-St. Elias National Park and Preserve encompasses approximately 13.2 million acres (Figure 3.4). There are approximately 784,000 acres of non-Federal lands within WRST. Native corporations, pursuant to the Alaska Native Claims Settlement Act, own a majority of these non-Federal lands. Ahtna, Incorporated owns 620,478 acres; Chitina Village Corporation owns 62,688 acres; and Chugach Alaska Corporation owns 51,809 acres. There are thirty-six Native allotments containing 3,650 acres and 7 pending Native allotments with 560 acres.

The State of Alaska owns 34,430 acres of uplands, some managed by the Department of Natural Resources, the rest by the University of Alaska. There are 286 patented mining claims containing 5,625 acres and 27 unpatented mining claims containing 491 acres. The remaining non-Federal lands consist of 64 parcels transferred from the Federal public domain to private owners under the Federal land disposal statutes (4,874 acres) and 73 lots subdivided from the surface estate of patented mining claims in Kennecott (186 acres).

The number of landowners with inholdings has increased as non-Native private lands and university lands have been subdivided. Subdivision and sale of non-federal lands within WRST are not reported to the National Park Service. There are inholdings throughout WRST, but the majority of established access routes to inholdings are along the Nabesna and McCarthy Roads and in the Chisana area. NPS's inventory show that approximately 120 landowners have access to their inholdings across non-federal lands while approximately 90 landowners cross NPS lands to reach their inholding. An estimated additional 40 landowners previously crossed NPS lands or may need to cross NPS lands in the future for access to their inholdings. The NPS has previously authorized temporary and/or short-term access to multiple private landowners since 1980.

These non-Federal lands are used by inholders as residences, second homes or recreational sites, for trade and manufacturing, business ventures (including guiding and outfitting into the park and preserve), mining, recreation, and subsistence. Some Native Corporation lands have been logged.

Figure 3.4 Land Status in WRST



3.4 Public Access and Recreational Use

While existing access facilities to inholdings are scattered throughout the park and preserve, the majority of the properties are situated along the Nabesna and McCarthy Roads and other more developed front country locations such as Kennecott and McCarthy. The Kennecott National Historic Landmark (NHL) is the most popular visitor destination in the park. The average visitation to the Kennecott area ranges between 8 and 12 thousand people per year. (Littlejohn 1995 & USNPS 1990 - WRST Mining EIS). The ADOT&PF has periodically placed traffic counters on both the McCarthy and Nabesna Roads. The most recent results counted 10,000 trips per year on the McCarthy Road and 3,500 trips per year for the Nabesna Road. These trips would include both residents and visitors. As of yet there is not a methodology to differentiate between the two groups.

For recreational purposes, park management would classify such areas as "Front country", meaning that amenities for visitor use, such as constructed and maintained trails would be appropriate. This term should not be construed to mean that the area is highly developed. While trails have been maintained and trailheads have been improved to include vault toilets and orientation information, these facilities would be classified as fairly simple and Spartan. In the Recreation Opportunity Spectrum system they would meet the primitive classification.

Because these areas have easier access connected to the road system or a well-maintained airstrip, they serve as portal to areas where a variety of recreational activities occur. From these front country areas visitors enter the larger wilderness and backcountry areas. The primary recreational activities for these areas include hiking, sightseeing, backpacking, camping, horseback riding, sport hunting, touring historic districts, fishing, boating, snowmobiling, ORV riding, and flight seeing. While overnight activities are popular, most uses are a day long or less.

In the Nabesna District there are a number of multi-use trails that are used by hikers, hunters, subsistence users, commercial operators, and landowners gaining access to inholdings. Some use the trails via foot and others with an ORV. Those who use an ORV for recreational purposes do so under an NPS permit. Trails include the Copper Lake, Suslota Lake, Tanada Lake, Caribou Creek, Trail Creek, Reeves Field, and Skookum Volcano (foot trail only). There are a number of camping areas, two principal areas at Jack Creek and Twin Lakes. Along the Nabesna Road, both adjacent to and within the park boundary, are a number of commercial operators who provide a variety of services from food and lodging to flight seeing, backcountry drop-offs, and guided hunting and fishing. The NPS provides visitor orientation and interpretive programs at the Slana Ranger Station and a public use cabin.

Chisana is a historic mining town in the northeast corner of the Preserve. During the apex of the mining era it was the largest log constructed town in the State. Today it is a mixture of public and private lands that is accessed via airplane. Recreational opportunities in this area include many of the same activities mentioned for the Nabesna

area- hiking, sightseeing, backpacking, camping, sport hunting, touring historic districts, fishing, boating, and flight seeing. There are also hunting guide outfitters in this location. A number of visitors explore the historic structures in Chisana and in the Gold Hill area where the placer gold was mined. The NPS has exhibits and historic photographs at the Commissioner's Court in Chisana and a public use cabin.

The McCarthy Road corridor has a few trails that provide visitors with recreational opportunities. They include the Nugget Creek Trail, Dixie Pass and Crystalline Hills. Nugget Creek is a multiple use trail with a public use cabin at its terminus. Dixie Pass is a popular backpacking route and Crystalline Hills is a day hiking trail. A number of small lakes are adjacent to the road where there is fishing. There are a number of historic structures for visitors to enjoy since the road follows the Copper River and Northwestern railroad route. The Kuskulana Bridge and Gilihina Trestle are two of the more significant structures. As on the Nabesna Road, there are a number of commercial operators that provide services along the route. The NPS provided visitor orientation at the Chitina Ranger Station at the beginning of the McCarthy Road. There is a public use cabin at the terminus of the Nugget Creek Trail.

The towns of McCarthy and Kennecott are a visitor destinations and portals to enter the larger backcountry and wilderness areas. Visitors have opportunities to tour the historic towns of McCarthy and Kennecott. A history museum is in McCarthy. Day hiking is available to the Copper Mines above Kennecott Mill Town and out the Root Glacier Trail. Commercial operators provide air taxi service to back country and wilderness destinations. There are mountaineering, hiking, and rafting guide services, including glacier hiking and ice climbing and a concessioner who provides guided tours of the Kennecott Mill Building. A full spectrum of lodging and restaurant opportunities are available at McCarthy and Kennecott. The NPS provides visitor information and interpretive programs at the McCarthy Road Information Station and the Kennecott Visitor Center.

Overall, visitors to these areas typically expect the following recreational settings:

Area feels accessible and frequently visited, but the landscape is still primarily natural with few visible reminders of permanent human presence once you leave the road corridor or town. In the portal access areas visitors will find trails, campsites, airstrips, and primitive toilet facilities. Visitors experience solitude most of the time, but they may encounter up to 10 parties a day and opportunities for solitude are limited during popular use times. Visiting the area requires a moderate degree of self reliance, advance planning, and time commitment.

Minor resource impacts may be common at access points, but resources impacts are infrequent elsewhere. Social trails may be common in some places, such as popular access points. Infrequent transient evidence of human activity occurs elsewhere.

Natural sounds are undisturbed the greater part of the time over the area. Depending on the season, weather, and proximity to travel corridors, there may be frequent intrusions of

human noise from snowmobiles, aircraft, ORVs, and highway vehicles, some of which may be loud.

3.5 Soils

The areas affected by the proposed action are located in the Copper River Plateau, South Central Alaska Mountains, and Alaska Range Land Resource Areas as described by the Exploratory Soil Survey of Alaska (Rieger, 1979). The discussion below and Soils Appendix H describes the Land Resource Areas and the soil associations within the Nabesna, McCarthy Road, and Chisana areas separately.

3.5.1 Copper River Plateau Land Resource Area and Soil Map Components

The Exploratory Soil Survey describes the Copper River Plateau as a broad basin of rolling to hilly moraines and glacial lacustrine sediment, interspersed with many lakes. Within Wrangell-St. Elias Park and Preserve the plateau is bordered by Wrangell Mountains to the east, the Chugach Mountains to the south and the Alaska Range - Mentasta/Nutzotin subunit to the north. Arms of the plateau unit extend up into the headwaters of the upper Copper River in the Nabesna area, and the middle Copper River valley roughly from Copper Center down river below McCarthy.

Elevations range between 1,500 and 3,000 feet for this unit in the study area. Within this elevation range the unit is generally covered with a forest of black spruce and willow. Along the Copper and Chitna Rivers are second-growth forests of white spruce, paper birch and quaking aspen. Similar forests occur in a few places at higher elevations on steep south-facing slopes. The climate is strongly continental with long and cold winters and short relatively warm summers. Mean annual temperatures are below freezing and precipitation is light to moderate. Summer frosts are common in this area.

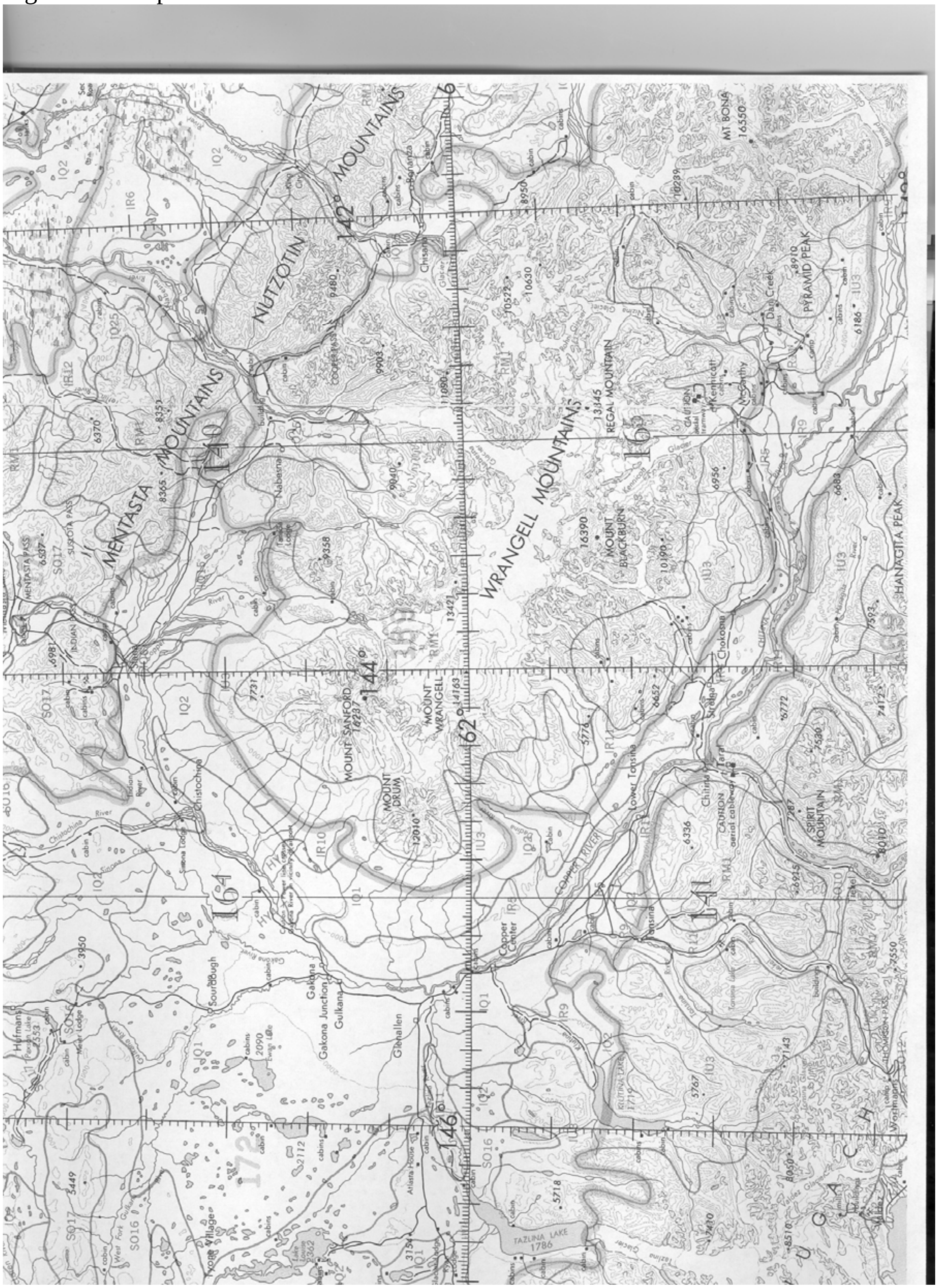
3.5.1.1 Nabesna Area

There are four soil mapping units within the Copper River Plateau Land Resource Area in the Nabesna Area.

IQ-15
The most extensive of the four soil mapping units is IQ-15. It occupies the broad relatively flat outwash plain north of Tanada and Copper Lakes and the lower piedmont slopes east of Slana. The majority of soils within this unit are poorly drained and shallow to permafrost. They formed in very gravelly glacial drift or outwash. Some associated soils are well drained and occur on higher terraces. Small ponds and lakes are common within this unit.

IQ-6
The IQ-6 mapping unit occupies the area immediately surrounding Slana. It occupies a landform shaped by the Copper River. Meandering sloughs, small rivers and undrained

Figure 3.5. Map of Soils in WRST



depressions are common in this unit. Most of the poorly drained loamy soils formed in nonacid or calcareous alluvium.

IQ-2
The IQ-2 mapping unit occupies the area immediately west and south of Slana.
It is characterized by nearly level to rolling ground moraines, outwash plains, and long mountain slopes. Some moraine hills, small floodplains, and a few stream terraces are included. The dominant soils in this association formed in silty material of variable thickness over very gravelly drift. Most of the soils have a shallow permafrost table, but in some of the very gravelly well drained soils permafrost is deep or absent.

SO-17
The SO-17 is found on the southwest facing steeper slopes of the Mentasta Mountains southeast of Slana. It occupies alpine areas adjoining mountains of the Alaska Range. High sharp ridges and peaks of bare rock or rubble, steep mountain sides, and deep glacial valleys dominant the landscape. Most of the soils formed in very gravelly and stony colluvium or glacial drift under a cover of alpine tundra. Although the mean annual soil temperature is below freezing, most soils do not retain enough moisture for the formation of ice-rich permafrost.

3.5.1.2 McCarthy Road Area

There are three soil association mapping units within the Copper River Plateau in the McCarthy Road area of the study unit.

IR-11
In the area down river from Copper Center to just west of McCarthy the dominant soils unit is IR-11. This soil unit occupies moraines and mountain foothills within the Copper River valley. The landscape is made up of hills and ridges formed in thick deposits of very gravelly till and colluvium, but a few soils on steep ridges and peaks are shallow over bedrock. Most of the soils in this association formed in deposits of very gravelly till and colluvium, but a few soils on steep ridges and peaks are shallow over bedrock. The dominant soils are well drained without. They occur on nearly all slopes below tree line except those facing directly north. Poorly drained soils with permafrost occur in valleys and on steep north-facing slopes.

IR-5
The IR-5 soil unit occupies the north side of the Copper River valley from Lower Tonsina to just west of McCarthy. This soil association occupies low moraines, former lake basins and terraces in areas close to the Copper River. Though much of the area is nearly level to rolling a few steep narrow valleys of deeply incised streams are included. The principle soils formed in a silty loess mantle of variable thickness over very gravelly drift on moraines and clayey lacustrine sediment in former lake basins and terraces. A thin layer of volcanic ash may occur on some surfaces. Soils under forests of white spruce, quaking aspen and paper birch are well drained and free of permafrost. They are

commonly interspersed with scattered areas of poorly drained soils with a shallow permafrost table.

IR-9
In the area downstream from McCarthy within the greater Copper River valley is the IR-9 soil association. This group of soils occupies broad plains bordering the tributaries to the Copper River. Nearly level forested terraces interrupted by low floodplains along the rivers dominant the landscape. Short steep escarpments on terrace edges and a few rolling moraines are included. The dominant soils are formed in well drained silty loess over thick deposits of very gravely outwash. Poorly drained soils with permafrost support forests in valley bottoms and in broad swales in terraces. Also included are poorly drained deep fibrous peat soils in scattered depressions.

3.5.2 Alaska Range Land Resource Area and Soil Map Components

The Exploratory Soil Survey describes the Alaska Range Land Resource Area as a long, relatively narrow mountain chain that arcs around south central Alaska and separates it from the hills and lowlands of the State's interior. Within the study area, it forms the northern edge of the Nabesna subunit, and the area surrounding Chisana and the upper White River. The Mentasta and Nutzotin Ranges located in these areas are named subunits of this Land Resource Area. Overall the unit is very rugged with extensive high mountains and a number of low passes that permit relatively easy passage through the range. Almost all of the landforms are of glacier origin. The transition to adjoining lowlands is generally sharp. Most of the high slopes are bare. Shrubby alpine vegetation covers most of the lower slopes and passes. Black spruce forests occupy some lower slopes, and natural grasslands occur in a few places. Mean annual temperatures are well below freezing even in low passes. Precipitation is fairly heavy on southern and southeastern slopes.

3.5.2.1 Chisana and White River Area

There are two soil associations within the Alaska Range Land Resource Area in the Chisana and White River Area: IQ-25 and RM-1.

IQ-25
The IQ-25 soils association occupies the area surrounding Chisana and upper White River. This association occupies foothills and high mountain valleys such as those surrounding Chisana and the White River. Most of the association is above tree line. The soils have developed predominantly in glacial till, with a thin mantle of volcanic ash or loess in places. Bedrock outcrops on peaks and ridges and loose rubble occurs in many high areas. Most soils are poorly drained, but well drained soils have developed in very gravelly material at the foot of high ridges and on some south-facing slopes and hilly moraines at lower elevations.

RM-1

The RM-1 unit is made up of steep rocky slopes, ice fields, and glaciers. Some slopes in the mountains support a sparse shrubby vegetation cover, but most are barren. Thin soils occur in the vegetated areas on lower slopes and in valleys, but almost all are stony and shallow over bedrock or boulder deposits.

3.5.3 South Central Alaska Mountains Land Resource Area and Soil Map Components

The Exploratory Soil Survey delineates this land resource area to include the Wrangell Mountains. Both the southern fringe of the Nabesna area and the northern fringe of the McCarthy area –including McCarthy and Kennicott town sites, and the headwaters of the Kotsina, Kuskulana, Chokosna, and Gilahina Rivers fall within this area. Within this resource area, a large ice field caps the Wrangell Mountains and numerous glaciers descend its flanks to form moraines, outwash plains, and other glacial features. These are clearly visible on lower slopes and in areas adjacent to the mountain. This area has relatively low precipitation and marked seasonal temperature differences with interior Alaska. At higher elevations precipitation is mostly snow which is incorporated into the glacial ice even in summer time.

3.5.3.1 Nabesna Area

Within the Nabesna area two soil mapping units are found: IU-25, and IU-3.

IU-25
This soil association is located in the uplands east of Tanada Lake and the area surrounding Nabesna. Most of the association is above tree line. The soils are dominantly formed in glacial till with a thin mantle of volcanic ash or loess in places. Bedrock outcrops on peaks and ridges and loose rubble occurs in many high places. Most soils are poorly drained. Well drained soils have developed in very gravelly material at the foot of high ridges and on some south-facing slopes and hilly moraines at lower elevations.

IU-3
This soil association occupies hilly alpine plateaus, rocky peaks, sharp ridges, steep mountain valleys and foot slopes. It includes the area south of Tanada and Copper Lakes and the head waters of Copper River and Drop Creek. The dominant soils in most areas formed in very stony and gravelly colluvial material of variable thickness over bedrock, but some of the soils in valleys and on foot slopes in glaciated areas formed in deposits of till.

3.5.3.2 McCarthy Road Area

Three soil association units within this Land Resource Area are found within the McCarthy Road area.

IU-3
The IU-3 map unit is located in the highlands both north and south of the McCarthy

Road. The description for the unit in this area is identical for the IU-3 unit described for the Nabesna area presented above.

IR-11
The IR-11 soil association is located in the area surrounding and immediately south of May Creek, the steep slopes north of the McCarthy Road, and the mountain foot slopes south of the Copper River. This soil unit occupies moraines and mountain foothills within the Copper River valley. The landscape is made up of hills and ridges formed in thick deposits of very gravelly till and colluvium, but a few soils on steep ridges and peaks are shallow over bedrock.

RM-1
The RM-1 unit is made up of steep rocky slopes, ice fields, and glaciers. Some slopes in the mountains support a sparse shrubby vegetation cover, but most are barren. Thin soils occur in the vegetated areas on lower slopes and in valleys, but almost all are stony and shallow over bedrock or boulder deposits.

3.5.4 Soils in Established Access Facilities:

The degree to which soils are impacted is a function of the established level of development (covered, bladed, or trammeled), use of motorized vehicles (frequency, vehicle class, period of use) ongoing maintenance (grading, ditching, and placing fill) as well as natural processes responding to these disturbances. Direct soil impacts are primarily confined to the established access disturbance footprint. Within established facilities soils have degraded through compaction, erosion and thermokarsting. Many sections of the established facilities are impacted and have lost soil and/or exposed underlying unconsolidated surficial mineral deposits. Impacts are worst on those portions of facilities which pass through wetlands or traverse steep slopes.

Impacts to soils adjacent to a facility principally result from indirect consequence to the surface hydrology and changes to the underlying permafrost. These include the disruption of surface water flow, reductions in infiltration and percolation, surface ponding, and the loss of water-holding capacity. Other indirect impacts include wind and water erosion and deposition of transported material.

For constructed facilities where gravel has been placed to support the passage of motorized vehicles, the principle affect on soils is that the in situ soils are covered. Soils in established facilities that were bladed with motorized equipment such as a bulldozer commonly have had all or most of the organic soil horizon removed from the facility footprint and some of the underlying mineral soils. Soils underlying unimproved ORV trails and 4-wheeled drive tracks are impacted from wheel contact by abrasion, shearing, compression, and displacement within the established footprint. For established facilities located in barren floodplains and relatively young upland terraces containing a gravel and/or sand substrate which are generally well drained, the impacts are negligible principally because of the lack of any well developed soils.

3.6 Vegetation and Wetlands

The spatial extent evaluated in this environmental assessment is that portion of the park north of the Chitina River, south of the Mentasta and Nutzotin Mountains, east of the Copper River and west of the Alaska-Yukon border. It also includes the Malaspina Forelands in Yakutat Bay on the coast of the park. Facilities are located within the Nutzotin, Mentasta, and southern Wrangell Mountain foothills and mountains and within the Upper Copper, Chitina, Nabesna, Chisana and White River basins. The study area traverses three climate divisions (coastal, interior basin and Copper River (Milkovich 1989)) and eight ecological regions (Nowacki et. al. 2001). This area is in the subarctic vegetation region and is dominated by boreal forest vegetation below tree line (approximately 3000 ft), mixed shrub and herbaceous types near tree line and alpine tundra communities above tree line.

Four components of vegetation are addressed in this description and the analysis in Chapter 4. These are: (1) vegetation in general - which includes structure, distribution, abundance and composition of plant species; (2) wetlands, (3) exotic plants, and (4) rare plants. Wetlands, exotic and rare plants are sub-components of vegetation but are discussed separately. The term 'vegetation' refers to plant community structure, distribution and composition. The term 'wetland' refers to jurisdictional wetlands as defined by the National Park Service Director's Order #77-1 and Cowardin et al. 1979. Landform, landcover and vegetation descriptions that follow for the regions adjacent to the Nabesna and McCarthy Road are from 2006 field surveys conducted by Mike Loso (Loso 2006). Vegetation and landcover data for other regions were derived from digital landcover data as referenced below. Wetland descriptions and estimates were derived from National Wetland Inventory (NWI) maps that cover the Nabesna Road, the Western Wrangells and Malaspina Forelands, digital landcover maps and field surveys conducted by Mike Loso in 2006 and the park botanist in previous years. Information on exotic plants is from the park's voucher data (NPSpecies), the Alaska Exotic Plant Information Clearinghouse (AKEPIC) Database, and surveys conducted from 2004-2006 by the National Park Service Alaska Exotic Plant Management Team from (EPMT). Data on rare plant distribution in the park is from NPSpecies, surveys conducted in the park from 1994-1997 and 2003, historical collections and voucher collections at the University of Alaska Fairbanks. Vegetation types are generally to level four of the Alaska vegetation classification (Viereck et. al. 1992), wetland classes are those used by the USFWS National Wetland Inventory program (Cowardin et al 1979), and plant nomenclature follows Hultén (1968) and Cody (1996).

3.6.1 Vegetation

Vegetation types that occur on and near facilities are listed in Table 3.1 and described by region below.

Table 3.4 Vegetation Types in Facilities.

Region	**Vegetation Types within Facilities**
Nabesna Road	Open white spruce forest White spruce woodland Black spruce woodland Open mixed white spruce-poplar forest Open low willow-graminoid shrub bog Open tall willow scrub Herbaceous seral
McCarthy Road	Closed white spruce forest Open white spruce forest White spruce woodland Closed mixed aspen-white spruce forest Closed mixed forest Open mixed forest Open black spruce forest Open low willow-graminoid shrub bog Open low mixed shrub-sedge tussock bog Willow-birch shrub Alpine forb herbaceous Open dwarf scrub
Chisana River (Cathenda Creek)	Woodland needleleaf forest Open needleleaf forest Disturbed graminoid-forb herbaceous Dwarf shrub sedge bog Dwarf shrub-scrub
Gold Hill	Dwarf shrub scrub Dwarf shrub-sedge bog
White River	Seral forb herbaceous Woodland needleleaf forest Closed dwarf shrub Open dwarf shrub-scrub Willow-birch shrub-scrub
Horsfeld & Beaver Creek	Open dwarf shrub sedge bog Woodland needleleaf forest
Francis & Ptarmigan Creeks	Disturbed graminoid-forb herbaceous Needleleaf woodland Open dwarf shrub-scrub
Western Wrangell Mountains	Seral dry forb herbaceous Closed tall shrub scrub Open tall shrub scrub
Chitina River	Woodland needleleaf forest Closed needleleaf forest Open needleleaf forest Willow-alder shrub-scrub Closed dwarf shrub-scrub Willow-birch shrub-scrub
Malaspina Forelands	Non-vegetated coastal strand Sparsely vegetated graminoid-forb herbaceous

3.6.1.1 Nabesna Road

Vegetation communities in the vicinity of the Nabesna Road are primarily distributed in relation to depositional features created by glacial Lake Ahtna, ground moraines left behind after the Wisconsin Glaciation in the Alaska Range, recent alluvial deposits from drainages flowing from the Mentasta Mountains, older alluvial deposits on these river terraces and inactive fluvial terraces. The dominate vegetation types along the Nabesna Road associated with facilities evaluated in this document are: open white spruce forest, white spruce woodland, black spruce woodland, open mixed white spruce-poplar forest, open low willow-graminoid shrub bog, open tall willow scrub and herbaceous seral communities (Loso 2006).

3.6.1.2 McCarthy Road, McCarthy, & Kennicott

Facilities accessible from the McCarthy Road are on river terraces and moraines in the Kuskulana and Kotsina River drainages, alluvial fans emanating from the southern Wrangell Mountains in the Chokosna River drainage and terraces in the Crystalline Hills formed by the retreat of glacial Lake Ahtna. Facilities in the Kennicott and McCarthy Creek drainages are in inactive river channels, on ground and terminal moraines and on outwash floodplains. Outwash areas on the Kennicott River floodplain have primary succession vegetation. Most of the forested area directly adjacent to the McCarthy Road has been logged for the Kennicott railroad construction or was burned in historical fires. This area has been heavily infested by the spruce bark beetle. The following vegetation types are found within facilities accessed from the McCarthy Road: closed white spruce forest, open white spruce forest, white spruce woodland, closed mixed aspen-white spruce forest, open mixed white spruce-poplar forest, closed mixed poplar-white spruce forest, open black spruce forest, open low willow-graminoid shrub bog and open low mixed shrub-sedge tussock bog (Loso 2006). The vegetation types in the upper Kotsina River drainage in the vicinity of facilities are: willow-birch shrub (90%), woodland needle leaf forest, open mixed forest and closed mixed forest (Alaska Department of Natural Resources 1985). Vegetation types near facilities in the Upper Kuskulana River drainage are alpine forb herbaceous (90%), open dwarf scrub and willow-birch shrub.

3.6.1.3 Western Wrangell Mountains

Facilities in the western Wrangell Mountains are located on floodplains, river terraces and lateral moraines of the Sanford and Cheshnina River drainages flowing from Mounts Drum and Sanford between 2,500 and 3,500 foot elevation. Floodplains are barren with seral dry forb herbaceous vegetation; whereas lateral moraines and river terraces have closed tall shrub and open tall shrub landcover types (Pacific Meridian Resources 1995).

3.6.1.4 Upper Chitina River Valley

Facilities in the Chitina River Valley are located on river terraces, floodplains and lateral moraines from 1,250 to 3,300 foot elevation. River terraces are predominately vegetated with woodland needleleaf forest with areas of closed forest, open needleleaf forest, and

willow-alder shrub (Alaska Department of Natural Resources 1985). Lateral moraine vegetation is also predominately woodland needleleaf forest with areas of closed dwarf shrub and willow-birch shrub.

3.6.1.5 Chisana River, White River, and Nutzotin Mountains

Facilities accessed from Chisana are on river terraces and floodplains of the Chisana River and White River drainages (including Cathenda Creek, Beaver Creek, Horsfeld Creek, Francis Creek and Ptarmigan Creek) from 3,200 to 3,550 foot elevation. There are also facilities in upland areas of the eastern Nutzotin Mountains in the Gold Hill area (between Big Eldorado and Bonanza Creeks) and on a northwest facing slope above Snag Creek. Elevations in the upland areas range from 4,500 to 5,000 feet.

Vegetation at Chisana (on the river terraces and floodplains of the Chisana River and Cathenda Creek) is predominately disturbed graminoid-forb herbaceous surrounded by woodland needle leaf forest (80%), dwarf shrub sedge bog (5%), open needle leaf forest (10%) and dwarf shrubs (5%) (Alaska Department of Natural Resources 1985). Facilities in the upper White River are located on active and inactive floodplains (90%) with seral herbs, and on river terraces (10%) with woodland need leaf forest, closed dwarf shrub, open dwarf shrub, and willow-birch shrub vegetation types. The facilities in the floodplains and river terraces of Beaver and Horsfeld Creek are located in open dwarf shrub (50%); dwarf shrub sedge bog (25%) and woodland needle leaf forest (25%). Vegetation of facilities in the Francis and Ptarmigan Creek drainages is primarily disturbed graminoid-forb herbaceous surrounded by need leaf woodland (95%) and open dwarf shrub (5%).

Seral herbs, open tall scrub and need leaf forest occur in and adjacent to creeks in the Gold Hill area. The remaining uplands at Gold Hill are predominately subalpine to alpine dwarf shrub and dwarf shrub-sedge bog plant communities. The upland slopes above Snag Creek range from barren alpine scree at the highest elevation to woodland need leaf forest on the moraine above the creek.

3.6.1.6 Malaspina Forelands

Facilities in Yakutat Bay on the Malaspina Forelands near Point Manby are in non-vegetated coastal strand and sparsely vegetated graminoid-forb herbaceous plant communities (USGS 1987).

3.6.2 Wetlands

National Wetland Inventory (NWI) maps have been completed for only 15 of the 68 USGS 1:63360 quadrangles covering the study area, so a summary of the wetland types in the study area is limited. Although the extent of wetlands has not been mapped for the park (there is no park-wide vegetation map), 50.7% of the surface area of Alaska is classified as wetlands (Hall, Frayer and Willen 1994) and we estimate a similar ratio for the vegetated landscape of this park. One NWI map covers a portion of the Nabesna

Road, one covers a small portion of the McCarthy Road (but there are no facilities on this map) and there is coverage of a portion of the Malaspina Forelands where there are facilities. There are no NWI maps in the Chisana area. A landcover map for a portion of the study area (Pacific Meridian 1977) indicates that the forested and scrub-shrub wetland types are common throughout the park. Riverine and lacustrine wetland types are also common throughout the park as are estuarine and marine communities on the coast.

The ice-free acreage for the park is approximately 8.4 million acres. Summarizing wetland landcover types for a portion of the park indicates that 52% of the mapped area has wetland landcover types. Application of this ratio to the ice-free area of the park results in an estimated 4.4 million acres of wetland in the park. Established facilities cover a maximum of 50 acres, a portion of which are classified as wetlands - an estimated 15.5 miles (Table 3.5). Regional descriptions of wetlands and known facilities follow.

3.6.2.1 Nabesna Road

The vegetation map for the Nabesna Quad (Alaska Department of Natural Resources 1985) indicates that woodland forest was 41% of the quadrat and other wetland types (wet sedge meadow, wet herbaceous meadow, dwarf shrub-sedge bog, floating and emergent aquatic and deep water) were 11% of the mapped area. Three facilities accessed from the Nabesna Road that are within the area mapped by the National Wetland Inventory program cover approximately 3.05 miles of palustrine needle-leaf forest, palustrine scrub-shrub and palustrine emergent wetlands. Field surveys during 2006 along the Nabesna Road indicated that an additional 0.07 miles of two facilities are within white spruce woodland forested wetlands (Loso 2006).

3.6.2.2 McCarthy Road, McCarthy, and Kennicott

Portions of four facilities accessed from the McCarthy Road are within forested or scrub-shrub wetlands (Loso 2007). Approximately 825 ft are adjacent to open low willow graminoid shrub bog or mixed shrub sedge tussock bog communities and approximately 3,656 feet are adjacent to an open black spruce forested wetland community.

3.6.2.3 Chisana River, White River and Nutzotin Mountains

A maximum of 2,800 feet along an access route in the Cathenda Creek floodplain may be within riverine wetlands. The White River facilities most likely occur in riverine and shrub-scrub wetlands. Palustrine scrub-shrub, forested, emergent and moss-lichen wetlands occur in the Horsfeld and Beaver Creek drainages. Ptarmigan and Francis Creek drainages are predominately palustrine forested and scrub shrub wetlands. Facilities at Snag Creek are not adjacent to or in wetlands.

Table 3.5 Estimated miles of established access to facilities that may pass through or be adjacent to wetlands.

Region	**Miles**	**Wetlands Types**
Nabesna Road	3.12	Palustrine forested Palustrine scrub-shrub Palustrine emergent
McCarthy Road	0.85	Palustrine forested Palustrine scrub-shrub Palustrine emergent
Chisana River (Cathenda Creek)	0.53	Palustrine unconsolidated shore Riverine unconsolidated shore Riverine unconsolidated bottom Riverine emergent
Gold Hill	8.44	Palustrine scrub-shrub Palustrine moss-lichen
White River	0.90	Riverine unconsolidated shore Riverine unconsolidated bottom Riverine emergent Palustrine scrub-shrub Palustrine unconsolidated shore
Horsfeld & Beaver Creek	0.81	Palustrine scrub-shrub Palustrine moss-lichen Palustrine emergent Palustrine forested
Western Wrangell Mountains	0.20	Palustrine unconsolidated shore Riverine unconsolidated shore Riverine unconsolidated bottom
Upper Chitina River	0.22	Riverine unconsolidated shore Riverine unconsolidated bottom Riverine emergent Palustrine unconsolidated shore
Malaspina Forelands	0.43	Estuarine subtidal unconsolidated bottom Estuarine intertidal unconsolidated shore
Total:	15.50	

3.6.2.4 Western Wrangell Mountains

Facilities on the upper Sanford River are just outside a NWI map which covers the adjacent portions of the Sanford River. Wetland types found here are: riverine unconsolidated shore, riverine unconsolidated bottom and palustrine unconsolidated shore. Facilities in the upper Cheshnina River drainage are most likely in upland, non-wetland communities.

3.6.2.5 Upper Chitina River Valley

Riverine unconsolidated shore, riverine unconsolidated bottom, riverine emergent and palustrine unconsolidated shore wetlands are found adjacent to facilities in the Chitina River drainage.

3.6.2.6 Malaspina Forelands

According to the NWI map for the Yakutat Quadrat, access to facilities on the Malaspina Forelands is through estuarine wetland plant communities.

3.6.2.7 Unique/Special Wetland Communities

The dominate wetland types on facilities are palustrine forested, palustrine scrub-shrub, and palustrine emergent, common wetland types in the park. It is not known if special or unique wetland communities occur on facilities since wetland inventories of all facilities have not been conducted and most of the park's wetlands have never been surveyed. However, 25% of the rare plant species that occur in the park are restricted to wetlands. Rare species and their communities are unique components of our ecosystems and are sensitive indicators to change as indicated by the fact that 45% of the nation's Threatened and Endangered Species depend on wetlands (Hall 1998). The following rare plants have been documented in wetlands in the vicinity of facilities and these communities should be considered sensitive:

Nabesna Road: *Carex atratiformis* and *Montia bostockii* - Lost Creek drainage (palustrine scrub shrub wetland).

McCarthy Road: *Carex lapponica* (Kuskulana River drainage -palustrine scrub shrub wetland), *Cypripedium parviflorum* (Gilihina River drainage - palustrine emergent wetland), *Myriophyllum verticillatum, Najas flexilus* and *Potamogeton subsibiricus* (Chokosna River drainage - palustrine scrub-shrub wetland and palustrine emergent wetland).

Upper Chitina River Valley: *Carex atherodes, C. parryi, C. eburnea* and *Tricophorum pumilum* var. *rollandii* (Barnard Glacier terminus, Clear Stream, Short River Pond, palustrine scrub shrub wetland and palustrine emergent wetland).

Chisana Vicinity: *Carex holostoma* (Horsfeld Creek - palustrine scrub shrub wetland).

3.6.3 Exotic Plants

Exotics plants are spreading along the road systems of Alaska and pose a threat to the native plant communities within the park (Lapina & Carlson 2004, AKEPIC 2005). There are 26 non-native plants known to occur on NPS land within this park, 14 of these are considered invasive by the Alaska Exotic Plant Information Clearinghouse (AKEPIC) and are referred to in this document as exotic species. An additional twelve exotic species

occur along state roads into the park, on private lands within the park or on the highways in the Copper River basin. (See appendix I.) No exotic plants have been documented for the Western Wrangell Mountains and Malaspina Forelands. Exotic plant concerns in the remaining regions are described below.

3.6.3.1 Nabesna Road

There are 11 exotic species occurring in the vicinity of the Nabesna Road. The most problematic is an extensive population of *Melilotus alba* (white sweet clover) at the junction of the Tok Cutoff and the Nabesna Road. This species is highly invasive and has been documented colonizing natural riverine habitats in southeast Alaska. It has the potential to spread down the Nabesna Road and into the Slana, Copper and Nabesna rivers. Along the road system, it successfully out competes all other herbaceous species due to its rapid growth of a deep taproot and extremely high seed output. Control efforts for the past five years at this location have had positive results, however, populations of white sweet clover on the rest of the road system in the Copper River Basin have continued to spread.

Compared to the McCarthy Road, the Nabesna Road is relatively weed free. There are a few small populations of *Crepis tectorum* (narrowleaf hawksbeard) and *Lappula squarrosa* (European stickseed) that have been controlled as well as scattered populations of *Taraxacum officinale* (common dandelion) that are being monitored and controlled. A population of *Lappula squarrosa* was also documented at Reeves Field at the end of the Nabesna Road in 1996. The other exotic species on the Nabesna Road are species commonly found near habitation, have occurred along the road for at least 20 years and are less likely to be a threat to native plant communities.

3.6.3.2 McCarthy Road, McCarthy, & Kennicott

Exotic plant species have been rapidly spreading from both ends of the McCarthy Road such that in the summer of 2006, there were very few areas along the McCarthy Road that were free of exotic species. One relatively weed free area is the west end of the Crystalline Hills. A growing population of *Melilotus alba* near the Chitina Airport on the Edgerton Highway has the potential to spread into the Copper and Chitina River drainages and down the McCarthy Road.

There are 15 exotic species documented along the McCarthy Road and 17 exotic species known to occur in the communities of McCarthy and Kennicott. Factors contributing to the spread of exotic plants in these areas include: extensive road work along the McCarthy Road in the past few years with the moving of infested fill one area to another; the increase in the number of vehicles using the road to access McCarthy and Kennicott, many of these traveling from the Anchorage area where weed seed is prevalent; increased development of private lands adjacent to the road and in Kennicott and McCarthy; and, increased visitor use of Kennicott and McCarthy with the spread by foot and clothing of exotic weed seed and material.

Fortunately, exotics have not yet been documented on park lands adjacent to the McCarthy Road except a population of *Bromus inermis* (smooth brome) which has spread from road fill to an adjacent drainage near Long Lake. However, without some control, there are many other species that may soon invade native plant communities adjacent to the road, particularly along creeks and drainages. *Vicia americana* (American vetch), considered a native to southeast Alaska, is spreading along the road at Long Lake into the adjacent forest. An undetermined *Vicia* has also been reported from park land adjacent to a facility at Crystal Creek. *V. americana* is as invasive in its life history as the problematic *Vicia cracca* (tufted bird vetch) which is spreading along the road system from Anchorage.

Exotics in McCarthy and Kennicott are primarily associated with private land. The two species that are spreading most rapidly (and which the NPS has been trying to control) are *Taraxacum officinale* (which has been spreading steadily out the Root Glacier trail and up the Bonanza Ridge trail), and *Leucanthemum vulgare* (oxeye daisy) which has been spreading downslope from the Kennicott Lodge where it is planted as an ornamental. *Taraxacum officinale* is likely to out compete the native dandelions that were known from the Bonanza Ridge trail as well as other native species, particularly some rare sub-alpine species documented by Nordell and Schmitt (1974). *Leucanthemum vulgare* has invaded the roadsides south of Anchorage and has displaced the native seral communities throughout much of the Kenai Peninsula. It has been spreading rapidly down the moraines from the Kennicott Lodge and could invade the Kennicott floodplain and adjacent drainages and out compete the native floodplain seral communities.

3.6.3.3 Chisana River, White River & Nutzotin Mountains

No exotic plant inventories have been conducted in the Nutzotin Mountains except for the Chisana airstrip where three exotic plant species were documented: *Lappula squarrosa* (European stickseed), *Bromus inermis* and *Descurania sophia* (flixweed) (McKee 2003). Vouchers of other exotic plants have been made from Stuver Creek (*Taraxacum officinale*), Horsfeld Creek (*Poa pratensis* ssp. *pratensi*s - Kentucky bluegrass) and the White River (*Achillea millefolium* - common yarrow). It is likely that exotics occur at other airstrips and within grazing areas in the park.

3.6.3.4 Upper Chitina River Valley

Lappula squarosa was collected in 1984 from a grazing lease in the Chitina River and from two localities at the head of the Chitina River in 1995 and 2003 (Blondie Ridge and Baldwin Glacier). *Polygonum aviculare* (prostrate knotweed) was collected on Mt. Chitina at the head of the Chitina River in 1995.

3.6.4 Rare Plants

Botrychium lineare (slender moonwort - Ophioglossaceae), a USFWS candidate for the Threatened and Endangered List is known from two localities in the park: an off-road

vehicle trail connecting to the Chisana airstrip, and a remote bluff above the Chisana River. It could occur in facilities at Chisana.

The state of Alaska does not have a rare plant list. However, federal agencies in Alaska use the Alaska Natural Heritage Program (AKNHP) rare vascular plant tracking list to guide their protection of rare plants and their habitat. Species with a state rank of three or less (known from less than 100 occurrences in the state) are on this list and it is National Park Service policy to avoid actions that would have negative effects on these species and their habitat. There are 89 species in the park that are on the 2007 AKNHP rare vascular plant tracking list for the park (appendix J). Twenty-five of these rare species have been documented adjacent to facilities. These are:

Nabesna Road

Carex atratiformis
Montia bostockii
Phacelia mollis

McCarthy Road, Kennicott & /McCarthy

Carex lapponica
Cypripedium parviflorum
Juniperus horizontalis
Myriophyllum verticillatum
Najas flexilus
Papaver alboroseum
Potamogeton subsibiricus
Viola selkirkii

Upper Chitina River Valley

Arenaria longipedunculata
Carex atherodes
Carex parryi
Carex eburnea
Douglasii gormanii
Juniperus horizontalis
Montia bostockii
Poa secunda subsp. *secunda*
Stellaria alaskana
Tricophorum pumilum var. *rollandii*

Malaspina Forelands

Salix hookeriana

Chisana River, White River & Nutzotin Mountains

Botrychium lineare
Botrychium tunux
Botrychium yaaxudakeit
Carex holostoma
Cryptogramma stelleri
Draba stenopetala

Based on their known spatial and ecological distribution in the park, an additional 15 species have the potential to occur in or near facilities. These are:

Astragalus harringtonii
Carex adelostoma
Carex laxa
Carex phaeocephala
Ceratophyllum demersum
Chamaerhodos erecta
subsp. *nuttallii*
Elymus calderi
Eriophorum viridicarinatum
Limosella aquatica
Lupinus kuschei
Pedicularis macrodonta
Poa leptocoma
Potamogeton obtusifolius
Salix setchelliana
Trisetum sibiricum
subs*p. Litorale*

3.7 Wilderness

The Wilderness Act of 1964 (P.L. 88-577) describes wilderness as an area "untrammeled by man…retaining its primeval character and influence, without permanent improvements of human habitation… [with] outstanding opportunities for solitude or a primitive and unconfined type of recreation." Wrangell-St. Elias National Park and Preserve is the largest unit of the national park system and includes the largest unit of the national wilderness preservation system. The wilderness was designated by ANILCA in 1980 and its size and scope give this wilderness national and international recognition. WRST contains approximately 9,677,000 acres of designated wilderness (NPS Wilderness FEIS 1988), or about 8.5% of the national wilderness preservation system. This encompasses approximately 200,000 acres of private lands.

ANILCA Section 707 directs that wilderness be managed in accordance with the Wilderness Act of 1964, except as otherwise expressly provided for in ANILCA. ANILCA Title XI offers specific exceptions to the Wilderness Act for the purposes of access. This provision extends special provisions for access to lands within WRST using motorized or mechanical means on permanent trails, roads or airstrips that would otherwise be prohibited.

3.7.1 NPS Management Policies

By policy the term "wilderness" includes the categories of eligible, study, proposed, recommended and potential, as well as designated. In policy, "the NPS will take no action that would diminish the wilderness eligibility of an area possessing wilderness characteristics until the legislative process of wilderness designation has been

completed." (NPS Mgt. Policies, Ch. 6.3.1, 2006). This includes use of the minimum requirements concept regardless of wilderness category.

Wilderness character is the fundamental concept in the Wilderness Act of 1964 and is broadly defined in Section 2(c) but is not further defined in NPS policies. Wilderness character is the overarching and supplemental park management goal for areas so delineated. The NPS manages wilderness areas to be protected and remain unimpaired for future enjoyment as wilderness. Any proposal having the potential to impact wilderness resources will be evaluated in accordance with NPS policy or implementing NEPA. In evaluating environmental impacts, the NPS will consider: 1) wilderness characteristics and values, including the primeval character and influence of the wilderness; 2) the preservation of natural conditions, and 3) assurance that there will be outstanding opportunities for solitude, that the public will be provided with a primitive and unconfined type of recreational experience, and that wilderness will be preserved and used in an unimpaired condition. (NPS Mgt. Policies, Ch. 6.3.4.3, 2006)

The management of rights-of-way in Alaska national park wilderness areas are directed by policies at 6.4.8, which indicate access procedures affecting these areas are governed by ANILCA and its regulations in 43 CFR Part 36 and 36 CFR Part 13. See section 1.3.1.2 for more in depth discussion of these policies.

3.7.2 WRST Wilderness

The Wrangell-St. Elias Wilderness encompasses a wide variety of terrain, including mountains, ice fields, beaches, boreal forest and alpine tundra. Wilderness resources (including undeveloped, untrammeled, naturalness and opportunity for solitude) are in excellent condition throughout most of the park and preserve. Wilderness areas are affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable, keeping them largely untrammeled and natural. Human use and occupancy has occurred for a long period in this conservation system unit, however, and some facilities and historic features are compatible with the wilderness character. The WRST designated and eligible wilderness areas already contain many anthropogenic features, which detract from its undeveloped character. These include roads, trails, airstrips, mines, communities, remote cabins and camps, seismic and climate monitoring stations, and radio repeaters. Nevertheless, the WRST's wilderness retains outstanding opportunities for solitude or a primitive and unconfined type of recreation. Visitors to WRST's remote backcountry areas rarely encounter other people or signs of human presence except at their access portal or in areas near developed roads or communities.

ANILCA Section 1317(a) directs the Secretary of the Interior to review the wilderness suitability of all National Park Service lands in Alaska not already designated as wilderness for future designation. Wilderness review criteria specific to WRST were developed to accomplish that task. The park completed its review in the mid-1980s and included its findings in its General Management Plan, the FONSI for which was signed on November 26, 1986. WRST identified seven general areas which do not meet wilderness criteria: 1) a narrow strip of land paralleling the shore of the Malaspina

Forelands is unsuitable because of commercial fishing activities; 2) the area around Chisana is unsuitable because of extensive mineral development and nonfederal interests; 3) several scattered parcels of federal land between the Copper River and Mt. Drum are unsuitable because they are surrounded by nonfederal lands; 4) the Kuskulana Valley is unsuitable because of mineral development and well-defined routes to several nonfederal interests; 5) an area east of McCarthy is unsuitable because of its extensive mining claims, active mining operations, human habitation, and numerous buildings; 6) an area between the Nabesna Road and Tanada Lake, and the Suslota Lake Trail north of the Nabesna Road that provides access to BLM lands north of the preserve, are unsuitable because of the impacts from regularly used access routes for subsistence, recreation, and nonfederal interests; and 7) the main road corridors, including the McCarthy Road, the Nabesna Road, the Dan Creek Road, and McCarthy-Kennecott Road. The are approximately 3,498,000 acres not designated as wilderness, of which 2,243,800 acres are considered suitable for future wilderness designation (NPS 1986 - WRST GMP pp 34-36).

The Wilderness Suitability Map presented in the WRST's General Management Plan (NPS 1986) reflects the finding described in the GMP/EA. Even small nonfederal parcels are excluded, as well as a half-mile-wide buffer on every side. This also applies to roads and trails, where a half-mile-wide buffer is excluded on each side of the corridor. Under these criteria, we anticipate that five of WRST's existing access corridors possess potential to affect either eligible or designated wilderness.

The full wilderness review process required under ANILCA section 1317(b) has not yet been completed. An EIS was drafted for WRST Wilderness Review (NPS 1988), but no final action was taken in the Secretary of the Interior's office and no record of decision was published in the Federal Register. This leaves all eligible wilderness acreage managed under NPS policies that protect wilderness character until Congress chooses to act.