SOIL SURVEY OF

TOTCHAKET AREA ALASKA

United States Department of Agriculture
Soil Conservation Service
in cooperation with
University of Alaska Agricultural Experiment Station

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1975-77. Soil names and descriptions were approved in 1978. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1978. This survey was made cooperatively by the Soil Conservation Service and the University of Alaska Agricultural Experiment Station. It is part of the technical assistance furnished to the Alaska Soil Conservation Districts.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Typical landscape in the Totchaket Area. The soil is Kantishna peat.

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Foreword

This soil survey contains information that can be used in land-planning programs in Totchaket Area, Alaska. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to permafrost. Some are too unstable to be used as a foundation for buildings or roads. Permafrost or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

State Conservationist

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Location of Totchaket Area in Alaska.

Soil Survey of Totchaket Area, Alaska

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TOTCHAKET AREA is in the south-central part of Alaska. It extends west from Nenana to the Kantishna River. It has a total area of 579,790 acres, or 906 square miles.

The survey area consists mainly of a large outwash plain that is almost encompassed by a broad, nearly level alluvial plain. Stabilized sand dunes are on the outwash plain, and in places, on the alluvial plain. Elevation generally ranges from 300 to 600 feet. The highest elevation, on a sand dune, is 684 feet above sea level.

The entire survey area drains north into the Tanana River. Drainage of the proglacial outwash plain is mostly internal. The soils on the outwash plain are dominantly well drained to excessively drained. Only a few intermittent drainageways and small lakes are in this area. The soils on the alluvial plain generally have a water table at or near the surface. Several shallow lakes are on the alluvial plain, which is drained by a few discontinuous drainageways and numerous sloughs. Also on the alluvial plain, in the eastern part of the survey area, are two small rivers—the East Middle River and the West Middle River.

The well drained soils in the survey area support extensive stands of aspen, paper birch, and white spruce. The poorly drained soils generally support stands of black spruce, and the broad areas of waterlogged soils support mosses, sedges, and low-growing shrubs.

Permafrost in the area occurs only in some of the soils. It generally is at a depth of less than 30 inches in the silty sediment on the alluvial plain and in depressional areas on the outwash plain. In these areas the permafrost is preserved by a thick surface cover of moss or other organic matter, which serves as insulating material. If the organic material is removed, burned, or otherwise disturbed, the permafrost recedes to a greater depth. The depth to which the permafrost recedes depends on several factors, such as the thickness of the organic layer, the direction in which slopes face, drainage, and the moisture content of the soil.

Much of the acreage in the survey area has potential for crops such as potatoes, hardy vegetables, perennial grasses, oats, and barley.

Descriptions, names, and delineations of soils in this soil survey may not fully agree with those on soil maps for adjacent survey areas. Differences are the result of better knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of the soils within the survey area.

General nature of the survey area

This section briefly discusses the climate, settlement and development, geology, and permafrost and frost action in the survey area.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina

The climate of the Totchaket Area is very cold during long winters that are characterized by few hours of daylight and a continuous snow cover. Summers, though short, are moderately warm because the sun shines for as long as 18 to 21 hours each day. Most precipitation falls during the growing season and is adequate for crops adapted to the temperature and duration of the season.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Nenana, Alaska, for the period 1951 to 1971. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is -8 degrees F and the average daily minimum temperature is -18 degrees. The lowest temperature on record, which occurred at Nenana on December 28, 1961, is -69 degrees. In summer, the average temperature is 57 degrees and the average daily maximum temperature is 68 degrees. The highest recorded temperature, which occurred on June 15, 1969, is 93 degrees.

Growing degree days, shown in table 1, are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 9 inches, or 80 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 6 inches. The heaviest 1-day rainfall during the period of record was 3.04 inches at Nenana, on August 12, 1967. Thunderstorms occur on about 5 days each year, and most occur in summer.

Average seasonal snowfall is 49 inches. The greatest snow depth at any one time during the period of record was 44 inches. On the average, 78 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 70 percent. The percentage of possible sunshine is 50 in summer and 40 in winter.

The prevailing wind is from the north. Average windspeed is highest in summer, at 8 miles per hour.

Settlement and development

Nenana is the largest town adjoining the survey area. It is on the east bank of the Nenana River at its confluence with the Tanana River. It was originally an Indian village named after the nearby stream. In 1907 the St. Marks Indian Mission was established nearby. In 1916 a base was built for the construction of the Alaska Railroad, and this was the beginning of the modern town. At Nenana, trains connected with freight and passenger steamers that operated on the Yukon River system. Nenana was, and still is, a major distribution point for a large part of central Alaska bordering the Yukon River and its principal tributaries.

In 1970 Nenana had a population of about 362. The railroad and barge line are still important businesses in the town. Two small lumber mills are located nearby. Clear Air Force Base provides a major source of income. Hunting, fishing, and trapping remain important in the economy of the area.

Geology

The proglacial outwash plain in the central part of the survey area probably is the result of melting glaciers washing sandy material northward from the retreating glacial front on the north slope of the Alaska Range (fig. 1). This outwash plain slopes gradually to the Tanana River in the north (*8*).

Cold air rushing down the mountains blows sand on the plains into dunes. Eddying winds around the toe slopes of the Kantishna Hills have blown the sand dunes into an unusual rosette pattern. These dunes, located in the south-central part of the area, are about 50 to 150 feet high. Many elongated dunes have formed farther away from the mountains. These dunes are oriented from southwest to northeast, which was the direction of the strong prevailing winds at the time of deposition. Some of these dunes are several miles long.

Silty micaceous loess, derived chiefly from the Tanana River, has covered the plains with a mantle a few inches to several feet thick. It generally is thinner in places farther away from the Tanana River.

As the glacial front retreated, glaciers continued to discharge water that carried heavy loads of material into meandering rivers, forming broad alluvial plains. The alluvial deposits on the flood plains are mostly stratified micaceous silt and sand. The only place where gravel has been observed is in the river channels, where it is overlain by several feet of alluvium.

Permafrost and frost action

Permafrost, or perennially frozen soil, is a major concern in the Totchaket Area (*9*). The Dotlake and Goldstream soils on outwash plains have a perennially frozen subsoil. The subsoil of the Bolio soils also has permafrost. Large areas of Bradway, Goldstream, and Tanana soils on alluvial plains and low terraces are underlain by permafrost. When moss or other insulating vegetation is removed from the surface of these soils, the uppermost part of the permafrost thaws. This commonly causes subsidence of the overlying soil material.

Roads and structures constructed on permafrost soils are susceptible to uneven settling unless special construction methods are used. In summer, the soils are nea always saturated in the zone above the permafros. If the excess water is not removed, especially along roads, even more irregular settling is likely because the hazard of frost heaving in these soils is severe in winter. In areas of the Bolio and Kantishna soils, which formed in peat and have permafrost, removal of the surface mat will cause melting of the permafrost and ponding.

Frost action is a concern on all of the soils in the survey area. Among the soil properties that influence frost action are texture, porosity, and depth to the water table during periods of freezing. Although a precise correlation has not been established, only the soils in the Totchaket Area that contain less than 3 percent material

Figure 1.—Natural erosion where Toklat River cuts into proglacial outwash plain of stratified sandy material.

finer than 0.074 millimeter are believed to be nonsusceptible to frost heaving. None of the soils in the area fully meet this requirement. The well drained soils on alluvial plains, outwash plains, and stabilized dunes have a sandy substratum, and they generally have low or moderate frost action potential. The soils that formed in deep silty and very fine sandy material and that have permafrost and a high water table have high frost action potential.

How this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby areas and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show vegetation, muskegs, streams, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are examined in the field to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

General soil map for broad land use planning

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The map units in the Totchaket Area are discussed in the following pages.

Descriptions of map units

1. Nenana-Volkmar

Deep, nearly level to strongly sloping, well drained and moderately well drained, silty soils; on outwash plains

This map unit is on outwash plains in the north-central part of the survey area. The soils formed in silty loess that is underlain by sand. Elevation is 300 to 500 feet. Average annual air temperature is about 26 degrees F, and average annual precipitation is 12 inches. The frost-free period is about 82 days.

This unit supports pure and mixed stands of young white spruce, paper birch, and quaking aspen. Scattered stands of black spruce are common.

This unit makes up about 29 percent of the survey area. Nenana soils make up about 55 percent of the unit and Volkmar soils about 25 percent. The remaining 20 percent is soils of minor extent.

Nenana soils are on broad outwash plains. They are well drained, nearly level to strongly sloping silt loams.

Volkmar soils are in slightly depressional areas on outwash plains. The soils are moderately well drained, nearly level silt loams.

Minor in this unit are Beales soils on dunes; Fairbanks and Koyukuk soils on outwash plains; and Dotlake, Goldstream, Richardson, Toklat, and Bolio soils in depressional areas on outwash plains.

This unit is used for wildlife habitat.

The soils in this unit are potentially the most productive ones in the survey area for farm crops. If cleared, fertilized, and properly managed, the soils are suitable for frost-resistant vegetables, potatoes, barley, oats, and grasses. The potential for irrigation appears to be high.

Merchantable stands of paper birch, quaking aspen, and white spruce can be grown on the Nenana soils and on the similar minor soils.

The potential for urban uses is good for the Nenana soils, except in places where slope and frost action potential are limitations.

2. Teklanika-Beales-Nenana

Deep, nearly level to steep, well drained to excessively drained, silty soils that are underlain by sand; on outwash plains

This map unit is on outwash plains in the southern part of the survey area. The soils formed in silty loess. Elevation is about 500 to 600 feet. Average annual temperature is about 26 degrees F, and average annual precipitation is 12 inches. The frost-free period is about 82 days.

This unit supports stands of white spruce, paper birch, quaking aspen, and black spruce.

This unit makes up about 22 percent of the survey area. Teklanika soils make up about 30 percent of the unit, Beales soils about 28 percent, and Nenana soils about 24 percent. The remaining 18 percent is soils of minor extent.

Teklanika soils are on dunes and escarpments on outwash plains. These soils are excessively drained. They are rolling to steep, wind-laid sands.

Beales soils are on low dunes on outwash plains. These soils are somewhat excessively drained. They are nearly level to undulating wind-laid silt loams.

Nenana soils are on outwash plains. These soils are well drained. They are wind-laid silt loams.

Minor in this unit are Dotlake and Goldstream soils in depressional areas.

This unit is used for wildlife habitat.

The Nenana soils in this unit are suitable for cultivated crops and grasses. The Beales soils are droughty and require supplemental irrigation for maximum production. The Teklanika soils are highly susceptible to water erosion and soil blowing if they are cleared.

3. Goldstream-Bolio-Kantishna

Shallow to deep, nearly level, poorly drained, silty soils and very poorly drained peat soils; on broad alluvial plains

This map unit is on broad alluvial plains with scattered dunes. The soils formed in water-laid sediment or in peaty muskegs and have permafrost. Elevation is 300 to 450 feet. Average annual air temperature is about 26 degrees F, and average annual precipitation is about 12 inches. The average frost-free period is about 82 days.

This unit supports a sparse forest of black spruce, low-growing shrubs, sedge tussocks, moss, and lichens or scattered tamarack, low-growing shrubs, grasses, sedges, and hypnum moss. Treeless areas that have a plant cover dominantly of sphagnum moss are common. Areas of paper birch, quaking aspen, white spruce, and brush are on low dunes.

This unit makes up about 38 percent of the survey area. Goldstream soils make up about 60 percent of the unit, Bolio soils about 22 percent, and Kantishna soils about 10 percent. The remaining 8 percent is soils of minor extent.

Goldstream soils are poorly drained silt loams with a thick surface mat of organic material. Permafrost is at a depth of about 21 inches.

Bolio and Kantishna soils are shallow, very poorly drained peat soils. Bolio soils are dominantly partly decomposed sedge. Permafrost is at a depth of 8 to 20 inches. Kantishna soils are mostly coarse sphagnum moss and sedge fibers.

Minor in this unit are Beales soils on low dunes and Volkmar and Dotlake soils in low-lying areas.

This unit is used for wildlife habitat.

The soils in this unit are poorly suited to cultivated crops because of flooding and wetness. The potential for urban uses or commercial timber stands generally is very poor. The unit is limited by extensive areas of poorly drained soils that are intermingled with scattered areas of more suitable soils.

4. Tanana-Salchaket

Moderately deep and deep, nearly level, well drained and somewhat poorly drained, silty soils and very fine sandy loams; on flood plains

This map unit is on the narrow flood plains bordering the Kantishna, Tanana, Nenana, and Toklanika Rivers. The soils formed in water-laid material. Elevation is about 300 to 450 feet. Average annual air temperature is about 26 degrees F, and average annual precipitation is about 12 inches. The frost-free period is about 82 days.

This unit supports a forest dominantly of white spruce, paper birch, quaking aspen, and cottonwood. Areas of black spruce, which are interspersed with treeless areas that have a cover of low-growing shrubs, sedges, and moss, are on the poorly drained minor soils of this unit.

This unit makes up about 11 percent of the survey area. Tanana soils make up about 52 percent of the unit and Salchaket soils 32 percent. The remaining 16 percent is soils of minor extent.

The Tanana soils are on broad flood plains. They are moderately deep, somewhat poorly drained silt loams. Permafrost is at a depth of 20 to 40 inches.

Salchaket soils are on natural levees. They are deep and well drained very fine sandy loams that are underlain by sandy alluvial deposits.

Minor in this unit are Goldstream and Bradway soils in old abandoned stream channels and on the lower parts of flood plains.

This unit is used for wildlife habitat.

The soils in this unit are subject to occasional flooding. If the Tanana soils are properly drained, they are suited to hardy vegetables, grain, and grasses. The Salchaket soils are suited to all crops that are adapted to the area, but they tend to be droughty.

The Salchaket and Tanana soils can support good stands of white spruce and paper birch. In places where they have been subject to repeated fires, however, they generally support willow, alder, young birch, and aspen. The potential for commercial timber is good on the Salchaket soils and fair on the Tanana soils.

The potential for urban uses is limited by flooding, poor drainage, and permafrost.

Soil maps for detailed planning

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil. They can be used to plan management for food and fiber production; to plan land use; and to enhance, protect, and preserve the environment. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil, a brief description of the soil profile, and a listing of the principal hazards and limitations to be considered in planning management.

Soils that have about the same profile make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture, slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Koyukuk silt loam, rolling, is one of several phases in the Koyukuk series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more major soils. Areas of these soils are so intricately intermingled or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Toklat-Bolio complex is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ from those of the major soil or soils. Such differences could significantly affect use and management of the map unit. The included soils are identified in each map unit description. In some survey areas, a few included soils are identified on the soil maps by a spot symbol.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil descriptions

1—Beales silt loam, nearly level. This somewhat excessively drained soil is on stabilized dunes and in dry lake basins on outwash plains. It formed in loamy loess underlain by sandy outwash. Slope is 0 to 3 percent. The native vegetation is mainly an open forest of quaking aspen, paper birch, and white spruce in pure and mixed stands. In places the vegetation is mainly black spruce, lowbush cranberry, and moss. Elevation is 300 to 650 feet.

Typically, the surface is covered with a mat of partially decomposed forest litter and many fine roots about 1 inch thick. The surface layer is dark brown silt loam 2 inches thick. The upper 4 inches of the subsoil is brown silt loam. The lower 4 inches is reddish brown fine sandy loam and brown loamy fine sand. The substratum to a depth of 40 inches or more is olive brown and grayish brown fine sand.

Included in this unit are small areas of Dotlake, Goldstream, Nenana, Teklanika, Toklat, and Volkmar soils.

Permeability of this Beales soil is rapid. Available water capacity is low. Rooting depth is about 40 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate if the plant cover is removed.

This unit is used for wildlife habitat.

This unit is suited to climatically adapted crops. It is limited mainly by droughtiness. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crops respond to nitrogen, phosphorus, and potassium fertilizer.

This unit can produce about 800 cubic feet of paper birch and quaking aspen per acre from a fully stocked stand of even-aged, 60-year-old trees 4.5 inches or more in diameter at breast height. Conventional methods can be used for harvesting timber except during thaw in spring and during short periods following heavy showers in summer.

This unit is well suited to homesite development if community sewage systems are used. Onsite sewage disposal systems are limited by seepage and the hazard of polluting ground water.

This map unit is in capability subclass IVs.

2—Beales silt loam, undulating. This somewhat excessively drained soil is on stabilized dunes and in dry lake basins on outwash plains. It formed in loamy loess underlain by sandy outwash. Slope is 3 to 7 percent. The native vegetation is mainly an open forest of quaking aspen, paper birch, and white spruce in pure and mixed stands (fig. 2). In places the vegetation is mainly black spruce, lowbush cranberry, and moss. Elevation is 300 to 650 feet.

Typically, the surface is covered with a mat of partially decomposed forest litter and many fine roots about 1 inch thick. The surface layer is dark brown silt loam 2 inches thick. The upper 4 inches of the subsoil is brown silt loam. The lower 4 inches is reddish brown fine sandy loam and brown loamy fine sand. The substratum to a depth of 40 inches or more is olive brown and grayish brown fine sand.

Included in this unit are small areas of Dotlake, Goldstream, Nenana, Teklanika, Toklat, and Volkmar soils.

Permeability of this Beales soil is rapid. Available water capacity is low. Rooting depth is 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate if the plant cover is removed.

This unit is used for wildlife habitat.

This unit is suited to climatically adapted crops. It is limited mainly by droughtiness and the hazard of erosion. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crops respond to nitrogen, phosphorus, and potassium fertilizer.

This unit can produce about 600 cubic feet of paper birch per acre from a fully stocked stand of even-aged, 60-year-old trees 4.5 inches or more in diameter at breast height. Conventional methods can be used for harvesting timber except during thaw in spring and during short periods following heavy showers in summer.

This unit is well suited to homesite development if community sewage systems are used. Onsite sewage disposal systems are limited by seepage and the hazard of polluting ground water.

This map unit is in capability subclass IVe.

Figure 2.—A mixed forest of quaking aspen, paper birch, and white spruce on Nenana and Beales soils.

3—Bolio peat. This deep, poorly drained soil is in broad, depressional areas on low terraces. It formed in partially decomposed peat derived dominantly from sedges. The native vegetation is mainly sedge, sedge tussocks, moss, and shrubs. Slopes are 0 to 1 percent. Elevation is 300 to 450 feet.

Typically, the surface is covered with a mat of living plants and roots about 3 inches thick. The soil to a depth of 20 inches or more is black and dark reddish brown, partly decomposed organic matter. Permafrost is at a depth below 8 inches.

Included in this unit are small areas of Dotlake, Goldstream, Kantishna, and Volkmar soils. Also included are small areas of ponded soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Bolio soil is moderate above the permafrost. Water is perched above the permafrost in summer. This soil is subject to frequent ponding during the spring thaw. It can be expected to subside under the influence of loads on the surface or drainage.

This unit is used for wildlife habitat.

This map unit is in capability subclass VIw.

4—Bradway very fine sandy loam. This deep, poorly drained soil is in former stream channels on alluvial plains. It formed in stratified, loamy alluvial sediment. Slope is 0 to 3 percent. The native vegetation is mainly a dense stand of sedges and grass (fig. 3). Black spruce, willows, and shrubs grow in places. Elevation is 300 to 350 feet.

Typically, the surface is covered with a mat of partly decomposed organic material and live roots about 6 inches thick. The surface layer is dark brown very fine sandy loam 5 inches thick. The upper 9 inches of the underlying material is gray fine sandy loam. The lower part to a depth of 32 inches is gray loamy fine sand. Permafrost is at a depth below 30 inches.

Included in this unit are small areas of Salchaket and Tanana soils.

Permeability of this Bradway soil is moderately rapid above the permafrost. Available water capacity is moder-

Figure 3.—An area of Bradway soils. The plant cover is willows and sedges.

ate. Rooting depth is 30 inches. Runoff is slow to ponded, and the hazard of water erosion is slight. The water table is within 6 inches of the surface in summer. This soil is subject to occasional flooding and ponding during the spring thaw.

This unit is used for wildlife habitat.

This unit is poorly suited to crops. The main limitations are wetness, permafrost, and ponding.

This map unit is in capability subclass VIw.

5—Dotlake silt loam. This deep, somewhat poorly drained soil is in depressional areas on outwash plains, and it borders dunes on alluvial plains. It formed in a thin layer of silty loess and is underlain by fine, sandy outwash material. Slope is 0 to 3 percent. The native vegetation is mainly black spruce, low-growing shrubs, sedges, polytrichum moss, lichens, and horsetail. Elevation is 300 to 500 feet.

Typically, the surface is covered with a mat of moss, forest litter, mycelia, and many live roots about 3 inches thick. The surface layer is very dark grayish brown silt loam 1 inch thick. The subsoil is gray and dark yellowish brown silt loam 14 inches thick. The substratum to a depth of 40 inches or more is dark grayish brown fine sand. Permafrost is at a depth of 28 inches.

Included in this unit are small areas of Beales, Goldstream, Nenana, and Volkmar soils.

Permeability of this Dotlake soil is moderately rapid above the permafrost. Available water capacity is moderate. Runoff is very slow, and the hazard of water erosion is slight. Water is perched above the permafrost in summer.

This unit is used for wildlife habitat.

This unit is suited to climatically adapted crops. It is limited mainly by wetness and a short growing season.

This map unit is in capability subclass IIIw.

6—Fairbanks silt loam, undulating. This deep, well drained soil is on outwash plains. It formed in silty loess and is underlain by sandy outwash. Slope is 0 to 7 percent. The native vegetation is mainly pure and mixed stands of quaking aspen, paper birch, and white spruce. Elevation is 300 to 400 feet.

Typically, the surface is covered with a mat of forest litter and roots about 2 inches thick. The surface layer is dark brown and brown silt loam 5 inches thick. The upper 8 inches of the subsoil is dark yellowish brown silt loam. The lower 6 inches is yellowish brown silt. The upper 19 inches of the substratum is grayish brown silt. The lower part to a depth of 60 inches is gray silt loam.

Included in this unit are small areas of Goldstream, Nenana, Richardson, and Volkmar soils.

Permeability of this Fairbanks soil is moderate. Available water capacity is high. Rooting depth is about 30 inches. It is restricted by cold soil temperatures and low biological activity within the root zone. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used for wildlife habitat.

This unit is well suited to climatically adapted crops. It is limited mainly by the moderate hazards of water erosion and soil blowing. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

The organic matter content can be maintained by using all crop residue, plowing under cover crops, and using a suitable rotation. Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control erosion. Crops respond to nitrogen, phosphorus, and potassium fertilizer. Stripcropping and field windbreaks help to control soil blowing and to conserve moisture.

This unit can produce about 2,600 cubic feet or 5,700 board feet (International rule) of white spruce, quaking aspen, and paper birch per acre from a fully stocked stand of even-aged, 80-year-old trees 4.5 inches or more in diameter at breast height. This unit has few limitations. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if heavy equipment is used while the soil is wet.

This unit is well suited to homesite development. It has few limitations.

This map unit is in capability subclass IIe.

7—Fairbanks silt loam, rolling. This deep, well drained soil is on outwash plains. It formed in silty loess and is underlain by sandy outwash. Slope ranges from 7 to 20 percent but is dominantly less than 12 percent. The native vegetation is mainly pure and mixed stands of quaking aspen, paper birch, and white spruce. Elevation is 300 to 400 feet.

Typically, the surface is covered with a mat of forest litter and roots about 2 inches thick. The surface layer is dark brown and brown silt loam 5 inches thick. The upper 8 inches of the subsoil is dark yellowish brown silt loam. The lower 6 inches is yellowish brown silt. The upper 19 inches of the substratum is grayish brown silt. The lower part to a depth of 60 inches is gray silt loam.

Included in this unit are small areas of Nenana and Volkmar soils.

Permeability of this Fairbanks soil is moderate. Available water capacity is high. Rooting depth is about 30 inches. It is restricted by cold soil temperatures and low biological activity within the root zone. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used for wildlife habitat.

If this unit is used for cultivated crops, the main limitations are steepness of slope and the hazard of erosion.

This unit can produce about 2,600 cubic feet or 5,700 board feet (International rule) of white spruce, quaking aspen, and paper birch per acre from a fully stocked stand of even-aged, 80-year-old trees 4.5 inches or more in diameter at breast height. Minimizing the risk of erosion is essential in harvesting timber. Roads should be on the contour, and skid trails should be provided with many water bars after logging.

This unit is suited to homesite development. The main limitation is steepness of slope. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed.

This map unit is in capability subclass IIIe.

8—Fairbanks silt loam, very steep. This deep, well drained soil is on stabilized dunes on outwash plains. It formed in silty loess and is underlain by sandy outwash. Slope ranges from 20 to 50 percent but is dominantly more than 30 percent. The native vegetation is mainly pure and mixed stands of quaking aspen, paper birch, and white spruce (fig. 4). Elevation is 300 to 400 feet.

Typically, the surface is covered with a mat of forest litter and roots about 2 inches thick. The surface layer is dark brown and brown silt loam 5 inches thick. The upper 8 inches of the subsoil is dark yellowish brown silt loam. The lower 6 inches is yellowish brown silt. The upper 19 inches of the substratum is grayish brown silt. The lower part to a depth of 80 inches or more is gray silt loam.

Included in this unit are small areas of Nenana soils.

Permeability of this Fairbanks soil is moderate. Available water capacity is high. Rooting depth is about 30 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used for wildlife habitat.

This unit can produce about 2,600 cubic feet or 5,700 board feet (International rule) of white spruce, quaking aspen, and paper birch per acre from a fully stocked stand of even-aged, 80-year-old trees 4.5 inches in diameter at breast height. The main concerns in producing and harvesting timber are steepness of slope and the hazard of erosion. Conventional methods of harvesting timber can be used. Minimizing the risk of erosion is essential in harvesting timber. Roads should be on the contour, and water bars should be provided.

This map unit is in capability subclass VIIe.

9—Goldstream silt loam. This deep, poorly drained soil is on broad alluvial plains and in depressional areas on outwash plains. It formed in silty alluvium. Slope is 0 to 3 percent. The native vegetation is mainly sedge tussocks, low-growing shrubs, moss, and some black spruce and tamarack. Elevation is 300 to 500 feet.

Figure 4.—Stand of white spruce on Fairbanks silt loam near junction of Kantishna and Tanana Rivers.

Figure 5.—An area of Kantishna peat. Mosses and marsh plants are the main vegetation.

Typically, the surface is covered with a mat of sedges and roots about 9 inches thick. The surface layer is black mucky silt loam 2 inches thick. The subsoil is dark gray and olive gray silt loam 19 inches thick.

Included in this unit are small areas of Bolio, Bradway, Lameta, Tanana, and Volkmar soils. Also included are small areas of Goldstream soils that have slopes of 3 to 12 percent.

Permeability of this Goldstream soil is moderate above the permafrost. Available water capacity is high. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. The water table is within 6 inches of the surface in summer. This soil is subject to ponding in spring.

This unit is used for wildlife habitat. The main limitations for cultivated crops are wetness and depth to permafrost.

This map unit is in capability subclass VIw.

10—Kantishna peat. This deep, very poorly drained soil is in filled-in lakes and abandoned stream channels on broad alluvial plains (fig. 5). It formed in coarse organic material. The native vegetation is mainly mosses, sedges, and marsh plants. Elevation is 300 to 350 feet.

Typically, the surface is covered with a mat of slightly decomposed mosses and sedges about 8 inches thick. The soil to a depth of 60 inches or more is dark reddish brown peat that is underlain by sparse fibrous peat suspended in water.

Included in this unit are small areas of Bolio, Bradway, Goldstream, Tanana, and Volkmar soils. Also included are small areas of open water.

Water is within 6 inches of the surface in summer. This soil is subject to frequent flooding, and water is ponded on the surface in spring.

This unit is used for wildlife habitat.

This map unit is in capability subclass VIIIw.

11—Koyukuk silt loam, nearly level. This deep, well drained soil is on high terraces and dunes on outwash plains. It formed in silty loess. Slope is 0 to 3 percent. The native vegetation is mainly a mixed forest of white spruce, quaking aspen, and paper birch. Elevation is 350 to 450 feet.

Typically, the surface is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is dark brown silt loam 1 inch thick. The subsoil is dark brown, yellowish brown, and strong brown silt loam 22 inches thick. The substratum to a depth of 42 inches or more is grayish brown silt loam.

Included in this unit are small areas of Nenana and Beales soils.

Permeability of this Koyukuk soil is moderate. Available water capacity is high. Rooting depth is about 30 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used for wildlife habitat.

This unit is well suited to climatically adapted crops. It has few limitations. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water.

The organic matter content can be maintained by using all crop residue, plowing under cover crops, and using a suitable rotation. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crops respond to nitrogen, phosphorus, and potassium fertilizer.

This unit is well suited to white spruce, quaking aspen, and paper birch. It can produce about 3,300 cubic feet, or 9,800 board feet (International rule), of merchantable timber per acre from a fully stocked stand of even-aged trees 80 years old. This unit has few limitations.

This unit is well suited to homesite development. It has few limitations.

This map unit is in capability subclass IIc.

12—Koyukuk silt loam, undulating. This deep, well drained soil is on high terraces and dunes on outwash plains. It formed in silty loess. Slope is 3 to 7 percent. The native vegetation is mainly white spruce, quaking aspen, and paper birch. Elevation is 350 to 450 feet.

Typically, the surface is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is dark brown silt loam 1 inch thick. The subsoil is dark brown, yellowish brown, and strong brown silt loam 22 inches thick. The substratum to a depth of 42 inches or more is grayish brown silt loam.

Included in this unit are small areas of Nenana and Beales soils.

Permeability of this Koyukuk soil is moderate. Available water capacity is high. Rooting depth is about 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used for wildlife habitat.

This unit is well suited to climatically adapted crops. It is limited mainly by slope and the hazard of erosion. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

The organic matter content can be maintained by using all crop residue, plowing under cover crops, and using a suitable rotation. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crops respond to nitrogen, phosphorus, and potassium fertilizer.

This unit is well suited to white spruce, quaking aspen, and paper birch. It can produce about 3,300 cubic feet, or 9,800 board feet (International rule), of merchantable timber per acre from a fully stocked stand of even-aged trees 80 years old. This unit has few limitations.

This unit is well suited to homesite development. It has few limitations.

This map unit is in capability subclass IIe.

13—Koyukuk silt loam, rolling. This deep, well drained soil is on high terraces and dunes on outwash plains. It formed in silty loess. Slope is 7 to 12 percent. The native vegetation is mainly a mixed forest of white spruce, quaking aspen, and paper birch. Elevation is 350 to 450 feet.

Typically, the surface is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is dark brown silt loam 1 inch thick. The subsoil is dark brown, yellowish brown, and strong brown silt loam 22 inches thick. The substratum to a depth of 42 inches or more is grayish brown silt loam.

Included in this unit are small areas of Nenana and Beales soils.

Permeability of this Koyukuk soil is moderate. Available water capacity is high. Rooting depth is about 30 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used for wildlife habitat.

This unit is suited to climatically adapted crops. It is limited mainly by slope and the high hazard of erosion. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

The organic matter content can be maintained by using all crop residue, plowing under cover crops, and using a suitable rotation. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crops respond to nitrogen, phosphorus, and potassium fertilizer.

This unit is well suited to white spruce, quaking aspen, and paper birch. It can produce about 3,300 cubic feet, or 9,800 board feet (International rule), of merchantable timber per acre from a fully stocked stand of even-aged trees 60 years old. The main concerns in producing and harvesting timber are runoff and the hazard of erosion.

This unit is suited to homesite development. The main limitation is slope.

This map unit is in capability subclass IIIe.

14—Nenana silt loam, moderately deep, nearly level. This well drained soil is on outwash plains. It is moderately deep over sand. It formed in silty loess underlain by fine sandy alluvium. Slope is 0 to 3 percent. The native vegetation is mainly pure and mixed stands of white spruce, quaking aspen, and paper birch. Elevation is 300 to 400 feet.

Typically, the surface is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is dark brown silt loam 2 inches thick. The upper 3 inches of the subsoil is dark yellowish brown silt loam. The lower 23 inches is olive brown silt. The substratum to a depth of 64 inches or more is olive gray stratified fine and medium sand.

Included in this unit are small areas of Koyukuk, Richardson, and Volkmar soils.

Permeability of this Nenana soil is moderate to a depth of 28 inches and rapid below this depth. Available water capacity is moderate. Rooting depth is about 30 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate if the plant cover is removed.

This unit is used for wildlife habitat.

This unit is well suited to climatically adapted crops. It has few limitations. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water.

The organic matter content can be maintained by using all crop residue, plowing under cover crops, and using a suitable rotation. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crops respond to nitrogen, phosphorus, and potassium fertilizer.

This unit is well suited to white spruce, quaking aspen, and paper birch. It can produce about 2,600 cubic feet, or 5,700 board feet (International rule), of merchantable timber per acre from a fully stocked stand of even-aged trees 80 years old. This unit has few limitations.

This unit is well suited to homesite development if community sewage systems are used. Onsite sewage disposal systems are limited by seepage and the hazard of polluting ground water.

This map unit is in capability subclass IIc.

15—Nenana silt loam, moderately deep, undulating. This well drained soil is on outwash plains. It is moderately deep over sand. It formed in silty loess and is underlain by fine sandy alluvium. Slope is 3 to 7 percent. The native vegetation is mainly pure and mixed stands of white spruce, quaking aspen, and paper birch. Elevation is 300 to 400 feet.

Typically, the surface is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is dark brown silt loam 2 inches thick. The upper 3 inches of the subsoil is dark yellowish brown silt loam. The lower 23 inches is olive brown silt. The substratum to a depth of 64 inches or more is olive gray stratified fine and medium sand.

Included in this unit are small areas of Beales, Koyukuk, Richardson, and Volkmar soils.

Permeability of this Nenana soil is moderate to a depth of 28 inches and rapid below this depth. Available water capacity is moderate. Rooting depth is about 30 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate if the plant cover is removed.

This unit is used for wildlife habitat.

This unit is well suited to climatically adapted crops. It is limited mainly by slope and the hazard of erosion. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

The organic matter content can be maintained by using all crop residue, plowing under cover crops, and using a suitable rotation. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crops respond to nitrogen, phosphorus, and potassium fertilizer.

This unit is well suited to white spruce, quaking aspen, and paper birch. It can produce about 2,600 cubic feet, or 5,700 board feet (International rule), of merchantable timber per acre from a fully stocked stand of even-aged trees 80 years old. This unit has few limitations.

This unit is well suited to homesite development if community sewage systems are used. Onsite sewage disposal systems are limited by seepage and the hazard of polluting ground water.

This map unit is in capability subclass IIe.

16—Nenana silt loam, moderately deep, rolling. This well drained soil is on outwash plains. It is moderately deep over sand. It formed in silty loess underlain by fine sandy alluvium. Slope is 7 to 12 percent. The native vegetation is mainly pure and mixed stands of white spruce, quaking aspen, and paper birch. Elevation is 300 to 400 feet.

Typically, the surface is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is dark brown silt loam 2 inches thick. The upper 3 inches of the subsoil is dark yellowish brown silt loam. The lower 23 inches is olive brown silt. The substratum to a depth of 64 inches or more is olive gray stratified fine and medium sand.

Included in this unit are small areas of Koyukuk, Richardson, and Volkmar soils.

Permeability of this Nenana soil is moderate to a depth of 28 inches and rapid below this depth. Available water capacity is moderate. Rooting depth is about 30 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate if the plant cover is removed.

This unit is used for wildlife habitat.

This unit is suited to climatically adapted crops. It is limited mainly by slope and the high hazard of erosion. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

The organic matter content can be maintained by using all crop residue, plowing under cover crops, and using a suitable rotation. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crops respond to nitrogen, phosphorus, and potassium fertilizer.

This unit can produce about 2,600 cubic feet, or 5,700 board feet (International rule), of white spruce, quaking aspen, and paper birch per acre from a fully stocked stand of even-aged, 80-year-old trees 4.5 inches in diameter at breast height. The main concerns in producing and harvesting timber are runoff and the hazard of erosion.

This unit is well suited to homesite development if community sewage systems are used. Onsite sewage disposal systems are limited by seepage and the hazard of polluting ground water.

This map unit is in capability subclass IIIe.

17—Nenana silt loam, shallow, nearly level. This well drained soil is on outwash plains. It is shallow over sand. It formed in silty loess and is underlain by fine sandy alluvium. Slope is 0 to 3 percent. The native vegetation is mainly pure and mixed stands of white spruce, quaking aspen, and paper birch. Elevation is 300 to 400 feet.

Typically, the surface is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is dark brown silt loam 2 inches thick. The upper 3 inches of the subsoil is dark yellowish brown silt loam. The lower 14 inches is olive brown silt. The substratum to a depth of 64 inches or more is olive gray, stratified fine and medium sand.

Included in this unit are small areas of Beales, Fairbanks, Richardson, and Volkmar soils.

Permeability of this Nenana soil is moderate to a depth of 19 inches and rapid below this depth. Available water capacity is low. Rooting depth is about 30 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate if the plant cover is removed.

This unit is used for wildlife habitat.

This unit is well suited to climatically adapted crops. It has few limitations. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water.

The organic matter content can be maintained by using all crop residue, plowing under cover crops, and using a suitable rotation. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crops respond to nitrogen, phosphorus, and potassium fertilizer.

This unit is well suited to white spruce, quaking aspen, and paper birch. It can produce about 2,600 cubic feet, or 5,700 board feet (International rule), of merchantable timber per acre from a fully stocked stand of even-aged trees 80 years old. This unit has few limitations.

This unit is well suited to homesite development if community sewage systems are used. Onsite sewage disposal systems are limited by seepage and the hazard of polluting ground water.

This map unit is in capability subclass IIs.

18—Nenana silt loam, shallow, undulating. This well drained soil is on outwash plains. It is shallow over sand. It formed in silty loess underlain by fine sandy alluvium. Slope is 3 to 7 percent. The native vegetation is mainly pure and mixed stands of white spruce, quaking aspen, and paper birch. Elevation is 300 to 400 feet.

Typically, the surface is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is dark brown silt loam 2 inches thick. The upper 3 inches of the subsoil is dark yellowish brown silt loam. The lower 14 inches is olive brown silt. The substratum to a depth of 64 inches or more is olive gray, stratified fine and medium sand.

Included in this unit are small areas of Beales, Fairbanks, Richardson, and Volkmar soils.

Permeability of this Nenana soil is moderate to a depth of 19 inches and rapid below this depth. Available water capacity is low. Rooting depth is about 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate if the plant cover is removed.

This unit is used for wildlife habitat.

This unit is well suited to climatically adapted crops. It is limited mainly by slope and the hazard of erosion. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

The organic matter content can be maintained by using all crop residue, plowing under cover crops, and using a suitable rotation. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crops respond to nitrogen, phosphorus, and potassium fertilizer.

This unit is well suited to white spruce, quaking aspen, and paper birch. It can produce about 2,600 cubic feet, or 5,700 board feet (International rule), of merchantable timber per acre from a fully stocked stand of even-aged trees 80 years old. This unit has few limitations.

This unit is well suited to homesite development if community sewage systems are used. Onsite sewage disposal systems are limited by seepage and the hazard of polluting ground water.

This map unit is in capability subclass IIIe.

19—Nenana silt loam, shallow, rolling. This well drained soil is on outwash plains. It is shallow over sand. It formed in silty loess and is underlain by fine sandy alluvium. Slope is 7 to 12 percent. The native vegetation is mainly pure and mixed stands of white spruce, quaking aspen, and paper birch. Elevation is 300 to 400 feet.

Typically, the surface is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is dark brown silt loam 2 inches thick. The upper 3 inches of the subsoil is dark yellowish brown silt loam. The lower 14 inches is olive brown silt loam. The substratum to a depth of 64 inches or more is olive gray, stratified fine and medium sand.

Included in this unit are small areas of Beales, Fairbanks, Richardson, and Volkmar soils.

Permeability of this Nenana soil is moderate to a depth of 19 inches and rapid below this depth. Available water capacity is low. Rooting depth is about 30 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate if the plant cover is removed.

This unit is used for wildlife habitat.

This unit is suited to climatically adapted crops. It is limited mainly by slope and the high hazard of erosion. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

The organic matter content can be maintained by using all crop residue, plowing under cover crops, and using a suitable rotation. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crops respond to nitrogen, phosphorus, and potassium fertilizer.

This unit is well suited to white spruce, quaking aspen, and paper birch. It can produce about 2,600 cubic feet, or 5,700 board feet (International rule), of merchantable timber per acre from a fully stocked stand of even-aged trees 80 years old. The main concerns in producing and harvesting timber are runoff and hazard of erosion.

This unit is well suited to homesite development if community sewage systems are used. Onsite sewage disposal systems are limited by seepage and the hazard of polluting ground water.

This map unit is in capability subclass IIIe.

20—Nenana silt loam, shallow, hilly. This well drained soil is on outwash plains. It is shallow over sand. It formed in silty loess underlain by fine sandy alluvium. Slope is 12 to 20 percent. The native vegetation is mainly pure and mixed stands of white spruce, quaking aspen, and paper birch. Elevation is 300 to 400 feet.

Typically, the surface is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is dark brown silt loam 2 inches thick. The upper 3 inches of the subsoil is dark yellowish brown silt loam. The lower 14 inches is olive brown silt loam. The substratum to a depth of 64 inches or more is olive gray, stratified fine and medium sand.

Included in this unit are small areas of Beales, Fairbanks, Richardson, and Volkmar soils.

Permeability of this Nenana soil is moderate to a depth of 19 inches and rapid below this depth. Available water capacity is low. Rooting depth is about 30 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate if the plant cover is removed.

This unit is used for wildlife habitat.

This unit is suited to climatically adapted crops. It is limited mainly by slope and the high hazard of erosion. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

The organic matter content can be maintained by using all crop residue, plowing under cover crops, and using a suitable rotation. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crops respond to nitrogen, phosphorus, and potassium fertilizer.

This unit is well suited to white spruce, quaking aspen, and paper birch. It can produce about 2,600 cubic feet, or 5,700 board feet (International rule), of merchantable timber per acre from a fully stocked stand of even-aged trees 80 years old. The main concerns in producing and harvesting timber are runoff and the hazard of erosion. Water bars are needed on all skid trails.

This unit is suited to homesite development. The main limitations are slope and seepage.

This map unit is in capability subclass IVe.

21—Richardson silt loam. This deep, moderately well drained soil is in slightly depressional areas on outwash plains. It formed in silty loess and is underlain by sandy sediment. Slope is 0 to 3 percent. The native vegetation is mainly black spruce, low-growing shrubs, and moss. In places there are young stands of paper birch and white spruce. Elevation is 300 to 500 feet.

Typically, the surface is covered with a mat of partially decomposed forest litter, moss, and roots about 2 inches thick. The surface layer is black and dark grayish brown silt loam 5 inches thick. The subsoil is olive silt loam 11 inches thick. The upper 35 inches of the substratum is olive gray and gray silt. The lower part to a depth of 60 inches or more is gray fine sand.

Included in this unit are small areas of Goldstream, Nenana, Tanana, and Volkmar soils.

Permeability of this Richardson soil is moderate. Available water capacity is high. Effective rooting depth is 51 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate if the plant cover is removed. The water table is at a depth of 6 to 24 inches in summer.

This unit is used for wildlife habitat.

This unit is poorly suited to crops. The main limitation is wetness.

This unit is poorly suited to timber.

This unit is poorly suited to homesite development. The main limitation is wetness.

This map unit is in capability subclass IIc.

22—Salchaket very fine sandy loam. This deep, well drained soil is on natural levees and low terraces adjacent to rivers and streams. It formed in silty and sandy alluvium. Slope is 0 to 3 percent. The native vegetation is mainly white spruce, but there is some balsam poplar. Elevation is 300 to 500 feet.

Typically, the surface is covered with a mat of forest litter about 2 inches thick. The surface layer is dark grayish brown very fine sandy loam about 6 inches thick. The upper 19 inches of the underlying material is stratified, dark grayish brown very fine sandy loam and dark grayish brown fine sand. The lower part to a depth of 60 inches or more is gray fine sand.

Included in this unit are small areas of Tanana and Bradway soils.

Permeability of this Salchaket soil is moderately rapid. Available water capacity is moderate. Rooting depth is about 30 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high if the plant cover is removed. This soil is subject to occasional, brief periods of flooding in spring.

This unit is used for timber production and wildlife habitat.

This unit is suited to climatically adapted crops. The main limitation is the hazard of flooding. In some summers, irrigation is needed for maximum production of crops. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water.

The organic matter content can be maintained by using all crop residue, plowing under cover crops, and using a suitable rotation. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crops respond to fertilizer.

This unit is well suited to white spruce. It can produce about 3,300 cubic feet, or 9,800 board feet (International rule), of merchantable timber per acre from a fully stocked stand of even-aged trees 80 years old. This unit has few limitations.

This unit is poorly suited to homesite development. The main limitation is the hazard of flooding. Onsite sewage disposal systems are limited by the hazard of flooding, seepage, and the hazard of polluting ground water.

This map unit is in capability subclass IIc.

23—Tanana silt loam. This deep, somewhat poorly drained soil is on alluvial plains. It formed in silty and sandy sediment. Slope is 0 to 3 percent. The native vegetation is mainly black spruce, low-growing shrubs, and moss. There is also some paper birch, willow, and alder. Elevation is 300 to 500 feet.

Typically, the surface is covered with a mat of moss, leaves, and twigs about 3 inches thick. The surface layer is very dark gray and olive brown silt loam 6 inches thick. The underlying material to a depth of 40 inches or more is olive brown and olive silt loam. Permafrost is at a depth below 20 inches.

Included in this unit are small areas of Bradway, Salchaket, and Goldstream soils.

Permeability of this Tanana soil is moderate above the permafrost. Available water capacity is moderate. Rooting depth is about 20 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate if the plant cover is removed. This soil is subject to occasional, brief periods of flooding in spring. The water table is within 12 inches of the surface in spring and summer.

This unit is used for timber production and wildlife habitat.

If this unit is used for cultivated crops, the main limitations are the presence of permafrost, wetness, and the hazard of flooding. Permafrost is at a greater depth in cleared areas of this unit than in uncleared areas. The soil in this unit is dry enough to be cultivated about 1 year after it has been cleared. In spring, shallow ditches may be needed in places to remove excess water.

In some summers, irrigation is needed for maximum production of crops. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crops respond to nitrogen, phosphorus, and potassium fertilizer.

This unit is well suited to white spruce. It can produce about 2,600 cubic feet, or 5,700 board feet (International rule), of merchantable timber per acre from a fully stocked stand of even-aged trees 80 years old.

The main concerns in producing and harvesting timber are plant competition and wetness. Conventional methods can be used for harvesting timber except during thaw in spring and during short periods following heavy showers in summer. Good stands of white spruce and birch can be established where fire or clearing operations have destroyed the plant cover and the mossy mat on the forest floor.

This unit is poorly suited to homesite development. The main limitations are flooding, wetness, and the presence of permafrost.

This map unit is in capability subclass IIIw.

24—Teklanika loamy fine sand, rolling. This deep, excessively drained soil is on stabilized dunes on outwash plains (fig. 6). It formed in sand. Slope is 7 to 12 percent. The native vegetation is mainly stunted black spruce, white spruce, paper birch, quaking aspen, lowbush cranberry, lichens, and mosses. Elevation is 300 to 650 feet.

Typically, the surface is covered with a mat of partially decomposed forest litter and roots about 2 inches thick. The surface layer is yellowish red loamy fine sand 4 inches thick. The underlying material to a depth of 55 inches is strong brown and light olive brown fine sand.

Included in this unit are small areas of Beales, Dotlake, and Nenana soils.

Permeability of this Teklanika soil is rapid. Available water capacity is low. Rooting depth is about 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high if the plant cover is removed.

This unit is used for wildlife habitat.

Figure 6.—An area of stabilized dunes on outwash plains. The soil is Teklanika loamy fine sand.

This unit is poorly suited to cultivated crops. It is limited mainly by steepness of slope and the hazard of erosion.

This unit is poorly suited to the production of merchantable timber.

This unit is suited to homesite development. The main limitations are slope and seepage.

This map unit is in capability subclass VIe.

25—Teklanika loamy fine sand, hilly. This deep, excessively drained soil is on stabilized dunes on outwash plains. It formed in sand. Slope is 12 to 20 percent. The native vegetation is mainly stunted black spruce, white spruce, paper birch, quaking aspen, lowbush cranberry, lichens, and mosses. Elevation is 300 to 650 feet.

Typically, the surface is covered with a mat of partially decomposed forest litter and roots about 2 inches thick. The surface layer is yellowish red loamy fine sand 4 inches thick. The underlying material to a depth of 55 inches or more is strong brown and light olive brown fine sand.

Included in this unit are small areas of Teklanika soils that are more gently sloping or are steeper than this Teklanika soil.

Permeability of this Teklanika soil is rapid. Available water capacity is low. Rooting depth is about 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high if the plant cover is removed.

This unit is used for wildlife habitat.

This unit is poorly suited to the production of merchantable timber.

This unit is poorly suited to homesite development. The main limitations are slope and seepage.

This map unit is in capability subclass VIe.

26—Teklanika loamy fine sand, steep. This deep, excessively drained soil is on stabilized dunes on outwash plains. It formed in sand. Slope is 20 to 30 percent. The native vegetation is mainly stunted black spruce, white spruce, paper birch, quaking aspen, lowbush cranberry, lichens, and mosses. Elevation is 300 to 650 feet.

Typically, the surface is covered with a mat of partially decomposed forest litter and roots about 2 inches thick. The surface layer is yellowish red loamy fine sand 4 inches thick. The underlying material to a depth of 55 inches or more is strong brown and light olive brown fine sand.

Included in this unit are small areas of Teklanika soils that are more gently sloping or are steeper than this Teklanika soil.

Permeability of this Teklanika soil is rapid. Available water capacity is low. Rooting depth is about 30 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is high if the plant cover is removed.

This unit is used for wildlife habitat.

This unit is poorly suited to the production of merchantable timber.

This unit is poorly suited to homesite development. The main limitations are slope and seepage.

This map unit is in capability subclass VIe.

27—Teklanika loamy fine sand, very steep. This deep, excessively drained soil is on stabilized dunes and escarpments on outwash plains. It formed in sand. Slope is 30 to 55 percent. The native vegetation is mainly stunted black spruce, white spruce, paper birch, quaking aspen, lowbush cranberry, lichens, and mosses. Elevation is 300 to 650 feet.

Typically, the surface is covered with a mat of partially decomposed forest litter and roots about 2 inches thick. The surface layer is yellowish red loamy fine sand 4 inches thick. The underlying material to a depth of 55 inches or more is strong brown and light olive brown fine sand.

Included in this unit are small areas of Teklanika soils that are more gently sloping than this Teklanika soil.

Permeability of this Teklanika soil is rapid. Available water capacity is low. Rooting depth is about 30 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is high if the plant cover is removed.

This unit is used for wildlife habitat.

This unit is poorly suited to the production of timber.

This unit is poorly suited to homesite development. The main limitations are slope and seepage.

This map unit is in capability subclass VIIe.

28—Toklat silt loam. This deep, well drained soil is in slightly depressional areas and on dunes and on outwash plains. It formed in sandy outwash that has been reworked by wind. Slope is 0 to 3 percent. The native vegetation is mainly white spruce, quaking aspen, paper birch, willow, rose, and horsetail. Elevation is 350 to 550 feet.

Typically, the surface is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is dark grayish brown silt loam 1/2 inch thick. The subsurface layer is light gray loamy very fine sand 14 1/2 inches thick. The subsoil is dark reddish brown, strongly cemented sand 7 inches thick. Below this to a depth of 40 inches or more is light gray loamy very fine sand and dark reddish brown strongly cemented sand.

Included in this unit are small areas of Beales, Nenana, and Volkmar soils.

Permeability of this Toklat soil is rapid above the cemented layer. Available water capacity is low. Rooting depth is limited by the strongly cemented layer of sand at a depth of 15 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate if the plant cover is removed. Water is ponded on the surface during spring thaw.

This unit is suited to climatically adapted crops. It is limited mainly by shallow depth to the cemented layer and the hazard of soil blowing. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is the most suitable method of applying water. Water should be applied in amounts sufficient to wet the root zone but in amounts small enough to minimize the leaching of plant nutrients.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crops respond to nitrogen, phosphorus, and potassium fertilizer.

This unit is suited to white spruce, quaking aspen, and paper birch. It can produce 1,900 cubic feet or 2,100 board feet (International rule) of merchantable timber from a stand of trees 80-years-old. Because of droughtiness, seedling mortality is a concern.

This unit is poorly suited to homesite development. The main limitations are wetness in spring and the cemented pan.

This map unit is in capability subclass IIIs.

29—Toklat-Bolio complex. This map unit is in depressional areas on outwash plains. Slope is 0 to 3 percent. The native vegetation is mainly white spruce, quaking aspen, and paper birch. Elevation is 300 to 550 feet.

This unit is about 50 percent Toklat silt loam that has slopes of 0 to 3 percent and 45 percent Bolio peat that has slopes of 0 to 1 percent. The Toklat soil is on the outer edge of depressional areas, and the Bolio soil is on the lower part of the depressional areas. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of a Volkmar silt loam that has slopes of 0 to 3 percent.

The Toklat soil is deep and well drained. It formed in sandy outwash that has been reworked by wind. Typically, the surface is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is dark grayish brown silt loam 1/2 inch thick. The subsurface layer is light gray loamy very fine sand 14 1/2 inches thick. The subsoil is dark reddish brown, strongly cemented sand 7 inches thick. Below this to a depth of 40 inches or more is light gray loamy very fine sand and dark reddish brown sand.

Permeability of the Toklat soil is rapid. Available water capacity is low. Rooting depth is limited by the strongly cemented layer of sand at a depth of 15 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate if the plant cover is removed. This soil is ponded during the spring thaw.

The Bolio soil is deep and poorly drained. It formed in partially decomposed peat derived dominantly from sedges. Typically, the surface is covered with a mat of living plants and roots about 3 inches thick. The soil to a depth of 20 inches or more is black and dark reddish brown, partly decomposed organic matter. Permafrost is at a depth below 8 inches. This soil is ponded during the spring thaw.

Permeability of the Bolio soil is moderate above the permafrost. Water is perched above the permafrost in summer.

This unit is used for wildlife habitat.

This unit is poorly suited to crops. It is limited mainly by the hazard of ponding, the seasonal high water table, and depth to permafrost.

The Toklat soil is suited to the production of white spruce, quaking aspen, and paper birch. It can produce 1,900 cubic feet or 2,100 board feet (International rule) of merchantable timber from a stand of trees 80 years old. Because of droughtiness, seedling mortality is a concern.

This unit is poorly suited to homesite development. The main limitations are the hazard of ponding, the presence of permafrost, and wetness.

This map unit is in capability subclass VIw.

30—Volkmar silt loam. This deep, moderately well drained soil is in slightly depressional areas on outwash plains. It formed in silty loess and is underlain by sandy sediment. Slope is 0 to 3 percent. The native vegetation is mainly white spruce, quaking aspen, paper birch, black spruce, willow, grass, sedges, and hypnum moss. Elevation is 300 to 500 feet.

Typically, the surface is covered with a mat of partially decomposed forest litter and roots about 3 inches thick. The surface layer is streaked dark gray, black, and dark brown silt loam 12 inches thick. The subsoil is dark grayish brown silt loam 12 inches thick. The upper 6 inches of the substratum is dark grayish brown silt loam. The lower part to a depth of 40 inches or more is olive gray, stratified fine and medium sand.

Included in this unit are small areas of Beales, Nenana, and Richardson soils.

Permeability of this Volkmar soil is moderate to a depth of 28 inches and rapid below this depth. Available water capacity is moderate. Rooting depth is about 28 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate if the plant cover is removed. The water table is at a depth of 6 to 24 inches late in spring and in summer if the soil is in native vegetation and the insulating organic mat is maintained.

This unit is used for wildlife habitat.

This unit is suited to climatically adapted crops if it is cleared and the water table is lowered. In summer, irrigation is required for maximum production of most crops. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water.

The organic matter content can be maintained by using all crop residue, plowing under cover crops, and using a suitable cropping system. Maintaining crop residue on or near the surface helps to maintain soil tilth and organic matter content. Crops respond to nitrogen, phosphorus, and potassium fertilizer.

This unit is poorly suited to the production of timber. Depth to the water table in spring is the main factor affecting the establishment and growth of trees. Where the water table drops rapidly, this unit can produce 3,300 cubic feet, or 9,800 board feet (International rule), of timber from a stand of trees 60-years-old.

This unit is poorly suited to homesite development. The main limitation is wetness.

This map unit is in capability subclass IIc.

31—Volkmar-Nenana complex. This map unit is in undulating to rolling areas on outwash plains. Slope is 0 to 12 percent. The native vegetation is mainly white spruce, paper birch, quaking aspen, and black spruce. Elevation is 300 to 500 feet.

This unit is about 50 percent Volkmar silt loam that has slopes of 0 to 3 percent and 35 percent Nenana silt loam that has slopes of 0 to 12 percent. The Volkmar soil is in slightly depressional areas, and the Nenana soil is on dunes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Beales and Dotlake soils.

The Volkmar soil is deep and moderately well drained. It formed in silty loess and is underlain by sandy sediment. Typically, the surface is covered with a mat of partially decomposed forest litter and roots about 3 inches thick. The surface layer is streaked dark gray, black, and dark brown silt loam 12 inches thick. The subsoil is dark grayish brown silt loam 12 inches thick. The upper 6 inches of the substratum is dark grayish brown silt loam. The lower part to a depth of 40 inches or more is olive gray, stratified fine and medium sand.

Permeability of the Volkmar soil is moderate to a depth of 28 inches and rapid below this depth. Available water capacity is moderate. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate if the plant cover is removed. The water table is at a depth of 6 to 24 inches late in spring and in summer if the soil is in native vegetation and the insulating organic mat is maintained.

The Nenana soil is deep and well drained. It formed in silty loess overlying sandy alluvium. Typically, the surface is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is dark brown silt loam 2 inches thick. The upper 3 inches of the subsoil is dark yellowish brown silt loam. The lower 23 inches is olive brown silt. The substratum to a depth of 64 inches or more is olive gray stratified fine and medium sand.

Permeability of this Nenana soil is moderate to a depth of 26 inches and rapid below this depth. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate if the plant cover is removed.

This unit is used for wildlife habitat.

This unit is suited to climatically adapted crops if it is cleared and the water table is lowered. In summer, irrigation is required for maximum production of most crops. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water.

The organic matter content can be maintained by using all crop residue, plowing under cover crops, and using a suitable cropping system. Maintaining crop residue on or near the surface helps to maintain soil tilth and organic matter content. Crops respond to nitrogen, phosphorus, and potassium fertilizer.

This unit is well suited to the production of white spruce, quaking aspen, and paper birch. It can produce about 2,600 cubic feet, or 5,700 board feet (International rule), of merchantable timber per acre from a fully stocked stand of even-aged trees 60-years-old. The main limitations are the droughtiness of the Nenana soil and the wetness of the Volkmar soil, both of which offset seedling survival.

The Nenana soil is well suited to homesite development. The Volkmar soil is poorly suited to homesite development. The main limitation is wetness.

This map unit is in capability subclass IIIe.

Use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and pasture

General management needed for crops and pasture is discussed in this section. The crops or pasture plants best suited to the soil are identified; suitable land clearing practices are described; and the system of land capability classification used by the Soil Conservation Service is explained.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Soil maps for detailed planning." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Most of the soils in the Totchaket Area are silt loams. About 33 percent of the acreage is suited to cultivated crops. The most suitable crops are frost-hardy vegetables, potatoes, small grain, and legumes and grasses grown for hay and pasture. Poorly drained soils and steep sandy soils are in much of the area. They generally are not suited to cultivated crops, but in some places they can be used for pasture.

Good growth of crops in the area requires adequate fertilization. Large amounts of nitrogen, phosphate, potash, and other amendments are needed on all of the soils. Newly cleared soils need large quantities of nitrogen, because much of this element is used by bacteria to decompose the native organic matter.

On the basis of experience and research, the Institute of Agricultural Sciences periodically publishes information on minimum fertilizer application rates (*7*). These rates, provided as a general guide for determining needs, are subject to change.

Under continued cultivation, the tilth of the soils in the survey area tends to deteriorate. Adding manure or other organic material helps to maintain tilth.

Land clearing

Several methods can be used to clear land in the survey area. The most suitable methods and equipment are determined by the type of plant cover on the soils, the kinds of soil, and the time of year when the soils are cleared. Suitable equipment and methods include bulldozers, hydro-axes, large rototillers, large breaking plows, heavy-duty disks, and controlled burning.

The well drained and moderately well drained soils in the area can be cleared at any time of the year but clearing is most efficiently done when the soils are frozen. When the soils are not frozen, trees, shrubs, and large roots left after logging can be pushed over and windrowed with a bulldozer equipped with a scarifier blade. Land clearing under these conditions, however, often creates windrows with large quantities of soil material.

When the soil is frozen, the trees can be sheared by use of a bulldozer and piled in windrows without disturbing the soil. Most soils in the interior of Alaska are cleared by this method. Later, in spring or summer, the stumps and large roots can be moved to the windrows with a bulldozer fitted with a scarifier blade. Where the soils are sloping, the windrows should be arranged diagonally to the slope. This keeps runoff from ponding on the upper side of the windrows and helps to control runoff from cleared fields. Natural drainageways should not be blocked by the windrows. To allow for better drainage and fire control, it is a good practice to place the windrows 200 to 300 feet apart. The trees, shrubs, and roots in the windrows should be burned when they are dry, generally about a year after clearing. Several burnings and restackings of the vegetation generally are needed to dispose of the vegetation.

When clearing the land, it is important to leave as much of the decomposed forest litter as possible so that it can be added to the soil. Adding organic matter to the soil helps to maintain good tilth, increases the water intake rate of the soil, and reduces erosion. A heavy disk can be used to incorporate chips, small stumps, and roots into the soil. Because these materials decompose very slowly, however, the larger pieces should be removed so that they will not interfere with cultivation.

The somewhat poorly drained and poorly drained soils in the survey area have permafrost and are covered with brush and moss or sedge tussocks. When the soil is frozen, this plant cover can most easily be removed with a bulldozer equipped with a shear blade. The depth to permafrost will gradually increase when the insulating vegetation is removed. Before crops can be grown on some soils, the excess moisture perched above the permafrost must be removed by drainage ditches.

Where soil blowing is a hazard in cultivated fields, adequately spaced windbreaks are needed to help control soil blowing and drifting. Erosion can also be reduced by using a heavy-duty disk to better mix the plant residue into the upper part of the soil profile.

Land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations if they are used for field crops, the risk of damage if they are used, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 5. The capability classification of each map unit is given in the section "Soil maps for detailed planning."

Woodland management and productivity

The Totchaket Area has natural mixed and pure stands of black spruce, white spruce, paper birch, quaking aspen, and cottonwood, but large treeless areas are common. Stands differ in size, age, and density. Sharp boundaries between stands of contrasting age and type are commonly the result of forest fires and abrupt differences in environmental influences. A few small areas of trees along the Tanana River have been harvested for house logs, rough lumber, and fuel. White spruce, paper birch, and quaking aspen are used for fuel, and white spruce is the main species used for logs and lumber.

Quaking aspen, paper birch, and white spruce are dominant on the well drained soils of outwash plains and alluvial plains. Black spruce is common on the poorly drained soils, both in the depressional areas on the outwash plains and on the alluvial plains. Cottonwood, or balsam poplar, is common on the well drained soils of the alluvial plains along the major streams of the area, and tamarack grows in a few places where drainage is poor. American green alder, thinleaf alder, and willow grow along streams and on the edges of muskegs. Many poorly drained soils that have a high permafrost table are treeless. They commonly have a thick cover of moss, sedge tussocks, low shrubs, and some sedge.

White spruce is the most valued species in what can be considered the merchantable stands of trees in the area. The best stands average around 90 to 100 feet in height, are 100 to 200 years old, and can produce an average of 10,000 to 15,000 board feet per acre. A wide range of yields can be expected on sites that are on different aspects. The diameter of trees at breast height ranges from 8 inches to about 28 inches. If the forest is destroyed by fire, the site naturally reseeds to paper birch, quaking aspen, or white spruce, or to a mixture of two or more of these species. White spruce will invade as an understory plant in stands of birch or aspen, and it will eventually become dominant in the stand. It can be assumed that, if left untouched by fire or other disturbances, and if the site is suitable, merchantable stands of white spruce will develop on well drained soils.

Because of fires, most of the trees in the area are in either young or mature stands. Most mature stands are in areas that are isolated by large muskegs or streams. Stands of white spruce as much as 300 years old are on some well drained soils of the Tanana River flood plain.

In the course of the soil survey, age and height of trees were determined in plots on each soil considered to be suitable for merchantable timber. In all, 77 plots, each containing 3 to 6 trees, were observed. Largely on the basis of this information, each soil was rated as to its ability to produce quaking aspen, paper birch, and white spruce. Published yield tables for these species are available (*3*, *4*).

Although yield tables are not available for cottonwood, 30 trees in 6 plots were measured. The average age of these trees was 66 years, and the average height was 59 feet.

Table 6 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 6, *slight*, *moderate*, and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* consider the soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade where there are openings in the tree canopy. The invading plants compete with native plants or planted seedlings. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* indicates that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed to control undesirable plants.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 7 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 7 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

Recreation

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camp sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife habitat

Many kinds of wildlife inhabit the Totchaket Area because the various soils provide many kinds of vegetation suitable for food and shelter. The number of animals in the area fluctuates because of hunting and trapping pressure, weather, predators, feeding conditions, and other factors.

Moose is the most important big game animal in the area. It is principally a browser, feeding on willow, birch, and aspen brush in winter and on grass, aquatic plants, and other succulent plants in spring and summer. In winter, the moose stay at low elevations, where browse is more readily available and the snow conditions are more favorable. In spring and summer, the bulls migrate to higher elevations. The cows remain in thickets at lower elevations, where their calves are born.

Some black bears and a few grizzly bears are in the area. These are omnivorous animals that have a diet that includes large and small mammals, carrion, fish, grass, horsetail, berries, and the roots of many plants. Among the other furbearing animals and predatory birds are fox, lynx, wolf, land otter, mink, eagle, hawk, owl, and raven. Among the other animals in the area are snowshoe hare, red squirrel, porcupine, weasel, muskrat, beaver, shrew, and mice.

The most important fish in the area are grayling, northern pike, and salmon. Northern pike are plentiful in some lakes and slow-moving streams. The Tanana River is the primary channel for the running of salmon to the spawning grounds in the upstream tributaries.

Mosquitoes, flies, ants, bees, and other insects are fairly numerous in the area. They are an important part of the diet of some of the larger forms of wildlife.

The distribution of wildlife in relation to the different general map units in the Totchaket Area is explained in the following paragraphs. The map units are described in the section "General soil map for broad land use planning," and they are delineated on the general soil map in the back of this survey.

Nenana-Volkmar. Wildlife in this unit is somewhat similar to that in the Teklanika-Beales-Nenana unit. Nenana soils are well drained. In areas of fairly recent fires, these soils support young stands of aspen, paper birch, and willow as well as grasses and low-growing shrubs that provide moderate amounts of food for moose, bear, grouse, rabbit, and other mammals and for a variety of songbirds. The Volkmar soils in the unit support a dense cover of brush and grass and patches of spruce, paper birch, and alder brush. This unit is not favorable for waterfowl and furbearing animals that live along lakes and streams. There are no fishing streams and only a few small, shallow lakes.

Teklanika-Beales-Nenana. Wildlife in this unit is limited to species that are adapted to upland forest habitat. The Beales and Nenana soils are mostly forested and provide only sparse food for moose except in areas that have been burned fairly recently. These soils provide cover and food for summer songbirds, grouse, marten, red squirrel, weasel, and porcupine. There are no fishing streams and only a few small shallow lakes.

Goldstream-Bolio-Kantishna. Nearly all wildlife species common to the area are in areas of this unit, which is in nearly level to depressional areas on alluvial plains. The Tanana soils have dense stands of either paper birch and willow or black spruce and brush. This cover provides habitat for bear, wolf, fox, and lynx. The Goldstream soils produce berries, sedges, and willow brush used by moose, small mammals, songbirds, and other birds. At the borders of ponds and streams, brush and succulent water-tolerant plants are used by waterfowl, furbearing animals, and moose. Northern pike inhabit some ponds and streams.

Tanana-Salchaket. This map unit supports vegetation such as white spruce, paper birch, willow, and alder brush. Migratory ducks, geese, and other waterfowl use the small ponds and streams in the area for stopover and nesting areas. Furbearing animals and moose feed on the brush and succulent water-tolerant plants in this unit. Among the fish in the streams are grayling, northern pike, sheefish, and salmon.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

Hardwood trees and woody understory produce fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are paper birch, balsam, poplar, alder, highbush cranberry, and blueberry.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to permafrost, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, sloughs, and ponds.

Habitats for various kinds of wildlife are described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, and areas that are overgrown with grasses, herbs, and shrubs. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants.

Habitat for wetland wildlife consists of open, marshy shallow water areas.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land-use planning, for evaluating land-use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to permafrost, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building site development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to permafrost, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected mainly by the frozen soil, depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, frost action potential, and organic layers can cause the movement of footings. A high water table, depth to permafrost or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to permafrost or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Sanitary facilities

Table 11 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to permafrost or to a cemented pan, and flooding affect absorption of the effluent. Frozen ground and a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel are less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to permafrost or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon cause a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, permafrost, and cemented pans can cause construction problems.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to permafrost or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, highly organic layers, and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils are the best cover for a landfill. Sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over a cemented pan or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good*, *fair*, or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by frozen ground, cemented pans, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential and slopes of 15 to 25 percent. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 14.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering index properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic-matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

The estimated AASHTO classification for soils is given in table 14.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and chemical properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (oven dry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 15, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and water features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of soils that have permafrost at a shallow depth and soils that have a permanent high water table during the spring thaw and throughout the summer. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes is not considered flooding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; June-August, for example, means that flooding can occur during the period June through August.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, or silt deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 16. The depth to the water table is given for undisturbed soil. If the organic layer is destroyed, the soil thaws during spring and the water table drops to a depth of more than 6 feet.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*12*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 17, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Cryaquepts (*Cry*, meaning cold, plus *aquept*, the suborder of the Inceptisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Cryaquepts.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is loamy, mixed, nonacid, Typic Cryaquepts.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil series and morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*11*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*12*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Soil maps for detailed planning."

Beales series

The Beales series consists of somewhat excessively drained soils on stabilized dunes and outwash plains and in dry lake basins. These soils formed in sandy water-laid sediment that has been reworked by wind. They have a thin mantle of silty loess that contains a moderate amount of fine mica. Slope is 0 to 7 percent. Elevation is 300 to 650 feet. The average annual precipitation is about 12 inches, and the average annual air temperature is about 27 degrees F.

These soils are sandy, mixed Typic Cryochrepts.

Typical pedon of a Beales silt loam, nearly level, in the NW1/4NW1/4 of sec. 31, T. 5 S., R. 13 W.

O1—1 inch to 0; dark reddish brown (5YR 2.5/2) mat of partly decomposed organic litter; few clean sand grains; many fine roots; charcoal fragments; abrupt smooth boundary.

Al—0 to 2 inches; dark brown (7.5YR 3/2) silt loam; weak fine granular structure; very friable; many fine roots; strongly acid; clear smooth boundary.

B1—2 to 6 inches; brown (7.5YR 4/4) silt loam; weak fine subangular blocky structure; very friable; many fine roots; moderate amounts of mica; medium acid; abrupt wavy boundary.

B2—6 to 8 inches; reddish brown (5YR 4/4) fine sandy loam; massive parting to weak medium subangular blocky structure; very friable; common roots; slightly acid; abrupt wavy boundary.

B3—8 to 10 inches; brown (7.5YR 4/4) loamy fine sand; weak medium subangular blocky structure; very friable; common roots; slightly acid; clear wavy boundary.

IIC—10 to 40 inches; olive brown (2.5Y 4/4) and grayish brown (2.5Y 5/2) fine sand in thick horizontal bands; massive; slightly compact; slightly acid.

The mantle of coarse, silty material commonly is 5 to 10 inches thick, but in places it is as much as 14 inches thick. It is strongly acid to neutral. The A horizon is dark brown or brown. The B horizon is reddish brown, brown, dark brown, or dark yellowish brown. The IIC horizon is grayish brown, light olive brown, or olive. In places it has a thin layer of sandy loam and medium sand.

Bolio series

The Bolio series consists of poorly drained soils in slightly depressional areas on alluvial plains and in depressional areas on outwash plains. These soils formed in partly decomposed organic material derived mainly from sedges. Slope is 0 to 1 percent. Elevation is 300 to 350 feet. The average annual precipitation is about 12 inches, and the average annual air temperature is about 26 degrees F.

These soils are Dysic Pergelic Cryohemists.

Typical pedon of a Bolio peat in the SW1/4SW1/4 of sec. 16, T. 2 S., R. 10 W.

Oi1—0 to 3 inches; dark reddish brown (2.5YR 3/2) mat of undecomposed plant parts and living roots; 100 percent fiber, rubbed; many roots; loose; extremely acid; abrupt smooth boundary.

Oe1—3 to 8 inches; black (5YR 2/1, broken face and rubbed) to dark reddish brown (5YR 2/2, pressed) sedge peat; 60 percent fiber, 20 percent rubbed; thin platy structure; nonsticky and slightly plastic; extremely acid; abrupt smooth boundary.

Oe2f—8 to 20 inches; black (5YR 2/1, broken face and rubbed) to dark reddish brown (5YR 2/2, pressed) sedge peat; 50 percent fiber, 20 percent rubbed; extremely acid; frozen in midsummer.

Permafrost generally is at a depth of 14 to 18 inches, but depth ranges from 6 inches to more than 40 inches. The hemic material is about 5 to 15 percent silt. It has hue of 5YR to 10YR, value of 2 or 3, and chroma of 1 or 2.

Bradway series

The Bradway series consists of poorly drained soils in former stream channels on alluvial plains. These soils formed in stratified alluvial sediment of loamy material overlying loamy fine sand. Slope is 0 to 3 percent. Elevation is about 300 to 350 feet. The average annual precipitation is about 12 inches, and the average annual air temperature is about 26 degrees F.

These soils are loamy, mixed, nonacid Pergelic Cryaquepts.

Typical pedon of Bradway very fine sandy loam in the SW1/4SW1/4SW1/4 of sec. 27, T. 4 S., R. 12 W.

O1—6 to 2 inches; very dark brown (10YR 2/2) mat of dead sedges.

O2—2 inches to 0; black (10YR 2/1) mat of partially decomposed organic matter; many fine roots; abrupt boundary.

A7—0 to 2 inches; dark brown (7.5YR 3/2) very fine sandy loam; weak fine granular structure; very friable; medium acid; abrupt smooth boundary.

A3—2 to 5 inches; dark brown (10YR 3/3) very fine sandy loam; weak fine platy structure; very friable; medium acid; abrupt smooth boundary.

C1g—5 to 14 inches; gray (10YR 5/1) fine sandy loam; common fine distinct brown (10YR 5/3) mottles; massive; very friable; micaceous; slightly acid; gradual boundary.

C2g—14 to 32 inches; gray (5Y 5/1) loamy fine sand; single grain; loose, micaceous; thin silt layers; frozen below a depth of 30 inches; slightly acid.

Permafrost is at a depth of 2 to 3 feet. The profile is medium acid to mildly alkaline. The O horizon is 3 to 6 inches thick. The C horizon is dominantly loamy fine sand and has thin layers of silt. It is gray to greenish gray.

Dotlake series

The Dotlake series consists of somewhat poorly drained soils in depressional areas on outwash plains and bordering dunes on alluvial plains. These soils formed in a thin layer of silty loess overlying fine sandy outwash. Slope is 0 to 3 percent. Elevation is 300 to 500 feet. The average annual precipitation is about 12 inches, and the average annual temperature is about 26 degrees F.

These soils are loamy, mixed, nonacid Pergelic Cryaquepts.

Typical pedon of Dotlake silt loam in the NW1/4SE1/4SE1/4 of sec. 31, T. 3 S., R. 12 W., Fairbanks Meridian.

Oi1—3 inches to 0; mat of undecomposed organic material; many roots; very strongly acid; abrupt smooth boundary.

A1—0 to 1 inch; very dark grayish brown (10YR 3/2) silt loam; weak very fine subangular blocky structure; very friable; many roots; very strongly acid; abrupt smooth boundary.

B2g—1 inch to 15 inches; gray (10YR 5/1) silt loam; many coarse prominent mottles of dark yellowish brown (10YR 4/6) that make up about 50 percent of the matrix; weak thin platy structure; friable; few roots; medium acid; abrupt smooth boundary.

IIC—15 to 28 inches; dark grayish brown (2.5Y 4/2) fine sand; few thin silty lenses; single grain; loose; slightly acid; abrupt smooth boundary overlying sand that is frozen early in summer.

The A horizon is very strongly acid to slightly acid. The IIC horizon has strata of fine sand and silt that vary in number and in thickness. Depth to permafrost ranges from 5 to 40 inches or more.

Fairbanks series

The Fairbanks series consists of well drained soils on outwash plains near the Tanana River. These soils are dominantly in the northern part of the survey area. They formed in deep silty loess overlying stratified silty and sandy outwash. Slope is 0 to 50 percent. Elevation is 300 to 400 feet. The average annual precipitation is about 12 inches, and the average annual air temperature is about 26 degrees F.

These soils are coarse-silty, mixed Alfic Cryochrepts.

Typical pedon of Fairbanks silt loam, undulating, in the SW1/4SW1/4 of sec. 10, T. 4 S., R. 9 W.

O1—2 inches to 0; very dark brown (10YR 2/2) partially decomposed forest litter; charcoal fragments; many roots; abrupt smooth boundary.

A1—0 to 2 inches; dark brown (10YR 3/3) silt loam; weak very fine granular structure; very friable; many roots; medium acid; clear smooth boundary.

A2—2 to 5 inches; brown (10YR 5/3) silt loam; weak very fine subangular structure; very friable; many roots; slightly acid; clear smooth boundary.

B2—5 to 13 inches; dark yellowish brown (10YR 4/4) silt loam; weak very thin platy structure; very friable; common roots; common undulating thin bands of very fine angular blocky silt loam slightly darker than matrix; slightly acid; clear wavy boundary.

B3—13 to 19 inches; yellowish brown (10YR 5/4) silt; weak very thin platy structure; very friable; few roots; slightly acid; gradual boundary.

C1—19 to 32 inches; grayish brown (2.5Y 5/2) silt; weak very thin platy structure; very friable; few roots; slightly acid; gradual boundary.

C2—32 to 38 inches; grayish brown (2.5Y 5/2) silt that has streaks of gray (5Y 6/1); weak very thin platy structure; very friable; slightly acid; clear wavy boundary.

C3—38 to 74 inches; gray (5Y 6/1) silt loam; common large distinct olive (5Y 4/3) mottles; weak very thin platy structure; very friable; slightly acid; clear wavy boundary.

IIC4—74 to 80 inches; gray (5Y 6/1) silt loam that has thin lenses of fine sand that increase in number and thickness as depth increases.

The mantle of loess ranges from 40 inches to many feet in thickness, and it overlies stratified silt and silt loam.

Goldstream series

The Goldstream series consists of poorly drained soils on broad alluvial plains and in depressional areas on outwash plains. These soils formed in deep silty alluvium and have permafrost. Slope is 0 to 3 percent. Elevation is 300 to 500 feet. The average annual precipitation is about 12 inches, and the average annual air temperature is about 26 degrees F.

These soils are loamy, mixed, acid Histic Pergelic Cryaquepts.

Typical pedon of a Goldstream silt loam in the SW1/4NW1/4SW1/4 of sec. 21, T. 28 S., R. 10 W.

O1—9 to 2 inches; dark brown (7.5YR 3/2) coarse sedge and roots; very strongly acid; abrupt smooth boundary.

O2—2 inches to 0; dark reddish brown (5YR 2.5/2) finely divided organic matter; nonsticky and slightly plastic; few fine roots; very strongly acid; abrupt, smooth boundary.

A1—0 to 2 inches; black (5Y 2.5/2) mucky silt loam; massive; nonsticky and slightly plastic; few fine roots; medium acid; clear wavy boundary.

B21g—2 to 7 inches; dark gray (5Y 4/1) silt loam; common medium distinct dark brown (10YR 4/3) mottles; massive; friable; medium acid; clear wavy boundary.

B22gt—7 to 21 inches; olive gray (5Y 4/2) silt loam; many coarse faint olive (5Y 4/3) mottles; streaks and pockets of black (N 2/0) organic material; frozen; thin ice lenses; slightly acid.

The organic mat is 6 to 14 inches thick. Lenses of fine sand are in the profile in places. Permafrost is 10 to 24 inches below the mineral surface layer.

Kantishna series

The Kantishna series consists of very poorly drained soils in filled-in lakes and in abandoned stream channels on broad alluvial plains. These soils formed in floating coarse mosses and sedges. Slope is 0 to 1 percent. Elevation is 300 to 350 feet. The average annual precipitation is about 12 inches, and the average annual air temperature is about 27 degrees F.

These soils are Dysic Hydric Borofibrists.

Typical pedon of Kantishna peat in the NE1/4NE1/4 of sec. 19, T. 1 S., R. 8 W., Fairbanks Meridian.

Oi1—0 to 8 inches; dark reddish brown (5YR 3/2) mat of coarse mosses and sedges; 90 percent fiber, rubbed; many fine and medium roots; very strongly acid; clear smooth boundary.

Oi2—8 to 20 inches; dark reddish brown (5YR 3/3) slightly decomposed sedge and moss peat; 90 percent fiber, rubbed; few roots; very strongly acid; frozen until late in summer; gradual boundary.

Oi3—20 to 60 inches; sparse fibrous peat in water; not sufficiently coherent for sampling and observation.

Thickness of the peat over water ranges from 16 inches to about 40 inches. Open ponds are common within areas of the peat. In some years the peat immediately above the water, in places, is frozen throughout the summer.

Koyukuk series

The Koyukuk series consists of well drained soils on high terraces and dunes on outwash plains. These soils formed in deep silty loess that has moderate amounts of fine mica. Slope is 0 to 12 percent. Elevation is 350 to 450 feet. The average annual precipitation is about 12 inches, and the average annual air temperature is about 27 degrees F.

These soils are coarse-silty, mixed Typic Cryochrepts.

Typical pedon of Koyukuk silt loam, rolling, in the SW1/4SW1/4NE1/4 of sec. 6, T. 4 S., R. 9 W., Fairbanks Meridian.

O1—1 inch to 0; black (N 2/0) partially decomposed forest litter; many roots; very strongly acid; abrupt wavy boundary.
A1—0 to 1 inch; dark brown (10YR 3/3) silt loam; weak very fine granular structure; very friable; many roots; medium acid; abrupt wavy boundary.
B2—1 to 11 inches; dark brown (10YR 4/3) silt loam; weak very thin platy structure; very friable; common roots; medium acid; clear wavy boundary.
B3—11 to 23 inches; yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6) silt loam; few black (5YR 2/1) stains and concretions; weak very thin platy structure; very friable; common roots; neutral; clear wavy boundary.
C1—23 to 42 inches; grayish brown (2.5Y 5/2) silt loam; streaks of brown (7.5YR 5/4); weak very thin platy structure; very friable; few roots; neutral.

A dark brown A1 horizon or a grayish brown A2 horizon, or both, can occur in the same pedon. The B2 horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 3 to 6. Brown or black concretions are in the lower part of the B horizon in places. The C horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 2 to 4. Brown horizontal streaks are common in the C horizon. The loess is 40 inches to many feet deep over fine sand.

Nenana series

The Nenana series consists of well drained soils on outwash plains. These soils formed in shallow and moderately deep, micaceous silty loess overlying sandy alluvium. Slope is 0 to 20 percent. Elevation is 300 to 500 feet. The average annual precipitation is about 12 inches, and the average annual air temperature is about 26 degrees F.

These soils are coarse-silty over sandy or sandy-skeletal, mixed Typic Cryochrepts.

Typical pedon of Nenana silt loam, shallow, nearly level, in the NE1/4NE1/4 of sec. 8, T. 4 S., R. 9 W.

O1—1 inch to 0; black (5YR 2/1) partially decomposed forest litter; mycelia; many roots; slightly acid; abrupt smooth boundary.
A1—0 to 2 inches; dark brown (10YR 3/3) silt loam; very thin discontinuous patches of dark grayish brown (10YR 4/2) at the top of the horizon; weak very fine granular structure; very friable; many roots; slightly acid; abrupt wavy boundary.
B21—2 to 5 inches; dark yellowish brown (10YR 4/4) silt loam; very thin platy structure; very friable; many roots; slightly acid; abrupt wavy boundary.
B22—5 to 12 inches; olive brown (2.5Y 4/4) silt; weak very thin platy structure; very friable; few roots; slightly acid; gradual boundary.
B3—12 to 19 inches; olive brown (2.5Y 4/4) silt; weak medium subangular blocky structure parting to weak very thin platy; yellowish brown (10YR 5/4) coatings on faces of peds; very friable; few roots; slightly acid; abrupt irregular boundary.
IIC1—19 to 64 inches; olive gray (5Y 5/2) stratified fine and medium sand; single grain; loose; neutral.

The silt loam and silt mantle is 12 to 34 inches thick. The A horizon is strongly acid to slightly acid. The B horizon has hue of 5YR to 2.5Y and value of 4 or 5. The C horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 2 or 3.

Richardson series

The Richardson series consists of moderately well drained soils in slightly depressional areas on outwash plains in the eastern part of the survey area. These soils formed in silty loess overlying sandy water-laid sediment. Slope is 0 to 3 percent. Elevation is 300 to 450 feet. The average annual precipitation is about 12 inches, and the average annual air temperature is about 26 degrees F.

These soils are coarse-silty, mixed Aquic Cryochrepts.

Typical pedon of Richardson silt loam in the NE1/4NE1/4 of sec. 9, T. 4 S., R. 9 W.

O1—2 inches to 0; very dark brown (10YR 2/2) partially decomposed forest litter and moss; many roots; extremely acid; abrupt smooth boundary.
A1—0 to 2 inches; mixed black (N 2/0) and dark brown (10YR 3/3) silt loam; weak very fine granular structure; many roots; common charcoal; very strongly acid; abrupt irregular boundary.
A3—2 to 5 inches; dark grayish brown (2.5Y 4/2) silt loam; streaks and patches of very dark grayish brown (10YR 3/2) and black (N 2/0); weak very thin platy structure; very friable; common roots; strongly acid; abrupt wavy boundary.
B2g—5 to 16 inches; olive (5Y 4/3) silt loam; common medium distinct mottles of dark brown (10YR 3/3); weak very thin platy structure; very friable; common roots, slightly acid; gradual boundary.
C1—16 to 27 inches; olive gray (5Y 5/2) silt; many medium prominent mottles of olive brown (2.5Y

4/4); very friable; few roots; neutral; gradual boundary.

C2—27 to 51 inches; gray (5Y 5/1) silt; common large prominent mottles of dark yellowish brown (10YR 4/4); weak very thin platy structure; very friable; neutral; abrupt smooth boundary.

IIC3—51 to 60 inches; gray (5Y 5/1) fine sand.

The silty loess mantle is 40 to 60 inches thick over a sandy or sandy-skeletal C horizon. The loess is commonly high in content of mica. Mottling occurs in the A horizon in some pedons. The B and C horizons have hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4.

Salchaket series

The Salchaket series consists of well drained soils on natural levees and low terraces adjacent to rivers and streams. These soils formed in sandy and silty alluvial deposits. Slope is 0 to 3 percent. The vegetation is mainly paper birch, cottonwood, balsam poplar, and white spruce. Elevation is 300 to 500 feet. The average annual precipitation is about 2 inches, and the average annual air temperature is about 26 degrees F.

These soils are coarse-loamy, mixed, nonacid Typic Cryofluvents.

Typical pedon of Salchaket very fine sandy loam in the NE1/4NW1/4 of sec. 2, T. 4 S., R. 8 W.

O1—2 inches to 0; dark reddish brown (5YR 2/2) forest litter; admixture of silt; many roots; neutral; abrupt smooth boundary.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) very fine sandy loam; many coarse distinct dark brown (10YR 3/3) mottles; layers and pockets of dark, partly decomposed organic matter; weak fine granular structure; very friable; common roots; neutral; clear smooth boundary.

C1—6 to 25 inches; stratified dark grayish brown (10YR 4/2) very fine sandy loam and dark grayish brown (2.5Y 4/2) fine sand; strata of sand 1/2 inch to 1 1/2 inches thick make up about 20 percent of the horizon; few lenses of organic matter; very fine sandy loam is massive and very friable; fine sand is single grain and loose; common to few roots; neutral; abrupt smooth boundary.

C2—25 to 60 inches; gray (10YR 5/1) fine sand; single grain; loose; few roots; neutral.

The profile commonly is neutral throughout, but in places it is slightly acid or medium acid in the upper part. The strata in the upper part of the C horizon vary in thickness and are silt loam to sand.

Tanana series

The Tanana series consists of somewhat poorly drained soils on broad outwash plains and alluvial plains. These soils formed in silty and sandy sediment. Permafrost is at a depth of about 20 inches below a thin surface mat of organic material. Slope is 0 to 3 percent. The vegetation is mainly black spruce, low-growing shrubs, and moss. In places, it is white spruce, paper birch, willow, and alder. Elevation is 300 to 500 feet. The average annual precipitation is about 12 inches, and the average annual air temperature is about 26 degrees F.

These soils are loamy, mixed, nonacid Pergelic Cryaquepts.

Typical pedon of Tanana silt loam in the NW1/4NW1/4 of sec. 26, T. 5 S., R. 4 E.

O11—3 inches to 1 inch; mat of fresh moss, leaves, and twigs.

O12—1 inch to 0; dark reddish brown (5YR 2/2) mat of decomposing moss, leaves, and twigs; many charcoal fragments; very strongly acid; abrupt smooth boundary.

A1—0 to 3 inches; very dark gray (10YR 3/1) silt loam; many dark grayish brown (2.5Y 4/2) streaks; weak fine granular structure; very friable; micaceous; many roots; medium acid; clear wavy boundary.

B2—3 to 6 inches; olive brown (2.5Y 4/4) silt loam; many dark grayish brown (2.5Y 4/2) streaks; common medium distinct brown (7.5YR 4/4) mottles; weak thin platy structure; very friable; micaceous; few roots; medium acid; gradual boundary.

Cg—6 to 40 inches; olive (5Y 4/3) silt loam; lenses of very fine sand 1/4 to 1 inch thick; olive brown (2.5Y 4/4) streaks; few medium distinct brown (7.5YR) mottles; weak to moderate thin platy structure; friable; frozen below a depth of 20 inches in summer; micaceous; few dark reddish brown concretions; few rounded pebbles; few roots; medium acid.

Reaction ranges from medium acid to neutral. Thin sandy lenses are in the lower layers in some pedons. Depth to permafrost is 20 to 40 inches.

Teklanika series

The Teklanika series consists of excessively drained soils on stabilized dunes and escarpments on outwash plains. These soils formed in deep sandy water-laid sediment that has been reworked by wind. Slope is 7 to 55 percent. The vegetation commonly is an open forest of quaking aspen, paper birch, and white spruce in pure and mixed stands. The dominant vegetation in places includes black spruce, lowbush cranberry, and moss. Elevation is 300 to 650 feet. The average annual precipitation is about 12 inches, and the average annual air temperature is about 27 degrees F.

These soils are mixed Typic Cryopsamments.

Typical pedon of Teklanika loamy fine sand in the NW1/4SW1/4 of sec. 9, T. 6 S., R. 12 W., Fairbanks Meridian.

O1—2 inches to 0; reddish brown (5YR 4/3) mat of partially decomposed forest litter; many roots; abrupt smooth boundary.
A1—0 to 4 inches; yellowish red (5YR 5/6) loamy fine sand; weak fine granular structure; very friable; common roots; very strongly acid; abrupt smooth boundary.
AC—4 to 7 inches; strong brown (7.5YR 5/6) fine sand; single grain; loose; common roots; medium acid; abrupt smooth boundary.
C—7 to 55 inches; light olive brown (2.5Y 5/4) fine sand; single grain; loose; few roots; slightly acid.

The A horizon is 2 to 5 inches thick. It has hue of 10YR to 5YR, value of 4 or 5, chroma of 4 to 6. The C horizon has value of 4 or 5 and chroma of 2 to 4. Irregular strata of medium sand occur in the C horizon in places.

Toklat series

The Toklat series consists of well drained soils in depressional areas on outwash plains and on low dunes. These soils formed in deep sandy sediment. They have a thin mantle of silty loess. Slope is 0 to 3 percent. The vegetation commonly is large clusters of quaking aspen, but in places it includes white spruce, paper birch, and willow. Elevation is 350 to 550 feet. The average annual precipitation is about 13 inches, and the average annual air temperature is about 27 degrees F.

These soils are coarse-loamy, mixed, ortstein Typic Cryorthods.

Typical pedon of Toklat silt loam in the SW1/4SE1/4 of sec. 19, T. 4 S., R. 12 W., Fairbanks Meridian.

O1—2 inches to 0; dark brown (7.5YR 3/2) mat of partially decomposed forest litter; many roots; abrupt smooth boundary.
A1—0 to 1/2 inch; dark grayish brown (10YR 4/2) silt loam; weak very fine granular structure; very friable; many roots; very strongly acid; abrupt smooth boundary.
A2—1/2 inch to 15 inches; light gray (10YR 7/1) loamy very fine sand; weak very thin platy structure; very friable; common roots; strongly acid; abrupt smooth boundary.
B2m—15 to 22 inches; dark reddish brown (5YR 3/2 with patches of 5YR 2/3) sand; strong thick platy structure; strongly cemented; vertical fractures; very strongly acid; abrupt wavy boundary.
A2'—22 to 25 inches; light gray (10YR 7/1) loamy very fine sand; weak very thin platy structure; very friable; common roots; strongly acid; abrupt smooth boundary.
B2'm—25 to 40 inches; dark reddish brown (5 YR 3/2 with patches of 5YR 2/3) sand; strong thick platy structure; strongly cemented; vertical fractures; very strongly acid; abrupt wavy boundary.

The A2 horizon is 4 to 20 inches thick. The B2 horizon is strongly cemented to indurated.

Volkmar series

The Volkmar series consists of moderately well drained soils in low areas on outwash plains. These soils formed in silty micaceous loess overlying sandy outwash. Slope is 0 to 3 percent. The vegetation includes quaking aspen, paper birch, black spruce, willow, grasses, sedges, and hypnum moss. Elevation is 300 to 500 feet. The average annual precipitation is about 12 inches, and the average annual temperature is about 26 degrees F.

These soils are coarse-silty over sandy or sandy-skeletal, mixed Aquic Cryochrepts.

Typical pedon of a Volkmar silt loam in the SE1/4SE1/4 of sec. 6, T. 4 S., R. 9 W.

O1—3 inches to 0; dark reddish brown (5YR 2/2) partially decomposed forest litter; charcoal fragments; many roots; very strongly acid; abrupt smooth boundary.
A1—0 to 5 inches; streaked dark gray (10YR 4/1), black (10YR 2/1), and dark brown (10YR 3/3) silt loam; weak very fine subangular blocky structure; friable; many roots; strongly acid; abrupt irregular boundary.
A3—5 to 12 inches; dark brown (10YR 3/3) silt loam; common irregular streaks of very dark grayish brown (10YR 3/2) and few streaks of black (10YR 2/1); weak very thin platy structure; very friable; common roots; medium acid; abrupt irregular boundary.
B2g—12 to 22 inches; dark grayish brown (10YR 4/2) silt loam; many medium distinct mottles of dark yellowish brown (10YR 4/4) and few irregular streaks of very dark grayish brown (10YR 3/2); weak very thin platy structure; very friable; few roots; medium acid; clear wavy boundary.
C1g—22 to 28 inches; dark grayish brown (2.5Y 4/2) silt loam; horizontal streaks of dark brown (7.5YR 4/4) and few patches of very dusky red (2.5YR 2/2) in old root channels; weak very thin platy structure; very friable; few roots; slightly acid; irregular strata of silt loam and sand in lower part of the horizon; abrupt irregular boundary.
IIC2g—28 to 40 inches; olive gray (5Y 4/2) stratified fine and medium sand; common medium prominent mottles of dark reddish brown (5YR 3/4), which increase in number as depth increases; single grain; loose; no roots; mildly alkaline.

Reaction is strongly acid in the A horizon to mildly alkaline in the IIC horizon. In most places the silt loam is 12 to 20 inches thick over fine sand, but in some places it is as much as 40 inches thick.

Formation of the soils

This section discusses the factors of soil formation, relates them to the formation of soils in the survey area, and explains the processes of soil formation.

Factors of soil formation

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic forces. The characteristics of the soil at any given point are determined by the interaction of five major factors: (1) parent material, (2) climate, (3) plants and animals, (4) relief, and (5) time. Also important are the cultural environment and man's use of the soil (*5*).

Climate and plants and animals are the active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and, in places, through subsequent transportation by water and wind, and they slowly change it into a natural body with genetically related horizons. The effects of climate and plants and animals are conditioned by relief. The soils in low-lying areas of the Totchaket Area, for example, are quite different from those on the well drained outwash plains because they have a permanently high water table. The parent material also affects the kind of profile that can form, and in extreme cases, determines it almost entirely. Finally, time is needed to change parent material into soil. Generally, a long time is needed for distinct horizons to form.

Parent material

Parent material is the unconsolidated mass from which a soil forms. It determines the limits of the chemical and mineral composition of the soil.

The soils in the Totchaket Area formed mainly in outwash, alluvial material, and loess (*10*). These materials are micaceous because many of the rocks in the area and those in the areas of origin of these materials contain significant amounts of mica. Fairbanks, Nenana, and Volkmar soils on outwash plains formed in loess derived from glacial outwash. Tanana and Salchaket soils on broad alluvial plains along the major rivers of the area formed in water-deposited sand and silt produced principally from glacial action. The peats in the Bolio and Kantishna series are in depressional areas on broad alluvial plains.

Climate

The survey area has a continental climate characterized by long, cold winters and short, warm summers. The total annual precipitation is only about 12 inches, about half of which falls as rain in summer. Winds generally are light over most of the area, but strong winds can be expected in all seasons. Noncultivated, well drained soils generally are moist throughout the summer, but they are likely to be dry in years of exceptionally low rainfall. The other soils in the area are moist or wet in summer. Most of the soils that are cleared for farming, however, probably will be deficient in moisture for part of each year.

Plants and animals

All of the well drained soils and most of the moderately well drained soils in the survey area formed under vegetation that consisted mainly of paper birch, quaking aspen, and white spruce. The somewhat poorly drained Tanana and Dotlake soils support stunted stands of these trees mixed with black spruce, tamarack, and willow. These soils also have a dense cover of grasses, low shrubs, and moss. Some areas of the poorly drained Goldstream soils and the very poorly drained Kantishna and Bolio soils support sparse stands of trees, mainly black spruce or tamarack, but other areas are treeless. These soils have a ground cover of moss, sedge tussocks, and shrubs.

Relief

In this survey area, the influence of relief on soil formation is strongest in its effect on natural drainage. The soils on outwash plains are mostly well drained or excessively drained, and the runoff and seepage that do occur are received by depressions. Dotlake and Goldstream soils, for example, are in depressions. They are underlain by permafrost in most places, and they are always cold and wet. In contrast, most of the soils that are nearly level to steep do not have permafrost, and they are moderately well drained or excessively well drained (*6*). Goldstream and Tanana soils on broad, low alluvial plains have a perennially frozen substratum. In the well drained Salchaket soils, which are in the slightly higher positions on levees along rivers, permafrost is at a great depth or is not present.

Time

A long time is needed for the formation of soils that have distinct horizons. The length of time that parent material has been in place generally is reflected in the degree of formation of the soil profile.

Only the outwash plain in the central part of the Totchaket Area has soils that probably formed since the maximum glacial advance from the mountains to the south. The well drained Fairbanks soils on the outwash plains, on which loess is no longer being deposited, are the oldest soils. They have been in place long enough to develop a B horizon that has thin bands of clay accumulation. The well drained Nenana soils and the excessively drained Beales soils are intermediate in age. They have been in place long enough to develop a B horizon, but they do not have clay bands. The soils that are forming in recent deposits on alluvial plains are young and have not had time for horizon differentiation to take place. The somewhat poorly drained and poorly drained soils on outwash and alluvial plains show weak horizon development.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Coarse fragments. Mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Depth to rock. A restrictive feature is too near the surface for the specified use.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permafrost. Layers of soil, or even bedrock, occurring in arctic or subarctic regions, in which a temperature below freezing has existed continuously for a long time.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Pitting (in tables). Pits caused by melting ground ice. They form on the soil after plant cover is removed.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	Less than 0.002

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-71 at Nenana, Alaska]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	-1.6	-20.6	-11.1	37	-59	0	.55	.17	.85	2	7.7
February---	7.0	-15.5	-4.2	40	-51	0	.56	.14	.88	2	7.4
March------	20.2	-8.2	6.0	48	-48	18	.39	.10	.61	1	5.4
April------	38.0	15.5	26.8	62	-21	21	.29	.08	.45	1	3.2
May--------	57.1	33.6	45.4	79	17	200	.60	.24	.88	2	.2
June-------	69.2	44.6	56.9	86	30	507	1.56	.62	2.31	5	.0
July-------	70.0	47.2	58.6	88	33	577	2.27	1.23	3.11	6	.0
August-----	64.5	43.2	53.9	81	26	431	2.50	1.13	3.60	6	.0
September--	52.7	32.8	42.8	71	12	127	1.32	.40	2.05	4	.8
October----	30.8	15.2	23.0	56	-18	16	.66	.31	.95	2	6.7
November---	12.5	-4.2	4.2	44	-40	0	.59	.16	.93	2	8.6
December---	-.1	-17.7	-8.9	38	-58	0	.63	.18	.98	2	8.6
Yearly:											
Average---	35.2	19.3	26.5	---	---	---	---	---	---	---	---
Extreme---	---	---	---	89	-61	---	---	---	---	---	---
Total-----	---	---	---	---	---	1,897	11.92	9.10	14.58	35	48.6

[1]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-71 at Nenana, Alaska]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 19	May 31	June 11
2 years in 10 later than--	May 15	May 27	June 7
5 years in 10 later than--	May 6	May 19	May 30
First freezing temperature in fall:			
1 year in 10 earlier than--	August 29	August 19	July 27
2 years in 10 earlier than--	September 4	August 25	August 4
5 years in 10 earlier than--	September 14	September 3	August 21

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-71 at Nenana, Alaska]

Probability	Daily minimum temperature		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	109	87	53
8 years in 10	116	94	63
5 years in 10	130	107	82
2 years in 10	144	120	101
1 year in 10	151	127	111

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Beales silt loam, nearly level	12,140	2.1
2	Beales silt loam, undulating	41,230	7.1
3	Bolio peat	42,190	7.3
4	Bradway very fine sandy loam	11,040	1.9
5	Dotlake silt loam	29,110	5.0
6	Fairbanks silt loam, undulating	50	*
7	Fairbanks silt loam, rolling	2,580	0.4
8	Fairbanks silt loam, very steep	170	*
9	Goldstream silt loam	117,130	20.2
10	Kantishna peat	23,950	4.1
11	Koyukuk silt loam, nearly level	930	0.2
12	Koyukuk silt loam, undulating	5,960	1.0
13	Koyukuk silt loam, rolling	150	*
14	Nenana silt loam, moderately deep, nearly level	640	0.1
15	Nenana silt loam, moderately deep, undulating	910	0.2
16	Nenana silt loam, moderately deep, rolling	130	*
17	Nenana silt loam, shallow, nearly level	26,720	4.6
18	Nenana silt loam, shallow, undulating	78,990	13.6
19	Nenana silt loam, shallow, rolling	17,390	3.0
20	Nenana silt loam, shallow, hilly	940	0.2
21	Richardson silt loam	5,880	1.0
22	Salchaket very fine sandy loam	20,480	3.5
23	Tanana silt loam	33,210	5.7
24	Teklanika loamy fine sand, rolling	34,590	6.0
25	Teklanika loamy fine sand, hilly	13,610	2.3
26	Teklanika loamy fine sand, steep	4,230	0.7
27	Teklanika loamy fine sand, very steep	4,720	0.8
28	Toklat silt loam	2,200	0.4
29	Toklat-Bolio complex	4,160	0.7
30	Volkmar silt loam	26,800	4.6
31	Volkmar-Nenana complex	17,560	3.0
	Water	8,250	1.4
	Total	579,790	100.0

* Less than 0.1 percent.

TABLE 5.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I	---	---	---	---	---
II	184,920	85,910	---	---	99,010
III	86,850	20,250	62,320	4,280	---
IV	54,310	42,170	---	12,140	---
V	---	---	---	---	---
VI	224,870	52,430	172,440	---	---
VII	4,890	4,890	---	---	---
VIII	23,950	---	23,950	---	---

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordi-nation symbol	Management concerns: Equip-ment limita-tion	Management concerns: Seedling mortal-ity	Management concerns: Wind-throw hazard	Management concerns: Plant competi-tion	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
1, 2 Beales	3s	Moderate	Moderate	Slight	Slight	Paper birch	42	White spruce.
						Quaking aspen	42	
						White spruce	---	
6, 7 Fairbanks	3o	Moderate	Moderate	Slight	Moderate	White spruce	83	White spruce.
						Quaking aspen	65	
						Paper birch	60	
8 Fairbanks	3r	Severe	Moderate	Slight	Moderate	White spruce	83	White spruce.
						Quaking aspen	65	
						Paper birch	60	
11, 12, 13 Koyukuk	2o	Moderate	Moderate	Slight	Moderate	White spruce	87	White spruce.
						Quaking aspen	65	
						Paper birch	60	
14, 15 Nenana	3o	Moderate	Moderate	Slight	Moderate	White spruce	83	White spruce.
						Quaking aspen	57	
						Paper birch	50	
16 Nenana	3o	Moderate	Moderate	Slight	Moderate	White spruce	83	White spruce.
						Quaking aspen	57	
						Paper birch	50	
17, 18 Nenana	3o	Moderate	Moderate	Slight	Moderate	White spruce	83	White spruce.
						Quaking aspen	57	
						Paper birch	50	
19, 20 Nenana	3s	Moderate	Moderate	Slight	Moderate	White spruce	83	White spruce.
						Quaking aspen	57	
						Paper birch	50	
22 Salchaket	2o	Moderate	Moderate	Slight	Moderate	White spruce	94	White spruce.
						Balsam poplar	---	
23 Tanana	3w	Moderate	Moderate	Slight	Severe	White spruce	79	White spruce.
						Paper birch	53	
						Black spruce	---	
28 Toklat	4d	Moderate	Moderate	Slight	Moderate	White spruce	70	White spruce.
						Quaking aspen	42	
						Paper birch	42	
29*: Toklat	4d	Moderate	Moderate	Slight	Moderate	White spruce	70	White spruce.
						Quaking aspen	42	
						Paper birch	42	
30 Volkmar	2w	Moderate	Slight	Slight	Moderate	White spruce	87	White spruce.
						Paper birch	61	
						Black spruce	---	
31*: Volkmar	2w	Moderate	Slight	Slight	Moderate	White spruce	87	White spruce.
						Paper birch	61	
						Black spruce	---	
31*: Nenana	3o	Moderate	Moderate	Slight	Moderate	White spruce	83	White spruce.
						Quaking aspen	57	
						Paper birch	50	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--		
	8-15	16-25	26-35
1, 2 Beales	White spruce	Paper birch, quaking aspen.	---
3. Bolio			
4. Bradway			
5 Dotlake	---	White spruce	---
6, 7, 8 Fairbanks	---	White spruce, paper birch.	Quaking aspen.
9. Goldstream			
10. Kantishna			
11, 12, 13 Koyukuk	---	White spruce, paper birch.	Quaking aspen.
14, 15, 16, 17, 18, 19, 20 Nenana	---	White spruce, paper birch.	Quaking aspen.
21 Richardson	---	White spruce, paper birch.	---
22 Salchaket	---	White spruce	Balsam poplar.
23 Tanana	---	White spruce	---
24, 25, 26, 27 Teklanika	White spruce	Paper birch, quaking aspen.	---
28 Toklat	White spruce	Paper birch, quaking aspen.	---
29*: Toklat	White spruce	Paper birch, quaking aspen.	---
Bolio.			
30 Volkmar	---	White spruce, paper birch.	Quaking aspen.
31*: Volkmar	---	White spruce, paper birch.	Quaking aspen.
Nenana	---	White spruce, paper birch.	Quaking aspen.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
1-----Beales	Slight	Slight	Slight	Severe: erodes easily.
2-----Beales	Slight	Slight	Moderate: slope.	Severe: erodes easily.
3-----Bolio	Severe: permafrost, ponding.	Severe: permafrost, ponding, excess humus.	Severe: permafrost, excess humas, ponding.	Severe: permafrost, ponding, excess humus.
4-----Bradway	Severe: permafrost, floods, ponding.	Severe: permafrost, ponding, excess humus.	Severe: permafrost, excess humus, ponding.	Severe: permafrost, ponding, excess humus.
5-----Dotlake	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness, erodes easily.
6-----Fairbanks	Slight	Slight	Moderate: slope.	Severe: erodes easily.
7-----Fairbanks	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.
8-----Fairbanks	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
9-----Goldstream	Severe: permafrost, ponding.	Severe: permafrost, ponding, excess humus.	Severe: permafrost, excess humus, ponding.	Severe: permafrost, ponding, excess humus.
10-----Kantishna	Severe: floods, ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding, floods.	Severe: ponding, excess humus.
11-----Koyukuk	Slight	Slight	Slight	Severe: erodes easily.
12-----Koyukuk	Slight	Slight	Moderate: slope.	Severe: erodes easily.
13-----Koyukuk	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.
14-----Nenana	Slight	Slight	Slight	Severe: erodes easily.
15-----Nenana	Slight	Slight	Moderate: slope.	Severe: erodes easily.
16-----Nenana	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.
17-----Nenana	Slight	Slight	Slight	Severe: erodes easily.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
18-------------------- Nenana	Slight---------------	Slight---------------	Moderate: slope.	Severe: erodes easily.
19-------------------- Nenana	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.
20-------------------- Nenana	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
21-------------------- Richardson	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, erodes easily.
22-------------------- Salchaket	Severe: floods.	Slight---------------	Moderate: floods.	Severe: erodes easily.
23-------------------- Tanana	Severe: permafrost, floods, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness, erodes easily.
24-------------------- Teklanika	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.
25-------------------- Teklanika	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
26, 27---------------- Teklanika	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
28-------------------- Toklat	Severe: ponding, cemented pan.	Severe: cemented pan, ponding.	Severe: cemented pan, ponding.	Severe: erodes easily, ponding.
29*:				
Toklat---------------	Severe: ponding, cemented pan.	Severe: cemented pan, ponding.	Severe: cemented pan, ponding.	Severe: erodes easily, ponding.
Bolio----------------	Severe: permafrost, ponding.	Severe: permafrost, ponding, excess humus.	Severe: permafrost, excess humus, ponding.	Severe: permafrost, ponding, excess humus.
30-------------------- Volkmar	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, erodes easily.
31*:				
Volkmar--------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, erodes easily.
Nenana---------------	Slight---------------	Slight---------------	Moderate: slope.	Severe: erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
1, 2 Beales	Poor	Poor	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
3 Bolio	Poor	Fair	Fair	Fair	Fair	Good	Good	Good	Fair	Fair	Good	Fair.
4 Bradway	Poor	Fair	Fair	Fair	Fair	Good	Good	Good	Fair	Fair	Good	Fair.
5 Dotlake	Fair	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair	Good.
6 Fairbanks	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
7 Fairbanks	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
8 Fairbanks	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
9 Goldstream	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Fair	Fair	Fair.
10 Kantishna	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	Very poor.
11, 12 Koyukuk	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
13 Koyukuk	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
14, 15 Nenana	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
16 Nenana	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
17, 18 Nenana	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
19, 20 Nenana	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
21 Richardson	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.
22 Salchaket	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
23 Tanana	Fair	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair	Good.
24, 25, 26 Teklanika	Poor	Poor	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
27 Teklanika	Very poor.	Very poor.	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
28 Toklat	Poor	Poor	Fair	Fair	Fair	Fair	Good	Good	Poor	Fair	Good	Fair.

TABLE 9.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
29*:												
Toklat	Poor	Poor	Fair	Fair	Fair	Fair	Good	Good	Poor	Fair	Good	Fair.
Bolio	Poor	Fair	Fair	Fair	Fair	Good	Good	Good	Fair	Fair	Good	Fair.
30 Volkmar	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.
31*:												
Volkmar	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.
Nenana	Good	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1 Beales	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
2 Beales	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.
3 Bolio	Severe: permafrost, ponding.	Severe: permafrost, ponding.	Severe: permafrost, ponding.	Severe: permafrost, ponding.	Severe: permafrost, ponding.
4 Bradway	Severe: permafrost, cutbanks cave, wetness.	Severe: permafrost, floods, wetness.	Severe: permafrost, floods, wetness.	Severe: permafrost, floods, wetness.	Severe: permafrost, wetness, floods.
5 Dotlake	Severe: permafrost, cutbanks cave, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.
6 Fairbanks	Moderate: cutbanks cave.	Slight	Slight	Moderate: slope.	Severe: frost action.
7 Fairbanks	Moderate: cutbanks cave, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.
8 Fairbanks	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.
9 Goldstream	Severe: permafrost, ponding.	Severe: permafrost, ponding.	Severe: permafrost, ponding.	Severe: permafrost, ponding.	Severe: permafrost, ponding.
10 Kantishna	Severe: excess humus, ponding.	Severe: floods, ponding, low strength.	Severe: floods, ponding, low strength.	Severe: floods, ponding, low strength.	Severe: ponding, floods, frost action.
11 Koyukuk	Slight	Slight	Slight	Slight	Severe: frost action.
12 Koyukuk	Slight	Slight	Slight	Moderate: slope.	Severe: frost action.
13 Koyukuk	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.
14 Nenana	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
15 Nenana	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.
16 Nenana	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
17 Nenana	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
18 Nenana	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.
19 Nenana	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
20 Nenana	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
21 Richardson	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.
22 Salchaket	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
23 Tanana	Severe: permafrost, wetness.	Severe: permafrost, floods, wetness.	Severe: permafrost, floods, wetness.	Severe: permafrost, floods, wetness.	Severe: permafrost, wetness, floods.
24 Teklanika	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
25, 26, 27 Teklanika	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
28 Toklat	Severe: cemented pan, cutbanks cave, ponding.	Severe: ponding.	Severe: ponding, cemented pan.	Severe: ponding.	Moderate: cemented pan, ponding. frost action.
29*:					
Toklat	Severe: cemented pan, cutbanks cave, ponding.	Severe: ponding.	Severe: ponding, cemented pan.	Severe: ponding.	Severe: ponding.
Bolio	Severe: permafrost, ponding.	Severe: permafrost, ponding.	Severe: permafrost, ponding.	Severe: permafrost, ponding.	Severe: permafrost, ponding.
30 Volkmar	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
31*:					
Volkmar	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Nenana	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1, 2: Beales	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
3: Bolio	Severe: permafrost, ponding.	Severe: permafrost, ponding, excess humus.	Severe: permafrost, ponding.	Severe: permafrost, ponding.	Poor: permafrost, ponding.
4: Bradway	Severe: permafrost, floods, wetness.	Severe: permafrost, seepage, floods.	Severe: permafrost, floods, seepage.	Severe: permafrost, floods, seepage.	Poor: permafrost, too sandy, wetness.
5: Dotlake	Severe: permafrost, wetness.	Severe: permafrost, seepage, wetness.	Severe: permafrost, wetness, seepage.	Severe: permafrost, wetness, seepage.	Poor: permafrost, too sandy, wetness.
6: Fairbanks	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
7: Fairbanks	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
8: Fairbanks	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
9: Goldstream	Severe: permafrost, ponding.	Severe: permafrost, ponding.	Severe: permafrost, ponding.	Severe: permafrost, ponding.	Poor: permafrost, hard to pack, ponding.
10: Kantishna	Severe: floods, ponding, poor filter.	Severe: seepage, floods, excess humus.	Severe: floods, seepage, ponding.	Severe: floods, seepage, ponding.	Poor: ponding, excess humus.
11: Koyukuk	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
12: Koyukuk	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
13: Koyukuk	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
14, 15: Nenana	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
16: Nenana	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
17, 18: Nenana	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
19 Nenana	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
20 Nenana	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
21 Richardson	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.
22 Salchaket	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage, too sandy.	Severe: floods, seepage.	Fair: too sandy.
23 Tanana	Severe: permafrost, floods, wetness.	Severe: permafrost, floods, wetness.	Severe: permafrost, floods, wetness.	Severe: permafrost, floods, wetness.	Poor: permafrost, wetness.
24 Teklanika	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
25, 26, 27 Teklanika	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
28 Toklat	Severe: cemented pan, poor filter, ponding.	Severe: seepage, cemented pan, ponding.	Severe: seepage, ponding.	Severe: cemented pan, seepage, ponding.	Poor: area reclaim, ponding.
29*:					
Toklat	Severe: ponding, cemented pan, poor filter.	Severe: seepage, cemented pan, ponding.	Severe: ponding, seepage.	Severe: ponding, cemented pan, seepage.	Poor: area reclaim, ponding.
Bolio	Severe: permafrost, ponding.	Severe: permafrost, ponding. excess humus.	Severe: permafrost, ponding.	Severe: permafrost, ponding.	Poor: permafrost, ponding.
30 Volkmar	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
31*:					
Volkmar	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Nenana	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1, 2-----Beales	Good	Probable	Improbable: too sandy.	Poor: thin layer.
3-----Bolio	Poor: permafrost, wetness.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, excess humus, wetness.
4-----Bradway	Poor: permafrost, wetness.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, wetness.
5-----Dotlake	Poor: permafrost, wetness.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, wetness.
6-----Fairbanks	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
7-----Fairbanks	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
8-----Fairbanks	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
9-----Goldstream	Poor: permafrost, wetness.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, wetness.
10-----Kantishna	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
11, 12-----Koyukuk	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
13-----Koyukuk	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
14, 15-----Nenana	Good	Probable	Improbable: too sandy.	Fair: thin layer.
16-----Nenana	Good	Probable	Improbable: too sandy.	Fair: thin layer, slope.
17, 18-----Nenana	Good	Probable	Improbable: too sandy.	Fair: thin layer.
19-----Nenana	Good	Probable	Improbable: too sandy.	Fair: thin layer, slope.
20-----Nenana	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
21-----Richardson	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
22-----Salchaket	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
23 Tanana	Poor: permafrost, wetness.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, wetness.
24 Teklanika	Good	Probable	Improbable: too sandy.	Fair: too sandy.
25 Teklanika	Fair: slope.	Probable	Improbable: too sandy.	Fair: too sandy.
26, 27 Teklanika	Poor: slope.	Probable	Improbable: too sandy.	Fair: too sandy.
28 Toklat	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
29*:				
Toklat	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Bolio	Poor: permafrost, wetness.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, excess humus, wetness.
30 Volkmar	Poor: wetness.	Probable	Improbable: too sandy.	Poor: thin layer, wetness.
31*:				
Volkmar	Poor: wetness.	Probable	Improbable: too sandy.	Poor: thin layer, wetness.
Nenana	Good	Probable	Improbable: too sandy.	Fair: thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
1 Beales	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, erodes easily.	Erodes easily, droughty.
2 Beales	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, slope, erodes easily.	Erodes easily, droughty.
3 Bolio	Severe: permafrost.	Severe: permafrost, ponding.	Severe: no water.	Permafrost, ponding, frost action.	Permafrost, ponding.	Permafrost, wetness.
4 Bradway	Severe: permafrost, seepage.	Severe: permafrost, piping, ponding.	Severe: no water.	Permafrost, floods, frost action.	Permafrost, ponding. floods.	Permafrost, wetness, erodes easily.
5 Dotlake	Severe: permafrost, seepage.	Severe: permafrost, piping, wetness.	Severe: no water.	Permafrost, frost action.	Permafrost, wetness.	Permafrost, wetness, erodes easily.
6 Fairbanks	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Erodes easily.
7, 8 Fairbanks	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
9 Goldstream	Severe: permafrost.	Severe: permafrost, piping, excess humus.	Severe: no water.	Permafrost, ponding, frost action.	Permafrost, ponding.	Permafrost, wetness.
10 Kantishna	Severe: seepage.	Severe: excess humus, ponding.	Slight	Ponding, floods, frost action.	Ponding, floods.	Wetness.
11 Koyukuk	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
12 Koyukuk	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Erodes easily.
13 Koyukuk	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
14 Nenana	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
15 Nenana	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Erodes easily.
16 Nenana	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
17 Nenana	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
19, 20------------ Nenana	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
21---------------- Richardson	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action---	Wetness, erodes easily.	Wetness, erodes easily.
22---------------- Salchaket	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing, erodes easily, floods.	Erodes easily.
23---------------- Tanana	Severe: permafrost.	Severe: permafrost, piping, wetness.	Severe: no water.	Permafrost, floods, frost action.	Permafrost, wetness, erodes easily.	Permafrost, wetness, erodes easily.
24, 25, 26, 27---- Teklanika	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, erodes easily, droughty.
28---------------- Toklat	Severe: seepage, cemented pan.	Severe: ponding, piping.	Severe: no water.	Ponding--------	Fast intake, soil blowing, ponding.	Erodes easily, cemented pan.
29*:						
Toklat-----------	Severe: seepage, cemented pan.	Severe: ponding, piping.	Severe: no water.	Ponding--------	Fast intake, soil blowing, ponding.	Erodes easily, cemented pan.
Bolio------------	Severe: permafrost.	Severe: permafrost, ponding.	Severe: no water.	Permafrost, ponding, frost action.	Permafrost, ponding.	Permafrost, wetness.
30---------------- Volkmar	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, erodes easily, droughty.
31*:						
Volkmar----------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, erodes easily, droughty.
Nenana-----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

[The symbol > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	Percentage passing sieve number--: 10	Percentage passing sieve number--: 40	Percentage passing sieve number--: 200	Liquid limit	Plasticity index
	In				Pct					Pct	
1, 2------------- Beales	0-6	Silt loam--------	ML	A-4	0	100	100	100	75-90	30-40	NP-10
	6-60	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3	0	100	100	95-100	5-25	---	NP
3---------------- Bolio	0-8	Peat-------------	PT	A-8	0	---	---	---	---	---	---
	8-20	Ice or frozen soil.	---	---	---	---	---	---	---	---	---
4---------------- Bradway	0-5	Very fine sandy loam.	OL	A-5	0	100	100	90-100	70-90	40-50	NP-10
	5-32	Stratified very fine sandy loam to fine sand.	ML, SM	A-4	0	100	100	85-95	45-65	---	NP
	32-40	Ice or frozen soil.	---	---	---	---	---	---	---	---	---
5---------------- Dotlake	0-15	Silt loam--------	ML	A-4	0	100	100	95-100	75-90	25-40	NP-10
	15-28	Stratified fine sand to silt loam.	SM	A-2, A-4	0	100	100	70-80	25-40	---	NP
	28-30	Ice or frozen soil.	---	---	---	---	---	---	---	---	---
6, 7, 8---------- Fairbanks	0-5	Silt loam--------	ML	A-4	0	100	100	95-100	75-90	25-40	NP-10
	5-74	Silt loam, silt	ML	A-4	0	100	100	95-100	75-90	25-40	NP-10
9---------------- Goldstream	0-2	Mucky silt loam	OL	A-4, A-5	0	100	95-100	85-95	65-85	30-50	NP-10
	2-21	Silt loam--------	ML, OL	A-4, A-5	0	100	95-100	85-95	65-85	30-50	NP-10
	21-25	Ice or frozen soil.	---	---	---	---	---	---	---	---	---
10--------------- Kantishna	0-20	Peat-------------	PT	A-8	0	---	---	---	---	---	---
	20-60	Peat, fibric material.	PT	A-8	0	---	---	---	---	---	---
11, 12, 13------- Koyukuk	0-1	Silt loam--------	ML	A-4	0	100	100	95-100	75-90	25-40	NP-10
	1-60	Silt loam--------	ML	A-4	0	100	100	95-100	75-90	25-40	NP-10
14, 15, 16------- Nenana	0-10	Silt loam--------	ML	A-4	0	100	100	90-100	75-90	25-40	NP-10
	10-28	Silt loam, silt	ML	A-4	0	100	100	90-100	75-90	25-40	NP-10
	28-60	Fine sand, sand	SP-SM, SM	A-2, A-3	0	100	100	75-95	5-20	---	NP
17, 18, 19, 20--- Nenana	0-10	Silt loam--------	ML	A-4	0	100	100	90-100	75-90	25-40	NP-10
	10-19	Silt loam, silt	ML	A-4	0	100	100	90-100	75-90	25-40	NP-10
	19-60	Fine sand, sand	SP-SM, SM	A-2, A-3	0	100	100	75-95	5-20	---	NP
21--------------- Richardson	0-5	Silt loam--------	ML	A-4	0	100	100	95-100	75-95	25-40	NP-10
	5-51	Silt loam, silt	ML	A-4	0	100	100	95-100	75-95	25-40	NP-10
	51-60	Fine sand--------	SP-SM, SM	A-2, A-3	0	100	100	75-95	5-20	---	NP
22--------------- Salchaket	0-6	Very fine sandy loam.	ML	A-4	0	100	100	85-95	50-65	---	NP
	6-60	Stratified very fine sand to silt loam.	ML, SM	A-4	0	100	100	85-95	40-65	---	NP
23--------------- Tanana	0-20	Silt loam--------	ML	A-4, A-5	0	100	100	90-100	70-90	35-45	NP-10
	20-40	Ice or frozen soil.	---	---	---	---	---	---	---	---	---
24, 25, 26, 27--- Teklanika	0-4	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	100	85-100	5-30	---	NP
	4-55	Fine sand--------	SP-SM, SM	A-2, A-3	0	100	100	65-80	5-20	---	NP

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
28	0-15	Silt loam	ML	A-4	0	100	100	90-100	70-80	---	NP
Toklat	15-22	Cemented	---	---	---	---	---	---	---	---	---
	22-25	Loamy very fine sand.	SM, ML	A-4	0	100	100	90-95	45-55	---	NP
	25-40	Cemented	---	---	---	---	---	---	---	---	---
29*:											
Toklat	0-15	Loamy very fine sand.	SM, ML	A-4	0	100	100	90-95	45-55	---	NP
	15-22	Cemented	---	---	---	---	---	---	---	---	---
	22-25	Loamy very fine sand.	SM, ML	A-4	0	100	100	90-95	45-55	---	NP
	25-40	Cemented	---	---	---	---	---	---	---	---	---
Bolio	0-8	Peat	PT	A-8	0	---	---	---	---	---	---
	8-20	Ice or frozen soil.	---	---	---	---	---	---	---	---	---
30	0-5	Silt loam	ML	A-4	0	100	100	95-100	75-95	25-40	NP-10
Volkmar	5-28	Silt loam	ML	A-4	0	100	100	95-100	75-95	25-40	NP-10
	28-60	Fine sand, sand	SP-SM, SM	A-2, A-3	0	100	100	75-95	5-20	---	NP
31*:											
Volkmar	0-5	Silt loam	ML	A-4	0	100	100	95-100	75-95	25-40	NP-10
	5-28	Silt loam	ML	A-4	0	100	100	95-100	75-95	25-40	NP-10
	28-60	Fine sand, sand	SP-SM, SM	A-2, A-3	0	100	100	75-95	5-20	---	NP
Nenana	0-10	Silt loam	ML	A-4	0	100	100	90-100	75-90	25-40	NP-10
	10-19	Silt loam, silt	ML	A-4	0	100	100	90-100	75-90	25-40	NP-10
	19-60	Fine sand, sand	SP-SM, SM	A-2, A-3	0	100	100	75-95	5-20	---	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
1, 2 Beales	0-6	5-10	1.35-1.55	0.6-2.0	0.19-0.23	5.1-7.3	Low	0.55	1	5	1-4
	6-60	0-5	1.55-1.65	6.0-20	0.04-0.08	4.5-6.5	Low	0.15			
3 Bolio	0-8	---	---	0.6-2.0	---	3.6-4.4	Low	----	---	8	---
	8-20	---	---	---	---	---	---	----			
4 Bradway	0-5	5-10	1.30-1.35	2.0-6.0	0.20-0.25	5.6-6.5	Low	0.32	5	8	2-6
	5-32	0-5	1.45-1.65	2.0-6.0	0.12-0.16	7.4-7.8	Low	0.37			
	32-40	---	---	---	---	---	---	----			
5 Dotlake	0-15	5-10	1.35-1.45	0.6-2.0	0.18-0.23	4.5-6.0	Low	0.55	2	5	2-6
	15-28	0-5	1.45-1.65	2.0-6.0	0.12-0.16	6.1-6.5	Low	0.37			
	28-30	---	---	---	---	---	---	----			
6, 7, 8 Fairbanks	0-5	5-10	1.35-1.45	0.6-2.0	0.18-0.23	5.6-6.0	Low	0.43	5	5	1-4
	5-74	5-10	1.35-1.55	0.6-2.0	0.18-0.23	5.6-7.3	Low	0.55			
9 Goldstream	0-2	5-10	1.35-1.55	0.6-2.0	0.19-0.21	4.5-5.5	Low	0.43	5	8	10-15
	2-21	5-10	1.35-1.55	0.6-2.0	0.19-0.21	4.5-5.5	Low	0.43			
	21-25	---	---	---	---	---	---	----			
10 Kantishna	0-20	---	---	6.0-20	---	4.5-5.0	Low	----	---	8	---
	20-60	---	---	>20	---	4.5-5.0	Low	----			
11, 12, 13 Koyukuk	0-1	---	1.35-1.55	0.6-2.0	0.18-0.23	5.6-7.3	Low	0.43	5	5	1-4
	1-60	5-10	1.35-1.55	0.6-2.0	0.18-0.23	5.6-7.3	Low	0.55			
14, 15, 16 Nenana	0-10	5-10	1.35-1.55	0.6-2.0	0.19-0.21	5.1-6.0	Low	0.55	1	5	1-4
	10-28	5-10	1.35-1.55	0.6-2.0	0.19-0.21	5.1-6.0	Low	0.55			
	28-60	0-5	1.55-1.70	6.0-20	0.05-0.07	5.6-7.3	Low	0.15			
17, 18, 19, 20 Nenana	0-10	5-10	1.35-1.55	0.6-2.0	0.19-0.21	5.1-6.0	Low	0.55	1	5	1-4
	10-19	5-10	1.35-1.55	0.6-2.0	0.19-0.21	5.1-6.0	Low	0.55			
	19-60	0-5	1.55-1.70	6.0-20	0.05-0.07	5.6-7.3	Low	0.15			
21 Richardson	0-5	5-10	1.35-1.55	0.6-2.0	0.18-0.23	4.5-7.3	Low	0.43	3	5	1-4
	5-51	5-10	1.35-1.55	0.6-2.0	0.18-0.23	4.5-7.3	Low	0.55			
	51-60	0-5	1.55-1.70	6.0-20	0.02-0.08	6.6-7.3	Low	0.10			
22 Salchaket	0-6	0-5	1.40-1.60	0.6-2.0	0.18-0.23	5.6-7.3	Low	0.55	3	3	1-4
	6-60	0-5	1.40-1.60	0.6-6.0	0.12-0.18	5.6-7.3	Low	0.37			
23 Tanana	0-20	5-10	1.35-1.55	0.6-2.0	0.18-0.23	5.6-7.3	Low	0.55	5	5	2-6
	20-40	---	---	---	---	---	---	----			
24, 25, 26, 27 Teklanika	0-4	0-5	1.35-1.65	6.0-20	0.04-0.08	4.5-5.0	Low	0.43	3	1	1-2
	4-55	0-5	1.55-1.65	6.0-20	0.04-0.08	5.6-6.5	Low	0.43			
28 Toklat	0-15	0-5	1.35-1.55	6.0-20	0.13-0.15	4.5-5.0	Low	0.49	1	4	1-2
	15-22	---	---	---	---	---	---	----			
	22-25	0-5	1.45-1.55	6.0-20	0.13-0.15	4.5-5.5	Low	0.55			
	25-40	---	---	---	---	4.5-5.0	Low	----			
29*:											
Toklat	0-15	0-5	1.35-1.55	6.0-20	0.13-0.15	4.5-5.5	Low	0.49	1	2	1-2
	15-22	---	---	---	---	---	---	----			
	22-25	0-5	1.45-1.55	6.0-20	0.13-0.15	4.5-5.5	Low	0.55			
	25-40	---	---	---	---	4.5-5.0	Low	----			
Bolio	0-8	---	---	0.6-2.0	---	3.6-4.4	Low	----	---	8	---
	8-20	---	---	---	---	---	---	----			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
30----------------	0-5	5-10	1.35-1.55	0.6-2.0	0.18-0.23	5.1-7.3	Low-----------	0.43	2	5	1-4
Volkmar	5-28	5-10	1.35-1.55	0.6-2.0	0.18-0.23	4.5-7.3	Low-----------	0.55			
	28-60	0-5	1.55-1.70	6.0-20	0.02-0.08	5.1-7.8	Low-----------	0.10			
31*:											
Volkmar----------	0-5	5-10	1.35-1.55	0.6-2.0	0.18-0.23	4.5-7.3	Low-----------	0.43	2	5	1-4
	5-28	5-10	1.35-1.55	0.6-2.0	0.18-0.23	4.5-7.3	Low-----------	0.55			
	28-60	0-5	1.55-1.70	6.0-20	0.02-0.08	5.1-7.8	Low-----------	0.10			
Nenana-----------	0-10	5-10	1.35-1.55	0.6-2.0	0.19-0.21	5.1-6.0	Low-----------	0.55	1	5	1-4
	10-19	5-10	1.35-1.55	0.6-2.0	0.19-0.21	5.1-6.0	Low-----------	0.55			
	19-60	0-5	1.55-1.70	6.0-20	0.05-0.07	5.6-7.3	Low-----------	0.15			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "occasional," "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
1, 2: Beales	B	None	---	---	>6.0	---	---	Moderate	High	High.
3*: Bolio	D	None	---	---	+1-0.5	Perched	May-Sep	High	High	High.
4*: Bradway	D	Occasional	Brief	Jun-Aug	+1-0.5	Perched	May-Sep	High	Moderate	Low.
5: Dotlake	D	None	---	---	0-2.0	Perched	May-Sep	High	High	High.
6, 7, 8: Fairbanks	B	None	---	---	>6.0	---	---	High	Moderate	Moderate.
9*: Goldstream	D	None	---	---	+1-0.5	Perched	May-Sep	High	High	High.
10*: Kantishna	D	Frequent	Brief	Jun-Aug	+1-0.5	Apparent	May-Sep	High	High	High.
11, 12, 13: Koyukuk	B	None	---	---	>6.0	---	---	High	Moderate	Moderate.
14, 15, 16, 17, 18, 19, 20: Nenana	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
21: Richardson	B	None	---	---	0.5-2.0	Perched	May-Sep	High	High	High.
22: Salchaket	B	Occasional	Brief	Jun-Aug	>6.0	---	---	Moderate	Moderate	Moderate.
23: Tanana	D	Occasional	Brief	Jun-Aug	0-1.0	Perched	May-Sep	High	High	Moderate.
24, 25, 26, 27: Teklanika	A	None	---	---	>6.0	---	---	Low	Moderate	Moderate.
28*: Toklat	D	None	---	---	+1-2.0	Perched	May-Jun	Moderate	High	High.
29*:										
Toklat	D	None	---	---	+1-2.0	Perched	May-Jun	Moderate	High	High.
Bolio	D	None	---	---	+1-0.5	Perched	May-Sep	High	High	High.
30: Volkmar	B	None	---	---	0.5-2.0	Apparent	May-Sep	Moderate	High	High.
31:										
Volkmar	B	None	---	---	0.5-2.0	Perched	May-Sep	Moderate	High	High.
Nenana	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.

* In the "High water table--Depth" column, a plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Beales	Sandy, mixed Typic Cryochrepts
Bolio	Dysic Pergelic Cryohemists
Bradway	Loamy, mixed, nonacid Pergelic Cryaquepts
Dotlake	Loamy, mixed, nonacid Pergelic Cryaquepts
Fairbanks	Coarse-silty, mixed Alfic Cryochrepts
Goldstream	Loamy, mixed, acid Histic Pergelic Cryaquepts
Kantishna	Dysic Hydric Borofibrists
Koyukuk	Coarse-silty, mixed Typic Cryochrepts
Nenana	Coarse-silty over sandy or sandy-skeletal, mixed Typic Cryochrepts
Richardson	Coarse-silty, mixed Aquic Cryochrepts
Salchaket	Coarse-loamy, mixed, nonacid Typic Cryofluvents
Tanana	Loamy, mixed, nonacid Pergelic Cryaquepts
Teklanika	Mixed Typic Cryopsamments
Toklat	Coarse-loamy, mixed, ortstein Typic Cryorthods
Volkmar	Coarse-silty over sandy or sandy-skeletal, mixed Aquic Cryochrepts

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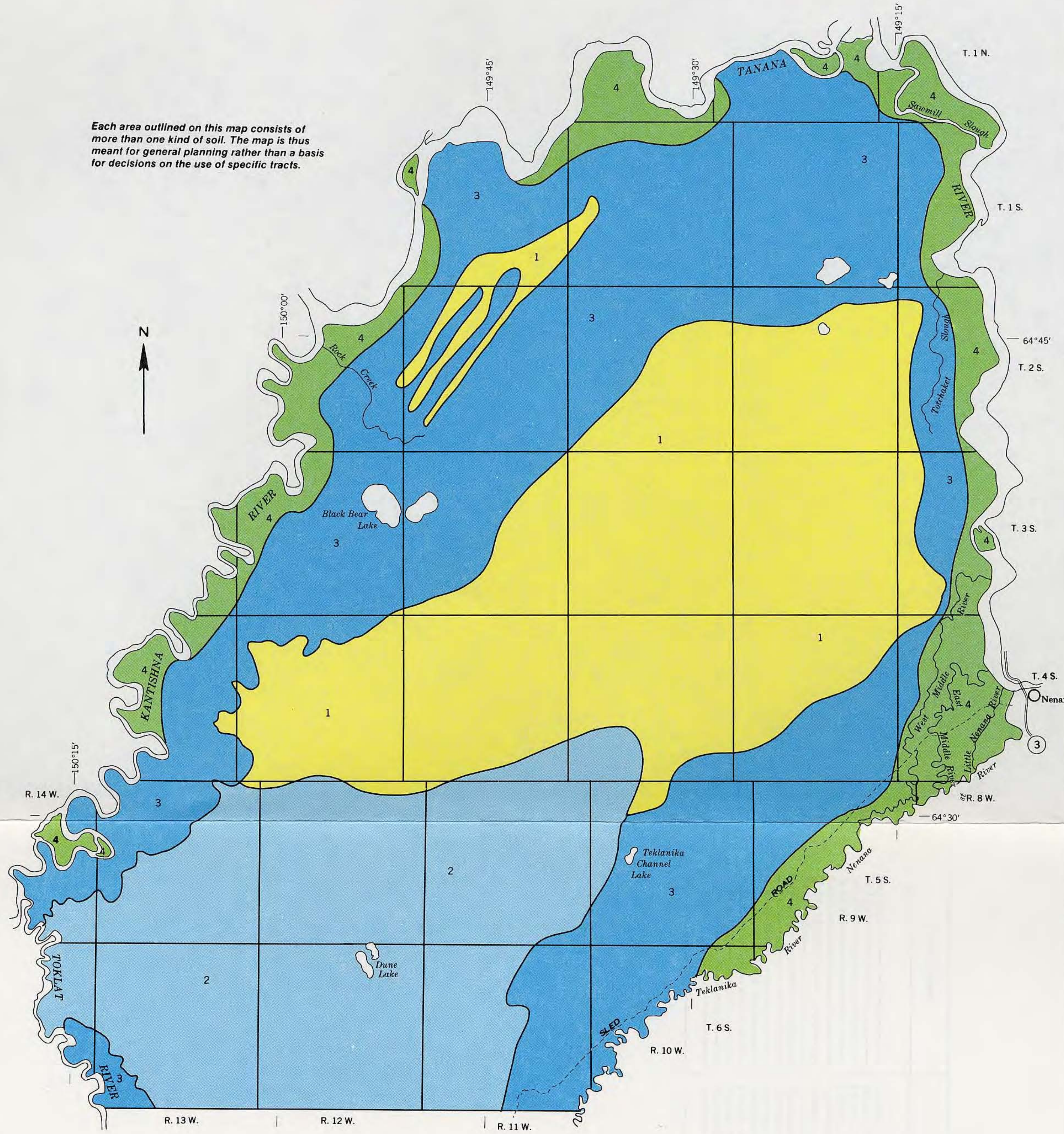


U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
UNIVERSITY OF ALASKA
AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
TOTCHAKET AREA, ALASKA

SCALE 1:253,440

1 0 1 2 3 4 5 MILES

MAP UNITS*

1 — Nenana-Volkmar: Deep, nearly level to strongly sloping, well drained and moderately well drained, silty soils; on outwash plains

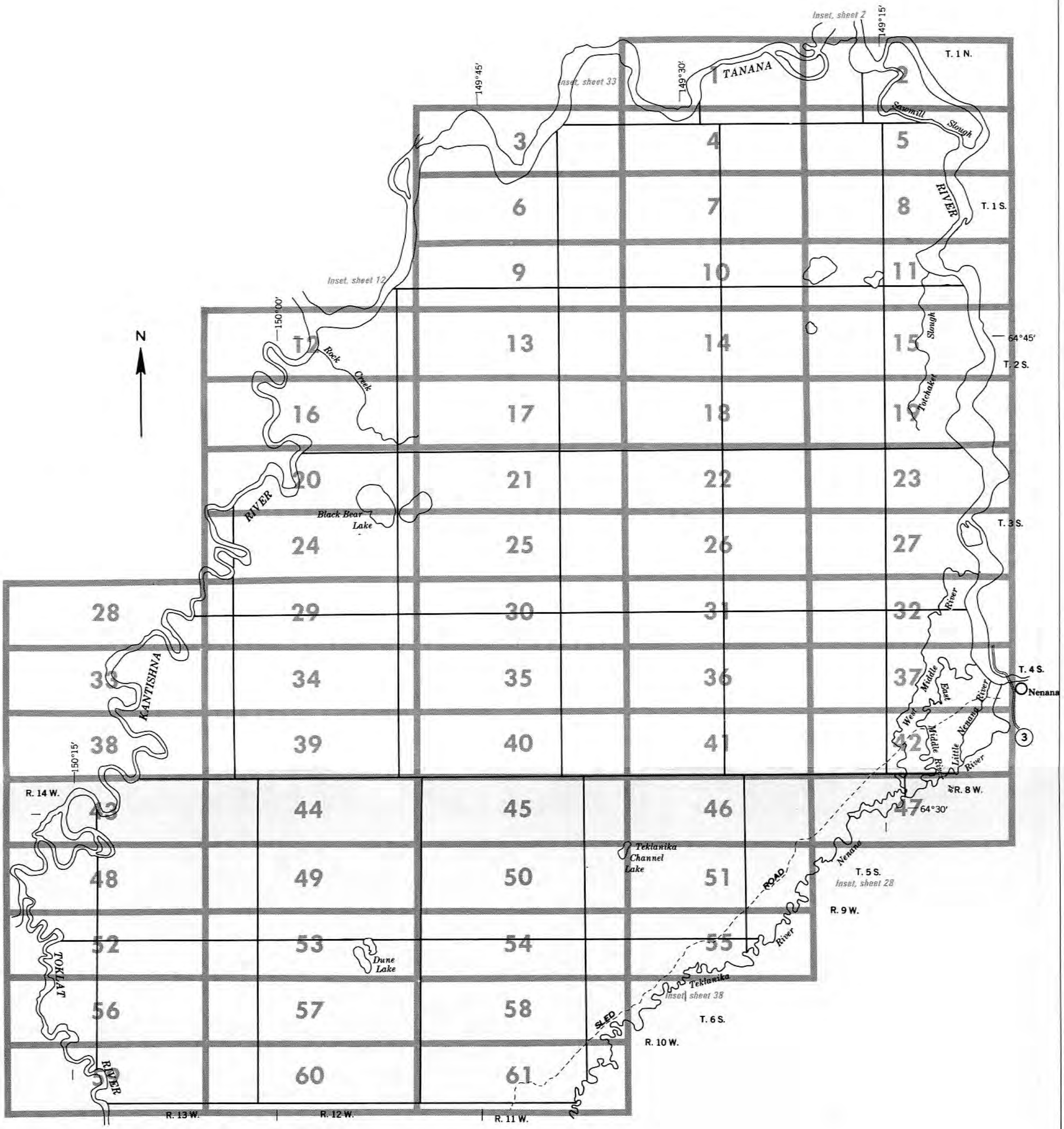
2 — Teklanika-Beales-Nenana: Deep, nearly level to steep, well drained to excessively drained; silty soils that are underlain by sand; on outwash plains

3 — Goldstream-Bolio-Kantishna: Shallow to deep, nearly level, poorly drained, silty soils and very poorly drained peat soils; on broad alluvial plains

4 — Tanana-Salchaket: Moderately deep and deep, nearly level, well drained and somewhat poorly drained, silty soils and very fine sandy loams; on flood plains

*Texture named in map units is that of the surface layer

Compiled 1979



INDEX TO MAP SHEETS

TOTCHAKET AREA, ALASKA

SCALE 1:253,440

1 0 1 2 3 4 5 MILES

SOIL LEGEND

SYMBOL	NAME
1	Beales silt loam, nearly level
2	Beales silt loam, undulating
3	Bolio peat
4	Bradway very fine sandy loam
5	Dotlake silt loam
6	Fairbanks silt loam, undulating
7	Fairbanks silt loam, rolling
8	Fairbanks silt loam, very steep
9	Goldstream silt loam
10	Kantishna peat
11	Koyukuk silt loam, nearly level
12	Koyukuk silt loam, undulating
13	Koyukuk silt loam, rolling
14	Nenana silt loam, moderately deep, nearly level
15	Nenana silt loam, moderately deep, undulating
16	Nenana silt loam, moderately deep, rolling
17	Nenana silt loam, shallow, nearly level
18	Nenana silt loam, shallow, undulating
19	Nenana silt loam, shallow, rolling
20	Nenana silt loam, shallow, hilly
21	Richardson silt loam
22	Salchaket very fine sandy loam
23	Tanana silt loam
24	Teklanika loamy fine sand, rolling
25	Teklanika loamy fine sand, hilly
26	Teklanika loamy fine sand, steep
27	Teklanika loamy fine sand, very steep
28	Toklat silt loam
29	Toklat-Bolio complex
30	Volkmar silt loam
31	Volkmar-Nenana complex

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water; w)

PITS

- Gravel pit (G.P.)
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; w)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (SvE 107)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

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