dium blocky; hard, friable, sticky and plastic; common very fine roots; common very fine pores; slightly effervescent; gradual, wavy boundary.

C1ca—16 to 27 inches, pale-yellow (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) moist; weak, coarse, prismatic structure parting to moderate, medium, blocky; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; strongly effervescent; common fine lime threads and soft lime masses; gradual, wavy boundary.

C2ca—27 to 36 inches, light yellowish-brown (2.5Y 6/4) silt loam, olive brown (2.5Y 4/4) moist; weak, coarse, prismatic structure parting to weak, coarse, blocky; hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine pores; strongly effervescent; few fine lime threads and soft lime masses; diffuse, wavy boundary.

C3—36 to 62 inches, light yellowish-brown (2.5Y 6/4) silt loam, olive brown (2.5Y 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; strongly effervescent.

Depth to the B3 or C horizon ranges from 6 to 10 inches. Hue is 10YR or 2.5Y throughout. A few fine pebbles are at any depth in places. The A1 horizon ranges from grayish brown to light brownish gray. The B2t horizon is 35 to 45 percent clay. The Cca horizon is pale olive, light yellowish brown, and light gray.

Xavier silty clay loam, gently undulating (Xa).—This gently undulating soil is on high benches and terraces. Relief of the surface undulations is 5 to 20 feet. The soil has a profile similar to the one described as representative of the series, but it is less sloping. Included in mapping are spots of Savage silty clay loam and Belfield silt loam.

Runoff is slow, and the hazard of erosion is slight. This soil is used for irrigated and dryfarmed crops, hay, wildlife, watershed, recreation, and range. Capability unit IIe–2 dryland, IIe–1 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

Xavier silty clay loam, undulating (Xc).—This undulating soil is on benches and terraces. Drainageways make local relief of 10 to 25 feet. The soil has the profile described as representative of the series. Included in mapping are spots of Savage silty clay loam and Belfield silt loam.

Runoff is medium, and the hazard of erosion is moderate. This soil is used for irrigated and dryfarmed crops, hay, wildlife, watershed, recreation, and range. Capability unit IIIe–2 dryland, IIIe–1 irrigated; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

Xavier silty clay loam, rolling (Xe).—This rolling soil is on the eroded edges of terraces and benches and short fans below them. The fans below consist of material washed from the terrace. The soil has a profile similar to the one described as representative of the series, but it is gravelly.

Included with this soil in mapping are areas of Savage silty clay loam and Maschetah gravelly silt loam making up about 15 percent and 10 percent, respectively, of the area of this mapping unit.

Runoff is rapid, and the hazard of erosion is severe. This soil is used for dryfarmed crops, hay, pasture, wildlife, watershed, recreation, and range. Capability unit IVe–2 dryland; Silty range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

Xavier-Shaak complex, undulating (Xh).—This complex is made up of undulating soils on dissected terraces that are underlain by sedimentary bedrock. It is about 60 percent Xavier silty clay loam and 40 percent Shaak silty clay loam. The Xavier soil is on ridges and northwest-facing hillsides. The Shaak soil is on east- and south-facing hillsides.

Runoff is medium, and the hazard of erosion is moderate. These soils are used for dryfarmed crops, hay, wildlife, watershed, recreation, and range. Capability unit IIIe–2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

Xavier-Shaak complex, rolling (Xk).—This complex is made up of rolling soils on dissected terraces that are underlain by sedimentary bedrock. It is about 50 percent Xavier silty clay loam, 40 percent Shaak silty clay loam, and 10 percent Maschetah silt loam. Slopes are 8 to 15 percent. The Xavier soil is on the hilltops and ridgetops and the west and north sides of hills and ridges. The Shaak soil is on the east and south sides of hills and ridges. The Maschetah soil is on narrow ridges and the edges of drainageways. The Xavier and Shaak soils in this complex have profiles similar to the ones described as representative of their respective series, but they are steeper.

Runoff is medium, and the hazard of erosion is moderate. These soils are suited to dryfarmed crops, hay, pasture, wildlife, watershed, recreation, and range. Capability unit IVe–2 dryland; Clayey range site, 15- to 19-inch precipitation zone; windbreak suitability group 1.

Use and Management of the Soils

The soils of the Big Horn County Area are used mainly for pasture and range and for irrigated and nonirrigated crops. This section of the survey explains how the soils can be managed for these purposes as well as for windbreaks, woodland, recreation, and wildlife and for building highways, farm ponds, and other engineering structures. It also shows predicted yields of the principal irrigated and nonirrigated crops. Information on crops is given by describing general practices suitable for all soils, then by grouping the soils that require similar management, describing the group, and suggesting suitable management practices.

Management for Irrigated Crops

About 59,672 acres in the Area was irrigated in 1967. The main irrigated crops are winter wheat, spring wheat, barley, oats, corn for grain and silage, sugar beets, dry beans, alfalfa hay, and pasture. The most common needs in managing irrigated soils are practices for maintaining fertility, using water efficiently, and controlling erosion.

The soils have a low to medium content of nitrogen and phosphorus. Including legumes in the cropping system (*7*) and applying nitrogen and phosphorus fertilizers help correct this deficiency. Mineral fertilizer supplements the natural supply during the year it is applied (*4*). Part of the phosphorus fertilizer applied one year may be left over for future years, but nitrogen fertilizer generally is not. The residual benefit of fertilizer varies with crop response. Nitrogen fertilizer

is lost readily through excessive use of irrigation water. Barnyard and green manure help to increase organic matter and fertility, improve soil structure, and increase the water intake rate of clayey soils. Fall plowing is better for the clayey soils than spring plowing.

Irrigation systems are chosen to provide optimum control and distribution of water at minimum cost and labor. Overirrigation wastes water, leaches plant nutrients, and may erode the soil. Overirrigation can also create drainage problems, raise the water table, and increase soil salinity. The risk of erosion is greater on steep soils than on more nearly level ones. On some soils, as the surface layer is removed by erosion, subsurface layers that contain a large amount of carbonates or soluble salts may be exposed and mixed in the plow layer. This situation tends to reduce crop yields and increase the cost of management.

Management for Nonirrigated Crops

About 189,672 acres in the Big Horn County Area was dryfarmed in 1967. Winter wheat and barley are the major dryfarm crops. Alfalfa hay, grass hay, and oats are also grown. Where the annual precipitation in the Area is 12 to 16 inches, conservation of water is the main concern in managing dryfarmed soils. If 8 to 12 inches of water is available in the soil during the growing season, crops can be expected to grow well.

Most dryfarmed soils have moderate fertility, but nitrogen and phosphorus fertilizers may be needed. Fertility is highest immediately after the soils are plowed out of sod. Burning the stubble temporarily increases crop yields but is ultimately harmful because it destroys the crop residue that restores organic matter to the soil.

The most common cropping system is small grain one year and fallow the next (*5*). Grasses and legumes can be grown on all dryfarmed soils (*3*). Fallow tillage helps to eliminate weeds, store moisture, and control soil blowing (*6*). Tilling is done mostly with sweeps, chisel implements, and rod weeders. Such implements leave crop residue on the surface, which helps to control erosion.

Soil blowing and water erosion can be controlled by protecting the surface with stubble mulch, by stripcropping, by planting a cover crop on steep slopes, and by keeping a good stand of grass in pastures. Large fields can be stripcropped, but some fields are too small or too irregular in shape to stripcrop. Soils that have slopes of 2 to 4 percent may be suited to contour plowing. Stubble-mulch tillage is needed on sandy soils, such as Alice fine sandy loam, and a permanent cover of grass is needed in large areas of steep, thin, or sandy soils. Grasses should be grown as cover in drainageways to help control erosion.

Management of Saline and Alkali Soils

Approximately 10,000 acres of irrigated land in the Big Horn County Area have harmful acumulations of salt. Some areas that are affected by salts are not irrigated.

Weathering of primary minerals is the indirect source of nearly all soluble salts; however, there are few places where harmful accumulations of salts result from this source alone. Salt generally accumulates in arid areas that receive salts from other locations. Salts move into these areas in surface and ground water. Topography, restricted drainage, low permeability, high water table, seepage in irrigation canals and ditches, overirrigation, and salts in irrigation water are all contributing factors.

Saline soils contain soluble salts in amounts that impair the germination of seeds and growth of plants. They frequently have a white surface crust of salt. They do not have significant amounts of exchangeable sodium. Excess salts and lack of exchangeable sodium keep these soils generally flocculated; as a result, permeability to air and water is satisfactory.

Saline soils can be reclaimed by removal of excess salts. If drainage is adequate, salts can be removed by leaching with water. This is done by ponding water on the soil or by overirrigating. Incorporating organic material, such as manure and cover crops, or any practices that improve the surface tilth and increase water infiltration facilitates the reclamation of these soils.

Alkali soils do not contain a harmful amount of soluble salts but are more than 15 percent exchangeable sodium. The clay in these soils is dispersed, and this dispersion increases as the proportion of exchangeable sodium increases. Such soils have a high shrink-swell potential, very slow water infiltration rate, and slow permeability to water and air.

Saline-alkali soils contain a harmful amount of soluble salts and more than 15 percent exchangeable sodium. So long as the excess salts are present, the appearance and properties of these soils are similar to those of the saline soils. If the excess salts are removed, these soils take on characteristics similar to those of the alkali soils.

Reclamation of alkali and saline-alkali soils is difficult. Each area has a unique combination of kinds and amount of salts, cations, and exchangeable sodium. No single method of reclamation applies in all cases. Thorough sampling and testing of the soils are necessary to determine what combination of methods is needed. If the sodium is concentrated near the surface in scattered pans or slickspots, the soil may be reclaimable by deep plowing or by spreading large amounts of gypsum or sulphur and organic matter on the spots. Reclamation of these soils requires not only the leaching of soluble salt, but the replacing of exchangeable sodium with calcium. A source of calcium must be provided, and movement of water through the soil must be maintained to remove excess salt.

Reclamation of saline, saline-alkali, and alkali soils is not always feasible or practical. Crop production can be improved and farm income increased in many salt-affected areas by using suitable practices. Among the beneficial management practices on these soils are careful application of irrigation water to surrounding soils, land leveling to improve application of irrigation water, selection of salt-tolerant crops, use of special planting techniques and seedbed preparation to minimize salt accumulation around the seeds, keeping the

soil moderately moist, providing periodic leaching of soil and at the same time controlling water applications so that the water table is not raised appreciably, maintaining water system conveyance and drainage systems, leaching pre-emergence irrigation to reduce salt content for better seed germination, tilling soils that have exchangeable sodium with caution to prevent unnecessary puddling of the surface layer, and use of soil amendments, organic matter, and sod crops to improve soil structure as needed.

Where salinity cannot be entirely eliminated, crops that produce satisfactorily under existing saline conditions can be selected. In selecting crops for salt-affected soils, particular attention should be given to the salt tolerance of the crops during germination, because poor results are frequently caused by failure to obtain a satisfactory stand. Some crops that are salt tolerant during the later stages of growth are quite sensitive to salinity during germination.

Among the highly tolerant crops are barley, sugar beets, and western wheatgrass. Crops that have low salt tolerance include beans, alsike, red clover, and ladino clover.

The control of salinity and alkalinity is generally accomplished most easily in the sandy textured soils. These soils are more rapidly permeable and are less likely to deteriorate in tilth than are the more clayey soils. Loam and clay loam soils have a greater available water capacity, and salinity is generally not difficult to control if the soils have good structure and are underlain by permeable soil material. Prevention of salt accumulations or reclamation of saline-affected soils is most difficult in clay soils that have slowly permeable material extending to a considerable depth.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, the kinds of soils are grouped at three levels: the capability class, the subclass, and the unit. These groupings are described in the following paragraphs.

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

Class I soils have few limitations that restrict their use.

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

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

Class IV soils have very severe limitations that reduce the choice of plants, 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 largely to pasture, range, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and restrict their use largely to pasture, range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, water supply, or esthetic purposes.

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 too cold or too dry.

Class I has no subclass, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, although they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–4 or IIIe–6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in the Big Horn County Area are described, and suggestions for the use and management of the soils are given.

Irrigated capability units

In this section each irrigated capability unit is described, soil characteristics and hazards of management are discussed, and suitable crops and management practices are given.

CAPABILITY UNIT IIe-1 IRRIGATED

This unit consists of deep, well-drained, and nearly level, gently sloping, and gently undulating soils that formed in alluvium. They have a surface layer of loam, silt loam, or silty clay loam and underlying material of loam, clay loam, silty clay loam, and silty clay.

Permeability is moderate or moderately slow. Runoff is slow or medium, the hazard of erosion is slight or moderate, and available water capacity is moderate or high. The frost-free period is mostly 105 to 125 days, but in some areas it is as few as 90 days.

The main concerns of management are the moderately slow permeability and proper use of water to control water erosion on the more sloping soil. These soils are suited to most irrigated crops grown in the Area. Dry beans, sugar beets, and corn grown for grain are not suitable on these soils where the growing season is less than 115 days.

CAPABILITY UNIT IIe-2 IRRIGATED

This unit consists of deep, well-drained, gently sloping soils that formed in alluvium. They have a surface layer of fine sandy loam and underlying material of stratified fine sandy loam, sandy loam, and loamy sand.

Permeability is moderately rapid. Runoff is slow, the hazard of erosion is moderate, and available water capacity is moderate. The frost-free period is 120 to 125 days.

The main concerns of management are controlling water erosion and soil blowing and managing water on these moderately rapidly permeable soils. The soils are suited to most irrigated crops grown in the Area. Dry beans, sugar beets, and corn grown for grain are not suitable where the growing season is less than 115 days.

CAPABILITY UNIT IIs-1 IRRIGATED

This unit consists of deep, well-drained, nearly level soils that formed in alluvium. They have a surface layer of silt loam, clay loam, silty clay loam, or silty clay and underlying material of loam, silty clay loam, or sity clay.

Permeability is moderately slow or slow. Runoff is slow, the hazard of erosion is slight, and available water is moderate or high. The frost-free period is mostly 105 to 125 days.

These soils require timely tillage where the surface layer is silty clay loam or silty clay. Good water management is needed because of the moderately slowly and slowly permeable subsoil. These soils are suited to most of the irrigated crops grown in the Area. Sugar beets, corn grown for grain, and dry beans are not suitable where the frost-free period is less than 115 days.

CAPABILITY UNIT IIs-2 IRRIGATED

This unit consists of deep, well-drained, nearly level soils that formed in sandy alluvium. They have a surface layer of loam or fine sandy loam and underlying material of stratified fine sandy loam, sandy loam, and loamy sand.

Permeability is moderately rapid. Runoff is slow, the hazard of erosion is slight or moderate, and available water capacity is moderate. The frost-free period is 120 to 125 days.

The surface layer on about half of the acreage is fine sandy loam, and on the rest it is loam. Good management of the fine sandy loam soil is needed to prevent soil blowing. Water must be well managed because the soils are moderately rapidly permeable. The soils are suited to most of the irrigated crops grown in the Area. Sugar beets, corn grown for grain, and dry beans are not suitable where the frost-free period is less than 115 days.

CAPABILITY UNIT IIc-1 IRRIGATED

This unit consists of deep, well-drained, nearly level soils that formed in alluvium. They have a surface layer of loam, silt loam, clay loam, or silty clay loam and underlying material of loam, clay loam, silty clay loam, or silty clay.

Permeability is moderate. Runoff is slow, the hazard of erosion is slight, and available water capacity is moderate or high. The frost-free period is mostly 105 to 125 days, but in some areas it is as few as 95 days.

The surface layer on most of the acreage is silt loam or loam that is easy to till, but in some areas it is silty clay loam that needs timely tillage. Crops grown on these soils respond well to applications of fertilizer and to good water management.

These soils are suited to all irrigated crops grown in the Area, but corn grown for grain is a marginal crop at elevations of more than 3,500 feet.

CAPABILITY UNIT IIc-2 IRRIGATED

This unit consists of deep, well-drained, nearly level soils that formed in alluvium. They have a surface layer of silty clay loam and a subsoil of silty clay loam or silty clay.

Permeability is moderately slow. Runoff is slow, the hazard of erosion is slight, and available water capacity is moderate or high. The frost-free period is mostly 105 to 125 days, but in some areas it is as few as 95 days.

These soils need timely tillage because of their surface texture. They respond well to fertilizer. Good water management is needed because of the moderately slow permeability.

These soils are suited to all irrigated crops grown in the Area, but corn grown for grain is a marginal crop at elevations of more than 3,500 feet.

CAPABILITY UNIT IIIe-1 IRRIGATED

This unit consists of deep, well-drained, undulating and gently sloping soils that formed in alluvium. They have a surface layer of loam, clay loam, silt loam, or

silty clay loam and underlying material of loam, clay loam, silty clay loam, silty clay, or clay.

Permeability is mostly moderate or moderately slow, but in places it is slow. Runoff is medium, the hazard of erosion is moderate, and available water capacity is moderate or high. The frost-free season is mostly 105 to 125 days, but in some areas it is as few as 90 days.

The main concerns of management are controlling water erosion and managing water, especially on soils where permeability is moderately slow. These soils are well suited to most crops, hay, and pasture grasses commonly grown in the Area, but corn grown for grain and sugar beets are not suitable where the frost-free period is less than 115 days.

CAPABILITY UNIT IIIe-2 IRRIGATED

This unit consists of deep, well-drained, moderately sloping soils that formed in alluvium. They have a surface layer of fine sandy loam and underlying material of stratified fine sandy loam, sandy loam, and loamy sand.

Permeability is moderately rapid. Runoff is medium, the hazard of erosion is moderate, and available water capacity is moderate. The frost-free period is 120 to 125 days.

The main concerns of management are controlling soil blowing and water erosion and managing water. These soils are suited to most irrigated crops, hay, and pasture grasses commonly grown in the Area.

CAPABILITY UNIT IIIe-3 IRRIGATED

This unit consists of deep, well-drained, gently undulating soils that formed in alluvium. They have a surface layer of silty clay loam, silty clay, or clay and underlying material of silty clay or clay.

Permeability is slow or very slow. Runoff is slow or medium, the hazard of erosion is slight or moderate, and available water capacity is moderate or high. The frost-free period is mostly 105 to 125 days, but in some areas it is as few as 90 days.

The main concerns of management are the slow and very slow permeability, timely tillage, and proper use of water to control water erosion. These soils are suited to most irrigated crops, hay, and pasture grasses commonly grown in the Area. Corn grown for grain and sugar beets are not suitable where the frost-free period is less than 115 days.

CAPABILITY UNIT IIIs-1 IRRIGATED

This unit consists of deep, well-drained, nearly level soils that formed in alluvium. They have a surface layer of silty clay loam, silty clay, or clay and underlying material of silty clay or clay.

Permeability is very slow or slow. Runoff is slow, the hazard of erosion is slight, and available water capacity is moderate or high. The frost-free period is mostly 105 to 125 days, but in some areas it is as few as 90 days.

The moisture range within which these soils can be tilled is narrow, and the power requirement is high. Their very slow permeability makes them difficult to irrigate. Good irrigation practices and those that maintain soil structure are important for high crop yields.

These soils are suited to most irrigated crops grown in the Area, but corn grown for grain and sugar beets are not suitable where the frost-free period is less than 115 days.

CAPABILITY UNIT IVe-1 IRRIGATED

This unit consists of deep, well-drained, nearly level, undulating and gently sloping soils that formed in alluvium. They have a surface layer of clay loam, silty clay loam, or clay and underlying material of clay.

Permeability is slow or very slow. Runoff is slow or medium, the hazard of erosion is slight or moderate, and available water capacity is moderate or high. The frost-free period is mostly 105 to 125 days, but in some areas it is as few as 90 days.

The main concerns of management are the slowly or very slowly permeable subsoil, timely tillage of the surface layer, and managing irrigation water to prevent water erosion. These soils are suited to small grain, hay, pasture, and range.

CAPABILITY UNIT IVe-2 IRRIGATED

This unit consists of deep, well-drained, strongly sloping or rolling soils that formed in alluvium. They have a surface layer of silt loam or silty clay loam and underlying material of silty clay loam.

Permeability is moderate or moderately slow. Runoff is medium or rapid, the hazard of erosion is moderate to severe, and available water capacity is high. The frost-free period is mostly 110 to 125 days.

The main concerns of management are controlling water erosion and timely tillage of the silty clay loam soils. These soils are suited to small grain, hay, pasture, and range.

CAPABILITY UNIT IVs-1 IRRIGATED

This unit consists of deep, well-drained, nearly level and gently sloping soils that formed in alluvium. They have a surface layer of silty clay loam and clay and underlying material of clay.

Permeability is slow or very slow. Runoff is slow, the hazard of erosion is slight, and available water capacity is moderate or high. The frost-free period ranges from 115 to 125 days.

The main concerns of management are timely tillage and managing water. In some areas the soils have an uneven surface, which causes uneven water distribution. These soils are suited to small grain, hay, pasture, and range.

Dryland capability units

In this section, each dryland capability unit is described, soil characteristics and hazards of management are discussed, and suitable crops and management practices are given.

CAPABILITY UNIT IIe-2 DRYLAND

This unit consists of moderately deep and deep, nearly level to gently sloping and undulating soils on fans, terraces, gravel- and loess-mantled benches, and shale highlands. The surface layer ranges from loam to clay.

These soils are well drained, and permeability is moderate to very slow. Available water capacity is

low to high, and runoff is slow to medium. On cultivated fields the hazards of water erosion and soil blowing are slight to moderate. The frost-free period is 90 to 125 days, and annual precipitation is 14 to 18 inches.

The soils in this unit are easy to till. Crops respond well to applications of nitrogen and phosphorus fertilizer.

These soils are used mostly for small grain, alfalfa and grass hay, and pasture. Small grain is commonly grown in a crop-fallow system but can be grown annually without fallow.

CAPABILITY UNIT IIs-2 DRYLAND

This unit consists of deep, nearly level soils on fans, terraces, and gravelly benches. The surface layer ranges from silt loam or clay loam to clay.

These soils are well drained, and permeability is very slow to moderate. Available water capacity is moderate or high, and runoff is slow. The frost-free period is 90 to 120 days, and annual precipitation is 14 to 17 inches.

The soils in this unit need extra care if they are cultivated. The power requirement is high. Good tilth is difficult to maintain where plowing extends into the clay subsoil. Water erosion is a slight hazard on all of the soils, and soil blowing is a moderate hazard on the bare, dry soils. All of the soils benefit from applications of nitrogen and phosphorus fertilizer.

These soils are used mostly for small grain, hay, and pasture. They are also suited to range. Crested wheatgrass, green needlegrass, western wheatgrass, Siberian wheatgrass, and bromegrass are suitable for hay and pasture planting.

CAPABILITY UNIT IIc-2 DRYLAND

This unit consists of deep, nearly level soils on flood plains, terraces, fans, and gravelly high benches. They have a surface layer of silt loam, loam, and silty clay loam.

These soils are well drained, and permeability is moderate to moderately slow. Available water capacity is moderate or high, and runoff is slow. The hazards of soil blowing and water erosion are slight. The frost-free period is 95 to 125 days, and annual precipitation is 14 to 18 inches.

The soils in this unit are easy to till. Crops respond to applications of nitrogen and phosphorus fertilizer.

These soils are used mostly for small grain, alfalfa and grass hay, and pasture. Small grain is commonly grown in a crop-fallow system but can be grown annually without fallow.

CAPABILITY UNIT IIIe-2 DRYLAND

This unit consists of deep to moderately deep, nearly level to gently sloping and undulating soils on terraces, fans, foot slopes, gravelly high benches, and loess-mantled uplands. These soils range from fine sandy loam to clay.

These soils are well drained, and permeability is moderately rapid to very slow. Available water capacity is low to high, and runoff is slow to rapid. The hazard of water erosion is slight to moderate. Soil blowing is a hazard on benches near the mountains. The frost-free period is 90 to 125 days, and annual precipitation is 14 to 18 inches.

The soils in this unit are easy to till. The soils on the valley foot slopes need diversion terraces to intercept runoff from soils above. The main watercourse should be in permanent sod. Crops respond to applications of nitrogen and phosphorus fertilizer.

These soils are used mostly for small grain, alfalfa and grass hay, and pasture. Small grain is commonly grown in a crop-fallow system but can be grown annually without fallow. Crested wheatgrass, smooth bromegrass, Siberian wheatgrass, and green needlegrass are suitable for hay and pasture planting.

CAPABILITY UNIT IIIe-3 DRYLAND

This unit consists of deep and moderately deep, nearly level to sloping soils on stream terraces, fans, foot slopes, gravelly benches, and shale and sandstone highlands. These soils range from fine sandy loam to clay.

These soils are well drained, and permeability is moderately rapid to very slow. Available water capacity is low to high, and runoff is slow to rapid. The frost-free period is 90 to 125 days, and annual precipitation is 10 to 14 inches.

The soils in this unit have a slight to moderate hazard of water erosion. The soils that have a surface layer of sandy loam, silt loam, or clay are moderately susceptible to soil blowing. The soils on valley foot slopes need protection from runoff from soils above them. The watercourse needs to be sodded to prevent gullying.

These soils are mostly suited to dryfarmed small grain, hay, and pasture. They are also suited to range. Alfalfa, crested wheatgrass, and pubescent wheatgrass are suitable for hay and pasture planting. Green needlegrass is also suitable on the moderately fine textured and fine textured soils.

CAPABILITY UNIT IIIw-2 DRYLAND

This unit consists of deep, level soils in undrained basins and potholes in the shale highlands and on high gravel terraces.

These soils are poorly drained and somewhat poorly drained, and permeability is slow or very slow. Ponding is common early in spring. Available water capacity is moderate or high. The frost-free period is 105 to 125 days, and annual precipitation is 13 to 17 inches.

The soils in this unit have only a slight hazard of soil blowing. Surface drainage and control of surface water are needed on most areas. Crops may be lost from excessive moisture in some years.

These soils are suited mostly to dryfarmed small grain, hay, and pasture. They are also suited to range. Bromegrass, western wheatgrass, and green needlegrass are suitable for hay and pasture planting.

CAPABILITY UNIT IIIs-2 DRYLAND

This unit consists of deep, nearly level soils on flood plains, terraces, and fans. These soils have a texture of loam or silty clay loam.

These soils are well drained, and permeability is moderate to slow. A seasonal high water table is within

a depth of 5 feet. The soils are moderately saline. Available water capacity is moderate or high, and runoff is slow. The hazard of erosion is slight. The frost-free period is 105 to 125 days, and annual precipitation is 12 to 15 inches.

The soils in this unit are easy to till, but they need careful management if they are used for crops. Drainage and the selection of such salt-tolerant crops as barley are recommended. Tall wheatgrass, birdsfoot trefoil, and western wheatgrass are suitable for hay and pasture plantings.

CAPABILITY UNIT IIIs-3 DRYLAND

This unit consists of deep, nearly level soils on fans and terraces. These soils are silty clay loam throughout.

These soils are well drained, and permeability is slow. Available water capacity is moderate or high, and runoff is slow. The frost-free period is 110 to 125 days, and annual precipitation is 12 to 15 inches.

These soils are difficult to till, and power costs are above average. To maintain good tilth, the soils must be tilled at the proper moisture content. Sodium-affected soils puddle and crust easily. All crop residue should be left on the surface of these soils. Water erosion is a slight hazard on all the soils, and soil blowing is a moderate hazard in cultivated areas. Crops respond well to applications of nitrogen and phosphorus fertilizer.

These soils are used for small grain, hay, and pasture. Crested wheatgrass, Siberian wheatgrass, green needlegrass, and western wheatgrass are suitable for hay and pasture planting.

CAPABILITY UNIT IIIc-1 DRYLAND

This unit consists of deep, nearly level soils on flood plains, terraces, fans, and gravelly high benches. The surface layer is loam, silt loam, and silty clay loam.

These soils are well drained, and permeability is moderate to slow. Available water capacity is moderate or high, and runoff is slow to medium. The frost-free period is 105 to 125 days, and annual precipitation is 11 to 15 inches.

The soils in this unit are easy to till. They have a slight to moderate hazard of water erosion and soil blowing. Crops respond to applications of nitrogen and phosphorus fertilizer if the soil is moist to a depth of 3 feet at seeding time and if precipitation early in spring is above normal.

These soils are used mostly for small grain, alfalfa and grass hay, and pasture. Crested wheatgrass, pubescent wheatgrass, and Russian wildrye are suitable for pasture planting.

CAPABILITY UNIT IVe-2 DRYLAND

This unit consists of shallow, moderately deep, and deep, mainly strongly sloping and rolling soils on fans, foot slopes, valley sides, high gravel- and loess-mantled benches, and shale and sandstone highlands. The surface layer ranges from sandy loam to clay.

These soils are well drained to excessively drained, and permeability is very slow to moderately rapid. Available water capacity is very low to high, and runoff is medium to rapid. Generally, the frost-free period is 90 to 115 days, and annual precipitation is 14 to 18 inches. In some small areas the frost-free period is 60 to 80 days and annual precipitation is 18 to 24 inches.

The soils in this unit have a moderate to severe hazard of water erosion. The hazard of soil blowing is moderate on the soils that have a surface layer of silt loam, clay, or sandy loam. The deep and moderately deep soils are suitable for dryfarmed small grain only where the frost-free period is more than 90 days. Erosion control measures and diversion of runoff from higher soils are necessary. Unless drainageways are kept in sod, severe gullying results where runoff collects.

These soils are used mostly for pasture, hay, and range. Bromegrass, alfalfa, crested wheatgrass, green needlegrass, Siberian wheatgrass, and pubescent wheatgrass are suitable for hay and pasture planting. Intermediate wheatgrass is also suitable where annual precipitation is more than 16 inches.

CAPABILITY UNIT IVe-3 DRYLAND

This unit consists of shallow, moderately deep, and deep, nearly level to moderately steep soils on flood plains, terraces, fans, foot slopes, and shale and sandstone highlands. The surface layer ranges from fine sandy loam to clay.

These soils are well drained, and permeability is rapid to very slow. Available water capacity is very low to high, and runoff is slow to rapid. The frost-free period is 105 to 125 days, and annual precipitation is 12 to 14 inches.

The soils in this unit have a slight to severe hazard of water erosion. The hazard of soil blowing is moderate on soils that have a surface layer of clay, silt loam, or fine sandy loam. The deep and moderately deep soils are suitable for dryfarmed small grain only where erosion control measures are adequate and where runoff from adjacent, higher soils is diverted. Unless drainageways are kept in sod, severe gullying results where runoff collects.

These soils are used mostly for pasture, hay, and range. Bromegrass, alfalfa, crested wheatgrass, and pubescent wheatgrass are suitable for hay and pasture planting.

CAPABILITY UNIT IVw-2 DRYLAND

This unit consists of deep, nearly level soils on flood plains, low terraces, and fans. These soils are loam, silt loam, silty clay loam, and clay. They have a water table within 3 feet of the surface during part of the growing season.

Permeability is moderate to very slow, and in some areas the soils are moderately affected by salinity. Occasional overflow occurs early in spring. Available water capacity is moderate or high, and runoff is slow. The hazard of erosion is slight to severe. The frost-free period is 95 to 125 days.

These soils are suited to pasture and range.

CAPABILITY UNIT IVs-2 DRYLAND

This unit consists of shallow, moderately deep, and deep, nearly level to strongly sloping soils on terraces,

fans, flood plains, and shale highlands. The surface layer ranges from loam and gravelly loam to clay.

These soils are well drained, and permeability ranges from very slow to rapid. Available water capacity is very low to high, and runoff is slow to rapid. The hazard of water erosion is slight to severe. The frost-free period is 90 to 125 days, and annual precipitation is 11 to 14 inches.

These soils are suited to range and dryfarmed small grain. Some small areas of saline soils are suited to salt-tolerant grasses, such as tall wheatgrass. The silty clay and clay soils are hard when dry and very sticky and plastic when wet. They have a narrow moisture range at which they can be tilled. Bromegrass, crested wheatgrass, Siberian wheatgrass, green needlegrass, and pubescent wheatgrass are suitable for hay and pasture planting.

CAPABILITY UNIT VIe-1 DRYLAND

This unit consists of shallow, moderately deep, and deep, gently sloping, strongly sloping, hilly, and steep soils on valley bottoms, terraces, loess-covered hills, and shale, sandstone, and limestone uplands. The surface layer ranges from sandy loam to clay and in places is gravelly and channery.

These soils are excessively drained to well drained, and permeability ranges from rapid to very slow. Available water capacity is very low to high, and runoff is medium to rapid. The frost-free period is 60 to 125 days, and annual precipitation is 11 to 24 inches.

The soils in this unit have a moderate to severe hazard of water erosion. The soils that have a surface layer of clay, loamy sand, and sandy loam are subject to moderate or severe soil blowing. Some areas are subject to streambank erosion and occasional overflow early in spring. A hard surface crust forms on sodium-affected soils as they dry. They are difficult to work, and seedling emergence is slowed.

Most of these soils occur as complexes in which shallow depth makes them unsuitable for cultivation. They are used mostly for range.

CAPABILITY UNIT VIw-1 DRYLAND

This unit consists of deep soils on flood plains, low terraces, and valley bottoms. They are loam and silty clay soils that are subject to flooding and that in places have a water table within 3 feet of the surface.

Permeability is slow to moderate, and available water capacity is moderate or high. Runoff is slow, and the hazard of erosion is severe during flooding. The frost-free period is 95 to 125 days, and annual precipitation is 12 to 15 inches.

These soils are suited only to range.

CAPABILITY UNIT VIs-1 DRYLAND

This unit consists of shallow, moderately deep, and deep, nearly level, gently sloping, sloping, and rolling soils on terraces, fans, valley bottoms, and limestone, shale, and sandstone uplands. These soils range from sandy loam to clay and in places are stony, gravelly, channery, and cobbly. Several of the soils are sodium and salt affected.

These soils are well drained, and permeability ranges from very slow to rapid. Available water capacity is very low to high, and runoff is slow to medium. The frost-free period ranges from 60 to 125 days, and annual precipitation is 12 to 24 inches.

The soils in this unit have a slight to severe hazard of water erosion. The hazard of soil blowing is moderate on several of the soils. The clay soils are sticky and plastic when wet and very hard when dry. Surface crusting on the saline soils prevents seedling emergence, and such soils are suited only to salt-tolerant plants.

Most of these soils occur in complexes of two or more soils that differ widely in their suitability for crops and in management requirements. Consequently, they are used mostly for range. The moderately deep, stone- and gravel-free soils are suitable for pasture and hay. Crested wheatgrass, green needlegrass, and Siberian wheatgrass are suitable for pasture and hay planting where annual precipitation is less than 14 inches. In the areas of higher rainfall, pubescent wheatgrass, smooth bromegrass, and intermediate wheatgrass are suitable.

CAPABILITY UNIT VIIe-1 DRYLAND

This unit consists of shallow, moderately deep, and deep, steep and very steep soils that are mixed with outcrops of limestone, shale, sandstone, and porcelanite on deeply dissected highlands. These soils range from clay to loam and include extremely stony, channery, and gravelly phases.

These soils are excessively drained to well drained, and permeability ranges from very slow to rapid. Available water capacity is very low in the shallow soils and low or moderate in the moderately deep and deep soils. Runoff is rapid, and the hazard of erosion is severe. Gully erosion is active in drainageways. Runoff water carries large amounts of sediment. The frost-free period is 60 to 125 days.

These soils are used for range, game range, and recreation. Grazing management is necessary for an adequate cover of plants.

CAPABILITY UNIT VIIs-1 DRYLAND

This unit consists of deep soils in river valleys, on fans, and in steep mountain valleys. These soils range from clay to gravelly and stony loam.

Permeability is very slow to moderate, and available water capacity is low to high. Runoff is slow to rapid, and the hazard of erosion is slight to severe. The frost-free period is 60 to 125 days.

These soils are used for range. Some areas are used for forest land. Grazing management is necessary for adequate cover of plants.

CAPABILITY UNIT VIIIs-1 DRYLAND

This unit consists of areas of Shale outcrop and Rock outcrop in the highlands and sand and gravel bars of Riverwash in river valleys. These land types are barren or nearly barren. Shale outcrop and Rock outcrop are steep and very steep and are on narrow ridges and along rims of deep valleys. Riverwash is flooded annually and is subject to constant change in size and shape.

These land types are not suitable for grazing. Migratory waterfowl use Riverwash as resting areas. Shale

outcrop produces a high volume of runoff and silt during summer rain. Shale outcrop and Rock outcrop provide wildlife habitat and some recreation.

Predicted Yields of Irrigated Crops

In table 2 the predicted yields per acre of the principal irrigated crops grown in the Area are listed. The yield figures are averages of yields over long periods under an improved level of management. Information was obtained from individual farmers, the Huntley Experiment Station, and farm field trails. The management for each crop is described in the following paragraphs. Fertilizer rates are expressed in actual pounds of nitrogen (N) and phosphoric acid (P_2O_5).

Most management recommendations in this section include references to the use of herbicidal sprays. Some states have restrictions on the use of certain pesticides, so check state and local regulations before such sprays are used. Because registrations of pesticides are under review by the Federal Environmental Protection Agency, consult your county extension agent or State Extension specialist to be sure the intended use is still registered. Follow all instructions and precautions listed on the container, and ask your county agent for advice when you plan to use pesticides.

Improved management for spring wheat consists of applying 80 pounds of nitrogen and 70 pounds phosphorus per acre if banded or 140 pounds if broadcast at seeding time; seeding as early as possible; spraying for weed control before the grain is in the boot stage; and irrigating uniformly by border dikes.

Improved management for barley consists of applying 80 pounds of nitrogen and 70 pounds of phosphorus per acre if banded or 140 pounds if broadcast at seeding time; seeding at the earliest possible date; irrigating uniformly by border dikes; spraying to control weeds before grain is in the boot stage; and timing the last irrigation to prevent lodging.

Improved management for oats consists of applying 80 pounds of nitrogen and 70 pounds of phosphorus per acre if banded or 140 pounds if broadcast at seeding time; irrigating uniformly by border dikes; and spraying to control weeds before the grain is in the boot stage.

Improved management for grain corn consists of plowing down 20 tons of barnyard manure per acre; preparing a firm seedbed; applying weed control spray at planting time; applying 50 pounds of nitrogen and 60 pounds of phosphorus per acre; planting 85- to 95-day maturing varieties at the earliest date possible; seeding about 30,000 plants per acre; controlling weeds by spraying until the canopy develops; side dressing with 50 pounds of nitrogen before the tasseling state; irrigating at maturity; and harvesting at minimum moisture content late in October.

Improved management for silage corn consists of plowing down 20 tons of barnyard manure per acre; preparing a firm seedbed; applying weed control spray at planting time; applying 100 pounds of nitrogen and 60 pounds of phosphorus per acre; planting 90- to 100-day maturing varieties at the earliest date possible; seeding about 30,000 plants per acre; controlling weeds by spraying until the canopy develops; irrigating between tasseling and silking stages; and harvesting at the dent stage or immediately after the first killing frost.

Improved management for sugar beets consists of applying 100 pounds of nitrogen, 125 pounds of phosphorus, and 10 to 15 tons of barnyard manure per acre; plowing in fall; preparing the seedbed by harrowing, floating, or packing; seeding no later than April 15 and as early as possible after the last killing frost; and irrigating early to insure that seedlings have ample moisture.

Improved management for dry beans consists of planting in strict rotation and never after a sod crop; preparing a firm, smooth seedbed; applying weed control spray at time of planting; applying 40 pounds of nitrogen, 80 pounds of phosphorus, and 15 tons of barnyard manure per acre; planting after the last killing frost; preventing sunscald by timing of irrigation in the latter part of the growing season and controlling mold on the silty clay loam, clay loam, and clay soils; and harvesting in time to prevent shattering.

Improved management for alfalfa hay consists of plowing down 120 pounds of phosphorus per acre; seeding without a nurse crop; seeding into weed-free grain stubble between August 15 and 31; irrigating uniformly in border dikes; controlling alfalfa weevils; cutting no more than 3 times a year; topdressing with 100 pounds of phosphorus per acre each year; and replanting every 4 or 5 years.

Improved management for irrigated pasture consists of good seedbed preparation; timely planting; weed control; fertilization according to need dictated from soil tests; exercising water management practices in accordance with irrigation design and plant needs; and proper rotation grazing practices.

Predicted Yields of Dryland Crops

In table 2 the predicted yields per acre of dryfarmed winter wheat, barley, oats, hay, and pasture are listed. The yields are based on information provided mostly by farmers and by experiments on test plots at the Huntley Experiment Station.

Improved management for winter wheat consists of destroying volunteer wheat plants by a fall fallow operation; using stubble mulch tillage; beginning spring fallow operations late in April or early in May for weed control; spraying for weed control; planting when the soil temperature is less than 50° F; applying 5 to 7 pounds of nitrogen and 25 pounds of phosphorus per acre at seeding; topdressing with 40 to 45 pounds of nitrogen in spring; and spraying for weeds before the grain is in the boot stage.

Improved management for barley consists of using a crop-fallow system; seeding at the earliest date possible; controlling weeds by spraying during fallow and in the planted grain; and applying 25 pounds of nitrogen and 40 pounds of phosphorus if banded or 80 pounds if broadcast per acre at seeding.

Improved management for oats consists of using a crop-fallow system; seeding at the earliest date possible; controlling weeds by spraying during fallow and in the planted grain; and applying 25 pounds of

TABLE 2.—*Predicted average yields per acre of principal crops*

[Absence of a yield figure indicates that the soil is not suitable for the crop or that the crop is not generally grown on the soil. Only soils suitable for irrigated crops are listed in this table]

Soil	Winter wheat (Dry-land)	Spring wheat (Irri-gated)	Barley		Oats		Corn for—		Sugar beets (Irri-gated)	Dry beans (Irri-gated)	Alfalfa hay		Tame hay (Dry-land)	Pasture	
			(Dry-land)	(Irri-gated)	(Dry-land)	(Irri-gated)	Grain (Irri-gated)	Silage (Irri-gated)			(Dry-land)	(Irri-gated)		(Dry-land)	(Irri-gated)
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*	*Cwt*	*Tons*	*Tons*	*Tons*	*AUM*[1]	*AUM*
Absarokee silty clay loam, gently undulating	35		55		73						1.5		1.2	1.2	
Absarokee silty clay loam, undulating	35		55								1.3		1.0	1.2	
Absarokee silty clay loam, rolling	24		39								1.1		.9	1.2	
Absarokee-Armington association, gently sloping	35		54								1.3		1.0	1.1	
Adel-Mayflower association, sloping														1.5	
Alice fine sandy loam, 4 to 15 percent slopes	23		35								1.0		.8	.9	
Allentine clay, 0 to 2 percent slopes		30		40		45		14	15			4.0	.7	.8	9
Allentine clay, 2 to 4 percent slopes		25		33		38						3.5	.7	.8	
Allentine-Bone complex, 0 to 1 percent slopes		26		38		43		12				3.5	.6	.8	8
Alluvial land, wet														2.5	
Amherst loam, undulating	24		36								1.0		.8	1.2	
Amherst loam, rolling	22		34										.8	1.0	
Armington silty clay loam													1.0	1.3	
Armington complex, rolling														1.0	
Arnegard loam, 8 to 15 percent slopes	24		35								1.2		.9	1.2	
Arnegard silt loam, 2 to 4 percent slopes	32	55	48	65	58	80		22			1.3	5.0	1.1	1.3	11
Arnegard silt loam, 4 to 8 percent slopes	37		55								1.3		1.0	1.3	
Ascalon sandy loam, 4 to 8 percent slopes	33		49								1.3		1.0	1.1	
Babb silt loam, rolling														1.4	
Beauvais silty clay loam, gently undulating	35	55	55	70	64			22			1.5	5.0	1.2	1.2	11
Beauvais silty clay loam, undulating	34	46	53	66							1.3	4.5	1.0	1.2	8
Beauvais silty clay loam, rolling	26	35	39	53							1.2	3.5	.9	.9	7
Beauvais-Gilt Edge silty clay loams, gently undulating	36	50	52	67				21			1.2	5.0	.9	.9	9
Belfield silt loam, 0 to 1 percent slopes	36	48	55	69	65			19			1.3	5.0	1.1	1.2	9
Belfield silt loam, gently undulating	38	46	50	67	68			19			1.3	5.0	1.1	1.2	10
Belfield silt loam, undulating	35	48	48	60							1.3	4.5	1.1	1.1	8
Belfield-Adger complex, 0 to 1 percent slopes	34		58		65						1.4		1.2	1.1	
Belfield-Adger complex, gently undulating	33		56		60						1.3		1.0	1.0	
Belfield-Adger complex, undulating	31		46								1.2		1.0	.9	
Bew silty clay loam, 0 to 1 percent slopes	23	45	33	55	45	70	90	18	16		1.0	5.0	.8	.9	10
Bew silty clay loam, gently undulating	23	44	33	52	50	69					.9	4.5	.7	.9	8
Bitton gravelly loam, 2 to 8 percent slopes	13		20										.4	.6	7
Cherry silty clay loam, 2 to 8 percent slopes	33	47	49	65	58	80					1.3	5.0	1.0	1.2	9
Chugter loam, 2 to 8 percent slopes	22	48	33	58	51						.9	4.5	.6	.8	7
Chugter complex, 2 to 15 percent slopes	16		24								.8		.6	.8	7
Colby silt loam, 4 to 8 percent slopes	23	50	38	66	55	85					1.1	4.5	.9	1.0	9
Colby silt loam, 8 to 15 percent slopes	14	35	22	50		60					1.0	3.5	.8	.9	7
Colby silty clay loam, 1 to 4 percent slopes	30	52	44	68		90	115	24		24	1.3	5.0	1.0	.9	9
Colby silty clay loam, 4 to 8 percent slopes	24	45	39	61		82					1.1	4.5	.8	.9	8
Colby silty clay loam, 8 to 15 percent slopes	16	34	27	48		55					1.0	3.5	.7	.7	7
Colby-Beauvais silt loams, undulating	23	49	39	62		84					1.1	4.5	.9	.8	9
Colby-Beauvais silt loams, rolling	15	30	24	42		50					1.0	3.5	.8	.8	7
Colby-Clapper silt loams, rolling	13		21								1.0			.8	

TABLE 2.—*Predicted average yields per acre of principal crops*—Continued

Soil	Winter wheat (Dry-land)	Spring wheat (Irri-gated)	Barley (Dry-land)	Barley (Irri-gated)	Oats (Dry-land)	Oats (Irri-gated)	Corn for— Grain (Irri-gated)	Corn for— Silage (Irri-gated)	Sugar beets (Irri-gated)	Dry beans (Irri-gated)	Alfalfa hay (Dry-land)	Alfalfa hay (Irri-gated)	Tame hay (Dry-land)	Pasture (Dry-land)	Pasture (Irri-gated)
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*	*Cwt*	*Tons*	*Tons*	*Tons*	*AUM*[1]	*AUM*
Colby-Keiser silty clay loams, 4 to 8 percent slopes	25	46	40	65		86					1.1	4.5	0.8	0.8	8
Colby-Midway complex, 8 to 15 percent slopes											1.0			.6	
Colby association, rolling	15		23								1.0			.6	
Cushman loam, undulating	20		33								.9			.9	
Danvers silty clay loam, 0 to 1 percent slopes	45	55	65	70	79	90		20			1.5	5.0	1.2	1.2	11
Danvers silty clay loam, gently undulating	40	50	60	65	72	80					1.4	5.0	1.1	1.2	10
Danvers silty clay loam, undulating	37	45	56	66							1.3	4.5	1.0	1.2	11
Danvers cobbly silty clay loam, 1 to 4 percent slopes	35		56		66						1.4		.9	1.1	
Danvers-Judith silty clay loams, gently undulating	38		58		68						1.4		1.1	1.0	
Danvers-Judith silty clay loams, undulating	34		48								1.3		1.0	1.0	
Danvers-Judith silty clay loams, hilly	21		32								1.1			1.0	
Dast sandy loam, rolling											1.1			.9	
Dast-Parshall sandy loams, rolling	21		33								1.1			1.0	
Doney loam, rolling	21		33											.8	
Doney-Reeder loams, rolling	22		35								1.1			1.0	
Eltsac clay, undulating	30		44											1.0	
Eltsac clay, rolling														.9	
Farnuf loam, 0 to 2 percent slopes	42	55	60	69		90		21			1.5	5.0	1.2	1.2	12
Farnuf loam, 2 to 4 percent slopes	41	57	58	69	73	85		23			1.4	5.0	1.1	1.2	12
Farnuf loam, 4 to 8 percent slopes	37	47	50	55		75					1.3	4.5	1.1	1.2	10
Farnuf-Doney association, sloping	21		36								1.1		1.0	1.0	9
Fergus silt loam, 2 to 4 percent slopes	37		55								1.3			1.2	
Fergus silt loam, 4 to 8 percent slopes	30		44											1.4	
Fergus silt loam, 8 to 15 percent slopes														1.3	
Fort Collins loam, 0 to 2 percent slopes	30	57	49	74	60	95	135	25	22	28	1.1	5.5	.9	.9	12
Fort Collins loam, 2 to 4 percent slopes	25	57	39	74	51	95	120	23	21	25	.9	5.0	.9	.9	11
Fort Collins loam, 4 to 8 percent slopes	24	51	37	58		85					.9	4.5	.8	.8	10
Fort Collins loam, channeled, 4 to 8 percent slopes											.9			.7	
Frazer silty clay loam	34	43	50	59				19			1.4	5.0	1.1	1.2	12
Frazer silty clay loam, saline	24		34								1.2		.8	1.0	
Frazer silty clay	32	42	49	58				19			1.3	4.0	.9	1.3	10
Gilt Edge silty clay loam, 0 to 2 percent slopes	14	33	20	41							.5	3.0	.8	.9	9
Gilt Edge silty clay loam, 2 to 4 percent slopes	13	35	20	41							.5	3.0	.8	.9	9
Gilt Edge-Bone complex, 0 to 1 percent slopes	13	30	20	38							.4			.9	9
Gilt Edge-Bone complex, 1 to 4 percent slopes	12	30	20	38							.4			.8	9
Glenberg fine sandy loam, 0 to 2 percent slopes	17	52	26	66		80	100	21	16	19	1.0	4.5	.6	1.1	10
Glenberg fine sandy loam, 2 to 4 percent slopes	15	50	21	66				19	14		.9	4.5	.6	.9	10
Glenberg fine sandy loam, 4 to 8 percent slopes	15	45	21	55							.9	4.0	.6	.9	10
Glenberg loam, 0 to 2 percent slopes	16	45	23	60		80	100	22	18	21	.9	4.0	.7	.9	12
Grail clay loam, 0 to 2 percent slopes	40	45	58	64		70		17			1.5	4.5	1.2	1.3	12
Grail clay loam, 2 to 8 percent slopes	35	44	49	57		75					1.3	4.5	1.2	1.3	11
Grail clay loam, 8 to 15 percent slopes	22		38								1.1			1.2	

TABLE 2.—*Predicted average yields per acre of principal crops*—Continued

Soil	Winter wheat (Dry-land)	Spring wheat (Irri-gated)	Barley		Oats		Corn for—		Sugar beets (Irri-gated)	Dry beans (Irri-gated)	Alfalfa hay		Tame hay (Dry-land)	Pasture	
			(Dry-land)	(Irri-gated)	(Dry-land)	(Irri-gated)	Grain (Irri-gated)	Silage (Irri-gated)			(Dry-land)	(Irri-gated)		(Dry-land)	(Irri-gated)
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*	*Cwt*	*Tons*	*Tons*	*Tons*	*AUM*[1]	*AUM*
Grail silty clay, 0 to 2 percent slopes	30	37	44	50	60						1.3	4.5	0.9	1.1	10
Harvey loam, gently undulating	19	50	31	71		88		23		23	1.1	5.5	.9	.8	12
Harvey loam, undulating	19	47	31	66		85					1.1	4.5	.8	.8	11
Harvey loam, rolling	15		22								1.0		.7	.8	
Harvey gravelly loam, undulating	22		33								1.1			.7	
Harvey complex, undulating											1.1			.7	
Haverson loam, 0 to 2 percent slopes	30	57	48	70		90	135	25	22	26	.9	5.5	.9	.9	12
Haverson loam, 2 to 4 percent slopes	24	52	35	68		87	120	23	18	24	.9	5.0	.9	.9	12
Haverson loam, saline	20		30								1.0			2.5	
Haverson silty clay loam	31	57	49	79		95	135	25	21	26	.9	5.5	.9	.9	12
Haverson silty clay		48		72		85	95	20	16		.9	4.5	.8	.8	11
Haverson silty clay, thick surface		50		70		80	100	21	17		1.1	5.0	.9	.9	12
Haverson-Hysham silty clay loams	20		32								.9		.6	.7	
Haverson and Glenberg soils											1.1			.8	
Haverson soils, saline	13		22								.5		1.0	1.5	
Heldt silty clay loam, 0 to 2 percent slopes	23	52	35	74	45	93	95	23	20		1.0	5.0	.9	.9	12
Heldt silty clay loam, 2 to 4 percent slopes	23	52	35	74	50	93	100	23	20		.9	5.0	.8	.9	11
Heldt silty clay loam, 4 to 8 percent slopes	21	47	33	66		80					.9	4.5	.8	.9	10
Heldt silty clay loam, 8 to 15 percent slopes	15		23								.8		.7	.9	
Heldt silty clay, 0 to 2 percent slopes		45		55				18	17			5.0		.9	12
Heldt-Hysham silty clay loams, 0 to 2 percent slopes	20		30								.9			.7	
Heldt-Hysham silty clay loams, 2 to 4 percent slopes	19		31								.9			.8	
Hesper silty clay loam, 0 to 1 percent slopes	33	50	50	70		90	135	24	20	24	1.0	5.5	1.1	.9	12
Hesper silty clay loam, 1 to 4 percent slopes	25	47	39	65		85	120	23	19		.9	5.0	.9	.9	11
Hesper silty clay loam, 4 to 8 percent slopes	23	45	37	60		70					.9	4.0	.8	.9	10
Hydro loam, 0 to 8 percent slopes	27		40								.9			.9	
Hydro silt loam, 0 to 2 percent slopes	30	50	46	72		83		20			1.0	4.5	.8	.8	10
Hydro silt loam, 2 to 4 percent slopes	36	44	54	58		68		18			.9	1.1	.8	.8	10
Hydro silt loam, 4 to 8 percent slopes	30		44											.9	
Hydro silty clay loam, 0 to 2 percent slopes	21	50	30	72		80					1.0	4.5	.8	.7	10
Hydro silty clay loam, 2 to 4 percent slopes	25	50	35	70		77					1.0	4.5	.8	.7	10
Hydro-Allentine complex, 1 to 4 percent slopes	13		21										.7	.7	
Hydro-Allentine complex, 4 to 8 percent slopes	12		19										.7	.7	
Hydro-Gilt Edge complex, 0 to 1 percent slopes	23		34											.9	
Judith clay loam, 0 to 2 percent slopes	36	48	54	62				18			1.3	4.5	1.0	1.2	11
Judith clay loam, 2 to 4 percent slopes	39	46	59	59							1.2	4.5	1.0	1.2	10
Judith clay loam, 4 to 8 percent slopes	36	29	55	45							1.2	3.5	1.0	1.2	10
Judith-Windham complex, 4 to 8 percent slopes	31		46								1.1		.9		
Judith-Windham complex, 8 to 15 percent slopes	21		32								.9		.8		
Keiser silty clay loam, 0 to 2 percent slopes	27	56	42	70		85	120	22	18	23	.9	5.5	.7	.9	12
Keiser silty clay loam, 2 to 4 percent slopes	23	47	35	65		80			17		.9	5.0	.7	.9	10
Keiser silty clay loam, 4 to 8 percent slopes	20		31								.9	4.5	.6	.9	10

TABLE 2.—*Predicted average yields per acre of principal crops*—Continued

Soil	Winter wheat (Dry-land)	Spring wheat (Irri-gated)	Barley (Dry-land)	Barley (Irri-gated)	Oats (Dry-land)	Oats (Irri-gated)	Corn for— Grain (Irri-gated)	Corn for— Silage (Irri-gated)	Sugar beets (Irri-gated)	Dry beans (Irri-gated)	Alfalfa hay (Dry-land)	Alfalfa hay (Irri-gated)	Tame hay (Dry-land)	Pasture (Dry-land)	Pasture (Irri-gated)
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*	*Cwt*	*Tons*	*Tons*	*Tons*	*AUM*[1]	*AUM*
Keiser-Colby complex, gently undulating	20		32								1.0		0.8	0.8	
Kim loam, 4 to 15 percent slopes											.8			.8	
Korchea loam, 0 to 2 percent slopes	46	57	60	67				21	21		1.3	5.0	1.2	1.2	12
Korchea loam, 2 to 4 percent slopes	42	57	60	67				24	20		1.3	4.5	1.1	1.2	12
Korchea silt loam, 0 to 2 percent slopes	41	52	57	62				20			1.5	4.5	1.1	1.2	12
Korchea silty clay loam, 0 to 2 percent slopes	45	48	55	62							1.5	4.5	1.2	1.2	12
Korchea silty clay loam, 2 to 4 percent slopes	42	45	62	56							1.4	4.5	1.1	1.1	11
Korchea and Frazer soils, water table														1.2	
Kyle silty clay, 0 to 2 percent slopes	22	40	34	60	43	77	90	19	15		1.1	4.0	.7	.9	12
Kyle silty clay, 2 to 4 percent slopes	20	40	34	56	43	75					1.1	4.0	.7	.9	12
Kyle silty clay, 4 to 8 percent slopes	19		31		43						1.1		.6	.9	
Kyle gravelly silty clay, 8 to 15 percent slopes	15		25								.9		.7	.8	
Kyle clay, saline	13		20								.6			.9	
La Fonda loam, 2 to 4 percent slopes	20		32								1.1		.8	.8	
Lavina-Travessilla loams, undulating	14		20											.9	
Lennep loam, 2 to 4 percent slopes	35		54								1.1			1.3	
Lennep loam, 4 to 8 percent slopes	25		35								1.1			1.3	
Lennep-Adger complex, gently undulating	31		46								1.1			1.0	
Lennep-Adger complex, undulating	22		37											1.0	
Lismas-Vananda clays, undulating	15		26											.8	
Lohmiller silty clay loam, 0 to 2 percent slopes	22	54	35	70	55	85	100	22	20	21	1.1	5.0	.8	.9	12
Lohmiller silty clay loam, 2 to 4 percent slopes	20	52	33	62	50	77		21	18	20	.9	5.0	.8	.9	12
Lohmiller silty clay loam, 4 to 8 percent slopes	20	47	33	57							.9	4.5	.7	.9	11
Lohmiller silty clay loam, 8 to 15 percent slopes	16		27								.8			.8	
Lohmiller silty clay, saline, 0 to 2 percent slopes	13		23											.6	
Lohmiller silty clay, saline, 2 to 4 percent slopes	12		22											.6	
Lohmiller-Midway silty clay loams, undulating											.8			.8	
Macar loam, 4 to 8 percent slopes	25	46	38	58							1.1	4.0	1.1	1.0	10
Marias clay, 0 to 2 percent slopes	36	44	50	55		60		15			1.2	4.0	1.1	.9	10
Marias clay, 2 to 4 percent slopes	33	43	48	49							1.2	4.0	1.0	.9	10
Marias clay, 4 to 8 percent slopes	25	30	39	41							.9	3.0	1.0	.9	10
Marias clay, 8 to 15 percent slopes	24		39								.9			.7	
Maschetah complex, rolling	23		33								1.0		1.1	1.1	
McKenzie clay	28		40											1.3	
McRae loam, 0 to 1 percent slopes	28	57	43	77	60	85	135	25	21	27	1.0	5.5	.8	.9	12
McRae loam, 1 to 4 percent slopes	24	52	39	65	52	78	120	23	19	24	1.1	5.0	.8	.9	12
McRae loam, 4 to 8 percent slopes	22	49	37	62		72					1.1	4.5	.7	.8	11
McRae silty clay loam, 0 to 1 percent slopes	31	55	45	79	60	95	135	25	22	26	1.1	5.5		.9	12
Midway silty clay loam, undulating	14		21											.9	12
Midway-Thurlow association, rolling														.9	
Morton silt loam, undulating	39		58								1.3		1.3	1.3	
Nelson fine sandy loam, undulating	15		22											.9	
Nelson-Alice fine sandy loams, rolling													.9	.9	
Nelson-Glenberg sandy loams, undulating														.8	
Neville loam, rolling	19	31									1.0			.7	

TABLE 2.—*Predicted average yields per acre of principal crops*—Continued

Soil	Winter wheat (Dry-land)	Spring wheat (Irri-gated)	Barley (Dry-land)	Barley (Irri-gated)	Oats (Dry-land)	Oats (Irri-gated)	Corn for— Grain (Irri-gated)	Corn for— Silage (Irri-gated)	Sugar beets (Irri-gated)	Dry beans (Irri-gated)	Alfalfa hay (Dry-land)	Alfalfa hay (Irri-gated)	Tame hay (Dry-land)	Pasture (Dry-land)	Pasture (Irri-gated)
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*	*Cwt*	*Tons*	*Tons*	*Tons*	*AUM*[1]	*AUM*
Nunn silty clay loam, 0 to 1 percent slopes	29	54	43	74	57	90	100	23	20		1.2	5.0	1.0	1.2	12
Nunn silty clay loam, 1 to 4 percent slopes	29	54	43	74	51	85	115	22	18		1.3	5.0	1.0	1.2	12
Nunn silty clay loam, 4 to 8 percent slopes	29	50	43	65	60	80					1.1	4.5	.8	1.1	10
Nunn silty clay loam, 8 to 15 percent slopes	17		27								1.0		.8	1.0	
Nunn-Midway silty clay loams, 4 to 15 percent slopes													.9	.7	
Olney fine sandy loam, 4 to 12 percent slopes	22		35								1.0		.8	.9	
Parshall fine sandy loam, 4 to 8 percent slopes	35		54								1.3		1.1	1.2	
Peritsa silt loam, undulating	32		48								1.1		1.1	1.2	
Peritsa-Abac loams, rolling														1.0	
Peritsa complex, rolling														1.0	
Pierre clay, undulating	17		27		40									.9	
Pierre-Kyle clays, gently undulating	15		24		28									.9	
Pultney-Neville association, undulating	19	31									1.0			.7	
Raynesford loam, undulating														1.3	
Reeder loam, gently undulating	39		59								1.3		1.2	1.1	
Reeder loam, undulating	32		47								1.2		1.0	1.1	
Reeder-Regent complex, rolling	22		36								1.1		1.2	1.2	
Reeder-Darret association, undulating											1.4			1.3	
Reeder-Darret association, rolling											1.1			1.3	
Regent silty clay loam, gently undulating	35		54								1.3		1.0	1.2	
Regent silty clay loam, undulating	34		52								1.2		1.0	1.1	
Regent silty clay loam, rolling	23		34								1.0		.8	1.1	
Renohill silty clay loam, undulating	22		34								.9		.8	.9	
Richfield silty clay loam, 0 to 2 percent slopes	33	55	48	79		95	120	25	20	26	1.1	5.5	.9	1.1	12
Richfield silty clay loam, gently undulating	21	52	33	72		90	100	23	19		1.0	5.5	.9	1.0	11
Richfield silty clay loam, undulating	20	45	33								1.0	5.0	.8	.9	10
Richfield-Beauvais silty clay loams, gently undulating	23	52	36	70		90					1.1	5.0	.9	1.0	11
Richfield-Beauvais silty clay loams, undulating	20	44	34								1.1	4.5	.8	.9	11
Rottulee silt loam, gently undulating	34		51								1.2		.9	1.1	
Rottulee silt loam, undulating	32		47								1.0		.8	1.0	
Rottulee silt loam, rolling													.8	1.0	
Savage silty clay loam, 0 to 2 percent slopes	39	57	58	67		85		22			1.3	5.0	1.1	1.2	12
Savage silty clay loam, 2 to 4 percent slopes	39	50	58	65		77		20			1.3	5.0	1.0	1.2	12
Savage silty clay loam, 4 to 8 percent slopes	34		50								1.3	4.5	1.0	1.1	10
Savage silty clay loam, undulating	31		45								1.3		1.0	1.1	
Savage silty clay loam, rolling	21		35								1.0		1.0	1.1	
Savage-Wayden silty clay loams, 4 to 15 percent slopes											.9		1.1	1.2	
Searing loam, undulating	32		48								1.1		.9	.9	
Searing-Ringling complex, rolling														1.0	
Shaak clay loam, 4 to 8 percent slopes	31	37	46	53		64					1.2	3.5	1.0	1.1	10
Shaak silty clay loam, 0 to 2 percent slopes	37	37	52	53							1.2	4.0	1.1	1.2	12
Shaak silty clay loam, gently undulating	43	39	49	52							1.3	4.5	1.0	1.1	10
Shaak silty clay loam, undulating	37	35	45	50							1.2	3.5	1.0	1.0	9
Shaak silty clay loam, rolling	22		35								1.0		.8	1.0	9

TABLE 2.—*Predicted average yields per acre of principal crops*—Continued

Soil	Winter wheat (Dry-land)	Spring wheat (Irri-gated)	Barley (Dry-land)	Barley (Irri-gated)	Oats (Dry-land)	Oats (Irri-gated)	Corn for— Grain (Irri-gated)	Corn for— Silage (Irri-gated)	Sugar beets (Irri-gated)	Dry beans (Irri-gated)	Alfalfa hay (Dry-land)	Alfalfa hay (Irri-gated)	Tame hay (Dry-land)	Pasture (Dry-land)	Pasture (Irri-gated)
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*	*Cwt*	*Tons*	*Tons*	*Tons*	*AUM*[1]	*AUM*
Shaak complex, 4 to 15 percent slopes													1.1	1.0	
Shonkin clay loam	36		50								1.1		1.4	1.3	
Sofia silty clay, 0 to 2 percent slopes	34	45	52	62				16	19		1.3	5.0	1.2	1.2	11
Sofia silty clay, gently undulating	32	45	50	60		77					1.2	4.5	1.2	1.1	10
Spearman loam, undulating	20		33										.7	.9	
Spearman-Wibaux complex, rolling	15		21										.6	.7	
Stormitt complex, 0 to 4 percent slopes													.7	.8	
Stormitt complex, 4 to 15 percent slopes													.6	.8	
Tarrete silty clay loam, 8 to 15 percent slopes														1.5	
Terry fine sandy loam, undulating	15		21											.9	
Teton loam, 8 to 25 percent slopes														1.4	
Thedalund loam, undulating	30		44										.7	.7	
Thedalund-Cushman loams, undulating	20		37										.8	.8	
Thedalund-Fort Collins complex, rolling													.7	.7	
Thedalund-McRae loams, dissected														.8	
Thedalund-Midway complex, rolling														.7	
Thedalund-Nelson complex, rolling														.8	
Thurlow silty clay loam, 0 to 1 percent slopes	29	57	42	67	55	95	135	24	21	28	.9	5.5	.9	.9	11
Thurlow silty clay loam, 1 to 4 percent slopes	22	57	34	67	50	90	120	22	20	24	.9	5.5	.8	.9	10
Thurlow silty clay loam, 4 to 8 percent slopes	20	51	33	62	50	85					.9	4.5	.7	.9	9
Thurlow-Midway silty clay loams, 4 to 15 percent slopes											.8		.8	.7	
Toluca-Harvey complex, undulating	20		33		50						.9		.8	.9	
Twin Creek loam, 2 to 4 percent slopes	40	47	60	57							1.3	4.5	1.0	1.3	9
Twin Creek loam, 4 to 8 percent slopes	32		48								1.3		1.1	1.3	11
Twin Creek loam, 8 to 15 percent slopes	25		38								1.1		.9	1.1	9
Twin Creek-Korchea complex, 2 to 8 percent slopes	36		59								1.3		1.0	1.2	
Vananda clay, 0 to 1 percent slopes		25		35				10	11					.3	6
Vebar fine sandy loam, undulating	30		46										.9	1.2	
Vebar fine sandy loam, rolling	23		33								1.1			1.2	
Vebar complex, rolling														1.1	
Wages loam, 0 to 2 percent slopes	30	55	49	79	60	95	135	24	22	28	1.1	5.5	1.0	1.2	12
Wages loam, 2 to 4 percent slopes	24	50	37	72	50	90	125	21	20	24	1.1	5.5	.9	1.1	11
Wages loam, 4 to 8 percent slopes	21	45	34	62							1.0	4.5	.9	1.1	10
Wayden-Savage silty clay loams, rolling											.9		.8	.9	
Xavier silty clay loam, gently undulating	40	53	52	59		85					1.3	5.0	1.0	1.2	10
Xavier silty clay loam, undulating	31	40	46	52		73					1.1	4.5	.9	1.1	9
Xavier silty clay loam, rolling	25		36										.9	1.0	
Xavier-Shaak complex, undulating	32		47								1.2		1.0	1.1	
Xavier-Shaak complex, rolling	24		36								1.1		.8	1.0	

[1] AUM = Animal-unit-months. An animal-unit-month expresses the carrying capacity of pasture. It is the number of animal units, or 1,000 pounds of live weight, that can be grazed on an area of pasture for 30 days.

nitrogen and 40 pounds of phosphorus if banded or 80 pounds if broadcast per acre at seeding.

Improved management for alfalfa hay consists of seeding without a nurse crop; seeding into weed-free grain stubble between August 15 and 31; controlling alfalfa weevils; cutting once each year; controlling weeds; and reseeding when needed.

Improved management for hay and pasture consists of seeding into a firm weed-free seedbed, preferably in fall; controlling weeds by spraying and slipping; and topdressing grass plantings with 50 pounds of nitrogen and 50 pounds of phosphorus per acre each year.

The amount of water available in the soil during the growing season is the most important factor that affects dryfarmed crops. Rainfall from April to June is the most important for crop growth. Rain during the summer fallow period provides moisture for crops the next year. In fall, rain helps germinate new seedings and provides moisture for growth early in spring.

Use of the Soils for Range[2]

In the Big Horn County Area, rangeland makes up 2,501,257 acres, or about 78 percent of the total acreage. It is the basis for the livestock enterprises that form the largest income-producing industry in the Area. It also provides habitat for most of the wildlife, protection for the vast acreage of watershed, and recreation, and it has esthetic value.

The north half of the Area receives 11 to 14 inches of precipitation annually, while most of the southern part averages 15 to 19 inches annually. Some of the mountainous areas receive 20 to 24 inches.

Range sites and condition classes

There are many differences in the soils and climate of the Big Horn County Area. For this reason there are several different kinds of rangeland, called range sites.

A given range site has the ability to produce different kinds or amounts, or both, of climax vegetation than any other range site. Over the centuries, nature has developed a combination of plants that is best suited to a particular climate and soil. This group of plants is called the potential, or climax, plant community for the site. The climax plant community for a site varies slightly from year to year, but the kinds and percentages of plants remain about the same in undisturbed areas.

The original combination of plants fitted the soil and climate of the site so perfectly that other kinds of plants could not move in unless the area was disturbed. So consistent is the relation among plants, climate, and soils that the climax plant community can be predicted even on severely disturbed sites if the soil is identified. If good management is practiced, near-climax plant communities may be maintained, or, in the case of disturbed vegetation, the climax community may be gradually re-established unless the soils have been seriously eroded.

[2] By STERLE E. DALE, range conservationist, Soil Conservation Service.

Plants are categorized as decreasers, increasers, or invaders according to their response to grazing pressures.

Decreasers are dominant climax plants that tend to decrease in relative amount under close grazing. They are generally the most productive and the most palatable to grazing animals.

Increasers are plants in the climax vegetation that increase in relative amount as the more desirable decreaser plants are reduced by close grazing. They are generally less palatable and are woody, spiny, or so short that they escape close grazing.

Range condition is an expression of the present kind and amount of vegetation in relation to the climax plant community for that site. The more nearly the present kinds and amounts of plants are like the climax plant community, the higher the range condition.

A range is in *excellent* condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand. It is in *good* condition if the percentage is 51 to 75. It is in *fair* condition if the percentage is 26 to 50 and in *poor* condition if the percentage is less than 25.

The present range condition provides an index to changes that have taken place in the plant community. More important, however, range condition is a basis for predicting the kinds and amounts of changes in the present plant community that can be expected from management and treatment measures. Thus, the range condition rating indicates the nature of the present plant community, and the climax plant cover represents a goal toward which rangeland management may be directed.

Knowledge of the climax plant communities of range sites and the nature of present plant communities in relation to their potential is important in planning and applying conservation on rangeland. Such information is the basis for selecting management objectives, designing grazing systems, managing wildlife, determining potential for recreation, and rating the condition of the watershed.

Any management objective on rangeland must provide for plant cover that adequately protects or improves the soil and water resources and meets the needs of the operator. This usually involves increasing desirable plants and restoring the plant community to near-climax conditions. Sometimes, however, a plant cover somewhat less than climax will better fit specific grazing needs or provide better wildlife habitat while still protecting the soil and water resources.

All range sites respond favorably to proper grazing use and systems of grazing deferment.

Descriptions of range sites

In the following pages the range sites of the Area are described, and the climax plants and principal invaders on the site are named. Also shown are estimates of the potential annual yield per acre of air-dry herbage for each site if in excellent condition. The soils in each site can be determined by referring to the "Guide to Mapping Units" at the back of this soil survey.

OVERFLOW SITE, 10- TO 14-INCH PRECIPITATION ZONE

This range site is made up of deep, well-drained silty clay loams, loams, and fine sandy loams. It is on low terraces and flood plains that regularly receive more than normal soil moisture because of runoff or stream overflow. This site makes up about 1 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Western and thickspike wheatgrass	40
Other tall grasses	15
Green needlegrass	10
Woody plants	10
Needleandthread	5
Little bluestem	5
Slender wheatgrass	5
Perennial forbs	5
Annuals	5

Total annual yield on range in excellent condition is 2,400 pounds air-dry herbage per acre. In less favorable years yield is as little as 800 pounds per acre. About 90 percent of the plants in this site furnish forage for cattle, horses, sheep, deer, and antelope.

Under continuous heavy use green needlegrass, western wheatgrass, and the other climax plants decrease and are replaced by silver sagebrush, Kentucky bluegrass, Canada bluegrass, and annual plants. Range deterioration is often reflected by an increase in silver sagebrush, rosebush, snowberry, and Kentucky and Canada bluegrass.

SALINE LOWLAND SITE, 10- TO 14-INCH PRECIPITATION ZONE

This range site is made up of deep, mixed alluvial soils of silty clay loam, loam, silt loam, and clay loam. It is characterized by subirrigated and overflow land where accumulations of salt or alkali, or both, are apparent, and salt-tolerant plants occur over a major part of the area. This site makes up about 0.5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Alkali cordgrass	25
Western wheatgrass	25
Alkali sacaton	15
Saltgrass	10
Alkali grass	10
Sedges	5
Muhly	5
Forbs	5

Total annual yield on range in excellent condition is 1,800 pounds air-dry herbage per acre. In less favorable years yield is as little as 1,400 pounds per acre. About 60 percent of the plants in this site furnish forage for cattle, sheep, deer, and antelope.

Under continuous heavy use the taller decreasers are replaced by annuals of the goosefoot family.

Range recovery is somewhat slow because of the salt content of the soils. This site is unsuitable for mechanical treatment.

SANDS SITE, 10- TO 14-INCH PRECIPITATION ZONE

This range site is made up of sand and loamy sand soils that are more than 20 inches deep. The intake rate favors light rainfall because runoff is low. Soil blowing is a hazard in places where plant cover is destroyed by excessive grazing. This site makes up about 0.5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Prairie sandreed	35
Little bluestem	20
Needleandthread	10
Woody plants	10
Sand bluestem	5
Western wheatgrass	5
Perennial forbs	5
Upland sedges	5
Short grasses	5
Big bluestem	Trace

Total annual yield on range in excellent condition is 1,800 pounds air-dry herbage per acre. In less favorable years yield is as little as 900 pounds per acre. About 90 percent of the plants in this site furnish forage for grazing animals.

Under continuous heavy use prairie sandreed, little bluestem, sand bluestem, and big bluestem decrease in the plant community and are replaced by needleandthread, western wheatgrass, sedges, and large amounts of annual grasses and forbs.

This site is poorly suited to mechanical treatments because soil blowing is a hazard.

SANDY SITE, 10- TO 14-INCH PRECIPITATION ZONE

This range site is made up coarse sandy loam to fine sandy loam soils that are more than 20 inches deep. It makes up about 2 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Bluebunch wheatgrass	15
Little bluestem	15
Needleandthread	15
Prairie sandreed	15
Western wheatgrass	15
Other tall grasses	10
Sand bluestem	5
Woody plants	5
Sand dropseed	3
Side-oats grama	2
Short grasses	Trace
Green sagewort	Trace

Total annual yield on range in excellent condition is 2,300 pounds air-dry herbage per acre. In less favorable years yield is as little as 800 pounds per acre. About 90 percent of the plants in this site furnish forage for cattle, sheep, deer, and antelope.

Under continuous heavy use the bluestems, needleandthread, prairie sandreed, side-oats grama, and other high-producing grasses decrease in the plant community and are replaced by upland sedges, green sagewort, tumblegrass, fringed sagewort, and annual grasses and forbs.

Range recovery is slow on this site where the climax dominants have been nearly grazed out. Where topography is favorable, most mechanical treatments hasten recovery if enough of the original climax vegetation remains. In other areas a complete seedbed preparation followed by range seeding offers the best opportunity for range improvement. Brush management is advan-

tageous in areas that have an excessive growth of rosebush, snowberry, or other brushy vegetation.

SILTY SITE, 10- TO 14-INCH PRECIPITATION ZONE

This range site is made up of moderately deep and deep soils that have a surface layer of loam, silt loam, or silty clay loam. The infiltration rate is good, and the soils hold most of the usual precipitation. This site makes up about 9 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Western wheatgrass	20
Needleandthread	20
Bluebunch wheatgrass	15
Green needlegrass	10
Forbs	10
Little bluestem	5
Plains muhly	5
Blue grama	5
Silver sagebrush	5
Threadleaf sedge	5

Total annual yield on range in excellent condition is about 1,800 pounds air-dry herbage per acre. In less favorable years yield is as little as 600 pounds per acre.

Good management has permitted sizeable areas to remain in excellent condition, and range in poor condition is normally confined to recently abandoned cropland and areas of livestock concentrations. Under continuous heavy use the climax plants in the plant community decrease and are replaced by blue grama, Sandberg bluegrass, threadleaf sedge, brushy plants, and other species that are less palatable to livestock.

This site is suitable for such mechanical treatments as shallow chiseling, range pitting, and furrowing followed by range deferment. Complete seedbed preparation followed by seeding of suited species of native grasses is the quickest treatment for restoration of range in poor condition. Brush management is feasible in many areas that have a heavy growth of big sagebrush.

CLAYEY SITE, 10- TO 14-INCH PRECIPITATION ZONE

This range site is made up of moderately deep to deep granular clay loam, silty clay loam, silty clay, sandy clay, and clay soils. It makes up about 10 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Western wheatgrass	40
Green needlegrass	15
Forbs	15
Bluebunch wheatgrass	10
Blue grama	5
Plains reedgrass	5
Greasewood	5
Big sagebrush	5

Total annual yield on range in excellent condition is about 1,800 pounds air-dry herbage per acre. In less favorable years yield is as little as 600 pounds per acre.

Under continuous heavy use bluebunch wheatgrass, green needlegrass, western wheatgrass, and prairie clover decrease in the plant community and are replaced by big sagebrush, blue grama, plains reedgrass, and Sandberg bluegrass.

This site is well suited to mechanical treatments if adequate amounts of western wheatgrass and green needlegrass are present. Seeding adapted species results in satisfactory range improvement if it is followed by good management. Brush management is feasible in many areas that have a heavy growth of big sagebrush.

THIN HILLY SITE, 10- TO 14-INCH PRECIPITATION ZONE

This range site is made up of loam to silty clay loam soils that have an effective rooting depth of more than 20 inches. Slopes range from 15 to 50 percent. Small eroded areas are common. This site makes up about 18 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Western and thickspike wheatgrass	25
Needleandthread	20
Little bluestem	10
Woody plants	10
Prairie sandreed	5
Blue grama	5
Green needlegrass	5
Sedges	5
Perennial forbs	5
Plains muhly	5
Bluebunch wheatgrass	5
Side-oats grama	Trace
Plains reedgrass	Trace
Annual grasses and forbs	Trace

Total annual yield on range in excellent condition is 1,300 pounds air-dry herbage per acre. In less favorable years it is as little as 650 pounds per acre. About 90 percent of the plants in this site furnish forage for cattle, horses, sheep, deer, and antelope.

Under continuous heavy use western wheatgrass, thickspike wheatgrass, prairie sandreed, green needlegrass, and bluebunch wheatgrass decrease in the plant community and are replaced by blue grama, upland sedges, fringed sagewort, and such invaders as curlycup gumweed, broom snakeweed, and annual forbs and grasses.

This site is not well suited to mechanical treatments because it has steep slopes and erosion is a hazard.

SHALLOW CLAY SITE, 10- TO 14-INCH PRECIPITATION ZONE

This range site is made up of soils that have a thin, granular surface layer and a dense, weak blocky to massive subsurface layer that rests abruptly on platy, fractured shale at a depth of less than 20 inches. A few scattered, barren shale areas may occur in this site. This site makes up about 6 percent of the range of the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Western wheatgrass	45
Green needlegrass	20
Perennial forbs	10
Little bluestem	5
Prairie sandreed	5
Bluebunch wheatgrass	5
Rocky Mountain juniper	5
Annual grasses and forbs	5
Plains muhly	Trace
Greasewood	Trace
Nuttal saltbush	Trace
Winterfat	Trace

Total annual yield on range in excellent condition is 1,200 pounds air-dry herbage per acre. In less favorable years yield is as little as 600 pounds per acre. About 90 percent of the plants in this site furnish forage for cattle, sheep, horses, deer, and antelope.

Under continuous heavy use western wheatgrass, plains muhly, prairie sandreed, green needlegrass, bluebunch wheatgrass, little bluestem, nuttal saltbush, and greasewood decrease in the plant community and are replaced by curlycup gumweed, broom snakeweed, foxtail barley, sunflower, and numerous other annual grasses and forbs.

This site is not suited to mechanical treatments because the soils are shallow and soil blowing is a hazard. Uniform distribution of grazing is difficult on this site because of the varied terrain and lack of good permanent water development. Stock-water ponds on this site generally become filled with sediment in a few years.

SHALLOW TO GRAVEL SITE, 10- TO 14-INCH PRECIPITATION ZONE

This range site is made up of soils that have a thin surface layer of loam or gravelly sandy loam that rests on clean sand and gravel at a depth of 6 to 12 inches. It is on steep, dissected edges of gravel terraces. This site makes up about 1 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Needleandthread	25
Western and thickspike wheatgrass	20
Bluebunch wheatgrass	10
Short grasses	10
Perennial forbs	10
Little bluestem	5
Prairie sandreed	5
Sand dropseed	5
Sedges	5
Annuals	5

Total annual yield on range in excellent condition is 1,200 pounds air-dry herbage per acre. In less favorable years yield is as little as 600 pounds per acre. About 95 percent of the plants in this site furnish forage for cattle, horses, sheep, deer, and antelope.

Under continuous heavy use needleandthread, western wheatgrass, thickspike wheatgrass, and bluebunch wheatgrass decrease in the plant community and are replaced by sedges, blue grama, Sandberg bluegrass, red three-awn, hairy goldaster, and annual forbs.

This site is unsuitable for such mechanical treatments as pitting, shallow chiseling, and range seeding.

SHALLOW SITE, 10- TO 14-INCH PRECIPITATION ZONE

This range site is made up of loam and sandy loam soils that are 10 to 20 inches deep over hard or soft decomposed granite, siltstone, or sandstone bedrock. Few roots penetrate to a depth of more than 20 inches. This site makes up about 2 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Needleandthread	25
Bluebunch wheatgrass	20
Western wheatgrass	20
Blue grama	10
Forbs	10
Green needlegrass	5
Little bluestem	5
Prairie junegrass	5
Big sagebrush	Trace

Total annual yield on range in excellent condition is 1,200 pounds air-dry herbage per acre. In less favorable years yield is as little as 600 pounds per acre. About 90 percent of the plants in this site furnish forage for cattle, horses, sheep, deer, and antelope.

Under continuous heavy use bluebunch wheatgrass, green needlegrass, and little bluestem decrease in the plant community and are replaced in part by shorter grasses, such as blue grama, Sandberg bluegrass, and annuals.

This site is not suitable for mechanical treatments because soil blowing is a hazard. Range seeding is not practical except on abandoned cultivated land where the climax vegetation has been destroyed.

PAN SPOTS SITE, 10- TO 14-INCH PRECIPITATION ZONE

This range site is made up of silty, clayey, or sandy soils that are mapped in complex with soils in shallow depressions that have hard clay or other impervious material at or near the surface. The shallow depressions make up 20 to 50 percent of this site. If the site is in good to excellent condition, runoff is not excessive because the soils are gently sloping. This site makes up 1 percent of the range of the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Western wheatgrass	35
Green needlegrass	10
Plains reedgrass	10
Blue grama	10
Forbs	10
Needleandthread	5
Sandberg bluegrass	5
Prairie junegrass	5
Big sagebrush	5
Sedges	5
Annuals	Trace

Total annual yield on range in excellent condition is as much as 1,200 pounds air-dry herbage per acre. In less favorable years yield is as little as 600 pounds per acre.

Under continuous heavy use western wheatgrass and green needlegrass decrease in the plant community and are replaced by blue grama, Sandberg bluegrass, prairie junegrass, big sagebrush, and annuals.

In areas where a sufficient amount of the climax grasses remain, this site is suitable for such mechanical treatments as shallow chiseling, range pitting, and furrowing followed by deferred grazing. Where the range is in poor condition, complete seedbed preparation followed by seeding a suitable mixture of climax plants helps restore acceptable range condition. The management of big sagebrush may hasten improvement of the range.

DENSE CLAY SITE, 10- TO 14-INCH PRECIPITATION ZONE

This range site is made up of relatively impervious, deep clay that in places is overlain by a thin layer of other material. The soils are very hard to extremely

hard when dry and very sticky when wet. This site makes up about 0.5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Western wheatgrass	60
Forbs	15
Sandberg bluegrass	5
Squirreltail	5
Sedges	5
Big sagebrush	5
Greasewood	5
Annuals	Trace

Total yield on range in excellent condition is 1,200 pounds air-dry herbage per acre. In less favorable years yield is as low as 600 pounds per acre.

Under continuous heavy use western wheatgrass decreases in the plant community and is replaced by Sandberg bluegrass, blue grama, bottlebrush squirreltail, big sagebrush, cactus, curlycup gumweed, and other invaders.

This site is suitable for such mechanical treatments as shallow chiseling, pitting, or furrowing followed by periods of deferment. A good seedbed is difficult to prepare on this site, but there is rarely a need for range seeding unless the original vegetation has been destroyed by cultivation.

THIN BREAKS SITE, 10- TO 14-INCH PRECIPITATION ZONE

This range site is made up of soils of various depths that have hard outcroppings of bedrock at different levels and are on steep, irregular slopes. Trees occur locally in places above the outcrops. Soil texture ranges from sandy loam to clay loam. This site makes up about 1 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Bluebunch wheatgrass	25
Western wheatgrass	25
Needleandthread	15
Blue grama	10
Threadleaf sedge	10
Green needlegrass	5
Side-oats grama	5
Prairie junegrass	5
Annuals	Trace

Total annual yield on range in excellent condition is 900 pounds air-dry herbage per acre. In less favorable years yield is as little as 300 pounds per acre.

The irregular topography characteristic of the site discourages overuse by grazing animals and makes this site unsuitable for mechanical practices and seeding.

SHALE SITE, 10- TO 14-INCH PRECIPITATION ZONE

This site is made up of soils that are shallow over shale on readily puddled uplands where weathered, angular raw shale fragments are exposed at the surface in places. This site makes up about 0.5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Western wheatgrass	25
Bluebunch wheatgrass	15
Alkali sacaton	15
Greasewood	15
Prairie sandreed	10
Green needlegrass	5
Short grasses	5
Forbs	5
Annuals	5

Total annual yield on range in excellent condition is about 500 pounds air-dry herbage per acre. In less favorable years yield is as little as 100 pounds per acre. About 75 percent of the plants in this site furnish forage for cattle, sheep, deer, and antelope.

Under continuous heavy use bluebunch wheatgrass and western wheatgrass decrease in the plant community and are replaced by annual forbs, blue grama, Sandberg bluegrass, or annual bromes.

The steep, rough topography limits the use of this site by livestock. Mechanical treatment and range seeding are not suitable on this range site.

WET LAND SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of lands where seepage, ponding, and flooding raise the water table above the surface during part of the growing season. This site is adjacent to perennial streams and on their flood plains. It makes up about 0.5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Sedges	50
Cordgrasses	25
Tall reedgrasses	10
Forbs	10
Woody plants	5
Invaders	Trace

Total annual yield on range in excellent condition is about 9,000 pounds air-dry herbage per acre. In less favorable years yield is as little as 3,000 pounds per acre. About 75 percent of the plants in this site furnish forage for cattle, deer, and antelope.

Under continuous heavy use cordgrasses, reedgrasses, and tall sedges decrease in the plant community and are replaced by silver sagebrush, Kentucky bluegrass, redtop, and annual vegetation.

This site is unsuitable for mechanical practices that would improve range condition because of the difficulty in tilling wet soil.

OVERFLOW SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of soils that regularly receive more than normal moisture in the form of runoff or stream overflow. This site makes up about 0.5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Western wheatgrass	25
Basin wildrye	15
Forbs	15
Little bluestem	10
Big bluestem	10
Sedges	10

Bearded wheatgrass	5
Shrubby cinquefoil	5
Woody plants	5

Total annual yield on range in excellent condition is about 4,200 pounds air-dry herbage per acre. In less favorable years yield is as little as 1,400 pounds per acre. About 90 percent of the plants in this site furnish forage for cattle, horses, sheep, deer, and antelope.

Under continuous heavy use the taller grasses decrease in the plant community and are replaced by silver sagebrush, snowberry, rosebush, Kentucky bluegrass, annuals, or noxious weeds.

This site responds to reseeding where the climax vegetation has been destroyed if a good seedbed is prepared and suitable native species are seeded.

SANDY SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of coarse sandy loam to fine sandy loam soils that are more than 20 inches deep over bedrock. This site makes up about 1 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Prairie sandreed	20
Sand bluestem	15
Needleandthread	15
Idaho fescue	15
Big bluestem	10
Little bluestem	10
Forbs	10
Sedges	5

Total annual yield on range in excellent condition is about 3,000 pounds air-dry herbage per acre. In less favorable years yield is as little as 1,400 pounds per acre. Approximately 90 percent of the plants in this site furnish forage for cattle, horses, deer, and antelope.

Under continuous heavy use the bluestems, needleandthread, prairie sandreed, and sedges decrease in the plant community and are replaced in part by blue grama, forbs, sageworts, and annuals.

Recovery of excellent range condition is slow where the preferred climax species have been nearly grazed out. Under these conditions the range can be improved rapidly by seeding to suitable species. Brush management offers opportunities for range improvement where there is an excessive growth of rose, snowberry, or other brush species.

SILTY SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of moderately deep to deep soils that have a surface layer of loam, silt loam, or clay loam. These soils have good water infiltration rates and are capable of holding most of the normal precipitation. This site makes up about 5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Big bluestem	20
Idaho fescue	15
Western wheatgrass	15
Basin wildrye	10
Needleandthread	10
Green needlegrass	5
Bearded wheatgrass	5
Mountain brome	5
Little bluestem	5
Forbs	5
Woody plants	5

Total annual yield on range in excellent condition is as much as 3,000 pounds air-dry herbage per acre. In less favorable years yield is as little as 1,400 pounds per acre.

Under continuous use the bluestems, wheatgrasses, green needlegrass, and Idaho fescue decrease in the plant community and are replaced by the shorter grasses, forbs, and woody plants.

This site is suited to such mechanical treatments as shallow chiseling, range pitting, and furrowing followed by range deferment if enough of the preferred grasses remain. Preparation of a good seedbed followed by range seeding and deferment hasten the restoration of seriously depleted range. Brush management is practical and feasible on areas that have an excessive growth of woody vegetation.

CLAYEY SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of moderately deep to deep, well-drained clay loams, silty clay loams, silty clays, sandy clays, and clays. This site makes up about 7 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Bluebunch wheatgrass	20
Western wheatgrass	20
Idaho fescue	20
Basin wildrye	10
Green needlegrass	5
Canby bluegrass	5
Plains reedgrass	5
Forbs	5
Big sagebrush	5
Woody plants	5

Total annual yield on range in excellent condition is about 3,000 pounds air-dry herbage per acre. In less favorable years yield is as little as 1,400 pounds per acre. Approximately 90 percent of the plants in this site furnish forage for grazing animals.

Under continuous heavy use the wheatgrasses, needlegrasses, basin wildrye, and other tall grasses decrease in the plant community and are replaced by short grasses, sageworts, and annual forbs and grasses.

Where the topography is favorable and sufficient desired species remain, range improvement can be hastened on this site by such mechanical treatments as furrowing or pitting. Where the climax plant community has been destroyed, complete seedbed preparation and range seeding are practical and provide rapid range improvement. Brush management is practical in areas that have an excessive growth of rosebush, snowberry, sagebrush, or other brush if some climax species are present.

THIN HILLY SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of calcareous loam to clay soils that are 20 inches deep or more. It is on steep or hilly landscapes. This site makes up approximately 9 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Idaho fescue	20
Prairie sandreed	15
Western wheatgrass	15
Bluebunch wheatgrass	10
Little bluestem	10
Needleandthread	10
Forbs	10
Green needlegrass	5
Woody plants	5
Blue grama	Trace

Total annual yield on range in excellent condition is 1,800 pounds air-dry herbage per acre. In less favorable years yield is as little as 800 pounds per acre. About 90 percent of the plants in this site furnish forage for cattle, horses, sheep, deer, and antelope.

Under continuous heavy use bluebunch wheatgrass, prairie sandreed, green needlegrass, little bluestem, and western wheatgrass decrease in the plant community and are replaced by blue grama, sedges, forbs, annuals, and woody plants.

This site is not suitable for mechanical treatment because of the steep topography and the hazard of erosion. Range seeding and brush management may be justified under extreme conditions if quick range improvement is needed; however, these practices on this site involve considerable risk of increased erosion.

SHALLOW CLAY SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of granular clays that are 10 to 20 inches deep over underlying shale or nearly impervious clay. A few nearly barren areas occur in this range site. The site makes up about 1 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Western wheatgrass	30
Bluebunch wheatgrass	15
Green needlegrass	10
Prairie sandreed	10
Forbs	10
Woody plants	10
Prairie junegrass	5
Plains reedgrass	5
Sandberg bluegrass	5

Total annual yield on range in excellent condition is about 2,300 pounds air-dry herbage per acre. In less favorable years yield is as little as 800 pounds per acre. Approximately 90 percent of the plants in this site furnish forage for cattle, horses, sheep, deer, and antelope.

Under continuous heavy use bluebunch wheatgrass, green needlegrass, and prairie sandreed decrease in the plant community and are partly replaced by prairie junegrass, plains reedgrass, Sandberg bluegrass, and annuals.

Limited depth and topography make this site unsuitable for mechanical tillage practices and range seeding. Brush management followed by deferred grazing is beneficial where there is an excessive growth of brush and some climax plants are present.

SHALLOW TO GRAVEL SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of soils that are 10 to 20 inches deep over sandy gravel. It is on the steep, dissected edges of gravel terraces and benches. This site makes up about 0.5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Bluebunch wheatgrass	20
Needleandthread	15
Western wheatgrass	15
Blue grama	15
Sandberg bluegrass	10
Sedges	10
Little bluestem	5
Prairie junegrass	5
Woody plants	5

Total annual yield on range in excellent condition is about 2,300 pounds air-dry herbage per acre. In less favorable years yield is as little as 800 pounds per acre. Approximately 90 percent of the plants in this site furnish forage for cattle, horses, sheep, deer, and antelope.

Under continuous heavy use bluebunch wheatgrass, little bluestem, needleandthread, and western wheatgrass decrease in the plant community and are replaced in part by blue grama, prairie junegrass, Sandberg bluegrass, sedges, fringed and green sagewort, and annuals.

This site is not suitable for mechanical treatment or range seeding.

SHALLOW SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of soils that are 10 to 20 inches deep over hard or soft bedrock of decomposed granite, siltstone, or sandstone. Few roots penetrate below a depth of 20 inches. This site makes up about 5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Bluebunch wheatgrass	30
Little bluestem	20
Idaho fescue	15
Western wheatgrass	10
Needleandthread	10
Prairie junegrass	5
Sedges	5
Forbs	5
Sandberg bluegrass	Trace
Woody plants	Trace

Total annual yield on range in excellent condition is about 2,300 pounds air-dry herbage per acre. In less favorable years yield is as little as 800 pounds per acre. Approximately 90 percent of the plants on this site furnish forage for cattle, sheep, horses, deer, and antelope.

Under continuous heavy use bluebunch wheatgrass, little bluestem, and needleandthread decrease in the plant community and are replaced in part by prairie junegrass, Sandberg bluegrass, sedges, and forbs.

PAN SPOTS SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of silty, clayey, or sandy soils in complex with soils in shallow depressions that

have hard clay or other impervious material at or near the surface. The shallow depressions occupy 20 to 50 percent of the site. This site makes up 0.5 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Western wheatgrass	30
Needleandthread	20
Bluebunch wheatgrass	10
Little bluestem	10
Plains reedgrass	5
Blue grama	5
Sandberg bluegrass	5
Squirreltail	5
Saltgrass	5
Forbs	5
Woody plants	Trace

Total annual yield on range in excellent condition is about 2,200 pounds air-dry herbage per acre. In less favorable years yield is as little as 800 pounds per acre. Approximately 90 percent of the plants on this site furnish forage for cattle, horses, sheep, deer, and antelope.

Under continuous heavy use bluebunch wheatgrass, little bluestem, and needleandthread decrease in the plant community and are replaced in part by blue grama, Sandberg bluegrass, squirreltail, saltgrass, and forbs.

Range seeding and mechanical treatments are not suitable for this site unless the climax plants have been destroyed. Brush management followed by deferred grazing is advisable where there is an excessive cover of brush.

THIN BREAKS SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of soils of various depth that have outcrops of hard bedrock at different levels on steep, irregular slopes. Trees grow locally above the outcrops. The soils are loam, silt loam, silty clay loam, and clay loam. Slopes are mostly more than 15 percent. This site makes up about 3 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Bluebunch wheatgrass	25
Idaho fescue	15
Basin wildrye	10
Green needlegrass	10
Needleandthread	10
Prairie sandreed	10
Western wheatgrass	5
Little bluestem	5
Dryland sedges	5
Prairie junegrass	5
Blue grama	Trace
Sandberg bluegrass	Trace

Total annual yield on range in excellent condition is as much as 1,200 pounds air-dry herbage per acre. In less favorable years yield is as little as 400 pounds.

The rough topography has discouraged overuse of this range by grazing animals. Proper grazing use and a system of deferred grazing maintain or improve the range vegetation. Mechanical renovation practices and seeding are not suitable because of the topography.

Under continuous heavy use nearly all the climax grasses decrease in the plant community and are replaced by annuals, red three-awn, broom snakeweed, and sandworts.

Where this site has deteriorated through overuse, it responds only slowly to proper grazing use and a deferred grazing system. It is not suitable for mechanical improvement practices or seeding because it is very shallow and has steep slopes.

SHALE SITE, 15- TO 19-INCH PRECIPITATION ZONE

This range site is made up of shallow, readily puddled soils that have some weathered, angular, raw shale fragments on the surface and areas of shale outcrop. This site makes up about 1 percent of the range in the Area. It is on uplands.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Bluebunch wheatgrass	25
Western wheatgrass	25
Prairie sandreed	10
Alkali sacaton	10
Blue grama	10
Forbs	10
Idaho fescue	5
Green needlegrass	5

Total annual yield on range in excellent condition is about 700 pounds air-dry herbage per acre. In less favorable years yield is as little as 200 pounds per acre. About 75 percent of the plants on this site furnish forage for cattle, sheep, deer, and antelope.

Under continuous heavy use the desirable grass species that provide most of the forage decrease in the plant community and are replaced by blue grama, Sandberg bluegrass, and annuals.

Because the topography is rough, livestock rarely overgraze this site. Mechanical treatments and range seeding are not suitable for this site because of the topography and shallowness.

SANDY SITE, 20- TO 24-INCH PRECIPITATION ZONE

This range site is made up of coarse sandy loam to fine sandy loam more than 20 inches deep. This site makes up about 1 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Forbs	25
Idaho fescue	20
Mountain bromes	15
Bearded wheatgrass	15
Richardson needlegrass	10
Big bluegrass	5
Alpine timothy	5
Letterman needlegrass	5

Total annual yield on range in excellent condition is about 4,000 pounds air-dry herbage per acre. In less favorable years yield is as little as 1,600 pounds per acre. Approximately 90 percent of the plants on this site furnish forage for cattle, horses, sheep, deer, elk, and buffalo.

Under continuous heavy use by cattle such tall grasses as mountain brome, big bluegrass, and bearded wheatgrass decrease in the plant community and are

replaced in part by lupines, cinquefoils, balsamroots, and yarrow.

SILTY SITE, 20- TO 24-INCH PRECIPITATION ZONE

This range site is made up of very fine sandy loam, loam, and silt loam soils that are more than 20 inches deep and some soils that have 2 inches or more of loam or silt loam over a subsoil of clay. These soils have moderate water infiltration rates and are capable of holding most of the normal precipitation. Runoff is heavy in spring when the snow melts. This site makes up about 4 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Mountain brome	20
Richardson needlegrass	15
Forbs	15
Idaho fescue	15
Columbia needlegrass	10
Tufted hairgrass	10
Alpine timothy	5
Prairie junegrass	5
Canby bluegrass	5

Total annual yield on range in excellent condition is as much as 4,000 pounds per acre. In less favorable years yield is as little as 1,600 pounds per acre. Approximately 90 percent of the plants on this site furnish forage for cattle, horses, sheep, deer, elk, and buffalo.

Under continuous heavy use mountain brome, Columbia needlegrass, and tufted hairgrass decrease in the plant community and are partly replaced by big sagebrush, other brushes, and short grasses, such as Canby bluegrass, mat muhly, Idaho fescue, danthonias, and forbs. Forb increasers are lupine, cinquefoil, yarrow, little sunflower, and annuals.

Where the climax vegetation has been destroyed, range seeding improves the range vegetation in a minimum of time. Brush management along with deferred use hasten range improvement where there is an excessive growth of brush species and some climax grasses are present.

SHALLOW SITE, 20- TO 24-INCH PRECIPITATION ZONE

This range site is made up of soils that are 10 to 20 inches deep over hard bedrock or soft decomposed granite, siltstone, or sandstone. Few roots penetrate below a depth of 20 inches. This site makes up about 6 percent of the range in the Area.

The approximate species composition, by air-dry weight, of the climax (potential) plant community is:

Species	*Percent*
Bluebunch wheatgrass	20
Idaho fescue	20
Columbia needlegrass	15
Forbs	15
Woody plants	15
Letterman needlegrass	10
Prairie junegrass	5

Total annual yield on range in excellent condition is about 2,600 pounds air-dry herbage per acre. In less favorable years yield is as little as 1,000 pounds per acre. Approximately 80 percent of the plants in this site furnish forage for cattle, horses, sheep, deer, elk, and buffalo.

Under continuous heavy use the wheatgrass, Columbia needlegrass, mountain brome, and sticky geranium decrease in the plant community and are partly replaced by prairie junegrass, danthonias, Idaho fescue, sagebrush, shrubby cinquefoil, prairie smoke, chickweed, and annuals.

Brush management is feasible in areas of this site that have a heavy growth of big sagebrush or shrubby cinquefoil if some climax grasses are present.

Use of the Soils for Windbreaks

In this section the management of windbreaks is discussed, and the windbreak suitability groups in which soils of the Area have been placed are described.

Tree windbreaks

Tree windbreaks are planted on farms and rangeland to control snow drifting and soil blowing. They are most effective where trees are planted in rows at right angles to the direction of the prevailing wind. In the Big Horn County Area windbreaks are generally required on dryfarmed soils in areas where the annual precipitation is less than 14 inches. They are particularly effective in controlling soil blowing on cultivated sandy soils. In irrigated valleys they are planted mainly around feedlots and for home beautification.

Soil characteristics that affect windbreak suitability are the amount of lime and depth to the zone of concentrated lime, depth to bedrock, the available water capacity, texture, content of coarse fragments, permeabiliy, the degree of wetness, the alkali content and salinity of the soil, and slope.

Windbreaks typically consist of single or multiple-row plantings of shrubs, broadleaf trees, and evergreens. The most common and best suited shrubs are caragana, honeysuckle, lilac, chokecherry, skunkbush sumac, purple willow, and buffaloberry. Broadleaf trees suitable for planting are Russian-olive, Siberian elm, American elm, white willow, golden willow, cottonwood, and green ash. Suitable evergreen trees are ponderosa pine, Colorado blue spruce, Rocky Mountain juniper, and Scotch pine.

For suitability on specific sites, refer to the species listed in the description of each windbreak suitability group.

Site preparation, consisting of 1 year of fallow, should precede the planting. Multiple-row windbreaks should have at least one shrub row on the windward side and an evergreen row on the leeward, or inside. Between-row spacings, depending on the moisture available, range from 14 to 24 feet. In-row spacings are 2 to 4 feet for shrubs, 6 to 8 feet for low trees, and 8 to 12 feet for tall trees. Evergreen spacings are 8 to 10 feet for pine and spruce and 4 to 6 feet for juniper.

Tall wheatgrass barriers

Grass barriers are helpful in controlling erosion on soils that are particularly susceptible to soil blowing. They also help to conserve moisture through snow accumulation, and they increase habitat for upland game

birds. Tall wheatgrass is recommended for this type of grass barrier. Spacings of the grass plantings at 60 foot intervals effectively reduces soil blowing.

Windbreak suitability groups

The soils of the Big Horn County Area are placed in 10 groups according to their suitability for windbreak plantings. In the following paragraphs each windbreak suitability group is described, and the species of trees and shrubs most suitable to the group are listed. Windbreaks planted on any soil within a suitability group require similar management. Soils in windbreak suitability group 4 are not suitable for windbreak plantings. To identify the soils in a windbreak suitability group, refer to the "Guide to Mapping Units" at the back of this survey.

WINDBREAK SUITABILITY GROUP 1

This group consists of soils that have no or only slight soil and soil-related hazards or limitations. Available water capacity is 5 inches or more. Slopes are less than 15 percent.

These soils are well suited to windbreaks. Species suitable for planting on irrigated and dryfarmed soils of this group are caragana, honeysuckle, lilac, chokecherry, skunkbush sumac, buffaloberry, Russian-olive, Siberian elm, American elm, white willow, golden willow, cottonwood, green ash, ponderosa pine, Colorado blue spruce, Rocky Mountain juniper, and Scotch pine. Purple willow is suitable for planting on irrigated sites only.

WINDBREAK SUITABILITY GROUP 2M

This group consists of soils that have available water capacity of 5 inches or more and are either sandy loam or fine sandy loam, are gravelly, are moderately deep or deep over bedrock, or a combination of these. They are well drained. Any layer of lime accumulation is below a depth of 24 inches. Slopes are less than 15 percent.

Trees grow less well on these soils than on those in group 1. Species suitable for planting on irrigated and dryfarmed soils of this group are caragana, honeysuckle, lilac, chokecherry, skunkbush sumac, buffaloberry, Russian-olive, Siberian elm, green ash, ponderosa pine, Colorado blue spruce, Rocky Mountain juniper, and Scotch pine. Purple willow, American elm, white willow, golden willow, and cottonwood are suitable for planting on irrigated sites only.

WINDBREAK SUITABILITY GROUP 2L

This group consists of soils that have a layer of lime accumulation that is more than 15 percent calcium at a depth of 15 to 24 inches. Available water capacity is at least 5 inches. The soils are well drained. Slopes are less than 15 percent.

Species suitable for planting on irrigated and dryfarmed soils of this group are caragana, honeysuckle, lilac, chokeberry, skunkbush sumac, buffaloberry, Russian-olive, Siberian elm, green ash, ponderosa pine, and Rocky Mountain juniper.

WINDBREAK SUITABILITY GROUP 2W

This group consists of soils that have a water table at a depth of 36 to 60 inches. Available water capacity is at least 5 inches. There is no horizon of lime accumulation within 15 inches of the surface. Slopes are less than 15 percent.

Species suitable for planting on irrigated and dryfarmed soils of this group are honeysuckle, lilac, chokecherry, skunkbush sumac, purple willow, buffaloberry, Russian-olive, Siberian elm, white willow, golden willow, cottonwood, green ash, ponderosa pine, Colorado blue spruce, Rocky Mountain juniper, and Scotch pine.

WINDBREAK SUITABILITY GROUP 2S

This group consists of soils that are limited because of salinity. The conductivity of a saturated extract ranges from 4 to 10 millimhos per centimeter at 25° C. Available water capacity is at least 5 inches. Any horizon of lime accumulation is at a depth of more than 15 inches. The water table is more than 36 inches below the surface. Slopes are less than 15 percent.

Species suitable for planting on irrigated and dryfarmed soils of this group are caragana, chokecherry, skunkbush sumac, buffaloberry, Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper.

WINDBREAK SUITABILITY GROUP 3M

This group consists of soils that have available water capacity of 2 to 5 inches because of soil texture, depth, or both. Any horizon of lime accumulation is at a depth of more than 15 inches. These soils are well drained. Slopes are less than 15 percent.

Species suitable for planting on irrigated and dryfarmed soils of this group are caragana, buffaloberry, Russian-olive, Siberian elm, and Rocky Mountain juniper. Honeysuckle, lilac, chokecherry, skunkbush sumac, purple willow, white willow, golden willow, cottonwood, green ash, and Colorado blue spruce are suitable for planting on irrigated sites only.

WINDBREAK SUITABILITY GROUP 3L

This group consists of soils that have a horizon of lime accumulation that is more than 15 percent calcium carbonate at a depth of less than 15 inches. Any permanent water table is at a depth of more than 30 inches. Available water capacity is more than 5 inches. Slopes are less than 15 percent.

Species suitable for planting on irrigated and dryfarmed soils of this group are caragana, honeysuckle, lilac, skunkbush sumac, buffaloberry, Russian-olive, and Siberian elm.

WINDBREAK SUITABILITY GROUP 3W

This group consists of soils that have a water table at a depth of 12 to 36 inches during most of the growing season. Any horizon of lime accumulation is at a depth of more than 15 inches. Available water capacity is 2 inches or more. Slopes are less than 15 percent.

Species suitable for planting on irrigated and dryfarmed soils of this group are purple willow, buffaloberry, Russian-olive, Siberian elm, white willow, golden willow, cottonwood, Colorado blue spruce, and Rocky Mountain juniper.

WINDBREAK SUITABILITY GROUP 3S

This group consists of soils that are limited by salinity or alkalinity. The conductivity of a saturation

extract ranges from 10 to 16 millimhos per centimeter at 25° C., and the content of exchangeable sodium is more than 15 percent. Available water capacity is 5 inches or more. In places there is a horizon of carbonate accumulation at a depth of more than 15 inches. The water table is more than 20 inches below the surface. Slopes are less than 15 percent.

Species suitable for planting on irrigated and dry-farmed soils of this group are caragana, lilac, skunkbush sumac, buffaloberry, Russian-olive, and Siberian elm. Cottonwood is suitable for planting on irrigated sites only.

WINDBREAK SUITABILITY GROUP 4

This group consists of soils that have slopes of more than 15 percent or soils that have lesser slopes and one or more very severe soil limitations. Among these limitations are available water capacity of less than 2 inches in soils that are shallow or very shallow and that in places are stony or gravelly; texture of dense fine clay; soils that are strongly saline and alkali; and presence of Rock outcrop.

Use of the Soils for Woodland

Natural woodlands cover 252,500 acres of the Big Horn County Area. Of this, 212,500 acres is softwoods, and 40,000 acres is hardwoods, including brushy flood plains of rivers.

The softwoods consist of ponderosa pine, lodgepole pine, Douglas-fir, Rocky Mountain juniper, limber pine, Engelmann spruce, and subalpine fir. The species of commercial importance are Douglas-fir, ponderosa pine, lodgepole pine, and Rocky Mountain juniper.

The hardwoods consist of cottonwood, box elder, aspen, willow, and ash. They grow mainly in the valleys of the Little Big Horn and Big Horn Rivers. Small groves of quaking aspen are scattered on the mountains at elevations of less than 6,000 feet. Sawlog volume is low in all the stands.

In the Pryor Mountains is about 30,200 acres of softwoods, and the trees on 9,853 acres are of commercial quality. The species are lodgepole pine, ponderosa pine, Douglas-fir, and limber pine. Sawlog volume on the commercial-quality areas is relatively low, averaging only 2,440 board feet per acre. Most of the trees are less than 12 inches in diameter at breast height. The entire area is under the control of the Crow Indian Tribe.

The Big Horn Mountains have about 50,600 acres of forest land consisting mainly of Engelmann spruce, Douglas-fir, and lodgepole pine. The Garvin Basin on the west slopes of the mountains has scattered stands of Rocky Mountain juniper and Utah juniper. All of the land is owned by the Crow Indian Tribe. Although there is timber of commercial quality, the area is considered a prime recreation and big-game area, and no logging is permitted.

The Wolf Mountains contain about 25,000 acres of ponderosa pine, all of commercial quality. Of this acreage, about 14,500 acres is owned by the Crow Indian Tribe. Average volume is 3,296 board feet per acre.

The Pine Ridge area northwest of Hardin contains about 26,000 acres of privately owned ponderosa pine forest. The trees on about 25,000 acres are of commercial quality. Average volume is about 2,900 board feet per acre. The dominant trees are 10 to 12 inches in diameter at breast height.

Fire protection is considered to be adequate and effective on all the Indian land except in the deep, steep-walled canyons of the Pryor and Big Horn Mountains. The privately owned forest lands have no organized fire protection and control. They rely on county fire-fighting equipment for fire control.

At the present time no sawmills operate in the Area. Timber sales are held yearly in the Pryor and Wolf Mountains, and the logs are trucked to mills outside the Area. Studs, dimension lumber, house logs, fence posts, and corral posts are the main uses for the harvested timber. In the past a few Christmas trees have been harvested in the Pryor Mountains.

Information about woodland management for each forested soil series is contained in the mapping unit descriptions in the section "Descriptions of the Soils." Site index, principal species, timber harvest limitations, and other management information are given. A list of the forested mapping units is in the "Guide to Mapping Units."

Use of the Soils for Recreation

The natural resources in the Big Horn County Area provide high potential for recreational development. The Big Horn Canyon Recreational Area, Big Horn Lake, the Wolf and Rosebud Mountains, the Tongue River, Lodgegrass Creek Reservoir, the Pryor and Big Horn Mountains, Custer Battlefield National Monument, and the Little Big Horn and Big Horn Rivers are among the many places that attract local and out-of-State visitors. Camping, picnicking, sightseeing, riding, hiking, and lodging facilities are needed in these places. The concentration of a large number of people in recreational areas subjects soils to stresses and produces limitations in soil management different from those that affect farm and engineering uses.

In table 3 the soils in the Big Horn County Area are rated for selected recreational uses. These are playgrounds, camp areas, picnic areas, and paths and trails. The ratings are given in terms of degree of limitation, which are slight, moderate, or severe. A rating of *slight* means the soils have few, if any, limitations for use that cannot be readily overcome. A rating of *moderate* indicates limitations that need to be recognized but can be overcome with good management or special design. A *severe* rating indicates the limitations are severe enough to make use questionable. A severe rating does not mean the soil cannot be used as intended, but it does mean that careful planning and design and very good management are needed. In some cases intense alterations are needed but may not be economically feasible.

For information about road construction, foundations for cottage and utility buildings, and septic tank filter fields, see table 5 in the section "Engineering Uses of the Soils."

TABLE 3.—*Limitations of the soils for selected recreational uses*

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Abac loam, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Abac loam, hilly	Severe: slopes are 15 to 40 percent.	Severe: slopes are 15 to 40 percent.	Severe: slopes are 15 to 40 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Abac-Bitton complex, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate: slopes are 15 to 35 percent.
Abac-Rock outcrop complex, very steep	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.
Absarokee silty clay loam, gently undulating	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Absarokee silty clay loam, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Absarokee silty clay loam, rolling	Severe: slopes are 8 to 15 percent.	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Absarokee silty clay loam, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Absarokee-Castner complex, undulating	Moderate: slopes are 2 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Absarokee-Castner complex, hilly	Severe: slopes are 8 to 30 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 30 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 30 percent.	Slight where slopes are 8 to 15 percent. Moderate where slopes are 15 to 30 percent.
Absarokee-Armington association, gently sloping	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Absher-Nobe clays	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Adel-Mayflower association, sloping	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Adger clay, 0 to 8 percent slopes	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Alice fine sandy loam, 4 to 15 percent slopes	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Allentine clay, 0 to 2 percent slopes	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Allentine clay, 2 to 4 percent slopes	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Allentine-Bone complex, 0 to 1 percent slopes	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Allentine-Bone complex, 1 to 4 percent slopes	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Alluvial land, gravelly	Severe: flooding; coarse fragments on surface.	Severe: flooding; coarse fragments on surface.	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.
Alluvial land, cobbly	Severe: flooding; coarse fragments on surface.	Severe: flooding; coarse fragments on surface.	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.
Alluvial land, wet	Severe: water table; flooding.	Moderate: water table	Moderate: water table	Moderate: water table.

TABLE 3.—*Limitations of the soils for selected recreational uses*—Continued

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Amherst loam, undulating	Severe: bedrock at a depth of less than 20 inches.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Amherst loam, rolling	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Amherst complex, rolling	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Amherst complex, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes 15 to 25 percent. Severe where slopes are more than 25 percent.
Amherst-Maginnis complex, hilly	Severe: coarse fragments; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Armington silty clay loam	Severe: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Armington complex, rolling	Severe: slopes are 8 to 15 percent; silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: clay surface layer.
Arnegard loam, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Arnegard silt loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Slight	Slight	Slight.
Arnegard silt loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Arvada silty clay loam	Severe: very slow permeability.	Severe: very slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Arvada-Bone clays	Severe: very slow permeability.	Severe: very slow permeability.	Severe: clay surface layer.	Severe: clay surface layer.
Ascalon sandy loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Babb silt loam, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Babb silt loam, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Beauvais silty clay loam, gently undulating	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Beauvais silty clay loam, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Beauvais silty clay loam, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Beauvais-Gilt Edge silty clay loams, gently undulating	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Belfield silt loam, 0 to 1 percent slopes	Moderate: moderately slow permeability.	Moderate: moderately slow permeability.	Slight	Slight.
Belfield silt loam, gently undulating	Moderate: moderately slow permeability.	Moderate: moderately slow permeability.	Slight	Slight.
Belfield silt loam, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: moderately slow permeability.	Slight	Slight.

TABLE 3.—*Limitations of the soils for selected recreational uses*—Continued

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Belfield-Adger complex, 0 to 1 percent slopes	Moderate: moderately slow or slow permeability.	Moderate: moderately slow or slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Belfield-Adger complex, gently undulating	Moderate: moderately slow or slow permeability.	Moderate: moderately slow or slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Belfield-Adger complex, undulating	Moderate: moderately slow or slow permeability.	Moderate: moderately slow or slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Benteen loam, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Benteen loam, hilly	Severe: slopes are 15 to 45 percent.	Severe: slopes are 15 to 45 percent.	Severe: slopes are 15 to 45 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are 25 to 45 percent.
Bew silty clay loam, 0 to 1 percent slopes	Moderate: slow permeability.	Moderate: slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Bew silty clay loam, gently undulating	Moderate: slow permeability.	Moderate: slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Bitton gravelly loam, 2 to 8 percent slopes	Moderate: slopes are 2 to 8 percent.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.
Bitton soils, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Bone clay	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Castner-Reeder loams, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Castner-Reeder loams, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent:	Moderate: slopes are 8 to 15 percent.	Slight.
Castner-Rock outcrop complex, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: coarse fragments on surface.
Castner-Vebar sandy loams, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Cherry silty clay loam, 2 to 8 percent slopes	Moderate: slopes are 2 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Chugter loam, 2 to 8 percent slopes	Moderate: slopes are 2 to 8 percent.	Slight	Slight	Slight.
Chugter complex, 2 to 15 percent slopes	Moderate where slopes are 2 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 2 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 2 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Clapper-Harvey complex, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Clapper-Midway complex, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Colby silt loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Colby silt loam, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Colby silty clay loam, 1 to 4 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.

TABLE 3.—*Limitations of the soils for selected recreational uses*—Continued

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Colby silty clay loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Colby silty clay loam, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Colby-Beauvais silt loams, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Colby-Beauvais silt loams, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Colby-Clapper silt loams, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Colby-Keiser silty clay loams, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Colby-Midway complex, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Colby association, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Colby association, hilly	Severe: slopes are 15 to 35 percent; coarse fragments on surface.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Cushman loam, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Danvers silty clay loam, 0 to 1 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Danvers silty clay loam, gently undulating	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Danvers silty clay loam, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Danvers cobbly silty clay loam, 1 to 4 percent slopes	Severe: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.
Danvers-Judith silty clay loams, gently undulating	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Danvers-Judith silty clay loams, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Danvers-Judith silty clay loams, hilly	Severe: slopes are 8 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Moderate: silty clay loam surface layer.
Dast sandy loam, rolling	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Dast sandy loam, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Dast complex, hilly	Severe: slopes are 25 to 50 percent.	Severe: slopes are 25 to 50 percent.	Severe: slopes are 25 to 50 percent.	Severe: slopes are 25 to 50 percent.
Dast complex, very steep	Severe: slopes are 15 to 90 percent.	Severe: slopes are 15 to 90 percent.	Severe: slopes are 15 to 90 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are 25 to 90 percent.
Dast-Parshall sandy loams, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Doney loam, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.

TABLE 3.—*Limitations of the soils for selected recreational uses*—Continued

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Doney silty clay loam, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Doney-Reeder loams, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Doney-Ringling complex, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Doney-Ringling complex, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Doney-Ringling complex, very steep	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.
Doney-Rock outcrop complex, very steep	Severe: slopes are more than 30 percent.	Severe: slopes are more than 30 percent.	Severe: slopes are more than 30 percent.	Severe: slopes are more than 30 percent.
Doney-Wayden complex, hilly	Severe: slopes are 8 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Slight where slopes are 8 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Duncom extremely channery loam, rolling	Severe: slopes are 8 to 15 percent; coarse fragments on surface.	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.
Duncom complex, rolling	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: coarse fragments on surface.
Duncom-Tarrete association, rolling	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: coarse fragments on surface.
Duncom-Tarrete association, hilly	Severe: slopes are 15 to 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Eltsac clay, undulating	Severe: clay surface layer.	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer.	Severe: clay surface layer.
Eltsac clay, rolling	Severe: slopes are 8 to 15 percent.	Severe: very slow permeability; clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Eltsac cobbly clay, hilly	Severe: slopes are 15 to 35 percent; coarse fragments on surface.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: clay surface layer.
Farnuf loam, 0 to 2 percent slopes	Slight	Slight	Slight	Slight.
Farnuf loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Slight	Slight	Slight.
Farnuf loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Farnuf-Doney association, sloping	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Fergus silt loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Slight	Slight	Slight.
Fergus silt loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.

TABLE 3.—*Limitations of the soils for selected recreational uses*—Continued

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Fergus silt loam, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Fort Collins loam, 0 to 2 percent slopes	Slight	Slight	Slight	Slight.
Fort Collins loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Slight	Slight	Slight.
Fort Collins loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Fort Collins loam, channeled, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Frazer silty clay loam	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Frazer silty clay loam, saline	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Frazer silty clay	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Frazer and Korchea soils, channeled	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Gilt Edge silty clay loam, 0 to 2 percent slopes	Moderate: slow permeability; silty clay loam surface layer.	Moderate: slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Gilt Edge silty clay loam, 2 to 4 percent slopes	Moderate: slow permeability; silty clay loam surface layer.	Moderate: slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Gilt Edge-Bone complex, 0 to 1 percent slopes	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Gilt Edge-Bone complex, 1 to 4 percent slopes	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Glenberg fine sandy loam, 0 to 2 percent slopes	Slight	Slight	Slight	Slight.
Glenberg fine sandy loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Slight	Slight	Slight.
Glenberg fine sandy loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Glenberg loam, 0 to 2 percent slopes	Slight	Slight	Slight	Slight.
Grail clay loam, 0 to 2 percent slopes	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.
Grail clay loam, 2 to 8 percent slopes	Moderate: slopes are 2 to 8 percent.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.
Grail clay loam, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: clay loam surface layer.
Grail clay loam, 15 to 35 percent slopes	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Grail silty clay, 0 to 2 percent slopes	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Hanson extremely stony loam, rolling	Severe: slopes are 8 to 15 percent; coarse fragments on surface.	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.

TABLE 3.—*Limitations of the soils for selected recreational uses*—Continued

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Hanson-Babb association, very steep	Severe: slopes are 35 to 70 percent.	Severe: slopes are 35 to 70 percent.	Severe: slopes are 35 to 70 percent.	Severe: slopes are 35 to 70 percent.
Harvey loam, gently undulating	Moderate: slopes are 2 to 4 percent.	Slight	Slight	Slight.
Harvey loam, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Harvey loam, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Harvey gravelly loam, undulating	Moderate: slopes are 2 to 8 percent.	Slight	Slight	Slight.
Harvey complex, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Haverson loam, 0 to 2 percent slopes	Slight	Slight	Slight	Slight.
Haverson loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Slight	Slight	Slight.
Haverson loam, saline	Slight	Slight	Slight	Slight.
Haverson silty clay loam	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Haverson silty clay	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Haverson silty clay, thick surface	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Haverson-Hysham silty clay loams	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Haverson and Glenberg soils	Moderate: flooding hazard.	Moderate: flooding hazard.	Slight	Slight.
Haverson and Lohmiller soils, channeled	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Haverson and Lohmiller soils, frequently flooded	Severe: flooding	Severe: flooding	Moderate: flooding	Moderate: flooding.
Haverson and Lohmiller soils, wet	Severe: water table above a depth of 20 inches.	Severe: water table above a depth of 20 inches.	Severe: water table above a depth of 20 inches.	Severe: water table above a depth of 20 inches.
Haverson soils, saline	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Heldt silty clay loam, 0 to 2 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Heldt silty clay loam, 2 to 4 percent slopes	Moderate: silty clay loam surface layer; slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Heldt silty clay loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Heldt silty clay loam, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Heldt silty clay, 0 to 2 percent slopes	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Heldt-Hysham silty clay loams, 0 to 2 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.

TABLE 3.—*Limitations of the soils for selected recreational uses*—Continued

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Heldt-Hysham silty clay loams, 2 to 4 percent slopes	Moderate: silty clay loam surface layer; slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Hester silty clay loam, 0 to 1 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Hester silty clay loam, 1 to 4 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Hester silty clay loam, 4 to 8 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Hydro loam, 0 to 8 percent slopes	Moderate: slow permeability.	Moderate: slow permeability.	Slight	Slight.
Hydro silt loam, 0 to 2 percent slopes	Moderate: slow permeability.	Moderate: slow permeability.	Slight	Slight.
Hydro silt loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent; slow permeability.	Moderate: slow permeability.	Slight	Slight.
Hydro silt loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: slow permeability.	Slight	Slight.
Hydro silty clay loam, 0 to 2 percent slopes	Moderate: slow permeability.	Moderate: slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Hydro silty clay loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent; slow permeability.	Moderate: slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Hydro-Allentine complex, 1 to 4 percent slopes	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Hydro-Allentine complex, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent; clay loam surface layer.	Moderate: slow permeability.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.
Hydro-Gilt Edge complex, 0 to 1 percent slopes	Moderate: slow permeability.	Moderate: slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Hysham loam, 0 to 2 percent slopes	Moderate: slow permeability.	Moderate: slow permeability.	Slight	Slight.
Hysham silty clay loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent; silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Hysham silty clay loam, channeled, 0 to 4 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Hysham-Midway silty clay loams, 4 to 15 percent slopes	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer; slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Hysham and Lohmiller silty clay loams, 0 to 8 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Judith clay loam, 0 to 2 percent slopes	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.
Judith clay loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.
Judith clay loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.

TABLE 3.—*Limitations of the soils for selected recreational uses*—Continued

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Judith-Windham complex, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: coarse fragments; clay loam surface layer.	Moderate: coarse fragments; clay loam surface layer.	Moderate: clay loam surface layer.
Judith-Windham complex, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: coarse fragments.
Keiser silty clay loam, 0 to 2 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Keiser silty clay loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Keiser silty clay loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Keiser-Colby complex, gently undulating	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Kim loam, 4 to 15 percent slopes	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Korchea loam, 0 to 2 percent slopes	Slight	Slight	Slight	Slight.
Korchea loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Slight	Slight	Slight.
Korchea silt loam, 0 to 2 percent slopes	Slight	Slight	Slight	Slight.
Korchea silt loam, frequently flooded	Moderate: flooding hazard.	Severe: flooding hazard	Moderate: flooding hazard.	Slight.
Korchea silty clay loam, 0 to 2 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Korchea silty clay loam, 2 to 4 percent slopes	Moderate: silty clay loam surface layer; slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Korchea and Frazer soils, water table	Severe: water table above a depth of 20 inches.	Severe: water table above a depth of 20 inches.	Severe: water table above a depth of 20 inches.	Severe: water table above a depth of 20 inches.
Kyle silty clay, 0 to 2 percent slopes	Severe: silty clay surface layer; very slow permeability.	Severe: silty clay surface layer; very slow permeability.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Kyle silty clay, 2 to 4 percent slopes	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Kyle silty clay, 4 to 8 percent slopes	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Kyle gravelly silty clay, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Kyle clay, saline	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
La Fonda loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Slight	Slight	Slight.
Lap-Trulon complex, rolling	Severe: bedrock at a depth of less than 20 inches.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.
Lap association, undulating	Severe: bedrock at a depth of less than 20 inches.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.

TABLE 3.—*Limitations of the soils for selected recreational uses*—Continued

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Lap association, rolling	Severe: slopes are 8 to 20 percent; bedrock at a depth of less than 20 inches.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Moderate: coarse fragments on surface.
Lap-Armington association, rolling	Severe: slopes are 8 to 35 percent; bedrock at a depth of less than 20 inches.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Slight where slopes are 8 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Lavina-Travessilla loams, undulating	Severe: bedrock at a depth of less than 20 inches.	Slight	Slight	Slight.
Lennep loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent; slow permeability.	Moderate: slow permeability.	Slight	Slight.
Lennep loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: slow permeability.	Slight	Slight.
Lennep-Adger complex, gently undulating	Moderate: slow permeability.	Moderate: slow permeability.	Slight	Slight.
Lennep-Adger complex, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: slow permeability.	Slight	Slight.
Lismas clay, undulating	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Lismas gravelly clay, rolling	Severe: slopes are 8 to 15 percent.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Lismas gravelly clay, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: clay surface layer.
Lismas-Shale outcrop complex, rolling	Severe: slopes are 8 to 20 percent.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Lismas-Shale outcrop complex, steep	Severe: slopes are 20 to 75 percent.	Severe: slopes are 20 to 75 percent.	Severe: slopes are 20 to 75 percent.	Severe: clay surface layer.
Lismas-Vananda clays, undulating	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Lohmiller silty clay loam, 0 to 2 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Lohmiller silty clay loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Lohmiller silty clay loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Lohmiller silty clay loam, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Lohmiller silty clay, saline, 0 to 2 percent slopes	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Lohmiller silty clay, saline, 2 to 4 percent slopes	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Lohmiller-Midway silty clay loams, undulating	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Macar loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.

TABLE 3.—*Limitations of the soils for selected recreational uses*—Continued

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Maginnis-Shale outcrop complex, very steep	Severe: slopes are more than 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.
Maginnis-Windham complex, hilly	Severe: slopes are more than 15 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are more than 15 percent.	Severe: slopes are more than 15 percent.	Severe: silty clay surface layer; coarse fragments on surface.
Marias clay, 0 to 2 percent slopes	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Marias clay, 2 to 4 percent slopes	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Marias clay, 4 to 8 percent slopes	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Marias clay, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Maschetah complex, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Maschetah-Norbert complex, hilly	Severe: slopes are 15 to 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Mayflower silt loam, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Mayflower association, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
McKenzie clay	Severe: flooding hazard; poorly drained.	Severe: very slow permeability.	Severe: poorly drained.	Severe: poorly drained.
McRae loam, 0 to 1 percent slopes	Slight	Slight	Slight	Slight.
McRae loam, 1 to 4 percent slopes	Slight where slopes are 1 to 2 percent. Moderate where slopes are 2 to 4 percent.	Slight	Slight	Slight.
McRae loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
McRae silty clay loam, 0 to 1 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Midway silty clay loam, undulating	Severe: bedrock at a depth of less than 20 inches.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Midway silty clay loam, rolling	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Midway silty clay loam, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Midway-Lismas complex, rolling	Severe: slopes are 8 to 15 percent.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Midway-Lismas complex, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: clay surface layer.

TABLE 3.—*Limitations of the soils for selected recreational uses*—Continued

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Midway-Thedalund complex, rolling	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: clay loam surface layer.
Midway-Thedalund complex, hilly	Severe: slopes are 8 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Slight where slopes are 8 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Midway-Thurlow association, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Morton silt loam, undulating	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight	Slight	Slight.
Nelson fine sandy loam, undulating	Moderate where slopes are 2 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 2 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 2 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Nelson-Alice fine sandy loams, rolling	Severe: slopes are 8 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Slight.
Nelson-Glenberg sandy loams, undulating	Severe: slopes are 8 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Slight.
Neville loam, rolling	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Norbert-Eltsac clays, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: clay surface layer.
Norbert-Shale outcrop complex, steep	Severe: slopes are 15 to 75 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 75 percent.	Severe: slopes are 15 to 75 percent.	Severe: clay surface layer.
Nunn silty clay loam, 0 to 1 percent slopes	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Nunn silty clay loam, 1 to 4 percent slopes	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Nunn silty clay loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.
Nunn silty clay loam, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Nunn-Midway silty clay loams, 4 to 15 percent slopes	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Olney fine sandy loam, 4 to 12 percent slopes	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 12 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 12 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 12 percent.	Slight.

TABLE 3.—*Limitations of the soils for selected recreational uses*—Continued

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Parshall fine sandy loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Peritsa silt loam, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Peritsa-Abac loams, rolling	Severe: slopes are 8 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Slight.
Peritsa complex, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Pierre clay, undulating	Severe: clay surface layer.	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer.	Severe: clay surface layer.
Pierre clay, rolling	Severe: slopes are 8 to 15 percent.	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer.	Severe: clay surface layer.
Pierre-Kyle clays, gently undulating	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer.	Severe: clay surface layer.
Pierre-Lismas clays, rolling	Severe: slopes are 8 to 15 percent.	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer.	Severe: clay surface layer.
Pierre-Lismas clays, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: clay surface layer.
Pultney-Neville association, undulating	Moderate: slopes are 2 to 8 percent.	Slight	Slight	Slight.
Quietus loam	Severe: slopes are 15 to 45 percent.	Severe: slopes are 15 to 45 percent.	Severe: slopes are 15 to 45 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are are 25 to 45 percent.
Raynesford loam, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Reeder loam, gently undulating	Moderate: slopes are 2 to 4 percent; bedrock at a depth of less than 20 to 40 inches.	Slight	Slight	Slight.
Reeder loam, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Reeder loam, hilly	Severe: slopes are 15 to 25 percent.	Severe: slopes are 15 to 25 percent.	Severe: slopes are 15 to 25 percent.	Moderate: slopes are 15 to 25 percent.
Reeder-Regent complex, rolling	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Reeder-Rentsac complex, undulating	Severe: bedrock at a depth of less than 20 inches.	Slight	Slight	Slight.
Reeder-Darret association, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Reeder-Darret association, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Regent silty clay loam, gently undulating	Moderate: slopes are 2 to 4 percent.	Moderate: slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Regent silty clay loam, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.

TABLE 3.—*Limitations of the soils for selected recreational uses*—Continued

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Regent silty clay loam, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Renohill silty clay loam, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Rentsac-Doney complex, rolling	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Richfield silty clay loam, 0 to 2 percent slopes	Moderate: silty clay loam surface layer; moderately slow permeability.	Moderate: silty clay loam surface layer; moderately slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Richfield silty clay loam, gently undulating	Moderate: slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer; moderately slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Richfield silty clay loam, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer; moderately slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Richfield-Beauvais silty clay loams, gently undulating	Moderate: silty clay loam surface layer; slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer; moderately slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Richfield-Beauvais silty clay loams, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer; moderately slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Riverwash	Severe: flooding hazard.	Severe: flooding hazard.	Severe: flooding hazard.	Severe: flooding hazard.
Rock outcrop-Duncom complex, very steep	Severe: slopes are more than 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.
Rock outcrop-Lap complex, very steep	Severe: slopes are more than 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.
Rock outcrop-Pultney complex, very steep	Severe: slopes are more than 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.
Rock outcrop-Rentsac complex, rolling	Severe: bedrock at a depth of less than 20 inches.	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.
Rock outcrop-Windham complex, very steep	Severe: slopes are more than 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.
Rottulee silt loam, gently undulating	Moderate: slopes are 2 to 4 percent; dusty when dry.	Slight	Slight	Slight.
Rottulee silt loam, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Rottulee silt loam, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.

TABLE 3.—*Limitations of the soils for selected recreational uses*—Continued

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Rottulee-Abac complex, rolling	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Ryorp sandy loam, undulating	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Saline land	Severe: mostly clay surface layer.	Severe: mostly clay surface layer.	Severe: mostly clay surface layer.	Severe: mostly clay surface layer.
Savage silty clay loam, 0 to 2 percent slopes	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Savage silty clay loam, 2 to 4 percent slopes	Moderate: silty clay loam surface layer; slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Savage silty clay loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent; silty clay loam surface layer.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Savage silty clay loam, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Savage silty clay loam, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Savage-Wayden silty clay loams, 4 to 15 percent slopes	Severe: bedrock at a depth of less than 20 inches.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Savage and Frazer soils, 0 to 4 percent slopes	Severe: flooding hazard	Severe: flooding hazard	Moderate: flooding hazard; silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Searing loam, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Searing loam, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Searing-Ringling complex, rolling	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Shaak clay loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: clay loam surface layer; slow permeability.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.
Shaak silty clay loam, 0 to 2 percent slopes	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Shaak silty clay loam, gently undulating	Moderate: silty clay loam surface layer; slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer; slow permeability.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Shaak silty clay loam, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Shaak silty clay loam, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Shaak complex, 4 to 15 percent slopes	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.	Moderate: clay loam surface layer.

TABLE 3.—*Limitations of the soils for selected recreational uses*—Continued

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Shale outcrop	Severe: bedrock at surface.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.	Severe: slopes are more than 35 percent.
Shale outcrop-Midway complex, steep	Severe: slopes are 25 to 90 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 25 to 90 percent.	Severe: slopes are 15 to 90 percent.	Severe: slopes are 25 to 90 percent.
Shale outcrop-Norbert complex, hilly	Severe: slopes are 15 to 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 25 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Shonkin clay loam	Severe: water table above a depth of 20 inches.	Severe: water table above a depth of 20 inches.	Moderate: water table above a depth of 20 inches.	Moderate: water table above a depth of 20 inches.
Sofia silty clay, 0 to 2 percent slopes	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Sofia silty clay, gently undulating	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.	Severe: silty clay surface layer.
Spearfish-Clapper complex, hilly	Severe: slopes are 15 to 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Spearfish-Rock outcrop complex, very steep	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.
Spearfish-Pultney association, rolling	Severe: slopes are 8 to 25 percent; bedrock at a depth of less than 20 inches.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 25 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 25 percent.	Slight where slopes are 8 to 15 percent. Moderate where slopes are 15 to 25 percent.
Spearfish-Pultney association, hilly	Severe: slopes are 15 to 50 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 50 percent.	Severe: slopes are 15 to 50 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Spearman loam, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Spearman-Wibaux complex, rolling	Severe: bedrock at a depth of less than 20 inches.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Splitro-Sawcreek sandy loams, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Splitro-Sawcreek sandy loams, hilly	Severe: slopes are 15 to 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Stormitt extremely stony loam, hilly	Severe: slopes are 8 to 35 percent; coarse fragments on surface.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate: coarse fragments on surface.
Stormitt complex, 0 to 4 percent slopes	Severe: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.
Stormitt complex, 4 to 15 percent slopes	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Talag clay, 0 to 8 percent slopes	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.
Talag-Allentine complex, 0 to 4 percent slopes	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.	Severe: clay surface layer.

TABLE 3.—*Limitations of the soils for selected recreational uses*—Continued

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Tarrete silty clay loam, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Terrace escarpments, gravelly	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.	Severe: coarse fragments on surface.
Terrace escarpments, loamy	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Terry fine sandy loam, undulating	Moderate: slopes are 2 to 8 percent.	Slight	Slight	Slight.
Terry-Travessilla sandy loams, undulating	Severe: bedrock at a depth of less than 20 inches.	Slight	Slight	Slight.
Teton loam, 8 to 25 percent slopes	Severe: slopes are 8 to 25 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Slight where slopes are 8 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Teton complex, 25 to 45 percent slopes	Severe: slopes are 25 to 45 percent.	Severe: slopes are 25 to 45 percent.	Severe: slopes are 25 to 45 percent.	Severe: slopes are 25 to 45 percent.
Thedalund loam, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Thedalund-Clapper complex, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Thedalund-Cushman loams, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Thedalund-Fort Collins complex, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Thedalund-McRae loams, dissected	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 35 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Slight where slopes are 4 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Thedalund-Midway complex, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Thedalund-Nelson complex, rolling	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight.
Thedalund-Rock outcrop complex, hilly	Severe: slopes are 15 to 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Thedalund-Rock outcrop complex, very steep	Severe: slopes are 35 to 90 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.
Thedalund-Travessilla loams, rolling	Severe: bedrock at a depth of less than 20 inches.	Slight	Slight	Slight.
Thedalund-Wibaux loams, undulating	Severe: bedrock at a depth of less than 20 inches.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.

TABLE 3.—*Limitations of the soils for selected recreational uses*—Continued

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Thedalund-Wibaux complex, rolling	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: coarse fragments on surface.
Thedalund-Wibaux stony loams, hilly	Severe: slopes are 25 to 40 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 25 to 40 percent.	Severe: slopes are 25 to 40 percent.	Severe: slopes are 25 to 40 percent.
Thedalund-Wibaux complex, very steep	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.	Severe: slopes are 35 to 90 percent.
Thurlow silty clay loam, 0 to 1 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Thurlow silty clay loam, 1 to 4 percent slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Thurlow silty clay loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Thurlow-Midway silty clay loams, 4 to 15 percent slopes	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Toluca-Harvey complex, undulating	Moderate: slopes are 2 to 8 percent.	Slight	Slight	Slight.
Travessilla-Rock outcrop complex, rolling	Severe: bedrock at a depth of less than 20 inches.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.
Travessilla-Thedalund loams, rolling	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Tullock loamy fine sand, rolling	Moderate where slopes are 4 to 8 percent. Severe where slopes are 8 to 15 percent.	Moderate: loamy fine sand surface layer.	Moderate: loamy fine sand surface layer.	Moderate: loamy fine sand surface layer.
Twin Creek loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Slight	Slight	Slight.
Twin Creek loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Twin Creek loam, 8 to 15 percent slopes	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.
Twin Creek-Korchea complex, 2 to 8 percent slopes	Moderate: slopes are 2 to 8 percent.	Slight	Slight	Slight.
Vananda clay, 0 to 1 percent slopes	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer.	Severe: clay surface layer.
Vananda clay, 1 to 8 percent slopes	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer; very slow permeability.	Severe: clay surface layer.	Severe: clay surface layer.
Vebar fine sandy loam, undulating	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Vebar fine sandy loam, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Slight.

TABLE 3.—*Limitations of the soils for selected recreational uses*—Continued

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Vebar-Castner complex, undulating	Severe: bedrock at a depth of less than 20 inches.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.	Moderate: coarse fragments on surface.
Vebar-Castner complex, rolling	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: coarse fragments on surface.
Vebar complex, rolling	Severe: slopes are 8 to 25 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 25 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 25 percent.	Slight where slopes are 8 to 15 percent. Moderate where slopes are 15 to 25 percent.
Wages loam, 0 to 2 percent slopes	Slight	Slight	Slight	Slight.
Wages loam, 2 to 4 percent slopes	Moderate: slopes are 2 to 4 percent.	Slight	Slight	Slight.
Wages loam, 4 to 8 percent slopes	Moderate: slopes are 4 to 8 percent.	Slight	Slight	Slight.
Wayden silty clay loam, rolling	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Wayden silty clay loam, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes of 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Wayden-Arnegard complex, hilly	Severe: slopes are 15 to 75 percent.	Severe: slopes are 15 to 75 percent.	Severe: slopes are 15 to 75 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are 25 to 75 percent.
Wayden-Grail complex, hilly	Severe: slopes are 8 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate: silty clay loam surface layer. Severe where slopes are more than 25 percent.
Wayden-Judith silty clay loams, hilly	Severe: slopes are 8 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 35 percent.	Moderate: silty clay loam surface layer. Severe where slopes are more than 25 percent.
Wayden-Regent silty clay loams, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate: silty clay loam surface layer. Severe where slopes are more than 25 percent.
Wayden-Savage silty clay loams, rolling	Severe: slopes are 8 to 20 percent; bedrock at a depth of less than 20 inches.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 20 percent.	Moderate: silty clay loam surface layer.
Wayden-Rock outcrop complex, rolling	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Wayden-Rock outcrop complex, hilly	Severe: slopes are 15 to 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Wayden-Shale outcrop complex, very steep	Severe: slopes are 25 to 90 percent.	Severe: slopes are 25 to 90 percent.	Severe: slopes are 25 to 90 percent.	Severe: slopes are 25 to 90 percent.
Wayden complex, hilly	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.

TABLE 3.—*Limitations of the soils for selected recreational uses*—Continued

Soil	Playgrounds	Camp areas	Picnic areas	Paths and trails
Wibaux loam, hilly	Severe: slopes are 15 to 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Wibaux-Spearman complex, rolling	Severe: slopes are 8 to 15 percent; bedrock at a depth of less than 20 inches.	Moderate: slopes are 8 to 15 percent; coarse fragments on surface.	Moderate: slopes are 8 to 15 percent; coarse fragments on surface.	Moderate: coarse fragments on surface.
Windham cobbly loam, 15 to 35 percent slopes	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Windham complex, 15 to 35 percent slopes	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Windham-Arnegard complex, 15 to 35 percent slopes	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Windham-Norbert complex, 15 to 50 percent slopes	Severe: slopes are 15 to 50 percent.	Severe: slopes are 15 to 50 percent.	Severe: slopes are 15 to 50 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are 25 to 50 percent.
Windham-Wayden complex, 15 to 35 percent slopes	Severe: slopes are 15 to 35 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 35 percent.	Severe: slopes are 15 to 35 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are 25 to 35 percent.
Windham-Lap association, very steep	Severe: slopes are 15 to 75 percent; bedrock at a depth of less than 20 inches.	Severe: slopes are 15 to 75 percent.	Severe: slopes are 15 to 75 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are 25 to 75 percent.
Winnett complex, undulating	Severe: very slow permeability.	Severe: very slow permeability.	Severe: clay surface layer.	Severe: clay surface layer.
Xavier silty clay loam, gently undulating	Moderate: slopes are 2 to 4 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Xavier silty clay loam, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Xavier silty clay loam, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.
Xavier-Shaak complex, undulating	Moderate: slopes are 4 to 8 percent.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.
Xavier-Shaak complex, rolling	Severe: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: slopes are 8 to 15 percent.	Moderate: silty clay loam surface layer.

Use of the Soils for Wildlife[3]

Wildlife is a product of the land. The abundance of a species is directly related to the extent and diversity of its habitat. The relationship of wildlife to soils is more aptly expressed as a soil-vegetation-wildlife relationship, inasmuch as species of wildlife are more readily associated with the plant communities that grow on their habitat than to specific soils alone. Productive, well-managed soils generally support vigorous wildlife populations; infertile, poorly managed soils usually support a sparse population. Together, plants and animals make up a natural community that is governed by many environmental factors, of which soil is but a part.

Coniferous forest, range, dry and irrigated farmland, riparian woodlands, streams and rivers, ponds, and reservoirs provide a variety of wildlife habitat in Big Horn County.

[3] By RONALD F. BATCHELOR, biologist, Soil Conservation Service.

Irrigated farming has made possible the successful, although limited, introduction of the ring-necked pheasant, particularly in the bottom lands along the Little Big Horn and Big Horn Rivers. This was possible because of land-use pattern that included small grain, annual weeds, and adequate cover. The pheasant population is limited, however, by the same farm practices that fostered it. In recent years, fewer acres of small grain have been grown and more pasture has been used, resulting in a decline in the number of pheasants.

Gray, or Hungarian partridge are also associated with cropland and grassland in the Area. The gray partridge population fluctuates, building to a fairly high number and then declining because of weather, disease, or changes in habitat.

Sharp-tailed grouse occur throughout much of the grassland in the Area, especially during winter in the Little Big Horn Valley where grainfields, brushy cover, and an abundance of fruit-bearing shrubs, including cherry, rose, snowberry, sumac, and buffaloberry, provide excellent habitat. Important management practices beneficial to sharp-tailed grouse include proper grazing to insure that sufficient vegetation remains for nesting and the protection of woody vegetation in draws and fencerows, which provide both food and shelter.

Sage grouse inhabit areas of range that have a cover of sagebrush. Blue grouse, forest-dwelling birds, occupy foothills and mountains covered with mixed conifers.

Pronghorn antelope share the range of the Area with cattle. The potential for maintaining herds of antelope in the Area is dependent upon the proper management of range. If the range is overgrazed, competition for food between cattle and antelope becomes serious; on properly managed range, however, competition seldom exists. Antelope utilize forbs and browse species that cattle do not commonly eat unless forced to do so because of overgrazing.

Both mule deer and white-tailed deer live in the Area. White-tailed deer generally inhabit the lowlands, the valleys and islands of the Little Big Horn and Big Horn Rivers, brushy bottoms, and lower foothills adjacent to farmland. Mule deer range throughout the Pryor and Big Horn Mountains and along the breaks, brushy bottoms, and timbered slopes of the sedimentary plains.

A few Rocky Mountain elk inhabit the Big Horn Mountains at the extreme southern boundary of the Area.

The Yellowtail and Tongue River Reservoirs, as well as numerous ponds, provide habitat for waterfowl during migrations in spring and fall. From these lakes and ponds, ducks and geese fly to nearby fields to feed on waste grains.

Sport fishing for rainbow trout, walleye, and northern pike is provided by Yellowtail and Tongue River Reservoirs. Brown trout are common in the upper reaches of the Little Big Horn River and Pass and Lodgegrass Creeks. Trout fishing is excellent in the upper 5 miles of the Big Horn River. Sedimentation from irrigation waste water and tributary streams below St. Xavier limit fish populations to essentially nongame species.

Beaver and muskrat inhabit the major watercourses. Cottontail rabbits, raccoon, badger, ground squirrels, coyotes, and other small mammals can be found throughout the Area.

The abundance of game and nongame species could be increased by applying conservation practices that improve habitat. Among these are the development of oddly or irregularly shaped areas in and adjacent to farmland, protection of such areas from fire and grazing, and the establishment of woody vegetation that provides winter cover. Wildlife may also be enhanced through increased application of such commonly employed conservation practices as proper grazing use, a planned grazing system, stripcropping, field windbreaks, and the construction of ponds.

Engineering Uses of the Soils[4]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among the properties of soils that are highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain-size distribution, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and soil slope. These properties, in various degrees and combinations, affect the construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate the performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting the performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 4 and 5, which show, respectively, several

[4] F. WODNIK, Soil Conservation Service, helped prepare the tables in this section.

TABLE 4.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in the series is made up of two or more kinds of soil. The instructions for referring to other series in the first column of this

Soil series and map symbols	Depth to bedrock and gravel	Depth from surface	Dominant USDA texture	Classification	
				Unified	AASHTO
	Inches	*Inches*			
*Abac: Aa, AB, AC, AD For properties of Bitton soil in AC, refer to Bitton series. Rock outcrop part of AD is too variable to rate.	6–20 (shale or sandstone)	0–19 19	Loam, gravelly loam Shale.	GM or ML	A–4
*Absarokee: Ae, Af, Ag, AH, Ak, AL, AM For properties of Castner soils in Ak and AL and of Armington soil in AM, refer to Castner and Armington series, respectively.	20–40 (hard sandstone or shale)	0–31 31	Silty clay loam, clay Shale or sandstone.	CL	A–6
*Absher: An For properties of Nobe soil, refer to Nobe series.	>60	0–62	Clay, clay loam, silty clay loam.	CL	A–6 or A–7
*Adel: AO For properties of Mayflower soil, refer to Mayflower series.	40–60 (shale)	0–14 14–40 40	Loam Clay loam Clay shale.	ML CL	A–4 A–6
Adger: Ap	>60	0–18 18–60	Clay Silty clay	CL CL	A–7 A–7
Alice: Ar	>60	0–65	Sandy loam, loamy sand	SM	A–2 or A–4
*Allentine: Asa, Asb, Asc, Asd For properties of Bone soils in Asc and Asd, refer to Bone series.	>60	0–60	Clay	CL or CH	A–7
*Alluvial land: ATa, ATb, ATc. Too variable to rate.					
*Amherst: Au, AVa, AVb, AVc, AVd For properties of Maginnis soil in AVd, refer to Maginnis series.	10–20 (hard shale)	0–19 19	Channery silty clay loam, clay. Shale.	CL	A–7
Armington: AWa, AWb	>60	0–60	Clay	CH	A–7
Arnegard: Axa, Axb, Axc	>60	0–14 14–61	Loam Clay loam	ML CL	A–4 A–7
*Arvada: Ayd, Aye For properties of Bone soil in Aye, refer to Bone series.	>60	0–60	Silty clay and clay	CL or CH	A–7
Ascalon: Az	>60	0–7 7–27 27–65	Sandy loam Sandy clay loam Sandy loam	SM SC SM	A–2 or A–4 A–6 A–2 or A–4
Babb: BA, BB	40–>60 (bedrock)	0–20 20–60	Loam and clay loam Channery loam, very channery loam.	CL or ML GM	A–4 A–2, A–4, or A–1
*Beauvais: Bc, Bd, Be, Bf For properties of Gilt Edge soil in Bf, refer to Gilt Edge series.	>60	0–60	Silty clay loam	CL	A–6
*Belfield: Bg, Bh, Bk, Bm, Bn, Bo For properties of Adger soils in Bm, Bn, and Bo, refer to Adger series.		0–60	Silty clay loam, silty clay	CL	A–7
Benteen: Bp, Br	20–40 (limestone)	0–22 22–29 29	Loam and clay loam Channery loam Limestone.	CL CL	A–6 A–6
Bew: Bs, Bt	>60	0–60	Clay	CL or CH	A–7
Bitton: BU, BV	>60	0–11 11–64	Gravelly loam Very gravelly loam	ML GM	A–4 A–1, A–2
Bone: Bw	>60	0–62	Clay and silty clay	CL or CH	A–7

significant in engineering

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the table. The symbol > means more than; the symbol < means less than]

Percentage larger than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential	Frost-action potential	Corrosivity	
	No. 4	No. 10	No. 40	No. 200						Untreated steel	Concrete
					Inches per hour	*Inches per inch of soil*	*pH*				
10	65–85	65–85	50–65	40–60	0.6–2.0	0.10–0.15	7.4–7.8	Low	Moderate	High	Low.
	100	100	95–100	80–95	0.2–0.6	0.12–0.18	6.6–7.3	Moderate or high.	Moderate or high.	High	Low.
	100	100	90–100	75–85	<0.06	0.12–0.18	7.9–8.4	High	Moderate	High	Low.
	100	100	85–95	60–70	0.6–2.0	0.16–0.18	6.6–7.3	Low	High	High	Low.
	100	100	90–100	75–85	0.6–2.0	0.17–0.20	6.6–7.8	Moderate	Moderate	High	Low.
	100	100	90–100	85–95	0.06–0.2	0.12–0.18	7.9–8.4	High	Moderate	High	Low.
	100	100	95–100	90–95	0.06–0.2	0.12–0.18	8.5–9.0	High	Moderate	High	Low.
	100	100	60–65	30–40	2.0–6.0	0.10–0.16	7.4–7.8	Low	Moderate	High	Low.
	100	100	95–100	85–95	<0.06	0.12–0.18	7.9–8.4	High	Moderate	High	Low.
0–10	65–90	60–85	55–85	50–80	0.6–2.0	0.12–0.17	7.4–7.8	Moderate or high.	Moderate or high.	High	Low.
	100	95–100	95–100	85–95	<0.06	0.13–0.17	7.4–8.4	High	Moderate	High	Low.
	100	100	85–95	60–75	0.6–2.0	0.14–0.20	6.6–7.3	Low	High	High	Low.
	100	100	90–95	70–80	0.6–2.0	0.14–0.18	7.4–7.8	Moderate	High	High	Low.
	100	100	95–100	90–95	<0.6	0.12–0.18	7.8–9.5	High	Moderate	High	Low.
	90–100	85–100	60–70	30–40	2.0–6.0	0.12–0.16	7.4–7.8	Low	Moderate	High	Low.
	90–100	85–100	80–90	35–50	0.6–2.0	0.12–0.18	7.4–7.8	Moderate	Moderate	High	Low.
	90–100	85–100	60–70	30–40	2.0–6.0	0.12–0.16	7.4–7.8	Low	Moderate	High	Low.
	80–90	75–90	70–85	50–65	0.6–2.0	0.10–0.16	6.6–7.3	Moderate	Moderate	High	Low.
0–10	40–75	35–70	30–65	20–50	2.0–6.0	0.06–0.12	7.4–7.9	Low or moderate.	Low or moderate.	High	Low.
	100	100	90–100	85–95	0.2–0.6	0.14–0.20	6.6–8.4	Moderate	High	High	Low.
	100	100	95–100	85–95	0.2–0.6	0.14–0.20	7.4–8.4	Moderate	High	High	Low.
0–10	75–100	70–90	65–85	50–70	0.6–2.0	0.12–0.18	6.6–7.3	Moderate	High	High	Low.
10–20	75–90	70–85	60–75	55–65	0.6–2.0	0.10–0.14	7.4–7.8	Moderate	High	High	Low.
	100	100	95–100	90–95	0.06–0.2	0.12–0.18	7.4–8.4	High	Moderate	High	Moderate.
5–10	85–100	80–90	60–75	55–65	2.0–6.0	0.12–0.17	7.4–7.8	Low	Moderate	High	Low.
10–30	50–70	30–55	25–50	15–35	6.0–20.0	0.07–0.10	7.4–7.8	Low	Low	High	Low.
	100	100	90–100	75–95	<0.06	0.12–0.18	7.9–9.0	High	Moderate	High	Moderate.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Depth to bedrock and gravel	Depth from surface	Dominant USDA texture	Classification	
				Unified	AASHTO
	Inches	*Inches*			
*Castner: CA, CB, CC, CD For properties of Reeder soils in CA and CB and of Vebar soil in CD, refer to Reeder and Vebar series, respectively. Rock outcrop part of CC is too variable to rate.	6–20 (shale and sandstone)	0–12 12	Channery sandy loam Sandy shale.	SM	A–2, A–4
Cherry: Ce	>60	0–60	Silty clay loam	CL	A–7
Chugter: Cf, CG	>60	0–63	Loam	ML	A–4 or A–6
*Clapper: CH, CK For properties of Harvey soil in CH and of Midway soil in CK, refer to Harvey and Midway series, respectively.	>60	0–16 16–60	Gravelly loam Very gravelly loam	GM or ML GM	A–4 A–2 or A–1
*Colby: Cm, Cn, Co, Cp, Cr, Cs, Ct, CU, Cv, CW, CX, CY. For properties of Beauvais soils in Cs and Ct, of Clapper soil in CU, of Keiser soil in Cv, and of Midway soil in CW, refer to Beauvais, Clapper, Keiser, and Midway series, respectively.	>60	0–60	Silty clay loam, silt loam	CL	A–6
Cushman: Cz	20–40 (shale or sandstone)	0–10 10–35 35	Clay loam Loam Shale.	CL CL	A–6 or A–7 A–6
*Danvers: Da, Db, Dc, Dd, De, Df, Dg For properties of Judith soils in De, Df, and Dg, refer to Judith series.	>60	0–43 43–65	Silty clay loam Loam	CL ML	A–6 or A–7 A–4 or A–6
Darret Mapped only with Reeder soils.	20–40 (shale or sandstone)	0–7 7–35 35	Silt loam Silty clay, silty clay loam Shale or sandstone.	ML CL	A–4 A–7
*Dast: DHa, DHb, DHc, DHd, Dk For properties of Parshall soil in Dk, refer to Parshall series.	20–40 (sandstone)	0–26 26	Sandy loam Sandstone.	SM	A–4 or A–2
*Doney: DMa, DMb, Dn, DOa, DOb, DOc, DOd, DOe. For properties of Reeder soil in Dn, of Ringling soils in DOa, DOb, and DOc, and of Wayden soil in DOe, refer to Reeder, Ringling, and Wayden series, respectively. Rock outcrop part of DOd is too variable to rate.	20–40 (shale or sandstone)	0–21 21	Loam Sandstone or siltstone.	ML or GM	A–4 or A–2
*Duncom: Dp, DR, DS, DT For properties of Tarrete soils in DS and DT, refer to Tarrete series.	10–20 (limestone)	0–18 18	Gravelly loam Dolomite.	GM	A–2 or A–1
Eltsac: Ec, Ed, EH	20–40 (shale)	0–24 24–34 34	Clay Clay Shale.	CH CH	A–7 A–7
*Farnuf: Fa, Fb, Fc, FD For properties of Doney soil in FD, refer to Doney series.	>60	0–16 16–24 24–63	Loam Clay loam Loam	ML–CL CL ML–CL	A–4 A–6 or A–7 A–4
Fergus: Fe, Ff, Fg	>60	0–14 14–31 31–62	Silt loam Silty clay loam Silt loam	ML–CL CL ML–CL	A–4 A–7 A–4
Fort Collins: Fh, Fk, Fm, Fn	>60	0–12 12–65	Clay loam Loam	CL ML	A–6 A–4

significant in engineering—Continued

Percentage larger than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential	Frost-action potential	Corrosivity	
	No. 4	No. 10	No. 40	No. 200						Untreated steel	Concrete
					Inches per hour	*Inches per inch of soil*	*pH*				
10–50	95–100	95–100	60–70	30–40	0.6–2.0	0.08–0.13	7.4–7.8	Low	Moderate	High	Low.
	100	100	95–100	85–95	0.2–0.6	0.16–0.20	7.9–8.4	Moderate	High	High	Low.
	95–100	95–100	80–90	60–75	0.6–2.0	0.14–0.20	7.4–8.4	Low	High	High	Low.
	65–90	60–70	50–65	40–55	0.6–2.0	0.10–0.16	7.4–8.4	Low	Moderate or high.	High	Low.
10–30	50–70	35–50	30–50	20–35	0.6–2.0	0.07–0.10	7.9–8.4	Low	Low	High	Low.
	100	100	95–100	85–95	0.6–2.0	0.16–0.20	7.4–7.8	Moderate	High	High	Low.
	100	100	90–100	70–80	0.6–2.0	0.12–0.18	7.4–7.8	Moderate	High	High	Low.
	100	100	90–100	60–70	0.6–2.0	0.15–0.20	7.4–7.8	Moderate	High	High	Low.
0–30	85–100	85–100	80–100	75–95	0.6–2.0	0.14–0.20	7.4–7.8	Moderate	High	High	Low.
0–30	85–100	85–100	75–95	50–75	0.6–2.0	0.14–0.20	7.4–7.8	Low	High	High	Low.
	85–100	75–100	70–85	60–75	0.6–2.0	0.16–0.20	6.6–7.3	Low	High	High	Low.
	85–100	75–100	75–100	65–95	0.6–2.0	0.12–0.16	7.4–7.8	High or moderate.	Moderate	High	Low.
	100	100	60–70	30–40	2.0–6.0	0.10–0.16	6.6–7.8	Low	Moderate	High	Low.
	60–95	50–90	40–75	30–50	0.6–2.0	0.11–0.16	7.4–7.8	Low	High or moderate.	High	Low.
15–45	55–65	40–60	35–50	20–35	0.6–2.0	0.07–0.10	7.4–8.4	Low	Moderate	High	Low.
	100	100	100	75–95	<0.06	0.12–0.18	7.4–7.8	High	Moderate	High	Low.
	70–95	60–90	60–90	60–80	<0.06	0.11–0.14	7.9–8.4	High	Moderate	High	Moderate.
	100	100	85–95	60–75	0.6–2.0	0.15–0.20	7.4–7.9	Low	High	High	Low.
	100	100	90–100	70–80	0.6–2.0	0.14–0.18	7.9–8.4	Moderate	High	High	Low.
	85–100	75–100	60–95	50–75	0.6–2.0	0.15–0.20	7.9–8.4	Low	High	High	Low.
	100	100	95–100	75–85	0.6–2.0	0.18–0.22	6.6–7.3	Low	High	High	Low.
	100	100	95–100	85–95	0.2–0.6	0.15–0.20	7.4–8.4	Moderate	High	High	Low.
	100	100	90–95	70–85	0.6–2.0	0.17–0.20	7.4–8.4	Low	High	High	Low.
	90–100	85–100	80–95	70–80	0.6–2.0	0.14–0.18	7.4–7.8	Moderate	High	High	Low.
	100	100	85–95	60–75	0.6–2.0	0.16–0.20	7.4–8.4	Low	High	High	Low.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Depth to bedrock and gravel	Depth from surface	Dominant USDA texture	Classification	
				Unified	AASHTO
	Inches	*Inches*			
*Frazer: Fo, Fr, Fs, FT	>60	0–38	Silty clay loam	CL	A–7
For properties of Korchea soil in FT, refer to Korchea series.		38–65	Silty clay loam, silt loam (stratified).	CL	A–6
*Gilt Edge: Gc, Gd, Ge, Gf	>60	0–3	Loam, silt loam	ML–CL	A–4
For properties of Bone soils in Ge and Gf, refer to Bone series.		3–27	Clay, silty clay	CH	A–7
		27–60	Silty clay loam	CL	A–7
Glenberg: Gg, Gh, Gk, Gm	>60	0–60	Fine sandy loam	SM	A–2 or A–4
Grail: Gn, Go, Gr, GS, Gt		0–8	Clay loam	CL	A–6 or A–7
		8–65	Silty clay	CL or CH	A–7
*Hanson: HA, HB	>60	0–108	Very gravelly loam	GM or SM	A–2 or A–1
For properties of Babb soil in HB, refer to Babb series.					
Harvey: Hca, Hcb, Hcc, Hd, He	>60	0–31	Loam	CL	A–6
		31–43	Gravelly loam	GM	A–4 or A–6
		43–50	Very gravelly loam	GM	A–2 or A–1
*Haverson:					
Hfa, Hfb, Hfc, HGa, HGb, HGc, Hh, HK	>60	0–33	Loam	ML–CL	A–4
For properties of Hysham soil in Hfh, of Glenberg soil in HGa, and of Lohmiller soils in HGb, HGc, and Hh, refer to Hysham, Glenberg, and Lohmiller series, respectively.		33–60	Sandy loam	SM	A–4 or A–2
Hfd, Hfe, Hff, Hfh	>60	0–12	Silty clay loam or silty clay	CL	A–6 or A–7
		12–60	Loam and thin strata of silty clay loam and silty clay.	ML–CL, CL	A–4
*Heldt: Hla, Hlb, Hlc, Hld, Hle, Hlf, Hlg	>60	0–60	Silty clay loam	CL	A–7
For properties of Hysham soils in Hlf and Hlg, refer to Hysham series.					
Hesper: Hma, Hmb, Hmc	>40 (sand and gravel)	0–49	Silty clay, silty clay loam	CL	A–7
		49–60	Very gravelly sand	GW or GP	A–1
*Hydro: Hna, Hnb, Hnc, Hnd, Hne, Hnf, Hng, Hnh, Hnk.	>60	0–39	Silty clay	CL	A–7
For properties of Allentine soils in Hng and Hnh and of Gilt Edge soil in Hnk, refer to Allentine and Gilt Edge series, respectively.		39–65	Stratified silt loam, very fine sandy loam.	ML–CL	A–4
*Hysham: Ho, Hp, Hr, HS, HT	>60	0–63	Silty clay loam	CL	A–6 or A–7
For properties of Midway soil in HS and of Lohmiller soil in HT, refer to Midway and Lohmiller series, respectively.					
*Judith: Jc, Jd, Je, Jh, Jk	>60	0–25	Loam and clay loam	CL	A–6
For properties of Windham soils in Jh and Jk, refer to Windham series.		25–60	Very gravelly loam	GM or GP–GM	A–2
*Keiser: Kc, Kd, Ke, Kf	>60	0–21	Silty clay loam	CL	A–7
For properties of Colby soil in Kf, refer to Colby series.		21–60	Silt loam	ML	A–4
Kim: Kg	>60	0–33	Loam	ML	A–4
		33–65	Silt loam	ML	A–4
*Korchea: Kh, Kk, Km, Kn, Ko, Kp, KR	>60	0–72	Loam, silt loam	ML	A–4
For properties of Frazer soil in KR, refer to Frazer series.					
Kyle: Ks, Kt, Ku, KV, Kw	>60	0–62	Clay	CH	A–7

significant in engineering—Continued

Percentage larger than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential	Frost-action potential	Corrosivity	
	No. 4	No. 10	No. 40	No. 200						Untreated steel	Concrete
					Inches per hour	*Inches per inch of soil*	*pH*				
	100	100	95–100	85–95	0.06–0.2	0.14–0.20	7.4–7.8	Moderate	High	High	Low.
	100	100	90–100	80–95	0.06–0.2	0.14–0.20	7.4–8.4	Moderate	High	High	Low.
	100	100	90–95	60–90	0.6–2.0	0.18–0.22	7.9–8.4	Low	High	High	Low.
	100	100	90–100	75–95	0.06–0.2	0.12–0.18	7.9–8.4	High	Moderate	High	Low.
	100	100	95–100	85–95	0.2–0.6	0.14–0.20	8.5–9.0	Moderate	High	High	Low.
	100	100	60–70	30–40	2.0–6.0	0.11–0.14	7.4–8.4	Low	Moderate	High	Low.
	100	100	90–100	70–80	0.6–2.0	0.12–0.18	6.6–7.3	Moderate	High	High	Low.
	100	100	95–100	90–95	0.2–0.6	0.12–0.18	7.4–7.8	High	Moderate	High	Low.
25–35	40–70	35–65	30–45	20–35	0.6–2.0	0.09–0.11	6.6–8.4	Low	Moderate or low.	High	Low.
	80–100	70–100	65–95	50–70	0.6–2.0	0.15–0.20	7.4–7.8	Moderate	High	High	Low.
15–30	70–80	65–75	60–70	40–50	2.0–6.0	0.11–0.14	7.4–7.8	Low	Moderate	High	Low.
	50–60	35–45	30–40	20–30	2.0–6.0	0.09–0.11	7.4–7.8	Low	Low	High	Low.
	100	100	85–95	60–75	0.6–2.0	0.14–0.20	7.4–8.4	Low	High	High	Low.
	100	100	60–70	30–40	2.0–6.0	0.13–0.16	7.4–8.4	Low	High	High	Low.
	100	100	95–100	85–95	0.2–0.6	0.16–0.19	7.4–8.4	Moderate	High	High	Low.
	100	100	85–95	65–80	0.6–2.0	0.15–0.18	7.4–8.4	Low	High	High	Low.
	95–100	90–100	90–100	85–95	0.06–0.2	0.15–0.20	7.4–8.6	Moderate	High	High	Low.
	100	100	95–100	75–95	0.2–0.6	0.13–0.18	7.4–8.4	Moderate or high.	Moderate or high.	High	Low.
	35–50	20–35	10–25	0–15	>20.0	<0.04	7.4–8.4	Low	Low	High	Low.
	100	100	90–100	90–95	0.06–0.2	0.13–0.18	7.9–8.4	High	Moderate	High	Low.
	100	100	85–100	50–90	0.6–2.0	0.14–0.22	7.9–8.4	Low	High	High	Low.
	100	100	95–100	85–95	0.06–0.2	0.14–0.20	8.5–9.0	Moderate	High	High	Moderate.
0–30	100	85–100	75–95	55–75	0.6–2.0	0.14–0.20	7.9–8.4	Low or moderate.	High	High	Low.
0–10	40–65	35–60	25–50	10–30	2.0–6.0	0.08–0.10	7.9–8.4	Low	Low	High	Low.
	100	90–100	90–100	85–95	0.2–0.6	0.16–0.18	7.4–7.8	Moderate	High	High	Low.
	100	90–100	90–100	70–90	0.6–2.0	0.18–0.22	7.4–8.4	Low	High	High	Low.
	100	100	85–95	60–75	0.6–2.0	0.15–0.20	7.4–8.4	Low	High	High	Low.
	100	100	90–100	70–85	0.6–2.0	0.18–0.22	7.4–8.4	Low	High	High	Low.
	100	100	85–95	65–75	0.6–2.0	0.16–0.20	7.4–8.4	Low	High	High	Low.
0–25	70–100	65–100	60–100	50–95	<0.06	0.12–0.18	7.9–8.4	High	Moderate	High	Moderate.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Depth to bedrock and gravel	Depth from surface	Dominant USDA texture	Classification	
				Unified	AASHTO
	Inches	*Inches*			
La Fonda: La	>60	0–60	Loam	ML	A–4
*Lap: LCa, LCb, LCc, LCd For properties of Trulon soil in LCa and of Armington soil in LCd, refer to Trulon and Armington series, respectively.	10–20 (limestone)	0–19 19	Very channery loam Limestone.	GM	A–1
*Lavina: LD For properties of Travessilla soil, refer to Travessilla series.	10–20 (hard shale)	0–14 14	Loam, clay loam Shale and sandstone.	CL	A–6
*Lennep: Lea, Leb, Lec, Led For properties of Adger soils in Lec and Led, refer to Adger series.	>60	0–8 8–73	Loam, silty clay loam Silty clay, clay	CL CL or CH	A–6 A–7
*Lismas: LF, LG, LH, LK, LM, LN For properties of Vananda soil in LN, refer to Vananda series. Shale outcrop parts of LK and LM are too variable to rate.	10–20 (shale)	0–18 18	Clay Shale.	CL or CH	A–7
*Lohmiller: Lo, Lp, Lr, Ls, Lt, Lu, LV For properties of Midway soil in LV, refer to Midway series.	>60	0–63	Silty clay loam, silty clay	CL	A–7
Macar: Ma	>60	0–61	Loam, clay loam	CL or ML	A–4
*Maginnis: MB, MC For properties of Windham soil in MC, refer to Windham series. Shale outcrop part of MB is too variable to rate.	8–20 (shale)	0–16 16	Channery silty clay, very channery clay. Shale and sandstone.	GC	A–2 or A–7
Marias: Md, Me, Mf, Mg	>60	0–60	Clay	CL or CH	A–7
*Maschetah: MH, MK For properties of Norbert soil in MK, refer to Norbert series.	>60	0–65	Silty clay loam, silt loam	CL	A–6
Mayflower: Mm, MN	20–40 (clay shale and sandstone)	0–34 34	Silty clay, silty clay loam Shale and sandstone.	CL	A–7
McKenzie: Mo	>60	0–60	Clay	CH	A–7
McRae: Mp, Mr, Ms, Mt	>60	0–63	Loam	ML	A–4
*Midway: Mu, MVa, MVb, MVc, MVd, MVe, MVf, MVg. For properties of Lismas soils in MVc and MVd, of Thedalund soils in MVe and MVf, and of Thurlow soil in MVg, refer to Lismas, Thedalund, and Thurlow series, respectively.	10–20 (shale)	0–11 11	Silty clay loam Shale.	CL	A–7
Morton: Mw	20–40 (shale and sandstone)	0–5 5–38 38	Silt loam Silty clay loam Shale and sandstone.	ML CL	A–4 A–6
*Nelson: Nd, Ne, NF For properties of Alice soil in Ne and of Glenberg soil in NF, refer to Alice and Glenberg series, respectively.	20–40 (sandstone)	0–29 29	Sandy loam Sandstone.	SM	A–2
Neville: Ng	40–60 (shale)	0–41 41	Loam Shale.	CL or ML	A–6 or A–4

significant in engineering—Continued

Percentage larger than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential	Frost-action potential	Corrosivity	
	No. 4	No. 10	No. 40	No. 200						Untreated steel	Concrete
					Inches per hour	*Inches per inch of soil*	*pH*				
	75–100	65–100	60–95	50–70	0.6–2.0	0.15–0.20	7.4–8.4	Low	High	High	Low.
30–45	45–60	40–55	35–50	20–35	0.6–2.0	0.08–0.10	6.6–8.4	Low	Moderate	High	Low.
0–10	75–100	65–100	60–80	50–70	0.6–0.2	0.12–0.18	7.4–7.8	Moderate	High	Moderate or high.	Low.
	100	100	85–100	60–95	0.6–2.0	0.14–0.20	7.9–8.4	Moderate	High	High	Low.
	100	100	95–100	75–95	0.06–0.2	0.12–0.17	7.9–8.4	High	Moderate	High	Low.
	90–100	85–95	80–90	75–95	<0.06	0.12–0.18	7.9–8.4	High	Moderate	High	Moderate.
	90–100	90–100	85–100	80–95	0.2–0.6	0.15–0.20	7.9–8.4	Moderate	High	High	Low.
	80–100	75–100	70–90	50–70	0.6–2.0	0.15–0.20	7.4–8.4	Low	High	High	Low.
5–15	30–60	25–55	25–50	20–40	0.2–0.6	0.10–0.12	7.4–7.8	High	Moderate	High	Low.
	100	100	90–100	75–95	<0.06	0.12–0.18	7.9–8.4	High	Moderate	High	Moderate.
	95–100	95–100	90–100	85–95	0.2–0.6	0.14–0.20	7.4–8.4	Moderate	High	High	Low.
	80–100	70–100	60–100	60–95	0.06–0.2	0.15–0.17	7.4–8.4	Moderate or high.	Moderate or high.	High	Low.
	100	100	90–100	75–95	<0.06	0.12–0.18	7.9–9.0	High	Moderate	High	Moderate.
0–10	90–100	80–100	75–95	50–75	0.6–2.0	0.14–0.20	7.4–7.8	Low	High	High	Low.
	80–100	70–95	70–85	60–80	0.06–0.2	0.14–0.18	7.4–8.4	Moderate	High	High	Low.
	100	100	90–100	70–90	0.6–2.0	0.16–0.22	6.6–7.3	Low	High	High	Low.
	95–100	95–100	95–100	85–95	0.6–2.0	0.16–0.20	6.6–7.3	Moderate	High	High	Low.
	85–100	75–100	50–70	30–35	2.0–6.0	0.12–0.16	7.4–8.4	Low	Moderate	High	Low.
	80–100	75–100	70–95	50–75	0.6–2.0	0.16–0.20	7.4–8.4	Low or moderate.	High	High	Low.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Depth to bedrock and gravel	Depth from surface	Dominant USDA texture	Classification	
				Unified	AASHTO
	Inches	*Inches*			
Nobe Mapped only with Absher soils.	>60	0–62	Clay	CL or CH	A–7
*Norbert: NH, NK For properties of Eltsac soil in NH, refer to Eltsac series. Shale outcrop part of NK is too variable to rate.	10–20 (shale)	0–19 19	Clay Shale.	CL or CH	A–7
*Nunn: Nm, Nn, No, Nr, NS For properties of Midway soils in NS, refer to Midway series.	>60	0–8 8–17 17–60	Silty clay loam Silty clay Clay loam, silt loam, sandy clay loam.	CL CL CL	A–6 A–7 A–6
Olney: On	>60	0–25 25–62	Sandy clay loam Sandy loam	SC SM	A–6 A–4 or A–2
Parshall: Pa	>60	0–60	Sandy loam	SM	A–2 or A–4
*Peritsa: Pd, PE, PF For properties of Abac soil in PE, refer to Abac series.	20–40 (shale)	0–31 31	Silty clay loam Shale.	CL	A–6 or A–7
*Pierre: Pg, Ph, Pk, PM, PN For properties of Kyle soil in Pk and of Lismas soils in PM and PN, refer to Kyle and Lismas series, respectively.	20–40 (shale)	0–29 29	Clay Shale.	CL or CH	A–7
*Pultney: PO For properties of Neville soil, refer to Neville series.	20–40 (shale and sandstone)	0–30 30	Loam Shale.	ML	A–4
Quietus: QU	20–40 (limestone or dolomite)	0–11 11–27 27	Loam and clay loam Gravelly loam Dolomite.	CL ML or GM	A–6 A–4 or A–2
Raynesford: Ra	>60	0–30 30–49	Gravelly clay loam Very gravelly loam	CL or GC GM	A–6 A–4, A–2, or A–1
*Reeder: Rda, Rdb, Rdc, REa, REb, REc, REd For properties of Regent soil in REa, of Rentsac soil in REb, and of Darret soils in REc and REd, refer to Regent, Rentsac, and Darret series, respectively.	20–40 (shale and sandstone)	0–30 30	Loam, clay loam Shale and sandstone.	CL	A–6
Regent: Rfa, Rfc, Rfd	20–40 (shale)	0–26 26	Silty clay loam Shale.	CL	A–7
Renohill: Re	20–40 (shale)	0–33 33	Silty clay Shale.	CL	A–7
Rentsac: RH For properties of Doney soil, refer to Doney series.	4–20 (hard shale)	0–8 8	Loam, channery loam Sandy shale.	GM	A–1 or A–2
*Richfield: Rk, Rlc, Rld, Rle, Rlf For properties of Beauvais soils in Rle and Rlf, refer to Beauvais series.	>60	0–26 26–65	Silty clay loam Silt loam and loam	CL ML	A–7 A–4
Ringling Mapped only with Doney soils.	5–20 (hard platy shale)	0–13 13	Very channery loam Shale.	GM	A–2 or A–1
Riverwash: RM. Too variable to rate.					

significant in engineering—Continued

Percentage larger than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential	Frost-action potential	Corrosivity	
	No. 4	No. 10	No. 40	No. 200						Untreated steel	Concrete
					Inches per hour	*Inches per inch of soil*	*pH*				
	100	100	95–100	75–95	<0.06	0.12–0.18	7.3–9.0	High	Moderate	High	Moderate.
0–5	65–95	55–90	55–90	50–85	<0.06	0.12–0.18	7.8–8.4	High	Moderate	High	Low.
	90–100	85–100	85–100	75–95	0.2–0.6	0.14–0.20	6.6–7.3	Moderate	High	High	Low.
	90–100	85–100	85–100	80–95	0.06–0.2	0.13–0.18	7.9–8.4	High	Moderate	High	Low.
	90–100	85–100	75–95	60–80	0.2–0.6	0.12–0.18	7.9–8.4	Moderate	High	High	Low.
	100	95–100	80–90	40–50	0.6–2.0	0.13–0.15	7.4–7.8	Moderate	Moderate	High	Low.
	100	90–100	60–70	30–40	2.0–6.0	0.10–0.13	7.4–8.4	Low	Moderate	High	Low.
	100	100	60–70	30–40	2.0–6.0	0.10–0.13	6.6–7.3	Low	Moderate	High	Low.
	90–100	90–100	85–100	75–95	0.6–2.0	0.16–0.20	6.6–8.4	Moderate	High	High	Low.
	95–100	90–100	85–100	75–95	<0.06	0.13–0.18	7.9–8.4	High	Moderate	High	Moderate.
	85–100	75–100	65–95	55–75	0.6–2.0	0.14–0.18	7.4–7.8	Low	High	High	Low.
	80–100	75–100	70–95	50–70	0.6–2.0	0.15–0.20	6.1–6.5	Moderate	High	High	Low.
10–25	50–85	45–80	40–75	25–55	0.6–2.0	0.12–0.14	6.6–7.4	Low	Moderate	High	Low.
0–5	65–100	55–95	50–95	35–60	0.2–0.6	0.13–0.15	6.6–7.3	Moderate	Moderate	High	Low.
15–30	45–65	35–60	35–50	20–40	0.2–0.6	0.08–0.10	7.4–8.4	Low	Low	High	Low.
	80–100	75–100	70–95	50–80	0.6–2.0	0.12–0.17	7.4–7.8	Moderate	High	High	Low.
	100	100	95–100	85–90	0.06–0.2	0.16–0.20	7.4–7.8	Moderate	High	High	Low.
	100	100	95–100	85–95	0.06–0.2	0.12–0.15	7.9–8.4	High	Moderate or high.	High	Low.
0–15	45–60	35–55	25–50	20–35	2.0–6.0	0.14–0.16	7.4–7.8	Low	Moderate	High	Low.
	100	100	95–100	85–95	0.2–0.6	0.16–0.20	7.4–7.8	Moderate	High	High	Low.
	100	100	90–100	70–85	0.6–2.0	0.18–0.22	7.4–7.8	Low	High	High	Low.
15–30	40–50	35–45	30–40	20–30	6.0–20.0	0.10–0.12	6.6–7.8	Low	Low	High	Low.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Depth to bedrock and gravel	Depth from surface	Dominant USDA texture	Classification	
				Unified	AASHTO
	Inches	*Inches*			
*Rock outcrop: RN, RO, RP, RR, RS. For properties of Duncom soil in RN, of Lap soil in RO, of Pultney soil in RP, of Rentsac soil in RR, and of Windham soil in RS, refer to Duncom, Lap, Pultney, Rentsac, and Windham, series, respectively. Rock outcrop is too variable to rate.					
*Rottulee: Rt, Ru, Rv, RW. For properties of Abac soils in RW, refer to Abac series.	20–30 (limestone)	0–22 22	Silt loam, gravelly clay loam. Limestone.	ML, GM	A–6
Ryorp: Ry	20–40 (sandstone)	0–34 34	Fine sandy loam, sandy loam. Sandstone.	SM	A–4
Saline land: SA. Too variable to rate.					
*Savage: Sd, Sea, Seb, Sec, Sed, Sef, SF. For properties of Wayden soil in Sef and of Frazer soil in SF, refer to Wayden and Frazer series, respectively.	>60	0–61	Silty clay, silty clay loam	CL	A–7
Sawcreek. Mapped only with Splitro soils.	20–40 (sandstone)	0–36 36	Sandy loam Sandstone.	SM	A–4 or A–2
*Searing: Sg, SH, SI. For properties of Ringling soil in SI, refer to Ringling series.	20–40 (hard play shale and sandstone)	0–30 30	Loam, clay loam Shale and sandstone.	CL	A–6
Shaak: Ska, Skb, Skc, Skd, Ske, SM	>60	0–63	Clay loam, clay	CL	A–7
*Shale outcrop: SOa, SOc, SOd. For properties of Midway soil in SOc and of Norbert soil in SOd, refer to Midway and Norbert series, respectively. Shale outcrop is too variable to rate.					
Shonkin: Sp	>60	0–26 26–60	Clay loam, clay Silty clay	CL or CH CL or CH	A–7 A–7
Sofia: Sra, Srb	40–60 (sand and gravel)	0–40 40–60	Silty clay Very gravelly sand	CL or CH GP or GW	A–7 A–1
*Spearfish: SSa, SSb, SSc, SSd. For properties of Clapper soil in SSa and of Pultney soils in SSc and SSd, refer to Clapper and Pultney series, respectively. Rock outcrop part of SSb is too variable to rate.	10–20 (shale)	0–15 15	Silty clay loam Shale.	CL	A–6
*Spearman: St, SU. For properties of Wibaux soil in SU, refer to Wibaux series.	20–40 (shale)	0–15 15–23 23	Loam and clay loam Channery loam Shale.	CL ML or GM	A–6 A–4
*Splitro: SVa, SVb. For properties of Sawcreek soils, refer to Sawcreek series.	10–20 (sandstone)	0–13 13	Sandy loam Sandstone.	SM	A–2, A–4, or A–1
Stormitt: Swa, Swb, SX	>60	0–10 10–60	Loam Very gravelly loam	ML–CL or SM–SC GM	A–4 A–2

significant in engineering—Continued

Percentage larger than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential	Frost-action potential	Corrosivity	
	No. 4	No. 10	No. 40	No. 200						Untreated steel	Concrete
					Inches per hour	*Inches per inch of soil*	*pH*				
	70–90	65–85	60–80	40–60	0.6–2.0	0.15–0.17	7.4–7.8	Low	High	High	Low.
	70–90	65–85	55–80	35–45	6.0–20.0	0.10–0.14	6.1–6.5	Low	High	Moderate	Low.
	100	100	95–100	85–95	0.2–0.6	0.12–0.18	7.4–8.4	High	Moderate or high.	High	Low.
	85–100	75–100	60–70	30–40	6.0–20.0	0.10–0.16	6.1–7.3	Low	Moderate	Moderate	Low.
	90–100	85–100	80–90	50–70	0.6–2.0	0.15–0.20	7.4–7.8	Moderate	High	High	Low.
	95–100	95–100	90–100	70–90	0.06–0.2	0.13–0.18	7.4–8.4	Moderate or high.	Moderate or high.	High	Low.
	100	100	90–100	75–95	0.06–0.2	0.13–0.18	7.4–7.8	High	Moderate	High	Low.
	100	100	95–100	85–95	0.06–0.2	0.13–0.18	7.9–8.4	High	Moderate	High	Low.
	100	100	95–100	90–95	0.06–0.2	0.13–0.18	7.4–8.4	High	High	High	Low.
	25–30	15–25	5–15	0–15	<20.0	0.03–0.05	7.8–8.4	Low	Low	High	Low.
	85–100	75–100	70–100	60–95	0.6–2.0	0.14–0.20	7.9–8.4	Moderate	High	High	Low.
	90–100	85–100	80–95	60–70	0.6–2.0	0.14–0.18	6.6–7.3	Moderate	High	High	Low.
0–15	65–90	60–85	55–80	40–60	2.0–6.0	0.10–0.14	7.4–8.4	Low	High	High	Low.
	65–95	55–90	40–70	20–40	2.0–6.0	0.11–0.16	6.6–7.3	Low	Moderate	High	Low.
	95–100	70–95	60–90	40–70	0.6–2.0	0.14–0.18	7.9–8.4	Low	High	High	Low.
0–35	40–50	35–50	30–40	20–30	0.6–2.0	0.10–0.12	7.9–8.4	Low	Moderate	High	Low.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Depth to bedrock and gravel	Depth from surface	Dominant USDA texture	Classification	
				Unified	AASHTO
	Inches	*Inches*			
*Talag: Taa, Tab For properties of Allentine soil in Tab, refer to Allentine series.	>60	0–22 22–49	Clay Clay loam	CL or CH CL	A–7 A–6
Tarrete: Tb	>60	0–7 7–60	Silty clay Clay	CL or CH CH	A–7 A–7
Terrace escarpments: TCa, TCb. Too variable to rate.					
*Terry: Td, TE For properties of Travessilla soil in TE, refer to Travessilla series.	20–40 (sandstone)	0–25 25	Sandy loam Sandstone.	SM	A–2, A–4, or A–1
Teton: TFa, TFb	20–40 (shale)	0–29 29	Loam Sandstone.	ML or SM	A–4
*Thedalund: Tg, THa, THb, THc, THd, THe, THf, THg, THh, THk, THl, THm, THn, Tho. For properties of Clapper soil in THa, of Cushman soil in THb, of Fort Collins soil in THc, of McRae soil in THd, of Midway soil in THe, of Nelson soil in THf, of Travessilla soil in THk, and of Wibaux soils in THl, THm, THn, and THo, refer to Clapper, Cushman, Fort Collins, McRae, Midway, Nelson, Travessilla, and Wibaux series, respectively. Rock outcrop parts of THg and THh are too variable to rate.	20–40 (shale)	0–28 28	Loam Shale.	ML or SM	A–4
*Thurlow: Tk, Tm, Tn, To For properties of Midway soil in To, refer to Midway series.	>60	0–61	Silty clay loam	CL	A–7
*Toluca: Tp For properties of Harvey soil, refer to Harvey series.	>40 (sand and gravel)	0–17 17–41 41–60	Clay loam, loam Fine sandy loam Very gravelly sand	CL SM GP or GW	A–6 A–4 A–1
*Travessilla: TR, TS For properties of Thedalund soil in TS, refer to Thedalund series. Rock outcrop part of TR is too variable to rate.	6–20 (hard sandstone)	0–18 18	Sandy loam Sandstone.	SM	A–2 or A–1
Trulon Mapped only with Lap soils.	20–40 (limestone)	0–30 30	Loam Limestone.	ML or GM	A–4 or A–2
Tullock: Tu	20–40 (sandstone)	0–38 38	Loamy fine sand, loamy sand. Sandstone.	SM	A–2
*Twin Creek: Tv, Tw, Tx, TY For properties of Korchea soil in TY, refer to Korchea series.	>60	0–60	Loam	ML	A–4
Vananda: Va, Vc	>60	0–60	Clay	CL or CH	A–7
*Vebar: Vd, Ve, VF, VH, VM For properties of Castner soils in VF and VH, refer to Castner series.	20–40 (sandstone)	0–40 40	Sandy loam Sandstone.	SM	A–4
Wages: Wa, Wb, Wc	>60	0–31	Clay loam, loam	ML, ML–CL, or CL	A–4 or A–6
		31–60	Fine sandy loam	SM	A–4

significant in engineering—Continued

Percentage larger than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential	Frost-action potential	Corrosivity	
	No. 4	No. 10	No. 40	No. 200						Untreated steel	Concrete
					Inches per hour	*Inches per inch of soil*	*pH*				
	100	100	90–100	75–95	<0.06	0.13–0.18	7.9–8.4	High	Moderate	High	Low.
	90–100	90–100	80–100	70–85	0.06–0.2	0.14–0.18	8.5–9.0	Moderate	High	High	Low.
	90–100	85–100	80–100	80–95	0.06–0.2	0.13–0.18	6.6–7.3	High	Moderate	High	Low.
	90–100	85–100	80–100	70–95	0.06–0.2	0.13–0.18	7.4–8.4	High	Moderate	High	Low.
	70–100	60–100	40–70	20–40	6.0–20.0	0.10–0.16	7.4–8.4	Low	Moderate	High	Low.
	75–95	70–90	55–80	40–60	0.6–2.0	0.15–0.20	6.6–7.3	Low	High	High	Low.
0–30	80–100	70–100	65–95	45–75	0.6–2.0	0.14–0.20	7.4–7.8	Low	High	High	Low.
	100	100	95–100	85–95	0.2–0.6	0.14–0.20	7.9–8.4	Moderate	High	High	Low.
	85–100	75–100	70–100	50–80	0.6–2.0	0.15–0.18	7.4–7.8	Moderate	High	High	Low.
	85–100	75–100	65–95	35–50	0.6–2.0	0.13–0.16	7.9–8.4	Low	High	High	Low.
	30–40	25–35	15–20	0–5	>20.0	0.03–0.05	7.9–8.4	Low	Low	High	Low.
0–30	65–90	60–85	40–65	20–35	6.0–20.0	0.10–0.14	7.4–8.4	Low	Moderate	High	Low.
	55–85	50–75	40–70	30–55	0.2–0.6	0.11–0.16	7.4–7.8	Low	High or moderate.	High	Low.
	100	100	60–75	15–30	6.0–20.0	0.08–0.10	7.9–8.4	Low	Low	High	Low.
	90–100	80–100	85–95	50–75	0.6–2.0	0.14–0.20	7.4–8.4	Low	High	High	Low.
	100	100	90–100	75–95	<0.06	0.13–0.18	8.5–9.0	High	Moderate	High	Moderate.
	100	100	70–80	35–50	2.0–6.0	0.11–0.16	7.4–7.8	Low or moderate.	High	High	Low.
	100	100	85–100	60–80	0.6–2.0	0.14–0.20	7.4–8.4	Low or moderate.	High	High	Low.
	100	100	75–85	40–50	0.6–2.0	0.13–0.16	7.4–8.4	Low	High	High	Low.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Depth to bedrock and gravel	Depth from surface	Dominant USDA texture	Classification	
				Unified	AASHTO
	Inches	*Inches*			
*Wayden: WD, WE, WF, WG, WH, WI, WK, WL, WM, WN, WO. For properties of Arnegard soil in WF, of Grail soil in WG, of Judith soil in WH, of Regent soil in WI, and of Savage soil in WK, refer to Arnegard, Grail, Judith, Regent, and Savage series, respectively. Rock outcrop parts of WL and WM and Shale outcrop part of WN are too variable to rate.	10–20 (hard shale)	0–19 19	Silty clay loam Shale.	CL	A–7
*Wibaux: Wp, Wr. For properties of Spearman soil in Wr, refer to Spearman series.	8–20 (hard shale)	0–9 9	Channery loam Shale.	GM	A–2 or A–1
*Windham: Ws, WT, WU, WV, WW, WX. For properties of Arnegard soil in WU, of Norbert soil in WV, of Wayden soil in WW, and of Lap soil in WX, refer to Arnegard, Norbert, Wayden, and Lap series, respectively.	>60	0–60	Very gravelly loam	GM	A–2 or A–1
Winnett: Wy	20–40 (shale)	0–26 26	Clay Shale.	CL or CH	A–7
Xavier: Xa, Xc, Xe, Xh, Xk. For properties of Shaak soils in Xh and Xk, refer to Shaak series.	>60	0–16 16–60	Silty clay loam Silt loam	CL ML	A–6 A–4

estimated soil properties significant to engineering and interpretations for various engineering uses of the soils.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 4 and 5, and it also can be used to make other useful maps.

This information, however, does not eliminate the need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths of more than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists but are not known to all engineers. The Glossary defines many of these terms as they are commonly used in soil science.

Engineering classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*2*), used by the Soil Conservation Service, the Department of Defense, and other agencies, and the AASHTO system (*1*), adopted by the American Association of State Highway and Transportation Officials.

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. The Big Horn County Area has no highly organic soils. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML–CL.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system a soil is placed in one of seven basic groups that range from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b; A–2–4, A–2–5, A–2–6, A–2–7; and A–7–5 and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from

significant in engineering—Continued

Percentage larger than 3 inches	Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential	Frost-action potential	Corrosivity	
	No. 4	No. 10	No. 40	No. 200						Untreated steel	Concrete
					Inches per hour	*Inches per inch of soil*	*pH*				
	100	100	95–100	85–90	0.6–2.0	0.14–0.20	7.9–8.4	Moderate	High	High	Low.
15–35	35–65	30–60	15–50	15–35	0.6–2.0	0.08–0.10	7.4–7.8	Low	Moderate or low.	High	Low.
30–50	35–55	30–50	30–45	20–35	0.2–0.6	0.06–0.08	7.4–7.8	Low	Low	High	Low.
	100	100	95–100	75–90	<0.06	0.12–0.18	8.0–8.5	High	Moderate	High	Moderate.
	100	100	95–100	85–95	0.6–2.0	0.14–0.20	7.4–7.8	Moderate	High	High	Low.
	100	100	95–100	80–90	0.6–2.0	0.15–0.22	7.4–8.4	Low	High	High	Low.

0 for the best material to 20 or more for the poorest. The estimated classification, without group index numbers, is shown in table 4 for all soils mapped in the Area.

Estimated soil properties significant in engineering

Several estimated soil properties significant in engineering are shown in table 4. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of the columns in table 4.

Depth to bedrock and gravel is the distance from the surface of the soil to the upper surface of the rock layer.

Depth to seasonal high water table is not estimated for the soils of the Big Horn County Area, because the seasonal high water table is at a depth of 5 feet or more for most soils. It is at a depth of 1½ to 3 feet in Shonkin clay loam; at a depth of less than 3 feet in Haverson and Lohmiller soils, wet; at a depth of 2 to 5 feet in Haverson loam, saline, and Kyle clay, saline; at a depth of 3 to 5 feet in Haverson soils, saline, Korchea and Frazer soils, water table, and Lohmiller silty clay, saline, 2 to 4 percent slopes; and at a depth of 3 to 6 feet in Saline land.

Soil texture is described in table 4 in the standard terms used by the Department of Agriculture. These terms take into account the relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary of this soil survey.

Permeability is the quality of a soil that enables it to transmit water or air. It is estimated on the basis of soil characteristics observed in the field, particularly structure and texture. The estimates in table 4 do not take into account lateral seepage of such transient soil features as plowpans and surface crusts. A rate of less than 0.2 inch per hour is slow or very slow; 0.2 to 0.6 inch per hour is moderately slow; 0.6 inch to 2 inches, moderate; 2 to 6 inches, moderately rapid; and more than 6 inches, rapid or very rapid.

Available water capacity is the ability of a soil to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH value and terms

TABLE 5.—*Interpretations of engineering*

[An asterisk in the first column indicates that at least one mapping unit in the series is made up of two or more kinds of soil. The the instructions for referring to other

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
*Abac: Aa, AB, AC, AD For interpretations of the Bitton soil in AC, refer to the Bitton series. Rock outcrop part of AD is too variable to rate.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: slopes are more than 7 percent; bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.
*Absarokee: Ae, Af, Ag, AH, Ak, AL, AM For interpretations of the Castner soils in Ak, and AL, and Armington soils in AM, refer to the Castner and Armington series, respectively.	Moderate: bedrock at a depth of less than 40 inches. Severe where slopes are more than 15 percent.	Severe: bedrock at a depth of less than 40 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of less than 40 inches.	Severe: bedrock at a depth of less than 40 inches; slopes are more than 15 percent in places.
*Absher: An For interpretations of the Nobe soil, refer to the Nobe series.	Severe: very slow permeability.	Slight where slopes are 1 percent. Moderate where slopes are 2 to 4 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
*Adel: AO For interpretations of the Mayflower soil, refer to the Mayflower series.	Moderate: bedrock at a depth of 40 to 60 inches. Severe where bedrock is at a depth of less than 48 inches.	Moderate where slopes are 4 to 7 percent; moderate permeability. Severe where slopes are more than 7 percent; moderate permeability.	Moderate: bedrock at a depth of 40 to 60 inches.	Severe: high potential frost action.
Adger: Ap	Severe: slow permeability.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 7 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
Alice: Ar	Slight where slopes are 4 to 7 percent. Moderate where slopes are 8 to 15 percent.	Severe: moderately rapid permeability.	Slight where slopes are 4 to 7 percent. Moderate where slopes are 8 to 15 percent.	Moderate: moderate potential frost action.
*Allentine: Asa, Asb, Asc, Asd For interpretations of the Bone soils in Asc and Asd, refer to the Bone series.	Severe: very slow permeability.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 4 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
Alluvial land: ATa, ATb, ATc. Too variable to rate.				
*Amherst: Au, AVa, AVb, AVc, AVd For interpretations of the Maginnis soil in AVd, refer to the Maginnis series.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.

properties of the soils

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully series in the first column of this table]

Degree and kind of limitations for—Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type)[1]	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: bedrock at a depth of less than 20 inches; slopes are more than 25 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Poor: bedrock at a depth of less than 20 inches.	Not a source.	Poor: coarse fragments on surface; less than 8 inches thick.	Bedrock at a depth of less than 20 inches.	Bedrock at a depth of less than 20 inches.	Not applicable.
Severe: bedrock at a depth of less than 40 inches; slopes are more than 25 percent in places.	Moderate or severe: high or moderate shrink-swell potential; slopes are more than 15 percent in places.	Poor: high or moderate shrink-swell potential; slopes of more than 15 percent in places; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: silty clay loam texture.	Bedrock at a depth of 20 to 40 inches.	Moderate or high shrink-swell potential; fair or good compaction characteristics; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: less than 8 inches thick; clay texture.	All features favorable.	Medium compressibility; low shear strength; high shrink-swell potential.	Not applicable.
Severe: bedrock at a depth of 40 to 60 inches.	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Good	Moderately steep.	Medium piping hazard; bedrock at a depth of 40 to 60 inches.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture.	All features favorable.	Medium compressibility; high shrink-swell potential; low shear strength.	Slow permeability.
Severe: moderately rapid permeability.	Moderate: moderate potential frost action.	Fair: moderate potential frost action.	Poor for sand; excess fines.	Good	High seepage potential.	Medium piping hazard.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture.	All features favorable.	Medium compressibility; high shrink-swell potential; low shear strength.	Very slow permeability.
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Poor: bedrock at a depth of less than 20 inches; slopes are more than 25 percent in places.	Not a source.	Poor: more than 15 percent coarse fragments.	Bedrock at a depth of less than 20 inches.	Bedrock at a depth of less than 20 inches.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
Armington: AWa, AWb	Severe: very slow permeability.	Severe: slopes are more than 7 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
Arnegard: Axa, Axb, Axc	Moderate: slopes are 2 to 15 percent; moderate permeability.	Moderate where slopes are 2 to 7 percent. Severe where slopes are 8 to 15 percent.	Moderate: clay loam texture.	Severe: high potential frost action.
*Arvada: Ayd, Aye. For interpretations of the Bone soil in Aye, refer to the Bone series.	Severe: very slow permeability.	Moderate: slopes are 2 to 4 percent.	Severe: clay and silty clay texture.	Severe: high shrink-swell potential.
Ascalon: Az	Moderate: moderate permeability.	Severe: moderately rapid permeability below a depth of 30 inches.	Slight	Moderate: moderate potential frost action.
Babb: BA, BB	Moderate where slopes are 8 to 15 percent; moderate permeability. Severe where slopes are more than 15 percent.	Severe: slopes are more than 7 percent; moderately rapid permeability below a depth of 20 inches.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Moderate where slopes are 4 to 15 percent. Severe where slopes are more than 15 percent.
*Beauvais: Bc, Bd, Be, Bf. For interpretations of the Gilt Edge soil in Bf, refer to the Gilt Edge series.	Severe: slopes are 8 to 15 percent; moderately slow permeability.	Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.
*Belfield: Bg, Bh, Bk, Bm, Bn, Bo. For interpretations of the Adger soils in Bm, Bn, and Bo, refer to the Adger series.	Severe: moderately slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent.	Slight	Severe: high potential frost action.
Benteen: Bp, Br	Severe: bedrock at a depth of 20 to 40 inches.	Severe: slopes are more than 7 percent; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; bedrock at a depth of 20 to 40 inches.
Bew: Bs, Bt	Severe: slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 4 percent.	Severe: clay texture.	Severe: high shrink-swell potential.

properties of the soils—Continued

Degree and kind of limitations for—Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type)[1]	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture.	Moderately steep.	Poor compaction characteristics; high shrink-swell potential; low shear strength.	Not applicable.
Moderate: clay loam texture.	Severe: high potential frost action; low shear strength.	Poor: high potential frost action; low shear strength.	Not a source.	Good where slopes are less than 8 percent. Fair where slopes are 8 to 15 percent.	Slopes are more than 8 percent in places.	Medium piping hazard; low shear strength.	All features favorable.
Severe: clay and silty clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: less than 8 inches thick.	All features favorable.	Poor compaction characteristics; high shrink-swell potential; low shear strength.	Very slow permeability.
Severe: moderately rapid permeability below a depth of 30 inches.	Moderate: moderate potential frost action.	Fair: moderate potential frost action.	Poor for sand: excess fines.	Fair: sandy clay loam texture.	Moderately rapid permeability below a depth of 30 inches.	Piping hazard	Not applicable.
Severe: moderately rapid permeability below a depth of 20 inches.	Severe: slopes are more than 15 percent.	Fair or poor: slopes are more than 25 percent in places; moderate potential frost action.	Poor for gravel: excess fines.	Poor: more than 15 percent coarse fragments.	High seepage potential; moderately rapid permeability below a depth of 20 inches.	Steep slopes; piping hazard.	Not applicable.
Moderate: silty clay loam texture.	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Fair: silty clay loam texture.	Moderate seepage potential.	Medium piping hazard.	Moderately slow permeability.
Moderate: silty clay loam texture.	Severe: high potential frost action; low shear strength.	Poor: high potential frost action; low shear strength.	Not a source.	Fair: silty clay loam texture.	All features favorable.	Moderate shrink-swell potential; low shear strength.	Moderately slow permeability.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; slopes are more than 15 percent.	Poor: high potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: clay loam texture.	Bedrock at a depth of 20 to 40 inches.	High piping hazard; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture.	All features favorable.	High compressibility; poor compaction characteristics; high shrink-swell potential; low shear strength.	Slow permeability.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
Bitton: BU, BV	Slight where slopes are 2 to 7 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent	Severe: rapid permeability.	Severe: very gravelly material.	Slight where slopes are less than 15 percent. Severe where slopes are more than 15 percent.
Bone: Bw	Severe: very slow permeability.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 4 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
*Castner: CA, CB, CC, CD. For interpretations of the Reeder soils in CA and CB, and Vebar soil in CD, refer to the Reeder and Vebar series, respectively. Rock outcrop part of CC is too variable to rate.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.
Cherry: Ce	Severe: moderately slow permeability.	Moderate: slopes are 2 to 7 percent.	Slight: slopes are 2 to 7 percent.	Severe: high potential frost action.
Chugter: Cf, CG	Moderate: moderate permeability; slopes are 8 to 15 percent in places.	Moderate where slopes are 2 to 7 percent; moderate permeability. Severe where slopes are 7 to 15 percent.	Slight where slopes are 2 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.
*Clapper: CH, CK. For interpretations of the Harvey soil in CH and the Midway soil in CK, refer to the Harvey and Midway series, respectively.	Moderate where slopes are 8 to 15 percent; moderate permeability. Severe where slopes are more than 15 percent.	Severe: slopes are more than 7 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.
*Colby: Cm, Cn, Co, Cp, Cr, Cs, Ct, CU, Cv, CW, CX, CY. For interpretations of the Beauvais soils in Cs and Ct, the Clapper soil in CU, the Keiser soil in Cv, and the Midway soil in CW, refer to the Beauvais, Clapper, Keiser, and Midway series, respectively.	Moderate: moderate permeability; slopes are 8 to 15 percent in places.	Slight where slopes are 1 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Slight where slopes are 1 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.
Cushman: Cz	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; bedrock at a depth of 20 to 40 inches.

properties of the soils—Continued

Degree and kind of limitations for—Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type)[1]	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: rapid permeability.	Moderate: moderate potential frost action. Severe where slopes are more than 15 percent.	Good	Poor for gravel: excess fines.	Poor: more than 15 percent coarse fragments.	Rapid permeability.	Moderate compacted permeability; medium piping hazard.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: high salinity.	All features favorable.	High compressibility; high shrink-swell potential; low shear strength.	Very slow permeability.
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Poor: less than 20 inches thick.	Not a source.	Poor: more than 15 percent coarse fragments.	Bedrock at a depth of less than 20 inches.	Bedrock at a depth of less than 20 inches.	Not applicable.
Moderate: silty clay loam texture.	Severe: high potential frost action; low shear strength.	Poor: high potential frost action; low shear strength.	Not a source.	Fair: silty clay loam texture.	Slopes are more than 8 percent in places.	Moderate shrink-swell potential; low shear strength.	Moderately slow permeability.
Slight	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Good	Moderate permeability.	Moderate compacted permeability; high piping hazard.	Unstable ditch banks.
Slight where slopes are 8 to 15 percent. Moderate where slopes are 15 to 25 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Slight	Poor for gravel: excess fines.	Poor: more than 15 percent coarse fragments.	Slopes are more than 8 percent.	High piping hazard.	Not applicable.
Moderate: silty clay loam texture.	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Good to fair: silt loam and silty clay loam texture.	Moderate permeability.	Moderate permeability; erodible; medium shear strength.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action.	Poor: high potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: clay loam texture.	Bedrock at a depth of 20 to 40 inches.	Medium shear strength; bedrock at a depth of 20 to 40 inches.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
*Danvers: Da, Db, Dc, Dd, De, Df, Dg For interpretations of the Judith soils in De, Df, and Dg, refer to the Judith series.	Moderate: moderate permeability; slopes are 8 to 15 percent in places.	Moderate: moderate permeability. Severe where slopes are more than 7 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.
Darret Mapped only with Reeder soils.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.
*Dast: DHa, DHb, DHc, DHd, Dk For interpretations of the Parshall soil in Dk, refer to the Parshall series.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.
*Doney: DMa, DMb, Dn, DOa, DOb, DOc, DOd, DOe For interpretations of the Reeder soil in Dn, the Ringling soils in DOa, DOb, and DOc, and the Wayden soil in DOe, refer to the Reeder, Ringling and Wayden series, respectively. Rock outcrop part of DOd is too variable to rate.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.
*Duncom: Dp, DR, DS, DT For interpretations of the Tarrete soils in DS and DT, refer to the Tarrete series.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 20 percent in places.
Eltsac: Ec, Ed, EH	Severe: bedrock at a depth of 20 to 40 inches; very slow permeability.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.
*Farnuf: Fa, Fb, Fc, FD For interpretations of the Doney soil in FD, refer to the Doney series.	Moderate: moderate permeability; slopes are more than 8 percent in places.	Moderate where slopes are 2 to 7 percent; moderate permeability. Severe where slopes are more than 7 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.
Fergus: Fe, Ff, Fg	Severe: moderately slow permeability.	Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.
Fort Collins: Fh, Fk, Fm, Fn	Moderate: moderate permeability.	Moderate: moderate permeability; slopes are 2 to 7 percent.	Slight	Severe: high potential frost action.

properties of the soils—Continued

Degree and kind of limitations for—Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type)[1]	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Moderate: silty clay loam texture.	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Fair: silty clay loam texture.	Moderate permeability.	Moderate shrink-swell potential.	All features favorable.
Severe: bedrock at a depth of 20 to 40 inches.	Moderate or severe: moderate to high potential frost action.	Poor: bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: silty clay loam texture.	Bedrock at a depth of 20 to 40 inches.	Fair compaction characteristics; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 25 percent in places.	Moderate: moderate potential frost action. Severe where slopes are more than 15 percent.	Poor: bedrock at a depth of 20 to 40 inches.	Not a source.	Fair where slopes are 4 to 15 percent. Poor where slopes are more than 15 percent.	Steep slopes; moderately rapid permeability.	Medium piping hazard; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 25 percent in places.	Severe: slopes are more than 15 percent.	Poor: bedrock at a depth of 20 to 40 inches.	Not a source.	Poor: more than 15 percent coarse fragments.	Bedrock at a depth of 20 to 40 inches; moderately steep and steep in places.	Low shear strength; high piping hazard; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Poor: bedrock at a depth of less than 20 inches.	Not a source.	Poor: more than 15 percent coarse fragments.	Bedrock at a depth of less than 20 inches.	Bedrock at a depth of less than 20 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength; bedrock at a depth of 20 to 40 inches.	Not a source.	Poor: clay texture.	Shale at a depth of 20 to 40 inches; moderately steep in places.	High compressibility and shrink-swell potential; low shear strength; bedrock at a depth of 20 to 40 inches.	Not applicable.
Slight	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Good where slopes are 0 to 8 percent. Fair where slopes are 8 to 15 percent.	Moderate slopes in places.	High piping hazard.	Unstable ditch banks.
Moderate: silty clay loam texture.	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Good where slopes are 0 to 8 percent. Fair where slopes are 8 to 15 percent.	All features favorable.	Fair: fair compaction characteristics; medium shear strength; high piping hazard.	Moderately slow permeability.
Slight	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Fair: clay loam texture.	All features favorable.	High piping hazard.	All features favorable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
*Frazer: Fo, Fr, Fs, FT. For interpretations of the Korchea soil in FT, refer to the Korchea series.	Severe: slow permeability; flooding hazard.	Severe: flooding hazard.	Moderate: flooding hazard on river terraces.	Severe: high potential frost action; flooding hazard.
*Gilt Edge: Gc, Gd, Ge, Gf. For interpretations of the Bone soils in Ge and Gf, refer to the Bone series.	Severe: slow permeability.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 4 percent.	Slight	Severe: high shrink-swell potential.
Glenberg: Gg, Gh, Gk, Gm	Severe: flooding hazard.	Severe: moderately rapid permeability; flooding hazard.	Slight	Severe: flooding hazard.
Grail: Gn, Go, Gr, GS, Gt	Severe: moderately slow permeability; slopes are more than 15 percent in places.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Moderate where slopes are 0 to 15 percent; silty clay, clay loam texture. Severe where slopes are more than 15 percent.	Severe: high shrink-swell potential.
*Hanson: HA, HB. For interpretations of the Babb soil in HB, refer to the Babb series.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Severe: slopes are more than 7 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.
Harvey: Hca, Hcb, Hcc, Hd, He	Moderate: moderate permeability; slopes are 8 to 15 percent in places.	Moderate where slopes are 2 to 7 percent; moderate permeability. Severe where slopes are more than 7 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent.	Moderate: high potential frost action.
*Haverson: Hfa, Hfb, Hfc, Hfd, Hfe, Hff, Hfh, HGa, HGb, HGc, Hh, HK. For interpretations of the Hysham soil in Hfh, the Glenberg soil in HGa, and the Lohmiller soils in HGb, HGc, and Hh, refer to the Hysham, Glenberg, and Lohmiller series, respectively.	Moderate: moderate permeability; flooding hazard and high water table on the river terraces.	Moderate: moderate permeability; flooding hazard and high water table on the river terraces.	Slight or moderate: flooding hazard on the river terraces.	Severe: high potential frost action; flooding hazard and high water table on the river terraces.
*Heldt: Hla, Hlb, Hlc, Hld, Hle, Hlf, Hlg. For interpretations of the Hysham soils in Hlf and Hlg, refer to the Hysham series.	Severe: slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.

properties of the soils—Continued

Degree and kind of limitations for—Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type)[1]	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: flooding hazard.	Severe: high potential frost action; low shear strength.	Poor: high potential frost action; low shear strength.	Not a source.	Fair: silty clay loam texture.	All features favorable.	Low shear strength.	Flooding hazard.
Moderate: silty clay loam texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: less than 8 inches thick; clay texture.	All features favorable.	High shrink-swell potential; poor compaction characteristics; high compressibility; low shear strength.	Slow permeability.
Severe: moderately rapid permeability.	Moderate: moderate potential frost action.	Fair: moderate potential frost action.	Poor for sand: excess fines.	Good	Moderately rapid permeability.	High piping hazard; moderate compacted permeability.	Unstable ditch banks.
Severe: silty clay loam texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Fair: clay loam texture.	Slopes are more than 15 percent.	Medium compaction characteristics; low shear strength.	Moderately slow permeability.
Slight where slopes are 8 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Fair where slopes are 8 to 25 percent. Poor where slopes are more than 25 percent.	Poor for sand and gravel: excess fines.	Poor: more than 15 percent coarse fragments.	Very steep slopes.	High piping hazard.	Not applicable.
Slight	Severe: high potential frost action.	Good	Not a source.	Good where slopes are 0 to 8 percent. Fair where slopes are 8 to 15 percent.	Moderate permeability; slopes are 0 to 15 percent.	Medium stability and shear strength; high piping hazard.	Not applicable.
Slight or moderate: flooding hazard on the river terraces.	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Good	Water table at a depth of 3 to 5 feet on the river terraces.	Low shear strength; high piping hazard.	Unstable ditch banks.
Moderate: silty clay loam texture.	Severe: high potential frost action; low shear strength.	Poor: high potential frost action; low shear strength.	Not a source.	Fair: silty clay loam texture.	Moderate slopes in places.	Fair compaction characteristics; moderate shrink-swell potential; low shear strength.	Slow permeability.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
Hesper: Hma, Hmb, Hmc	Severe: moderately slow permeability.	Slight: slopes are 2 to 7 percent in places.	Slight	Moderate or severe: high or moderate potential frost action.
*Hydro: Hna, Hnb, Hnc, Hnd, Hne, Hnf, Hng, Hnh, Hnk. For interpretations of the Allentine soils in Hng and Hnh, and the Gilt Edge soil in Hnk, refer to the Allentine and Gilt Edge series, respectively.	Severe: slow permeability.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 7 percent.	Severe: silty clay texture.	Severe: high shrink-swell potential.
*Hysham: Ho, Hp, Hr, HS, HT. For interpretations of the Midway soil in HS and the Lohmiller soil in HT, refer to the Midway and Lohmiller series, respectively.	Severe: slow permeability.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.
*Judith: Jc, Jd, Je, Jh, Jk. For interpretations of the Windham soils in Jh and Jk, refer to the Windham series.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Severe: very gravelly below a depth of 25 inches.	Severe: high potential frost action.
*Keiser: Kc, Kd, Ke, Kf. For interpretations of the Colby soil in Kf, refer to the Colby series.	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight	Severe: high potential frost action.
Kim: Kg	Moderate: moderate permeability; slopes are 8 to 15 percent in places.	Moderate where slopes are 4 to 7 percent. Severe where slopes are more than 7 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.
*Korchea: Kh, Kk, Km, Kn, Ko, Kp, KR. For interpretations of the Frazer soil in KR, refer to the Frazer series.	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight	Severe: high potential frost action.
Kyle: Ks, Kt, Ku, KV, Kw	Severe: very slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
La Fonda: La	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight	Severe: high potential frost action.

properties of the soils—Continued

Degree and kind of limitations for—Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type)[1]	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Moderate: silty clay loam texture.	Severe: high or moderate potential frost action; low shear strength.	Poor: high potential frost action; low shear strength. Good below a depth of 40 inches.	Good for sand and clay: 4 to 5 feet of overburden.	Poor: less than 8 inches thick.	Very rapid permeability below a depth of 40 inches.	Medium to low shear strength; high compacted permeability below a depth of 40 inches.	Moderately slow permeability.
Severe: silty clay texture.	Severe: high or moderate potential frost action; high shrink-swell potential; low shear strength.	Poor: high or moderate potential frost action.	Not a source.	Poor: silty clay texture.	Moderate slopes in places.	Medium shear strength; high piping hazard below a depth of 30 inches.	Not applicable.
Moderate: silty clay loam texture.	Severe: high potential frost action; low shear strength.	Poor: high potential frost action; low shear strength.	Not a source.	Poor: contains soluble salts and sodium.	All features favorable.	Poor compaction characteristics; medium piping hazard; low shear strength.	Unstable ditch banks.
Severe: very gravelly loam below a depth of 25 inches.	Severe: high potential frost action.	Good	Poor for gravel: excess fines.	Good	High seepage potential.	High piping hazard.	Not applicable.
Moderate: silty clay loam texture.	Severe: high potential frost action; low shear strength.	Poor: high potential frost action.	Not a source.	Fair: silty clay loam texture.	Moderate permeability.	High piping hazard.	Not applicable.
Slight	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Good where slopes are 4 to 8 percent. Fair where slopes are 8 to 15 percent.	Moderate permeability.	High piping hazard; low shear strength; erodible.	Not applicable.
Slight	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Good	Moderate seepage potential.	High piping hazard; medium shear strength; erodible.	Unstable ditch banks.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high potential frost action; low shear strength.	Not a source.	Poor: clay texture.	Moderate slopes in places.	High compressibility; high shrink-swell potential; low shear strength.	Very slow permeability.
Slight	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Fair: less than 16 inches thick.	Moderate permeability.	High piping hazard.	Unstable ditch banks.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
*Lap: LCa, LCb, LCc, LCd For interpretations of the Trulon soil in LCa, and the Armington soil in LCd, refer to the Trulon and Armington series, respectively.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.
*Lavina: LD For interpretations of the Travessilla soil, refer to the Travessilla series.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.
*Lennep: Lea, Leb, Lec, Led For interpretations of the Adger soils in Lec and Led, refer to the Adger series.	Severe: slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent.	Severe: silty clay texture.	Severe: high shrink-swell potential.
*Lismas: LF, LG, LH, LK, LM, LN For interpretations of the Vananda soil in LN, refer to the Vananda series. Shale outcrop parts of LK and LM are too variable to rate.	Severe: bedrock at a depth of less than 20 inches; very slow permeability; slopes are more than 15 percent.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.
*Lohmiller: Lo, Lp, Lr, Ls, Lt, Lu, LV For interpretations of the Midway soil in LV, refer to the Midway series.	Severe: moderately slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Slight	Severe: high potential frost action.
Macar: Ma	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight	Severe: high potential frost action.
*Maginnis: MB, MC For interpretation of the Windham soil in MC, refer to the Windham series. Shale outcrop part of MB is too variable to rate.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent.
Marias: Md, Me, Mf, Mg	Severe: very slow permeability.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
*Maschetah: MH, MK For interpretations of the Norbert soil in MK, refer to the Norbert series.	Severe: moderately slow permeability; slopes are more than 15 percent.	Severe: slopes are more than 7 percent.	Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Severe: high potential frost action.

properties of the soils—Continued

Degree and kind of limitations for—Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type)[1]	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Poor: bedrock at a depth of less than 20 inches.	Not a source.	Poor: more than 15 percent coarse fragments.	Bedrock at a depth of less than 20 inches.	Medium piping hazard; coarse fragments; bedrock at a depth of less than 20 inches.	Not applicable.
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Poor: bedrock at a depth of less than 20 inches.	Not a source.	Poor: more than 15 percent coarse fragments.	Bedrock at a depth of less than 20 inches.	Bedrock at a depth of less than 20 inches.	Not applicable.
Severe: silty clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Fair: less than 16 inches thick; silty clay loam texture.	All features favorable.	Fair compaction characteristics; high shrink-swell potential; low shear strength.	Not applicable.
Severe: bedrock at a depth of less than 20 inches; slopes are more than 25 percent in places.	Severe: bedrock at a depth of less than 20 inches; high shrink-swell potential.	Poor: shale at a depth of less than 20 inches; high shrink-swell potential.	Not a source.	Poor: clay texture.	Shale at a depth of less than 20 inches.	Poor compaction characteristics; high shrink-swell potential; bedrock at a depth of less than 20 inches.	Not applicable.
Moderate: silty clay loam texture.	Severe: high potential frost action; low shear strength.	Poor: high potential frost action; low shear strength.	Not a source.	Fair: silty clay loam texture.	All features favorable.	Fair compaction characteristics; medium to low shear strength.	Moderately slow permeability.
Slight	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Good	All features favorable.	High piping hazard.	Not applicable.
Severe: bedrock at a depth of less than 20 inches; slopes are more than 25 percent.	Severe: shale at a depth of less than 20 inches.	Poor: shale at a depth of less than 20 inches; high shrink-swell potential.	Not a source.	Poor: more than 15 percent coarse fragments; silty clay, clay texture.	Steep; bedrock at a depth of less than 20 inches.	Medium compressibility; high content of gravel and channers; bedrock at a depth of less than 20 inches.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture.	All features favorable.	High compressibility; high shrink-swell potential; low shear strength.	Very slow permeability.
Moderate: silty clay loam texture.	Severe: high potential frost action.	Poor: high potential frost action; slopes are more than 25 percent in places.	Not a source.	Fair where slopes are 8 to 15 percent. Poor where slopes are more than 15 percent.	Slopes are more than 15 percent in places.	Fair compaction characteristics.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
Mayflower: Mm, MN	Severe: bedrock at a depth of 20 to 40 inches.	Severe: slopes are more than 7 percent; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.
McKenzie: Mo	Severe: very slow permeability.	Slight	Severe: clay texture.	Severe: high shrink-swell potential.
McRae: Mp, Mr, Ms, Mt	Moderate: moderate permeability. Severe where slopes are more than 15 percent.	Moderate where slopes are 2 to 7 percent; moderate permeability. Severe where slopes are more than 7 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Severe: high potential frost action.
*Midway: Mu, MVa, MVb, MVc, MVd, MVe, MVf, MVg. For interpretations of the Lismas soils in MVc and MVd, the Thedalund soils in MVe and MVf, and the Thurlow soil in MVg, refer to the Lismas, Thedalund, and Thurlow series, respectively.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.
Morton: Mw	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.
*Nelson: Nd, Ne, NF. For interpretations of the Alice soil in Ne, and the Glenberg soil in NF, refer to the Alice and Glenberg series, respectively.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: moderately rapid permeability; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.
Neville: Ng	Severe: bedrock at a depth of 40 to 60 inches.	Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Moderate: bedrock at a depth of 40 to 60 inches.	Severe: high potential frost action.
Nobe. Mapped only with Absher soils.	Severe: very slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 4 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
*Norbert: NH, NK. For interpretations of the Eltsac soil in NH, refer to the Eltsac series. Shale outcrop part of NK is too variable to rate.	Severe: very slow permeability; bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.

properties of the soils—Continued

Degree and kind of limitations for—Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type)[1]	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: bedrock at a depth of 20 to 40 inches.	Moderate or severe: high or moderate potential frost action; bedrock at a depth of 20 to 40 inches.	Poor: high or moderate potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair or poor: silty clay loam, silty clay texture.	Steep in places	Medium compressibility; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture.	All features favorable.	Poor compaction characteristics; high compressibility; low shear strength.	Very slow permeability.
Slight where slopes are 0 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more 25 percent.	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Good where slopes are 0 to 8 percent. Fair where slopes are 8 to 15 percent. Poor where slopes are more than 15 percent.	All features favorable.	High piping hazard.	Not applicable.
Severe: bedrock at a depth of less than 20 inches; slopes are more than 25 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Poor: shale at a depth of less than 20 inches.	Not a source.	Poor: less than 8 inches thick.	Shale at a depth of less than 20 inches.	Fair compaction characteristics; medium compressibility; shale at a depth of less than 20 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action.	Poor: high potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: silty clay loam texture.	Moderate: moderate permeability.	Low shear strength; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: moderately rapid permeability; bedrock at a depth of 20 to 40 inches.	Moderate: moderate potential frost action; slopes are more than 15 percent.	Poor: bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: less than 16 inches thick.	Moderately rapid permeability.	Medium shear strength and piping hazard; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of 40 to 60 inches.	Severe: high potential frost action.	Poor: high potential frost action; bedrock at a depth of 40 to 60 inches.	Not a source.	Good	Moderate permeability.	Medium piping hazard; bedrock at a depth of 40 to 60 inches.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture: high content of salts.	All features favorable.	High shrink-swell potential; low shear strength.	Very slow permeability.
Severe: clay texture; bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Poor: shale at a depth of less than 20 inches.	Not a source.	Poor: clay texture.	Shale at a depth of less than 20 inches.	High shrink-swell potential; low shear strength; bedrock at a depth of less than 20 inches.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
*Nunn: Nm, Nn, No, Nr, NS For interpretations of the Midway soil in NS, refer to the Midway series.	Severe: slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Moderate: clay loam texture; slopes are 8 to 15 percent in places.	Severe: high potential frost action.
Olney: On	Slight	Moderate where slopes are 4 to 7 percent; moderately rapid permeability below a depth of 25 inches. Severe where slopes are more than 7 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent.	Moderate: moderate potential frost action.
Parshall: Pa	Slight	Severe: moderately rapid permeability.	Slight	Moderate: moderate potential frost action.
*Peritsa: Pd, PE, PF For interpretations of the Abac soil in PE, refer to the Abac series.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; bedrock at a depth of 20 to 40 inches.
*Pierre: Pg, Ph, Pk, PM, PN For interpretations of the Kyle soil in Pk, and the Lismas soils in PM and PN, refer to the Kyle and Lismas series, respectively.	Severe: very slow permeability; bedrock at a depth of 20 to 40 inches.	Severe: slopes are more than 7 percent in places; bedrock at a depth of 20 to 40 inches.	Severe: clay texture; bedrock at a depth of 20 to 40 inches.	Severe: high shrink-swell potential; bedrock at a depth of 20 to 40 inches.
*Pultney: PO For interpretations of the Neville soil, refer to the Neville series.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; bedrock at a depth of 20 to 40 inches.
Quietus: QU	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent.	Severe: slopes are more than 15 percent; bedrock at a depth of 20 to 40 inches.
Raynesford: Ra	Severe: moderately slow permeability.	Moderate: slopes are 4 to 8 percent.	Severe: very gravelly.	Moderate or severe: high or moderate potential frost action. Good below a depth of 30 inches.

properties of the soils—Continued

Degree and kind of limitations for—Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type)[1]	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Moderate: clay loam texture.	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Fair: silty clay loam texture.	All features favorable.	Moderate shrink-swell potential; medium shear strength.	All features favorable.
Slight	Moderate: moderate potential frost action.	Fair: moderate potential frost action.	Poor for sand: excess fines.	Fair: sandy clay loam texture.	Moderate permeability.	High piping hazard.	All features favorable.
Severe: moderately rapid permeability.	Moderate: moderate potential frost action.	Fair: moderate potential frost action.	Poor for sand: excess fines.	Good	Moderately rapid permeability.	High piping hazard.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action.	Poor: high potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Good	All features favorable.	High piping hazard; low shear strength; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high shrink-swell potential; slopes are more than 15 percent in places.	Poor: high shrink-swell potential; bedrock at a depth of 20 to 40 inches.	Not a source.	Poor: clay texture.	Steep in places	Poor compaction characteristics; high shrink-swell potential; low shear strength; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action.	Poor: high potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Good or fair: 0 to 15 percent coarse fragments.	Bedrock at a depth of 20 to 40 inches.	Medium piping hazard; medium shear strength; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 25 percent in places.	Severe: slopes are more than 15 percent.	Poor: bedrock at a depth of 20 to 40 inches; slopes are as much as 25 percent.	Not a source.	Poor: slopes are more than 15 percent.	Moderately steep and steep.	Medium piping hazard; bedrock at a depth of 20 to 40 inches.	Not applicable.
Slight	Moderate or severe: high or moderate potential frost action.	Poor or fair: high or moderate potential frost action. Good below a depth of 30 inches.	Poor for gravel: excess fines.	Fair: more than 5 percent coarse fragments.	All features favorable.	High piping hazard.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
*Reeder: Rda, Rdb, Rdc, REa, REb, REc, REd. For interpretations of the Regent soil in REa, the Rentsac soil in REb, and the Darret soils in REc and REd, refer to the Regent, Rentsac, and Darret series, respectively.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: slopes are more than 7 percent in places; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; high potential frost action.
Regent: Rfa, Rfc, Rfd	Severe: bedrock at a depth of 20 to 40 inches.	Severe: slopes are more than 7 percent in places; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; bedrock at a depth of 20 to 40 inches.
Renohill: Re	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: high shrink-swell potential; bedrock at a depth of 20 to 40 inches.
*Rentsac: RH. For interpretations of the Doney soil, refer to the Doney series.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.
*Richfield: Rk, Rlc, Rld, Rle, Rlf. For interpretations of the Beauvais soils in Rle and Rlf, refer to the Beauvais series.	Severe: moderately slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent.	Slight	Severe: high potential frost action.
Ringling. Mapped only with Doney soils.	Severe: slopes are more than 15 percent in places; bedrock at a depth of less than 20 inches.	Severe: slopes are more than 7 percent in places; bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches.
Riverwash: RM. Too variable to rate.				
*Rock outcrop: RN, RO, RP, RR, RS. Too variable to rate. For interpretations of the Duncom soil in RN, the Lap soil in RO, the Pultney soil in RP, the Rentsac soil in RR, and the Windham soil in RS, refer to the Duncom, Lap, Pultney, Rentsac, and Windham series, respectively.				
*Rottulee: Rt, Ru, Rv, RW. For interpretations of the Abac soil in RW, refer to the Abac series.	Severe: bedrock at a depth of 20 to 30 inches.	Severe: bedrock at a depth of 20 to 30 inches.	Severe: bedrock at a depth of 20 to 30 inches.	Severe: bedrock at a depth of 20 to 30 inches; high potential frost action.
Ryorp: Ry	Severe: bedrock at a depth of 20 to 40 inches.	Severe: rapid permeability; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; bedrock at a depth of 20 to 40 inches.

properties of the soils—Continued

Degree and kind of limitations for—Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type)[1]	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; slopes are more than 15 percent in places.	Poor: high potential frost action; slopes are more than 25 percent in places; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: clay loam texture.	Bedrock at a depth at 20 to 40 inches; slopes are more than 15 percent in places.	Moderate stability; medium piping hazard; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; slopes are more than 15 percent in places.	Poor: high potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: silty clay loam texture.	Bedrock at a depth of less than 40 inches.	Fair compaction characteristics; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high shrink-swell potential; slopes are more than 15 percent in places.	Poor: high shrink-swell potential; bedrock at a depth of 20 to 40 inches.	Not a source.	Poor: silty clay texture.	Bedrock at a depth of 20 to 40 inches.	Fair compaction characteristics; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Poor: bedrock at a depth of less than 20 inches.	Not a source.	Poor: less than 8 inches thick.	Bedrock at a depth of less than 20 inches.	Bedrock at a depth of less than 20 inches.	Not applicable.
Slight or moderate: silty clay loam, silt loam texture.	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Fair: silty clay loam texture.	All features favorable.	High piping hazard.	Unstable ditch banks.
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent.	Poor: bedrock at a depth of less than 20 inches.	Not a source.	Poor: more than 15 percent coarse fragments.	High seepage potential.	Bedrock at a depth of less than 20 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 30 inches.	Severe: high potential frost action.	Poor: high potential frost action; bedrock at a depth of 20 to 30 inches.	Not a source.	Good to poor: 0 to 40 percent coarse fragments.	Bedrock at a depth of less than 3 feet.	High piping hazard; bedrock at a depth of 20 to 30 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action.	Poor: high potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Poor: loose when dry.	Rapid permeability; moderately steep.	Medium piping hazard; moderately steep; bedrock at a depth of 20 to 40 inches.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
Saline land: SA. Too variable to rate.				
*Savage: Sd, Sea, Seb, Sec, Sed, Sef, SF For interpretations of the Wayden soil in Sef and the Frazer soil in SF, refer to the Wayden and Frazer series, respectively.	Severe: moderately slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Severe: silty clay texture.	Severe: high shrink-swell potential; slopes are more than 8 percent in places.
Sawcreek Mapped only with Splitro soils.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: rapid permeability; slopes are more than 7 percent; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 8 percent in places.
*Searing: Sg, SH, SI For interpretations of the Ringling soil in SI, refer to the Ringling series.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; high potential frost action.
Shaak: Ska, Skb, Skc, Skd, Ske, SM	Severe: slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more 7 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high or moderate potential frost action; high or moderate shrink-swell potential.
*Shale outcrop: SOa, SOc, SOd. Too variable to rate. For interpretations of the Midway soil in SOc and the Norbert soil in SOd, refer to the Midway and Norbert series, respectively.				
Shonkin: Sp	Severe: slow permeability; flooding hazard; water table at a depth of 1½ to 3 feet.	Severe: water table at a depth of 1½ to 3 feet.	Severe: clay and silty clay texture; water table at a depth of 1½ to 3 feet.	Severe: flooding hazard; high shrink-swell potential; water table at a depth of 1½ to 3 feet.
Sofia: Sra, Srb	Severe: slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 4 percent.	Severe: silty clay texture.	Severe: high shrink-swell potential.

properties of the soils—Continued

Degree and kind of limitations for—Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type)[1]	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: silty clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: silty clay texture.	All features favorable.	High shrink-swell potential; low shear strength.	Moderately slow permeability.
Severe: bedrock at a depth of 20 to 40 inches.	Moderate where slopes are less than 15 percent; moderate potential frost action. Severe where slopes are more than 15 percent.	Poor: bedrock at a depth of 20 to 40 inches.	Not a source.	Poor: loose when dry.	Rapid permeability.	Moderate potential frost action; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action.	Poor: high potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: less than 16 inches thick. Poor where slopes are more than 15 percent.	Moderate permeability.	High piping hazard; bedrock at a depth of 20 to 40 inches.	Not applicable.
Moderate or severe: silty clay loam, clay texture.	Severe: high or moderate potential frost action; high or moderate shrink-swell potential; low shear strength.	Poor: high or moderate potential frost action; high or moderate shrink-swell potential; low shear strength.	Not a source.	Fair or poor: clay, clay loam texture.	Slopes are more than 15 percent in places.	Low shear strength; medium compressibility.	Slow permeability.
Severe: flooding hazard; clay and silty clay texture; water table at a depth of 1½ to 3 feet.	Severe: flooding hazard; high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay, silty clay texture.	All features favorable.	High shrink-swell potential; low shear strength.	Slow permeability.
Severe: silty clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength to a depth of 40 inches, good below.	Good for gravel below a depth of 40 inches.	Poor: silty clay texture.	Very rapid permeability below a depth of 40 inches.	High shrink-swell potential; medium compressibility; high compacted permeability below a depth of 40 inches.	Slow permeability.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
*Spearfish: SSa, SSb, SSc, SSd For interpretations of the Clapper soil in SSa, and the Pultney soils in SSc and SSd, refer to the Clapper and Pultney series, respectively. Rock outcrop part of SSb is too variable to rate.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches.
*Spearman: St, SU For interpretations of the Wibaux soil in SU, refer to the Wibaux series.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 8 percent in places.
*Splitro: SVa, SVb For interpretations of the Sawcreek soil, refer to the Sawcreek series.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 8 percent in places.
Stormitt: Swa, Swb, SX	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Moderate: moderate permeability. Severe where slopes are more than 7 percent.	Severe: very gravelly texture.	Moderate: moderate potential frost action. Severe where slopes are more than 15 percent.
*Talag: Taa, Tab For interpretations of the Allentine soil in Tab, refer to the Allentine series.	Severe: very slow permeability.	Slight where slopes are 0 to 1 percent. Moderate where slopes are 2 to 7 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
Tarrete: Tb	Severe: slow permeability.	Severe: slopes are more than 7 percent.	Severe: silty clay or clay texture.	Severe: high shrink-swell potential.
Terrace escarpments: TCa, TCb. Too variable to rate.				
*Terry: Td, TE For interpretations of the Travessilla soil in TE, refer to the Travessilla series.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.
Teton: TFa, TFb	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 7 percent.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 8 percent in places.

properties of the soils—Continued

Degree and kind of limitations for—Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type)[1]	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Poor: bedrock at a depth of less than 20 inches; slopes are more than 25 percent in places.	Not a source.	Fair: less than 16 inches thick.	Bedrock at a depth of less than 20 inches; steep.	Medium piping hazard; bedrock at a depth of less than 20 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; slopes are more than 15 percent in places.	Poor: high potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: less than 16 inches thick.	Moderate permeability.	Fair compaction characteristics; medium piping hazard; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Poor: bedrock at a depth of less than 20 inches.	Not a source.	Poor: loose when dry.	Moderately rapid permeability; sandstone at a depth of less than 20 inches.	Moderate permeability; medium piping hazard; bedrock at a depth of less than 20 inches.	Not applicable.
Moderate: moderate permeability. Severe where slopes are more than 25 percent.	Moderate: moderate potential frost action. Severe where slopes are more than 15 percent.	Fair: moderate potential frost action.	Poor for gravel: excess fines.	Poor: more than 15 percent coarse fragments.	Moderate permeability.	Medium piping hazard.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture.	All features favorable.	High shrink-swell potential; high compressibility; low shear strength.	Not applicable.
Severe: clay texture.	Severe: high shrink-swell potential; slopes are more than 15 percent; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: silty clay texture.	Slopes are more than 8 percent in places.	High shrink-swell potential; low shear strength.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Moderate: moderate potential frost action.	Poor: bedrock at a depth of 20 to 40 inches.	Not a source.	Good	High seepage potential.	Medium susceptibility to piping; bedrock at a depth of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 25 percent in places.	Severe: high potential frost action; slopes are more than 15 percent in places.	Poor: high potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair where slopes are 8 to 15 percent. Poor where slopes are more than 15 percent.	Steep	Fair compaction characteristics; medium susceptibility to piping; bedrock at a depth of 20 to 40 inches.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
*Thedalund: Tg, THa, THb, THc, THd, THe, THf, THg, THh, THk, THl, THm, THn, THo. For interpretations of the Clapper soil in THa, the Cushman soil in THb, the Fort Collins soil in THc, the McRae soil in THd, the Midway soil in THe, the Nelson soil in THf, the Travessilla soil in THk, and the Wibaux soils in THl, THm, THn, and THo, refer to the Clapper, Cushman, Fort Collins, McRae, Midway, Nelson, Travessilla, and Wibaux series, respectively. Rock outcrop parts of THg and THh are too variable to rate.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 8 percent in places.
*Thurlow: Tk, Tm, Tn, To. For interpretations of the Midway soil in To, refer to the Midway series.	Severe: moderately slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.
*Toluca: Tp. For interpretations of the Harvey soil, refer to the Harvey series.	Slight	Severe: very rapid permeability below a depth of 40 inches.	Slight	Severe: high potential frost action.
*Travessilla: TR, TS. For interpretations of the Thedalund soil in TS, refer to the Thedalund series. Rock outcrop part of TR is too variable to rate.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 8 percent in places.
Trulon. Mapped only with Lap soils.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; high or moderate potential frost action.
Tullock: Tu	Severe: bedrock at a depth of 20 to 40 inches.	Severe: rapid permeability; bedrock at a depth of 20 to 40 inches.	Moderate: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.
*Twin Creek: Tv, Tw, Tx, TY. For interpretations of the Korchea soil in TY, refer to the Korchea series.	Moderate: moderate permeability.	Moderate where slopes are less than 7 percent; moderate permeability. Severe where slopes are more than 7 percent.	Slight	Severe: high potential frost action; slopes are more than 8 percent in places.

properties of the soils—Continued

Degree and kind of limitations for—Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type)[1]	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: bedrock at a depth of 20 to 40 inches; slopes are more than 25 percent in places.	Severe: high potential frost action; slopes are more than 15 percent in places.	Poor: high potential frost action; slopes are more than 25 percent in places; bedrock at a depth of 20 to 40 inches.	Not a source.	Fair: less than 16 inches thick.	Bedrock at a depth of 20 to 40 inches.	Medium susceptibility to piping; bedrock at a depth of 20 to 40 inches.	Not applicable.
Moderate: silty clay loam texture.	Severe: high potential frost action; low shear strength.	Poor: high potential frost action; low shear strength.	Not a source.	Fair: silty clay loam texture.	All features favorable.	Moderate shrink-swell potential; low shear strength.	All features favorable.
Severe: very rapid permeability below a depth of 40 inches.	Severe: high potential frost action.	Poor above a depth of 40 inches: high potential frost action. Good below a depth of 40 inches.	Good for gravel and sand below a depth of 40 inches.	Fair: clay loam texture.	Very rapid permeability below a depth of 40 inches.	All features favorable; high compacted permeability below a depth of 40 inches.	All features favorable.
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Poor: bedrock at a depth of less than 20 inches.	Not a source.	Poor: less than 8 inches thick.	Bedrock at a depth of less than 20 inches.	Medium susceptibility to piping; bedrock at a depth of less than 20 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Moderate or severe: high or moderate potential frost action; slopes are more than 15 percent in places.	Poor: bedrock at a depth of 20 to 40 inches.	Not a source.	Poor: more than 15 percent coarse fragments.	Bedrock at a depth of 20 to 40 inches.	Medium susceptibility to piping; bedrock at a depth of of 20 to 40 inches.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches.	Moderate: bedrock at a depth of 20 to 40 inches. Severe where slopes are more than 15 percent.	Poor: bedrock at a depth of 20 to 40 inches.	Not a source.	Poor: loose when dry.	Rapid permeability; bedrock at a depth of 20 to 40 inches.	Sandy; rapid permeability; bedrock at a depth of 20 to 40 inches.	Not applicable.
Slight	Severe: high potential frost action; slopes are more than 15 percent in places.	Poor: high potential frost action.	Not a source.	Good	All features favorable.	High piping hazard; low shear strength.	Not applicable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—			
	Septic-tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements
Vananda: Va, Vc	Severe: very slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Severe: clay texture.	Severe: high shrink-swell potential.
Vebar: Vd, Ve, VF, VH, VM. For interpretations of the Castner soils in VF and VH, refer to the Castner series.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: moderately rapid permeability; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; bedrock at a depth of 20 to 40 inches.
Wages: Wa, Wb, Wc	Slight	Moderate: moderate permeability.	Slight	Severe: high potential frost action.
*Wayden: WD, WE, WF, WG, WH, WI, WK, WL, WM, WN, WO. For interpretations of the Arnegard soil in WF, the Grail soil in WG, the Judith soil in WH, the Regent soil in WI, and the Savage soil in WK, refer to the Arnegard, Grail, Judith, Regent, and Savage series, respectively. Rock outcrop parts of WL and WM and Shale outcrop part of WN are too variable to rate.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: shale at a depth of less than 20 inches; slopes are more than 8 percent in places.
*Wibaux: Wp, Wr. For interpretations of the Spearman soil in Wr, refer to the Spearman series.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 7 percent.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 15 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 8 percent in places.
*Windham: Ws, WT, WU, WV, WW, WX. For interpretations of the Arnegard soil in WU, the Norbert soil in WV, the Wayden soil in WW, and the Lap soil in WX, refer to the Arnegard, Norbert, Wayden, and Lap series, respectively.	Severe: moderately slow permeability.	Moderate where slopes are 4 to 7 percent. Severe where slopes are more than 7 percent.	Severe: very gravelly.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.
Winnett: Wy	Severe: very slow permeability; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: clay texture; bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches; high shrink-swell potential.
*Xavier: Xa, Xc, Xe, Xh, Xk. For interpretations of the Shaak soils in Xh and Xk, refer to the Shaak series.	Moderate: moderate permeability.	Moderate where slopes are less than 7 percent; moderate permeability. Severe where slopes are more than 7 percent.	Slight where slopes are 2 to 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: high potential frost action.

[1] Onsite studies of the underlying strata, water table, and hazards of aquifer pollution and drainage into ground water are

properties of the soils—Continued

Degree and kind of limitations for—Continued		Suitability as a source of—			Soil features affecting—		
Sanitary landfills (trench type)[1]	Roads and parking areas	Road fill	Sand or gravel	Topsoil	Pond reservoir areas	Dams, dikes, and levees	Drainage for crops and pasture
Severe: clay texture.	Severe: high shrink-swell potential; low shear strength.	Poor: high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture; high alkalinity.	All features favorable.	Poor compaction characteristics; high compressibility; low shear strength.	Not applicable.
Severe: moderately rapid permeability; bedrock at a depth of 20 to 40 inches.	Severe: high potential frost action; slopes are more than 15 percent in places.	Poor: high potential frost action; bedrock at a depth of 20 to 40 inches.	Not a source.	Good	Moderately rapid permeability; bedrock at a depth of 20 to 40 inches.	Bedrock at a depth of 20 to 40 inches.	Not applicable.
Slight	Severe: high potential frost action.	Poor: high potential frost action.	Poor for sand below a depth of 30 inches: excess fines.	Good	Moderate perability.	Moderate shear strength and permeability; high piping hazard.	Unstable ditch banks.
Severe: bedrock at a depth of less than 20 inches; slopes are more than 25 percent in places.	Severe: shale at a depth of less than 20 inches; slopes are more than 15 percent in places.	Poor: shale at a depth of less than 20 inches.	Not a source.	Poor: less than 8 inches thick.	Steep; bedrock at a depth of less than 20 inches.	Moderate shrink-swell potential; bedrock at a depth of less than 20 inches.	Not applicable.
Severe: bedrock at a depth of less than 20 inches; slopes are more than 25 percent in places.	Severe: bedrock at a depth of less than 20 inches; slopes are more than 8 percent.	Poor: bedrock at a depth of less than 20 inches; slopes are more than 25 percent in places.	Not a source.	Poor: more than 15 percent coarse fragments.	Slopes are more than 8 percent in places; bedrock at a depth of less than 20 inches.	Bedrock at a depth of less than 20 inches.	Not applicable.
Slight where slopes are 4 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Good where slopes are 0 to 15 percent. Fair where slopes are 15 to 25 percent. Poor where slopes are more than 25 percent.	Poor for gravel: excess fines.	Poor: more than 15 percent coarse fragments.	Steep; high seepage potential.	High piping hazard; medium compacted permeability.	Not applicable.
Severe: bedrock at a depth of 20 to 40 inches; clay texture.	Severe: high shrink-swell potential; low shear strength.	Fair: bedrock at a depth of 20 to 40 inches; high shrink-swell potential; low shear strength.	Not a source.	Poor: clay texture.	Bedrock at a depth of 20 to 40 inches; moderate seepage potential.	Fair compaction characteristics; bedrock at a depth of 20 to 40 inches.	Not applicable.
Slight	Severe: high potential frost action.	Poor: high potential frost action.	Not a source.	Fair: silty clay loam texture.	Slopes are more than 8 percent in places.	High piping hazard; low shear strength.	Not applicable.

needed for landfills more than 5 or 6 feet deep.

used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. The extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material that has this rating.

Frost-action potential indicates the suitability of soils for road construction and building sites. A soil that has high frost-action potential is not suitable for these uses unless special design critiera are used to offset the detrimental effects of frost action.

Corrosivity, as used in table 5, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of uncoated steel is related to such soil properties as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations made entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

Engineering interpretations

The estimated interpretations in table 5 are based on the engineering properties of soils shown in table 4, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of the Big Horn County Area. In table 5, ratings are used to summarize the limitation or suitability of the soils for all listed purposes other than for pond reservoir areas; dams, dikes, and levees; and drainage for crops and pasture. For these particular uses, table 5 lists those soil features not to be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means soil properties are generally favorable for the rated use, or in other words, limitations are minor and easy to overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation and special design. For some uses, the rating of severe is divided to obtain ratings of severe and very severe. *Very severe* means that one or more soil properties are so unfavorable for a particular use that overcoming the limitations is most difficult and costly and commonly not practical for the rated use.

Soil suitability is rated by the terms, *good, fair,* and *poor,* which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

Following are explanations of the columns in table 5.

Septic-tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material between depths of 18 inches and 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and sides, or embankments, of compacted soil material. The assumptions are made that the embankment is compacted to medium density and that the pond is protected from flooding. Properties that affect the pond floor are permeability, organic matter, and slope: if the floor needs to be leveled, depth to bedrock is important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified soil classification and the amount of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet; for example, excavations for pipelines, sewerlines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Dwellings with basements, as rated in table 5, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfills are areas in which refuse is disposed of in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated, the ratings in table 5 apply only to a depth of about 6 feet; therefore, limitation

ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 or 15 feet, but regardless of that, every site should be investigated before it is selected.

Roads and parking areas, as rated in table 5, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and parking areas are load-supporting capacity and stability of the subgrade and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material and the shrink-swell potential indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and the relative ease of excavating the material at borrow areas.

Sand or gravel is used in great quantities in many kinds of construction. The ratings in table 5 provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials. Neither do they indicate the quality of the deposit.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or the response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and the content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that results at the area from which topsoil is taken.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to permeability and the depth to fractured or permeable bedrock or other permeable material.

Dams, dikes, and levees require soil material that is resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among the factors that are unfavorable for this use.

Drainage for crops and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Formation and Classification of the Soils

This section describes the factors that influence soil formation and places the soil series in the higher categories of soil classification.

Factors of Soil Formation

Soil is a product of the interaction of soil-forming processes acting on material deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by the physical and mineral composition of the parent material; the climate under which the soil material has accumulated and existed; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life are active factors of soil formation. They act on parent material through weathering, slowly changing it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief and time. Parent material affects the kind of soil. It is the dominant factor in young soils, but its influence generally lessens with soil development. Time is necessary for the formation of a soil, but the length of time required depends upon the other factors of soil formation.

The factors of soil formation are closely interrelated. Few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other factors.

Parent material

Most soils in the Big Horn County Area formed in place over sandstone, siltstone, limestone, and shale bedrock. Some soils formed in alluvium and colluvium derived from sandstone and shale and deposited in major valleys and on bordering highlands. Soils that formed in weathered sandstone, such as those of the Nelson series, are generally sandy. The clay in these soils is from impurities in the sandstone released by weathering. Soils that formed in shale, such as those in the Pierre series, are clayey because clay is the basic constituent of shale. Soils that formed in mixed alluvium derived from sandstone and shale, such as those of the McRae series, are loamy. Soils that formed in limestone, such as those of the Lap series, are high in content of calcium carbonate. Many soils in the Area acquired salt and sodium from their parent material. Excess salt and sodium in the soil limit the kind and amount of plants that can grow on them. The density of the parent rock and its mineral composition can limit the rate of weathering and the depth of the soil, as in the shallow Rentsac soils.

Climate

Climate, an active force in the formation of soils, is determined mainly by temperature and precipitation. Erosion and alternate freezing and thawing break rocks down into material in which soils form. Water and wind are active agents in transporting and separating weathered material. The weathered material is further broken down by chemical reactions, such as solution and hydration. In this Area precipitation ranges from 11 to 24 inches. In the dry and warm northern part of the Area are Aridisols, such as those in the Cushman and Fort Collins series. In cooler, wetter parts of the Area are Mollisols, such as those in the Reeder series.

Temperature and the amount of distribution of precipitation also influence the kind and amount of vegetation that grows on the soil.

Living organisms

Living organisms also are active in the formation of soils. Organic matter is the main source of the dark color of the surface layer of soils. Fungi and algae are among the earliest inhabitants of rock material, contribute to the decomposition of rocks. As the rocks decompose, grasses, shrubs, and trees are able to grow and support animal life.

The kinds of plants and animals present largely determines that kind and amount of organic matter added to the soil and how this material is distributed within the mineral part of the soil. Roots, rodents, and insects penetrate the soil and influence its structure and permeability. Leaves, roots, and whole plants remain in the surface layer, where they are changed to humus by micro-organisms, chemicals in the soil, and insects.

The vegetation in the Big Horn County Area ranges from short and mid grasses, forbs, and shrubs in most areas to ponderosa pine, juniper, cedar, aspen, spruce, and fir in the Pryor, Big Horn, Wolf, and Rosebud Mountains. Common rodents are gophers, prairie dogs, badgers, rabbits, and marmots. Many of the pebbles and stones on the surface of terraces and other areas were dug up by burrowing rodents.

Relief

Relief, or topography, is determined by the uplift of mountain masses and the resistance of bedrock to erosion by water and wind. In the eroded highlands of the Area, runoff water has carved into the original bedrock deep valleys that have many branches. The rugged relief of the mountains contrasts sharply with the smooth, low relief of the terraces and flood plains of the river valleys.

In the highlands the number and the distinctness of soil horizons decrease as slope increases. Steep soils on which runoff is rapid have many characteristics that are similar to those of soils that formed in arid climates. Level soils that receive runoff water from soils above them have many characteristics of soils that formed in a more humid climate. An example of this pattern is the Thedalund-Cushman soil complex. Thedalund loam, occuping the convex slopes of ridges, has only a thin A horizon overlying a C horizon. Cushman loam, in swales between ridges, has an A horizon and a 7-inch B2t horizon and is leached of lime to a depth of 10 inches.

Time

The soils of the Big Horn County Area vary in age. The time available for a soil to form in unconsolidated sediments is the time that has elapsed since the last sediments were deposited. Soils on sedimentary rocks began to develop after the parent rock weathered into permeable material. The age, or maturity, of a soil is generally indicated by the thickness and distinctness of the subsurface horizons. The effect of time on soil formation can be modified greatly by the other factors of soil formation, particularly relief and parent material.

Haverson loam, a soil of the Entisol order, is an example of a youthful soil. It is also in a young geomorphic position on a flood plain adjacent to a flowing stream, where it receives additional soil material during periods of stream overflow. The soil contains little organic matter from which to form an A horizon; it has no evidence of clay weathering, translocation, and accumulation; and little translocation of carbonates has occurred.

Farnuf soils formed in similar parent material to Haverson silty clay loam, but on much older geomorphic surfaces. Farnuf soils are mature soils of the Mollisol order. They contain enough organic matter to have a dark A horizon. They have a distinct subsurface B2t horizon of clay accumulation, and carbonates have been leached to a depth of 18 inches or more.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories that are used in detailed soil surveys allow us to organize and apply knowledge about the soils in managing farms, fields, and woodland; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The system of soil classification currently used was adopted for general use by the National Cooperative Soil Survey in 1965. The current system is under continual study. Therefore, readers interested in developments of the current system should search the latest literature available (*9*, *11*). In table 6, the soil series of the Big Horn County Area are placed in some categories of the current system.

The current system of classification has six categories. Beginning with the broadest, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. In this system the criteria used as a basis for classification are soil

TABLE 6.—*Soils classified according to the current system of classification*

Series	Family	Subgroup	Order
Abac	Loamy, mixed (calcareous), frigid, shallow	Typic Ustorthents	Entisols.
Absarokee	Fine, montmorillonitic	Typic Argiborolls	Mollisols.
Absher	Fine, montmorillonitic	Borollic Natrargids	Aridisols.
Adel	Fine-loamy, mixed	Pachic Cryoborolls	Mollisols.
Adger	Fine, montmorillonitic	Typic Natriborolls	Mollisols.
Alice	Coarse-loamy, mixed, mesic	Aridic Haplustolls	Mollisols.
Allentine	Fine, montmorillonitic, mesic	Haplustollic Hatrargids	Aridisols.
Amherst	Clayey, montmorillonitic	Lithic Argiborolls	Mollisols.
Armington	Very fine, mixed	Vertic Haploborolls	Mollisols.
Arnegard	Fine-loamy, mixed	Pachic Haploborolls	Mollisols.
Arvada	Fine, montmorillonitic, mesic	Ustollic Natrargids	Aridisols.
Ascalon	Fine-loamy, mixed, mesic	Aridic Argiustolls	Mollisols.
Babb	Fine-loamy, mixed	Typic Cryoborolls	Mollisols.
Beauvais	Fine-silty, mixed, mesic	Aridic Argiustolls	Mollisols.
Belfield	Fine, montmorillonitic	Glossic Natriborolls	Mollisols.
Benteen	Fine-loamy, mixed	Argic Pachic Cryoborolls	Mollisols.
Bew	Fine, montmorillonitic, mesic	Ustollic Haplargids	Aridisols.
Bitton	Loamy-skeletal, mixed	Entic Haploborolls	Mollisols.
Bone	Fine, montmorillonitic (calcareous), mesic	Ustic Torriorthents	Entisols.
Castner[1]	Loamy-skeletal, mixed	Lithic Haploborolls	Mollisols.
Cherry	Fine-silty, mixed, frigid	Typic Ustochrepts	Inceptisols.
Chugter	Fine-loamy, mixed, mesic	Aridic Haplustolls	Mollisols.
Clapper	Loamy-skeletal, mixed, mesic	Ustollic Calciorthids	Aridisols.
Colby	Fine-silty, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
Cushman	Fine-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Danvers	Fine, montmorillonitic	Typic Argiborolls	Mollisols.
Darret	Fine, mixed	Typic Argiborolls	Mollisols.
Dast	Coarse-loamy, mixed (calcareous), frigid	Typic Ustorthents	Entisols.
Doney	Fine-loamy, mixed (calcareous), frigid)	Typic Ustorthents	Entisols.
Duncom[2]	Loamy, mixed	Lithic Cryoborolls	Mollisols.
Eltsac	Very-fine, montmorillonitic (calcareous), frigid.	Vertic Ustorthents	Entisols.
Farnuf	Fine-loamy, mixed	Typic Argiborolls	Mollisols.
Fergus	Fine, mixed	Typic Argiborolls	Mollisols.
Fort Collins	Fine-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Frazer	Fine, montmorillonitic	Fluventic Haploborolls	Mollisols.
Gilt Edge	Fine, montmorillonitic, mesic	Haplustollic Natrargids	Aridisols.
Glenberg	Coarse-loamy, mixed (calcareous), mesic	Ustic Torrifluvents	Entisols.
Grail	Fine, montmorillonitic	Pachic Argiborolls	Mollisols.
Hanson	Loamy-skeletal, carbonatic	Calcic Cryoborolls	Mollisols.
Harvey	Fine-loamy, mixed, mesic	Ustollic Calciorthids	Aridisols.
Haverson	Fine-loamy, mixed (calcareous), mesic	Ustic Torrifluvents	Entisols.
Heldt	Fine, montmorillonitic, mesic	Ustertic Camborthids	Aridisols.
Hesper	Fine, montmorillonitic, mesic	Ustollic Haplargids	Aridisols.
Hydro	Fine, montmorillonitic, mesic	Glossic Ustollic Natrargids	Aridisols.
Hysham	Fine-loamy, mixed (calcareous), mesic	Ustic Torrifluvents	Entisols.
Judith	Fine-loamy, carbonatic	Typic Calciborolls	Mollisols.
Keiser	Fine-silty, mixed, mesic	Ustollic Haplargids	Aridisols.
Kim	Fine-loamy, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
Korchea	Fine-loamy, mixed (calcareous), frigid	Typic Ustifluvents	Entisols.
Kyle	Very fine, montmorillonitic, mesic	Ustertic Camborthids	Aridisols.
La Fonda	Fine-loamy, mixed, mesic	Ustollic Camborthids	Aridisols.
Lap	Loamy-skeletal, carbonatic	Lithic Calciborolls	Mollisols.
Lavina	Clayey, montmorillonitic, mesic	Aridic Lithic Argiustolls	Mollisols.
Lennep	Fine, montmorillonitic	Glossic Natriborolls	Mollisols.
Lismas	Clayey, montmorillonitic (calcareous), mesic, shallow.	Ustic Torriorthents	Entisols.
Lohmiller	Fine, montmorillonitic (calcareous), mesic	Ustic Torrifluvents	Entisols.
Macar	Fine-loamy, mixed, frigid	Typic Ustochrepts	Inceptisols.
Maginnis	Clayey-skeletal, montmorillonitic	Lithic Haploborolls	Mollisols.

TABLE 6.—*Soils classified according to the current system of classification*—Continued

Series	Family	Subgroup	Order
Marias[3]	Fine, montmorillonitic (calcareous), frigid	Ustertic Torriorthents	Entisols.
Maschetah	Fine-silty, mixed	Typic Calciborolls	Mollisols.
Mayflower	Fine, montmorillonitic	Argic Pachic Cryoborolls	Mollisols.
McKenzie	Fine, montmorillonitic (calcareous), frigid	Typic Haplaquepts	Inceptisols.
McRae	Fine-loamy, mixed, mesic	Ustollic Camborthids	Aridisols.
Midway	Clayey, mortmorillonitic (calcareous), mesic, shallow.	Ustic Torriorthents	Entisols.
Morton	Fine-silty, mixed	Typic Argiborolls	Mollisols.
Nelson	Coarse-loamy, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
Neville	Fine-loamy, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
Nobe	Fine, mortmorillonitic (calcareous), frigid	Ustic Torriorthents	Entisols.
Norbert	Clayey, mortmorillonitic (calcareous), frigid, shallow.	Typic Ustorthents	Entisols.
Nunn	Fine, montmorillonitic, mesic	Aridic Argiustolls	Mollisols.
Olney	Fine-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Parshall	Coarse-loamy, mixed	Pachic Haploborolls	Mollisols.
Peritsa	Fine-silty, mixed	Typic Haploborolls	Mollisols.
Pierre	Very fine, montmorillitic, mesic	Ustertic Camborthids	Aridisols.
Pultney	Fine-loamy, mixed, mesic	Ustollic Calciorthids	Aridisols.
Quietus	Fine-loamy, mixed	Boralfic Cryoborolls	Mollisols.
Raynesford	Fine-loamy, carbonatic	Calcic Cryoborolls	Mollisols.
Reeder	Fine-loamy, mixed	Typic Argiborolls	Mollisols.
Regent	Fine, montmorillonitic	Typic Argiborolls	Mollisols.
Renohill	Fine, montmorillonitic, mesic	Ustollic Haplargids	Aridisols.
Rentsac	Loamy-skeletal, mixed (calcareous), frigid	Lithic Ustic Torriorthents	Entisols.
Richfield	Fine, montmorillonitic, mesic	Aridic Argiustolls	Mollisols.
Ringling	Loamy-skeletal, mixed	Lithic Haploborolls	Mollisols.
Rottulee	Fine-loamy, mixed	Typic Haploborolls	Mollisols.
Ryorp	Coarse-loamy, mixed	Typic Cryochrepts	Inceptisols.
Savage	Fine, montmorillonitic	Typic Argiborolls	Mollisols.
Sawcreek	Coarse-loamy, mixed	Typic Cryoborolls	Mollisols.
Searing	Fine-loamy, mixed	Typic Haploborolls	Mollisols.
Shaak	Fine, montmorillonitic	Abruptic Argiborolls	Mollisols.
Shonkin	Fine, montmorillonitic, mesic	Glossic Natraqualfs	Alfisols.
Sofia	Fine, montmorillonitic, mesic	Aridic Argiustolls	Mollisols.
Spearfish	Loamy, mixed (calcareous), mesic, shallow	Ustic Torriorthents	Entisols.
Spearman	Fine-loamy, mixed, mesic	Aridic Haplustolls	Mollisols.
Splitro	Loamy, mixed	Lithic Cryoborolls	Mollisols.
Stormitt	Loamy-skeletal, carbonatic, mesic	Ustollic Calciorthids	Aridisols.
Talag	Fine, montmorillonitic, mesic	Glossic Ustollic Natrargids	Aridisols.
Tarrete	Very fine, mixed	Vertic Cryoborolls	Mollisols.
Terry	Coarse-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Teton	Fine-loamy, mixed	Typic Cryoborolls	Mollisols.
Thedalund	Fine-loamy, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
Thurlow	Fine, montmorillonitic, mesic	Ustollic Haplargids	Aridisols.
Toluca	Fine-loamy, mixed, mesic	Ustollic Haplargids	Aridisols.
Travessilla	Loamy, mixed (calcareous), mesic	Lithic Ustic Torriorthents	Entisols.
Trulon	Fine-loamy, carbonatic	Typic Calciborolls	Mollisols.
Tullock	Mixed, mesic	Ustic Torripsamments	Entisols.
Twin Creek	Fine-loamy, mixed	Typic Haploborolls	Mollisols.
Vananda	Fine, montmorillonitic (calcareous), mesic	Ustic Torriorthents	Entisols.
Vebar	Coarse-loamy, mixed	Typic Haploborolls	Mollisols.
Wages	Fine-loamy, mixed, mesic	Aridic Argiustolls	Mollisols.
Wayden	Clayey, mixed (calcareous), frigid, shallow	Typic Ustorthents	Entisols.
Wibaux	Loamy-skeletal over fragmental, mixed, nonacid, mesic.	Ustic Torriorthents	Entisols.
Windham	Loamy-skeletal, carbonatic	Typic Calciborolls	Mollisols.
Winnett	Fine, montmorillonitic, mesic	Ustollic Natrargids	Aridisols.
Xavier	Fine-silty, mixed	Typic Argiborolls	Mollisols.

[1] Castner soils as mapped in the Big Horn County Area are taxadjuncts to the Castner series. They are classified as a member of the coarse-loamy, mixed family of Lithic Haploborolls.

[2] Duncom soils as mapped in the Big Horn County Area are taxadjuncts to the Duncom series. They are classified as a member of the loamy-skeletal, carbonatic family of Lithic Cryoborolls.

[3] Marias soils as mapped in the Big Horn County Area are taxadjuncts to the Marias series. They are classified as a member of the fine, montmorillonitic (calcareous), frigid family of Vertic Ustorthents.

properties that are observable and measurable. The properties are chosen, however, so that soils of similar genesis, or mode of origin, are grouped together. Most of the classes of the current system are defined briefly in the following paragraphs.

ORDER.—Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are Entisols and Histosols, which occur in many different climates. Table 6 shows that the five soil orders in the Big Horn County Area are Entisols, Inceptisols, Aridisols, Mollisols, and Alfisols.

Entisols are light-colored soils that do not have natural genetic horizons or that have only weakly expressed beginnings of such horizons. These soils do not have traits that reflect soil mixing caused by shrinking and swelling.

Inceptisols are light-colored soils that have only weakly expressed genetic horizons and are moist more than half of the time they are not frozen.

Aridisols are light-colored mineral soils that are high in bases and that have well-expressed mineral genetic horizons.

Mollisols are soils that formed under grass and have a thick, dark-colored surface horizon that contains colloids dominated by bivalent cations. The soil material in these soils has not been mixed by shrinking and swelling.

Alfisols are mineral soils that contain horizons of clay accumulation. Unlike Mollisols, they do not have a thick, dark-colored surface layer that contains colloids dominated by bivalent cations, but the base status of the lower horizons is not extremely low.

SUBORDER.—Each order has been divided into suborders, mainly on the basis of the characteristics that seem to produce classes that have the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging or soil differences that result from climate or vegetation.

GREAT GROUP.—Suborders are separated into great groups on the basis of uniformity in the kind and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus has accumulated; those that have a pan that interferes with growth of roots, movement of water, or both; and those that are thick, dark-colored surface horizon. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The great group is not shown separately in table 6, because it is the last word in the name of the subgroup.

SUBGROUP.—Great groups are divided into subgroups, one that represents the central (typic) segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups can also be made in those instances where soil properties intergrade outside the range of any great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives in front of the great group.

FAMILY.—Families are established within a subgroup, mainly on the basis of properties that are important to the growth of plants or behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

General Nature of the Area

The Big Horn County Area received its first foreign visitor in 1743, Chavalier de la Verendrye, who sought a route to the Pacific. In 1804 explorers surveyed fur resources in the Area. Captain Clark and party, of the Lewis and Clark Expedition, passed eastward on the Yellowstone River in 1806. Fort Manual Lisa, a fur-trading post, was established at the mouth of the Big Horn River in 1807. Except for a few fur traders and an occasional gold prospector, the Area was rarely visited by white men until the opening of the Bozeman Trail in 1864. Many miners and settlers passed over this trail. It crossed the foot slopes of the Big Horn Mountains, crossed the Big Horn River near the mouth of Big Horn Canyon, and continued westward across the foot slopes of the Pryor Mountains.

Fort C. F. Smith was built in 1866 to protect the fort across the river. The Indians resented this intrusion, and the Government temporarily appeased them by abandoning the fort in 1868 and ordering the miners and settlers to keep out of the Area. Disregarding this agreement, the miners and settlers continued to encroach on Indian territory, and the Indians resisted until 1876, when Federal troops were sent to control them. In the ensuing campaign, General George A. Custer and his entire troop were killed at the Battle of the Little Big Horn. The Custer Battlefield National Monument is located about 3 miles south of Crow Agency. After this reversal, the Government took effective action against the Indians. In 1877, Fort Custer was built on the bluffs overlooking the Big Horn and Little Big Horn Valleys, about 3 miles southeast of the present site of Hardin. The fort was maintained as a cavalry post until 1902.

From 1880 to 1890, soon after the danger of the Indian raids had passed, the first permanent settlers came to the Area. They were cattlemen who established headquarters adjacent to the Wolf, Rosebud, and Big Horn Mountains. These early ranches were operated by companies that had herds of as many as 30,000 head. In 1901 sheep raising had its beginning when large, company-owned flocks were brought into the Area to graze. About this time the entire Crow Indian Reservation was leased by one sheep outfit. In 1904 the Indian lands adjacent to the Yellowstone River and the land in the lower Big Horn Valley were ceded to the Federal Government, and they were opened to homesteading in 1906. Within a few years, a large acreage was taken up by settlers. Dryland farming prospered from 1906 to 1917 under conditions of abnormally high rainfall and high prices. During

later years, drought caused repeated failures, and dryland farming decreased.

In 1885 the Reno unit of the Crow Indian Project was constructed. It was the earliest irrigation development in the Area. Other irrigation projects, both Federal and private, were started in the 1890's. At present 17 major canals serve the irrigation projects in the Area.

The proposed Hardin Unit, under study by the Bureau of Reclamation, is designed to irrigate an additional 45,000 acres. It is located on the west side of the Big Horn River on what is locally known as the Hardin Bench. It is a strip of land 2 to 3 miles wide that extends from 6 miles north of Hardin to an area near the mouth of the Big Horn Canyon. Several small tracts of land east of the Big Horn River are included in the project.

The Crow Indian Reservation was established by an Act of Congress in 1868. Its present size is 2,119,530 acres, of which about 220,000 acres is in Yellowstone County. In the irrigated valleys about 40 percent of the land has been sold to non-Indian farmers. Small tracts of dry cropland and range have also been sold. Most of the land is rough range that is leased by the Indians to cattle ranches in the Area. A large area of dry cropland is on the gravelly benches west of the Big Horn River. This area includes the land proposed for irrigation under the Hardin Unit, and much of it is leased by the Campbell Farming Corporation. There is an area, about township size, of dry cropland on the gravelly bench between the Little Big Horn and Big Horn Rivers south of Hardin.

Hardin, the principal town of the Big Horn County Area and the county seat of Big Horn County, was settled in 1907. Crow Agency is the headquarters of the Crow Indian Reservation. The population of Big Horn county was 9,328 in 1950 and 10,057 in 1970. In 1970, 4,035 Crow Indians lived in the county.

In 1969, according to the U.S. Census of Agriculture, there were about 515 farms in the Area. Of these, 256 were irrigated. Tables 7 and 8 show, respectively, the numbers of selected kinds of livestock on farms in the Area and the acreage and yields of principal crops.

TABLE 7.—*Numbers of selected kinds of livestock on farms in stated years*

[Data from Montana Agricultural Statistics, v. XIII, Dec. 1970]

Livestock	1968	1969	1970
All cattle and calves	112,000	107,000	116,000
Cows 2 years old and older kept for milk	600	500	500
Sheep and lambs	15,000	15,000	15,000
Chickens	13,000	12,900	12,600
Hogs and pigs	11,000	10,000	9,019
Horses	—	2,934	—

From its central location in the Area, Hardin serves as the wheat and feed-grain marketing terminal. Three elevators, with a combined storage capacity of nearly 1 million bushels, serve the Area. Cattle are shipped by truck and rail from Hardin, Lodge Grass, and Wyola.

Natural gas pipelines supply heating fuel to all the towns and villages in the Area. Electric power is generated at the Yellowtail Dam for distribution to surrounding States.

A branch line of the Burlington Northern Railroad connects the Area with Billings, Montana, and Lincoln, Nebraska. Interstate Highway 90, presently under construction, enters the Area south of Wyola, follows the Little Big Horn River Valley to Hardin, then proceeds towards Billings, Montana, in a northwest direction. Highway 47 connects Hardin with Interstate Highway 94 just north of the county boundary. Highway 212 joins Interstate 90 only 1 mile south of Crow Agency and follows an easterly route into Rosebud County. Paved secondary roads connect Hardin with Pryor, Yellowtail Dam, and Sarpy Creek. Construction has begun on a road between St. Xavier and Pryor.

A carpet mill and a livestock feed processing mill are located on the Crow Indian Reservation.

Cash receipts from livestock and livestock products in 1969 were $11,194,800, and from crops, $5,793,900.

Oil is produced in the Snyder field east of Hardin, the Soap Creek field near Yellowtail Dam, and the

TABLE 8.—*Acreage and yields of principal crops*

[All data for 1969. Source: Montana Agricultural Statistics, v. XIII]

Crop	Acres—		Yield per harvested acre	Irrigated—		Nonirrigated—	
	planted	harvested		acres harvested	yield per acre	acres harvested	yield per acre
Winter wheat	58,500	53,124	27.2 bu	1,600	36.0 bu	51,524	26.9 bu
Durum wheat	300	200	29.0 bu	100	40.0 bu	100	18.0 bu
Other spring wheat	1,900	1,800	32.4 bu	1,000	36.0 bu	800	26.6 bu
Oats	6,600	5,500	48.5 bu	1,900	59.0 bu	3,600	43.0 bu
Barley	19,800	18,000	36.2 bu	3,800	42.7 bu	14,200	34.5 bu
Alfalfa hay	—	43,000	1.94 tons	22,200	2.55 tons	20,800	1.30 tons
Wild hay	—	2,100	1.14 tons	400	1.25 tons	1,700	1.12 tons
Alfalfa seed	—	2,300	93 lb	1,000	155 lb	1,300	45 lb
Sugar beets	12,700	12,500	17.6 tons	12,500	17.6 tons	—	—
Dry beans	700	700	15 cwt	700	15 cwt	—	—

Ash Creek field west of Decker. Crude oil production in 1969 was 110,770 barrels. The Hardin gas field supplies natural gas for local use.

Subbituminous coal is strip mined at Decker. A second mine is being opened on Sarpy Creek east of Hardin. Strippable reserves of coal are estimated at more than 3 trillion tons.

Timberland is generally in the ownership of the Crow Indian tribe. Several small contracts for logging have been let in the Pryor Mountains in recent years. Timber has been harvested on several privately owned ranches in the past 5 years.

Betonite deposits south of Wyola are mined on a small scale.

Sand and gravel deposits on terraces along the river valleys are used locally for road building and masonry structures.

Climate[5]

Elevation within the Area ranges from as high as 9,000 feet or more above sea level on some mountain peaks in the southern half to about 2,700 feet where the Big Horn River leaves the Area north of Hardin, and its effects on climate are significant. The Area as a whole has a modified continental climate; but within that general climate type, mountain effects on temperature and precipitation patterns have a wide range. Winter snowfall in the higher mountains along the Wyoming border, for example, is much greater than in most parts of the survey area, reaching a depth of 100 inches or more on some slopes before the snow begins to melt in spring. These mountain snowfields usually have a stabilizing influence on animal water supplies.

To a large extent, climate is a determining factor in the use of the land. Valley bottoms are warm enough to permit a well-developed farming system, particularly where water for irrigation is plentiful. Sugar beets, corn for silage, alfalfa hay, dry beans, winter wheat, oats, and barley are the major crops grown under irrigation. Above the valley bottoms are several ranches. Because of the limited growing season, these ranches produce winter wheat, barley, and some alfalfa hay. The ranches are generally combination dryfarmed crops-beef cattle operations.

The longest growing season in the Area is on the fairly level plains around Hardin, where the 32° freeze-free season averages 125 days and the 28° freeze-free season, 151 days, indicating a favorable regime for sugar beets, corn, alfalfa hay, dry beans, winter wheat, oats, and barley. At higher elevations, in most cases, production of dryfarmed wheat and cattle ranching are the major farm enterprises.

The Area is subject to air masses from several sources. During winter the coldest weather comes from a few Arctic air invasions, supplanted in each case a few days later by warmer air from the Pacific —sometimes borne on chinook (Foehn) winds. Spring and early summer are the wettest parts of the year. The heaviest rain is during storms from the Gulf of Mexico, mostly in May and June. Midsummer afternoon thunderstorms occur about 25 to 35 days a year, sometimes accompanied by hail and gusty winds. Damage to crops from hail, however, seldom is widespread, even though some hail falls somewhere in the Area almost every year.

The combination of precipitation early in the growing season—from two-thirds to three-fourths of the yearly average falls between April 1 and September 30—with rapid warming of the temperature in May and June has helped to produce a stable farming system in the arable sections of the Area.

Various data from climate records in the Big Horn County Area are summarized in tables 9 through 15. These tables have been prepared to emphasize the important differences from place to place within the Area. Hardin, for example, represents the drier, warmer northern part; Wyola, the foothills of the south; and Busby and Crow Agency, the hilly country of the southeast. A limited record at a station up the Big Horn River from St. Xavier, near the present site of Yellowtail Dam, indicates a climate there somewhat similar to that around Wyola, but perhaps a little wetter.

Physiography, Relief, and Drainage

The Big Horn County Area is in the unglaciated part of the Missouri Plateau section of the Great Plains physiographic province. It is adjacent to the mountains at the west edge of the plains. The broader physiographic aspect of the Area is that valleys emerge from the mountains and cross the plains to the north and east. Except for the Big Horn and Pryor Mountains, the Area has the appearance of mature dissection. The side stream drainageways are separated by relatively narrow but somewhat rounded divides. The divides rise 500 to 1,000 feet above the bottoms of the Big Horn, Little Big Horn, and Tongue Rivers; however, the difference in elevation between the side streams and the divides is only about half this amount. In the Big Horn and Little Big Horn Valleys are nearly level bottom lands and low terraces. Above these is a series of higher terraces at different levels, representing the various stages of entrenchment and temporary base leveling by the present or former streams. West of the Big Horn River, the terraces are at five distinct levels. They are mantled with gravelly mountain sediment, valley fill, loess, and reworked old alluvium. These materials are underlain at varying depth by shale and sandstone of the Colorado and Montana geologic groups.

The Big Horn Mountains rise sharply in the southern part of the Area to elevations of more than 9,000 feet above sea level. The Pryor Mountains cover about 3 townships in the southwestern corner of the Area. Garvin Basin, an area of about 70,000 acres, lies in a trough between the Big Horn and Pryor Mountains. The Big Horn Canyon, now filled with the waters held by Yellowtail Dam, traverses the basin. The Rosebud Mountains, in the southeastern part of the Area, rise abruptly to elevations of more than 5,000 feet. They are separated from the Wolf Mountains to the north by a narrow divide near the junction of Davis Creek

[5] By R. A. DIGHTMAN, meteorologist for Montana, National Weather Service, U.S. Department of Commerce.

TABLE 9.—*Temperature and precipitation*

[Data from Busby, Montana. Elevation 3,500 feet. Period of record 1937–66]

Month	Temperature					Precipitation							
						1 year in 10 will have:		2 years in 10 will have:		3 years in 10 will have:		4 years in 10 will have:	
	Average daily maximum	Average daily minimum	Average monthly highest temperature	Average monthly lowest temperature	Average monthly total	Less than—	More than—	Less than—	More than—	Less than—	More than—	Less than—	More than—
	°F	°F	°F	°F	In	In	In	In	In	In	In	In	In
January	32	3	49	−26	0.5	0.1	1.2	0.1	0.7	0.2	0.5	0.3	0.5
February	37	8	56	−19	.4	.1	.8	.2	.6	.2	.5	.3	.5
March	44	17	66	−11	.6	.2	1.2	.3	.9	.4	.7	.5	.6
April	59	29	79	13	1.2	.3	2.6	.6	2.0	.7	1.5	.9	1.3
May	69	38	87	24	2.1	.8	3.9	1.1	3.2	1.5	2.7	1.6	2.2
June	77	46	93	33	2.5	1.2	4.0	1.4	3.5	1.6	3.4	2.0	2.7
July	89	52	102	40	1.2	.1	2.7	.3	2.1	.6	1.5	.9	1.3
August	88	49	101	36	1.1	.1	3.0	.1	1.9	.3	1.4	.4	1.1
September	76	40	92	24	1.1	.2	2.3	.3	2.0	.5	1.5	.7	1.2
October	65	30	85	16	.8	.1	1.8	.4	1.5	.5	.9	.6	.9
November	46	18	67	− 6	.6	.1	1.2	.2	.9	.2	.8	.4	.8
December	37	10	57	−18	.5	.1	1.0	.2	.8	.3	.6	.3	.5
Year	60	28	[1]103	[2]−33	12.6	9.1	16.4	10.2	15.8	11.0	14.7	11.7	13.6

[1]Average annual highest temperature.
[2]Average annual lowest temperature.

TABLE 10.—*Temperature and precipitation*

[Data from Crow Agency. Elevation 3,030 feet. Period of record 1937–66]

Month	Temperature					Precipitation							
						1 year in 10 will have:		2 years in 10 will have:		3 years in 10 will have:		4 years in 10 will have:	
	Average daily maximum	Average daily minimum	Average monthly highest temperature	Average monthly lowest temperature	Average monthly total	Less than—	More than—	Less than—	More than—	Less than—	More than—	Less than—	More than—
	°F	°F	°F	°F	In	In	In	In	In	In	In	In	In
January	34	5	54	−24	0.6	0.1	1.1	0.2	1.0	0.3	0.8	0.4	0.6
February	40	11	59	−17	.6	.2	1.1	.4	.8	.5	.7	.5	.7
March	48	19	70	− 8	1.0	.4	2.1	.5	1.6	.5	1.3	.6	.8
April	62	30	81	15	1.8	.4	5.1	.6	3.1	.8	1.9	1.1	1.5
May	72	40	89	27	2.0	.9	4.0	1.2	2.9	1.3	2.2	1.5	2.1
June	79	48	95	36	2.8	.8	5.1	1.2	4.2	1.7	3.9	1.8	3.3
July	91	53	103	42	.8	.1	1.8	.2	1.5	.4	1.2	.5	.9
August	89	50	102	39	1.1	.1	2.1	.3	1.9	.6	1.3	.6	1.1
September	77	41	95	27	1.4	.2	4.1	.3	1.9	.4	1.7	1.1	1.3
October	68	31	86	18	1.1	.1	2.5	.4	1.7	.5	1.3	.7	1.2
November	49	19	69	− 3	.7	.1	1.5	.2	1.3	.4	.9	.5	.8
December	40	11	61	−15	.6	.1	1.3	.2	1.1	.3	1.1	.4	.9
Year	62	30	[1]104	[2]−29	14.5	10.1	19.5	10.6	17.9	12.3	15.9	13.5	15.3

[1]Average annual highest temperature.
[2]Average annual lowest temperature.

and Rosebud Creek. In the northwestern part of the Area is a range of rough hills, called the Pine Ridge, that are partly mantled by gravelly remnants of an ancient stream terrace.

Geology and Ground Water

About 12,000 feet of sedimentary rocks, predominantly of marine origin, are exposed in the Area. They represent every geologic period except the Silurian. Pre-Cambrian crystalline rocks are exposed only in the deepest part of the Big Horn Canyon. All information in this section is presented in Geological Survey Water Supply Paper 1487 (*8*).

Quarternary alluvium and lower terrace deposits.—The youngest sediments are on fans and valley bottoms of rivers. The most extensive deposits occur in the valleys of the Big Horn and Little Big Horn Rivers. Ground water from the Little Big Horn River Valley is generally suitable for domestic and livestock use but is unsuitable for domestic use in the Big Horn River Valley.

Other terrace deposits.—The alluvial deposits on high terraces are generally drained of ground water,

TABLE 11.—*Temperature and precipitation*

[Data from Hardin, Montana. Elevation 2,885 feet. Period of record 1941–66]

Month	Temperature				Precipitation								
	Average daily maximum	Average daily minimum	Average monthly highest temperature	Average monthly lowest temperature	Average monthly total	1 year in 10 will have:		2 years in 10 will have:		3 years in 10 will have:		4 years in 10 will have:	
						Less than—	More than—	Less than—	More than—	Less than—	More than—	Less than—	More than—
	°F	°F	°F	°F	In	In	In	In	In	In	In	In	In
January	33	5	55	−22	0.5	0.2	0.9	0.2	0.8	0.3	0.6	0.3	0.5
February	39	12	60	−15	.4	.1	.9	.2	.6	.3	.6	.3	.5
March	46	19	70	− 9	.6	.2	1.1	.3	.9	.4	.8	.4	.7
April	61	31	81	17	1.2	.2	3.4	.4	2.0	.6	1.4	.7	1.1
May	71	41	89	27	1.6	.7	2.6	.9	2.5	1.0	2.2	1.5	1.7
June	78	49	95	37	2.8	.7	5.5	1.0	4.3	1.5	3.6	2.0	3.2
July	90	54	102	44	.9	.2	2.1	.3	1.5	.4	1.1	.5	1.0
August	88	52	101	40	1.0	.2	2.2	.4	1.8	.4	1.4	.5	1.0
September	75	42	94	29	1.5	.1	3.0	.3	2.3	.4	1.8	.9	1.6
October	65	31	84	17	.7	.1	1.7	.2	1.2	.3	1.0	.4	1.0
November	47	20	68	1	.6	.1	1.1	.1	.9	.3	.7	.3	.6
December	38	11	59	−15	.5	.1	1.0	.2	.9	.2	.7	.2	.6
Year	61	31	[1]103	[2]−29	12.3	8.0	16.6	8.7	14.9	10.3	13.6	10.8	13.0

[1]Average annual highest temperature.
[2]Average annual lowest temperature.

TABLE 12.—*Temperature and precipitation*

[Data from Wyola, Montana. Elevation 3,705 feet. Period of record 1937–66]

Month	Temperature				Precipitation								
	Average daily maximum	Average daily minimum	Average monthly highest temperature	Average monthly lowest temperature	Average monthly total	1 year in 10 will have:		2 years in 10 will have:		3 years in 10 will have:		4 years in 10 will have:	
						Less than—	More than—	Less than—	More than—	Less than—	More than—	Less than—	More than—
	°F	°F	°F	°F	In	In	In	In	In	In	In	In	In
January	36	8	58	−20	0.7	0.1	1.6	0.3	1.0	0.4	0.9	0.4	0.9
February	40	12	61	−15	.7	.3	1.2	.5	1.0	.5	.8	.6	.7
March	46	19	68	− 8	1.0	.5	2.0	.5	1.6	.5	1.3	.6	1.0
April	60	30	79	15	2.0	.7	4.3	.9	2.6	1.3	2.4	1.5	2.1
May	69	39	87	26	2.4	1.2	3.9	1.5	3.3	1.7	3.0	1.8	2.4
June	77	46	93	33	2.6	.9	4.9	1.1	4.1	1.5	3.0	1.6	2.6
July	88	51	101	41	1.0	.1	2.2	.1	1.6	.4	1.4	.5	1.2
August	88	49	101	38	.9	.1	1.8	.3	1.5	.6	1.3	.6	1.1
September	75	40	94	26	1.4	.2	3.1	.3	2.7	.5	1.4	.7	1.2
October	66	32	85	17	1.2	.1	1.9	.4	1.6	.5	1.5	.7	1.4
November	48	20	69	− 3	.8	.2	1.8	.3	1.3	.5	1.0	.5	.8
December	41	14	62	−12	.7	.2	1.4	.3	1.0	.4	.9	.4	.8
Year	61	30	[1]102	[2]−26	15.4	9.6	20.0	11.7	19.6	12.9	17.5	13.7	16.6

[1]Average annual highest temperature.
[2]Average annual lowest temperature.

except near the middle of the more extensive remnants, or where there are springs along the bases of terrace escarpments. Gravel beds range from 10 to 30 feet in thickness.

Wasatch Formation.—The Wasatch Formation consists of interbedded light-gray sandy shale, sandstone, dark-gray clay shale. The fine-grained sandstone member is the ledge-forming rock along deep valleys near the crest of the Rosebud Mountains and in areas east of Decker. It is generally drained of water, but springs occur at the base in the Roland coal bed. The Wasatch Formation is about 350 feet thick in these areas.

Fort Union Formation.—The Fort Union Formation is divided into the Tullock member at the base, the Lebo shale member in the middle, and the Tongue River member at the top. The Tongue River member is interbedded light-gray sandy shale and sandstone that is 850 to 1,800 feet thick. Coal beds are common, including clinker beds that result from burning coal. Sandstone is more conspicuous than the shale because it is more resistant to weathering. The Lebo shale member consists of sandy shale, siltstone, and arkosic sandstone 150 to 300 feet thick. It is distinguished by its content of volcanic ash and ironstone and its bar-

TABLE 13.—*Average precipitation in inches*

[Length of record: at Decker and Lodge Grass, 17 years; at Pryor, 16 years; at Kirby, 7 years]

Month	Decker	Kirby	Lodge Grass	Pryor
January	0.3	1.1	0.7	0.6
February	.3	1.2	.7	.6
March	.4	.9	1.0	.8
April	1.2	2.0	1.8	2.4
May	1.7	2.1	2.0	2.6
June	2.1	2.6	2.7	2.1
July	1.0	.9	1.1	.8
August	1.2	1.5	1.0	1.3
September	.9	1.6	1.5	1.2
October	.8	.8	1.2	1.0
November	.5	.9	.9	.8
December	.4	1.0	.7	.5
Year	10.8	16.6	15.3	14.7

ren slopes. It tends to weather to badland topography and clay soil. The Tullock member, about 300 feet thick, consists of interbedded dark-gray shale and sandy shale and brownish-colored sandstone. Exposed sections have a banded appearance of yellowish gray and bright yellowish gray. Coal beds are common, but they are generally thin. The sandstone of the Tullock member is a reliable source of water.

Hell Creek Formation.—The Hell Creek Formation is Cretaceous rock that is 600 to 650 feet thick. It consists of interbedded dark-gray sandy shale and sandstone and olive-gray shale. It is darker than the overlying Tullock member but lighter than the underlying Bearpaw Formation. Thick, massive lenses of sandstone are common but generally can be traced for only a short distance. This formation yields only small quantities of water and contains more minerals than the overlying formations.

Bearpaw Shale Formation.—The Bearpaw Shale Formation is largely dark-gray, marine, fossiliferous shale 850 to 1,100 feet thick that has numerous brownish-colored, weathering, calcareous concretions and much bentonite in the middle part. It contains little water and is highly mineralized.

Judith River Formation.—The upper part of this formation is 700 feet of light-colored, interbedded sandy shale and sandstone. Near the Wyoming-Montana line the beds consist of massive, brown and gray sandstone interbedded with green and light brownish-gray sandy shale and dark-gray shale and a few coal beds just above the Parkman member. The lower Parkman sandstone member, 250 to 350 feet thick, is brownish colored and is typically soft but has harder, brownish-colored, weathering, concretionary sandstone that contains limonitic nodules. The town of Lodge Grass obtains its municipal water supply from the Parkman sandstone. Wells that tap the basal sandstone yield good quantities of potable water. The water is more mineralized north of Hardin, where the Parkman sandstone is interfingered with the overlying Bearpaw Shale.

Cody Shale Formation.—The upper part of the Cody Shale Formation is the Claggett member, 350 to 650 feet thick. It is dark-gray marine shale that weathers to reddish brown. It contains two beds of grayish-yellow bentonite near the base and calcareous concretions throughout that weather to light brown. Below the Claggett member is a 375-foot-thick member equivalent to Eagle Sandstone. It is mostly dark-gray sandy shale that has ferruginous concretions and weathers to brownish gray. The Telegraph Creek member, 780 to 870 feet thick, is mostly buff-colored sandy shale that has a few thin beds of sandstone and calcareous concretions. The Niobrara Shale is about 400 feet thick and crops out in the northern and central parts of the Area. It consists of dark-gray marine shale, many thin beds of bentonite, and several beds of septarian concretions. Carlile Shale, about 280 feet thick, is mostly dark-gray marine shale that weathers to light gray and has numerous fossiliferous, calcareous, septarian concretions and several beds of bentonite near the base. The Greenhorn calcareous member is 50 to 100 feet thick. It is dark-gray, very calcareous, marine shale that weathers to nearly white and has light-gray or buff limestone concretions Limonitic-stained bentonite that is 1 foot thick marks the base. The base of the Cody Shale is concretionary, dark-gray shale 200 feet thick that has several thin beds of sandstone in the lower part. Water supply in the Cody Shale is limited to a small amount of mineralized water from the sandy part of the Clagget

TABLE 14.—*Average snowfall in inches*

Month	Busby	Crow Agency	Hardin	Kirby	Pryor	Wyola
January	6	7	7	13	12	11
February	6	7	5	21	10	12
March	8	8	7	10	13	11
April	4	5	2	8	13	9
May	1	[1]T	T	T	1	1
June	[1]T	T	T	0	0	T
July	0	0	0	0	0	0
August	0	0	0	0	0	0
September	1	1	1	2	1	1
October	2	2	1	T	4	2
November	6	5	3	11	8	10
December	7	9	8	14	9	10
Year	41	44	34	79	71	67

[1]T = trace.

TABLE 15.—*Probabilities of last freezing temperatures in spring and first in fall*

Probability	Station	Dates for given probability and temperature		
		24° F or lower	28° F or lower	32° F or lower
Spring:				
1 year in 10 later than:	Busby	May 17	May 28	June 12
	Crow Agency	May 10	May 20	June 4
	Hardin	May 8	May 19	June 3
	Wyola	May 12	June 2	June 20
2 years in 10 later than:	Busby	May 12	May 23	June 7
	Crow Agency	May 4	May 14	May 28
	Hardin	May 2	May 13	May 28
	Wyola	May 6	May 26	June 14
5 years in 10 later than:	Busby	May 2	May 13	May 28
	Crow Agency	April 22	May 2	May 17
	Hardin	April 22	May 3	May 18
	Wyola	April 24	May 14	June 2
Fall:				
1 year in 10 earlier than:	Busby	September 17	September 8	August 30
	Crow Agency	September 28	September 13	September 2
	Hardin	October 1	September 15	September 4
	Wyola	September 29	September 14	September 1
2 years in 10 earlier than:	Busby	September 22	September 13	September 4
	Crow Agency	October 4	September 19	September 8
	Hardin	October 6	September 20	September 9
	Wyola	October 3	September 19	September 6
5 years in 10 earlier than:	Busby	October 2	September 23	September 14
	Crow Agency	October 15	September 30	September 19
	Hardin	October 16	October 1	September 19
	Wyola	October 12	September 28	September 15

member and from the equivalent to the Eagle sandstone.

Frontier Formation.—The Frontier Formation, about 260 feet thick, consists of mostly dark-gray, concretionary sandy shale and interbedded bentonite. It has a few lenses of sandstone, some of which are mostly small, black chert fragments of pebble size. The Soap Creek bentonite bed at the top is 5 to 10 feet thick over much of the area. Water is yielded in small amounts in the upper part.

Mowry Shale.—The Mowry Shale, 345 to 400 feet thick, consists of dark-gray shale and light-gray siltstone and sandstone. Some of the shale and much of the siltstone is hard and resistant to erosion because it is siliceous. The siliceous beds weather to light gray and light bluish gray. Fishscale impressions are characteristic of this formation. Water is present in small amounts and is mineralized.

Thermopolis Shale.—This formation consists of about 425 feet of dark-gray shale and many beds of bentonite and ironstone concretions. Three or four bentonite beds near the middle are 2 to 4 feet thick. Between 150 and 200 feet from the base, the shale is cut by sandstone dikes that are 1 inch to 8 inches thick and 5 to 15 feet or more long. This nearly impermeable shale contains little water.

Cloverly Formation.—The Cloverly Formation generally consists of 300 to 400 feet of a discontinuous basal conglomeritic sandstone member; a middle variegated shale member; and an upper shale, siltstone, and sandstone member. The lower member, or Pryor Conglomerate, ranges from 30 to 150 feet in thickness; the middle part ranges from a few feet to 140 feet thick; and the upper unit is about 250 feet thick along the east side of the Big Horn Mountains and consists of interbedded siltstone, dark-gray shale, and thinly bedded standstone. The Cloverly Formation yields a moderate to large supply of water to wells that tap the lower part of the formation. The water is mineralized but is usable for domestic purposes. In favorable topographic locations artesian flow is possible.

Morrison Formation.—The Morrison Formation consists of 140 to 280 feet of grayish-green siltstone, sandstone, and variegated shale. Some lower beds are cross bedded and calcareous. It yields a small quantity of water from the more permeable strata.

Swift Formation.—The Swift Formation, 90 to 250 feet thick, consists of grayish-green sandstone, siltstone, and shale. In places the sandstone contains glauconite, chert pebbles, and fossil shells. Water is yielded in small quantities.

Rierdon Formation.—This formation consists of 175 to 390 feet of nonresistant, calcareous, light-brown shale over gray shale. At the top is a 5- to 10-foot bed of sandy, oolitic, fossiliferous, ledge-forming limestone. It is underlain by 5 to 10 feet of highly calcareous, yellowish-gray, very fine grained sandstone. This unit forms ridges, in contrast to the otherwise smooth slopes of the Rierdon and Swift Formations. Little, if any, water is present.

Piper Formation.—This formation consists of about 150 feet of red sandstone and siltstone and gray lime-

stone and gypsum. The lower 45 feet is thickly bedded gypsum and layers of red and green shale; the middle part is gray argillaceous limestone interbedded with green and red shale; and the upper member consists of red shale and siltstone. Any water from this formation is highly mineralized.

Chugwater Formation.—This formation is 375 to 650 feet thick. It consists largely of red sandstone, mostly fine grained to very fine grained and medium red to dark red. Red siltstone and shale are interbedded with the sandstone in small amounts. Also, there are stringers of gypsum and some limestone. No water is in this relatively impermeable formation.

Tensleep Sandstone.—The Tensleep Sandstone is 175 to 220 feet thick. The upper part is thinly bedded limestone, dolomite, shale, siltstone, and sandstone. The lower 75 to 120 feet is light-gray to yellowish-brown crossbedded sandstone and a little interbedded limestone and dolomite. The sandstone contains well-rounded, fine-grained to medium-grained quartz sand. Groves of pine trees mark outcrops of Tensleep Sandstone on the mountain slopes. This formation yields a moderate to large amount of water to wells that tap the thick sections of the formation. Most of the water is fresh.

Amsden Formation.—The Amsden Formation consists of 230 to 280 feet of interbedded sandstone, limestone, and red shale and siltstone. The Amsden Formation is separated from the underlying Madison Limestone by an erosional unconformity. This formation yields a large quantity of water from the brecciated or cavernous limestone.

Madison Limestone.—This formation, 670 to 800 feet thick, consists of massive, light-gray limestone and dolomite that form prominent cliffs and canyon walls. It is the most prolific water-bearing formation underlying the Area. However, the water is mineralized, and the formation is at a great depth except in the Big Horn and Pryor Mountains.

Jefferson Limestone and Three Forks Shale, Undifferentiated.—These formations consist of 180 to 200 feet of limestone, dolomite, and greenish-gray shale, siltstone, and sand. The upper part is very sandy limestone and dolomite.

Big Horn Dolomite.—This formation, 200 to 500 feet thick, consists of a lower massive dolomitic limestone member and an upper thinly bedded dolomitic and limestone member.

Gallatin Limestone and Gros Ventre Shale, Undifferentiated.—This formation, about 700 feet thick, consists of limestone and shale of Cambrian age. It crops out in the deepest part of Big Horn Canyon.

The Pre-Cambrian crystalline rocks that form the core of the Big Horn Mountains are exposed only at Point Lookout, 16 miles south of the mouth of Big Horn Canyon.

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Glossary

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed 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 capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

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.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

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 and brittle; little affected by moistening.

Depth, soil. Depth to a layer that restricts movement of water and roots. Depth classes recognized in this survey are:

	Inches
Shallow	less than 20
Moderately deep	20–40
Deep	more than 40

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid* and *very rapid.*

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

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

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

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

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

Slope class. The slope classes used in this survey are:

	Percent
Nearly level	0–2
Gently sloping (undulating)	2–8
Strongly sloping (sloping or rolling)	8–15
Moderately steep (hilly)	15–25
Steep	25–45
Very steep	More than 45

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that 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.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. 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 together without any regular cleavage, as in many claypans and hardpans).

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

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 loam, silt, 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."

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland. (geology). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

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GUIDE TO MAPPING UNITS

For complete information about a mapping unit, read both the description of the mapping unit and that of the series to which it belongs. Explanations of capability units begin on page 122, of range sites on page 134, and of windbreak suitability groups on page 143.

Map symbol Low intensity	Map symbol Medium intensity	Mapping unit	Page	Capability unit Irrigated	Capability unit Dryland	Range site	Windbreak suitability group
				Symbol	Symbol	Name	Symbol
	Aa	Abac loam, rolling	13	------	VIe-1	Silty, 15- to 19-inch precipitation zone	3M
AB		Abac loam, hilly	14	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
AC		Abac-Bitton complex, hilly	14	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
AD		Abac-Rock outcrop complex, very steep	14	------	VIIe-1	Thin Breaks, 15- to 19-inch precipitation zone	4
	Ae	Absarokee silty clay loam, gently undulating	15	------	IIe-2	Clayey, 15- to 19-inch precipitation zone	2M
	Af	Absarokee silty clay loam, undulating	15	------	IIIe-2	Clayey, 15- to 19-inch precipitation zone	2M
	Ag	Absarokee silty clay loam, rolling	15	------	IVe-2	Clayey, 15- to 19-inch precipitation zone	2M
AH		Absarokee silty clay loam, hilly	15	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
	Ak	Absarokee-Castner complex, undulating	15	------	VIs-1	Shallow, 15- to 19-inch precipitation zone	4
AL		Absarokee-Castner complex, hilly	15	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
AM		Absarokee-Armington association, gently sloping	15	------	IIIe-2	Clayey, 15- to 19-inch precipitation zone	2M
	An	Absher-Nobe clays	16	------	VIs-1	Pan Spots, 15- to 19-inch precipitation zone	3S
AO		Adel-Mayflower association, sloping	17	------	IVe-2	Silty, 20- to 24-inch precipitation zone	1
	Ap	Adger clay, 0 to 8 percent slopes	17	------	VIs-1	Clayey, 15- to 19-inch precipitation zone	3S
	Ar	Alice fine sandy loam, 4 to 15 percent slopes	18	------	IIIe-3	Sandy, 10- to 14-inch precipitation zone	2M
	Asa	Allentine clay, 0 to 2 percent slopes	19	IVs-1	VIs-1	Clayey, 10- to 14-inch precipitation zone	2S
	Asb	Allentine clay, 2 to 4 percent slopes	19	IVs-1	VIs-1	Clayey, 10- to 14-inch precipitation zone	2S
	Asc	Allentine-Bone complex, 0 to 1 percent slopes	19	IVs-1	VIs-1	Pan Spots, 10- to 14-inch precipitation zone	3S
	Asd	Allentine-Bone complex, 1 to 4 percent slopes	19	------	VIs-1	Pan Spots, 10- to 14-inch precipitation zone	3S
ATa		Alluvial land, gravelly	19	------	VIs-1	Shallow to Gravel, 10- to 14-inch precipitation zone	4

Map symbol Low intensity	Map symbol Medium intensity	Mapping unit	Page	Capability unit Irrigated	Capability unit Dryland	Range site	Windbreak suitability group
				Symbol	Symbol	Name	Symbol
ATb		Alluvial land, cobbly	19	------	VIs-1	Shallow to Gravel, 15- to 19-inch precipitation zone	3M
ATc		Alluvial land, wet	19	------	IVw-2	Wet Land, 15- to 19-inch precipitation zone	3W
	Au	Amherst loam, undulating	20	------	IVe-2	Silty, 15- to 19-inch precipitation zone	3M
AVa		Amherst loam, rolling	20	------	IVe-2	Silty, 15- to 19-inch precipitation zone	3M
AVb		Amherst complex, rolling	20	------	VIe-1	Silty, 15- to 19-inch precipitation zone	3M
AVc		Amherst complex, hilly	20	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
AVd		Amherst-Maginnis complex, hilly	20	------	VIIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
AWa		Armington silty clay loam	21	------	IVe-2	Clayey, 15- to 19-inch precipitation zone	2M
AWb		Armington complex, rolling	21	------	IVe-2	Clayey, 15- to 19-inch precipitation zone	2M
	Axa	Arnegard loam, 8 to 15 percent slopes	22	------	IVe-2	Silty, 15- to 19-inch precipitation zone	1
	Axb	Arnegard silt loam, 2 to 4 percent slopes	22	IIe-1	IIe-2	Silty, 15- to 19-inch precipitation zone	1
	Axc	Arnegard silt loam, 4 to 8 percent slopes	22	------	IIIe-2	Silty, 15- to 19-inch precipitation zone	1
	Ayd	Arvada silty clay loam	23	------	VIs-1	Clayey, 10- to 14-inch precipitation zone	3S
	Aye	Arvada-Bone clays	23	------	VIs-1	Pan Spots, 10- to 14-inch precipitation zone	4
	Az	Ascalon sandy loam, 4 to 8 percent slopes	23	------	IIIe-2	Sandy, 10- to 14-inch precipitation zone	2M
BA		Babb silt loam, rolling [1/]	24	------	IVe-2	----------	--
BB		Babb silt loam, hilly [1/]	24	------	VIe-1	----------	--
	Bc	Beauvais silty clay loam, gently undulating	25	IIe-1	IIe-2	Silty, 15- to 19-inch precipitation zone	1
	Bd	Beauvais silty clay loam, undulating	25	IIIe-1	IIIe-2	Silty, 15- to 19-inch precipitation zone	1
	Be	Beauvais silty clay loam, rolling	25	IVe-2	IVe-2	Silty, 15- to 19-inch precipitation zone	1
	Bf	Beauvais-Gilt Edge silty clay loams, gently undulating	25	IIe-1	IIe-2	Clayey, 15- to 19-inch precipitation zone	2S
	Bg	Belfield silt loam, 0 to 1 percent slopes	26	IIs-1	IIs-2	Silty, 15- to 19-inch precipitation zone	1
	Bh	Belfield silt loam, gently undulating	26	IIe-1	IIe-2	Silty, 15- to 19-inch precipitation zone	1
	Bk	Belfield silt loam, undulating	26	IIIe-1	IIIe-2	Silty, 15- to 19-inch precipitation zone	1

Map symbol Low intensity	Map symbol Medium intensity	Mapping unit	Page	Capability unit Irrigated Symbol	Capability unit Dryland Symbol	Range site Name	Windbreak suitability group Symbol
	Bm	Belfield-Adger complex, 0 to 1 percent slopes	26	------	IIe-2	Pan Spots, 15- to 19-inch precipitation zone	3S
	Bn	Belfield-Adger complex, gently undulating	26	------	IIe-2	Pan Spots, 15- to 19-inch precipitation zone	3S
	Bo	Belfield-Adger complex, undulating	26	------	IIIe-2	Pan Spots, 15- to 19-inch precipitation zone	3S
	Bp	Benteen loam, rolling	27	------	VIe-1	Silty, 20- to 24-inch precipitation zone	1
	Br	Benteen loam, hilly	27	------	VIe-1	Silty, 20- to 24-inch precipitation zone	1
	Bs	Bew silty clay loam, 0 to 1 percent slopes	28	IIIs-1	IIIs-3	Clayey, 10- to 14-inch precipitation zone	1
	Bt	Bew silty clay loam, gently undulating	28	IIIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
BU		Bitton gravelly loam, 2 to 8 percent slopes	28	------	IVs-2	Silty, 15- to 19-inch precipitation zone	3M
BV		Bitton soils, hilly	28	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
	Bw	Bone clay	29	------	VIIs-1	Dense Clay, 10- to 14-inch precipitation zone	4
CA		Castner-Reeder loams, undulating	30	------	VIe-1	Shallow, 15- to 19-inch precipitation zone	3M
CB		Castner-Reeder loams, rolling	30	------	VIe-1	Shallow, 15- to 19-inch precipitation zone	3M
CC		Castner-Rock outcrop complex, rolling	30	------	VIe-1	Shallow, 15- to 19-inch precipitation zone	4
CD		Castner-Vebar sandy loams, hilly	30	------	VIe-1	Sandy, 15- to 19-inch precipitation zone	4
	Ce	Cherry silty clay loam, 2 to 8 percent slopes	30	IIIe-1	IIIe-2	Clayey, 15- to 19-inch precipitation zone	1
	Cf	Chugter loam, 2 to 8 percent slopes	31	IIIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
CG		Chugter complex, 2 to 15 percent slopes	31	------	IVe-3	Silty, 10- to 14-inch precipitation zone	1
CH		Clapper-Harvey complex, rolling	32	------	VIs-1	Silty, 10- to 14-inch precipitation zone	3L
CK		Clapper-Midway complex, hilly	32	------	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
	Cm	Colby silt loam, 4 to 8 percent slopes	33	IIIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
	Cn	Colby silt loam, 8 to 15 percent slopes	33	IVe-2	IVe-3	Silty, 10- to 14-inch precipitation zone	1
	Co	Colby silty clay loam, 1 to 4 percent slopes	33	IIe-1	IIIe-2	Clayey, 10- to 14-inch precipitation zone	1

GUIDE TO MAPPING UNITS--Continued

Map symbol Low intensity	Map symbol Medium intensity	Mapping unit	Page	Capability unit Irrigated Symbol	Capability unit Dryland Symbol	Range site Name	Windbreak suitability group Symbol
	Cp	Colby silty clay loam, 4 to 8 percent slopes	33	IIIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Cr	Colby silty clay loam, 8 to 15 percent slopes	33	IVe-2	IVe-3	Clayey, 10- to 14-inch precipitation zone	1
	Cs	Colby-Beauvais silt loams, undulating	33	IIIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
	Ct	Colby-Beauvais silt loams, rolling	33	IVe-2	IVe-3	Silty, 10- to 14-inch precipitation zone	1
CU		Colby-Clapper silt loams, rolling	34	------	IVe-3	Silty, 10- to 14-inch precipitation zone	3L
	Cv	Colby-Keiser silty clay loams, 4 to 8 percent slopes	34	IIIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
CW		Colby-Midway complex, 8 to 15 percent slopes	34	------	IVe-3	Clayey, 10- to 14-inch precipitation zone	3M
CX		Colby association, rolling	34	------	IVe-3	Silty, 10- to 14-inch precipitation zone	3M
CY		Colby association, hilly	34	------	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
	Cz	Cushman loam, undulating	35	------	IIIe-3	Silty, 10- to 14-inch precipitation zone	3M
	Da	Danvers silty clay loam, 0 to 1 percent slopes	35	IIc-1	IIc-2	Clayey, 15- to 19-inch precipitation zone	2L
	Db	Danvers silty clay loam, gently undulating	36	IIe-1	IIe-2	Clayey, 15- to 19-inch precipitation zone	2L
	Dc	Danvers silty clay loam, undulating	36	IIIe-1	IIIe-2	Clayey, 15- to 19-inch precipitation zone	2L
	Dd	Danvers cobbly silty clay loam, 1 to 4 percent slopes	36	------	IIe-2	Clayey, 15- to 19-inch precipitation zone	2L
	De	Danvers-Judith silty clay loams, gently undulating	36	------	IIe-2	Clayey, 15- to 19-inch precipitation zone	3L
	Df	Danvers-Judith silty clay loams, undulating	36	------	IIIe-2	Clayey, 15- to 19-inch precipitation zone	3L
	Dg	Danvers-Judith silty clay loams, hilly	36	------	IVe-2	Thin Hilly, 15- to 19-inch precipitation zone	3L
DHa		Dast sandy loam, rolling	37	------	IVe-2	Sandy, 15- to 19-inch precipitation zone	3M
DHb		Dast sandy loam, hilly	37	------	VIe-1	Sandy, 15- to 19-inch precipitation zone	4
DHc		Dast complex, hilly	37	------	VIe-1	Sandy, 15- to 19-inch precipitation zone	4
DHd		Dast complex, very steep	38	------	VIIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
	Dk	Dast-Parshall sandy loams, rolling	38	------	IVe-2	Sandy, 15- to 19-inch precipitation zone	3M

Map symbol Low intensity	Map symbol Medium intensity	Mapping unit	Page	Capability unit Irrigated	Capability unit Dryland	Range site	Windbreak suitability group
				Symbol	Symbol	Name	Symbol
DMa		Doney loam, rolling	38	------	IVe-2	Silty, 15- to 19-inch precipitation zone	3M
DMb		Doney silty clay loam, hilly 1/	38	------	VIe-1	----------	--
	Dn	Doney-Reeder loams, rolling	39	------	IVe-2	Silty, 15- to 19-inch precipitation zone	3M
DOa		Doney-Ringling complex, rolling	39	------	VIe-1	Silty, 15- to 19-inch precipitation zone	4
DOb		Doney-Ringling complex, hilly	39	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
DOc		Doney-Ringling complex, very steep	39	------	VIIe-1	Thin Breaks, 15- to 19-inch precipitation zone	4
DOd		Doney-Rock outcrop complex, very steep	39	------	VIIe-1	Thin Breaks, 15- to 19-inch precipitation zone	4
DOe		Doney-Wayden complex, hilly	40	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
	Dp	Duncom extremely channery loam, rolling	40	------	VIe-1	Shallow, 20- to 24-inch precipitation zone	4
DR		Duncom complex, rolling	40	------	VIs-1	Shallow, 20- to 24-inch precipitation zone	4
DS		Duncom-Tarrete association, rolling	40	------	VIe-1	Shallow, 20- to 24-inch precipitation zone	4
DT		Duncom-Tarrete association, hilly	41	------	VIe-1	Shallow, 20- to 24-inch precipitation zone	4
	Ec	Eltsac clay, undulating	41	------	IIIe-2	Clayey, 15- to 19-inch precipitation zone	3M
	Ed	Eltsac clay, rolling	41	------	IVe-2	Clayey, 15- to 19-inch precipitation zone	3M
EH		Eltsac cobbly clay, hilly	41	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
	Fa	Farnuf loam, 0 to 2 percent slopes	42	IIc-1	IIc-2	Silty, 15- to 19-inch precipitation zone	1
	Fb	Farnuf loam, 2 to 4 percent slopes	42	IIe-1	IIe-2	Silty, 15- to 19-inch precipitation zone	1
	Fc	Farnuf loam, 4 to 8 percent slopes	42	IIIe-1	IIIe-2	Silty, 15- to 19-inch precipitation zone	1
FD		Farnuf-Doney association, sloping	42	------	IVe-2	Silty, 15- to 19-inch precipitation zone	2M
	Fe	Fergus silt loam, 2 to 4 percent slopes	43	------	IIIe-2	Silty, 15- to 19-inch precipitation zone	1
	Ff	Fergus silt loam, 4 to 8 percent slopes	43	------	IIIe-2	Silty, 15- to 19-inch precipitation zone	1
	Fg	Fergus silt loam, 8 to 15 percent slopes	43	------	IVe-2	Silty, 15- to 19-inch precipitation zone	1
	Fh	Fort Collins loam, 0 to 2 percent slopes	44	IIc-1	IIIc-1	Silty, 10- to 14-inch precipitation zone	1
	Fk	Fort Collins loam, 2 to 4 percent slopes	44	IIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1

Map symbol Low intensity	Map symbol Medium intensity	Mapping unit	Page	Capability unit Irrigated Symbol	Capability unit Dryland Symbol	Range site Name	Windbreak suitability group Symbol
	Fm	Fort Collins loam, 4 to 8 percent slopes	44	IIIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
	Fn	Fort Collins loam, channeled, 4 to 8 percent slopes	44	------	IVe-3	Silty, 10- to 14-inch precipitation zone	1
	Fo	Frazer silty clay loam	45	IIs-1	IIe-2	Clayey, 15- to 19-inch precipitation zone	1
	Fr	Frazer silty clay loam, saline	45	------	IIIs-2	Saline Lowland, 10- to 14-inch precipitation zone	2S
	Fs	Frazer silty clay	45	IIs-1	IIs-2	Clayey, 15- to 19-inch precipitation zone	1
FT		Frazer and Korchea soils, channeled	45	------	VIe-1	Silty, 10- to 14-inch precipitation zone	4
	Gc	Gilt Edge silty clay loam, 0 to 2 percent slopes	46	IVs-1	IVs-2	Dense Clay, 10- to 14-inch precipitation zone	2S
	Gd	Gilt Edge silty clay loam, 2 to 4 percent slopes	46	IVe-1	IVs-2	Dense Clay, 10- to 14-inch precipitation zone	2S
	Ge	Gilt Edge-Bone complex, 0 to 1 percent slopes	46	IVs-1	IVs-2	Pan Spots, 10- to 14-inch precipitation zone	4
	Gf	Gilt Edge-Bone complex, 1 to 4 percent slopes	46	IVe-1	IVs-2	Pan Spots, 10- to 14-inch precipitation zone	4
	Gg	Glenberg fine sandy loam, 0 to 2 percent slopes	47	IIs-2	IVe-3	Sandy, 10- to 14-inch precipitation zone	2M
	Gh	Glenberg fine sandy loam, 2 to 4 percent slopes	47	IIe-2	IVe-3	Sandy, 10- to 14-inch precipitation zone	2M
	Gk	Glenberg fine sandy loam, 4 to 8 percent slopes	47	IIIe-2	IVe-3	Sandy, 10- to 14-inch precipitation zone	2M
	Gm	Glenberg loam, 0 to 2 percent slopes	47	IIs-2	IVe-3	Silty, 10- to 14-inch precipitation zone	1
	Gn	Grail clay loam, 0 to 2 percent slopes	48	IIs-1	IIc-2	Clayey, 15- to 19-inch precipitation zone	1
	Go	Grail clay loam, 2 to 8 percent slopes	48	IIIe-1	IIIe-2	Clayey, 15- to 19-inch precipitation zone	1
	Gr	Grail clay loam, 8 to 15 percent slopes	48	------	IVe-2	Clayey, 15- to 19-inch precipitation zone	1
GS		Grail clay loam, 15 to 35 percent slopes	48	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
	Gt	Grail silty clay, 0 to 2 percent slopes	48	IIs-1	IIIe-2	Clayey, 15- to 19-inch precipitation zone	1
HA		Hanson extremely stony loam, rolling	49	------	VIIe-1	Silty, 20- to 24-inch precipitation zone	4

GUIDE TO MAPPING UNITS--Continued

Map symbol Low intensity	Map symbol Medium intensity	Mapping unit	Page	Capability unit Irrigated	Capability unit Dryland	Range site	Windbreak suitability group
				Symbol	Symbol	Name	Symbol
HB		Hanson-Babb association, very steep[1/]	49	------	VIIs-1	----------	--
	Hca	Harvey loam, gently undulating-----	50	IIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	3L
	Hcb	Harvey loam, undulating----------	50	IIIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	3L
	Hcc	Harvey loam, rolling----------	50	------	IVe-3	Silty, 10- to 14-inch precipitation zone	3L
	Hd	Harvey gravelly loam, undulating---	50	------	IIIe-3	Silty, 10- to 14-inch precipitation zone	3L
	He	Harvey complex, undulating---------	50	------	IIIe-3	Silty, 10- to 14-inch precipitation zone	3L
	Hfa	Haverson loam, 0 to 2 percent slopes----------	51	IIc-1	IIIc-1	Silty, 10- to 14-inch precipitation zone	1
	Hfb	Haverson loam, 2 to 4 percent slopes----------	51	IIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
	Hfc	Haverson loam, saline----------	51	------	IIIs-2	Saline Lowland, 10- to 14-inch precipitation zone	2S
	Hfd	Haverson silty clay loam----------	51	IIc-2	IIIc-1	Clayey, 10- to 14-inch precipitation zone	1
	Hfe	Haverson silty clay----------	51	IIs-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Hff	Haverson silty clay, thick surface----------	51	IIs-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Hfh	Haverson-Hysham silty clay loams---	51	------	IIIe-3	Clayey, 10- to 14-inch precipitation zone	3S
HGa		Haverson and Glenberg soils[1/] -------	52	------	IIIe-3	Sandy, 10- to 14-inch precipitation zone	2W
HGb		Haverson and Lohmiller soils, channeled----------	52	------	VIe-1	Silty, 10- to 14-inch precipitation zone	4
HGc		Haverson and Lohmiller soils, frequently flooded----------	52	------	VIw-1	Overflow, 10- to 14-inch precipitation zone	4
	Hh	Haverson and Lohmiller soils, wet--	52	------	VIw-1	Saline Lowland, 10- to 14-inch precipitation zone	3W
HK		Haverson soils, saline----------	52	------	IVs-2	Saline Lowland, 10- to 14-inch precipitation zone	3S
	Hla	Heldt silty clay loam, 0 to 2 percent slopes----------	53	IIs-1	IIIs-3	Clayey, 10- to 14-inch precipitation zone	1
	Hlb	Heldt silty clay loam, 2 to 4 percent slopes----------	53	IIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Hlc	Heldt silty clay loam, 4 to 8 percent slopes----------	53	IIIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Hld	Heldt silty clay loam, 8 to 15 percent slopes----------	53	------	IVe-3	Clayey, 10- to 14-inch precipitation zone	1
	Hle	Heldt silty clay, 0 to 2 percent slopes----------	53	IIs-1	------	Clayey, 10- to 14-inch precipitation zone	1
	Hlf	Heldt-Hysham silty clay loams, 0 to 2 percent slopes----------	53	------	IIIs-3	Clayey, 10- to 14-inch precipitation zone	3S

Map symbol Low intensity	Map symbol Medium intensity	Mapping unit	Page	Capability unit Irrigated	Capability unit Dryland	Range site	Windbreak suitability group
				Symbol	Symbol	Name	Symbol
	Hlg	Heldt-Hysham silty clay loams, 2 to 4 percent slopes	54	------	IIIe-3	Clayey, 10- to 14-inch precipitation zone	3S
	Hma	Hesper silty clay loam, 0 to 1 percent slopes	54	IIc-2	IIIc-1	Clayey, 10- to 14-inch precipitation zone	1
	Hmb	Hesper silty clay loam, 1 to 4 percent slopes	54	IIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Hmc	Hesper silty clay loam, 4 to 8 percent slopes	54	IIIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Hna	Hydro loam, 0 to 8 percent slopes	55	------	IIIc-1	Silty, 10- to 14-inch precipitation zone	2S
	Hnb	Hydro silt loam, 0 to 2 percent slopes	55	IIs-1	IIIc-1	Silty, 10- to 14-inch precipitation zone	2S
	Hnc	Hydro silt loam, 2 to 4 percent slopes	55	IIe-1	IIIe-2	Silty, 10- to 14-inch precipitation zone	2S
	Hnd	Hydro silt loam, 4 to 8 percent slopes	55	------	IIIe-2	Silty, 10- to 14-inch precipitation zone	2S
	Hne	Hydro silty clay loam, 0 to 2 percent slopes	56	IIs-1	IIIs-3	Silty, 10- to 14-inch precipitation zone	2S
	Hnf	Hydro silty clay loam, 2 to 4 percent slopes	56	IIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	2S
	Hng	Hydro-Allentine complex, 1 to 4 percent slopes	56	------	IVs-2	Pan Spots, 10- to 14-inch precipitation zone	3S
	Hnh	Hydro-Allentine complex, 4 to 8 percent slopes	56	------	IVs-2	Pan Spots, 10- to 14-inch precipitation zone	3S
	Hnk	Hydro-Gilt Edge complex, 0 to 1 percent slopes	56	------	IIIs-3	Clayey, 10- to 14-inch precipitation zone	2S
	Ho	Hysham loam, 0 to 2 percent slopes	57	------	VIs-1	Silty, 10- to 14-inch precipitation zone	3S
	Hp	Hysham silty clay loam, 4 to 8 percent slopes	57	------	VIe-1	Clayey, 10- to 14-inch precipitation zone	3S
	Hr	Hysham silty clay loam, channeled, 0 to 4 percent slopes	57	------	VIs-1	Clayey, 10- to 14-inch precipitation zone	3S
HS		Hysham-Midway silty clay loams, 4 to 15 percent slopes	57	------	VIe-1	Clayey, 10- to 14-inch precipitation zone	3S
HT		Hysham and Lohmiller silty clay loams, 0 to 8 percent slopes	57	------	VIe-1	Overflow, 10- to 14-inch precipitation zone	3S
	Jc	Judith clay loam, 0 to 2 percent slopes	58	IIc-1	IIs-2	Clayey, 15- to 19-inch precipitation zone	2L
	Jd	Judith clay loam, 2 to 4 percent slopes	58	IIe-1	IIe-2	Clayey, 15- to 19-inch precipitation zone	2L

Map symbol Low intensity	Map symbol Medium intensity	Mapping unit	Page	Capability unit Irrigated Symbol	Capability unit Dryland Symbol	Range site Name	Windbreak suitability group Symbol
	Je	Judith clay loam, 4 to 8 percent slopes	58	IIIe-1	IIIe-2	Clayey, 15- to 19-inch precipitation zone	2L
	Jh	Judith-Windham complex, 4 to 8 percent slopes	58	------	IIIe-2	Clayey, 15- to 19-inch precipitation zone	3L
	Jk	Judith-Windham complex, 8 to 15 percent slopes	58	------	IVe-2	Clayey, 15- to 19-inch precipitation zone	3L
	Kc	Keiser silty clay loam, 0 to 2 percent slopes	59	IIc-1	IIIc-1	Clayey, 10- to 14-inch precipitation zone	1
	Kd	Keiser silty clay loam, 2 to 4 percent slopes	59	IIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Ke	Keiser silty clay loam, 4 to 8 percent slopes	59	IIIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Kf	Keiser-Colby complex, gently undulating	59	------	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Kg	Kim loam, 4 to 15 percent slopes	60	------	IVe-3	Silty, 10- to 14-inch precipitation zone	1
	Kh	Korchea loam, 0 to 2 percent slopes	60	IIc-1	IIc-2	Silty, 15- to 19-inch precipitation zone	1
	Kk	Korchea loam, 2 to 4 percent slopes	61	IIe-1	IIe-2	Silty, 15- to 19-inch precipitation zone	1
	Km	Korchea silt loam, 0 to 2 percent slopes	61	IIc-1	IIc-2	Silty, 15- to 19-inch precipitation zone	1
	Kn	Korchea silt loam, frequently flooded	61	------	VIw-1	Overflow, 15- to 19-inch precipitation zone	4
	Ko	Korchea silty clay loam, 0 to 2 percent slopes	61	IIc-1	IIc-2	Silty, 15- to 19-inch precipitation zone	1
	Kp	Korchea silty clay loam, 2 to 4 percent slopes	61	IIe-1	IIe-2	Silty, 15- to 19-inch precipitation zone	1
KR		Korchea and Frazer soils, water table	61	------	IVw-2	Overflow, 15- to 19-inch precipitation zone	2W
	Ks	Kyle silty clay, 0 to 2 percent slopes	62	IIIs-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Kt	Kyle silty clay, 2 to 4 percent slopes	62	IIIe-3	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Ku	Kyle silty clay, 4 to 8 percent slopes	62	------	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
KV		Kyle gravelly silty clay, 8 to 15 percent slopes	62	------	IVe-3	Clayey, 10- to 14-inch precipitation zone	1
	Kw	Kyle clay, saline	62	------	IVw-2	Saline Lowland, 10- to 14-inch precipitation zone	3S

Map symbol Low intensity	Map symbol Medium intensity	Mapping unit	Page	Capability unit Irrigated Symbol	Capability unit Dryland Symbol	Range site Name	Windbreak suitability group Symbol
	La	La Fonda loam, 2 to 4 percent slopes	63	------	IIIe-3	Silty, 10- to 14-inch precipitation zone	2M
LCa		Lap-Trulon complex, rolling	63	------	VIe-1	Silty, 15- to 19-inch precipitation zone	3L
LCb		Lap association, undulating	63	------	VIs-1	Shallow, 15- to 19-inch precipitation zone	3M
LCc		Lap association, rolling	64	------	VIe-1	Shallow, 15- to 19-inch precipitation zone	3M
LCd		Lap-Armington association, rolling	64	------	VIe-1	Shallow, 15- to 19-inch precipitation zone	4
LD		Lavina-Travessilla loams, undulating	64	------	IVs-2	Shallow, 10- to 14-inch precipitation zone	3M
	Lea	Lennep loam, 2 to 4 percent slopes	65	------	IIIe-2	Clayey, 15- to 19-inch precipitation zone	2S
	Leb	Lennep loam, 4 to 8 percent slopes	65	------	IVe-2	Clayey, 15- to 19-inch precipitation zone	2S
	Lec	Lennep-Adger complex, gently undulating	65	------	IIIe-2	Pan Spots, 15- to 19-inch precipitation zone	3S
	Led	Lennep-Adger complex, undulating	66	------	IVe-2	Pan Spots, 15- to 19-inch precipitation zone	3S
LF		Lismas clay, undulating	66	------	VIe-1	Shallow Clay, 10- to 14-inch precipitation zone	4
LG		Lismas gravelly clay, rolling	66	------	VIe-1	Shallow Clay, 10- to 14-inch precipitation zone	3M
LH		Lismas gravelly clay, hilly	66	------	VIe-1	Shallow Clay, 10- to 14-inch precipitation zone	4
LK		Lismas-Shale outcrop complex, rolling	66	------	VIe-1	Shallow Clay, 10- to 14-inch precipitation zone	3M
LM		Lismas-Shale outcrop complex, steep	67	------	VIIe-1	Shallow Clay, 10- to 14-inch precipitation zone	4
LN		Lismas-Vananda clays, undulating	67	------	IVe-3	Shallow Clay, 10- to 14-inch precipitation zone	2S
	Lo	Lohmiller silty clay loam, 0 to 2 percent slopes	67	IIs-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Lp	Lohmiller silty clay loam, 2 to 4 percent slopes	67	IIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Lr	Lohmiller silty clay loam, 4 to 8 percent slopes	68	IIIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Ls	Lohmiller silty clay loam, 8 to 15 percent slopes	68	------	IVe-3	Clayey, 10- to 14-inch precipitation zone	1
	Lt	Lohmiller silty clay, saline, 0 to 2 percent slopes	68	------	IVs-2	Saline Lowland, 10- to 14-inch precipitation zone	2S
	Lu	Lohmiller silty clay, saline, 2 to 4 percent slopes	68	------	IVs-2	Saline Lowland, 10- to 14-inch precipitation zone	2S

Map symbol Low intensity	Map symbol Medium intensity	Mapping unit	Page	Capability unit Irrigated	Capability unit Dryland	Range site	Windbreak suitability group
				Symbol	Symbol	Name	Symbol
LV		Lohmiller-Midway silty clay loams, undulating	68	------	IVe-3	Clayey, 10- to 14-inch precipitation zone	2M
	Ma	Macar loam, 4 to 8 percent slopes	69	IIIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
MB		Maginnis-Shale outcrop complex, very steep	69	------	VIIe-1	Thin Breaks, 15- to 19-inch precipitation zone	4
MC		Maginnis-Windham complex, hilly	69	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
	Md	Marias clay, 0 to 2 percent slopes	70	IIIs-1	IIs-2	Clayey, 15- to 19-inch precipitation zone	1
	Me	Marias clay, 2 to 4 percent slopes	70	IIIe-3	IIe-2	Clayey, 15- to 19-inch precipitation zone	1
	Mf	Marias clay, 4 to 8 percent slopes	70	IVe-1	IIIe-3	Clayey, 15- to 19-inch precipitation zone	1
	Mg	Marias clay, 8 to 15 percent slopes	70	------	IVe-2	Clayey, 15- to 19-inch precipitation zone	1
MH		Maschetah complex, rolling	71	------	IVe-2	Silty, 15- to 19-inch precipitation zone	3L
MK		Maschetah-Norbert complex, hilly	71	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
	Mm	Mayflower silt loam, rolling	72	------	IVe-2	Silty, 20- to 24-inch precipitation zone	2M
MN		Mayflower association, rolling	72	------	IVe-2	Silty, 20- to 24-inch precipitation zone	1
	Mo	McKenzie clay	73	------	IIIw-2	Overflow, 10- to 14-inch precipitation zone	1
	Mp	McRae loam, 0 to 1 percent slopes	73	IIc-1	IIIc-1	Silty, 10- to 14-inch precipitation zone	1
	Mr	McRae loam, 1 to 4 percent slopes	73	IIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
	Ms	McRae loam, 4 to 8 percent slopes	73	IIIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
	Mt	McRae silty clay loam, 0 to 1 percent slopes	73	IIc-1	IIIc-1	Clayey, 10- to 14-inch precipitation zone	1
	Mu	Midway silty clay loam, undulating	74	------	IVe-3	Clayey, 10- to 14-inch precipitation zone	3M
MVa		Midway silty clay loam, rolling	74	------	VIe-1	Clayey, 10- to 14-inch precipitation zone	3M
MVb		Midway silty clay loam, hilly	74	------	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
MVc		Midway-Lismas complex, rolling	74	------	VIe-1	Clayey, 10- to 14-inch precipitation zone	3M
MVd		Midway-Lismas complex, hilly	74	------	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
MVe		Midway-Thedalund complex, rolling	75	------	VIe-1	Clayey, 10- to 14-inch precipitation zone	3M
MVf		Midway-Thedalund complex, hilly	75	------	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
MVg		Midway-Thurlow association, rolling	75	------	IVe-2	Clayey, 10- to 14-inch precipitation zone	2M

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				Symbol	Symbol	Name	Symbol
	Mw	Morton silt loam, undulating-------	75	------	IIIe-2	Silty, 20- to 24-inch precipitation zone	2M
	Nd	Nelson fine sandy loam, undulating-----------------------	76	------	IVe-3	Sandy, 10- to 14-inch precipitation zone	3M
	Ne	Nelson-Alice fine sandy loams, rolling---------------------------	76	------	IVe-3	Sandy, 10- to 14-inch precipitation zone	3M
NF		Nelson-Glenberg sandy loams, undulating-----------------------	76	------	IVe-3	Sandy, 10- to 14-inch precipitation zone	3M
	Ng	Neville loam, rolling--------------	77	------	IIIe-3	Silty, 10- to 14-inch precipitation zone	2M
NH		Norbert-Eltsac clays, hilly--------	78	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
NK		Norbert-Shale outcrop complex, steep----------------------------	78	------	VIIe-1	Shallow Clay, 15- to 19-inch precipitation zone	4
	Nm	Nunn silty clay loam, 0 to 1 percent slopes-------------------	79	IIs-1	IIIs-3	Clayey, 10- to 14-inch precipitation zone	1
	Nn	Nunn silty clay loam, 1 to 4 percent slopes-------------------	79	IIe-1	IIIe-2	Clayey, 10- to 14-inch precipitation zone	1
	No	Nunn silty clay loam, 4 to 8 percent slopes-------------------	79	IIIe-1	IIIe-2	Clayey, 10- to 14-inch precipitation zone	1
	Nr	Nunn silty clay loam, 8 to 15 percent slopes-------------------	79	------	IVe-3	Clayey, 10- to 14-inch precipitation zone	1
NS		Nunn-Midway silty clay loams, 4 to 15 percent slopes-------------	79	------	IVe-3	Clayey, 10- to 14-inch precipitation zone	1
	On	Olney fine sandy loam, 4 to 12 percent slopes-------------------	80	------	IIIe-3	Sandy, 10- to 14-inch precipitation zone	2M
	Pa	Parshall fine sandy loam, 4 to 8 percent slopes--------------	80	------	IIIe-2	Sandy, 15- to 19-inch precipitation zone	1
	Pd	Peritsa silt loam, undulating------	81	------	IIIe-2	Silty, 15- to 19-inch precipitation zone	2M
PE		Peritsa-Abac loams, rolling--------	81	------	IVe-2	Silty, 15- to 19-inch precipitation zone	4
PF		Peritsa complex, rolling-----------	81	------	IVe-2	Silty, 15- to 19-inch precipitation zone	1
	Pg	Pierre clay, undulating------------	82	------	IVe-3	Clayey, 10- to 14-inch precipitation zone	2M
	Ph	Pierre clay, rolling---------------	82	------	VIe-1	Clayey, 10- to 14-inch precipitation zone	2M
	Pk	Pierre-Kyle clays, gently undulating-----------------------	82	------	IVs-2	Clayey, 10- to 14-inch precipitation zone	2M
PM		Pierre-Lismas clays, rolling-------	82	------	VIe-1	Clayey, 10- to 14-inch precipitation zone	3M
PN		Pierre-Lismas clays, hilly---------	82	------	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
PO		Pultney-Neville association, undulating-----------------------	83	------	IIIe-3	Silty, 10- to 14-inch precipitation zone	3L

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QU		Quietus loam[1/]	84	------	VIe-1	----------	--
	Ra	Raynesford loam, undulating	84	------	IVe-2	Silty, 20- to 24-inch precipitation zone	2L
	Rda	Reeder loam, gently undulating	85	------	IIe-2	Silty, 15- to 19-inch precipitation zone	2M
	Rdb	Reeder loam, undulating	85	------	IIIe-2	Silty, 15- to 19-inch precipitation zone	2M
	Rdc	Reeder loam, hilly	85	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
REa		Reeder-Regent complex, rolling	85	------	IVe-2	Silty, 15- to 19-inch precipitation zone	2M
REb		Reeder-Rentsac complex, undulating	85	------	VIs-1	Silty, 15- to 19-inch precipitation zone	3M
REc		Reeder-Darret association, undulating	85	------	IIIe-2	Silty, 15- to 19-inch precipitation zone	2M
REd		Reeder-Darret association, rolling	86	------	IVe-2	Silty, 15- to 19-inch precipitation zone	2M
	Rfa	Regent silty clay loam, gently undulating	86	------	IIe-2	Clayey, 15- to 19-inch precipitation zone	2M
	Rfc	Regent silty clay loam, undulating	86	------	IIIe-2	Clayey, 15- to 19-inch precipitation zone	2M
	Rfd	Regent silty clay loam, rolling	86	------	IVe-2	Clayey, 15- to 19-inch precipitation zone	2M
	Re	Renohill silty clay loam, undulating	87	------	IIIe-3	Clayey, 10- to 14-inch precipitation zone	2M
RH		Rentsac-Doney complex, rolling	87	------	VIe-1	Shallow, 15- to 19-inch precipitation zone	3M
	Rk	Richfield silty clay loam, 0 to 2 percent slopes	88	IIc-2	IIIc-1	Silty, 10- to 14-inch precipitation zone	1
	Rlc	Richfield silty clay loam, gently undulating	88	IIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
	Rld	Richfield silty clay loam, undulating	88	IIIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
	Rle	Richfield-Beauvais silty clay loams, gently undulating	88	IIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Rlf	Richfield-Beauvais silty clay loams, undulating	89	IIIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
RM		Riverwash	89	------	VIIIs-1	----------	--
---	---	Rock outcrop	89	------	VIIIs-1	----------	--
RN		Rock outcrop-Duncom complex, very steep	89	------	VIIe-1	Shallow, 20- to 24-inch precipitation zone	4
RO		Rock outcrop-Lap complex, very steep	89	------	VIIe-1	Shallow, 15- to 19-inch precipitation zone	4
RP		Rock outcrop-Pultney complex, very steep	90	------	VIIe-1	Shallow, 10- to 14-inch precipitation zone	4

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RR		Rock outcrop-Rentsac complex, rolling	90	------	VIe-1	Shallow, 15- to 19-inch precipitation zone	4
RS		Rock outcrop-Windham complex, very steep	90	------	VIIe-1	Thin Breaks, 15- to 19-inch precipitation zone	4
	Rt	Rottulee silt loam, gently undulating	91	------	IIe-2	Silty, 15- to 19-inch precipitation zone	3L
	Ru	Rottulee silt loam, undulating	91	------	IIIe-2	Silty, 15- to 19-inch precipitation zone	3L
	Rv	Rottulee silt loam, rolling	91	------	IVe-2	Silty, 15- to 19-inch precipitation zone	3L
RW		Rottulee-Abac complex, rolling	91	------	VIe-1	Silty, 15- to 19-inch precipitation zone	3L
	Ry	Ryorp sandy loam, undulating [1/]	91	------	IVe-2	----------	--
SA		Saline land	91	------	VIw-1	Saline Lowland, 10- to 14-inch precipitation zone	3S
	Sd	Savage silty clay loam, 0 to 2 percent slopes	92	IIc-2	IIs-2	Clayey, 15- to 19-inch precipitation zone	1
	Sea	Savage silty clay loam, 2 to 4 percent slopes	92	IIe-1	IIe-2	Clayey, 15- to 19-inch precipitation zone	1
	Seb	Savage silty clay loam, 4 to 8 percent slopes	92	------	IIIe-2	Clayey, 15- to 19-inch precipitation zone	1
	Sec	Savage silty clay loam, undulating	92	------	IIIe-2	Clayey, 15- to 19-inch precipitation zone	1
	Sed	Savage silty clay loam, rolling	93	------	IVe-2	Clayey, 15- to 19-inch precipitation zone	1
	Sef	Savage-Wayden silty clay loams, 4 to 15 percent slopes	93	------	IVe-2	Clayey, 15- to 19-inch precipitation zone	1
SF		Savage and Frazer soils, 0 to 4 percent slopes	93	------	VIw-1	Clayey, 15- to 19-inch precipitation zone	4
	Sg	Searing loam, undulating	94	------	IIIe-2	Silty, 15- to 19-inch precipitation zone	2M
SH		Searing loam, hilly	94	------	VIe-1	----------	--
SI		Searing-Ringling complex, rolling	94	------	IVe-2	Silty, 15- to 19-inch precipitation zone	3M
	Ska	Shaak clay loam, 4 to 8 percent slopes	95	IVe-1	IIIe-2	Clayey, 15- to 19-inch precipitation zone	1
	Skb	Shaak silty clay loam, 0 to 2 percent slopes	95	IIIs-1	IIs-2	Clayey, 15- to 19-inch precipitation zone	1
	Skc	Shaak silty clay loam, gently undulating	95	IIIe-3	IIe-2	Clayey, 15- to 19-inch precipitation zone	1
	Skd	Shaak silty clay loam, undulating	95	IVe-1	IIIe-2	Clayey, 15- to 19-inch precipitation zone	1
	Ske	Shaak silty clay loam, rolling	95	------	IVe-2	Clayey, 15- to 19-inch precipitation zone	1
SM		Shaak complex, 4 to 15 percent slopes	96	------	IVe-2	Clayey, 15- to 19-inch precipitation zone	2M

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SOa		Shale outcrop	96	------	VIIIs-1	----------	--
SOc		Shale outcrop-Midway complex, steep	96	------	VIIe-1	Shale, 10- to 14-inch precipitation zone	4
SOd		Shale outcrop-Norbert complex, hilly	96	------	VIIe-1	Shale, 15- to 19-inch precipitation zone	4
	Sp	Shonkin clay loam	97	------	IIIw-2	Overflow, 10- to 14-inch precipitation zone	1
	Sra	Sofia silty clay, 0 to 2 percent slopes	97	IIs-1	IIs-2	Clayey, 10- to 14-inch precipitation zone	1
	Srb	Sofia silty clay, gently undulating	97	IIIe-3	IIe-2	Clayey, 10- to 14-inch precipitation zone	1
SSa		Spearfish-Clapper complex, hilly	98	------	VIe-1	Shallow, 10- to 14-inch precipitation zone	4
SSb		Spearfish-Rock outcrop complex, very steep	98	------	VIIe-1	Thin Breaks, 10- to 14-inch precipitation zone	4
SSc		Spearfish-Pultney association, rolling	98	------	VIe-1	Shallow, 10- to 14-inch precipitation zone	4
SSd		Spearfish-Pultney association, hilly	98	------	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
	St	Spearman loam, undulating	99	-----	IIIe-3	Silty, 10- to 14-inch precipitation zone	2M
SU		Spearman-Wibaux complex, rolling	99	------	IVe-3	Silty, 10- to 14-inch precipitation zone	3M
SVa		Splitro-Sawcreek sandy loams, rolling	100	------	VIe-1	Sandy, 20- to 24-inch precipitation zone	3M
SVb		Splitro-Sawcreek sandy loams, hilly	100	------	VIe-1	Sandy, 20- to 24-inch precipitation zone	4
	Swa	Stormitt extremely stony loam, hilly	100	------	VIIs-1	Silty, 10- to 14-inch precipitation zone	3L
	Swb	Stormitt complex, 0 to 4 percent slopes	101	------	IVs-2	Shallow to Gravel, 10- to 14-inch precipitation zone	3M
SX		Stormitt complex, 4 to 15 percent slopes	101	------	IVs-2	Silty, 10- to 14-inch precipitation zone	3M
	Taa	Talag clay, 0 to 8 percent slopes	101	------	VIs-1	Clayey, 10- to 14-inch precipitation zone	3S
	Tab	Talag-Allentine complex, 0 to 4 percent slopes	102	------	VIs-1	Pan Spots, 10- to 14-inch precipitation zone	3S
	Tb	Tarrete silty clay loam, 8 to 15 percent slopes	102	------	IVe-2	Clayey, 15- to 19-inch precipitation zone	2M
TCa		Terrace escarpments, gravelly	102	------	VIIs-1	Shallow to Gravel, 10- to 14-inch precipitation zone	4
TCb		Terrace escarpments, loamy	103	------	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
	Td	Terry fine sandy loam, undulating	103	------	IVe-3	Sandy, 10- to 14-inch precipitation zone	2M

Map symbol Low intensity	Map symbol Medium intensity	Mapping unit	Page	Capability unit Irrigated	Capability unit Dryland	Range site	Windbreak suitability group
				Symbol	Symbol	Name	Symbol
TE		Terry-Travessilla sandy loams, undulating	103	------	VIs-1	Sandy, 10- to 14-inch precipitation zone	3M
TFa		Teton loam, 8 to 25 percent slopes	104	------	IVe-2	Silty, 20- to 24-inch precipitation zone	2M
TFb		Teton complex, 25 to 45 percent slopes	104	------	VIe-1	Silty, 20- to 24-inch precipitation zone	4
	Tg	Thedalund loam, undulating [1/]	105	------	IIIe-2	Silty, 10- to 14-inch precipitation zone	2M
THa		Thedalund-Clapper complex, hilly	105	------	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
THb		Thedalund-Cushman loams, undulating	105	------	IIIe-3	Silty, 10- to 14-inch precipitation zone	2M
THc		Thedalund-Fort Collins complex, rolling	105	------	IVe-3	Silty, 10- to 14-inch precipitation zone	2M
THd		Thedalund-McRae loams, dissected	105	------	IVe-3	Silty, 10- to 14-inch precipitation zone	2M
THe		Thedalund-Midway complex, rolling	105	------	IVe-3	Silty, 10- to 14-inch precipitation zone	3M
THf		Thedalund-Nelson complex, rolling	105	------	IVe-3	Silty, 10- to 14-inch precipitation zone	2M
THg		Thedalund-Rock outcrop complex, hilly	105	------	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
THh		Thedalund-Rock outcrop complex, very steep	106	------	VIIe-1	Thin Breaks, 10- to 14-inch precipitation zone	4
THk		Thedalund-Travessilla loams, rolling	106	------	VIs-1	Silty, 10- to 14-inch precipitation zone	3M
THl		Thedalund-Wibaux loams, undulating	106	------	VIs-1	Silty, 10- to 14-inch precipitation zone	3M
THm		Thedalund-Wibaux complex, rolling	106	------	VIe-1	Silty, 10- to 14-inch precipitation zone	3M
THn		Thedalund-Wibaux stony loams, hilly	106	------	VIe-1	Thin Hilly, 10- to 14-inch precipitation zone	4
THo		Thedalund-Wibaux complex, very steep	106	------	VIIe-1	Thin Breaks, 10- to 14-inch precipitation zone	4
	Tk	Thurlow silty clay loam, 0 to 1 percent slopes	107	IIc-2	IIIc-1	Clayey, 10- to 14-inch precipitation zone	1
	Tm	Thurlow silty clay loam, 1 to 4 percent slopes	107	IIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	Tn	Thurlow silty clay loam, 4 to 8 percent slopes	107	IIIe-1	IIIe-3	Clayey, 10- to 14-inch precipitation zone	1
	To	Thurlow-Midway silty clay loams, 4 to 15 percent slopes	107	------	IVe-3	Clayey, 10- to 14-inch precipitation zone	1
	Tp	Toluca-Harvey complex, undulating	108	------	IIIe-3	Clayey, 10- to 14-inch precipitation zone	2L

Map symbol Low intensity	Map symbol Medium intensity	Mapping unit	Page	Capability unit Irrigated	Capability unit Dryland	Range site	Windbreak suitability group
				Symbol	Symbol	Name	Symbol
TR		Travessilla-Rock outcrop complex, rolling	109	------	VIs-1	Shallow, 10- to 14-inch precipitation zone	4
TS		Travessilla-Thedalund loams, rolling	109	------	VIe-1	Silty, 10- to 14-inch precipitation zone	3M
	Tu	Tullock loamy fine sand, rolling	110	------	VIe-1	Sands, 10- to 14-inch precipitation zone	3M
	Tv	Twin Creek loam, 2 to 4 percent slopes	110	IIe-1	IIe-2	Silty, 15- to 19-inch precipitation zone	1
	Tw	Twin Creek loam, 4 to 8 percent slopes	111	------	IIIe-2	Silty, 15- to 19-inch precipitation zone	1
	Tx	Twin Creek loam, 8 to 15 percent slopes	111	------	IVe-2	Silty, 15- to 19-inch precipitation zone	1
TY		Twin Creek-Korchea complex, 2 to 8 percent slopes	111	------	IIe-2	Silty, 15- to 19-inch precipitation zone	1
	Va	Vananda clay, 0 to 1 percent slopes	111	IVs-1	VIs-1	Dense Clay, 10- to 14-inch precipitation zone	3S
	Vc	Vananda clay, 1 to 8 percent slopes	111	------	VIe-1	Dense Clay, 10- to 14-inch precipitation zone	3S
	Vd	Vebar fine sandy loam, undulating	112	------	IIIe-2	Sandy, 15- to 19-inch precipitation zone	2M
	Ve	Vebar fine sandy loam, rolling	112	------	IVe-2	Sandy, 15- to 19-inch precipitation zone	2M
VF		Vebar-Castner complex, undulating	112	------	VIs-1	Sandy, 15- to 19-inch precipitation zone	3M
VH		Vebar-Castner complex, rolling	112	------	VIs-1	Sandy, 15- to 19-inch precipitation zone	3M
VM		Vebar complex, rolling	112	------	IVe-2	Sandy, 15- to 19-inch precipitation zone	2M
	Wa	Wages loam, 0 to 2 percent slopes	113	IIc-1	IIIc-1	Silty, 10- to 14-inch precipitation zone	1
	Wb	Wages loam, 2 to 4 percent slopes	113	IIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
	Wc	Wages loam, 4 to 8 percent slopes	113	IIIe-1	IIIe-3	Silty, 10- to 14-inch precipitation zone	1
WD		Wayden silty clay loam, rolling	114	------	VIe-1	Clayey, 15- to 19-inch precipitation zone	3M
WE		Wayden silty clay loam, hilly	114	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
WF		Wayden-Arnegard complex, hilly	114	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
WG		Wayden-Grail complex, hilly	114	------	VIe-1	Clayey, 15- to 19-inch precipitation zone	4
WH		Wayden-Judith silty clay loams, hilly	115	------	VIe-1	Clayey, 15- to 19-inch precipitation zone	4
WI		Wayden-Regent silty clay loams, hilly	115	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
WK		Wayden-Savage silty clay loams, rolling	115	------	IVe-2	Clayey, 15- to 19-inch precipitation zone	2M

Map symbol Low intensity	Map symbol Medium intensity	Mapping unit	Page	Capability unit Irrigated Symbol	Capability unit Dryland Symbol	Range site Name	Windbreak suitability group Symbol
WL		Wayden-Rock outcrop complex, rolling	115	------	VIe-1	Clayey, 15- to 19-inch precipitation zone	3M
WM		Wayden-Rock outcrop complex, hilly-	115	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
WN		Wayden-Shale outcrop complex, very steep	115	------	VIIe-1	Shale, 15- to 19-inch precipitation zone	4
WO		Wayden complex, hilly	115	------	VIIe-1	Thin Breaks, 15- to 19-inch precipitation zone	4
	Wp	Wibaux loam, hilly	116	------	VIe-1	Shallow, 10- to 14-inch precipitation zone	3M
	Wr	Wibaux-Spearman complex, rolling---	116	------	VIe-1	Shallow, 10- to 14-inch precipitation zone	3M
	Ws	Windham cobbly loam, 15 to 35 percent slopes	117	------	VIe-1	Shallow to Gravel, 15- to 19-inch precipitation zone	4
WT		Windham complex, 15 to 35 percent slopes	117	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
WU		Windham-Arnegard complex, 15 to 35 percent slopes	117	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
WV		Windham-Norbert complex, 15 to 50 percent slopes	117	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
WW		Windham-Wayden complex, 15 to 35 percent slopes	117	------	VIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
WX		Windham-Lap association, very steep	117	------	VIIe-1	Thin Hilly, 15- to 19-inch precipitation zone	4
	Wy	Winnett complex, undulating	118	------	VIe-1	Pan Spots, 10- to 14-inch precipitation zone	3S
	Xa	Xavier silty clay loam, gently undulating	119	IIe-1	IIe-2	Silty, 15- to 19-inch precipitation zone	1
	Xc	Xavier silty clay loam, undulating-	119	IIIe-1	IIIe-2	Silty, 15- to 19-inch precipitation zone	1
	Xe	Xavier silty clay loam, rolling----	119	------	IVe-2	Silty, 15- to 19-inch precipitation zone	1
	Xh	Xavier-Shaak complex, undulating---	119	------	IIIe-2	Clayey, 15- to 19-inch precipitation zone	1
	Xk	Xavier-Shaak complex, rolling------	119	------	IVe-2	Clayey, 15- to 19-inch precipitation zone	1

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