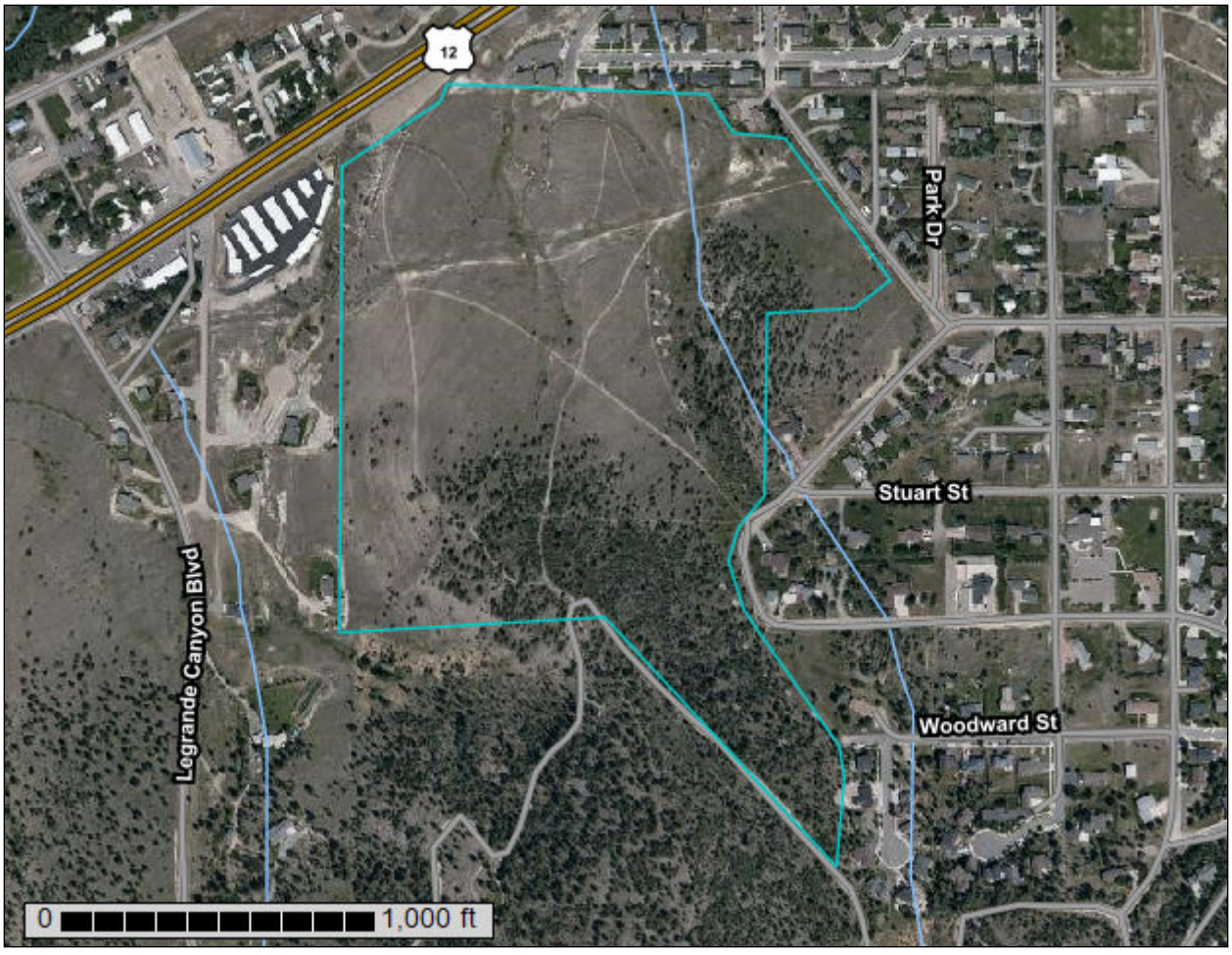
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Lewis and Clark County Area, Montana



July 22, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

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

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

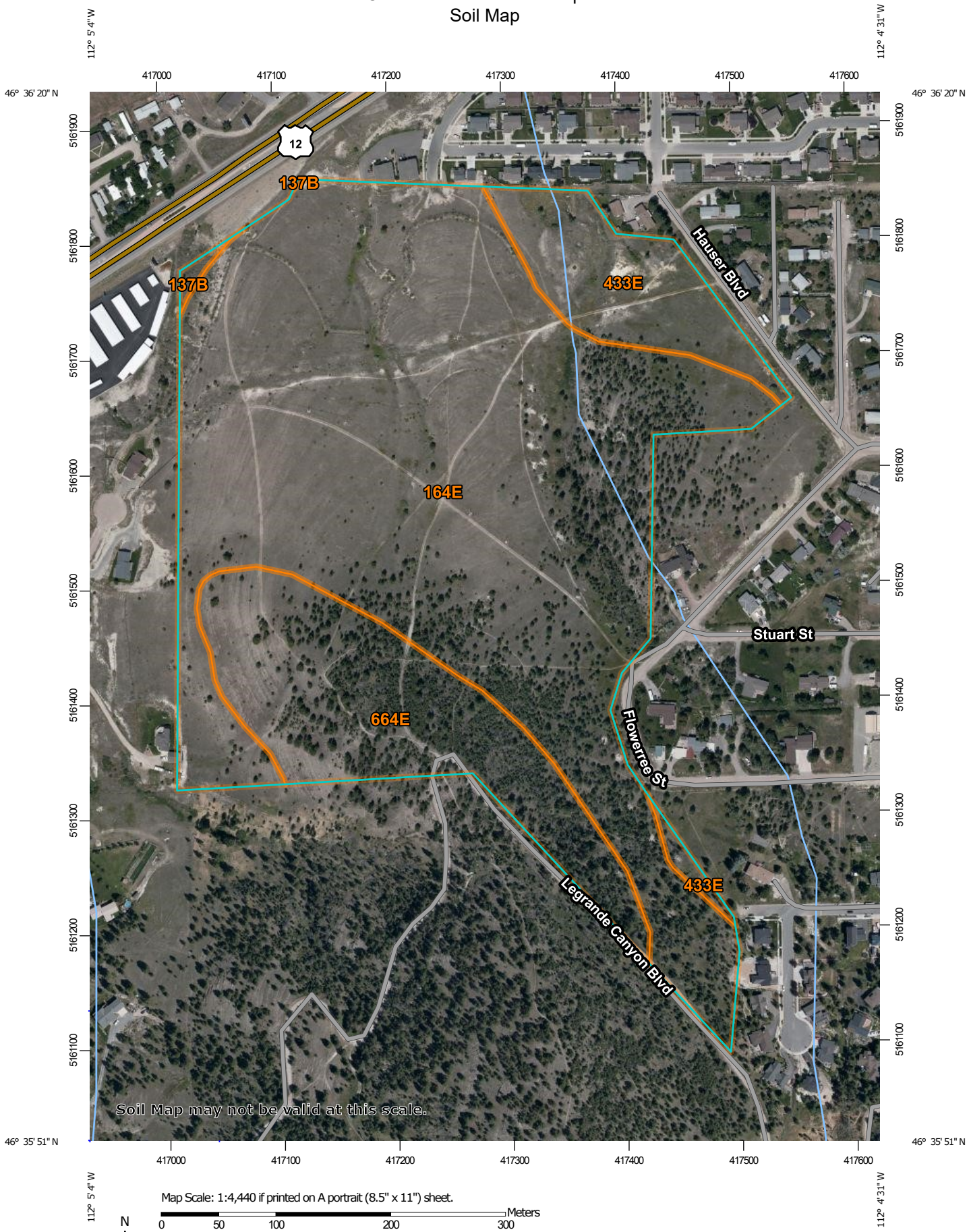
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:4,440 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lewis and Clark County Area, Montana
Survey Area Data: Version 15, Jun 4, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 24, 2019—Jul 27, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
137B	Musselshell-Crago complex, 2 to 8 percent slopes	0.2	0.3%
164E	Windham-Lap channery loams, 8 to 45 percent slopes	43.4	73.0%
433E	Crago-Musselshell gravelly loams, 4 to 35 percent slopes	5.2	8.8%
664E	Windham-Whitecow-Lap channery loams, 15 to 45 percent slopes	10.7	17.9%
Totals for Area of Interest		**59.5**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Lewis and Clark County Area, Montana

137B—Musselshell-Crago complex, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 4yph
Elevation: 3,600 to 4,500 feet
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 105 to 120 days
Farmland classification: Farmland of local importance

Map Unit Composition

Musselshell and similar soils: 70 percent
Crago and similar soils: 25 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Musselshell

Setting

Landform: Alluvial fans, hillsides, plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy alluvium derived from limestone; coarse-loamy slope alluvium derived from limestone

Typical profile

A - 0 to 4 inches: loam
Bk1 - 4 to 34 inches: gravelly loam
Bk2 - 34 to 60 inches: very gravelly sandy loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 60 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Limy (Ly) LRU 44B-A (R044BA030MT)
Hydric soil rating: No

Description of Crago

Setting

Landform: Alluvial fans, hillsides, escarpments, plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly alluvium derived from limestone; gravelly colluvium derived from limestone; gravelly slope alluvium derived from limestone

Typical profile

A - 0 to 4 inches: gravelly loam
Bk1 - 4 to 32 inches: very gravelly clay loam
Bk2 - 32 to 60 inches: extremely gravelly loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 70 percent
Available water storage in profile: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Limy (Ly) LRU 44B-A (R044BA030MT)
Hydric soil rating: No

Minor Components

Amesha

Percent of map unit: 2 percent
Landform: Hillsides, plains, knolls, alluvial fans
Landform position (two-dimensional): Footslope, toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Limy (SiLy) 10-14" p.z. (R044XC457MT)
Hydric soil rating: No

Crago, cobbly

Percent of map unit: 2 percent
Landform: Alluvial fans, hillsides, escarpments, plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Limy (SiLy) 10-14" p.z. (R044XC457MT)
Hydric soil rating: No

Delpoint

Percent of map unit: 1 percent
Landform: Escarpments, hills, knolls
Down-slope shape: Linear
Across-slope shape: Linear

Ecological site: Draft Silty (Si) RRU 46-N 13-19" p.z. (R046XN252MT)
Hydric soil rating: No

164E—Windham-Lap channery loams, 8 to 45 percent slopes

Map Unit Setting

National map unit symbol: 4ypy
Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 90 to 110 days
Farmland classification: Not prime farmland

Map Unit Composition

Windham and similar soils: 75 percent
Lap and similar soils: 20 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windham

Setting

Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly colluvium derived from limestone

Typical profile

A - 0 to 7 inches: channery loam
Bk1 - 7 to 30 inches: very gravelly loam
Bk2 - 30 to 60 inches: extremely gravelly loam

Properties and qualities

Slope: 8 to 45 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 60 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B

Ecological site: Draft Limy (Ly) RRU 46-N 13-17" p.z. (R046XN254MT)
Hydric soil rating: No

Description of Lap

Setting
Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from limestone

Typical profile
A - 0 to 6 inches: channery loam
Bk1 - 6 to 8 inches: very channery loam
Bk2 - 8 to 14 inches: extremely channery loam
R - 14 to 60 inches: unweathered bedrock

Properties and qualities
Slope: 8 to 45 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 60 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 1.3 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Shallow Grassland (R043BP810MT)
Hydric soil rating: No

Minor Components

Beanlake
Percent of map unit: 1 percent
Landform: Outwash fans, alluvial fans, moraines
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Limy (SiLy) 15-19" p.z. (R044XC473MT)
Hydric soil rating: No

Soils with bedrock at 20 to 40 inches
Percent of map unit: 1 percent
Landform: Escarpments, hillsides, hillsides, ridges, ridges, divides
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Droughty-Steep (SiDrStp) 15-19" p.z. (R043BS720MT)
Hydric soil rating: No

Rock outcrop
Percent of map unit: 1 percent

Hydric soil rating: No

Lap, very shallow

Percent of map unit: 1 percent
Landform: Ridges, divides, escarpments, hillsides, hillsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Shallow (Sw) 15-19" p.z. (R044XC469MT)
Hydric soil rating: No

Whitecow

Percent of map unit: 1 percent
Landform: Ridges, divides, escarpments, hillsides, hillsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

433E—Crago-Musselshell gravelly loams, 4 to 35 percent slopes

Map Unit Setting

National map unit symbol: 4yt8
Elevation: 3,600 to 5,000 feet
Mean annual precipitation: 10 to 14 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 105 to 120 days
Farmland classification: Not prime farmland

Map Unit Composition

Crago and similar soils: 50 percent
Musselshell and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Crago

Setting

Landform: Escarpments, plains, alluvial fans, hillsides
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly alluvium derived from limestone; gravelly colluvium derived from limestone; gravelly slope alluvium derived from limestone

Typical profile

A - 0 to 4 inches: gravelly loam
Bk1 - 4 to 32 inches: very gravelly clay loam
Bk2 - 32 to 60 inches: extremely gravelly loam

Properties and qualities

Slope: 4 to 35 percent
Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 70 percent
Available water storage in profile: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Limy Grassland (R043BP804MT)
Hydric soil rating: No

Description of Musselshell

Setting

Landform: Hillsides, plains, alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy alluvium derived from limestone; coarse-loamy slope alluvium derived from limestone

Typical profile

A - 0 to 4 inches: gravelly loam
Bk1 - 4 to 34 inches: gravelly loam
Bk2 - 34 to 60 inches: very gravelly sandy loam

Properties and qualities

Slope: 4 to 35 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 60 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Limy Grassland (R043BP804MT)
Hydric soil rating: No

Minor Components

Amesha

Percent of map unit: 3 percent
Landform: Alluvial fans, hillsides, plains, knolls
Landform position (two-dimensional): Footslope, toeslope

Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Limy (SiLy) 10-14" p.z. (R044XC457MT)
Hydric soil rating: No

Crago, greater slope
Percent of map unit: 3 percent
Landform: Alluvial fans, hillsides, escarpments, plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Limy (SiLy) 10-14" p.z. (R044XC457MT)
Hydric soil rating: No

Crago, cobbly
Percent of map unit: 2 percent
Landform: Alluvial fans, hillsides, escarpments, plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Limy (SiLy) 10-14" p.z. (R044XC457MT)
Hydric soil rating: No

Crago, stony
Percent of map unit: 1 percent
Landform: Plains, alluvial fans, hillsides, escarpments
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Limy (SiLy) 10-14" p.z. (R044XC457MT)
Hydric soil rating: No

Pensore
Percent of map unit: 1 percent
Landform: Hillsides, escarpments, ridges, knolls, strath terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Shallow (Sw) 10-14" p.z. (R044XC452MT)
Hydric soil rating: No

664E—Windham-Whitecow-Lap channery loams, 15 to 45 percent slopes

Map Unit Setting
National map unit symbol: 4ywd
Elevation: 4,000 to 5,000 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 90 to 110 days
Farmland classification: Not prime farmland

Map Unit Composition
Windham and similar soils: 45 percent
Whitecow and similar soils: 35 percent

Lap and similar soils: 15 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windham

Setting
Landform: Ridges, divides, escarpments, hillsides
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly colluvium derived from limestone

Typical profile
A - 0 to 7 inches: channery loam
Bk1 - 7 to 30 inches: very gravelly loam
Bk2 - 30 to 60 inches: extremely gravelly loam

Properties and qualities
Slope: 15 to 45 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 60 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 4.6 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: Draft Limy (Ly) RRU 46-N 13-17" p.z. (R046XN254MT)
Hydric soil rating: No

Description of Whitecow

Setting
Landform: Ridges, divides, escarpments, hillsides
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly colluvium derived from limestone

Typical profile
Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 3 inches: channery loam
Bk1 - 3 to 25 inches: very gravelly loam
Bk2 - 25 to 60 inches: extremely channery loam

Properties and qualities
Slope: 15 to 45 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 50 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: Limy Cool Woodland (F043BP912MT)
Other vegetative classification: Douglas-fir/bluebunch wheatgrass (PK210), Douglas-fir/rough fescue (PK230)
Hydric soil rating: No

Description of Lap

Setting

Landform: Ridges, divides, escarpments, hillsides
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly colluvium over residuum weathered from limestone; gravelly residuum weathered from limestone

Typical profile

A - 0 to 6 inches: channery loam
Bk1 - 6 to 8 inches: very channery loam
Bk2 - 8 to 14 inches: extremely channery loam
R - 14 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 45 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 60 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 1.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Limy Warm Woodland (F043BP913MT)
Hydric soil rating: No

Minor Components

Lap, very shallow

Percent of map unit: 2 percent

Landform: Divides, escarpments, hillsides, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Shallow (Sw) 15-19" p.z. (R044XC469MT)
Hydric soil rating: No

Whitecow, greater slope

Percent of map unit: 2 percent
Landform: Hillsides, ridges, divides, escarpments
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Maiden

Percent of map unit: 1 percent
Landform: Escarpments, hillsides, ridges, divides
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-Droughty-Steep (SiDrStp) 15-19" p.z. (R043BS720MT)
Hydric soil rating: No

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Dwellings and Small Commercial Buildings

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. This table shows the degree and kind of soil limitations that affect dwellings and small commercial buildings.

The ratings in the table are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Dwellings are single-family houses of three stories or less. For dwellings without basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet. The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a water table, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Small commercial buildings are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Information in this table is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

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

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

Report—Dwellings and Small Commercial Buildings

[Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The table shows only the top five limitations for any given soil. The soil may have additional limitations]

Dwellings and Small Commercial Buildings–Lewis and Clark County Area, Montana							
Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
137B—Musselshell-Crago complex, 2 to 8 percent slopes							
Musselshell	70	Not limited		Not limited		Somewhat limited	
						Slope	0.14
Crago	25	Not limited		Not limited		Somewhat limited	
						Slope	0.14

Dwellings and Small Commercial Buildings–Lewis and Clark County Area, Montana							
Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
164E—Windham-Lap channery loams, 8 to 45 percent slopes							
Windham	75	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
Lap	20	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Slope	1.00
		Slope	1.00	Slope	1.00	Depth to hard bedrock	1.00
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
433E—Crago-Musselshell gravelly loams, 4 to 35 percent slopes							
Crago	50	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
Musselshell	40	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
664E—Windham-Whitecow-Lap channery loams, 15 to 45 percent slopes							
Windham	45	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
Whitecow	35	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Large stones	0.02	Large stones	0.02	Large stones	0.02
Lap	15	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50

Data Source Information

Soil Survey Area: Lewis and Clark County Area, Montana
Survey Area Data: Version 15, Jun 4, 2020

Roads and Streets, Shallow Excavations, and Lawns and Landscaping

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. This table shows the degree and kind of soil limitations that affect local roads and streets, shallow excavations, and lawns and landscaping.

The ratings in the table are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or soil material stabilized by lime or cement; and a surface of flexible material (asphalt), rigid material (concrete), or gravel with a binder. The ratings are based on the soil properties that affect the ease of excavation and grading and the traffic-supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, depth to a water table, ponding, flooding, the amount of large stones, and slope. The properties that affect the traffic-supporting capacity are soil strength (as inferred from the AASHTO group index number), subsidence, linear extensibility (shrink-swell potential), the potential for frost action, depth to a water table, and ponding.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer.

Information in this table is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

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

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

Report—Roads and Streets, Shallow Excavations, and Lawns and Landscaping

[Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The table shows only the top five limitations for any given soil. The soil may have additional limitations]

Roads and Streets, Shallow Excavations, and Lawns and Landscaping–Lewis and Clark County Area, Montana							
Map symbol and soil name	Pct. of map unit	Lawns and landscaping		Local roads and streets		Shallow excavations	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
137B—Musselshell-Crago complex, 2 to 8 percent slopes							
Musselshell	70	Very limited		Somewhat limited		Somewhat limited	
		Carbonate content	1.00	Frost action	0.50	Dusty	0.12
		Dusty	0.12			Unstable excavation walls	0.01
Crago	25	Very limited		Somewhat limited		Somewhat limited	
		Carbonate content	1.00	Frost action	0.50	Dusty	0.22
		Droughty	0.50			Unstable excavation walls	0.01
		Gravel content	0.36				
		Dusty	0.22				
164E—Windham-Lap channery loams, 8 to 45 percent slopes							
Windham	75	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Carbonate content	1.00	Frost action	0.50	Dusty	0.08
		Gravel content	0.92			Unstable excavation walls	0.01
		Large stones content	0.08				
		Dusty	0.08				
Lap	20	Very limited		Very limited		Very limited	
		Droughty	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Depth to bedrock	1.00	Slope	1.00	Slope	1.00
		Slope	1.00	Frost action	0.50	Dusty	0.08
		Carbonate content	1.00	Shrink-swell	0.50	Unstable excavation walls	0.03
		Gravel content	0.54	Soluble bedrock	0.15		

Roads and Streets, Shallow Excavations, and Lawns and Landscaping–Lewis and Clark County Area, Montana							
Map symbol and soil name	Pct. of map unit	Lawns and landscaping		Local roads and streets		Shallow excavations	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
433E—Crago-Musselshell gravelly loams, 4 to 35 percent slopes							
Crago	50	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Carbonate content	1.00	Frost action	0.50	Dusty	0.22
		Droughty	0.50			Unstable excavation walls	0.01
		Gravel content	0.36				
		Dusty	0.22				
Musselshell	40	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Carbonate content	1.00	Frost action	0.50	Dusty	0.12
		Dusty	0.12			Unstable excavation walls	0.01
		Large stones content	0.08				
		Gravel content	0.01				

Roads and Streets, Shallow Excavations, and Lawns and Landscaping–Lewis and Clark County Area, Montana							
Map symbol and soil name	Pct. of map unit	Lawns and landscaping		Local roads and streets		Shallow excavations	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
664E—Windham-Whitecow-Lap channery loams, 15 to 45 percent slopes							
Windham	45	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Carbonate content	1.00	Frost action	0.50	Dusty	0.08
		Gravel content	0.92			Unstable excavation walls	0.01
		Large stones content	0.08				
		Dusty	0.08				
Whitecow	35	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Carbonate content	1.00	Frost action	0.50	Dusty	0.04
		Droughty	0.50	Large stones	0.02	Large stones	0.02
		Large stones content	0.20			Unstable excavation walls	0.01
		Dusty	0.04				
Lap	15	Very limited		Very limited		Very limited	
		Slope	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Droughty	1.00	Slope	1.00	Slope	1.00
		Depth to bedrock	1.00	Frost action	0.50	Dusty	0.08
		Carbonate content	1.00	Shrink-swell	0.50	Unstable excavation walls	0.03
		Gravel content	0.54				

Data Source Information

Soil Survey Area: Lewis and Clark County Area, Montana
Survey Area Data: Version 15, Jun 4, 2020