APPENDIX A

USDA Natural Resources Conservation Service Custom Soil Report for Granite County Area, Montana

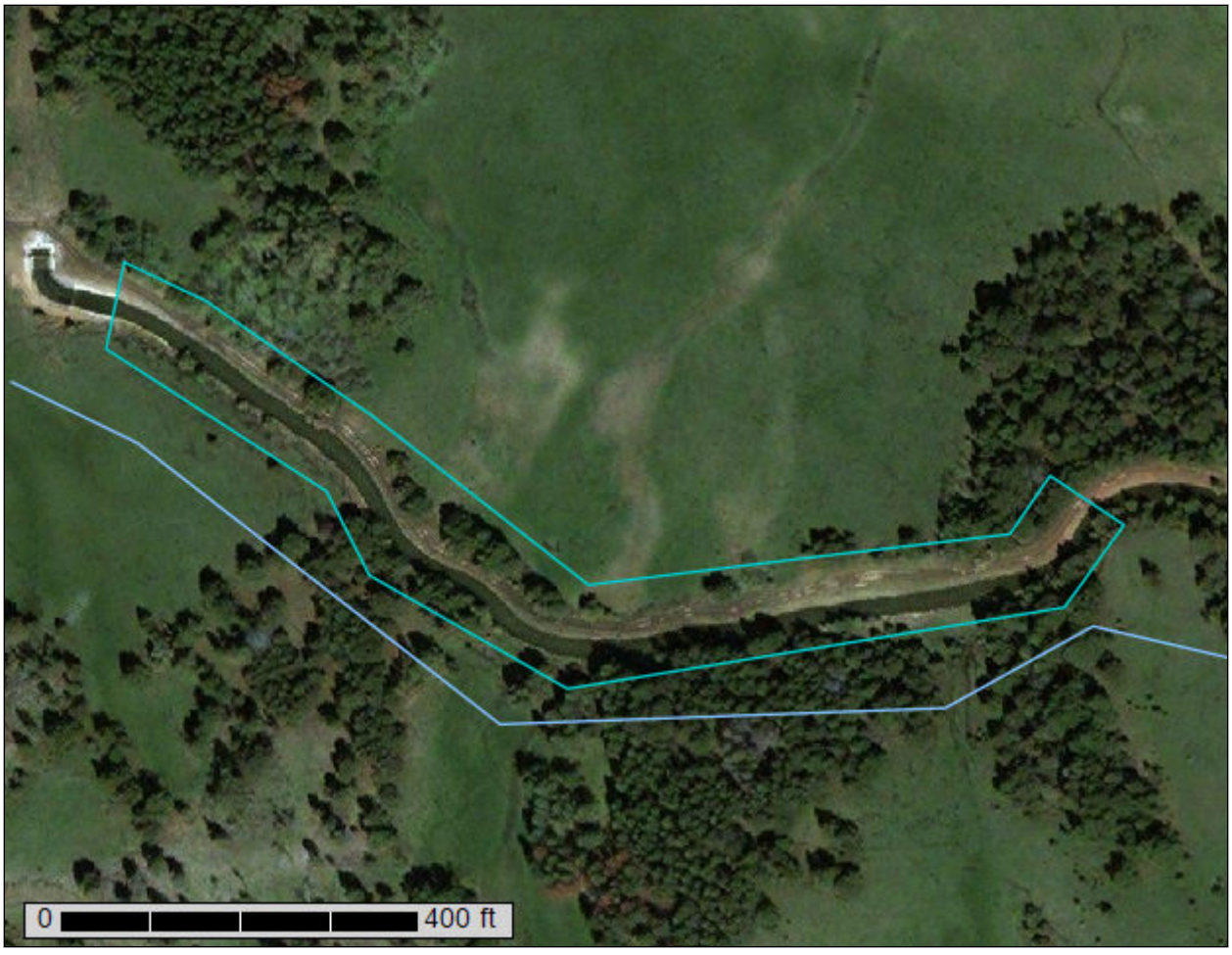
United States Department of Agriculture

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 Granite County Area, Montana



August 25, 2022

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: 1:1,910 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

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: Granite County Area, Montana
Survey Area Data: Version 21, Sep 2, 2021

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

Date(s) aerial images were photographed: Oct 16, 2009—Nov 2, 2016

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
28D	Donald loam, 8 to 15 percent slopes	0.2	6.9%
96E	Worock gravelly loam, cool, 15 to 35 percent slopes	2.9	93.1%
Totals for Area of Interest		**3.1**	**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.

Granite County Area, Montana

28D—Donald loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 4v5d
Elevation: 5,500 to 6,100 feet
Mean annual precipitation: 15 to 22 inches
Mean annual air temperature: 34 to 45 degrees F
Frost-free period: 30 to 70 days
Farmland classification: Farmland of local importance

Map Unit Composition

Donald and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Donald

Setting

Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium

Typical profile

A1 - 0 to 5 inches: loam
A2 - 5 to 9 inches: loam
E - 9 to 13 inches: sandy loam
Bt - 13 to 23 inches: clay
BC - 23 to 60 inches: clay

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R043BP818MT - Upland Grassland
Hydric soil rating: No

Minor Components

Julius

Percent of map unit: 5 percent

Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R044AB032MT - Loamy (Lo) LRU 44A-B
Hydric soil rating: No

Baggs

Percent of map unit: 5 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R044AB032MT - Loamy (Lo) LRU 44A-B
Hydric soil rating: No

Libeg

Percent of map unit: 5 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R043BE032MT - Loamy (Lo) LRU 43B-E
Hydric soil rating: No

96E—Worock gravelly loam, cool, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: 4vjc
Elevation: 5,800 to 7,500 feet
Mean annual precipitation: 24 to 30 inches
Mean annual air temperature: 36 to 45 degrees F
Frost-free period: 30 to 70 days
Farmland classification: Not prime farmland

Map Unit Composition

Worock and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Worock

Setting

Landform: Mountains
Landform position (two-dimensional): Backslope, footslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium and/or residuum weathered from igneous rock

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
E - 2 to 6 inches: gravelly loam
E/Bt - 6 to 17 inches: gravelly loam
Bt - 17 to 34 inches: very gravelly clay loam

C - 34 to 60 inches: very gravelly sandy clay loam

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: F043BP909MT - Upland Cold Woodland
Other vegetative classification: subalpine fir/twinflower (PK660), subalpine fir/beargrass (PK690)
Hydric soil rating: No

Minor Components

Elve

Percent of map unit: 5 percent
Landform: Mountains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Loberg

Percent of map unit: 4 percent
Landform: Mountains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Evaro

Percent of map unit: 3 percent
Landform: Mountains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Danaher

Percent of map unit: 3 percent
Landform: Mountains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

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Glossary

Many of the terms relating to landforms, geology, and geomorphology are defined in more detail in the following National Soil Survey Handbook link: “National Soil Survey Handbook.”

ABC soil

A soil having an A, a B, and a C horizon.

Ablation till

Loose, relatively permeable earthy material deposited during the downwasting of nearly static glacial ice, either contained within or accumulated on the surface of the glacier.

AC soil

A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil

The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil

Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil

A soil having 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 plant growth is restricted.

Alluvial cone

A semiconical type of alluvial fan having very steep slopes. It is higher, narrower, and steeper than a fan and is composed of coarser and thicker layers of material deposited by a combination of alluvial episodes and (to a much lesser degree) landslides (debris flow). The coarsest materials tend to be concentrated at the apex of the cone.

Alluvial fan

A low, outspread mass of loose materials and/or rock material, commonly with gentle slopes. It is shaped like an open fan or a segment of a cone. The material was deposited by a stream at the place where it issues from a narrow mountain valley or upland valley or where a tributary stream is near or at its junction with the main stream. The fan is steepest near its apex, which points upstream, and slopes gently and convexly outward (downstream) with a gradual decrease in gradient.

Alluvium

Unconsolidated material, such as gravel, sand, silt, clay, and various mixtures of these, deposited on land by running water.

Alpha,alpha-dipyridyl

A compound that when dissolved in ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction implies reducing conditions and the likely presence of redoximorphic features.

Animal unit month (AUM)

The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions

Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Argillic horizon

A subsoil horizon characterized by an accumulation of illuvial clay.

Arroyo

The flat-floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in unconsolidated material. It is usually dry but can be transformed into a temporary watercourse or short-lived torrent after heavy rain within the watershed.

Aspect

The direction toward which a slope faces. Also called slope aspect.

Association, soil

A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity)

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

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

Backslope

The position that forms the steepest and generally linear, middle portion of a hillslope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

Backswamp

A flood-plain landform. Extensive, marshy or swampy, depressed areas of flood plains between natural levees and valley sides or terraces.

Badland

A landscape that is intricately dissected and characterized by a very fine drainage network with high drainage densities and short, steep slopes and narrow interfluves. Badlands develop on surfaces that have little or no vegetative cover overlying unconsolidated or poorly cemented materials (clays, silts, or sandstones) with, in some cases, soluble minerals, such as gypsum or halite.

Bajada

A broad, gently inclined alluvial piedmont slope extending from the base of a mountain range out into a basin and formed by the lateral coalescence of a series of alluvial fans. Typically, it has a broadly undulating transverse profile, parallel to the mountain front, resulting from the convexities of component fans. The term is generally restricted to constructional slopes of intermontane basins.

Basal area

The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Base saturation

The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Base slope (geomorphology)

A geomorphic component of hills consisting of the concave to linear (perpendicular to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

Bedding plane

A planar or nearly planar bedding surface that visibly separates each successive layer of stratified sediment or rock (of the same or different lithology)

from the preceding or following layer; a plane of deposition. It commonly marks a change in the circumstances of deposition and may show a parting, a color difference, a change in particle size, or various combinations of these. The term is commonly applied to any bedding surface, even one that is conspicuously bent or deformed by folding.

Bedding system

A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock

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

Bedrock-controlled topography

A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace

A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum

Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout (map symbol)

A saucer-, cup-, or trough-shaped depression formed by wind erosion on a preexisting dune or other sand deposit, especially in an area of shifting sand or loose soil or where protective vegetation is disturbed or destroyed. The adjoining accumulation of sand derived from the depression, where recognizable, is commonly included. Blowouts are commonly small.

Borrow pit (map symbol)

An open excavation from which soil and underlying material have been removed, usually for construction purposes.

Bottom land

An informal term loosely applied to various portions of a flood plain.

Boulders

Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks

A landscape or tract of steep, rough or broken land dissected by ravines and gullies and marking a sudden change in topography.

Breast height

An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management

Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Butte

An isolated, generally flat-topped hill or mountain with relatively steep slopes and talus or precipitous cliffs and characterized by summit width that is less than the height of bounding escarpments; commonly topped by a caprock of resistant material and representing an erosion remnant carved from flat-lying rocks.

Cable yarding

A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil

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

Caliche

A general term for a prominent zone of secondary carbonate accumulation in surficial materials in warm, subhumid to arid areas. Caliche is formed by both geologic and pedologic processes. Finely crystalline calcium carbonate forms a nearly continuous surface-coating and void-filling medium in geologic (parent) materials. Cementation ranges from weak in nonindurated forms to very strong in indurated forms. Other minerals (e.g., carbonates, silicate, and sulfate) may occur as accessory cements. Most petrocalcic horizons and some calcic horizons are caliche.

California bearing ratio (CBR)

The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy

The leafy crown of trees or shrubs. (See Crown.)

Canyon

A long, deep, narrow valley with high, precipitous walls in an area of high local relief.

Capillary water

Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena

A sequence, or “chain,” of soils on a landscape that formed in similar kinds of parent material and under similar climatic conditions but that have different characteristics as a result of differences in relief and drainage.

Cation

An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity

The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps

See Terracettes.

Cement rock

Shaly limestone used in the manufacture of cement.

Channery soil material

Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chemical treatment

Control of unwanted vegetation through the use of chemicals.

Chiseling

Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Cirque

A steep-walled, semicircular or crescent-shaped, half-bowl-like recess or hollow, commonly situated at the head of a glaciated mountain valley or high on the side of a mountain. It was produced by the erosive activity of a mountain glacier. It commonly contains a small round lake (tarn).

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 depletions

See Redoximorphic features.

Clay film

A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Clay spot (map symbol)

A spot where the surface texture is silty clay or clay in areas where the surface layer of the soils in the surrounding map unit is sandy loam, loam, silt loam, or coarser.

Claypan

A dense, compact subsoil layer that contains much more clay than the overlying materials, from which it is separated by a sharply defined boundary. The layer restricts the downward movement of water through the soil. A claypan is commonly hard when dry and plastic and sticky when wet.

Climax plant community

The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil

Sand or loamy sand.

Cobble (or cobblestone)

A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material

Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

COLE (coefficient of linear extensibility)

See Linear extensibility.

Colluvium

Unconsolidated, unsorted earth material being transported or deposited on side slopes and/or at the base of slopes by mass movement (e.g., direct gravitational action) and by local, unconcentrated runoff.

Complex slope

Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil

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

Concretions

See Redoximorphic features.

Conglomerate

A coarse grained, clastic sedimentary rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system

Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage

A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil

Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the “Soil Survey Manual.”

Contour stripcropping

Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section

The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat)

A type of limnic layer composed predominantly of fecal material derived from aquatic animals.

Corrosion (geomorphology)

A process of erosion whereby rocks and soil are removed or worn away by natural chemical processes, especially by the solvent action of running water, but also by other reactions, such as hydrolysis, hydration, carbonation, and oxidation.

Corrosion (soil survey interpretations)

Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop

A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management

Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system

Growing crops according to a planned system of rotation and management practices.

Cross-slope farming

Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown

The upper part of a tree or shrub, including the living branches and their foliage.

Cryoturbate

A mass of soil or other unconsolidated earthy material moved or disturbed by frost action. It is typically coarser than the underlying material.

Cuesta

An asymmetric ridge capped by resistant rock layers of slight or moderate dip (commonly less than 15 percent slopes); a type of homocline produced by differential erosion of interbedded resistant and weak rocks. A cuesta has a long, gentle slope on one side (dip slope) that roughly parallels the inclined beds; on the other side, it has a relatively short and steep or clifflike slope (scarp) that cuts through the tilted rocks.

Culmination of the mean annual increment (CMAI)

The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave

The walls of excavations tend to cave in or slough.

Decreasers

The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing

Postponing grazing or resting grazing land for a prescribed period.

Delta

A body of alluvium having a surface that is fan shaped and nearly flat; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Dense layer

A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depression, closed (map symbol)

A shallow, saucer-shaped area that is slightly lower on the landscape than the surrounding area and that does not have a natural outlet for surface drainage.

Depth, soil

Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Desert pavement

A natural, residual concentration or layer of wind-polished, closely packed gravel, boulders, and other rock fragments mantling a desert surface. It forms where wind action and sheetwash have removed all smaller particles or where rock fragments have migrated upward through sediments to the surface. It typically protects the finer grained underlying material from further erosion.

Diatomaceous earth

A geologic deposit of fine, grayish siliceous material composed chiefly or entirely of the remains of diatoms.

Dip slope

A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace)

A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming

A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Drainage class (natural)

Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the “Soil Survey Manual.”

Drainage, surface

Runoff, or surface flow of water, from an area.

Drainageway

A general term for a course or channel along which water moves in draining an area. A term restricted to relatively small, linear depressions that at some time move concentrated water and either do not have a defined channel or have only a small defined channel.

Draw

A small stream valley that generally is shallower and more open than a ravine or gulch and that has a broader bottom. The present stream channel may appear inadequate to have cut the drainageway that it occupies.

Drift

A general term applied to all mineral material (clay, silt, sand, gravel, and boulders) transported by a glacier and deposited directly by or from the ice or transported by running water emanating from a glacier. Drift includes unstratified material (till) that forms moraines and stratified deposits that form outwash plains, eskers, kames, varves, and glaciofluvial sediments. The term is generally applied to Pleistocene glacial deposits in areas that no longer contain glaciers.

Drumlin

A low, smooth, elongated oval hill, mound, or ridge of compact till that has a core of bedrock or drift. It commonly has a blunt nose facing the direction from which the ice approached and a gentler slope tapering in the other direction. The longer axis is parallel to the general direction of glacier flow. Drumlins are products of streamline (laminar) flow of glaciers, which molded the subglacial floor through a combination of erosion and deposition.

Duff

A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Dune

A low mound, ridge, bank, or hill of loose, windblown granular material (generally sand), either barren and capable of movement from place to place or covered and stabilized with vegetation but retaining its characteristic shape.

Earthy fill

See Mine spoil.

Ecological site

An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other ecological sites in kind and/or proportion of species or in total production.

Eluviation

The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation

A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian deposit

Sand-, silt-, or clay-sized clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sheet of sand or loess.

Ephemeral stream

A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation

A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion

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

Erosion (accelerated)

Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion (geologic)

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

Erosion pavement

A surficial lag concentration or layer of gravel and other rock fragments that remains on the soil surface after sheet or rill erosion or wind has removed the finer soil particles and that tends to protect the underlying soil from further erosion.

Erosion surface

A land surface shaped by the action of erosion, especially by running water.

Escarpment

A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Most commonly applied to cliffs produced by differential erosion. Synonym: scarp.

Escarpment, bedrock (map symbol)

A relatively continuous and steep slope or cliff, produced by erosion or faulting, that breaks the general continuity of more gently sloping land surfaces. Exposed material is hard or soft bedrock.

Escarpment, nonbedrock (map symbol)

A relatively continuous and steep slope or cliff, generally produced by erosion but in some places produced by faulting, that breaks the continuity of more gently sloping land surfaces. Exposed earthy material is nonsoil or very shallow soil.

Esker

A long, narrow, sinuous, steep-sided ridge of stratified sand and gravel deposited as the bed of a stream flowing in an ice tunnel within or below the ice (subglacial) or between ice walls on top of the ice of a wasting glacier and left

behind as high ground when the ice melted. Eskers range in length from less than a kilometer to more than 160 kilometers and in height from 3 to 30 meters.

Extrusive rock

Igneous rock derived from deep-seated molten matter (magma) deposited and cooled on the earth's surface.

Fallow

Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan remnant

A general term for landforms that are the remaining parts of older fan landforms, such as alluvial fans, that have been either dissected or partially buried.

Fertility, soil

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

Fibric soil material (peat)

The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity

The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fill slope

A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil

Sandy clay, silty clay, or clay.

Firebreak

An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom

An obsolete, informal term loosely applied to the lowest flood-plain steps that are subject to regular flooding.

Flaggy soil material

Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone

A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain

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

Flood-plain landforms

A variety of constructional and erosional features produced by stream channel migration and flooding. Examples include backswamps, flood-plain splays, meanders, meander belts, meander scrolls, oxbow lakes, and natural levees.

Flood-plain splay

A fan-shaped deposit or other outspread deposit formed where an overloaded stream breaks through a levee (natural or artificial) and deposits its material (commonly coarse grained) on the flood plain.

Flood-plain step

An essentially flat, terrace-like alluvial surface within a valley that is frequently covered by floodwater from the present stream; any approximately horizontal surface still actively modified by fluvial scour and/or deposition. May occur individually or as a series of steps.

Fluvial

Of or pertaining to rivers or streams; produced by stream or river action.

Foothills

A region of steeply sloping hills that fringes a mountain range or high-plateau escarpment. The hills have relief of as much as 1,000 feet (300 meters).

Footslope

The concave surface at the base of a hillslope. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

Forb

Any herbaceous plant not a grass or a sedge.

Forest cover

All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type

A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragipan

A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Genesis, soil

The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai

Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

Glaciofluvial deposits

Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur in the form of outwash plains, valley trains, deltas, kames, eskers, and kame terraces.

Glaciolacustrine deposits

Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are bedded or laminated.

Gleyed soil

Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Graded stripcropping

Growing crops in strips that grade toward a protected waterway.

Grassed waterway

A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel

Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravel pit (map symbol)

An open excavation from which soil and underlying material have been removed and used, without crushing, as a source of sand or gravel.

Gravelly soil material

Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Gravelly spot (map symbol)

A spot where the surface layer has more than 35 percent, by volume, rock fragments that are mostly less than 3 inches in diameter in an area that has less than 15 percent rock fragments.

Green manure crop (agronomy)

A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water

Water filling all the unblocked pores of the material below the water table.

Gully (map symbol)

A small, steep-sided channel caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage whereas a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock

Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hard to reclaim

Reclamation is difficult after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Hardpan

A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head slope (geomorphology)

A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway. The overland waterflow is converging.

Hemic soil material (mucky peat)

Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops

Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill

A generic term for an elevated area of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline. Slopes are generally more than 15 percent. The distinction between a hill and a mountain is arbitrary and may depend on local usage.

Hillslope

A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of a hill.

Horizon, soil

A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the “Soil Survey Manual.” The major horizons of mineral soil are as follows:

O horizon: An organic layer of fresh and decaying plant residue.

L horizon: A layer of organic and mineral limnic materials, including coprogenous earth (sedimentary peat), diatomaceous earth, and marl.

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

E horizon: The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon: The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon: The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon: Soft, consolidated bedrock beneath the soil.

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

M layer: A root-limiting subsoil layer consisting of nearly continuous, horizontally oriented, human-manufactured materials.

W layer: A layer of water within or beneath the soil.

Humus

The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups

Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties include depth to a seasonal high water table, the infiltration rate, and depth to a layer that significantly restricts the downward movement of water. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Igneous rock

Rock that was formed by cooling and solidification of magma and that has not been changed appreciably by weathering since its formation. Major varieties include plutonic and volcanic rock (e.g., andesite, basalt, and granite).

Illuviation

The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil

A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers

Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration

The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity

The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate

The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate

The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Very low: Less than 0.2
Low: 0.2 to 0.4
Moderately low: 0.4 to 0.75
Moderate: 0.75 to 1.25
Moderately high: 1.25 to 1.75
High: 1.75 to 2.5
Very high: More than 2.5

Interfluve

A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways.

Interfluve (geomorphology)

A geomorphic component of hills consisting of the uppermost, comparatively level or gently sloping area of a hill; shoulders of backwearing hillslopes can narrow the upland or can merge, resulting in a strongly convex shape.

Intermittent stream

A stream, or reach of a stream, that does not flow year-round but that is commonly dry for 3 or more months out of 12 and whose channel is generally below the local water table. It flows only during wet periods or when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders

On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Iron depletions

See Redoximorphic features.

Irrigation

Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin: Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border: Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding: Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation: Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle): Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow: Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler: Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation: Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding: Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame

A low mound, knob, hummock, or short irregular ridge composed of stratified sand and gravel deposited by a subglacial stream as a fan or delta at the margin of a melting glacier; by a supraglacial stream in a low place or hole on the surface of the glacier; or as a ponded deposit on the surface or at the margin of stagnant ice.

Karst (topography)

A kind of topography that formed in limestone, gypsum, or other soluble rocks by dissolution and that is characterized by closed depressions, sinkholes, caves, and underground drainage.

Knoll

A small, low, rounded hill rising above adjacent landforms.

Ksat

See Saturated hydraulic conductivity.

Lacustrine deposit

Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake plain

A nearly level surface marking the floor of an extinct lake filled by well sorted, generally fine textured, stratified deposits, commonly containing varves.

Lake terrace

A narrow shelf, partly cut and partly built, produced along a lakeshore in front of a scarp line of low cliffs and later exposed when the water level falls.

Landfill (map symbol)

An area of accumulated waste products of human habitation, either above or below natural ground level.

Landslide

A general, encompassing term for most types of mass movement landforms and processes involving the downslope transport and outward deposition of soil and rock materials caused by gravitational forces; the movement may or may not involve saturated materials. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones

Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Lava flow (map symbol)

A solidified, commonly lobate body of rock formed through lateral, surface outpouring of molten lava from a vent or fissure.

Leaching

The removal of soluble material from soil or other material by percolating water.

Levee (map symbol)

An embankment that confines or controls water, especially one built along the banks of a river to prevent overflow onto lowlands.

Linear extensibility

Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at $^{1}/_{3}$- or $^{1}/_{10}$-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Liquid limit

The moisture content at which the soil passes from a plastic to a liquid state.

Loam

Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess

Material transported and deposited by wind and consisting dominantly of silt-sized particles.

Low strength

The soil is not strong enough to support loads.

Low-residue crops

Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Marl

An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal proportions; formed primarily under freshwater lacustrine conditions but also formed in more saline environments.

Marsh or swamp (map symbol)

A water-saturated, very poorly drained area that is intermittently or permanently covered by water. Sedges, cattails, and rushes are the dominant vegetation in marshes, and trees or shrubs are the dominant vegetation in swamps. Not used in map units where the named soils are poorly drained or very poorly drained.

Mass movement

A generic term for the dislodgment and downslope transport of soil and rock material as a unit under direct gravitational stress.

Masses

See Redoximorphic features.

Meander belt

The zone within which migration of a meandering channel occurs; the flood-plain area included between two imaginary lines drawn tangential to the outer bends of active channel loops.

Meander scar

A crescent-shaped, concave or linear mark on the face of a bluff or valley wall, produced by the lateral erosion of a meandering stream that impinged upon and undercut the bluff.

Meander scroll

One of a series of long, parallel, close-fitting, crescent-shaped ridges and troughs formed along the inner bank of a stream meander as the channel migrated laterally down-valley and toward the outer bank.

Mechanical treatment

Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil

Very fine sandy loam, loam, silt loam, or silt.

Mesa

A broad, nearly flat topped and commonly isolated landmass bounded by steep slopes or precipitous cliffs and capped by layers of resistant, nearly horizontal rocky material. The summit width is characteristically greater than the height of the bounding escarpments.

Metamorphic rock

Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement at depth in the earth’s crust. Nearly all such rocks are crystalline.

Mine or quarry (map symbol)

An open excavation from which soil and underlying material have been removed and in which bedrock is exposed. Also denotes surface openings to underground mines.

Mine spoil

An accumulation of displaced earthy material, rock, or other waste material removed during mining or excavation. Also called earthy fill.

Mineral soil

Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage

Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area

A kind of map unit that has little or no natural soil and supports little or no vegetation.

Miscellaneous water (map symbol)

Small, constructed bodies of water that are used for industrial, sanitary, or mining applications and that contain water most of the year.

Moderately coarse textured soil

Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil

Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon

A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine

In terms of glacial geology, a mound, ridge, or other topographically distinct accumulation of unsorted, unstratified drift, predominantly till, deposited primarily by the direct action of glacial ice in a variety of landforms. Also, a general term for a landform composed mainly of till (except for kame moraines, which are composed mainly of stratified outwash) that has been deposited by a glacier. Some types of moraines are disintegration, end, ground, kame, lateral, recessional, and terminal.

Morphology, soil

The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil

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

Mountain

A generic term for an elevated area of the land surface, rising more than 1,000 feet (300 meters) above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can

occur as a single, isolated mass or in a group forming a chain or range. Mountains are formed primarily by tectonic activity and/or volcanic action but can also be formed by differential erosion.

Muck

Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Mucky peat

See Hemic soil material.

Mudstone

A blocky or massive, fine grained sedimentary rock in which the proportions of clay and silt are approximately equal. Also, a general term for such material as clay, silt, claystone, siltstone, shale, and argillite and that should be used only when the amounts of clay and silt are not known or cannot be precisely identified.

Munsell notation

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

Natric horizon

A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil

A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules

See Redoximorphic features.

Nose slope (geomorphology)

A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside. The overland waterflow is predominantly divergent. Nose slopes consist dominantly of colluvium and slope-wash sediments (for example, slope alluvium).

Nutrient, plant

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

Organic matter

Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low: Less than 0.5 percent
Low: 0.5 to 1.0 percent
Moderately low: 1.0 to 2.0 percent
Moderate: 2.0 to 4.0 percent
High: 4.0 to 8.0 percent
Very high: More than 8.0 percent

Outwash

Stratified and sorted sediments (chiefly sand and gravel) removed or “washed out” from a glacier by meltwater streams and deposited in front of or beyond the end moraine or the margin of a glacier. The coarser material is deposited nearer to the ice.

Outwash plain

An extensive lowland area of coarse textured glaciofluvial material. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

Paleoterrace

An erosional remnant of a terrace that retains the surface form and alluvial deposits of its origin but was not emplaced by, and commonly does not grade to, a present-day stream or drainage network.

Pan

A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material

The unconsolidated organic and mineral material in which soil forms.

Peat

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

Ped

An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment

A layer of sediment, eroded from the shoulder and backslope of an erosional slope, that lies on and is being (or was) transported across a gently sloping erosional surface at the foot of a receding hill or mountain slope.

Pedon

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

Percolation

The movement of water through the soil.

Perennial water (map symbol)

Small, natural or constructed lakes, ponds, or pits that contain water most of the year.

Permafrost

Ground, soil, or rock that remains at or below 0 degrees C for at least 2 years. It is defined on the basis of temperature and is not necessarily frozen.

pH value

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

Phase, soil

A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Piping

Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting

Pits caused by melting around ice. They form on the soil after plant cover is removed.

Plastic limit

The moisture content at which a soil changes from semisolid to plastic.

Plasticity index

The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plateau (geomorphology)

A comparatively flat area of great extent and elevation; specifically, an extensive land region that is considerably elevated (more than 100 meters) above the adjacent lower lying terrain, is commonly limited on at least one side by an abrupt descent, and has a flat or nearly level surface. A comparatively large part of a plateau surface is near summit level.

Playa

The generally dry and nearly level lake plain that occupies the lowest parts of closed depressions, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff. Playa deposits are fine grained and may or may not have a high water table and saline conditions.

Plinthite

The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan

A compacted layer formed in the soil directly below the plowed layer.

Ponding

Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded

Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Pore linings

See Redoximorphic features.

Potential native plant community

See Climax plant community.

Potential rooting depth (effective rooting depth)

Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning

Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Productivity, soil

The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil

A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use

Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and

promotes the accumulation of litter and mulch necessary to conserve soil and water.

Rangeland

Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil

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

Ultra acid: Less than 3.5
Extremely acid: 3.5 to 4.4
Very strongly acid: 4.5 to 5.0
Strongly acid: 5.1 to 5.5
Moderately acid: 5.6 to 6.0
Slightly acid: 6.1 to 6.5
Neutral: 6.6 to 7.3
Slightly alkaline: 7.4 to 7.8
Moderately alkaline: 7.9 to 8.4
Strongly alkaline: 8.5 to 9.0
Very strongly alkaline: 9.1 and higher

Red beds

Sedimentary strata that are mainly red and are made up largely of sandstone and shale.

Redoximorphic concentrations

See Redoximorphic features.

Redoximorphic depletions

See Redoximorphic features.

Redoximorphic features

Redoximorphic features are associated with wetness and result from alternating periods of reduction and oxidation of iron and manganese compounds in the soil. Reduction occurs during saturation with water, and oxidation occurs when the soil is not saturated. Characteristic color patterns are created by these processes. The reduced iron and manganese ions may be removed from a soil if vertical or lateral fluxes of water occur, in which case there is no iron or manganese precipitation in that soil. Wherever the iron and manganese are oxidized and precipitated, they form either soft masses or hard concretions or nodules. Movement of iron and manganese as a result of redoximorphic processes in a soil may result in redoximorphic features that are defined as follows:

1. Redoximorphic concentrations.—These are zones of apparent accumulation of iron-manganese oxides, including:
   A. Nodules and concretions, which are cemented bodies that can be removed from the soil intact. Concretions are distinguished from nodules on the basis of internal organization. A concretion typically has concentric layers that are visible to the naked eye. Nodules do not have visible organized internal structure; *and*
   B. Masses, which are noncemented concentrations of substances within the soil matrix; *and*
   C. Pore linings, i.e., zones of accumulation along pores that may be either coatings on pore surfaces or impregnations from the matrix adjacent to the pores.
2. Redoximorphic depletions.—These are zones of low chroma (chromas less than those in the matrix) where either iron-manganese oxides alone or both iron-manganese oxides and clay have been stripped out, including:
   A. Iron depletions, i.e., zones that contain low amounts of iron and manganese oxides but have a clay content similar to that of the adjacent matrix; *and*
   B. Clay depletions, i.e., zones that contain low amounts of iron, manganese, and clay (often referred to as silt coatings or skeletans).
3. Reduced matrix.—This is a soil matrix that has low chroma *in situ* but undergoes a change in hue or chroma within 30 minutes after the soil material has been exposed to air.

Reduced matrix

See Redoximorphic features.

Regolith

All unconsolidated earth materials above the solid bedrock. It includes material weathered in place from all kinds of bedrock and alluvial, glacial, eolian, lacustrine, and pyroclastic deposits.

Relief

The relative difference in elevation between the upland summits and the lowlands or valleys of a given region.

Residuum (residual soil material)

Unconsolidated, weathered or partly weathered mineral material that accumulated as bedrock disintegrated in place.

Rill

A very small, steep-sided channel resulting from erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. A rill generally is not an obstacle to wheeled vehicles and is shallow enough to be smoothed over by ordinary tillage.

Riser

The vertical or steep side slope (e.g., escarpment) of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural, steplike landforms, such as successive stream terraces.

Road cut

A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments

Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rock outcrop (map symbol)

An exposure of bedrock at the surface of the earth. Not used where the named soils of the surrounding map unit are shallow over bedrock or where “Rock outcrop” is a named component of the map unit.

Root zone

The part of the soil that can be penetrated by plant roots.

Runoff

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

Saline soil

A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Saline spot (map symbol)

An area where the surface layer has an electrical conductivity of 8 mmhos/cm more than the surface layer of the named soils in the surrounding map unit. The surface layer of the surrounding soils has an electrical conductivity of 2 mmhos/cm or less.

Sand

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

Sandstone

Sedimentary rock containing dominantly sand-sized particles.

Sandy spot (map symbol)

A spot where the surface layer is loamy fine sand or coarser in areas where the surface layer of the named soils in the surrounding map unit is very fine sandy loam or finer.

Sapric soil material (muck)

The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saturated hydraulic conductivity (Ksat)

The ease with which pores of a saturated soil transmit water. Formally, the proportionality coefficient that expresses the relationship of the rate of water movement to hydraulic gradient in Darcy's Law, a law that describes the rate of water movement through porous media. Commonly abbreviated as "Ksat." Terms describing saturated hydraulic conductivity are:

Very high: 100 or more micrometers per second (14.17 or more inches per hour)

High: 10 to 100 micrometers per second (1.417 to 14.17 inches per hour)

Moderately high: 1 to 10 micrometers per second (0.1417 inch to 1.417 inches per hour)

Moderately low: 0.1 to 1 micrometer per second (0.01417 to 0.1417 inch per hour)

Low: 0.01 to 0.1 micrometer per second (0.001417 to 0.01417 inch per hour)

Very low: Less than 0.01 micrometer per second (less than 0.001417 inch per hour).

To convert inches per hour to micrometers per second, multiply inches per hour by 7.0572. To convert micrometers per second to inches per hour, multiply micrometers per second by 0.1417.

Saturation

Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification

The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Sedimentary rock

A consolidated deposit of clastic particles, chemical precipitates, or organic remains accumulated at or near the surface of the earth under normal low temperature and pressure conditions. Sedimentary rocks include consolidated equivalents of alluvium, colluvium, drift, and eolian, lacustrine, and marine deposits. Examples are sandstone, siltstone, mudstone, claystone, shale, conglomerate, limestone, dolomite, and coal.

Sequum

A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil

A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Severely eroded spot (map symbol)

An area where, on the average, 75 percent or more of the original surface layer has been lost because of accelerated erosion. Not used in map units in which “severely eroded,” “very severely eroded,” or “gullied” is part of the map unit name.

Shale

Sedimentary rock that formed by the hardening of a deposit of clay, silty clay, or silty clay loam and that has a tendency to split into thin layers.

Sheet erosion

The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Short, steep slope (map symbol)

A narrow area of soil having slopes that are at least two slope classes steeper than the slope class of the surrounding map unit.

Shoulder

The convex, erosional surface near the top of a hillslope. A shoulder is a transition from summit to backslope.

Shrink-swell

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

Shrub-coppice dune

A small, streamlined dune that forms around brush and clump vegetation.

Side slope (geomorphology)

A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel. Side slopes are dominantly colluvium and slope-wash sediments.

Silica

A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio

The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt

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

Siltstone

An indurated silt having the texture and composition of shale but lacking its fine lamination or fissility; a massive mudstone in which silt predominates over clay.

Similar soils

Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole (map symbol)

A closed, circular or elliptical depression, commonly funnel shaped, characterized by subsurface drainage and formed either by dissolution of the surface of underlying bedrock (e.g., limestone, gypsum, or salt) or by collapse of underlying caves within bedrock. Complexes of sinkholes in carbonate-rock terrain are the main components of karst topography.

Site index

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

Slickensides (pedogenic)

Grooved, striated, and/or glossy (shiny) slip faces on structural peds, such as wedges; produced by shrink-swell processes, most commonly in soils that have a high content of expansive clays.

Slide or slip (map symbol)

A prominent landform scar or ridge caused by fairly recent mass movement or descent of earthy material resulting from failure of earth or rock under shear stress along one or several surfaces.

Slope

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

Slope alluvium

Sediment gradually transported down the slopes of mountains or hills primarily by nonchannel alluvial processes (i.e., slope-wash processes) and characterized by particle sorting. Lateral particle sorting is evident on long slopes. In a profile sequence, sediments may be distinguished by differences in size and/or specific gravity of rock fragments and may be separated by stone lines. Burnished peds and sorting of rounded or subrounded pebbles or cobbles distinguish these materials from unsorted colluvial deposits.

Slow refill

The slow filling of ponds, resulting from restricted water transmission in the soil.

Slow water movement

Restricted downward movement of water through the soil. See Saturated hydraulic conductivity.

Sodic (alkali) soil

A soil having 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 plant growth is restricted.

Sodic spot (map symbol)

An area where the surface layer has a sodium adsorption ratio that is at least 10 more than that of the surface layer of the named soils in the surrounding map unit. The surface layer of the surrounding soils has a sodium adsorption ratio of 5 or less.

Sodicity

The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to $Ca^{++} + Mg^{++}$. The degrees of sodicity and their respective ratios are:

Slight: Less than 13:1
Moderate: 13-30:1
Strong: More than 30:1

Sodium adsorption ratio (SAR)

A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock

Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil

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

Soil separates

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

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

Solum

The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Spoil area (map symbol)

A pile of earthy materials, either smoothed or uneven, resulting from human activity.

Stone line

In a vertical cross section, a line formed by scattered fragments or a discrete layer of angular and subangular rock fragments (commonly a gravel- or cobble-sized lag concentration) that formerly was draped across a topographic surface and was later buried by additional sediments. A stone line generally caps material that was subject to weathering, soil formation, and erosion before burial. Many stone lines seem to be buried erosion pavements, originally formed by sheet and rill erosion across the land surface.

Stones

Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony

Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stony spot (map symbol)

A spot where 0.01 to 0.1 percent of the soil surface is covered by rock fragments that are more than 10 inches in diameter in areas where the surrounding soil has no surface stones.

Strath terrace

A type of stream terrace; formed as an erosional surface cut on bedrock and thinly mantled with stream deposits (alluvium).

Stream terrace

One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream; represents the remnants of an abandoned flood plain, stream bed, or valley floor produced during a former state of fluvial erosion or deposition.

Stripcropping

Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil

The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are:

Platy: Flat and laminated

Prismatic: Vertically elongated and having flat tops

Columnar: Vertically elongated and having rounded tops

Angular blocky: Having faces that intersect at sharp angles (planes)

Subangular blocky: Having subrounded and planar faces (no sharp angles)

Granular: Small structural units with curved or very irregular faces

Structureless soil horizons are defined as follows:

Single grained: Entirely noncoherent (each grain by itself), as in loose sand

Massive: Occurring as a coherent mass

Stubble mulch

Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil

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

Subsoiling

Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum

The part of the soil below the solum.

Subsurface layer

Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow

The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit

The topographically highest position of a hillslope. It has a nearly level (planar or only slightly convex) surface.

Surface layer

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

Surface soil

The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Talus

Rock fragments of any size or shape (commonly coarse and angular) derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose broken rock formed chiefly by falling, rolling, or sliding.

Taxadjuncts

Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terminal moraine

An end moraine that marks the farthest advance of a glacier. It typically has the form of a massive arcuate or concentric ridge, or complex of ridges, and is underlain by till and other types of drift.

Terrace (conservation)

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 water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field

generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geomorphology)

A steplike surface, bordering a valley floor or shoreline, that represents the former position of a flood plain, lake, or seashore. The term is usually applied both to the relatively flat summit surface (tread) that was cut or built by stream or wave action and to the steeper descending slope (scarp or riser) that has graded to a lower base level of erosion.

Terracettes

Small, irregular steplike forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may be induced or enhanced by trampling of livestock, such as sheep or cattle.

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.”

Thin layer

Otherwise suitable soil material that is too thin for the specified use.

Till

Dominantly unsorted and nonstratified drift, generally unconsolidated and deposited directly by a glacier without subsequent reworking by meltwater, and consisting of a heterogeneous mixture of clay, silt, sand, gravel, stones, and boulders; rock fragments of various lithologies are embedded within a finer matrix that can range from clay to sandy loam.

Till plain

An extensive area of level to gently undulating soils underlain predominantly by till and bounded at the distal end by subordinate recessional or end moraines.

Tilth, soil

The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope

The gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

Topsoil

The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements

Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Tread

The flat to gently sloping, topmost, laterally extensive slope of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural steplike landforms, such as successive stream terraces.

Tuff

A generic term for any consolidated or cemented deposit that is 50 percent or more volcanic ash.

Upland

An informal, general term for the higher ground of a region, in contrast with a low-lying adjacent area, such as a valley or plain, or for land at a higher elevation than the flood plain or low stream terrace; land above the footslope zone of the hillslope continuum.

Valley fill

The unconsolidated sediment deposited by any agent (water, wind, ice, or mass wasting) so as to fill or partly fill a valley.

Variegation

Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve

A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Very stony spot (map symbol)

A spot where 0.1 to 3.0 percent of the soil surface is covered by rock fragments that are more than 10 inches in diameter in areas where the surface of the surrounding soil is covered by less than 0.01 percent stones.

Water bars

Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering

All physical disintegration, chemical decomposition, and biologically induced changes in rocks or other deposits at or near the earth’s surface by atmospheric or biologic agents or by circulating surface waters but involving essentially no transport of the altered material.

Well graded

Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wet spot (map symbol)

A somewhat poorly drained to very poorly drained area that is at least two drainage classes wetter than the named soils in the surrounding map unit.

Wilting point (or permanent wilting point)

The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow

The uprooting and tipping over of trees by the wind.

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 Granite County Area, Montana

August 25, 2022

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.

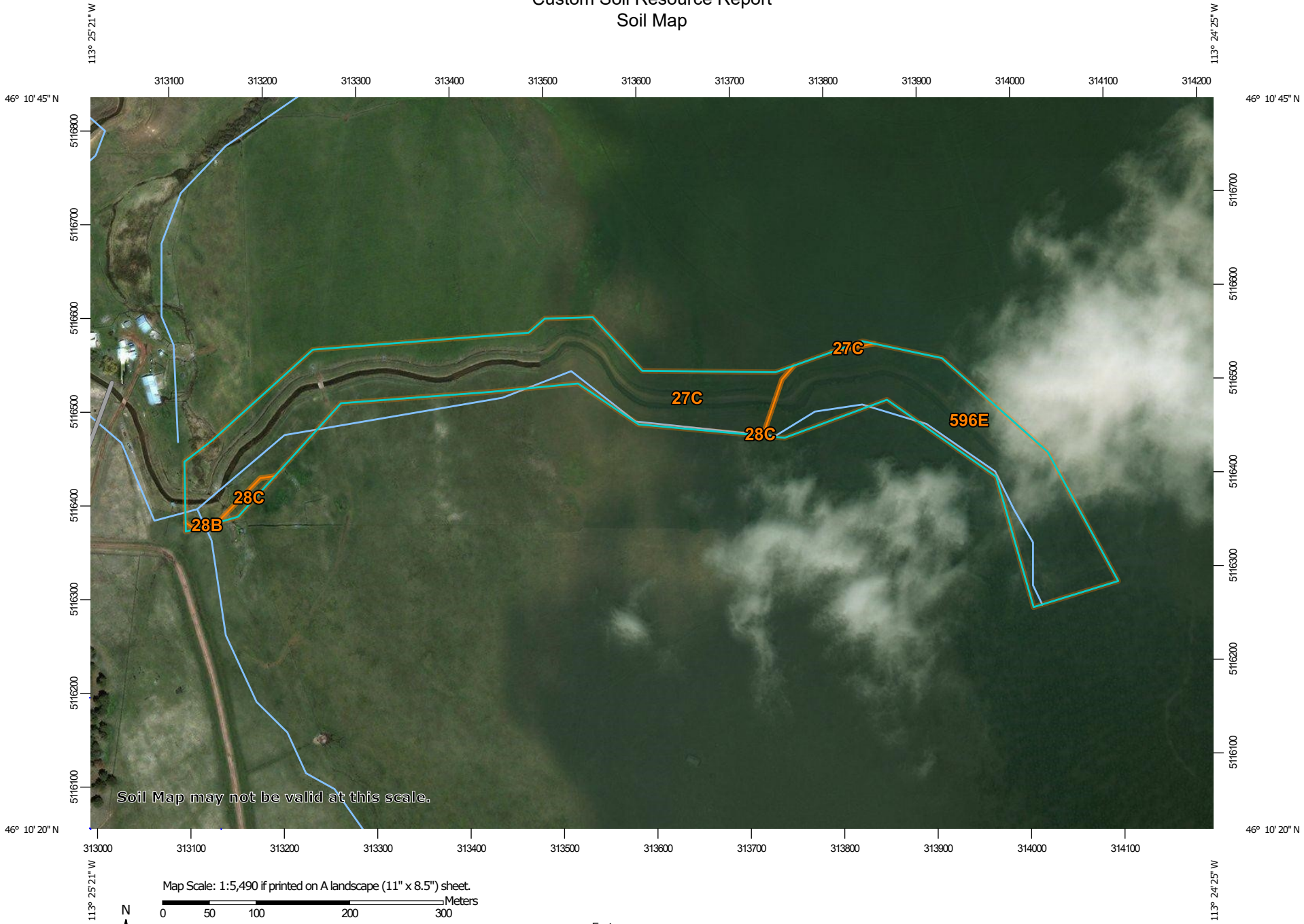
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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 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: Granite County Area, Montana
Survey Area Data: Version 21, Sep 2, 2021

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

Date(s) aerial images were photographed: Oct 16, 2009—Nov 2, 2016

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
27C	Julius loam, 4 to 8 percent slopes	10.9	58.1%
28B	Donald loam, 2 to 4 percent slopes	0.0	0.1%
28C	Donald loam, 4 to 8 percent slopes	0.2	1.0%
596E	Worock-Loberg complex, 15 to 35 percent slopes	7.7	40.8%
Totals for Area of Interest		**18.8**	**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.

Granite County Area, Montana

27C—Julius loam, 4 to 8 percent slopes

Map Unit Setting

National map unit symbol: 4v51
Elevation: 3,600 to 6,200 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 34 to 45 degrees F
Frost-free period: 70 to 90 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Julius and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Julius

Setting

Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and/or residuum weathered from tuff

Typical profile

Ap1 - 0 to 4 inches: loam
Ap2 - 4 to 11 inches: loam
Bt - 11 to 23 inches: clay
Bk - 23 to 33 inches: loam
Cr - 33 to 60 inches: bedrock

Properties and qualities

Slope: 4 to 8 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: R043BP818MT - Upland Grassland
Hydric soil rating: No

Minor Components

Danvers

Percent of map unit: 5 percent
Landform: Alluvial fans

Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R044AB032MT - Loamy (Lo) LRU 44A-B
Hydric soil rating: No

Donald

Percent of map unit: 5 percent
Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R044AB032MT - Loamy (Lo) LRU 44A-B
Hydric soil rating: No

Bandy

Percent of map unit: 5 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R044AP806MT - SUBIRRIGATED GRASSLAND ESG 44A LRU P
Hydric soil rating: Yes

28B—Donald loam, 2 to 4 percent slopes

Map Unit Setting

National map unit symbol: 4v5b
Elevation: 5,500 to 6,100 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 34 to 45 degrees F
Frost-free period: 30 to 70 days
Farmland classification: Farmland of local importance

Map Unit Composition

Donald and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Donald

Setting

Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium

Typical profile

A1 - 0 to 5 inches: loam
A2 - 5 to 9 inches: loam
E - 9 to 13 inches: sandy loam
Bt - 13 to 23 inches: clay
BC - 23 to 60 inches: clay

Properties and qualities

Slope: 2 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R043BP818MT - Upland Grassland
Hydric soil rating: No

Minor Components

Julius

Percent of map unit: 5 percent
Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R044AB032MT - Loamy (Lo) LRU 44A-B
Hydric soil rating: No

Baggs

Percent of map unit: 5 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R044AB032MT - Loamy (Lo) LRU 44A-B
Hydric soil rating: No

Libeg

Percent of map unit: 5 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R044AB032MT - Loamy (Lo) LRU 44A-B
Hydric soil rating: No

28C—Donald loam, 4 to 8 percent slopes

Map Unit Setting

National map unit symbol: 4v5c

Elevation: 5,500 to 6,100 feet
Mean annual precipitation: 15 to 22 inches
Mean annual air temperature: 34 to 45 degrees F
Frost-free period: 30 to 70 days
Farmland classification: Farmland of local importance

Map Unit Composition

Donald and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Donald

Setting

Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium

Typical profile

A1 - 0 to 5 inches: loam
A2 - 5 to 9 inches: loam
E - 9 to 13 inches: sandy loam
Bt - 13 to 23 inches: clay
BC - 23 to 60 inches: clay

Properties and qualities

Slope: 4 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R043BP818MT - Upland Grassland
Hydric soil rating: No

Minor Components

Julius

Percent of map unit: 5 percent
Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R043BE033MT - Loamy Argillic (LoA) LRU 43B-E
Hydric soil rating: No

Baggs

Percent of map unit: 5 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R043BE032MT - Loamy (Lo) LRU 43B-E
Hydric soil rating: No

Libeg

Percent of map unit: 5 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R043BE038MT - Droughty Steep (DrStp) LRU 43B-E
Hydric soil rating: No

596E—Worock-Loberg complex, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: 4vcx
Elevation: 5,800 to 7,500 feet
Mean annual precipitation: 20 to 30 inches
Mean annual air temperature: 34 to 45 degrees F
Frost-free period: 30 to 70 days
Farmland classification: Not prime farmland

Map Unit Composition

Worock and similar soils: 50 percent
Loberg and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Worock

Setting

Landform: Mountains
Landform position (two-dimensional): Backslope, footslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium and/or residuum weathered from igneous rock

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
E - 2 to 6 inches: gravelly loam
E/Bt - 6 to 17 inches: gravelly loam
Bt - 17 to 34 inches: very gravelly clay loam
C - 34 to 60 inches: very gravelly sandy clay loam

Properties and qualities

Slope: 15 to 35 percent

Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: F043BP909MT - Upland Cold Woodland
Other vegetative classification: subalpine fir/twinflower (PK660), subalpine fir/beargrass (PK690)
Hydric soil rating: No

Description of Loberg

Setting

Landform: Mountains
Landform position (two-dimensional): Backslope, footslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium derived from igneous rock

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
E - 2 to 10 inches: clay loam
Bt/E - 10 to 18 inches: very gravelly clay loam
Bt1 - 18 to 32 inches: very gravelly clay
Bt2 - 32 to 48 inches: very gravelly clay loam
Bt3 - 48 to 60 inches: very cobbly clay loam

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: F043BP909MT - Upland Cold Woodland
Other vegetative classification: subalpine fir/twinflower (PK660), subalpine fir/beargrass (PK690)
Hydric soil rating: No

Minor Components

Danaher

Percent of map unit: 4 percent
Landform: Mountains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Foolhen

Percent of map unit: 4 percent
Landform: Depressions
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R043BY181MT - Wet Meadow (WM) LRU 43B-Y
Hydric soil rating: Yes

Elve

Percent of map unit: 4 percent
Landform: Mountains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Rock outcrop

Percent of map unit: 3 percent
Hydric soil rating: No

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Glossary

Many of the terms relating to landforms, geology, and geomorphology are defined in more detail in the following National Soil Survey Handbook link: “National Soil Survey Handbook.”

ABC soil

A soil having an A, a B, and a C horizon.

Ablation till

Loose, relatively permeable earthy material deposited during the downwasting of nearly static glacial ice, either contained within or accumulated on the surface of the glacier.

AC soil

A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil

The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil

Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil

A soil having 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 plant growth is restricted.

Alluvial cone

A semiconical type of alluvial fan having very steep slopes. It is higher, narrower, and steeper than a fan and is composed of coarser and thicker layers of material deposited by a combination of alluvial episodes and (to a much lesser degree) landslides (debris flow). The coarsest materials tend to be concentrated at the apex of the cone.

Alluvial fan

A low, outspread mass of loose materials and/or rock material, commonly with gentle slopes. It is shaped like an open fan or a segment of a cone. The material was deposited by a stream at the place where it issues from a narrow mountain valley or upland valley or where a tributary stream is near or at its junction with the main stream. The fan is steepest near its apex, which points upstream, and slopes gently and convexly outward (downstream) with a gradual decrease in gradient.

Alluvium

Unconsolidated material, such as gravel, sand, silt, clay, and various mixtures of these, deposited on land by running water.

Alpha,alpha-dipyridyl

A compound that when dissolved in ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction implies reducing conditions and the likely presence of redoximorphic features.

Animal unit month (AUM)

The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions

Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Argillic horizon

A subsoil horizon characterized by an accumulation of illuvial clay.

Arroyo

The flat-floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in unconsolidated material. It is usually dry but can be transformed into a temporary watercourse or short-lived torrent after heavy rain within the watershed.

Aspect

The direction toward which a slope faces. Also called slope aspect.

Association, soil

A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity)

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

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

Backslope

The position that forms the steepest and generally linear, middle portion of a hillslope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

Backswamp

A flood-plain landform. Extensive, marshy or swampy, depressed areas of flood plains between natural levees and valley sides or terraces.

Badland

A landscape that is intricately dissected and characterized by a very fine drainage network with high drainage densities and short, steep slopes and narrow interfluves. Badlands develop on surfaces that have little or no vegetative cover overlying unconsolidated or poorly cemented materials (clays, silts, or sandstones) with, in some cases, soluble minerals, such as gypsum or halite.

Bajada

A broad, gently inclined alluvial piedmont slope extending from the base of a mountain range out into a basin and formed by the lateral coalescence of a series of alluvial fans. Typically, it has a broadly undulating transverse profile, parallel to the mountain front, resulting from the convexities of component fans. The term is generally restricted to constructional slopes of intermontane basins.

Basal area

The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Base saturation

The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Base slope (geomorphology)

A geomorphic component of hills consisting of the concave to linear (perpendicular to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

Bedding plane

A planar or nearly planar bedding surface that visibly separates each successive layer of stratified sediment or rock (of the same or different lithology)

from the preceding or following layer; a plane of deposition. It commonly marks a change in the circumstances of deposition and may show a parting, a color difference, a change in particle size, or various combinations of these. The term is commonly applied to any bedding surface, even one that is conspicuously bent or deformed by folding.

Bedding system

A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock

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

Bedrock-controlled topography

A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace

A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum

Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout (map symbol)

A saucer-, cup-, or trough-shaped depression formed by wind erosion on a preexisting dune or other sand deposit, especially in an area of shifting sand or loose soil or where protective vegetation is disturbed or destroyed. The adjoining accumulation of sand derived from the depression, where recognizable, is commonly included. Blowouts are commonly small.

Borrow pit (map symbol)

An open excavation from which soil and underlying material have been removed, usually for construction purposes.

Bottom land

An informal term loosely applied to various portions of a flood plain.

Boulders

Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks

A landscape or tract of steep, rough or broken land dissected by ravines and gullies and marking a sudden change in topography.

Breast height

An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management

Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Butte

An isolated, generally flat-topped hill or mountain with relatively steep slopes and talus or precipitous cliffs and characterized by summit width that is less than the height of bounding escarpments; commonly topped by a caprock of resistant material and representing an erosion remnant carved from flat-lying rocks.

Cable yarding

A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil

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

Caliche

A general term for a prominent zone of secondary carbonate accumulation in surficial materials in warm, subhumid to arid areas. Caliche is formed by both geologic and pedologic processes. Finely crystalline calcium carbonate forms a nearly continuous surface-coating and void-filling medium in geologic (parent) materials. Cementation ranges from weak in nonindurated forms to very strong in indurated forms. Other minerals (e.g., carbonates, silicate, and sulfate) may occur as accessory cements. Most petrocalcic horizons and some calcic horizons are caliche.

California bearing ratio (CBR)

The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy

The leafy crown of trees or shrubs. (See Crown.)

Canyon

A long, deep, narrow valley with high, precipitous walls in an area of high local relief.

Capillary water

Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena

A sequence, or “chain,” of soils on a landscape that formed in similar kinds of parent material and under similar climatic conditions but that have different characteristics as a result of differences in relief and drainage.

Cation

An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity

The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps

See Terracettes.

Cement rock

Shaly limestone used in the manufacture of cement.

Channery soil material

Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chemical treatment

Control of unwanted vegetation through the use of chemicals.

Chiseling

Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Cirque

A steep-walled, semicircular or crescent-shaped, half-bowl-like recess or hollow, commonly situated at the head of a glaciated mountain valley or high on the side of a mountain. It was produced by the erosive activity of a mountain glacier. It commonly contains a small round lake (tarn).

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 depletions

See Redoximorphic features.

Clay film

A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Clay spot (map symbol)

A spot where the surface texture is silty clay or clay in areas where the surface layer of the soils in the surrounding map unit is sandy loam, loam, silt loam, or coarser.

Claypan

A dense, compact subsoil layer that contains much more clay than the overlying materials, from which it is separated by a sharply defined boundary. The layer restricts the downward movement of water through the soil. A claypan is commonly hard when dry and plastic and sticky when wet.

Climax plant community

The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil

Sand or loamy sand.

Cobble (or cobblestone)

A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material

Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

COLE (coefficient of linear extensibility)

See Linear extensibility.

Colluvium

Unconsolidated, unsorted earth material being transported or deposited on side slopes and/or at the base of slopes by mass movement (e.g., direct gravitational action) and by local, unconcentrated runoff.

Complex slope

Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil

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

Concretions

See Redoximorphic features.

Conglomerate

A coarse grained, clastic sedimentary rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system

Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage

A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil

Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the “Soil Survey Manual.”

Contour stripcropping

Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section

The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat)

A type of limnic layer composed predominantly of fecal material derived from aquatic animals.

Corrosion (geomorphology)

A process of erosion whereby rocks and soil are removed or worn away by natural chemical processes, especially by the solvent action of running water, but also by other reactions, such as hydrolysis, hydration, carbonation, and oxidation.

Corrosion (soil survey interpretations)

Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop

A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management

Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system

Growing crops according to a planned system of rotation and management practices.

Cross-slope farming

Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown

The upper part of a tree or shrub, including the living branches and their foliage.

Cryoturbate

A mass of soil or other unconsolidated earthy material moved or disturbed by frost action. It is typically coarser than the underlying material.

Cuesta

An asymmetric ridge capped by resistant rock layers of slight or moderate dip (commonly less than 15 percent slopes); a type of homocline produced by differential erosion of interbedded resistant and weak rocks. A cuesta has a long, gentle slope on one side (dip slope) that roughly parallels the inclined beds; on the other side, it has a relatively short and steep or clifflike slope (scarp) that cuts through the tilted rocks.

Culmination of the mean annual increment (CMAI)

The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave

The walls of excavations tend to cave in or slough.

Decreasers

The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing

Postponing grazing or resting grazing land for a prescribed period.

Delta

A body of alluvium having a surface that is fan shaped and nearly flat; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Dense layer

A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depression, closed (map symbol)

A shallow, saucer-shaped area that is slightly lower on the landscape than the surrounding area and that does not have a natural outlet for surface drainage.

Depth, soil

Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Desert pavement

A natural, residual concentration or layer of wind-polished, closely packed gravel, boulders, and other rock fragments mantling a desert surface. It forms where wind action and sheetwash have removed all smaller particles or where rock fragments have migrated upward through sediments to the surface. It typically protects the finer grained underlying material from further erosion.

Diatomaceous earth

A geologic deposit of fine, grayish siliceous material composed chiefly or entirely of the remains of diatoms.

Dip slope

A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace)

A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming

A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Drainage class (natural)

Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the “Soil Survey Manual.”

Drainage, surface

Runoff, or surface flow of water, from an area.

Drainageway

A general term for a course or channel along which water moves in draining an area. A term restricted to relatively small, linear depressions that at some time move concentrated water and either do not have a defined channel or have only a small defined channel.

Draw

A small stream valley that generally is shallower and more open than a ravine or gulch and that has a broader bottom. The present stream channel may appear inadequate to have cut the drainageway that it occupies.

Drift

A general term applied to all mineral material (clay, silt, sand, gravel, and boulders) transported by a glacier and deposited directly by or from the ice or transported by running water emanating from a glacier. Drift includes unstratified material (till) that forms moraines and stratified deposits that form outwash plains, eskers, kames, varves, and glaciofluvial sediments. The term is generally applied to Pleistocene glacial deposits in areas that no longer contain glaciers.

Drumlin

A low, smooth, elongated oval hill, mound, or ridge of compact till that has a core of bedrock or drift. It commonly has a blunt nose facing the direction from which the ice approached and a gentler slope tapering in the other direction. The longer axis is parallel to the general direction of glacier flow. Drumlins are products of streamline (laminar) flow of glaciers, which molded the subglacial floor through a combination of erosion and deposition.

Duff

A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Dune

A low mound, ridge, bank, or hill of loose, windblown granular material (generally sand), either barren and capable of movement from place to place or covered and stabilized with vegetation but retaining its characteristic shape.

Earthy fill

See Mine spoil.

Ecological site

An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other ecological sites in kind and/or proportion of species or in total production.

Eluviation

The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation

A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian deposit

Sand-, silt-, or clay-sized clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sheet of sand or loess.

Ephemeral stream

A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation

A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion

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

Erosion (accelerated)

Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion (geologic)

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

Erosion pavement

A surficial lag concentration or layer of gravel and other rock fragments that remains on the soil surface after sheet or rill erosion or wind has removed the finer soil particles and that tends to protect the underlying soil from further erosion.

Erosion surface

A land surface shaped by the action of erosion, especially by running water.

Escarpment

A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Most commonly applied to cliffs produced by differential erosion. Synonym: scarp.

Escarpment, bedrock (map symbol)

A relatively continuous and steep slope or cliff, produced by erosion or faulting, that breaks the general continuity of more gently sloping land surfaces. Exposed material is hard or soft bedrock.

Escarpment, nonbedrock (map symbol)

A relatively continuous and steep slope or cliff, generally produced by erosion but in some places produced by faulting, that breaks the continuity of more gently sloping land surfaces. Exposed earthy material is nonsoil or very shallow soil.

Esker

A long, narrow, sinuous, steep-sided ridge of stratified sand and gravel deposited as the bed of a stream flowing in an ice tunnel within or below the ice (subglacial) or between ice walls on top of the ice of a wasting glacier and left

behind as high ground when the ice melted. Eskers range in length from less than a kilometer to more than 160 kilometers and in height from 3 to 30 meters.

Extrusive rock

Igneous rock derived from deep-seated molten matter (magma) deposited and cooled on the earth's surface.

Fallow

Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan remnant

A general term for landforms that are the remaining parts of older fan landforms, such as alluvial fans, that have been either dissected or partially buried.

Fertility, soil

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

Fibric soil material (peat)

The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity

The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fill slope

A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil

Sandy clay, silty clay, or clay.

Firebreak

An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom

An obsolete, informal term loosely applied to the lowest flood-plain steps that are subject to regular flooding.

Flaggy soil material

Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone

A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain

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

Flood-plain landforms

A variety of constructional and erosional features produced by stream channel migration and flooding. Examples include backswamps, flood-plain splays, meanders, meander belts, meander scrolls, oxbow lakes, and natural levees.

Flood-plain splay

A fan-shaped deposit or other outspread deposit formed where an overloaded stream breaks through a levee (natural or artificial) and deposits its material (commonly coarse grained) on the flood plain.

Flood-plain step

An essentially flat, terrace-like alluvial surface within a valley that is frequently covered by floodwater from the present stream; any approximately horizontal surface still actively modified by fluvial scour and/or deposition. May occur individually or as a series of steps.

Fluvial

Of or pertaining to rivers or streams; produced by stream or river action.

Foothills

A region of steeply sloping hills that fringes a mountain range or high-plateau escarpment. The hills have relief of as much as 1,000 feet (300 meters).

Footslope

The concave surface at the base of a hillslope. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

Forb

Any herbaceous plant not a grass or a sedge.

Forest cover

All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type

A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragipan

A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Genesis, soil

The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai

Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

Glaciofluvial deposits

Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur in the form of outwash plains, valley trains, deltas, kames, eskers, and kame terraces.

Glaciolacustrine deposits

Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are bedded or laminated.

Gleyed soil

Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Graded stripcropping

Growing crops in strips that grade toward a protected waterway.

Grassed waterway

A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel

Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravel pit (map symbol)

An open excavation from which soil and underlying material have been removed and used, without crushing, as a source of sand or gravel.

Gravelly soil material

Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Gravelly spot (map symbol)

A spot where the surface layer has more than 35 percent, by volume, rock fragments that are mostly less than 3 inches in diameter in an area that has less than 15 percent rock fragments.

Green manure crop (agronomy)

A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water

Water filling all the unblocked pores of the material below the water table.

Gully (map symbol)

A small, steep-sided channel caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage whereas a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock

Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hard to reclaim

Reclamation is difficult after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Hardpan

A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head slope (geomorphology)

A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway. The overland waterflow is converging.

Hemic soil material (mucky peat)

Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops

Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill

A generic term for an elevated area of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline. Slopes are generally more than 15 percent. The distinction between a hill and a mountain is arbitrary and may depend on local usage.

Hillslope

A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of a hill.

Horizon, soil

A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the “Soil Survey Manual.” The major horizons of mineral soil are as follows:

O horizon: An organic layer of fresh and decaying plant residue.

L horizon: A layer of organic and mineral limnic materials, including coprogenous earth (sedimentary peat), diatomaceous earth, and marl.

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

E horizon: The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon: The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon: The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon: Soft, consolidated bedrock beneath the soil.

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

M layer: A root-limiting subsoil layer consisting of nearly continuous, horizontally oriented, human-manufactured materials.

W layer: A layer of water within or beneath the soil.

Humus

The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups

Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties include depth to a seasonal high water table, the infiltration rate, and depth to a layer that significantly restricts the downward movement of water. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Igneous rock

Rock that was formed by cooling and solidification of magma and that has not been changed appreciably by weathering since its formation. Major varieties include plutonic and volcanic rock (e.g., andesite, basalt, and granite).

Illuviation

The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil

A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers

Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration

The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity

The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate

The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate

The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Very low: Less than 0.2
Low: 0.2 to 0.4
Moderately low: 0.4 to 0.75
Moderate: 0.75 to 1.25
Moderately high: 1.25 to 1.75
High: 1.75 to 2.5
Very high: More than 2.5

Interfluve

A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways.

Interfluve (geomorphology)

A geomorphic component of hills consisting of the uppermost, comparatively level or gently sloping area of a hill; shoulders of backwearing hillslopes can narrow the upland or can merge, resulting in a strongly convex shape.

Intermittent stream

A stream, or reach of a stream, that does not flow year-round but that is commonly dry for 3 or more months out of 12 and whose channel is generally below the local water table. It flows only during wet periods or when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders

On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Iron depletions

See Redoximorphic features.

Irrigation

Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin: Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border: Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding: Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation: Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle): Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow: Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler: Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation: Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding: Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame

A low mound, knob, hummock, or short irregular ridge composed of stratified sand and gravel deposited by a subglacial stream as a fan or delta at the margin of a melting glacier; by a supraglacial stream in a low place or hole on the surface of the glacier; or as a ponded deposit on the surface or at the margin of stagnant ice.

Karst (topography)

A kind of topography that formed in limestone, gypsum, or other soluble rocks by dissolution and that is characterized by closed depressions, sinkholes, caves, and underground drainage.

Knoll

A small, low, rounded hill rising above adjacent landforms.

Ksat

See Saturated hydraulic conductivity.

Lacustrine deposit

Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake plain

A nearly level surface marking the floor of an extinct lake filled by well sorted, generally fine textured, stratified deposits, commonly containing varves.

Lake terrace

A narrow shelf, partly cut and partly built, produced along a lakeshore in front of a scarp line of low cliffs and later exposed when the water level falls.

Landfill (map symbol)

An area of accumulated waste products of human habitation, either above or below natural ground level.

Landslide

A general, encompassing term for most types of mass movement landforms and processes involving the downslope transport and outward deposition of soil and rock materials caused by gravitational forces; the movement may or may not involve saturated materials. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones

Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Lava flow (map symbol)

A solidified, commonly lobate body of rock formed through lateral, surface outpouring of molten lava from a vent or fissure.

Leaching

The removal of soluble material from soil or other material by percolating water.

Levee (map symbol)

An embankment that confines or controls water, especially one built along the banks of a river to prevent overflow onto lowlands.

Linear extensibility

Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at $^{1}/_{3}$- or $^{1}/_{10}$-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Liquid limit

The moisture content at which the soil passes from a plastic to a liquid state.

Loam

Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess

Material transported and deposited by wind and consisting dominantly of silt-sized particles.

Low strength

The soil is not strong enough to support loads.

Low-residue crops

Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Marl

An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal proportions; formed primarily under freshwater lacustrine conditions but also formed in more saline environments.

Marsh or swamp (map symbol)

A water-saturated, very poorly drained area that is intermittently or permanently covered by water. Sedges, cattails, and rushes are the dominant vegetation in marshes, and trees or shrubs are the dominant vegetation in swamps. Not used in map units where the named soils are poorly drained or very poorly drained.

Mass movement

A generic term for the dislodgment and downslope transport of soil and rock material as a unit under direct gravitational stress.

Masses

See Redoximorphic features.

Meander belt

The zone within which migration of a meandering channel occurs; the flood-plain area included between two imaginary lines drawn tangential to the outer bends of active channel loops.

Meander scar

A crescent-shaped, concave or linear mark on the face of a bluff or valley wall, produced by the lateral erosion of a meandering stream that impinged upon and undercut the bluff.

Meander scroll

One of a series of long, parallel, close-fitting, crescent-shaped ridges and troughs formed along the inner bank of a stream meander as the channel migrated laterally down-valley and toward the outer bank.

Mechanical treatment

Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil

Very fine sandy loam, loam, silt loam, or silt.

Mesa

A broad, nearly flat topped and commonly isolated landmass bounded by steep slopes or precipitous cliffs and capped by layers of resistant, nearly horizontal rocky material. The summit width is characteristically greater than the height of the bounding escarpments.

Metamorphic rock

Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement at depth in the earth’s crust. Nearly all such rocks are crystalline.

Mine or quarry (map symbol)

An open excavation from which soil and underlying material have been removed and in which bedrock is exposed. Also denotes surface openings to underground mines.

Mine spoil

An accumulation of displaced earthy material, rock, or other waste material removed during mining or excavation. Also called earthy fill.

Mineral soil

Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage

Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area

A kind of map unit that has little or no natural soil and supports little or no vegetation.

Miscellaneous water (map symbol)

Small, constructed bodies of water that are used for industrial, sanitary, or mining applications and that contain water most of the year.

Moderately coarse textured soil

Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil

Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon

A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine

In terms of glacial geology, a mound, ridge, or other topographically distinct accumulation of unsorted, unstratified drift, predominantly till, deposited primarily by the direct action of glacial ice in a variety of landforms. Also, a general term for a landform composed mainly of till (except for kame moraines, which are composed mainly of stratified outwash) that has been deposited by a glacier. Some types of moraines are disintegration, end, ground, kame, lateral, recessional, and terminal.

Morphology, soil

The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil

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

Mountain

A generic term for an elevated area of the land surface, rising more than 1,000 feet (300 meters) above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can

occur as a single, isolated mass or in a group forming a chain or range. Mountains are formed primarily by tectonic activity and/or volcanic action but can also be formed by differential erosion.

Muck

Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Mucky peat

See Hemic soil material.

Mudstone

A blocky or massive, fine grained sedimentary rock in which the proportions of clay and silt are approximately equal. Also, a general term for such material as clay, silt, claystone, siltstone, shale, and argillite and that should be used only when the amounts of clay and silt are not known or cannot be precisely identified.

Munsell notation

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

Natric horizon

A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil

A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules

See Redoximorphic features.

Nose slope (geomorphology)

A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside. The overland waterflow is predominantly divergent. Nose slopes consist dominantly of colluvium and slope-wash sediments (for example, slope alluvium).

Nutrient, plant

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

Organic matter

Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low: Less than 0.5 percent
Low: 0.5 to 1.0 percent
Moderately low: 1.0 to 2.0 percent
Moderate: 2.0 to 4.0 percent
High: 4.0 to 8.0 percent
Very high: More than 8.0 percent

Outwash

Stratified and sorted sediments (chiefly sand and gravel) removed or “washed out” from a glacier by meltwater streams and deposited in front of or beyond the end moraine or the margin of a glacier. The coarser material is deposited nearer to the ice.

Outwash plain

An extensive lowland area of coarse textured glaciofluvial material. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

Paleoterrace

An erosional remnant of a terrace that retains the surface form and alluvial deposits of its origin but was not emplaced by, and commonly does not grade to, a present-day stream or drainage network.

Pan

A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material

The unconsolidated organic and mineral material in which soil forms.

Peat

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

Ped

An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment

A layer of sediment, eroded from the shoulder and backslope of an erosional slope, that lies on and is being (or was) transported across a gently sloping erosional surface at the foot of a receding hill or mountain slope.

Pedon

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

Percolation

The movement of water through the soil.

Perennial water (map symbol)

Small, natural or constructed lakes, ponds, or pits that contain water most of the year.

Permafrost

Ground, soil, or rock that remains at or below 0 degrees C for at least 2 years. It is defined on the basis of temperature and is not necessarily frozen.

pH value

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

Phase, soil

A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Piping

Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting

Pits caused by melting around ice. They form on the soil after plant cover is removed.

Plastic limit

The moisture content at which a soil changes from semisolid to plastic.

Plasticity index

The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plateau (geomorphology)

A comparatively flat area of great extent and elevation; specifically, an extensive land region that is considerably elevated (more than 100 meters) above the adjacent lower lying terrain, is commonly limited on at least one side by an abrupt descent, and has a flat or nearly level surface. A comparatively large part of a plateau surface is near summit level.

Playa

The generally dry and nearly level lake plain that occupies the lowest parts of closed depressions, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff. Playa deposits are fine grained and may or may not have a high water table and saline conditions.

Plinthite

The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan

A compacted layer formed in the soil directly below the plowed layer.

Ponding

Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded

Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Pore linings

See Redoximorphic features.

Potential native plant community

See Climax plant community.

Potential rooting depth (effective rooting depth)

Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning

Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Productivity, soil

The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil

A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use

Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and

promotes the accumulation of litter and mulch necessary to conserve soil and water.

Rangeland

Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil

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

Ultra acid: Less than 3.5
Extremely acid: 3.5 to 4.4
Very strongly acid: 4.5 to 5.0
Strongly acid: 5.1 to 5.5
Moderately acid: 5.6 to 6.0
Slightly acid: 6.1 to 6.5
Neutral: 6.6 to 7.3
Slightly alkaline: 7.4 to 7.8
Moderately alkaline: 7.9 to 8.4
Strongly alkaline: 8.5 to 9.0
Very strongly alkaline: 9.1 and higher

Red beds

Sedimentary strata that are mainly red and are made up largely of sandstone and shale.

Redoximorphic concentrations

See Redoximorphic features.

Redoximorphic depletions

See Redoximorphic features.

Redoximorphic features

Redoximorphic features are associated with wetness and result from alternating periods of reduction and oxidation of iron and manganese compounds in the soil. Reduction occurs during saturation with water, and oxidation occurs when the soil is not saturated. Characteristic color patterns are created by these processes. The reduced iron and manganese ions may be removed from a soil if vertical or lateral fluxes of water occur, in which case there is no iron or manganese precipitation in that soil. Wherever the iron and manganese are oxidized and precipitated, they form either soft masses or hard concretions or nodules. Movement of iron and manganese as a result of redoximorphic processes in a soil may result in redoximorphic features that are defined as follows:

1. Redoximorphic concentrations.—These are zones of apparent accumulation of iron-manganese oxides, including:
   A. Nodules and concretions, which are cemented bodies that can be removed from the soil intact. Concretions are distinguished from nodules on the basis of internal organization. A concretion typically has concentric layers that are visible to the naked eye. Nodules do not have visible organized internal structure; *and*
   B. Masses, which are noncemented concentrations of substances within the soil matrix; *and*
   C. Pore linings, i.e., zones of accumulation along pores that may be either coatings on pore surfaces or impregnations from the matrix adjacent to the pores.
2. Redoximorphic depletions.—These are zones of low chroma (chromas less than those in the matrix) where either iron-manganese oxides alone or both iron-manganese oxides and clay have been stripped out, including:
   A. Iron depletions, i.e., zones that contain low amounts of iron and manganese oxides but have a clay content similar to that of the adjacent matrix; *and*
   B. Clay depletions, i.e., zones that contain low amounts of iron, manganese, and clay (often referred to as silt coatings or skeletans).
3. Reduced matrix.—This is a soil matrix that has low chroma *in situ* but undergoes a change in hue or chroma within 30 minutes after the soil material has been exposed to air.

Reduced matrix

See Redoximorphic features.

Regolith

All unconsolidated earth materials above the solid bedrock. It includes material weathered in place from all kinds of bedrock and alluvial, glacial, eolian, lacustrine, and pyroclastic deposits.

Relief

The relative difference in elevation between the upland summits and the lowlands or valleys of a given region.

Residuum (residual soil material)

Unconsolidated, weathered or partly weathered mineral material that accumulated as bedrock disintegrated in place.

Rill

A very small, steep-sided channel resulting from erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. A rill generally is not an obstacle to wheeled vehicles and is shallow enough to be smoothed over by ordinary tillage.

Riser

The vertical or steep side slope (e.g., escarpment) of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural, steplike landforms, such as successive stream terraces.

Road cut

A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments

Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rock outcrop (map symbol)

An exposure of bedrock at the surface of the earth. Not used where the named soils of the surrounding map unit are shallow over bedrock or where “Rock outcrop” is a named component of the map unit.

Root zone

The part of the soil that can be penetrated by plant roots.

Runoff

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

Saline soil

A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Saline spot (map symbol)

An area where the surface layer has an electrical conductivity of 8 mmhos/cm more than the surface layer of the named soils in the surrounding map unit. The surface layer of the surrounding soils has an electrical conductivity of 2 mmhos/cm or less.

Sand

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

Sandstone

Sedimentary rock containing dominantly sand-sized particles.

Sandy spot (map symbol)

A spot where the surface layer is loamy fine sand or coarser in areas where the surface layer of the named soils in the surrounding map unit is very fine sandy loam or finer.

Sapric soil material (muck)

The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saturated hydraulic conductivity (Ksat)

The ease with which pores of a saturated soil transmit water. Formally, the proportionality coefficient that expresses the relationship of the rate of water movement to hydraulic gradient in Darcy's Law, a law that describes the rate of water movement through porous media. Commonly abbreviated as "Ksat." Terms describing saturated hydraulic conductivity are:

Very high: 100 or more micrometers per second (14.17 or more inches per hour)

High: 10 to 100 micrometers per second (1.417 to 14.17 inches per hour)

Moderately high: 1 to 10 micrometers per second (0.1417 inch to 1.417 inches per hour)

Moderately low: 0.1 to 1 micrometer per second (0.01417 to 0.1417 inch per hour)

Low: 0.01 to 0.1 micrometer per second (0.001417 to 0.01417 inch per hour)

Very low: Less than 0.01 micrometer per second (less than 0.001417 inch per hour).

To convert inches per hour to micrometers per second, multiply inches per hour by 7.0572. To convert micrometers per second to inches per hour, multiply micrometers per second by 0.1417.

Saturation

Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification

The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Sedimentary rock

A consolidated deposit of clastic particles, chemical precipitates, or organic remains accumulated at or near the surface of the earth under normal low temperature and pressure conditions. Sedimentary rocks include consolidated equivalents of alluvium, colluvium, drift, and eolian, lacustrine, and marine deposits. Examples are sandstone, siltstone, mudstone, claystone, shale, conglomerate, limestone, dolomite, and coal.

Sequum

A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil

A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Severely eroded spot (map symbol)

An area where, on the average, 75 percent or more of the original surface layer has been lost because of accelerated erosion. Not used in map units in which “severely eroded,” “very severely eroded,” or “gullied” is part of the map unit name.

Shale

Sedimentary rock that formed by the hardening of a deposit of clay, silty clay, or silty clay loam and that has a tendency to split into thin layers.

Sheet erosion

The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Short, steep slope (map symbol)

A narrow area of soil having slopes that are at least two slope classes steeper than the slope class of the surrounding map unit.

Shoulder

The convex, erosional surface near the top of a hillslope. A shoulder is a transition from summit to backslope.

Shrink-swell

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

Shrub-coppice dune

A small, streamlined dune that forms around brush and clump vegetation.

Side slope (geomorphology)

A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel. Side slopes are dominantly colluvium and slope-wash sediments.

Silica

A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio

The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt

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

Siltstone

An indurated silt having the texture and composition of shale but lacking its fine lamination or fissility; a massive mudstone in which silt predominates over clay.

Similar soils

Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole (map symbol)

A closed, circular or elliptical depression, commonly funnel shaped, characterized by subsurface drainage and formed either by dissolution of the surface of underlying bedrock (e.g., limestone, gypsum, or salt) or by collapse of underlying caves within bedrock. Complexes of sinkholes in carbonate-rock terrain are the main components of karst topography.

Site index

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

Slickensides (pedogenic)

Grooved, striated, and/or glossy (shiny) slip faces on structural peds, such as wedges; produced by shrink-swell processes, most commonly in soils that have a high content of expansive clays.

Slide or slip (map symbol)

A prominent landform scar or ridge caused by fairly recent mass movement or descent of earthy material resulting from failure of earth or rock under shear stress along one or several surfaces.

Slope

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

Slope alluvium

Sediment gradually transported down the slopes of mountains or hills primarily by nonchannel alluvial processes (i.e., slope-wash processes) and characterized by particle sorting. Lateral particle sorting is evident on long slopes. In a profile sequence, sediments may be distinguished by differences in size and/or specific gravity of rock fragments and may be separated by stone lines. Burnished peds and sorting of rounded or subrounded pebbles or cobbles distinguish these materials from unsorted colluvial deposits.

Slow refill

The slow filling of ponds, resulting from restricted water transmission in the soil.

Slow water movement

Restricted downward movement of water through the soil. See Saturated hydraulic conductivity.

Sodic (alkali) soil

A soil having 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 plant growth is restricted.

Sodic spot (map symbol)

An area where the surface layer has a sodium adsorption ratio that is at least 10 more than that of the surface layer of the named soils in the surrounding map unit. The surface layer of the surrounding soils has a sodium adsorption ratio of 5 or less.

Sodicity

The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to $Ca^{++} + Mg^{++}$. The degrees of sodicity and their respective ratios are:

Slight: Less than 13:1
Moderate: 13-30:1
Strong: More than 30:1

Sodium adsorption ratio (SAR)

A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock

Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil

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

Soil separates

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

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

Solum

The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Spoil area (map symbol)

A pile of earthy materials, either smoothed or uneven, resulting from human activity.

Stone line

In a vertical cross section, a line formed by scattered fragments or a discrete layer of angular and subangular rock fragments (commonly a gravel- or cobble-sized lag concentration) that formerly was draped across a topographic surface and was later buried by additional sediments. A stone line generally caps material that was subject to weathering, soil formation, and erosion before burial. Many stone lines seem to be buried erosion pavements, originally formed by sheet and rill erosion across the land surface.

Stones

Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony

Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stony spot (map symbol)

A spot where 0.01 to 0.1 percent of the soil surface is covered by rock fragments that are more than 10 inches in diameter in areas where the surrounding soil has no surface stones.

Strath terrace

A type of stream terrace; formed as an erosional surface cut on bedrock and thinly mantled with stream deposits (alluvium).

Stream terrace

One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream; represents the remnants of an abandoned flood plain, stream bed, or valley floor produced during a former state of fluvial erosion or deposition.

Stripcropping

Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil

The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are:

Platy: Flat and laminated

Prismatic: Vertically elongated and having flat tops

Columnar: Vertically elongated and having rounded tops

Angular blocky: Having faces that intersect at sharp angles (planes)

Subangular blocky: Having subrounded and planar faces (no sharp angles)

Granular: Small structural units with curved or very irregular faces

Structureless soil horizons are defined as follows:

Single grained: Entirely noncoherent (each grain by itself), as in loose sand

Massive: Occurring as a coherent mass

Stubble mulch

Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil

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

Subsoiling

Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum

The part of the soil below the solum.

Subsurface layer

Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow

The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit

The topographically highest position of a hillslope. It has a nearly level (planar or only slightly convex) surface.

Surface layer

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

Surface soil

The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Talus

Rock fragments of any size or shape (commonly coarse and angular) derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose broken rock formed chiefly by falling, rolling, or sliding.

Taxadjuncts

Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terminal moraine

An end moraine that marks the farthest advance of a glacier. It typically has the form of a massive arcuate or concentric ridge, or complex of ridges, and is underlain by till and other types of drift.

Terrace (conservation)

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 water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field

generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geomorphology)

A steplike surface, bordering a valley floor or shoreline, that represents the former position of a flood plain, lake, or seashore. The term is usually applied both to the relatively flat summit surface (tread) that was cut or built by stream or wave action and to the steeper descending slope (scarp or riser) that has graded to a lower base level of erosion.

Terracettes

Small, irregular steplike forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may be induced or enhanced by trampling of livestock, such as sheep or cattle.

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.”

Thin layer

Otherwise suitable soil material that is too thin for the specified use.

Till

Dominantly unsorted and nonstratified drift, generally unconsolidated and deposited directly by a glacier without subsequent reworking by meltwater, and consisting of a heterogeneous mixture of clay, silt, sand, gravel, stones, and boulders; rock fragments of various lithologies are embedded within a finer matrix that can range from clay to sandy loam.

Till plain

An extensive area of level to gently undulating soils underlain predominantly by till and bounded at the distal end by subordinate recessional or end moraines.

Tilth, soil

The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope

The gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

Topsoil

The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements

Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Tread

The flat to gently sloping, topmost, laterally extensive slope of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural steplike landforms, such as successive stream terraces.

Tuff

A generic term for any consolidated or cemented deposit that is 50 percent or more volcanic ash.

Upland

An informal, general term for the higher ground of a region, in contrast with a low-lying adjacent area, such as a valley or plain, or for land at a higher elevation than the flood plain or low stream terrace; land above the footslope zone of the hillslope continuum.

Valley fill

The unconsolidated sediment deposited by any agent (water, wind, ice, or mass wasting) so as to fill or partly fill a valley.

Variegation

Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve

A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Very stony spot (map symbol)

A spot where 0.1 to 3.0 percent of the soil surface is covered by rock fragments that are more than 10 inches in diameter in areas where the surface of the surrounding soil is covered by less than 0.01 percent stones.

Water bars

Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering

All physical disintegration, chemical decomposition, and biologically induced changes in rocks or other deposits at or near the earth’s surface by atmospheric or biologic agents or by circulating surface waters but involving essentially no transport of the altered material.

Well graded

Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wet spot (map symbol)

A somewhat poorly drained to very poorly drained area that is at least two drainage classes wetter than the named soils in the surrounding map unit.

Wilting point (or permanent wilting point)

The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow

The uprooting and tipping over of trees by the wind.

APPENDIX B

Montana Natural Heritage Program Environmental Summary Report

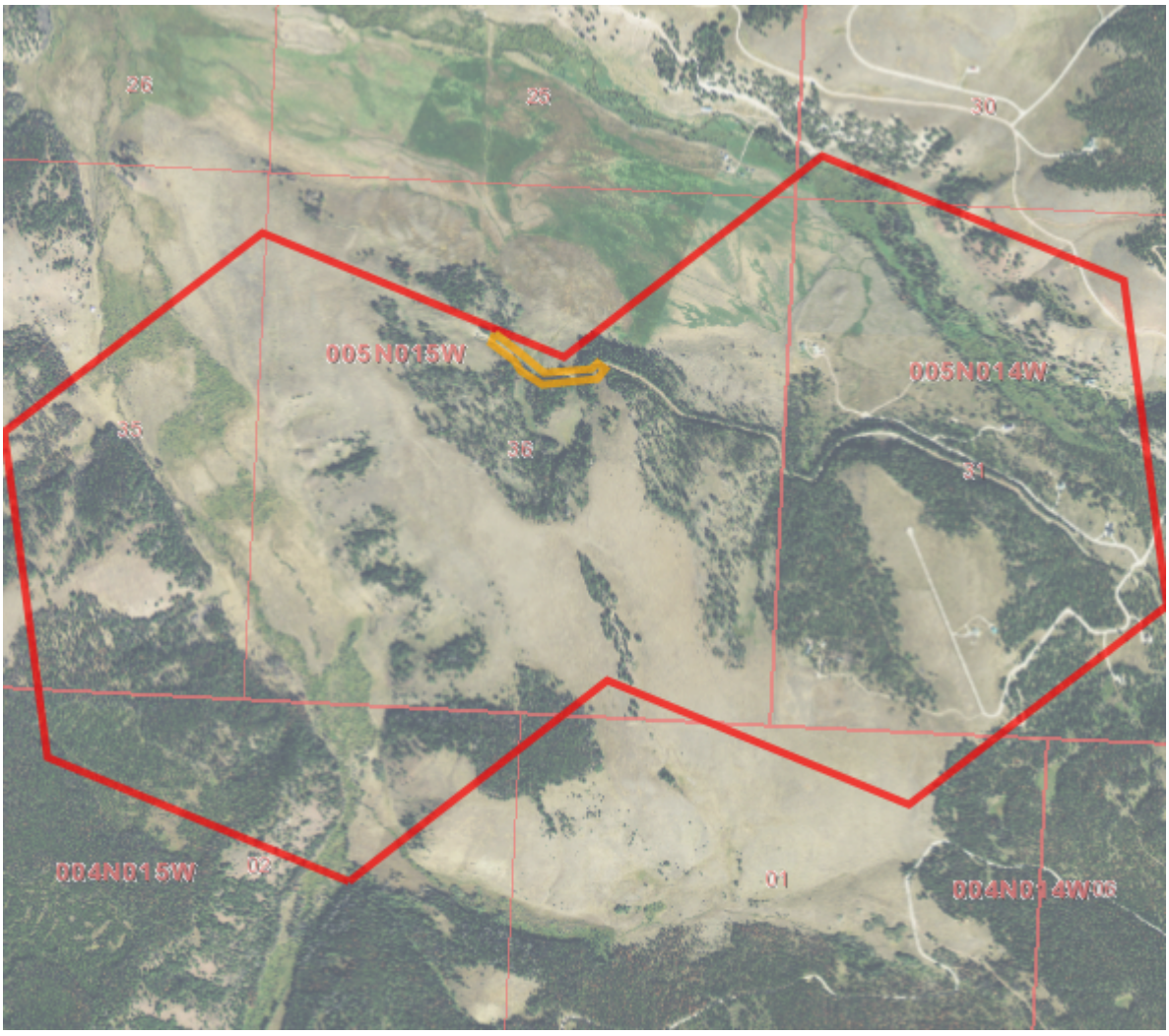
Environmental Summary

MONTANA
Natural Heritage Program

1515 East 6th Avenue
Helena, MT 59620
(406) 444-5363
mtnhp.org

Latitude	Longitude
46.13002	-113.39590
46.15151	-113.44041

Summarized by:
Flint Creek Phase 1
(Custom Area of Interest)



Suggested Citation
Montana Natural Heritage Program. Environmental Summary Report.
for Latitude 46.13002 to 46.15151 and Longitude -113.39590 to -113.44041. Retrieved on 8/29/2022.

The Montana Natural Heritage Program is part of the Montana State Library's Natural Resource Information System. Since 1985, it has served as a neutral and non-regulatory provider of easily accessible information on Montana's species and biological communities to inform all stakeholders in environmental review, permitting, and planning processes. The program is part of NatureServe, a network of over 80 similar programs in states, provinces, and nations throughout the Western Hemisphere, working to provide current and comprehensive distribution and status information on species and biological communities.

Montana Natural Heritage Program · Montana State Library · NatureServe

Table of Contents

Introduction to Environmental Summary Report

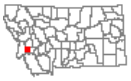
Environmental Summary Reports from the Montana Natural Heritage Program (MTNHP) provide information on species and biological communities to inform all stakeholders in environmental review, permitting, and planning processes. For information on environmental permits in Montana, please see permitting overviews by the Montana Department of Environmental Quality, the Montana Department of Natural Resources and Conservation, the Index of Environmental Permits for Montana and our Suggested Contacts for Natural Resource Management Agencies. The report for your area of interest consists of introductory and related materials in this PDF and an Excel workbook with worksheets summarizing information managed in the MTNHP databases for: (1) species occurrences; (2) other observed species without species occurrences; (3) other species potentially present based on their range, presence of associated habitats, or predictive distribution model output if available; (4) structured surveys that follow a protocol capable of detecting one or more species; (5) land cover mapped as ecological systems; (6) wetland and riparian mapping; (7) land management categories; and (8) biological reports associated with plant and animal observations. If your area of interest corresponds to a statewide polygon layer (e.g., watersheds, counties, or public land survey sections) information summaries in your report will exactly match those boundaries. However, if your report is for a custom area, users should be aware that summaries do not correspond to the exact boundaries of the polygon they have specified, but instead are a summary across a layer of hexagons intersected by the polygon they specified as shown on the report cover. Summarizing by these hexagons which are one square mile in area and approximately one kilometer in length on each side allows for consistent and rapid delivery of summaries based on a uniform grid that has been used for planning efforts across the western United States (e.g., Western Association of Fish and Wildlife Agencies - Crucial Habitat Assessment Tool).

In presenting this information, MTNHP is working towards assisting the user with rapidly assessing the known or potential species and biological communities, land management categories, and biological reports associated with the report area. Users are reminded that this information is likely incomplete and may be inaccurate as surveys to document species are lacking in many areas of the state, species' range polygons often include regions of unsuitable habitat, methods of predicting the presence of species or communities are constantly improving, and information is constantly being added and updated in our databases. **Field verification by professional biologists of the absence or presence of species and biological communities in a report area will always be an important obligation of users of our data. Users are encouraged to only use this environmental summary report as a starting point for more in depth analyses and are encouraged to contact state, federal, and tribal resource management agencies for additional data or management guidelines relevant to your efforts. Please see the Appendix for introductory materials to each section of the report, additional information resources, and a list of relevant agency contacts.**

MONTANA Natural Heritage Program
A program of the **Montana State Library's Natural Resource Information System**

Legend

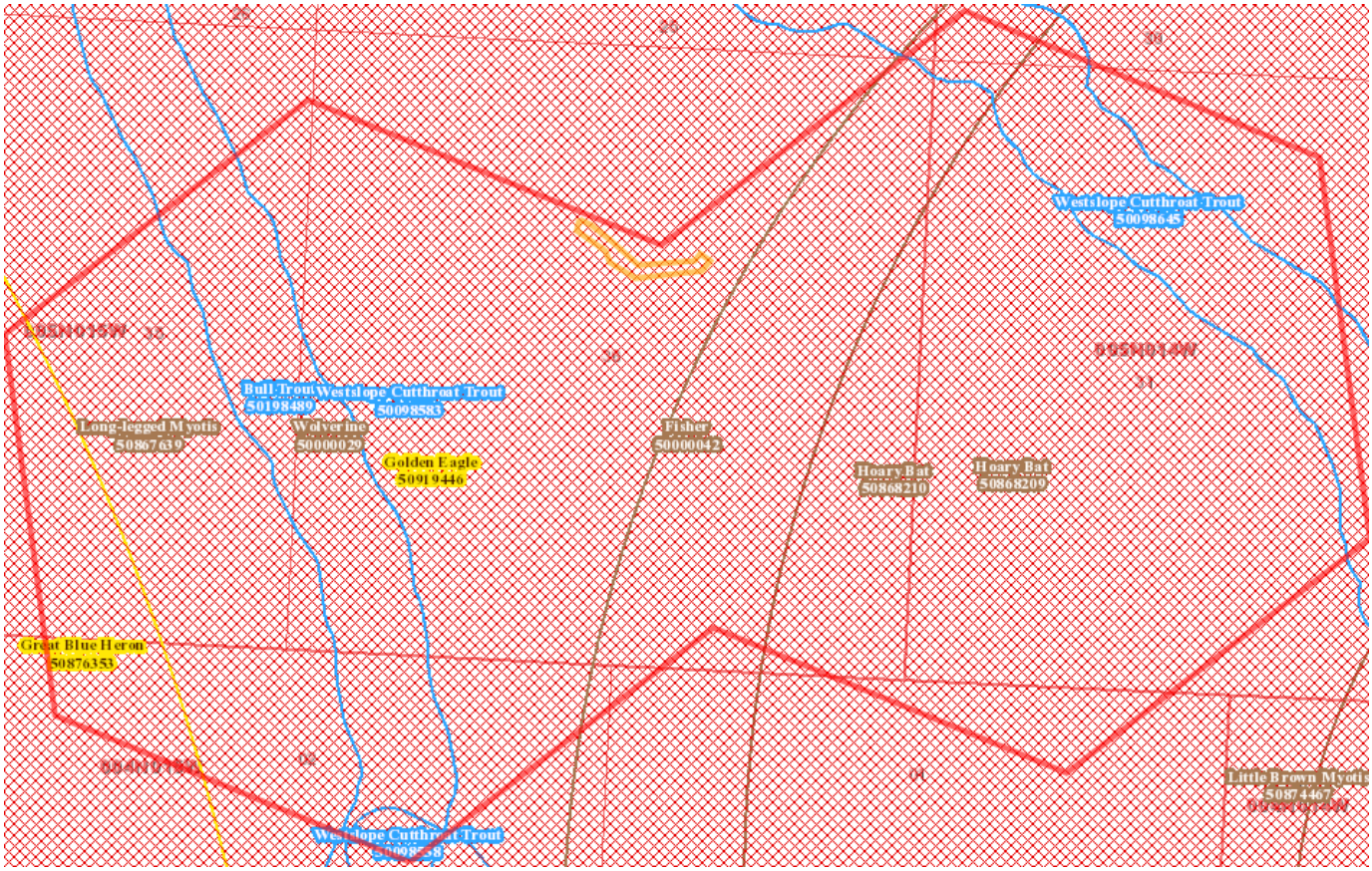
Model Icons	Habitat Icons	Range Icons	Num Obs
N Suitable (native range)	C Common	Y Native / Year-round	Count of obs with 'good precision' (<=1000m)
O Optimal Suitability	O Occasional	S Summer	+ indicates additional 'poor precision' obs (1001m-10,000m)
M Moderate Suitability		W Winter	
L Low Suitability		M Migratory	
I Suitable (introduced range)		N Non-native	
		H Historic	



Latitude	Longitude
46.13002	-113.39590
46.15151	-113.44041

Native Species

Summarized by: **Flint Creek Phase 1** *(Custom Area of Interest)*
All Species (not filtered by Status)



Species Occurrences

	USFWS Sec7	# SO	# Obs	Predicted Model	Range
F - Bull Trout *(Salvelinus confluentus)* SOC	7	1	4 +		Y

View in Field Guide **View Predicted Models** **View Range Maps**

Species of Concern - Native Species Global: **G5** State: **S2** USFWS: **LT; CH** BLM: **THREATENED** FWP SWAP: **SGCN2**

Delineation Criteria Stream reaches and standing water bodies where the species is believed to be present based on the professional judgement of a fisheries biologist, potentially supported by habitat assessment, direct capture, or confirmed presence in adjacent areas. In order to reflect the importance of adjacent terrestrial habitats to survival, stream reaches are buffered 100 meters, standing water bodies greater than 1 acre are buffered 50 meters, and standing water bodies less than 1 acre are buffered 30 meters into the terrestrial habitat based on PACFISH/INFISH Riparian Conservation Area standards. (Last Updated: Jul 18, 2022)

Predicted Models: N 100% Suitable (native range) (deductive)

F - Westslope Cutthroat Trout *(Oncorhynchus clarkii lewisi)* SOC		3	1 +		Y

View in Field Guide **View Predicted Models** **View Range Maps**

Species of Concern - Native/Non-native Species - (depends on location or taxa) Global: **G5T4** State: **S2**
USFS: **Sensitive - Known in Forests (BD, BRT, KOOT, LOLO)**
Species of Conservation Concern in Forests (CG, HLC) BLM: **SENSITIVE** FWP SWAP: **SGCN2**

Delineation Criteria Stream reaches and standing water bodies where the species presence has been confirmed through direct capture or where they are believed to be present based on the professional judgement of a fisheries biologist due to confirmed presence in adjacent areas. In order to reflect the importance of adjacent terrestrial habitats to survival, stream reaches are buffered 100 meters, standing water bodies greater than 1 acre are buffered 50 meters, and standing water bodies less than 1 acre are buffered 30 meters into the terrestrial habitat based on PACFISH/INFISH Riparian Conservation Area standards. (Last Updated: Jul 25, 2022)

Predicted Models: N 100% Suitable (native range) (deductive)

M - Hoary Bat *(Lasiurus cinereus)* SOC		2			S M

View in Field Guide **View Predicted Models** **View Range Maps**

Species of Concern - Native Species Global: **G3G4** State: **S3B** BLM: **SENSITIVE** FWP SWAP: **SGCN3**

Delineation Criteria Confirmed area of occupancy based on the documented presence (mistnet captures, definitively identified acoustic recordings, and definitively identified roosting individuals) of adults or juveniles during the active season. Point observation location is buffered by a minimum distance of 3,500 meters in order to be conservative about encompassing the maximum reported foraging distance for the congeneric Lasiurus borealis and otherwise buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Jul 20, 2022)

Predicted Models: M 100% Moderate (inductive)

M - Wolverine *(Gulo gulo)* SOC	7	1			Y

View in Field Guide **View Predicted Models** **View Range Maps**

Species of Concern - Native Species Global: **G4** State: **S3** USFS: **Sensitive - Known in Forests (BD, BRT, KOOT, LOLO)** BLM: **SENSITIVE** FWP SWAP: **SGCN3**

Delineation Criteria Confirmed area of occupancy supported by recent (post-1980), nearby (within 10 kilometers) observations of adults or juveniles. Tracking regions were defined by areas of primary habitat and adjacent female dispersal habitat as modeled by Inman et al. (2013). These regions were buffered by 1 kilometer in order to link smaller areas and account for potential inaccuracies in independent variables used in the model. (Last Updated: Jul 25, 2022)

Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

M - Long-legged Myotis *(Myotis volans)* SOC

View in Field Guide **View Predicted Models** **View Range Maps**

Species of Concern - Native Species Global: **G4G5** State: **S3**

Delineation Criteria Confirmed area of occupancy based on the documented presence (mistnet captures, definitively identified acoustic recordings, and definitively identified roosting individuals) of adults or juveniles. Point observation location is buffered by a minimum distance of 2,000 meters in order to encompass the average distances traveled from capture locations to roosts in Washington, Oregon, and in the Black Hills of South Dakota and otherwise buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. When cave locations are involved, point observations are mapped in the center of a one-square mile hexagon to protect the exact location of the cave entrance as per the Federal Cave Resource Protection Act and associated regulations (U.S. Code Title 16 Chapter 63, Code of Federal Regulations Title 43 Subtitle A Part 37). The outer edges of the hexagon are then buffered by a distance of 2,000 meters and otherwise by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. All of the one-square mile hexagons intersecting this buffered area are presented as the Species Occurrence record. (Last Updated: Jul 20, 2022)

Predicted Models: L 100% Low (inductive)

B - Golden Eagle *(Aquila chrysaetos)* SOC

View in Field Guide **View Predicted Models** **View Range Maps**

Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **BGEPA; MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3**

Delineation Criteria Confirmed nesting area buffered by a minimum distance of 3,000 meters in order to be conservative about encompassing the entire breeding territory and area commonly used for renesting and otherwise buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Jul 26, 2022)

Predicted Models: L 100% Low (inductive)

B - Great Blue Heron *(Ardea herodias)* SOC

View in Field Guide **View Predicted Models** **View Range Maps**

Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** FWP SWAP: **SGCN3**

Delineation Criteria Confirmed nesting area buffered by a minimum distance of 6,500 meters in order to be conservative about encompassing the areas commonly used for foraging near the breeding colony and otherwise buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Jul 20, 2022)

Predicted Models: L 100% Low (inductive)

M - Fisher *(Pekania pennanti)* SOC

View in Field Guide **View Predicted Models** **View Range Maps**

Species of Concern - Native Species Global: **G5** State: **S3** USFS: **Sensitive - Known in Forests (BD, BRT, KOOT, LOLO)** BLM: **SENSITIVE** FWP SWAP: **SGCN3**

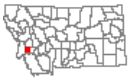
Delineation Criteria Confirmed area of occupancy based on the documented presence of adults or juveniles within tracking regions containing core habitat for the species. Outer boundaries of tracking regions are defined by areas of forest cover on individual mountain ranges or clusters of adjacent mountain ranges with continuous forest cover. (Last Updated: Oct 06, 2021)

Predicted Models: L 50% Low (inductive)

MONTANA Natural Heritage Program
A program of the **Montana State Library's Natural Resource Information System**

Legend

Model Icons	Habitat Icons	Range Icons	Num Obs
N Suitable (native range)	C Common	Y Native / Year-round	Count of obs with 'good precision' (<=1000m)
O Optimal Suitability	O Occasional	S Summer	+ indicates additional 'poor precision' obs (1001m-10,000m)
M Moderate Suitability		W Winter	
L Low Suitability		M Migratory	
I Suitable (introduced range)		N Non-native	
		H Historic	



Latitude	Longitude
46.13002	-113.39590
46.15151	-113.44041

Native Species

Summarized by: **Flint Creek Phase 1** *(Custom Area of Interest)*
All Species (not filtered by Status)

Other Observed Species

	USFWS Sec7	# Obs	Predicted Model	Range
B - Pileated Woodpecker *(Dryocopus pileatus)* SOC		+		Y

View in Field Guide **View Predicted Models** **View Range Maps**
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **2**
Predicted Models: L 100% Low (inductive)

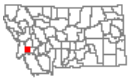
F - Lake Trout *(Salvelinus namaycush)* SOC		+	Not Available	

View in Field Guide
Species of Concern - Native/Non-native Species - (depends on location or taxa) Global: **G5** State: **S2** FWP SWAP: **SGCN2**

MONTANA Natural Heritage Program
A program of the **Montana State Library's Natural Resource Information System**

Legend

Model Icons	Habitat Icons	Range Icons	Num Obs
N Suitable (native range)	C Common	Y Native / Year-round	Count of obs with 'good precision' (<=1000m)
O Optimal Suitability	O Occasional	S Summer	+ indicates additional 'poor precision' obs (1001m-10,000m)
M Moderate Suitability		W Winter	
L Low Suitability		M Migratory	
I Suitable (introduced range)		N Non-native	
		H Historic	



Latitude	Longitude
46.13002	-113.39590
46.15151	-113.44041

Native Species

Summarized by: **Flint Creek Phase 1** *(Custom Area of Interest)*
All Species (not filtered by Status)

Other Potential Species

	USFWS Sec7	Predicted Model	Range
M - Fringed Myotis *(Myotis thysanodes)* SOC			Y
M - Little Brown Myotis *(Myotis lucifugus)* SOC			Y
M - Long-eared Myotis *(Myotis evotis)* SOC			Y
M - Preble's Shrew *(Sorex preblei)* SOC			Y
M - Silver-haired Bat *(Lasionycteris noctivagans)* PSOC			Y
B - Cassin's Finch *(Haemorhous cassinii)* SOC			Y
B - Clark's Nutcracker *(Nucifraga columbiana)* SOC			Y
B - Evening Grosbeak *(Coccothraustes vespertinus)* SOC			Y WM
B - Great Gray Owl *(Strix nebulosa)* SOC			Y
B - Northern Goshawk *(Accipiter gentilis)* SOC			Y WM
B - Western Screech-Owl *(Megascops kennicottii)* PSOC			Y
I - Bombus suckleyi *(Suckley Cuckoo Bumble Bee)* SOC			Y
V - Adoxa moschatellina *(Musk-root)* SOC			Y
V - Carex crawei *(Crawe's Sedge)* SOC			Y

M - Fringed Myotis *(Myotis thysanodes)* SOC

View in Field Guide | View Predicted Models | View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3** BLM: **SENSITIVE** FWP SWAP: **SGCN3**
Predicted Models: M 100% Moderate (inductive)

M - Little Brown Myotis *(Myotis lucifugus)* SOC

View in Field Guide | View Predicted Models | View Range Maps
Species of Concern - Native Species Global: **G3G4** State: **S3** FWP SWAP: **SGCN3**
Predicted Models: M 100% Moderate (inductive)

M - Long-eared Myotis *(Myotis evotis)* SOC

View in Field Guide | View Predicted Models | View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3**
Predicted Models: M 100% Moderate (inductive)

M - Preble's Shrew *(Sorex preblei)* SOC

View in Field Guide | View Predicted Models | View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3** FWP SWAP: **SGCN3**
Predicted Models: M 100% Moderate (inductive)

M - Silver-haired Bat *(Lasionycteris noctivagans)* PSOC

View in Field Guide | View Predicted Models | View Range Maps
Potential Species of Concern - Native Species Global: **G3G4** State: **S4**
Predicted Models: M 100% Moderate (inductive)

B - Cassin's Finch *(Haemorhous cassinii)* SOC

View in Field Guide | View Predicted Models | View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA; BCC10** FWP SWAP: **SGCN3** PIF: **3**
Predicted Models: M 100% Moderate (inductive)

B - Clark's Nutcracker *(Nucifraga columbiana)* SOC

View in Field Guide | View Predicted Models | View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** USFS: **Species of Conservation Concern in Forests (FLAT)** FWP SWAP: **SGCN3** PIF: **3**
Predicted Models: M 100% Moderate (inductive)

B - Evening Grosbeak *(Coccothraustes vespertinus)* SOC

View in Field Guide | View Predicted Models | View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA; BCC10** FWP SWAP: **SGCN3**
Predicted Models: M 100% Moderate (inductive)

B - Great Gray Owl *(Strix nebulosa)* SOC

View in Field Guide | View Predicted Models | View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3, SGIN** PIF: **3**
Predicted Models: M 100% Moderate (inductive)

B - Northern Goshawk *(Accipiter gentilis)* SOC

View in Field Guide | View Predicted Models | View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **2**
Predicted Models: M 100% Moderate (inductive)

B - Western Screech-Owl *(Megascops kennicottii)* PSOC

View in Field Guide | View Predicted Models | View Range Maps
Potential Species of Concern - Native Species Global: **G4G5** State: **S3S4** USFWS: **MBTA** FWP SWAP: **SGIN** PIF: **3**
Predicted Models: M 100% Moderate (inductive)

I - Bombus suckleyi *(Suckley Cuckoo Bumble Bee)* SOC

View in Field Guide | View Predicted Models | View Range Maps
Species of Concern - Native Species Global: **G2G3** State: **S1**
Predicted Models: M 100% Moderate (inductive)

V - Adoxa moschatellina *(Musk-root)* SOC

View in Field Guide | View Predicted Models | View Range Maps
USFS: **Sensitive - Known in Forests (BD, LOLO)**
Species of Concern - Native Species Global: **G5** State: **S3** **Species of Conservation Concern in Forests (CG, HLC)** MNPS: **3**
Predicted Models: M 100% Moderate (inductive)

V - Carex crawei *(Crawe's Sedge)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S2S3** MNPS: **3**
Predicted Models: M 100% Moderate (inductive)

V - Draba densifolia *(Dense-leaf Draba)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S2** USFS: **Species of Conservation Concern in Forests (CG, HLC)** MNPS: **2**
Predicted Models: M 100% Moderate (inductive)

V - Oxytropis lagopus var. conjugans *(Hare's-foot Locoweed)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G4G5T3T4** State: **S3S4** MNPS: **3**
Predicted Models: M 100% Moderate (inductive)

M - Canada Lynx *(Lynx canadensis)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **LT; CH** BLM: **THREATENED** FWP SWAP: **SGCN3**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

M - North American Water Vole *(Microtus richardsoni)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S4**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

A - Western Toad *(Anaxyrus boreas)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S2** USFS: **Sensitive - Known in Forests (BD, BRT, KOOT, LOLO)** BLM: **SENSITIVE** FWP SWAP: **SGCN2**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

V - Botrychium hesperium *(Western Moonwort)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3** USFS: **Sensitive - Known in Forests (BD, KOOT)** MNPS: **4**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

V - Botrychium paradoxum *(Peculiar Moonwort)* SOC

View in Field Guide View Predicted Models View Range Maps
USFS: **Sensitive - Known in Forests (BD, KOOT)**
Sensitive - Suspected in Forests (LOLO)
Species of Concern - Native Species Global: **G3G4** State: **S3** **Species of Conservation Concern in Forests (CG, FLAT, HLC)** BLM: **SENSITIVE** MNPS: **4**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

V - Botrychium simplex *(Least Moonwort)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S2** MNPS: **4**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

V - Delphinium glaucescens *(Electric Peak Larkspur)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G3G4** State: **S3S4**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

V - Gentianopsis simplex *(Hiker's Gentian)* SOC

View in Field Guide View Predicted Models View Range Maps
USFS: **Sensitive - Known in Forests (BD)**
Sensitive - Suspected in Forests (KOOT, LOLO)
Species of Concern - Native Species Global: **G5** State: **S2** **Species of Conservation Concern in Forests (CG)** MNPS: **3**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

V - Ranunculus hyperboreus *(High Northern Buttercup)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S3S4**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

V - Stipa lettermanii *(Letterman's Needlegrass)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S1S3** USFS: **Species of Conservation Concern in Forests (HLC)** MNPS: **3**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

V - Utricularia intermedia *(Flatleaf Bladderwort)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S2** USFS: **Sensitive - Known in Forests (KOOT)** MNPS: **3**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

B - Broad-tailed Hummingbird *(Selasphorus platycercus)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S4B** USFWS: **MBTA; BCC10** FWP SWAP: **SGIN**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

B - Green-tailed Towhee *(Pipilo chlorurus)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **3**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

B - Rufous Hummingbird *(Selasphorus rufus)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G4** State: **S4B** USFWS: **MBTA; BCC10** PIF: **3**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

B - Veery *(Catharus fuscescens)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

M - Grizzly Bear *(Ursus arctos)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S2S3** USFWS: **PS: LT; XN** BLM: **THREATENED** FWP SWAP: **SGCN2-3**
Predicted Models: L 100% Low (inductive)

M - North American Porcupine *(Erethizon dorsatum)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S3S4** FWP SWAP: **SGIN**
Predicted Models: L 100% Low (inductive)

M - Western Pygmy Shrew *(Sorex eximius)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3** FWP SWAP: **SGCN3**
Predicted Models: L 100% Low (inductive)

M - Western Spotted Skunk *(Spilogale gracilis)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **SU** FWP SWAP: **SGIN**
Predicted Models: L 100% Low (inductive)

B - Bald Eagle *(Haliaeetus leucocephalus)* SSS

View in Field Guide View Predicted Models View Range Maps
Special Status Species - Native Species Global: **G5** State: **S4** USFWS: **BGEPA; MBTA** USFS: **Sensitive - Known in Forests (BD, BRT, KOOT, LOLO)** BLM: **SENSITIVE** PIF: **2**
Predicted Models: L 100% Low (inductive)

B - Barrow's Goldeneye *(Bucephala islandica)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S4** USFWS: **MBTA** FWP SWAP: **SGIN** PIF: **2**
Predicted Models: L 100% Low (inductive)

B - Boreal Owl *(Aegolius funereus)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S3S4** USFWS: **MBTA** FWP SWAP: **SGIN** PIF: **3**
Predicted Models: L 100% Low (inductive)

B - Brown Creeper *(Certhia americana)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **1**
Predicted Models: L 100% Low (inductive)

B - Trumpeter Swan *(Cygnus buccinator)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3** USFWS: **MBTA** USFS: **Sensitive - Known in Forests (BD)** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **1**
Predicted Models: L 100% Low (inductive)

I - Rhyacophila betteni *(A Caddisfly)* SSS

View in Field Guide View Predicted Models View Range Maps
Special Status Species - Native Species Global: **G2G4** State: **S3S4**
Predicted Models: L 100% Low (inductive)

V - Agoseris aurantiaca var. carnea *(Pink Agoseris)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G4Q** State: **S3S4**
Predicted Models: L 100% Low (inductive)

V - Botrychium ascendens *(Upward-lobed Moonwort)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G3** State: **S3** USFS: **Sensitive - Known in Forests (KOOT)** MNPS: **4**
Predicted Models: L 100% Low (inductive)

V - Botrychium crenulatum *(Wavy Moonwort)* SOC

View in Field Guide View Predicted Models View Range Maps
USFS: **Sensitive - Known in Forests (BD, KOOT, LOLO)**
Species of Concern - Native Species Global: **G4** State: **S3** **Species of Conservation Concern in Forests (HLC)** MNPS: **4**
Predicted Models: L 100% Low (inductive)

V - Botrychium pedunculosum *(Stalked Moonwort)* SOC

View in Field Guide View Predicted Models View Range Maps
USFS: **Sensitive - Known in Forests (KOOT)**
Species of Concern - Native Species Global: **G3G4** State: **S2** **Species of Conservation Concern in Forests (FLAT)** MNPS: **4**
Predicted Models: L 100% Low (inductive)

V - Cypripedium parviflorum *(Small Yellow Lady's-slipper)* PSOC

View in Field Guide View Predicted Models View Range Maps
USFS: **Sensitive - Known in Forests (KOOT, LOLO)**
Sensitive - Suspected in Forests (BRT)
Potential Species of Concern - Native Species Global: **G5** State: **S3S4** **Species of Conservation Concern in Forests (CG, HLC)** MNPS: **2**
Predicted Models: L 100% Low (inductive)

V - Elodea bifoliata *(Long-sheath Waterweed)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4G5** State: **S2?** MNPS: **3**
Predicted Models: L 100% Low (inductive)

V - Erigeron linearis *(Linear-leaf Fleabane)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S2** MNPS: **2**
Predicted Models: L 100% Low (inductive)

V - Mimulus suksdorfii *(Suksdorf Monkeyflower)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G4** State: **S3S4**
Predicted Models: L 100% Low (inductive)

V - Physaria carinata *(Keeled Bladderpod)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G3G4TNR** State: **S1S2** USFS: **Sensitive - Known in Forests (BD)** BLM: **SENSITIVE** MNPS: **1**
Predicted Models: L 100% Low (inductive)

V - Primula incana *(Mealy Primrose)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFS: **Sensitive - Known in Forests (BD)** MNPS: **2**
Predicted Models: L 100% Low (inductive)

V - Stellaria crassifolia *(Fleshy Stitchwort)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S2** MNPS: **3**
Predicted Models: L 100% Low (inductive)

V - Thalictrum alpinum *(Alpine Meadowrue)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S2** USFS: **Sensitive - Known in Forests (BD)** MNPS: **2**
Predicted Models: L 100% Low (inductive)

B - Meesia triquetra *(Meesia Moss)* SOC

View in Field Guide View Predicted Models View Range Maps
USFS: **Sensitive - Known in Forests (BRT, KOOT)**
Sensitive - Suspected in Forests (LOLO)
Species of Concern - Native Species Global: **G5** State: **S2** **Species of Conservation Concern in Forests (CG, FLAT)**
Predicted Models: L 100% Low (inductive)

B - American Bittern *(Botaurus lentiginosus)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **3**
Predicted Models: L 100% Low (inductive)

B - Harlequin Duck *(Histrionicus histrionicus)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S2B** USFWS: **MBTA** USFS: **Sensitive - Known in Forests (BD, KOOT, LOLO)** FWP SWAP: **SGCN2** PIF: **1**
Predicted Models: L 100% Low (inductive)

B - Lewis's Woodpecker *(Melanerpes lewis)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S2B** USFWS: **MBTA; BCC10; BCC17** USFS: **Species of Conservation Concern in Forests (HLC)**
BLM: **SENSITIVE** FWP SWAP: **SGCN2** PIF: **2**
Predicted Models: L 100% Low (inductive)

B - Long-billed Curlew *(Numenius americanus)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA; BCC11** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**
Predicted Models: L 100% Low (inductive)

M - Townsend's Big-eared Bat *(Corynorhinus townsendii)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3** USFS: **Sensitive - Known in Forests (BD, BRT, KOOT, LOLO)** BLM: **SENSITIVE** FWP SWAP: **SGCN3**
Predicted Models: L 50% Low (inductive)

B - Gray-crowned Rosy-Finch *(Leucosticte tephrocotis)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S2** USFWS: **MBTA** FWP SWAP: **SGCN2, SGIN**
Predicted Models: L 50% Low (inductive)

B - Hooded Merganser *(Lophodytes cucullatus)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S4** USFWS: **MBTA** FWP SWAP: **SGIN** PIF: **2**
Predicted Models: L 50% Low (inductive)

V - Botrychium lanceolatum *(Lanceleaf Moonwort)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** MNPS: **3**
Predicted Models: L 50% Low (inductive)

V - Botrychium pinnatum *(Northern Moonwort)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** MNPS: **4**
Predicted Models: L 50% Low (inductive)

V - Carex stenoptila *(Small-winged Sedge)* SOC

View in Field Guide | View Predicted Models | View Range Maps

Species of Concern - Native Species Global: **G3** State: **S2S3** MNPS: **3**

Predicted Models: L 50% Low (inductive)

V - Drosera rotundifolia *(Roundleaf Sundew)* PSOC

View in Field Guide | View Predicted Models | View Range Maps

Potential Species of Concern - Native Species Global: **G5** State: **S3S4**

Predicted Models: L 50% Low (inductive)

V - Eleocharis rostellata *(Beaked Spikerush)* SOC

View in Field Guide | View Predicted Models | View Range Maps

USFS: **Sensitive - Known in Forests (BD)**

Species of Concern - Native Species Global: **G5** State: **S3** **Species of Conservation Concern in Forests (CG, FLAT, HLC)** MNPS: **2**

Predicted Models: L 50% Low (inductive)

V - Kobresia simpliciuscula *(Simple Kobresia)* SOC

View in Field Guide | View Predicted Models | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3** MNPS: **3**

Predicted Models: L 50% Low (inductive)

V - Micranthes apetala *(Tiny Swamp Saxifrage)* SOC

View in Field Guide | View Predicted Models | View Range Maps

Species of Concern - Native Species Global: **G3Q** State: **S2?** MNPS: **3**

Predicted Models: L 50% Low (inductive)

V - Orobanche corymbosa *(Flat-topped Broomrape)* PSOC

View in Field Guide | View Predicted Models | View Range Maps

Potential Species of Concern - Native Species Global: **G4** State: **S3S4**

Predicted Models: L 50% Low (inductive)

V - Pinus albicaulis *(Whitebark Pine)* SOC

View in Field Guide | View Predicted Models | View Range Maps

Species of Concern - Native Species Global: **G3G4** State: **S3** USFWS: **P** USFS: **Sensitive - Known in Forests (BD, BRT, KOOT, LOLO)** BLM: **SENSITIVE** MNPS: **2**

Predicted Models: L 50% Low (inductive)

V - Polygonum austiniae *(Austin's Knotweed)* PSOC

View in Field Guide | View Predicted Models | View Range Maps

USFS: **Sensitive - Known in Forests (BD)**

Potential Species of Concern - Native Species Global: **G5T4** State: **S3S4** **Species of Conservation Concern in Forests (HLC)** MNPS: **2**

Predicted Models: L 50% Low (inductive)

V - Ranunculus pedatifidus *(Northern Buttercup)* SOC

View in Field Guide | View Predicted Models | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3** USFS: **Species of Conservation Concern in Forests (HLC)** MNPS: **3**

Predicted Models: L 50% Low (inductive)

V - Rubus arcticus *(Nagoonberry)* SOC

View in Field Guide | View Predicted Models | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S2** MNPS: **3**

Predicted Models: L 50% Low (inductive)

V - Trichophorum cespitosum *(Tufted Club-rush)* SOC

View in Field Guide | View Predicted Models | View Range Maps

USFS: **Sensitive - Known in Forests (BD, KOOT)**

Species of Concern - Native Species Global: **G5** State: **S2** **Species of Conservation Concern in Forests (FLAT)** MNPS: **3**

Predicted Models: L 50% Low (inductive)

B - American White Pelican *(Pelecanus erythrorhynchos)* SOC

View in Field Guide | View Predicted Models | View Range Maps

Species of Concern - Native Species Global: **G4** State: **S3B** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **3**

Predicted Models: L 50% Low (inductive)

B - Bobolink *(Dolichonyx oryzivorus)* SOC

View in Field Guide | View Predicted Models | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA; BCC10; BCC11; BCC17** FWP SWAP: **SGCN3** PIF: **3**

Predicted Models: L 50% Low (inductive)

B - Brewer's Sparrow *(Spizella breweri)* SOC

View in Field Guide | View Predicted Models | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**

Predicted Models: L 50% Low (inductive)

B - Flammulated Owl *(Psiloscops flammeolus)* SOC

View in Field Guide | View Predicted Models | View Range Maps

USFS: **Sensitive - Known in Forests (BD, BRT, KOOT, LOLO)**

Species of Concern - Native Species Global: **G4** State: **S3B** USFWS: **MBTA; BCC10** **Species of Conservation Concern in Forests (FLAT, HLC)** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **1**

Predicted Models: L 50% Low (inductive)

B - Sage Thrasher *(Oreoscoptes montanus)* SOC

View in Field Guide | View Predicted Models | View Range Maps

Species of Concern - Native Species Global: **G4** State: **S3B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **3**

Predicted Models: L 50% Low (inductive)

MONTANA Natural Heritage Program
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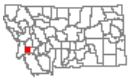


Latitude	Longitude
46.13002	-113.39590
46.15151	-113.44041

Structured Surveys

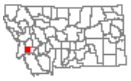
Summarized by: **Flint Creek Phase 1** *(Custom Area of Interest)*

The Montana Natural Heritage Program (MTNHP) records information on the locations where more than 80 different types of well-defined repeatable survey protocols capable of detecting an animal species or suite of animal species have been conducted by state, federal, tribal, university, or private consulting biologists. Examples of structured survey protocols tracked by MTNHP include: visual encounter and dip net surveys for pond breeding amphibians, point counts for birds, call playback surveys for selected bird species, visual surveys of migrating raptors, kick net stream reach surveys for macroinvertebrates, visual encounter cover object surveys for terrestrial mollusks, bat acoustic or mist net surveys, pitfall and/or snap trap surveys for small terrestrial mammals, track or camera trap surveys for large mammals, and trap surveys for turtles. Whenever possible, photographs of survey locations are stored in MTNHP databases.

MTNHP does not typically manage information on structured surveys for plants; surveys for invasive species may be a future exception.

Within the report area you have requested, structured surveys are summarized by the number of each type of structured survey protocol that has been conducted, the number of species detections/observations resulting from these surveys, and the most recent year a survey has been conducted.

AR-Amphibian/Reptile Lentic *(Lentic Amphibian/Reptile Surveys)*	**Survey Count**: 4	**Obs Count**: 4	**Recent Survey**: 2003
B-Raptor nest *(Raptor Nest Survey)*	**Survey Count**: 2	**Obs Count**:	**Recent Survey**: 2009
F-Bull Trout eDNA *(eDNA for Bull Trout)*	**Survey Count**: 4	**Obs Count**: 3	**Recent Survey**: 2016
F-Fish Electrofishing *(Fish Electrofishing Surveys)*	**Survey Count**: 1	**Obs Count**: 4	**Recent Survey**: 2008



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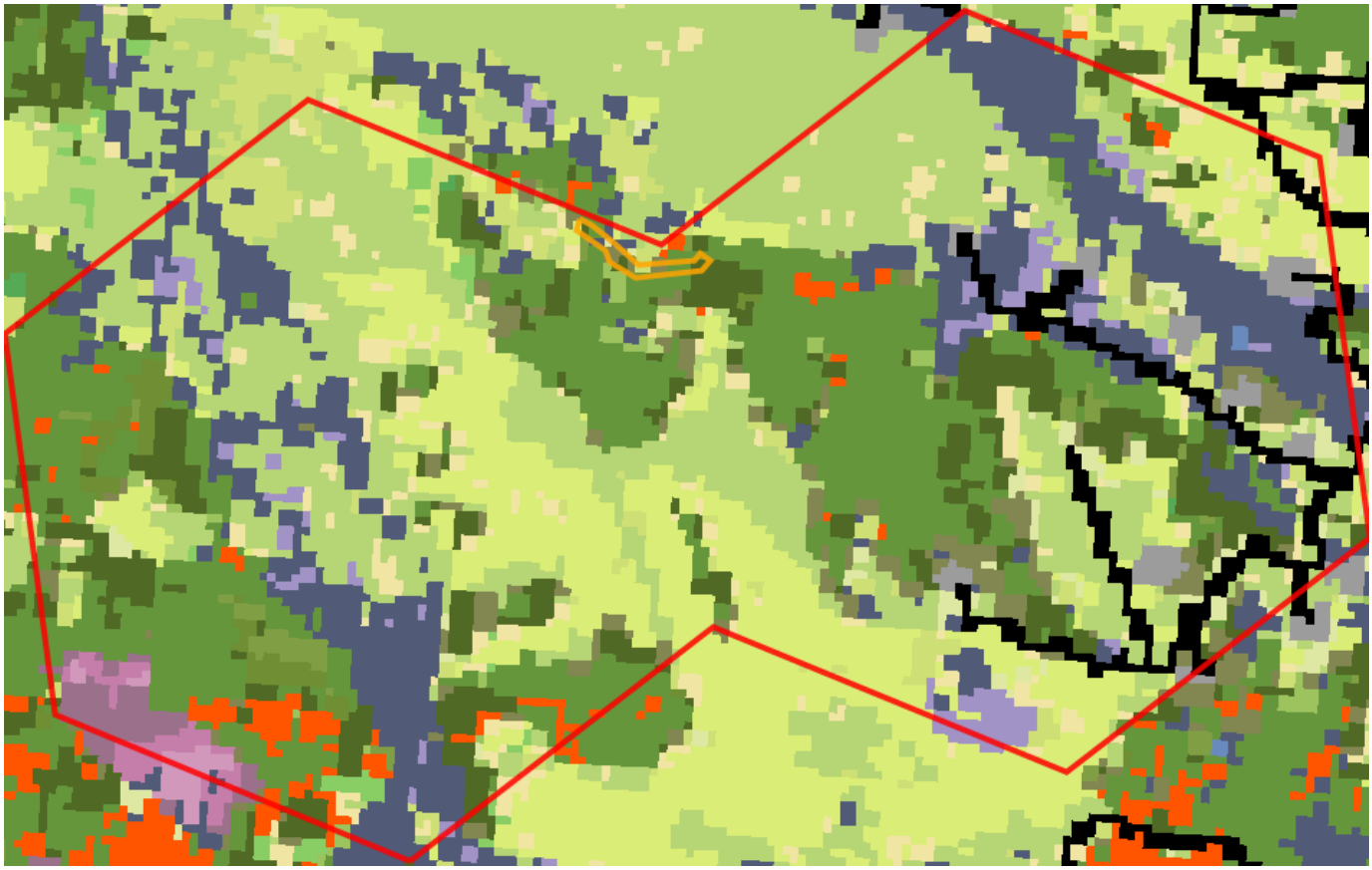
Land Cover

Summarized by: **Flint Creek Phase 1** *(Custom Area of Interest)*



22% (*280 Acres*)

Grassland Systems
Montane Grassland
Rocky Mountain Lower Montane, Foothill, and Valley Grassland

This grassland system of the northern Rocky Mountains is found at lower montane to foothill elevations in mountains and valleys throughout Montana. These grasslands are floristically similar to Big Sagebrush Steppe but are defined by shorter summers, colder winters, and young soils derived from recent glacial and alluvial material. They are found at elevations from 548 - 1,650 meters (1,800-5,413 feet). In the lower montane zone, they range from small meadows to large open parks surrounded by conifers; below the lower treeline, they occur as extensive foothill and valley grasslands. Soils are relatively deep, fine-textured, often with coarse fragments, and non-saline. Microphytic crust may be present in high-quality occurrences. This system is typified by cool-season perennial bunch grasses and forbs (>25%) cover, with a sparse shrub cover (<10%). Rough fescue (*Festuca campestris*) is dominant in the northwestern portion of the state and Idaho fescue (*Festuca idahoensis*) is dominant or co-dominant throughout the range of the system. Bluebunch wheatgrass (*Pseudoroegneria spicata*) occurs as a co-dominant throughout the range as well, especially on xeric sites. Western wheatgrass (*Pascopyrum smithii*) is consistently present, often with appreciable coverage (>10%) in lower elevation occurrences in western Montana and virtually always present, with relatively high coverages (>25%), on the edge of the Northwestern Great Plains region. Species diversity ranges from a high of more than 50 per 400 square meter plot on mesic sites to 15 (or fewer) on xeric and disturbed sites. Most occurrences have at least 25 vascular species present. Farmland conversion, noxious species invasion, fire suppression, heavy grazing and oil and gas development are major threats to this system.

18% (*234 Acres*)

Forest and Woodland Systems
Conifer-dominated forest and woodland (xeric-mesic)
Rocky Mountain Lodgepole Pine Forest

This forested system is widespread in upper montane to subalpine zones of the Montana Rocky Mountains, and east into island ranges of north-central Montana and the Bighorn and Beartooth ranges of south-central Montana. These are montane to subalpine forests where the dominance of lodgepole pine (*Pinus contorta*) is related to fire history and topoedaphic conditions. In Montana, elevation ranges from 975 to 2,743 meters (3,200-9000 feet). These forests occur on flats to slopes of all degrees and aspect, as well as valley bottoms. Fire is frequent, and stand-replacing fires are common. Following stand-replacing fires, lodgepole pinewill rapidly colonize and develop into dense, even-aged stands. Most forests in this ecological system occur as early- to mid-successional forests persisting for 50-200 years on warmer, lower elevation forests, and 150-400 years in subalpine forests. They generally occur on dry to intermediate sites with a wide seasonal range of temperatures and long precipitation-free periods in summer. Snowfall is heavy and supplies the major source of soil water used for growth in early summer. Vigorous stands occur where the precipitation exceeds 533 millimeters (21 inches). These lodgepole forests are typically associated with rock types weathering to acidic substrates, such as granite and rhyolite. In west-central Montana ranges such the Big Belts and the Rocky Mountain Front, these forests are found on limestone substrates. These systems are especially well developed on the broad ridges and high valleys near and east of the Continental Divide. Succession proceeds at different rates, moving relatively quickly on low-elevation, mesic sites and particularly slowly in high-elevation forests such as those along the Continental Divide in Montana.

14% (*180 Acres*)

Wetland and Riparian Systems
Floodplain and Riparian

Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland

This ecological system is found throughout the Rocky Mountain and Colorado Plateau regions. In Montana, sites occur at elevations of 609-1,219 meters (2,000-4,000 feet) west of the Continental Divide. East of the Continental Divide, this system ranges up to 1,676 meters (5,500 feet). It generally comprises a mosaic of multiple communities that are tree-dominated with a diverse shrub component. It is dependent on a natural hydrologic regime with annual to episodic flooding, so it is usually found within the flood zone of rivers, on islands, sand or cobble bars, and along streambanks. It can form large, wide occurrences on mid-channel islands in larger rivers, or narrow bands on small, rocky canyon tributaries and well-drained benches. It is also typically found in backwater channels and other perennially wet but less scoured sites, such as floodplains, swales and irrigation ditches. In some locations, occurrences extend into moderately high intermountain basins where the adjacent vegetation is sage steppe. Black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) is the key indicator species. Other dominant trees may include boxelder maple (*Acer negundo*), narrowleaf cottonwood (*Populus angustifolia*), eastern cottonwood (*Populus deltoides*), Douglas-fir (*Pseudotsuga menziesii*), peachleaf willow (*Salix amygdaloides*), or Rocky Mountain juniper (*Juniperus scopulorum*). Dominant shrubs include Rocky Mountain maple (*Acer glabrum*), thinleaf alder (*Alnus incana*), river birch (*Betula occidentalis*), redoiser dogwood (*Cornus sericea*), hawthorne (*Crataegus* species), chokecherry (*Prunus virginiana*), skunkbush sumac (*Rhus trilobata*), willows (*Salix* species), rose (*Rosa* species), silver buffaloberry (*Shepherdia argentea*), or snowberry (*Symphoricarpos* species).

14% (*175 Acres*)

Grassland Systems
Montane Grassland

Rocky Mountain Subalpine-Upper Montane Grassland

These lush grassland systems are found in upper montane to subalpine, high-elevation,zones, and are shaped by short summers, cold winters, and young soils derived from recent glacial and alluvial material. In subalpine settings, dry grasslands may occur as small meadows or large open parks surrounded by higher elevational forests, but typicall will have no tree cover within them. In general, soil textures are much finer, and soils are often deeper than in the neighboring forests. Most precipitation occurs as heavy snowpack in the mountains with spring and early summer rains. This system is composed of bunch grass species, with a diversity of cool season forbs. It is similar to the Rocky Mountain Lower Montane, Foothill and Valley Grassland ecological system, but is found at higher elevations and has additional floristic components with more subalpine taxa. In Montana, this system generally occurs as two plant communities: a rough fescue-Idaho fescue (*Festuca campestris-Festuca idahoensis*) association occurring on moister sites, such as the north and east-facing slopes and benches in the mountains; and the Idaho Fescue-bluebunch wheatgrass (*Festuca idahoensis-Pseudoroegneria spicata*) association occurring on drier sites, such as ridges, hilltops, and south and west facing slopes and benches. At elevations greater than 2286 meters (7,500 feet), Idaho fescue becomes dominant, sometimes associated with slender wheatgrass (*Elymus trachycaulus*), or in certain areas, tufted hairgrass (*Deschampsia cespitosa*). Noxious species invasion, fire suppression, heavy grazing, and oil and gas development are major threats to this system.

8% (*98 Acres*)

Forest and Woodland Systems
Conifer-dominated forest and woodland (xeric-mesic)

Rocky Mountain Montane Douglas-fir Forest and Woodland

In Montana, this ecological system occurs on the east side of the Continental Divide, north to about the McDonald Pass area, and along the Rocky Mountain Front. This system is associated with a dry to submesic continental climate regime with annual precipitation ranging from 51 to 102 centimeters (20-40 inches), with a maximum in winter or late spring. Winter snowpacks typically melt off in early spring at lower elevations. Elevations range from valley bottoms to 1,980 meters (6500 feet) in northern Montana and up to 2,286 meters (7500 feet) on warm aspects in southern Montana. It occurs on north-facing aspects in most areas, and south-facing aspects at higher elevations. This is a Douglas-fir (*Pseudotsuga menziesii*) dominated system without any maritime floristic composition. Fire disturbance intervals are as infrequent as 500 years, and as a result, individual trees and forests can attain great age on some sites (500 to 1,500 years). In Montana, this system occurs from lower montane to lower subalpine environments and is prevalent on calcareous substrates. Common understory shrubs include common ninebark (*Physocarpus malvaceus*), common juniper (*Juniperus communis*), Rocky Mountain juniper (*Juniperus scopulorum*), birch-leaf spiraea (*Spiraea betulifolia*), snowberry (*Symphoricarpos* species), creeping Oregon grape (*Mahonia repens*) and Canadian buffaloberry (*Shepherdia canadensis*). The Douglas-fir/pinegrass (*Calamogrostis rubescens*) type is the most ubiquitous association found within this system in Montana.

4% (*50 Acres*)

Shrubland, Steppe and Savanna Systems
Sagebrush Steppe

Montane Sagebrush Steppe

This system dominates the montane and subalpine landscape of southwestern Montana from valley bottoms to subalpine ridges and is found as far north as Glacier National Park. It can also be seen in the island mountain ranges of the north-central and south-central portions of the state. It primarily occurs on deep-soiled to stony flats, ridges, nearly flat ridgetops, and mountain slopes. In general, this system occurs in areas of gentle topography, fine soils, subsurface moisture or mesic conditions, within zones of higher precipitation and areas of snow accumulation. It occurs on all slopes and aspects, variable substrates and all soil types. The shrub component of this system is generally dominated by mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*). Other co-dominant shrubs include silver sagebrush (*Artemisia cana ssp. viscidula)*, subalpine big sagebrush (*Artemisia tridentata ssp. spiciformis*), three tip sagebrush (*Artemisia tripartita* ssp*. tripartita*) and antelope bitterbrush (*Purshia tridentata*). Little sagebrush (*Artemisia arbuscula ssp. arbuscula*) shrublands are only found in southwestern Montana on sites with a perched water table. Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*) sites may be included within this system if occurrences are at montane elevations, and are associated with montane graminoids such as Idaho fescue (*Festuca idahoensis),* spike fescue (*Leucopoa kingii*), or poverty oatgrass (*Danthonia intermedia)*. In ares where sage has been eliminated by human activities like burning, disking or poisoning, other shrubs may be dominant, especially rubber rabbitbrush (*Ericameria nauseosa*), and green rabbitbrush (*Chrysothamnus viscidiflorus*). Because of the mesic site conditions, most occurrences support a diverse herbaceous undergrowth of grasses and forbs. Shrub canopy cover is extremely variable, ranging from 10 percent to as high as 40 or 50 percent.

3% (*44 Acres*)

Grassland Systems
Montane Grassland

Rocky Mountain Subalpine-Montane Mesic Meadow

This system is restricted to sites from lower montane to subalpine elevations where finely textured soils, snow deposition, or windswept conditions limit tree establishment. Many occurrences are small patches, and are often found in mosaics within woodlands, dense shrublands, or just below alpine communities. Elevations range from 600 to2,011 meters (2,000-6,600 feet) in the northern Rocky Mountains and up to 2,286- 2,682 meters (7,500-8,800 feet) in the mountains of southwestern Montana. This system occurs on gentle to moderate-gradient slopes and in relatively moist habitats. Soils are typically seasonally moist to saturated in the spring, but dry out later in the growing season. At montane elevations, soils are usually clays or silt loams, and some occurrences may have inclusions of hydric soils in low, depressional areas. At subalpine elevations, soils are derived a variety of parent materials, and are usually rocky or gravelly with good aeration and drainage, but with a well developed organic layer. Some occurrences are more heavily dominated by grasses, while others are more dominated by forbs. Common grasses include tufted hairgrass (*Deschampsia caespitosa*), showy oniongrass (*Melica spectabilis*), mountain brome (*Bromus carinatus*), blue wildrye (*Elymus glaucus*), awned sedge (*Carex atherodes*), and small wing sedge (*Carex microptera*). Forb dominated meadows usually comprise a wide species diversity which differs from montane to subalpine elevations. Shrubs such as shrubby cinquefoil (*Dasiphora fruticosa* ssp. *floribunda*) and snowberry (*Symphoricarpos* species) are occasional but not abundant. This system differs from the Rocky Mountain Alpine Montane Wet Meadow system in that it soils dry out by mid-summer.

3% (*43 Acres*)

Forest and Woodland Systems
Deciduous dominated forest and woodland
Aspen Forest and Woodland

This widespread ecological system is more common in the southern and central Rocky Mountains, but occurs in the montane and subalpine zones throughout much of Montana north into Canada. It is similar to the Inter-Mountain Basins Aspen Mixed Conifer Forest-Woodland found in the Big Snowy Mountains, but lacks the conifer component. Distribution of this system is primarily limited by adequate soil moisture required to meet its high evapotranspirative demand, length of growing season, and temperatures. Mean annual precipitation where these systems occur is generally greater than 38 centimeters (15 inches) and typically greater than 51 centimeters (20 inches), except in semi-arid environments where occurrences are restricted to mesic microsites such as seeps or areas below large snow drifts. Stands can occur on gentle to moderate slopes, in swales, or on level sites. At lower elevations, occurrences are found on cooler, north aspects and mesic sites. Soils are usually deep and well developed with rock often absent from the soil. Soil texture ranges from sandy loam to clay loams. This system describes mesic forests and woodlands dominated by quaking aspen (*Populus tremuloides*) without a significant conifer component (<25% relative tree cover). This aspen system can be stable and long-lived with little encroachment of coniferous species. The understory structure may be complex with multiple shrub and herbaceous layers, or simple, with just an herbaceous layer. The herbaceous layer may be dense or sparse, dominated by mesic grasses or forbs. Occurrences of this system often originate, and are likely maintained, by stand-replacing disturbances such as crown fire, disease, windthrow, elk and beaver activity.

No Image

3% (*43 Acres*)

Human Land Use
Developed
Other Roads

County, city and or rural roads generally open to motor vehicles.

2% (*25 Acres*)

Wetland and Riparian Systems
Wet meadow
Alpine-Montane Wet Meadow

These moderate-to-high-elevation systems are found throughout the Rocky Mountains, dominated by herbaceous species found on wetter sites with very low-velocity surface and subsurface flows. Occurrences range in elevation from montane to alpine at 1,000 to 3,353 meters (3,280-11,000 feet). This system typically occurs in cold, moist basins, seeps and alluvial terraces of headwater streams or as a narrow strip adjacent to alpine lakes (Hansen et al., 1996). Wet meadows are typically found on flat areas or gentle slopes, but may also occur on sub-irrigated sites with slopes up to 10 percent. In alpine regions, sites are typically small depressions located below late-melting snow patches or on snowbeds. The growing season may only last for one to two months. Soils of this system may be mineral or organic. In either case, soils show typical hydric soil characteristics, including high organic content and/or low chroma and redoximorphic features. This system often occurs as a mosaic of several plant associations, often dominated by graminoids such as tufted hairgrass (*Deschampsia caespitosa*), and a diversity of montane or alpine sedges such as small-head sedge (*Carex illota*), small-winged sedge (*Carex microptera*), black alpine sedge (*Carex nigricans*), Holmâ€™s Rocky Mountain sedge (*Carex scopulorum*) shortstalk sedge (*Carex podocarpa*) and Paysonâ€™s sedge (*Carex paysonis*). Drummondâ€™s rush (*Juncus drummondii*), Mertenâ€™s rush (*Juncus mertensianus*), and high elevation bluegrasses (*Poa arctica* and *Poa alpina*) are often present. Forbs such as arrow-leaf groundsel (*Senecio triangularis*), slender-sepal marsh marigold (*Caltha leptosepala*), and spreading globeflower (*Trollius laxus*) often form high cover in higher elevation meadows. Wet meadows are associated with snowmelt and are usually not subjected to high disturbance events such as flooding.

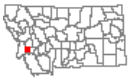
No Image

2% (*20 Acres*)

Recently Disturbed or Modified
Insect-Killed Forest
Insect-Killed Forest

Additional Limited Land Cover

1% (*16 Acres*) Rocky Mountain Subalpine Deciduous Shrubland
1% (*14 Acres*) Low Intensity Residential
1% (*13 Acres*) Rocky Mountain Ponderosa Pine Woodland and Savanna
1% (*13 Acres*) Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland
1% (*11 Acres*) Harvested forest-tree regeneration
1% (*10 Acres*) Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland
1% (*7 Acres*) Harvested forest-shrub regeneration
<1% (*6 Acres*) Mountain Mahogany Woodland and Shrubland
<1% (*3 Acres*) Harvested forest-grass regeneration
<1% (*0 Acres*) Aspen and Mixed Conifer Forest
<1% (*0 Acres*) Emergent Marsh



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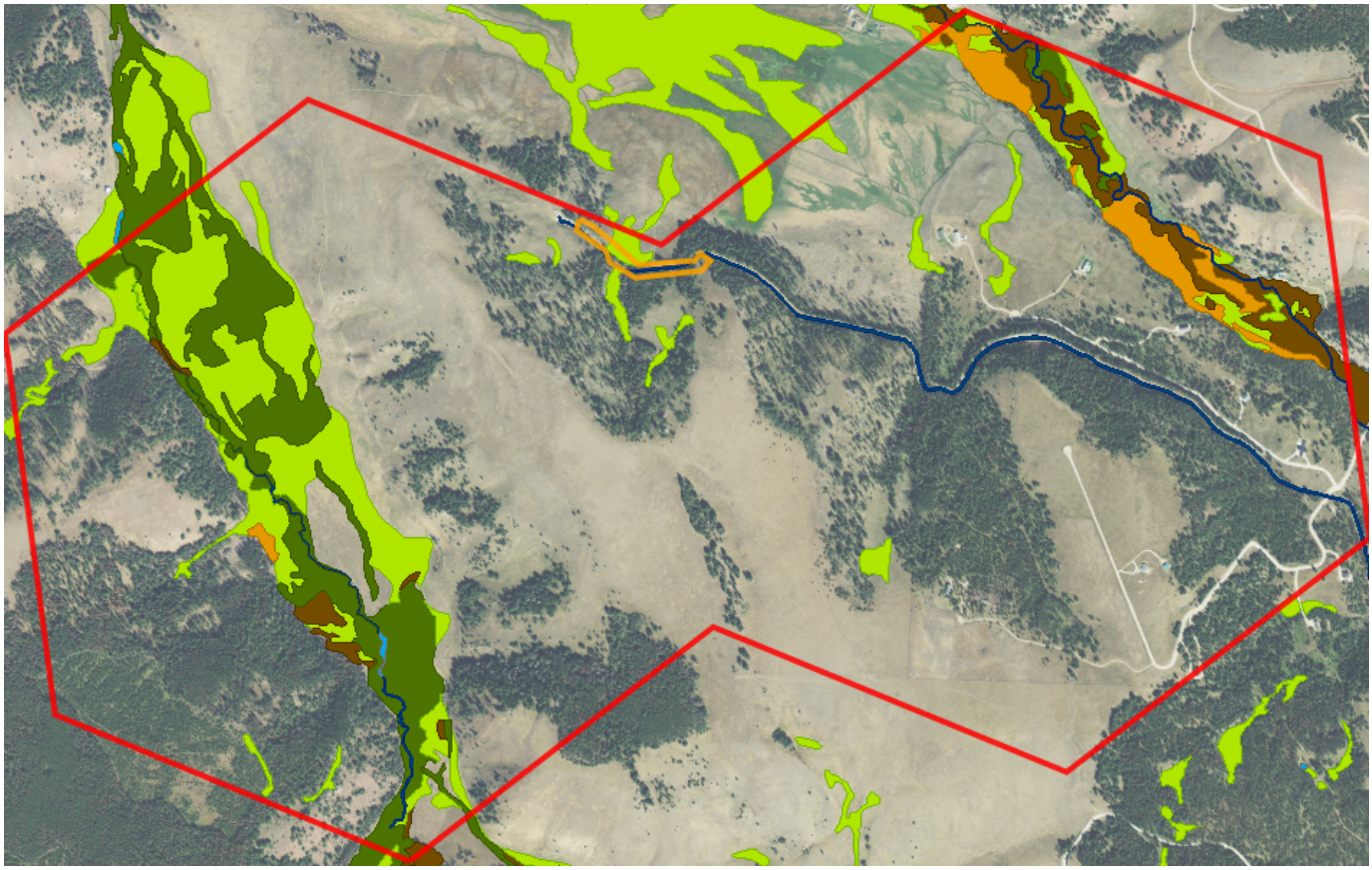
Wetland and Riparian

Summarized by: **Flint Creek Phase 1** *(Custom Area of Interest)*



Wetland and Riparian Mapping

Explain

P - Palustrine

AB - Aquatic Bed

F - Semipermanently Flooded	<1 Acres	
(no modifier)	**<1 Acres**	**PABF**
b - Beaver	**<1 Acres**	**PABFb**

P - Palustrine, AB - Aquatic Bed
Wetlands with vegetation growing on or below the water surface for most of the growing season.

EM - Emergent

A - Temporarily Flooded	79 Acres	
(no modifier)	**79 Acres**	**PEMA**
C - Seasonally Flooded	3 Acres	
(no modifier)	**3 Acres**	**PEMC**

P - Palustrine, EM - Emergent
Wetlands with erect, rooted herbaceous vegetation present during most of the growing season.

SS - Scrub-Shrub

A - Temporarily Flooded	5 Acres	
(no modifier)	**5 Acres**	**PSSA**
C - Seasonally Flooded	55 Acres	
(no modifier)	**27 Acres**	**PSSC**
b - Beaver	**28 Acres**	**PSSCb**

P - Palustrine, SS - Scrub-Shrub
Wetlands dominated by woody vegetation less than 6 meters (20 feet) tall. Woody vegetation includes tree saplings and trees that are stunted due to environmental conditions.

R - Riverine (Rivers)

3 - Upper Perennial

UB - Unconsolidated Bottom

G - Intermittently Exposed	4 Acres	
(no modifier)	**4 Acres**	**R3UBG**

R - Riverine (Rivers), 3 - Upper Perennial, UB - Unconsolidated Bottom
Stream channels where the substrate is at least 25% mud, silt or other fine particles.

4 - Intermittent

SB - Stream Bed

C - Seasonally Flooded	5 Acres	
x - Excavated	**5 Acres**	**R4SBCx**

R - Riverine (Rivers), 4 - Intermittent, SB - Stream Bed
Active channel that contains periodic water flow.

Rp - Riparian

1 - Lotic

SS - Scrub-Shrub (no modifier)	**16 Acres** **Rp1SS**	**Rp - Riparian, 1 - Lotic, SS - Scrub-Shrub** *This type of riparian area is dominated by woody vegetation that is less than 6 meters (20 feet) tall. Woody vegetation includes tree saplings and trees that are stunted due to environmental conditions.*
FO - Forested (no modifier)	**23 Acres** **Rp1FO**	**Rp - Riparian, 1 - Lotic, FO - Forested** *This riparian class has woody vegetation that is greater than 6 meters (20 feet) tall.*

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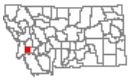

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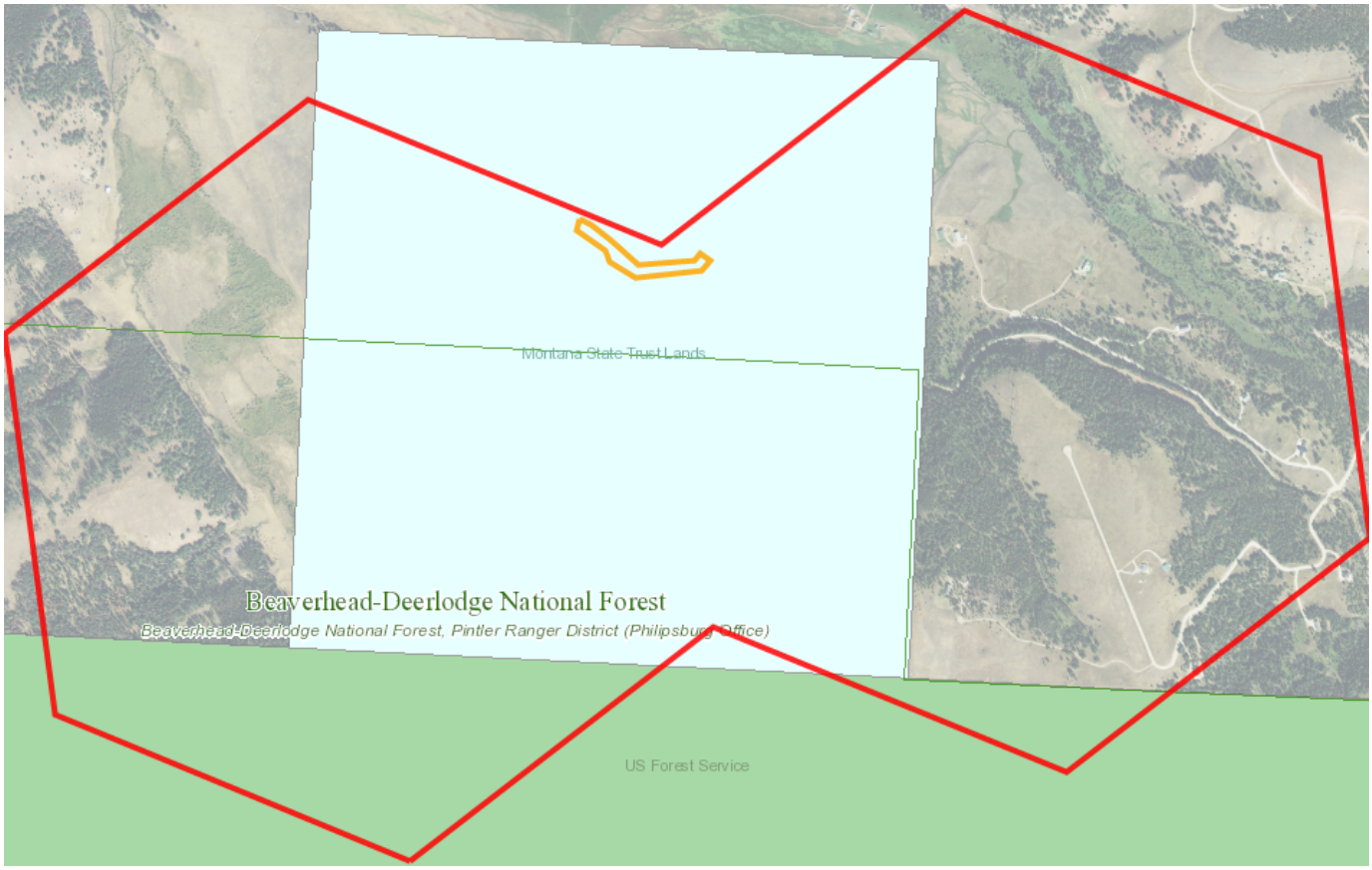
Land Management

Summarized by: **Flint Creek Phase 1** *(Custom Area of Interest)*

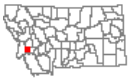


Land Management Summary

Explain

	Ownership	Tribal	Easements	Other Boundaries (possible overlap)
Public Lands	**671 Acres (52%)**			
Federal	**152 Acres (12%)**			
US Forest Service	**152 Acres (12%)**			
USFS Owned	**152 Acres (12%)**			
USFS Ranger Districts				**606 Acres**
Beaverhead-Deerlodge National Forest, Pintler Ranger District (Philipsburg Office)				606 Acres
USFS National Forest Boundaries				**606 Acres**
Beaverhead-Deerlodge National Forest				606 Acres
State	**519 Acres (41%)**			
Montana State Trust Lands	**519 Acres (41%)**			
MT State Trust Owned	**519 Acres (41%)**			
Private Lands or Unknown Ownership	**608 Acres (48%)**			

MONTANA Natural Heritage Program
A program of the **Montana State Library's Natural Resource Information System**



Latitude	Longitude
46.13002	-113.39590
46.15151	-113.44041

Biological Reports

Summarized by: **Flint Creek Phase 1** *(Custom Area of Interest)*

Within the report area you have requested, citations for all reports and publications associated with plant or animal observations in Montana Natural Heritage Program (MTNHP) databases are listed and, where possible, links to the documents are included.

The MTNHP plans to include reports associated with terrestrial and aquatic communities in the future as allowed for by staff resources. If you know of reports or publications associated with species or biological communities within the report area that are not shown in this report, please let us know: mtnhp@mt.gov

Young, M.K., D.J. Isaak, K.S. McKelvey, M.K. Schwartz, K.J. Carim, W. Fredenberg, T.M. Wilcox, T. Franklin, G.L. Chandler, D.E. Nagel, S.L. Parkes-Payne, D.L. Horan, S.P. Wollrab. 2017. ***Species occurrence data from the Range-Wide Bull Trout eDNA Project***. Fort Collins, CO: Forest Service Research Data Archive. https://doi.org/10.2737/RDS-2017-0038

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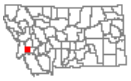
Legend

Model Icons	Habitat Icons	Range Icons	Num Obs
N Suitable (native range)	C Common	N Non-native	Count of obs with 'good precision' (<=1000m)
O Optimal Suitability	O Occasional		+ indicates additional 'poor precision' obs (1001m-10,000m)
M Moderate Suitability			
L Low Suitability			
I Suitable (introduced range)			



Latitude	Longitude
46.13002	-113.39590
46.15151	-113.44041

Invasive and Pest Species

Summarized by: **Flint Creek Phase 1** *(Custom Area of Interest)*

Aquatic Invasive Species

V - Iris pseudacorus *(Yellowflag Iris)* N2A/AIS — # Obs | Predicted Model | Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 2A - Aquatic Invasive Species - Non-native Species — Global: **GNR** State: **SNA**
Predicted Models: L 100% Low (inductive)

V - Nymphaea odorata *(American Water-lily)* AIS — # Obs | Predicted Model | Range: N

View in Field Guide | View Predicted Models | View Range Maps
Aquatic Invasive Species - Non-native Species — Global: **G5** State: **SNA**
Predicted Models: I 100% Suitable (introduced range) (deductive)

Noxious Weeds: Priority 1A

V - Centaurea solstitialis *(Yellow Starthistle)* N1A — # Obs | Predicted Model | Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 1A - Non-native Species — Global: **GNR** State: **SNA**
Predicted Models: M 100% Moderate (inductive)

V - Isatis tinctoria *(Dyer's Woad)* N1A — # Obs | Predicted Model | Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 1A - Non-native Species — Global: **GNR** State: **SNA**
Predicted Models: L 100% Low (inductive)

Noxious Weeds: Priority 1B

V - Echium vulgare *(Blueweed)* N1B — # Obs | Predicted Model | Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 1B - Non-native Species — Global: **GNR** State: **SNA**
Predicted Models: L 100% Low (inductive)

V - Polygonum cuspidatum *(Japanese Knotweed)* N1B — # Obs | Predicted Model | Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 1B - Non-native Species — Global: **GNRTNR** State: **SNA**
Predicted Models: L 100% Low (inductive)

V - Lythrum salicaria *(Purple Loosestrife)* N1B — # Obs | Predicted Model | Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 1B - Non-native Species — Global: **G5** State: **SNA**
Predicted Models: L 50% Low (inductive)

Noxious Weeds: Priority 2A

V - Ranunculus acris *(Tall Buttercup)* N2A — # Obs | Predicted Model | Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 2A - Non-native Species — Global: **G5** State: **SNA**
Predicted Models: M 100% Moderate (inductive)

V - Hieracium caespitosum *(Meadow Hawkweed)* N2A — # Obs | Predicted Model | Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 2A - Non-native Species — Global: **GNR** State: **SNA**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

V - Hieracium praealtum *(Kingdevil Hawkweed)* N2A — # Obs | Predicted Model | Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 2A - Non-native Species — Global: **GNR** State: **SNA**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

V - Ventenata dubia *(Ventenata)* N2A — # Obs | Predicted Model | Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 2A - Non-native Species — Global: **GNR** State: **SNA**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

V - Hieracium aurantiacum *(Orange Hawkweed)* N2A — # Obs | Predicted Model | Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 2A - Non-native Species — Global: **GNR** State: **SNA**
Predicted Models: L 100% Low (inductive)

V - Iris pseudacorus *(Yellowflag Iris)* N2A/AIS — # Obs | Predicted Model | Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 2A - Aquatic Invasive Species - Non-native Species — Global: **GNR** State: **SNA**
Predicted Models: L 100% Low (inductive)

V - Lepidium latifolium *(Perennial Pepperweed)* N2A — # Obs | Predicted Model | Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 2A - Non-native Species — Global: **GNR** State: **SNA**
Predicted Models: L 100% Low (inductive)

V - Senecio jacobaea *(Tansy Ragwort)* N2A

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2A - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: L 100% Low (inductive)

V - Rhamnus cathartica *(Common Buckthorn)* N2A

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2A - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: L 50% Low (inductive)

Noxious Weeds: Priority 2B

V - Centaurea stoebe *(Spotted Knapweed)* N2B 3

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 100% Moderate (inductive)

V - Cynoglossum officinale *(Common Hound's-tongue)* N2B

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 100% Moderate (inductive)

V - Linaria vulgaris *(Yellow Toadflax)* N2B

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 100% Moderate (inductive)

V - Cirsium arvense *(Canada Thistle)* N2B

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **G5** State: **SNA**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

V - Euphorbia virgata *(Leafy Spurge)* N2B

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNRTNR** State: **SNA**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

V - Lepidium draba *(Whitetop)* N2B

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

V - Leucanthemum vulgare *(Oxeye Daisy)* N2B

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

V - Linaria dalmatica *(Dalmatian Toadflax)* N2B

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **G5** State: **SNA**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

V - Tanacetum vulgare *(Common Tansy)* N2B

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 50% Moderate (inductive), L 50% Low (inductive)

V - Centaurea diffusa *(Diffuse Knapweed)* N2B

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: L 100% Low (inductive)

V - Hypericum perforatum *(Common St. John's-wort)* N2B

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: L 100% Low (inductive)

V - Potentilla recta *(Sulphur Cinquefoil)* N2B

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: L 100% Low (inductive)

V - Acroptilon repens *(Russian Knapweed)* N2B

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: L 50% Low (inductive)

V - Berteroa incana *(Hoary False-alyssum)* N2B

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: L 50% Low (inductive)

V - Convolvulus arvensis *(Field Bindweed)* N2B

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: L 50% Low (inductive)

Regulated Weeds: Priority 3

V - Bromus tectorum *(Cheatgrass)* R3

View in Field Guide View Predicted Models View Range Maps
Regulated Weed: Priority 3 - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: L 100% Low (inductive)

Biocontrol Species

I - Aphthona lacertosa *(Brown-legged Leafy Spurge Flea Beetle)* BIOCNTRL

View in Field Guide View Predicted Models View Range Maps
Biocontrol Species - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 100% Moderate (inductive)

I - Aphthona nigriscutis *(Black Dot Leafy Spurge Flea Beetle)* BIOCNTRL

View in Field Guide View Predicted Models View Range Maps
Biocontrol Species - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 100% Moderate (inductive)

I - Cyphocleonus achates *(Knapweed Root Weevil)* BIOCNTRL

View in Field Guide View Predicted Models View Range Maps
Biocontrol Species - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 100% Moderate (inductive)

I - Oberea erythrocephala *(Red-headed Leafy Spurge Stem Borer)* BIOCNTRL

View in Field Guide View Predicted Models View Range Maps
Biocontrol Species - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 100% Moderate (inductive)

I - Mecinus janthiniformis *(Dalmatian Toadflax Stem-boring Weevil)* BIOCNTRL

View in Field Guide View Predicted Models View Range Maps
Biocontrol Species - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: L 100% Low (inductive)

Introduction to Montana Natural Heritage Program

P.O. Box 201800 • 1515 East Sixth Avenue • Helena, MT 59620-1800 • fax 406.444.0266 • phone 406.444.5363 • mtnhp.org

Introduction

The Montana Natural Heritage Program (MTNHP) is Montana's source for reliable and objective information on Montana's native species and habitats, emphasizing those of conservation concern. MTNHP was created by the Montana legislature in 1983 as part of the Natural Resource Information System (NRIS) at the Montana State Library (MSL). MTNHP is "a program of information acquisition, storage, and retrieval for data relating to the flora, fauna, and biological community types of Montana" (MCA 90-15-102). MTNHP's activities are guided by statute as well as through ongoing interaction with, and feedback from, principal data source agencies such as Montana Fish, Wildlife, and Parks, the Montana Department of Environmental Quality, the Montana Department of Natural Resources and Conservation, the Montana University System, the US Forest Service, and the US Bureau of Land Management. Since the first staff was hired in 1985, the Program has logged a long record of success, and developed into a highly respected, service-oriented program. MTNHP is widely recognized as one of the most advanced and effective of over 80 natural heritage programs throughout the Western Hemisphere.

Vision

Our vision is that public agencies, the private sector, the education sector, and the general public will trust and rely upon MTNHP as the source for information and expertise on Montana's species and habitats, especially those of conservation concern. We strive to provide easy access to our information in order for users to save time and money, speed environmental reviews, and inform decision making.

Core Values

- We endeavor to be a single statewide source of accurate and up-to-date information on Montana's plants, animals, and aquatic and terrestrial biological communities.
- We actively listen to our data users and work responsively to meet their information and training needs.
- We strive to provide neutral, trusted, timely, and equitable service to all of our information users.
- We make every effort to be transparent to our data users in setting work priorities and providing data products.

Confidentiality

All information requests made to the Montana Natural Heritage Program are considered library records and are protected from disclosure by the Montana Library Records Confidentiality Act (MCA 22-1-11).

Information Managed

Information managed at the Montana Natural Heritage Program is botanical, zoological, and ecological information that describes the distribution (e.g., observations, structured surveys, range polygons, predicted habitat suitability models), conservation status (e.g., global and state conservation status ranks, including threats), and other supporting information (e.g., accounts and references) on the biology and ecology of species and biological communities.

Data Use Terms and Conditions

- Montana Natural Heritage Program (MTNHP) products and services are based on biological data and the objective interpretation of those data by professional scientists. MTNHP does not advocate any particular philosophy of natural resource protection, management, development, or public policy.
- MTNHP has no natural resource management or regulatory authority. Products, statements, and services from MTNHP are intended to inform parties as to the state of scientific knowledge about certain natural resources, and to further develop that knowledge. The information is not intended as natural resource management guidelines or prescriptions or a determination of environmental impacts. MTNHP recommends consultation with appropriate state, federal, and tribal resource management agencies and authorities in the area where your project is located.
- Information on the status and spatial distribution of biological resources produced by MTNHP are intended to inform parties of the state-wide status, known occurrence, or the likelihood of the presence of those resources. **These products are not intended to substitute for field-collected data, nor are they intended to be the sole basis for natural resource management decisions.**
- MTNHP does not portray its data as exhaustive or comprehensive inventories of rare species or biological communities. **Field verification of the absence or presence of sensitive species and biological communities will always be an important obligation of users of our data.**
- MTNHP responds equally to all requests for products and services, regardless of the purpose or identity of the requester.
- Because MTNHP constantly updates and revises its databases with new data and information, products will become outdated over time. Interested parties are encouraged to obtain the most current information possible from MTNHP, rather than using older products. We add, review, update, and delete records on a daily basis. Consequently, we strongly advise that you update your MTNHP data sets at a minimum of every four months for most applications of our information.
- MTNHP data require a certain degree of biological expertise for proper analysis, interpretation, and application. Our staff is available to advise you on questions regarding the interpretation or appropriate use of the data that we provide. See Contact Information for MTNHP Staff
- The information provided to you by MTNHP may include sensitive data that if publicly released might jeopardize the welfare of threatened, endangered, or sensitive species or biological communities. This information is intended for distribution or use only within your department, agency, or business. Subcontractors may have access to the data during the course of any given project, but should not be given a copy for their use on subsequent, unrelated work.
- MTNHP data are made freely available. Duplication of hard-copy or digital MTNHP products with the intent to sell is prohibited without written consent by MTNHP. Should you be asked by individuals outside your organization for the type of data that we provide, please refer them to MTNHP.
- MTNHP and appropriate staff members should be appropriately acknowledged as an information source in any third-party product involving MTNHP data, reports, papers, publications, or in maps that incorporate MTNHP graphic elements.
- Sources of our data include museum specimens, published and unpublished scientific literature, field surveys by state and federal agencies and private contractors, and reports from knowledgeable individuals. MTNHP actively solicits and encourages additions, corrections and updates, new observations or collections, and comments on any of the data we provide.
- MTNHP staff and contractors do not enter or cross privately-owned lands without express permission from the landowner. However, the program cannot guarantee that information provided to us by others was obtained under adherence to this policy.

Suggested Contacts for Natural Resource Management Agencies

As required by Montana statute (MCA 90-15), the Montana Natural Heritage Program works with state, federal, tribal, nongovernmental organizations, and private partners to ensure that the latest animal and plant distribution and status information is incorporated into our databases so that it can be used to inform a variety of permitting and planning processes and management decisions. We encourage you to contact state, federal, and tribal resource management agencies in the area where your project is located and review the permitting overviews by the Montana Department of Environmental Quality, the Montana Department of Natural Resources and Conservation and the Index of Environmental Permits for Montana for guidelines relevant to your efforts. In particular, we encourage you to contact the Montana Department of Fish, Wildlife, and Parks for the latest data and management information regarding hunted and high-profile management species and to use the U.S. Fish and Wildlife Service's Information Planning and Consultation (IPAC) website regarding U.S. Endangered Species Act listed Threatened, Endangered, or Candidate species.

For your convenience, we have compiled a list of relevant agency contacts and links below:

Montana Fish, Wildlife, and Parks

Fish Species	Zachary Shattuck zshattuck@mt.gov (406) 444-1231 or Eric Roberts eroberts@mt.gov (406) 444-5334
American Bison Black-footed Ferret Black-tailed Prairie Dog Bald Eagle Golden Eagle Common Loon Least Tern Piping Plover Whooping Crane	Kristian Smucker KSmucker@mt.gov (406) 444-5209
Grizzly Bear Greater Sage Grouse Trumpeter Swan Big Game Upland Game Birds Furbearers	Brian Wakeling Brian.Wakeling@mt.gov (406) 444-3940
Managed Terrestrial Game and Nongame Animal Data	Smith Wells – MFWP Data Analyst smith.wells@mt.gov (406) 444-3759
Fisheries Data	Ryan Alger – MFWP Data Analyst ryan.alger@mt.gov (406) 444-5365
Wildlife and Fisheries Scientific Collector's Permits	https://fwp.mt.gov/buyandapply/commercialwildlifeandscientificpermits/scientific Kammi McClain for Wildlife Kammi.McClain@mt.gov (406) 444-2612 Kim Wedde for Fisheries kim.wedde@mt.gov (406) 444-5594
Fish and Wildlife Recommendations for Subdivision Development	Charlie Sperry CSperry@mt.gov (406) 444-3888 See https://fwp.mt.gov/conservation/living-with-wildlife/subdivision-recommendations
Regional Contacts  	Region 1 (Kalispell) (406) 752-5501 fwprg12@mt.gov Region 2 (Missoula) (406) 542-5500 fwprg22@mt.gov Region 3 (Bozeman) (406) 577-7900 fwprg3@mt.gov Region 4 (Great Falls) (406) 454-5840 fwprg42@mt.gov Region 5 (Billings) (406) 247-2940 fwprg52@mt.gov Region 6 (Glasgow) (406) 228-3700 fwprg62@mt.gov Region 7 (Miles City) (406) 234-0900 fwprg72@mt.gov

Montana Department of Agriculture
General Contact Information: https://agr.mt.gov/About/Office-Locations/Office-Locations-and-Field-Offices
Noxious Weeds: https://agr.mt.gov/Noxious-Weeds

Montana Department of Environmental Quality
Permitting and Operator Assistance for all Environmental Permits: https://deq.mt.gov/Permitting

Montana Department of Natural Resources and Conservation
Overview of, and contacts for, licenses and permits for state lands, water, and forested lands:
http://dnrc.mt.gov/licenses-and-permits

Stream Permitting (310 permits) and an overview of various water and stream related permits (e.g., Stream Protection Act 124, Federal Clean Water Act 404, Federal Rivers and Harbors Act Section 10, Short-term Water Quality Standard for Turbidity 318 Authorization, etc.).
http://dnrc.mt.gov/divisions/cardd/conservation-districts/the-310-law

Flood and Fire Resources: http://dnrc.mt.gov/flood-and-fire

Bureau of Land Management

Montana Field Office Contacts:

Billings	(406) 896-5013
Butte	(406) 533-7600
Dillon	(406) 683-8000
Glasgow	(406) 228-3750
Havre	(406) 262-2820
Lewistown	(406) 538-1900
Malta	(406) 654-5100
Miles City	(406) 233-2800
Missoula	(406) 329-3914

United States Army Corps of Engineers
Montana Regulatory Office for federal permits related to construction in water and wetlands
https://www.nwo.usace.army.mil/Missions/Regulatory-Program/Montana/ (406) 441-1375

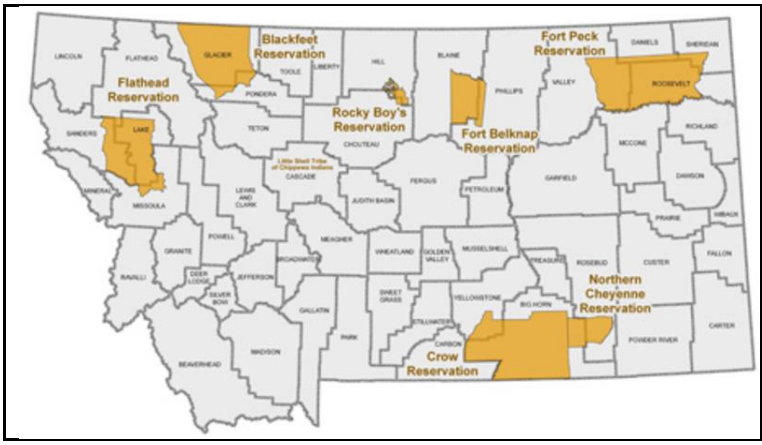
United States Environmental Protection Agency
Environmental information, notices, permitting, and contacts https://www.epa.gov/mt
Gateway to state resource locators https://www.envcap.org/srl/index.php

United States Fish and Wildlife Service
Information Planning and Conservation (IPAC) website: https://ecos.fws.gov/ipac/
Montana Ecological Services Field Office: https://www.fws.gov/montanafieldoffice/ (406) 449-5225

United States Forest Service

Regional Office – Missoula, Montana Contacts			
Wildlife Program Leader	Tammy Fletcher	tammy.fletcher2@usda.gov	(406) 329-3086
Wildlife Ecologist	Cara Staab	cara.staab@usda.gov	(406) 329-3677
Fish Program Leader	Scott Spaulding	scott.spaulding@usda.gov	(406) 329-3287
Fish Ecologist	Cameron Thomas	cameron.thomas@usda.gov	(406) 329-3087
TES Program	Lydia Allen	lydia.allen@usda.gov	(406) 329-3558
Interagency Grizzly Bear Coordinator	Scott Jackson	scott.jackson@usda.gov	(406) 329-3664
Acting Regional Botanist	Amanda Hendrix	amanda.hendrix@usda.gov	(651) 447-3016
Regional Vegetation Ecologist	Mary Manning	marry.manning@usda.gov	(406) 329-3304
Invasive Species Program Manager	Michelle Cox	michelle.cox2@usda.gov	(406) 329-3669

Tribal Nations



[Assiniboine & Gros Ventre Tribes – Fort Belknap Reservation]

[Assiniboine & Sioux Tribes – Fort Peck Reservation]

[Blackfeet Tribe - Blackfeet Reservation]

[Chippewa Creek Tribe - Rocky Boy's Reservation]

[Crow Tribe – Crow Reservation]

[Little Shell Chippewa Tribe]

[Northern Cheyenne Tribe – Northern Cheyenne Reservation]

[Salish & Kootenai Tribes - Flathead Reservation]

Natural Heritage Programs and Conservation Data Centers in Surrounding States and Provinces

[Alberta Conservation Information Management System]
[British Columbia Conservation Data Centre]
[Idaho Natural Heritage Program]
[North Dakota Natural Heritage Program]
[Saskatchewan Conservation Data Centre]
[South Dakota Natural Heritage Program]
[Wyoming Natural Diversity Database]

Invasive Species Management Contacts and Information

Aquatic Invasive Species

[Montana Fish, Wildlife, and Parks Aquatic Invasive Species staff]
[Montana Department of Natural Resources and Conservation's Aquatic Invasive Species Grant Program]
[Montana Invasive Species Council (MISC)]
[Upper Columbia Conservation Commission (UC3)]

Noxious Weeds

[Montana Weed Control Association Contacts Webpage]
[Montana Biological Weed Control Coordination Project]
[Montana Department of Agriculture - Noxious Weeds]
[Montana Weed Control Association]
[Montana Fish, Wildlife, and Parks - Noxious Weeds]
[Montana State University Integrated Pest Management Extension]
[Integrated Noxious Weed Management after Wildfires]
[Fire Management and Invasive Plants]

Introduction to Native Species

Within the report area you have requested, separate summaries are provided for: (1) Species Occurrences (SO) for plant and animal Species of Concern, Special Status Species (SSS), Important Animal Habitat (IAH) and some Potential Plant Species of Concern; (2) other observed non Species of Concern or Species of Concern without suitable documentation to create Species Occurrence polygons; and (3) other non-documented species that are potentially present based on their range, predicted suitable habitat model output, or presence of associated habitats. Each of these summaries provides the following information when present for a species: (1) the number of Species Occurrences and associated delineation criteria for construction of these polygons that have long been used for considerations of documented Species of Concern in environmental reviews; (2) the number of observations of each species; (3) the geographic range polygons for each species that the report area overlaps; (4) predicted relative habitat suitability classes that are present if a predicted suitable habitat model has been created; (5) the percent of the report area that is mapped as commonly associated or occasionally associated habitat as listed for each species in the Montana Field Guide; and (6) a variety of conservation status ranks and links to species accounts in the Montana Field Guide. Details on each of these information categories are included under relevant section headers below or are defined on our Species Status Codes page. In presenting this information, the Montana Natural Heritage Program (MTNHP) is working towards assisting the user with rapidly determining what species have been documented and what species are potentially present in the report area. We remind users that this information is likely incomplete as surveys to document native and introduced species are lacking in many areas of the state, information on introduced species has only been tracked relatively recently, the MTNHP's staff and resources are restricted by budgets, and information is constantly being added and updated in our databases. **Thus, field verification by professional biologists of the absence or presence of species and biological communities will always be an important obligation of users of our data.**

If you are aware of observation datasets that the MTNHP is missing, please report them to the Program Botanist apipp@mt.gov or Senior Zoologist dbachen@mt.gov. If you have animal observations that you would like to contribute, you can submit them to our Animal Observation Entry Tool You can also submit plant and animal observations via Excel spreadsheets posted at https://mtnhp.org/observations.asp or via the Montana Natural Heritage Observations project in iNaturalist

Observations

The MTNHP manages information on several million animal and plant observations that have been reported by professional biologists and private citizens from across Montana. The majority of these observations are submitted in digital format from standardized databases associated with research or monitoring efforts and spreadsheets of incidental observations submitted by professional biologists and amateur naturalists. At a minimum, accepted observation records must contain a credible species identification (i.e. appropriate geographic range, date, and habitat and, if species are difficult to identify, a photograph and/or notes on key identifying features), a date or date range, observer name, locational information (ideally with latitude and longitude in decimal degrees), notes on numbers observed, and species behavior or habitat use (e.g., is the observation likely associated with reproduction). Bird records are also required to have information associated with date-appropriate breeding or overwintering status of the species observed. MTNHP reviews observation records to ensure that they are mapped correctly, occur within date ranges when the species is known to be present or detectable, occur within the known seasonal geographic range of the species, and occur in appropriate habitats. MTNHP also assigns each record a locational uncertainty value in meters to indicate the spatial precision associated with the record's mapped coordinates. Only records with locational uncertainty values of 10,000 meters or less are included in environmental summary reports and number summaries are only provided for records with locational uncertainty values of 1,000 meters or less.

Species Occurrences

The MTNHP evaluates plant and animal observation records for species of higher conservation concern to determine whether they are worthy of inclusion in the Species Occurrence (SO) layer for use in environmental reviews; observations not worthy of inclusion in this layer include long distance dispersal events, migrants observed away from key migratory stopover habitats, and winter observations. An SO is a polygon depicting what is known about a species occupancy from direct observation with a defined level of locational uncertainty and any inference that can be made about adjacent habitat use from the latest peer-reviewed science. If an observation can be associated with a map feature that can be tracked (e.g., a wetland boundary for a wetland associated plant) then this polygon feature is used to represent the SO. Areas that can be inferred as probable occupied habitat based on direct observation of a species location and what is known about the foraging area or home range size of the species may be incorporated into the SO. Species Occurrences generally belong to one of the following categories:

Plant Species Occurrences

A documented location of a specimen collection or observed plant population. In some instances, adjacent, spatially separated clusters are considered subpopulations and are grouped as one occurrence (e.g., the subpopulations occur in ecologically similar habitats, and their spatial proximity likely allows them to interbreed). Tabular information for multiple observations at the same SO location is generally linked to a single polygon. Plant SO's are only created for Species of Concern and Potential Species of Concern.

Animal Species Occurrences

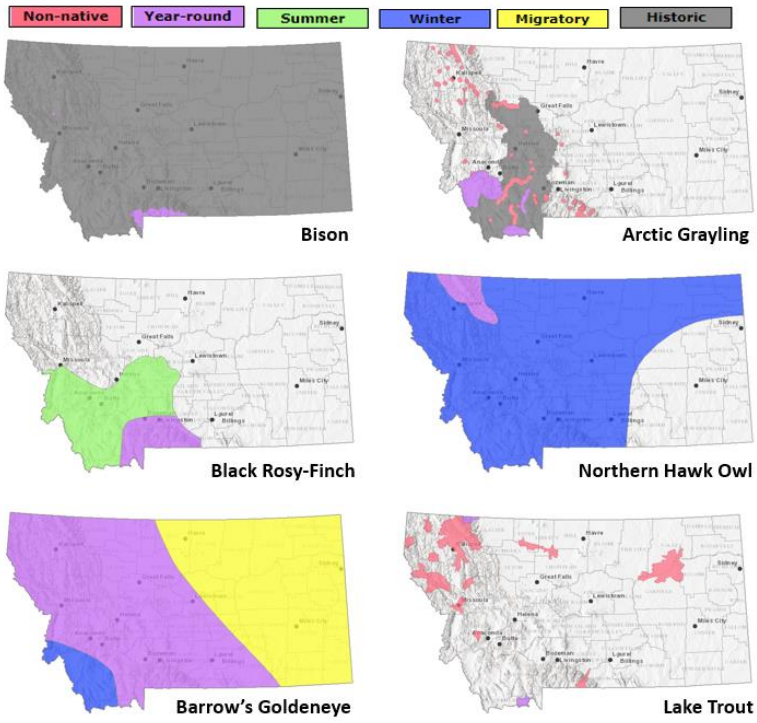
The location of a verified observation or specimen record typically known or assumed to represent a breeding population or a portion of a breeding population. Animal SO's are generally: (1) buffers of terrestrial point observations based on documented species' home range sizes; (2) buffers of stream segments to encompass occupied streams and immediate adjacent riparian habitats; (3) polygonal features encompassing known or likely breeding populations (e.g., a wetland for some amphibians or a forested portion of a mountain range for some wide ranging carnivores); or (4) combinations of the above. Tabular information for multiple observations at the same SO location is generally linked to a single polygon. Species Occurrence polygons may encompass some unsuitable habitat in some instances in order to avoid heavy data processing associated with clipping out habitats that are readily assessed as unsuitable by the data user (e.g., a point buffer of a terrestrial species may overlap into a portion of a lake that is obviously inappropriate habitat for the species). Animal SO's are only created for Species of Concern and Special Status Species (e.g., Bald Eagle).

Other Occurrence Polygons

These include significant biological features not included in the above categories, such as Important Animal Habitats like bird rookeries and bat roosts, and peatlands or other wetland and riparian communities that support diverse plant and animal communities.

Geographic Range Polygons

Geographic range polygons are still under development for most plant and invertebrate species. Native year-round, summer, winter, migratory and historic geographic range polygons as well as polygons for introduced populations have been defined for most vertebrate animal species for which there are enough observations, surveys, and knowledge of appropriate seasonal habitat use to define them (see examples to left). These native or introduced range polygons bound the extent of known or likely occupied habitats for non-migratory and relative sedentary species and the regular extent of known or likely occupied habitats for migratory and long-distance dispersing species; polygons may include unsuitable intervening habitats. For most species, a single polygon can represent the year-round or seasonal range, but breeding ranges of some colonial nesting water birds and some introduced species are represented more patchily when supported by data. Some ranges are mapped more broadly than actual distributions in order to be visible on statewide maps (e.g., fish).



Predicted Suitable Habitat Models

Predicted habitat suitability models have been created for plant and animal Species of Concern and are undergoing development for non-Species of Concern. For species for which models have been completed, the environmental summary report includes simple rule-based associations with streams for aquatic species and seasonal habitats for game species as well as mathematically complex Maximum Entropy models (Phillips et al. 2006, Ecological Modeling 190:231-259) constructed from a variety of statewide biotic and abiotic layers and presence only data for individual species for most terrestrial species. For the Maximum Entropy models, we reclassified 90 x 90-meter continuous model output into suitability classes (unsuitable, low, moderate, and optimal) then aggregated that into the one square mile hexagons used in the environmental summary report; this is the finest spatial scale we suggest using this information in management decisions and survey planning. Full model write ups for individual species that discuss model goals, inputs, outputs, and evaluation in much greater detail are posted on the MTNHP's Predicted Suitable Habitat Models webpage. Evaluations of predictive accuracy and specific limitations are included with the metadata for models of individual species. **Model outputs should not be used in place of on-the-ground surveys for species. Instead model outputs should be used in conjunction with habitat evaluations to determine the need for on-the-ground surveys for species.** We suggest that the percentage of predicted optimal and moderate suitable habitat within the report area be used in conjunction with geographic range polygons and the percentage of commonly associated habitats to generate lists of potential species that may occupy broader landscapes for the purposes of landscape-level planning.

Associated Habitats

Within the boundary of the intersected hexagons, we provide the approximate percentage of commonly or occasionally associated habitat for vertebrate animal species that regularly breed, overwinter, or migrate through the state; a detailed list of commonly and occasionally associated habitats is provided in individual species accounts in the Montana Field Guide We assigned common or occasional use of each of the ecological

systems mapped in Montana by: (1) using personal knowledge and reviewing literature that summarizes the breeding, overwintering, or migratory habitat requirements of each species; (2) evaluating structural characteristics and distribution of each ecological system relative to the species' range and habitat requirements; (3) examining the observation records for each species in the state-wide point observation database associated with each ecological system; and (4) calculating the percentage of observations associated with each ecological system relative to the percent of Montana covered by each ecological system to get a measure of numbers of observations versus availability of habitat. Species that breed in Montana were only evaluated for breeding habitat use, species that only overwinter in Montana were only evaluated for overwintering habitat use, and species that only migrate through Montana were only evaluated for migratory habitat use. In general, species were listed as associated with an ecological system if structural characteristics of used habitat documented in the literature were present in the ecological system or large numbers of point observations were associated with the ecological system. However, species were not listed as associated with an ecological system if there was no support in the literature for use of structural characteristics in an ecological system, even if point observations were associated with that system. Common versus occasional association with an ecological system was assigned based on the degree to which the structural characteristics of an ecological system matched the preferred structural habitat characteristics for each species as represented in the scientific literature. The percentage of observations associated with each ecological system relative to the percent of Montana covered by each ecological system was also used to guide assignment of common versus occasional association.

We suggest that the percentage of commonly associated habitat within the report area be used in conjunction with geographic range polygons and the percentage of predicted optimal and moderate suitable habitat from predictive models to generate lists of potential species that may occupy broader landscapes for the purposes of landscape-level planning. Users of this information should be aware that land cover mapping accuracy is particularly problematic when the systems occur as small patches or where the land cover types have been altered over the past decade. Thus, particular caution should be used when using the associations in assessments of smaller areas (e.g., evaluations of public land survey sections).

Introduction to Land Cover

Land Use/Land Cover is one of 15 Montana Spatial Data Infrastructure framework layers considered vital for making statewide maps of Montana and understanding its geography. The layer records all Montana natural vegetation, land cover and land use, classified from satellite and aerial imagery, mapped at a scale of 1:100,000, and interpreted with supporting ground-level data. The baseline map is adapted from the Northwest ReGAP (NWGAP) project land cover classification, which used 30m resolution multi-spectral Landsat imagery acquired between 1999 and 2001. Vegetation classes were drawn from the Ecological System Classification developed by NatureServe (Comer et al. 2003). The land cover classes were developed by Anderson et al. (1976). The NWGAP effort encompasses 12 map zones. Montana overlaps seven of these zones. The two NWGAP teams responsible for the initial land cover mapping effort in Montana were Sanborn and NWGAP at the University of Idaho. Both Sanborn and NWGAP employed a similar modeling approach in which Classification and Regression Tree (CART) models were applied to Landsat ETM+ scenes. The Spatial Analysis Lab within the Montana Natural Heritage Program was responsible for developing a seamless Montana land cover map with a consistent statewide legend from these two separate products. Additionally, the Montana land cover layer incorporates several other land cover and land use products (e.g., MSDI Structures and Transportation themes and the Montana Department of Revenue Final Land Unit classification) and reclassifications based on plot-level data and the latest NAIP imagery to improve accuracy and enhance the usability of the theme. Updates are done as partner support and funding allow, or when other MSDI datasets can be incorporated. Recent updates include fire perimeters and agricultural land use (annually), energy developments such as wind, oil and gas installations (2014), roads, structures and other impervious surfaces (various years): and local updates/improvements to specific ecological systems (e.g., central Montana grassland and sagebrush ecosystems). Current and previous versions of the Land Use/Land Cover layer with full metadata are available for download at the Montana State Library's Geographic Information Clearinghouse

Within the report area you have requested, land cover is summarized by acres of Level 1, Level 2, and Level 3 Ecological Systems.

Literature Cited

Anderson, J.R. E.E. Hardy, J.T. Roach, and R.E. Witmer. 1976. A land use and land cover classification system for use with remote sensor data. U.S. Geological Survey Professional Paper 964.

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological systems of the United States: A working classification of U.S. terrestrial systems. NatureServe, Arlington, VA.

Introduction to Wetland and Riparian

Within the report area you have requested, wetland and riparian mapping is summarized by acres of each classification present. Summaries are only provided for modern MTNHP wetland and riparian mapping and not for outdated (NWI Legacy) or incomplete (NWI Scalable) mapping efforts; described here. MTNHP has made all three of these datasets and associated metadata available for separate download on the Montana Wetland and Riparian Framework web page.

Wetland and Riparian mapping is one of 15 Montana Spatial Data Infrastructure framework layers considered vital for making statewide maps of Montana and understanding its geography. The wetland and riparian framework layer consists of spatial data representing the extent, type, and approximate location of wetlands, riparian areas, and deep water habitats in Montana.

Wetland and riparian mapping is completed through photointerpretation of 1-m resolution color infrared aerial imagery acquired from 2005 or later. A coding convention using letters and numbers is assigned to each mapped wetland. These letters and numbers describe the broad landscape context of the wetland, its vegetation type, its water regime, and the kind of alterations that may have occurred. Ancillary data layers such as topographic maps, digital elevation models, soils data, and other aerial imagery sources are also used to improve mapping accuracy. Wetland mapping follows the federal Wetland Mapping Standard and classifies wetlands according to the Cowardin classification system of the National Wetlands Inventory (NWI) (Cowardin et al. 1979, FGDC Wetlands Subcommittee 2013). Federal, State, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands differently than the NWI. Similar coding, based on U.S. Fish and Wildlife Service conventions, is applied to riparian areas (U.S. Fish and Wildlife Service 2009). These are mapped areas where vegetation composition and growth is influenced by nearby water bodies, but where soils, plant communities, and hydrology do not display true wetland characteristics. **These data are intended for use at a scale of 1:12,000 or smaller. Mapped wetland and riparian areas do not represent precise boundaries and digital wetland data cannot substitute for an on-site determination of jurisdictional wetlands.**

See a detailed overview, with examples, of both wetland and riparian classification systems and associated codes

Literature Cited

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service, FWS/OBS-79/31. Washington, D.C. 103pp.

Federal Geographic Data Committee. 2013. Classification of wetlands and deepwater habitats of the United States. FGDC-STD-004-2013. Second Edition. Wetlands Subcommittee, Federal Geographic Data Committee and U.S. Fish and Wildlife Service, Washington, D.C.

U.S. Fish and Wildlife Services. 2009. A system for mapping riparian areas in the western United States. Division of Habitat and Resource Conservation, Branch of Resource and Mapping Support, Arlington, Virginia.

Introduction to Land Management

Within the report area you have requested, land management information is summarized by acres of federal, state, and local government lands, tribal reservation boundaries, private conservation lands, and federal, state, local, and private conservation easements. Acreage for "Owned", "Tribal", or "Easement" categories represents non-overlapping areas that may be totaled. However, "Other Boundaries" represents managed areas such as National Forest boundaries containing private inholdings and other mixed ownership which may cause boundaries to overlap (e.g. a wilderness area within a forest). Therefore, acreages may not total in a straight-forward manner.

Because information on land stewardship is critical to effective land management, the Montana Natural Heritage Program (MTNHP) began compiling ownership and management data in 1997. The goal of the Montana Land Management Database is to manage a single, statewide digital data set that incorporates information from both public and private entities. The database assembles information on public lands, private conservation lands, and conservation easements held by state and federal agencies and land trusts and is updated on a regular basis. Since 2011, the Information Management group in the Montana State Library's Digital Library Division has led the Montana Land Management Database in partnership with the MTNHP.

Public and private conservation land polygons are attributed with the name of the entity that owns it. The data are derived from the statewide Montana Cadastral Parcel layer Conservation easement data shows land parcels on which a public agency or qualified land trust has placed a conservation easement in cooperation with the land owner. The dataset contains no information about ownership or status of the mineral estate. For questions about the dataset or to report errors, please contact the Montana Natural Heritage Program at (406) 444-5363 or mtnhp@mt.gov. You can download various components of the Land Management Database and view associated metadata at the Montana State Library's GIS Data List at the following links:

Public Lands
Conservation Easements
Private Conservation Lands
Managed Areas

Map features in the Montana Land Management Database or summaries provided in this report are not intended as a legal depiction of public or private surface land ownership boundaries and should not be used in place of a survey conducted by a licensed land surveyor. Similarly, map features do not imply public access to any lands. The Montana Natural Heritage Program makes no representations or warranties whatsoever with respect to the accuracy or completeness of this data and assumes no responsibility for the suitability of the data for a particular purpose. The Montana Natural Heritage Program will not be liable for any damages incurred as a result of errors displayed here. Consumers of this information should review or consult the primary data and information sources to ascertain the viability of the information for their purposes.

Introduction to Invasive and Pest Species

Within the report area you have requested, separate summaries are provided for: Aquatic Invasive Species, Noxious Weeds, Agricultural Pests, Forest Pests, and Biocontrol species that have been documented or potentially occur there based on the predicted suitability of habitat. Definitions for each of these invasive and pest species categories can be found on our Species Status Codes page.

Each of these summaries provides the following information when present for a species: (1) the number of observations of each species; (2) the geographic range polygons for each species, if developed, that the report area overlaps; (3) predicted relative habitat suitability classes that are present if a predicted suitable habitat model has been created; (4) the percent of the report area that is mapped as commonly associated or occasionally associated habitat as listed for each species in the Montana Field Guide; and (5) links to species accounts in the Montana Field Guide. Details on each of these information categories are included under relevant section headers under the Introduction to Native Species above or are defined on our Species Status Codes page. In presenting this information, the Montana Natural Heritage Program (MTNHP) is working towards assisting the user with rapidly determining what invasive and pest species have been documented and what species are potentially present in the report area. We remind users that this information is likely incomplete as surveys to document introduced species are lacking in many areas of the state, information on introduced species has only been tracked relatively recently, the MTNHP's staff and resources are limited, and information is constantly being added and updated in our databases. **Thus, field verification by professional biologists of the absence or presence of species will always be an important obligation of users of our data.**

If you are aware of observation or survey datasets for invasive or pest species that the MTNHP is missing, please report them to the Program Coordinator bmaxell@mt.gov Program Botanist apipp@mt.gov or Senior Zoologist dbachen@mt.gov. If you have observations that you would like to contribute, you can submit animal observations using our online data entry system at mtnhp.org/AddObs or via Excel spreadsheets posted at mtnhp.org/observations.asp

Additional Information Resources

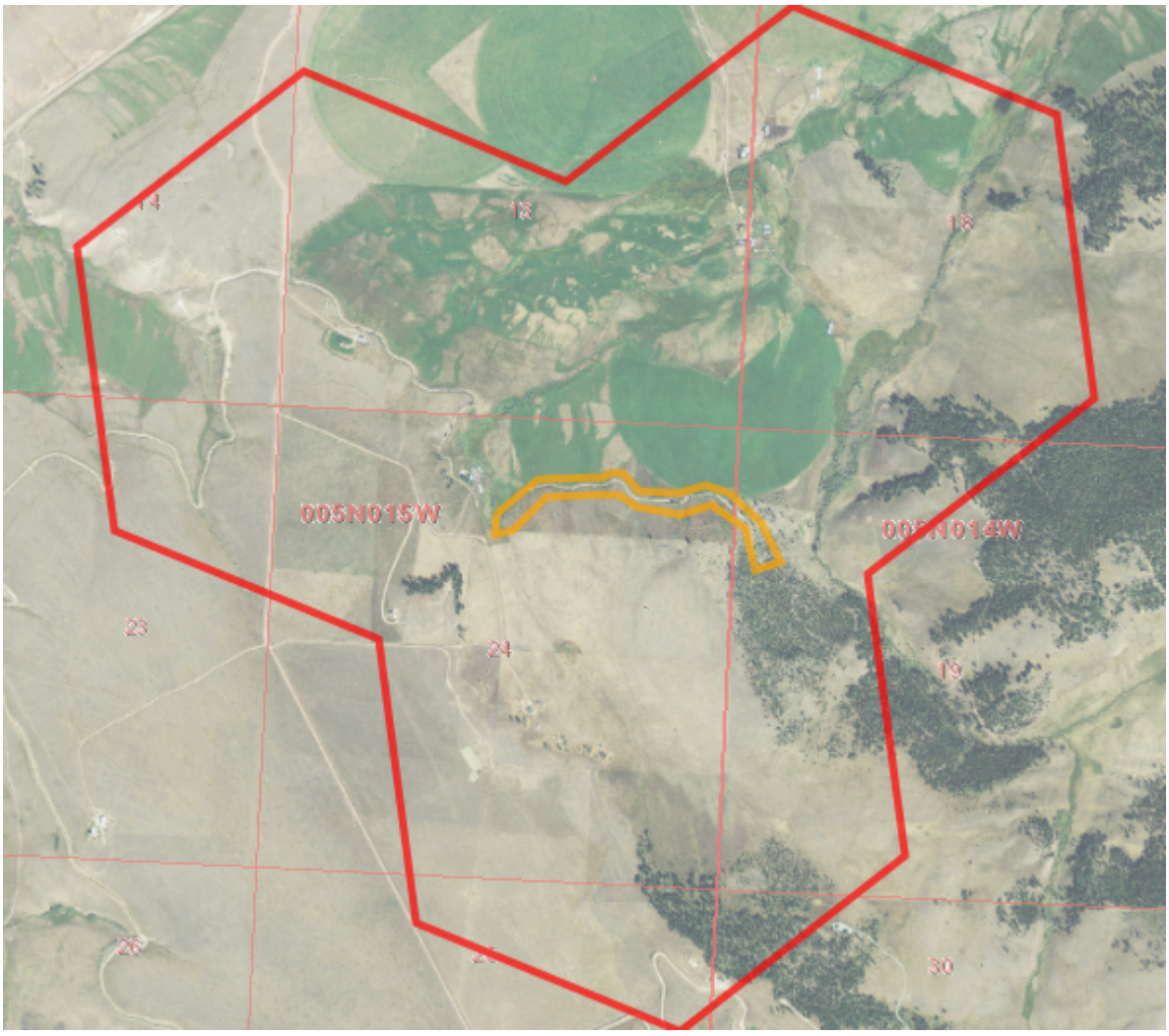
- MTNHP Staff Contact Information
- Montana Field Guide
- MTNHP Species of Concern Report - Animals and Plants
- MTNHP Species Status Codes - Explanation
- MTNHP Predicted Suitable Habitat Models (for select Animals and Plants)
- MTNHP Request Information page
- Montana Cadastral
- Montana Code Annotated
- Montana Fisheries Information System
- Montana Fish, Wildlife, and Parks Subdivision Recommendations
- Montana GIS Data Layers
- Montana GIS Data Bundler
- Montana Greater Sage-Grouse Project Submittal Site
- Montana Ground Water Information Center
- Montana Index of Environmental Permits, 21st Edition (2018)
- Montana Environmental Policy Act (MEPA)
- Montana Environmental Policy Act Analysis Resource List
- Laws, Treaties, Regulations, and Agreements on Animals and Plants
- Montana Spatial Data Infrastructure Layers
- Montana State Historic Preservation Office Review and Compliance
- Montana Stream Permitting: a guide for conservation district supervisors and others
- Montana Water Information System
- Montana Web Map Services
- National Environmental Policy Act
- Penalties for Misuse of Fish and Wildlife Location Data (MCA 87-6-222)
- U.S. Fish and Wildlife Service Information for Planning and Consultation (Section 7 Consultation)
- Web Soil Survey Tool

Environmental Summary

MONTANA
Natural Heritage Program
1515 East 6th Avenue
Helena, MT 59620
(406) 444-5363
mtnhp.org

Latitude	Longitude
46.15893	-113.39548
46.19275	-113.43913

Summarized by:
Flint Creek Phase 2
(Custom Area of Interest)



Suggested Citation
Montana Natural Heritage Program. Environmental Summary Report.
for Latitude 46.15893 to 46.19275 and Longitude -113.39548 to -113.43913. Retrieved on 8/29/2022.

The Montana Natural Heritage Program is part of the Montana State Library's Natural Resource Information System. Since 1985, it has served as a neutral and non-regulatory provider of easily accessible information on Montana's species and biological communities to inform all stakeholders in environmental review, permitting, and planning processes. The program is part of NatureServe, a network of over 80 similar programs in states, provinces, and nations throughout the Western Hemisphere, working to provide current and comprehensive distribution and status information on species and biological communities.

Montana Natural Heritage Program · Montana State Library · NatureServe

Table of Contents

Introduction to Environmental Summary Report

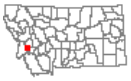
Environmental Summary Reports from the Montana Natural Heritage Program (MTNHP) provide information on species and biological communities to inform all stakeholders in environmental review, permitting, and planning processes. For information on environmental permits in Montana, please see permitting overviews by the Montana Department of Environmental Quality, the Montana Department of Natural Resources and Conservation, the Index of Environmental Permits for Montana and our Suggested Contacts for Natural Resource Management Agencies. The report for your area of interest consists of introductory and related materials in this PDF and an Excel workbook with worksheets summarizing information managed in the MTNHP databases for: (1) species occurrences; (2) other observed species without species occurrences; (3) other species potentially present based on their range, presence of associated habitats, or predictive distribution model output if available; (4) structured surveys that follow a protocol capable of detecting one or more species; (5) land cover mapped as ecological systems; (6) wetland and riparian mapping; (7) land management categories; and (8) biological reports associated with plant and animal observations. If your area of interest corresponds to a statewide polygon layer (e.g., watersheds, counties, or public land survey sections) information summaries in your report will exactly match those boundaries. However, if your report is for a custom area, users should be aware that summaries do not correspond to the exact boundaries of the polygon they have specified, but instead are a summary across a layer of hexagons intersected by the polygon they specified as shown on the report cover. Summarizing by these hexagons which are one square mile in area and approximately one kilometer in length on each side allows for consistent and rapid delivery of summaries based on a uniform grid that has been used for planning efforts across the western United States (e.g., Western Association of Fish and Wildlife Agencies - Crucial Habitat Assessment Tool).

In presenting this information, MTNHP is working towards assisting the user with rapidly assessing the known or potential species and biological communities, land management categories, and biological reports associated with the report area. Users are reminded that this information is likely incomplete and may be inaccurate as surveys to document species are lacking in many areas of the state, species' range polygons often include regions of unsuitable habitat, methods of predicting the presence of species or communities are constantly improving, and information is constantly being added and updated in our databases. **Field verification by professional biologists of the absence or presence of species and biological communities in a report area will always be an important obligation of users of our data. Users are encouraged to only use this environmental summary report as a starting point for more in depth analyses and are encouraged to contact state, federal, and tribal resource management agencies for additional data or management guidelines relevant to your efforts. Please see the Appendix for introductory materials to each section of the report, additional information resources, and a list of relevant agency contacts.**

MONTANA Natural Heritage Program
A program of the **Montana State Library's Natural Resource Information System**

Legend

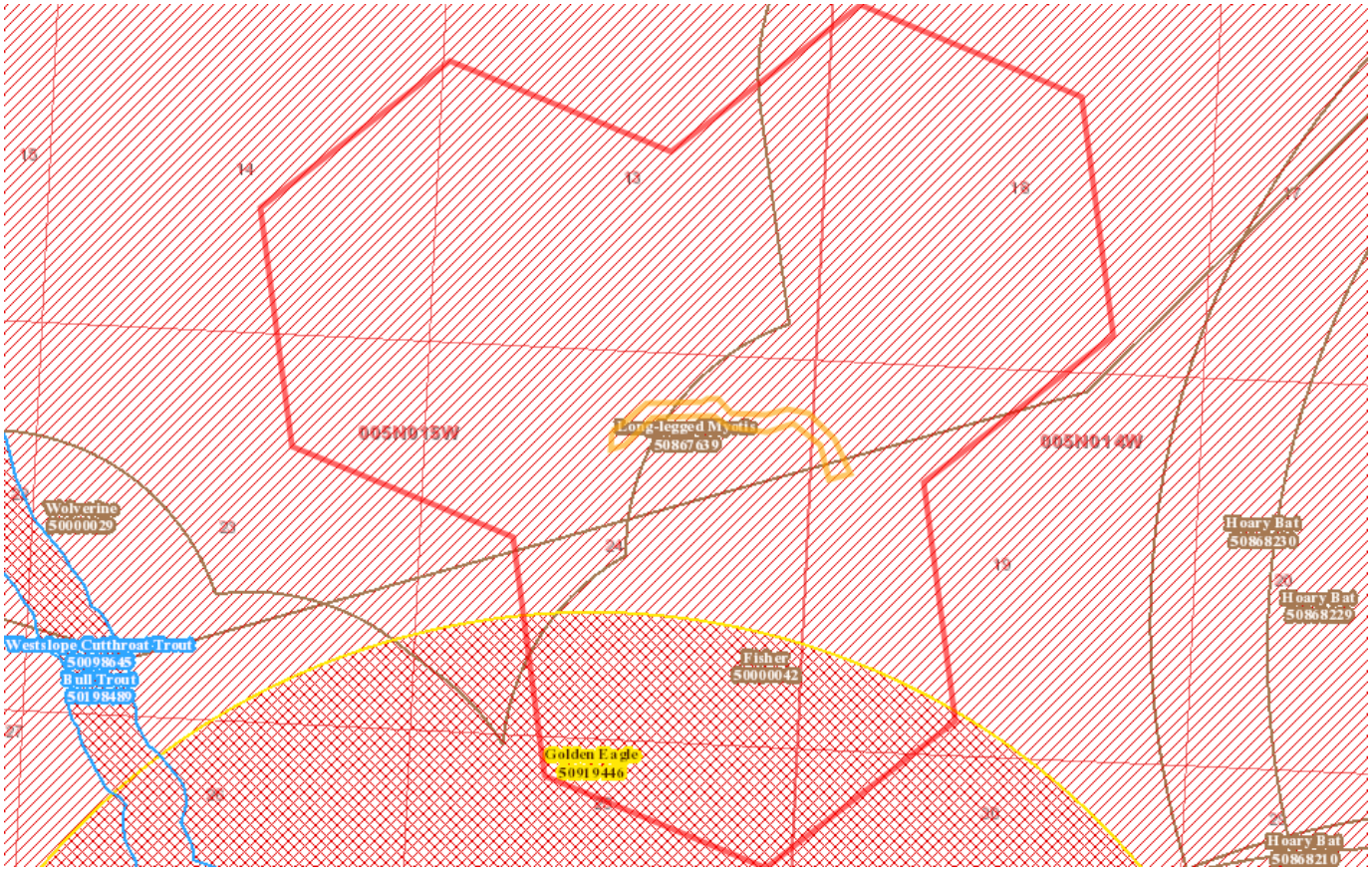
Model Icons	Habitat Icons	Range Icons	Num Obs
N Suitable (native range)	C Common	Y Native / Year-round	Count of obs with 'good precision' (<=1000m)
O Optimal Suitability	O Occasional	S Summer	+ indicates additional 'poor precision' obs (1001m-10,000m)
M Moderate Suitability		W Winter	
L Low Suitability		M Migratory	
I Suitable (introduced range)		N Non-native	
		H Historic	



Latitude	Longitude
46.15893	-113.39548
46.19275	-113.43913

Native Species

Summarized by: **Flint Creek Phase 2** *(Custom Area of Interest)*
All Species (not filtered by Status)



Species Occurrences

	USFWS Sec7	# SO	# Obs	Predicted Model	Range
M - Long-legged Myotis *(Myotis volans)* SOC		1	+		Y

View in Field Guide **View Predicted Models** **View Range Maps**
Species of Concern - Native Species Global: **G4G5** State: **S3**

Delineation Criteria Confirmed area of occupancy based on the documented presence (mistnet captures, definitively identified acoustic recordings, and definitively identified roosting individuals) of adults or juveniles. Point observation location is buffered by a minimum distance of 2,000 meters in order to encompass the average distances traveled from capture locations to roosts in Washington, Oregon, and in the Black Hills of South Dakota and otherwise buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. When cave locations are involved, point observations are mapped in the center of a one-square mile hexagon to protect the exact location of the cave entrance as per the Federal Cave Resource Protection Act and associated regulations (U.S. Code Title 16 Chapter 63, Code of Federal Regulations Title 43 Subtitle A Part 37). The outer edges of the hexagon are then buffered by a distance of 2,000 meters and otherwise by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. All of the one-square mile hexagons intersecting this buffered area are presented as the Species Occurrence record. (Last Updated: Jul 20, 2022)

Predicted Models: L 100% Low (inductive)

M - Wolverine *(Gulo gulo)* SOC	7	1			Y

View in Field Guide **View Predicted Models** **View Range Maps**
Species of Concern - Native Species Global: **G4** State: **S3** USFS: **Sensitive - Known in Forests (BD, BRT, KOOT, LOLO)** BLM: **SENSITIVE** FWP SWAP: **SGCN3**

Delineation Criteria Confirmed area of occupancy supported by recent (post-1980), nearby (within 10 kilometers) observations of adults or juveniles. Tracking regions were defined by areas of primary habitat and adjacent female dispersal habitat as modeled by Inman et al. (2013). These regions were buffered by 1 kilometer in order to link smaller areas and account for potential inaccuracies in independent variables used in the model. (Last Updated: Jul 25, 2022)

Predicted Models: L 100% Low (inductive)

B - Golden Eagle *(Aquila chrysaetos)* SOC		1			Y

View in Field Guide **View Predicted Models** **View Range Maps**
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **BGEPA; MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3**

Delineation Criteria Confirmed nesting area buffered by a minimum distance of 3,000 meters in order to be conservative about encompassing the entire breeding territory and area commonly used for renesting and otherwise buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Jul 26, 2022)

Predicted Models: L 67% Low (inductive)

M - Fisher *(Pekania pennanti)* SOC		1		Not Available	Y

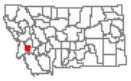
View in Field Guide **View Range Maps**
Species of Concern - Native Species Global: **G5** State: **S3** USFS: **Sensitive - Known in Forests (BD, BRT, KOOT, LOLO)** BLM: **SENSITIVE** FWP SWAP: **SGCN3**

Delineation Criteria Confirmed area of occupancy based on the documented presence of adults or juveniles within tracking regions containing core habitat for the species. Outer boundaries of tracking regions are defined by areas of forest cover on individual mountain ranges or clusters of adjacent mountain ranges with continuous forest cover. (Last Updated: Oct 06, 2021)

MONTANA Natural Heritage Program
A program of the **Montana State Library's Natural Resource Information System**

Legend

Model Icons	Habitat Icons	Range Icons	Num Obs
N Suitable (native range)	C Common	Y Native / Year-round	Count of obs with 'good precision' (<=1000m)
O Optimal Suitability	O Occasional	S Summer	+ indicates additional 'poor precision' obs (1001m-10,000m)
M Moderate Suitability		W Winter	
L Low Suitability		M Migratory	
I Suitable (introduced range)		N Non-native	
		H Historic	



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Native Species

Summarized by: **Flint Creek Phase 2** *(Custom Area of Interest)*
All Species (not filtered by Status)

Other Observed Species

	USFWS Sec7	# Obs	Predicted Model	Range
B - Bald Eagle *(Haliaeetus leucocephalus)* SSS		1		Y
B - Pileated Woodpecker *(Dryocopus pileatus)* SOC		+	Not Available	Y
F - Bull Trout *(Salvelinus confluentus)* SOC	7	+	Not Available	Y
F - Westslope Cutthroat Trout *(Oncorhynchus clarkii lewisi)* SOC		+	Not Available	Y
F - Lake Trout *(Salvelinus namaycush)* SOC		+	Not Available	N

View in Field Guide **View Predicted Models** **View Range Maps**
Special Status Species - Native Species Global: **G5** State: **S4** USFWS: **BGEPA; MBTA** USFS: **Sensitive - Known in Forests (BD, BRT, KOOT, LOLO)** BLM: **SENSITIVE** PIF: **2**
Predicted Models: L 100% Low (inductive)

View in Field Guide **View Range Maps**
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **2**

View in Field Guide **View Range Maps**
Species of Concern - Native Species Global: **G5** State: **S2** USFWS: **LT; CH** BLM: **THREATENED** FWP SWAP: **SGCN2**

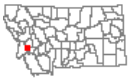
View in Field Guide **View Range Maps**
Species of Concern - Native/Non-native Species - (depends on location or taxa) Global: **G5T4** State: **S2**
USFS: **Sensitive - Known in Forests (BD, BRT, KOOT, LOLO)**
Species of Conservation Concern in Forests (CG, HLC) BLM: **SENSITIVE** FWP SWAP: **SGCN2**

View in Field Guide **View Range Maps**
Species of Concern - Native/Non-native Species - (depends on location or taxa) Global: **G5** State: **S2** FWP SWAP: **SGCN2**

MONTANA Natural Heritage Program
A program of the **Montana State Library's Natural Resource Information System**

Legend

Model Icons	Habitat Icons	Range Icons	Num Obs
N Suitable (native range)	C Common	Y Native / Year-round	Count of obs with 'good precision' (<=1000m)
O Optimal Suitability	O Occasional	S Summer	+ indicates additional 'poor precision' obs (1001m-10,000m)
M Moderate Suitability		W Winter	
L Low Suitability		M Migratory	
I Suitable (introduced range)		N Non-native	
		H Historic	



Latitude	Longitude
46.15893	-113.39548
46.19275	-113.43913

Native Species

Summarized by: **Flint Creek Phase 2** *(Custom Area of Interest)*
All Species (not filtered by Status)

Other Potential Species

	USFWS Sec7	Predicted Model	Range
M - Preble's Shrew *(Sorex preblei)* SOC			Y
I - Bombus suckleyi *(Suckley Cuckoo Bumble Bee)* SOC			Y
V - Carex crawei *(Crawe's Sedge)* SOC			Y
M - North American Water Vole *(Microtus richardsoni)* PSOC			Y
M - Western Pygmy Shrew *(Sorex eximius)* SOC			Y
B - Barrow's Goldeneye *(Bucephala islandica)* PSOC			Y WM
B - Clark's Nutcracker *(Nucifraga columbiana)* SOC			Y
V - Botrychium hesperium *(Western Moonwort)* SOC			Y
V - Botrychium paradoxum *(Peculiar Moonwort)* SOC			Y
V - Primula incana *(Mealy Primrose)* SOC			Y
V - Ranunculus hyperboreus *(High Northern Buttercup)* PSOC			Y
V - Stellaria crassifolia *(Fleshy Stitchwort)* SOC			Y
V - Utricularia intermedia *(Flatleaf Bladderwort)* SOC			Y
B - Long-billed Curlew *(Numenius americanus)* SOC			S M

Preble's Shrew *(Sorex preblei)* SOC

View in Field Guide | View Predicted Models | View Range Maps

Species of Concern - Native Species Global: **G4** State: **S3** FWP SWAP: **SGCN3**

Predicted Models: M 100% Moderate (inductive)

Bombus suckleyi *(Suckley Cuckoo Bumble Bee)* SOC

View in Field Guide | View Predicted Models | View Range Maps

Species of Concern - Native Species Global: **G2G3** State: **S1**

Predicted Models: M 100% Moderate (inductive)

Carex crawei *(Crawe's Sedge)* SOC

View in Field Guide | View Predicted Models | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S2S3** MNPS: **3**

Predicted Models: M 100% Moderate (inductive)

North American Water Vole *(Microtus richardsoni)* PSOC

View in Field Guide | View Predicted Models | View Range Maps

Potential Species of Concern - Native Species Global: **G5** State: **S4**

Predicted Models: M 67% Moderate (inductive), L 33% Low (inductive)

Western Pygmy Shrew *(Sorex eximius)* SOC

View in Field Guide | View Predicted Models | View Range Maps

Species of Concern - Native Species Global: **G4** State: **S3** FWP SWAP: **SGCN3**

Predicted Models: M 67% Moderate (inductive), L 33% Low (inductive)

Barrow's Goldeneye *(Bucephala islandica)* PSOC

View in Field Guide | View Predicted Models | View Range Maps

Potential Species of Concern - Native Species Global: **G5** State: **S4** USFWS: **MBTA** FWP SWAP: **SGIN** PIF: **2**

Predicted Models: M 67% Moderate (inductive), L 33% Low (inductive)

Clark's Nutcracker *(Nucifraga columbiana)* SOC

View in Field Guide | View Predicted Models | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** USFS: **Species of Conservation Concern in Forests (FLAT)** FWP SWAP: **SGCN3** PIF: **3**

Predicted Models: M 67% Moderate (inductive), L 33% Low (inductive)

Botrychium hesperium *(Western Moonwort)* SOC

View in Field Guide | View Predicted Models | View Range Maps

Species of Concern - Native Species Global: **G4** State: **S3** USFS: **Sensitive - Known in Forests (BD, KOOT)** MNPS: **4**

Predicted Models: M 67% Moderate (inductive), L 33% Low (inductive)

Botrychium paradoxum *(Peculiar Moonwort)* SOC

View in Field Guide | View Predicted Models | View Range Maps

USFS: **Sensitive - Known in Forests (BD, KOOT)**
Sensitive - Suspected in Forests (LOLO)

Species of Concern - Native Species Global: **G3G4** State: **S3** **Species of Conservation Concern in Forests (CG, FLAT, HLC)** BLM: **SENSITIVE** MNPS: **4**

Predicted Models: M 67% Moderate (inductive), L 33% Low (inductive)

Primula incana *(Mealy Primrose)* SOC

View in Field Guide | View Predicted Models | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S3** USFS: **Sensitive - Known in Forests (BD)** MNPS: **2**

Predicted Models: M 67% Moderate (inductive), L 33% Low (inductive)

Ranunculus hyperboreus *(High Northern Buttercup)* PSOC

View in Field Guide | View Predicted Models | View Range Maps

Potential Species of Concern - Native Species Global: **G5** State: **S3S4**

Predicted Models: M 67% Moderate (inductive), L 33% Low (inductive)

Stellaria crassifolia *(Fleshy Stitchwort)* SOC

View in Field Guide | View Predicted Models | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S2** MNPS: **3**

Predicted Models: M 67% Moderate (inductive), L 33% Low (inductive)

Utricularia intermedia *(Flatleaf Bladderwort)* SOC

View in Field Guide | View Predicted Models | View Range Maps

Species of Concern - Native Species Global: **G5** State: **S2** USFS: **Sensitive - Known in Forests (KOOT)** MNPS: **3**

Predicted Models: M 67% Moderate (inductive), L 33% Low (inductive)

Long-billed Curlew *(Numenius americanus)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA; BCC11** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**
Predicted Models: M 67% Moderate (inductive), L 33% Low (inductive)

V - Oxytropis lagopus var. conjugans *(Hare's-foot Locoweed)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G4G5T3T4** State: **S3S4** MNPS: **3**
Predicted Models: M 67% Moderate (inductive)

M - Little Brown Myotis *(Myotis lucifugus)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G3G4** State: **S3** FWP SWAP: **SGCN3**
Predicted Models: M 33% Moderate (inductive), L 67% Low (inductive)

M - Long-eared Myotis *(Myotis evotis)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3**
Predicted Models: M 33% Moderate (inductive), L 67% Low (inductive)

M - Silver-haired Bat *(Lasionycteris noctivagans)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G3G4** State: **S4**
Predicted Models: M 33% Moderate (inductive), L 67% Low (inductive)

B - Great Gray Owl *(Strix nebulosa)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3, SGIN** PIF: **3**
Predicted Models: M 33% Moderate (inductive), L 67% Low (inductive)

A - Western Toad *(Anaxyrus boreas)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S2** USFS: **Sensitive - Known in Forests (BD, BRT, KOOT, LOLO)** BLM: **SENSITIVE** FWP SWAP: **SGCN2**
Predicted Models: M 33% Moderate (inductive), L 67% Low (inductive)

V - Draba densifolia *(Dense-leaf Draba)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S2** USFS: **Species of Conservation Concern in Forests (CG, HLC)** MNPS: **2**
Predicted Models: M 33% Moderate (inductive), L 67% Low (inductive)

B - Meesia triquetra *(Meesia Moss)* SOC

View in Field Guide View Predicted Models View Range Maps
USFS: **Sensitive - Known in Forests (BRT, KOOT)**
Sensitive - Suspected in Forests (LOLO)
Species of Concern - Native Species Global: **G5** State: **S2** **Species of Conservation Concern in Forests (CG, FLAT)**
Predicted Models: M 33% Moderate (inductive), L 67% Low (inductive)

M - Hoary Bat *(Lasiurus cinereus)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G3G4** State: **S3B** BLM: **SENSITIVE** FWP SWAP: **SGCN3**
Predicted Models: M 33% Moderate (inductive), L 67% Low (inductive)

V - Gentianopsis simplex *(Hiker's Gentian)* SOC

View in Field Guide View Predicted Models View Range Maps
USFS: **Sensitive - Known in Forests (BD)**
Sensitive - Suspected in Forests (KOOT, LOLO)
Species of Concern - Native Species Global: **G5** State: **S2** **Species of Conservation Concern in Forests (CG)** MNPS: **3**
Predicted Models: M 33% Moderate (inductive), L 33% Low (inductive)

V - Botrychium simplex *(Least Moonwort)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S2** MNPS: **4**
Predicted Models: M 33% Moderate (inductive)

M - Canada Lynx *(Lynx canadensis)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **LT; CH** BLM: **THREATENED** FWP SWAP: **SGCN3**
Predicted Models: L 100% Low (inductive)

M - Fringed Myotis *(Myotis thysanodes)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3** BLM: **SENSITIVE** FWP SWAP: **SGCN3**
Predicted Models: L 100% Low (inductive)

M - Grizzly Bear *(Ursus arctos)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S2S3** USFWS: **PS: LT; XN** BLM: **THREATENED** FWP SWAP: **SGCN2-3**
Predicted Models: L 100% Low (inductive)

M - North American Porcupine *(Erethizon dorsatum)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S3S4** FWP SWAP: **SGIN**
Predicted Models: L 100% Low (inductive)

B - Cassin's Finch *(Haemorhous cassinii)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA; BCC10** FWP SWAP: **SGCN3** PIF: **3**
Predicted Models: L 100% Low (inductive)

B - Trumpeter Swan *(Cygnus buccinator)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3** USFWS: **MBTA** USFS: **Sensitive - Known in Forests (BD)** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **1**
Predicted Models: L 100% Low (inductive)

B - Western Screech-Owl *(Megascops kennicottii)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G4G5** State: **S3S4** USFWS: **MBTA** FWP SWAP: **SGIN** PIF: **3**
Predicted Models: L 100% Low (inductive)

V - Elodea bifoliata *(Long-sheath Waterweed)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4G5** State: **S2?** MNPS: **3**
Predicted Models: L 100% Low (inductive)

V - Thalictrum alpinum *(Alpine Meadowrue)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S2** USFS: **Sensitive - Known in Forests (BD)** MNPS: **2**
Predicted Models: L 100% Low (inductive)

B - American Bittern *(Botaurus lentiginosus)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **3**
Predicted Models: L 100% Low (inductive)

B - American White Pelican *(Pelecanus erythrorhynchos)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3B** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **3**
Predicted Models: L 100% Low (inductive)

B - Bobolink *(Dolichonyx oryzivorus)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA; BCC10; BCC11; BCC17** FWP SWAP: **SGCN3** PIF: **3**
Predicted Models: L 100% Low (inductive)

B - Brewer's Sparrow *(Spizella breweri)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**
Predicted Models: L 100% Low (inductive)

B - Broad-tailed Hummingbird *(Selasphorus platycercus)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S4B** USFWS: **MBTA; BCC10** FWP SWAP: **SGIN**
Predicted Models: L 100% Low (inductive)

B - Lewis's Woodpecker *(Melanerpes lewis)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S2B** USFWS: **MBTA; BCC10; BCC17** USFS: **Species of Conservation Concern in Forests (HLC)** BLM: **SENSITIVE** FWP SWAP: **SGCN2** PIF: **2**
Predicted Models: L 100% Low (inductive)

B - Rufous Hummingbird *(Selasphorus rufus)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G4** State: **S4B** USFWS: **MBTA; BCC10** PIF: **3**
Predicted Models: L 100% Low (inductive)

B - Sage Thrasher *(Oreoscoptes montanus)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **3**
Predicted Models: L 100% Low (inductive)

B - Veery *(Catharus fuscescens)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**
Predicted Models: L 100% Low (inductive)

B - Evening Grosbeak *(Coccothraustes vespertinus)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA; BCC10** FWP SWAP: **SGCN3**
Predicted Models: L 67% Low (inductive)

V - Adoxa moschatellina *(Musk-root)* SOC

View in Field Guide View Predicted Models View Range Maps
USFS: **Sensitive - Known in Forests (BD, LOLO)**
Species of Concern - Native Species Global: **G5** State: **S3** **Species of Conservation Concern in Forests (CG, HLC)** MNPS: **3**
Predicted Models: L 67% Low (inductive)

V - Botrychium ascendens *(Upward-lobed Moonwort)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G3** State: **S3** USFS: **Sensitive - Known in Forests (KOOT)** MNPS: **4**
Predicted Models: L 67% Low (inductive)

V - Eleocharis rostellata *(Beaked Spikerush)* SOC

View in Field Guide View Predicted Models View Range Maps
USFS: **Sensitive - Known in Forests (BD)**
Species of Concern - Native Species Global: **G5** State: **S3** **Species of Conservation Concern in Forests (CG, FLAT, HLC)** MNPS: **2**
Predicted Models: 67% Low (inductive)

V - Erigeron linearis *(Linear-leaf Fleabane)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S2** MNPS: **2**
Predicted Models: 67% Low (inductive)

V - Trichophorum cespitosum *(Tufted Club-rush)* SOC

View in Field Guide View Predicted Models View Range Maps
USFS: **Sensitive - Known in Forests (BD, KOOT)**
Species of Concern - Native Species Global: **G5** State: **S2** **Species of Conservation Concern in Forests (FLAT)** MNPS: **3**
Predicted Models: 67% Low (inductive)

B - Boreal Owl *(Aegolius funereus)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S3S4** USFWS: **MBTA** FWP SWAP: **SGIN** PIF: **3**
Predicted Models: 33% Low (inductive)

B - Great Blue Heron *(Ardea herodias)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** FWP SWAP: **SGCN3**
Predicted Models: 33% Low (inductive)

B - Northern Goshawk *(Accipiter gentilis)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **2**
Predicted Models: 33% Low (inductive)

B - Short-eared Owl *(Asio flammeus)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S4** USFWS: **MBTA; BCC11; BCC17** PIF: **3**
Predicted Models: 33% Low (inductive)

V - Agoseris aurantiaca var. carnea *(Pink Agoseris)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G4Q** State: **S3S4**
Predicted Models: 33% Low (inductive)

V - Botrychium crenulatum *(Wavy Moonwort)* SOC

View in Field Guide View Predicted Models View Range Maps
USFS: **Sensitive - Known in Forests (BD, KOOT, LOLO)**
Species of Concern - Native Species Global: **G4** State: **S3** **Species of Conservation Concern in Forests (HLC)** MNPS: **4**
Predicted Models: 33% Low (inductive)

V - Carex stenoptila *(Small-winged Sedge)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G3** State: **S2S3** MNPS: **3**
Predicted Models: 33% Low (inductive)

V - Delphinium glaucescens *(Electric Peak Larkspur)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G3G4** State: **S3S4**
Predicted Models: 33% Low (inductive)

V - Isoetes echinospora *(Spiny-spore Quillwort)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** MNPS: **3**
Predicted Models: 33% Low (inductive)

V - Mimulus suksdorfii *(Suksdorf Monkeyflower)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G4** State: **S3S4**
Predicted Models: 33% Low (inductive)

V - Orobanche corymbosa *(Flat-topped Broomrape)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G4** State: **S3S4**
Predicted Models: 33% Low (inductive)

V - Polygonum austiniae *(Austin's Knotweed)* PSOC

View in Field Guide View Predicted Models View Range Maps
USFS: **Sensitive - Known in Forests (BD)**
Potential Species of Concern - Native Species Global: **G5T4** State: **S3S4** **Species of Conservation Concern in Forests (HLC)** MNPS: **2**
Predicted Models: 33% Low (inductive)

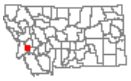
V - Stipa lettermanii *(Letterman's Needlegrass)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S1S3** USFS: **Species of Conservation Concern in Forests (HLC)** MNPS: **3**
Predicted Models: 33% Low (inductive)

B - Green-tailed Towhee *(Pipilo chlorurus)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **3**
Predicted Models: 33% Low (inductive)

MONTANA Natural Heritage Program
A program of the **Montana State Library's Natural Resource Information System**



Latitude	Longitude
46.15893	-113.39548
46.19275	-113.43913

Structured Surveys

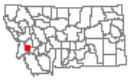
Summarized by: **Flint Creek Phase 2** *(Custom Area of Interest)*

The Montana Natural Heritage Program (MTNHP) records information on the locations where more than 80 different types of well-defined repeatable survey protocols capable of detecting an animal species or suite of animal species have been conducted by state, federal, tribal, university, or private consulting biologists. Examples of structured survey protocols tracked by MTNHP include: visual encounter and dip net surveys for pond breeding amphibians, point counts for birds, call playback surveys for selected bird species, visual surveys of migrating raptors, kick net stream reach surveys for macroinvertebrates, visual encounter cover object surveys for terrestrial mollusks, bat acoustic or mist net surveys, pitfall and/or snap trap surveys for small terrestrial mammals, track or camera trap surveys for large mammals, and trap surveys for turtles. Whenever possible, photographs of survey locations are stored in MTNHP databases.

MTNHP does not typically manage information on structured surveys for plants; surveys for invasive species may be a future exception.

Within the report area you have requested, structured surveys are summarized by the number of each type of structured survey protocol that has been conducted, the number of species detections/observations resulting from these surveys, and the most recent year a survey has been conducted.

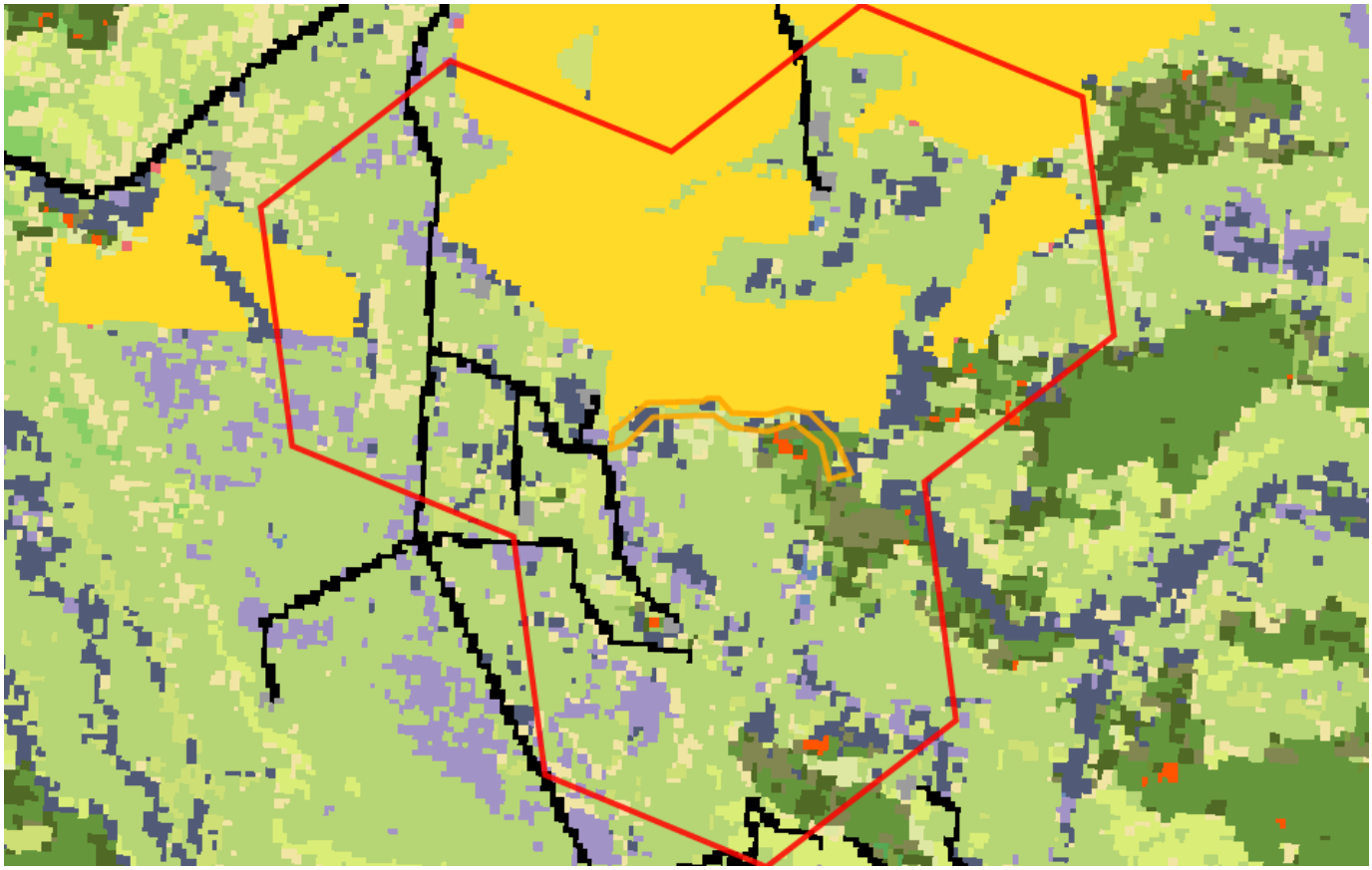
E-Noxious Weed, Road-based *(Noxious Weed Road-based Visual Surveys)* **Survey Count**: 2 **Obs Count**: 2 **Recent Survey**: 2003



Latitude	Longitude
46.15893	-113.39548
46.19275	-113.43913

Land Cover

Summarized by: **Flint Creek Phase 2** *(Custom Area of Interest)*



40% (*772 Acres*)

Grassland Systems
Montane Grassland
Rocky Mountain Lower Montane, Foothill, and Valley Grassland

This grassland system of the northern Rocky Mountains is found at lower montane to foothill elevations in mountains and valleys throughout Montana. These grasslands are floristically similar to Big Sagebrush Steppe but are defined by shorter summers, colder winters, and young soils derived from recent glacial and alluvial material. They are found at elevations from 548 - 1,650 meters (1,800-5,413 feet). In the lower montane zone, they range from small meadows to large open parks surrounded by conifers; below the lower treeline, they occur as extensive foothill and valley grasslands. Soils are relatively deep, fine-textured, often with coarse fragments, and non-saline. Microphytic crust may be present in high-quality occurrences. This system is typified by cool-season perennial bunch grasses and forbs (>25%) cover, with a sparse shrub cover (<10%). Rough fescue (*Festuca campestris*) is dominant in the northwestern portion of the state and Idaho fescue (*Festuca idahoensis*) is dominant or co-dominant throughout the range of the system. Bluebunch wheatgrass (*Pseudoroegneria spicata*) occurs as a co-dominant throughout the range as well, especially on xeric sites. Western wheatgrass (*Pascopyrum smithii*) is consistently present, often with appreciable coverage (>10%) in lower elevation occurrences in western Montana and virtually always present, with relatively high coverages (>25%), on the edge of the Northwestern Great Plains region. Species diversity ranges from a high of more than 50 per 400 square meter plot on mesic sites to 15 (or fewer) on xeric and disturbed sites. Most occurrences have at least 25 vascular species present. Farmland conversion, noxious species invasion, fire suppression, heavy grazing and oil and gas development are major threats to this system.

29% (*558 Acres*)

Human Land Use
Agriculture
Cultivated Crops

These areas used for the production of crops, such as corn, soybeans, small grains, sunflowers, vegetables, and cotton, typically on an annual cycle. Agricultural plant cover is variable depending on season and type of farming. Other areas include more stable land cover of orchards and vineyards.

6% (*123 Acres*)

Wetland and Riparian Systems
Floodplain and Riparian

Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland

This ecological system is found throughout the Rocky Mountain and Colorado Plateau regions. In Montana, sites occur at elevations of 609-1,219 meters (2,000-4,000 feet) west of the Continental Divide. East of the Continental Divide, this system ranges up to 1,676 meters (5,500 feet). It generally comprises a mosaic of multiple communities that are tree-dominated with a diverse shrub component. It is dependent on a natural hydrologic regime with annual to episodic flooding, so it is usually found within the flood zone of rivers, on islands, sand or cobble bars, and along streambanks. It can form large, wide occurrences on mid-channel islands in larger rivers, or narrow bands on small, rocky canyon tributaries and well-drained benches. It is also typically found in backwater channels and other perennially wet but less scoured sites, such as floodplains, swales and irrigation ditches. In some locations, occurrences extend into moderately high intermountain basins where the adjacent vegetation is sage steppe. Black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) is the key indicator species. Other dominant trees may include boxelder maple (*Acer negundo*), narrowleaf cottonwood (*Populus angustifolia*), eastern cottonwood (*Populus deltoides*), Douglas-fir (*Pseudotsuga menziesii*), peachleaf willow (*Salix amygdaloides*), or Rocky Mountain juniper (*Juniperus scopulorum*). Dominant shrubs include Rocky Mountain maple (*Acer glabrum*), thinleaf alder (*Alnus incana*), river birch (*Betula occidentalis*), redoiser dogwood (*Cornus sericea*), hawthorne (*Crataegus* species), chokecherry (*Prunus virginiana*), skunkbush sumac (*Rhus trilobata*), willows (*Salix* species), rose (*Rosa* species), silver buffaloberry (*Shepherdia argentea*), or snowberry (*Symphoricarpos* species).

4% (*82 Acres*)

Wetland and Riparian Systems
Wet meadow

Alpine-Montane Wet Meadow

These moderate-to-high-elevation systems are found throughout the Rocky Mountains, dominated by herbaceous species found on wetter sites with very low-velocity surface and subsurface flows. Occurrences range in elevation from montane to alpine at 1,000 to 3,353 meters (3,280-11,000 feet). This system typically occurs in cold, moist basins, seeps and alluvial terraces of headwater streams or as a narrow strip adjacent to alpine lakes (Hansen et al., 1996). Wet meadows are typically found on flat areas or gentle slopes, but may also occur on sub-irrigated sites with slopes up to 10 percent. In alpine regions, sites are typically small depressions located below late-melting snow patches or on snowbeds. The growing season may only last for one to two months. Soils of this system may be mineral or organic. In either case, soils show typical hydric soil characteristics, including high organic content and/or low chroma and redoximorphic features. This system often occurs as a mosaic of several plant associations, often dominated by graminoids such as tufted hairgrass (*Deschampsia caespitosa*), and a diversity of montane or alpine sedges such as small-head sedge (*Carex illota*), small-winged sedge (*Carex microptera*), black alpine sedge (*Carex nigricans*), Holmâ€™s Rocky Mountain sedge (*Carex scopulorum*) shortstalk sedge (*Carex podocarpa*) and Paysonâ€™s sedge (*Carex paysonis*). Drummondâ€™s rush (*Juncus drummondii*), Mertenâ€™s rush (*Juncus mertensianus*), and high elevation bluegrasses (*Poa arctica* and *Poa alpina*) are often present. Forbs such as arrow-leaf groundsel (*Senecio triangularis*), slender-sepal marsh marigold (*Caltha leptosepala*), and spreading globeflower (*Trollius laxus*) often form high cover in higher elevation meadows. Wet meadows are associated with snowmelt and are usually not subjected to high disturbance events such as flooding.

4% (*77 Acres*)

Shrubland, Steppe and Savanna Systems
Sagebrush Steppe

Montane Sagebrush Steppe

This system dominates the montane and subalpine landscape of southwestern Montana from valley bottoms to subalpine ridges and is found as far north as Glacier National Park. It can also be seen in the island mountain ranges of the north-central and south-central portions of the state. It primarily occurs on deep-soiled to stony flats, ridges, nearly flat ridgetops, and mountain slopes. In general, this system occurs in areas of gentle topography, fine soils, subsurface moisture or mesic conditions, within zones of higher precipitation and areas of snow accumulation. It occurs on all slopes and aspects, variable substrates and all soil types. The shrub component of this system is generally dominated by mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*). Other co-dominant shrubs include silver sagebrush (*Artemisia cana ssp. viscidula)*, subalpine big sagebrush (*Artemisia tridentata ssp. spiciformis*), three tip sagebrush (*Artemisia tripartita* ssp*. tripartita*) and antelope bitterbrush (*Purshia tridentata*). Little sagebrush (*Artemisia arbuscula ssp. arbuscula*) shrublands are only found in southwestern Montana on sites with a perched water table. Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*) sites may be included within this system if occurrences are at montane elevations, and are associated with montane graminoids such as Idaho fescue (*Festuca idahoensis),* spike fescue (*Leucopoa kingii*), or poverty oatgrass (*Danthonia intermedia)*. In ares where sage has been eliminated by human activities like burning, disking or poisoning, other shrubs may be dominant, especially rubber rabbitbrush (*Ericameria nauseosa*), and green rabbitbrush (*Chrysothamnus viscidiflorus*). Because of the mesic site conditions, most occurrences support a diverse herbaceous undergrowth of grasses and forbs. Shrub canopy cover is extremely variable, ranging from 10 percent to as high as 40 or 50 percent.

3% (*65 Acres*)

Grassland Systems
Montane Grassland

Rocky Mountain Subalpine-Montane Mesic Meadow

This system is restricted to sites from lower montane to subalpine elevations where finely textured soils, snow deposition, or windswept conditions limit tree establishment. Many occurrences are small patches, and are often found in mosaics within woodlands, dense shrublands, or just below alpine communities. Elevations range from 600 to2,011 meters (2,000-6,600 feet) in the northern Rocky Mountains and up to 2,286- 2,682 meters (7,500-8,800 feet) in the mountains of southwestern Montana. This system occurs on gentle to moderate-gradient slopes and in relatively moist habitats. Soils are typically seasonally moist to saturated in the spring, but dry out later in the growing season. At montane elevations, soils are usually clays or silt loams, and some occurrences may have inclusions of hydric soils in low, depressional areas. At subalpine elevations, soils are derived a variety of parent materials, and are usually rocky or gravelly with good aeration and drainage, but with a well developed organic layer. Some occurrences are more heavily dominated by grasses, while others are more dominated by forbs. Common grasses include tufted hairgrass (*Deschampsia caespitosa*), showy oniongrass (*Melica spectabilis*), mountain brome (*Bromus carinatus*), blue wildrye (*Elymus glaucus*), awned sedge (*Carex atherodes*), and small wing sedge (*Carex microptera*). Forb dominated meadows usually comprise a wide species diversity which differs from montane to subalpine elevations. Shrubs such as shrubby cinquefoil (*Dasiphora fruticosa* ssp. *floribunda*) and snowberry (*Symphoricarpos* species) are occasional but not abundant. This system differs from the Rocky Mountain Alpine Montane Wet Meadow system in that it soils dry out by mid-summer.

No Image

3% (*56 Acres*)

Human Land Use
Developed

Other Roads

County, city and or rural roads generally open to motor vehicles.

2% (*46 Acres*)

Forest and Woodland Systems
Conifer-dominated forest and woodland (xeric-mesic)

Rocky Mountain Lodgepole Pine Forest

This forested system is widespread in upper montane to subalpine zones of the Montana Rocky Mountains, and east into island ranges of north-central Montana and the Bighorn and Beartooth ranges of south-central Montana. These are montane to subalpine forests where the dominance of lodgepole pine (*Pinus contorta*) is related to fire history and topoedaphic conditions. In Montana, elevation ranges from 975 to 2,743 meters (3,200-9000 feet). These forests occur on flats to slopes of all degrees and aspect, as well as valley bottoms. Fire is frequent, and stand-replacing fires are common. Following stand-replacing fires, lodgepole pinewill rapidly colonize and develop into dense, even-aged stands. Most forests in this ecological system occur as early- to mid-successional forests persisting for 50-200 years on warmer, lower elevation forests, and 150-400 years in subalpine forests. They generally occur on dry to intermediate sites with a wide seasonal range of temperatures and long precipitation-free periods in summer. Snowfall is heavy and supplies the major source of soil water used for growth in early summer. Vigorous stands occur where the precipitation exceeds 533 millimeters (21 inches). These lodgepole forests are typically associated with rock types weathering to acidic substrates, such as granite and rhyolite. In west-central Montana ranges such the Big Belts and the Rocky Mountain Front, these forests are found on limestone substrates. These systems are especially well developed on the broad ridges and high valleys near and east of the Continental Divide. Succession proceeds at different rates, moving relatively quickly on low-elevation, mesic sites and particularly slowly in high-elevation forests such as those along the Continental Divide in Montana.

Additional Limited Land Cover

1% (*29 Acres*) Aspen Forest and Woodland
1% (*28 Acres*) Rocky Mountain Subalpine-Upper Montane Grassland
1% (*27 Acres*) Rocky Mountain Montane Douglas-fir Forest and Woodland
1% (*23 Acres*) Rocky Mountain Subalpine Deciduous Shrubland
1% (*13 Acres*) Rocky Mountain Ponderosa Pine Woodland and Savanna
<1% (*9 Acres*) Low Intensity Residential
<1% (*6 Acres*) Insect-Killed Forest
<1% (*2 Acres*) Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland
<1% (*2 Acres*) Emergent Marsh
<1% (*1 Acres*) Introduced Upland Vegetation - Annual and Biennial Forbland
<1% (*1 Acres*) Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland
<1% (*0 Acres*) Aspen and Mixed Conifer Forest

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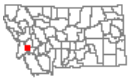

Latitude Longitude
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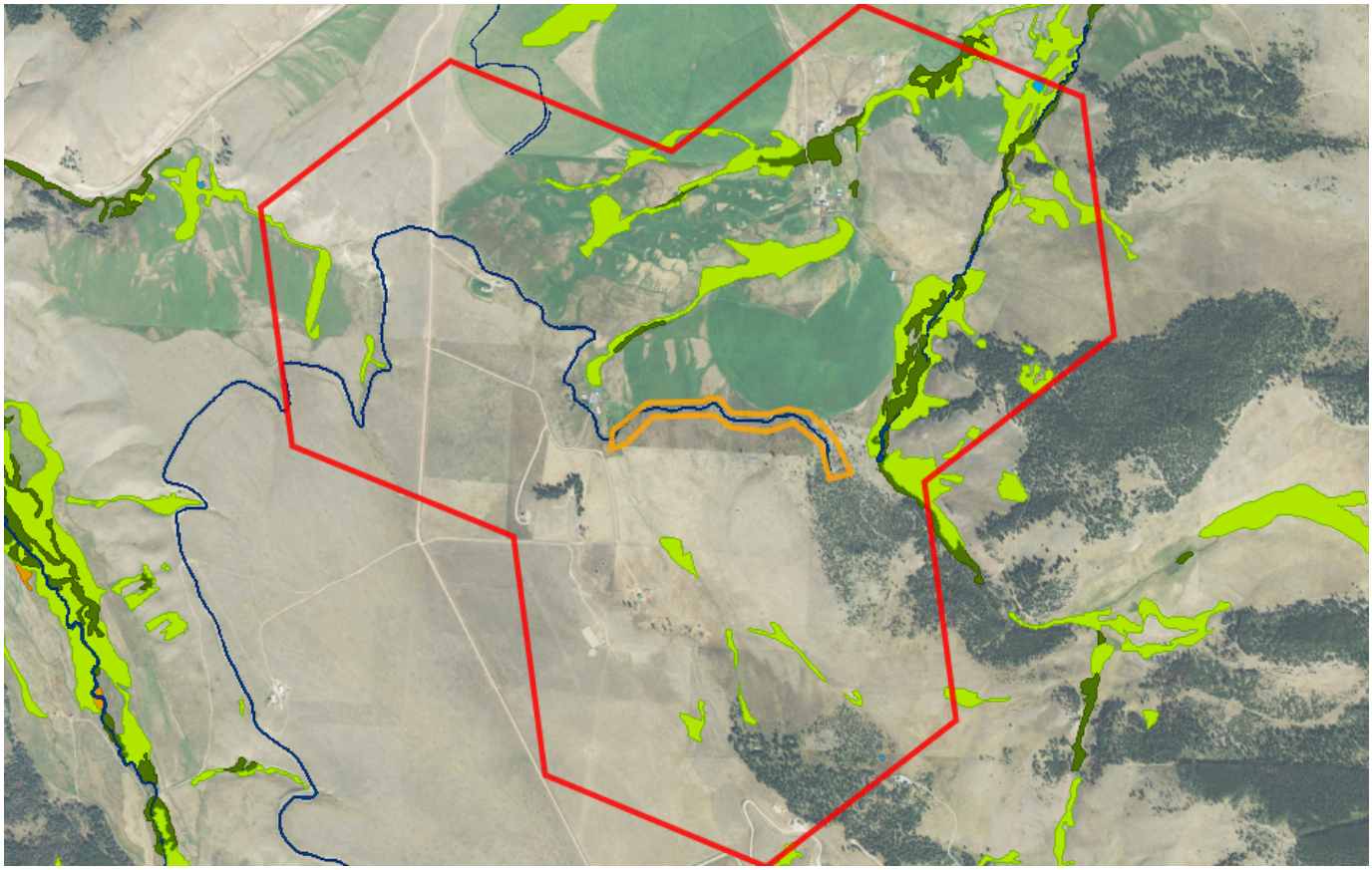
46.19275 -113.43913

Wetland and Riparian

Summarized by: **Flint Creek Phase 2** *(Custom Area of Interest)*



Wetland and Riparian Mapping

Explain

P - Palustrine

AB - Aquatic Bed

F - Semipermanently Flooded	1 Acres	
(no modifier)	**<1 Acres**	**PABF**
h - Diked/Impounded	**1 Acres**	**PABFh**
x - Excavated	**<1 Acres**	**PABFx**

P - Palustrine, AB - Aquatic Bed
Wetlands with vegetation growing on or below the water surface for most of the growing season.

EM - Emergent

A - Temporarily Flooded	111 Acres	
(no modifier)	**111 Acres**	**PEMA**

P - Palustrine, EM - Emergent
Wetlands with erect, rooted herbaceous vegetation present during most of the growing season.

SS - Scrub-Shrub

A - Temporarily Flooded	26 Acres	
(no modifier)	**26 Acres**	**PSSA**

P - Palustrine, SS - Scrub-Shrub
Wetlands dominated by woody vegetation less than 6 meters (20 feet) tall. Woody vegetation includes tree saplings and trees that are stunted due to environmental conditions.

R - Riverine (Rivers)

3 - Upper Perennial

UB - Unconsolidated Bottom

F - Semipermanently Flooded	3 Acres	
(no modifier)	**3 Acres**	**R3UBF**

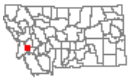
R - Riverine (Rivers), 3 - Upper Perennial, UB - Unconsolidated Bottom
Stream channels where the substrate is at least 25% mud, silt or other fine particles.

4 - Intermittent

SB - Stream Bed

C - Seasonally Flooded	8 Acres	
x - Excavated	**8 Acres**	**R4SBCx**

R - Riverine (Rivers), 4 - Intermittent, SB - Stream Bed
Active channel that contains periodic water flow.



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Land Management

Summarized by: **Flint Creek Phase 2** *(Custom Area of Interest)*

No Land Management records were found in the selected area

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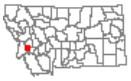

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Biological Reports

Summarized by: **Flint Creek Phase 2** *(Custom Area of Interest)*

Within the report area you have requested, citations for all reports and publications associated with plant or animal observations in Montana Natural Heritage Program (MTNHP) databases are listed and, where possible, links to the documents are included.

The MTNHP plans to include reports associated with terrestrial and aquatic communities in the future as allowed for by staff resources. If you know of reports or publications associated with species or biological communities within the report area that are not shown in this report, please let us know: mtnhp@mt.gov

No Biological Reports were found in the selected area

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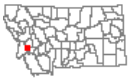
Legend

Model Icons	Habitat Icons	Range Icons	Num Obs
N Suitable (native range)	C Common	N Non-native	Count of obs with 'good precision' (<=1000m)
O Optimal Suitability	O Occasional		+ indicates additional 'poor precision' obs (1001m-10,000m)
M Moderate Suitability			
L Low Suitability			
I Suitable (introduced range)			



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Invasive and Pest Species

Summarized by: **Flint Creek Phase 2** *(Custom Area of Interest)*

	# Obs	Predicted Model	Range

Aquatic Invasive Species

V - Iris pseudacorus *(Yellowflag Iris)* N2A/AIS

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2A - Aquatic Invasive Species - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: L 33% Low (inductive)

V - Nymphaea odorata *(American Water-lily)* AIS

View in Field Guide | View Predicted Models | View Range Maps

Aquatic Invasive Species - Non-native Species Global: **G5** State: **SNA**

Predicted Models: I 100% Suitable (introduced range) (deductive)

Noxious Weeds: Priority 1A

V - Centaurea solstitialis *(Yellow Starthistle)* N1A

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 1A - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: M 67% Moderate (inductive), L 33% Low (inductive)

V - Isatis tinctoria *(Dyer's Woad)* N1A

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 1A - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: M 67% Moderate (inductive), L 33% Low (inductive)

V - Taeniatherum caput-medusae *(Medusahead)* N1A

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 1A - Non-native Species Global: **G4G5** State: **SNA**

Predicted Models: L 67% Low (inductive)

Noxious Weeds: Priority 1B

V - Echium vulgare *(Blueweed)* N1B

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 1B - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: L 100% Low (inductive)

V - Polygonum cuspidatum *(Japanese Knotweed)* N1B

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 1B - Non-native Species Global: **GNRTNR** State: **SNA**

Predicted Models: L 100% Low (inductive)

V - Lythrum salicaria *(Purple Loosestrife)* N1B

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 1B - Non-native Species Global: **G5** State: **SNA**

Predicted Models: L 67% Low (inductive)

Noxious Weeds: Priority 2A

V - Ventenata dubia *(Ventenata)* N2A

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2A - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: M 67% Moderate (inductive), L 33% Low (inductive)

V - Hieracium aurantiacum *(Orange Hawkweed)* N2A

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2A - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: L 100% Low (inductive)

V - Lepidium latifolium *(Perennial Pepperweed)* N2A

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2A - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: L 100% Low (inductive)

V - Ranunculus acris *(Tall Buttercup)* N2A

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2A - Non-native Species Global: **G5** State: **SNA**

Predicted Models: L 100% Low (inductive)

V - Hieracium caespitosum *(Meadow Hawkweed)* N2A

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2A - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: L 67% Low (inductive)

V - Rhamnus cathartica *(Common Buckthorn)* N2A

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2A - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: L 67% Low (inductive)

V - Hieracium praealtum *(Kingdevil Hawkweed)* N2A

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2A - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: L 33% Low (inductive)

V - Iris pseudacorus *(Yellowflag Iris)* N2A/AIS

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2A - Aquatic Invasive Species - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: L 33% Low (inductive)

V - Senecio jacobaea *(Tansy Ragwort)* N2A

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2A - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: L 33% Low (inductive)

Noxious Weeds: Priority 2B

V - Centaurea stoebe *(Spotted Knapweed)* N2B

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: M 100% Moderate (inductive)

V - Cynoglossum officinale *(Common Hound's-tongue)* N2B

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: M 100% Moderate (inductive)

V - Cirsium arvense *(Canada Thistle)* N2B

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2B - Non-native Species Global: **G5** State: **SNA**

Predicted Models: M 67% Moderate (inductive), L 33% Low (inductive)

V - Lepidium draba *(Whitetop)* N2B

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: M 67% Moderate (inductive), L 33% Low (inductive)

V - Linaria dalmatica *(Dalmatian Toadflax)* N2B

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2B - Non-native Species Global: **G5** State: **SNA**

Predicted Models: M 33% Moderate (inductive), L 67% Low (inductive)

V - Linaria vulgaris *(Yellow Toadflax)* N2B

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: M 33% Moderate (inductive), L 67% Low (inductive)

V - Euphorbia virgata *(Leafy Spurge)* N2B

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2B - Non-native Species Global: **GNRTNR** State: **SNA**

Predicted Models: L 100% Low (inductive)

V - Leucanthemum vulgare *(Oxeye Daisy)* N2B

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: L 100% Low (inductive)

V - Potentilla recta *(Sulphur Cinquefoil)* N2B

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: L 100% Low (inductive)

V - Tanacetum vulgare *(Common Tansy)* N2B

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: L 100% Low (inductive)

V - Acroptilon repens *(Russian Knapweed)* N2B

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: L 67% Low (inductive)

V - Berteroa incana *(Hoary False-alyssum)* N2B

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: L 67% Low (inductive)

V - Centaurea diffusa *(Diffuse Knapweed)* N2B

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: L 67% Low (inductive)

V - Convolvulus arvensis *(Field Bindweed)* N2B

View in Field Guide | View Predicted Models | View Range Maps

Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**

Predicted Models: L 33% Low (inductive)

Regulated Weeds: Priority 3

V - Bromus tectorum *(Cheatgrass)* R3

View in Field Guide View Predicted Models View Range Maps
Regulated Weed: Priority 3 - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: L 67% Low (inductive)

Biocontrol Species

I - Aphthona lacertosa *(Brown-legged Leafy Spurge Flea Beetle)* BIOCNTRL

View in Field Guide View Predicted Models View Range Maps
Biocontrol Species - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 100% Moderate (inductive)

I - Oberea erythrocephala *(Red-headed Leafy Spurge Stem Borer)* BIOCNTRL

View in Field Guide View Predicted Models View Range Maps
Biocontrol Species - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 67% Moderate (inductive), L 33% Low (inductive)

I - Aphthona nigriscutis *(Black Dot Leafy Spurge Flea Beetle)* BIOCNTRL

View in Field Guide View Predicted Models View Range Maps
Biocontrol Species - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 33% Moderate (inductive), L 67% Low (inductive)

I - Cyphocleonus achates *(Knapweed Root Weevil)* BIOCNTRL

View in Field Guide View Predicted Models View Range Maps
Biocontrol Species - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 33% Moderate (inductive), L 67% Low (inductive)

I - Mecinus janthiniformis *(Dalmatian Toadflax Stem-boring Weevil)* BIOCNTRL

View in Field Guide View Predicted Models View Range Maps
Biocontrol Species - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: L 100% Low (inductive)

Introduction to Montana Natural Heritage Program

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Introduction

The Montana Natural Heritage Program (MTNHP) is Montana's source for reliable and objective information on Montana's native species and habitats, emphasizing those of conservation concern. MTNHP was created by the Montana legislature in 1983 as part of the Natural Resource Information System (NRIS) at the Montana State Library (MSL). MTNHP is "a program of information acquisition, storage, and retrieval for data relating to the flora, fauna, and biological community types of Montana" (MCA 90-15-102). MTNHP's activities are guided by statute as well as through ongoing interaction with, and feedback from, principal data source agencies such as Montana Fish, Wildlife, and Parks, the Montana Department of Environmental Quality, the Montana Department of Natural Resources and Conservation, the Montana University System, the US Forest Service, and the US Bureau of Land Management. Since the first staff was hired in 1985, the Program has logged a long record of success, and developed into a highly respected, service-oriented program. MTNHP is widely recognized as one of the most advanced and effective of over 80 natural heritage programs throughout the Western Hemisphere.

Vision

Our vision is that public agencies, the private sector, the education sector, and the general public will trust and rely upon MTNHP as the source for information and expertise on Montana's species and habitats, especially those of conservation concern. We strive to provide easy access to our information in order for users to save time and money, speed environmental reviews, and inform decision making.

Core Values

- We endeavor to be a single statewide source of accurate and up-to-date information on Montana's plants, animals, and aquatic and terrestrial biological communities.
- We actively listen to our data users and work responsively to meet their information and training needs.
- We strive to provide neutral, trusted, timely, and equitable service to all of our information users.
- We make every effort to be transparent to our data users in setting work priorities and providing data products.

Confidentiality

All information requests made to the Montana Natural Heritage Program are considered library records and are protected from disclosure by the Montana Library Records Confidentiality Act (MCA 22-1-11).

Information Managed

Information managed at the Montana Natural Heritage Program is botanical, zoological, and ecological information that describes the distribution (e.g., observations, structured surveys, range polygons, predicted habitat suitability models), conservation status (e.g., global and state conservation status ranks, including threats), and other supporting information (e.g., accounts and references) on the biology and ecology of species and biological communities.

Data Use Terms and Conditions

- Montana Natural Heritage Program (MTNHP) products and services are based on biological data and the objective interpretation of those data by professional scientists. MTNHP does not advocate any particular philosophy of natural resource protection, management, development, or public policy.
- MTNHP has no natural resource management or regulatory authority. Products, statements, and services from MTNHP are intended to inform parties as to the state of scientific knowledge about certain natural resources, and to further develop that knowledge. The information is not intended as natural resource management guidelines or prescriptions or a determination of environmental impacts. MTNHP recommends consultation with appropriate state, federal, and tribal resource management agencies and authorities in the area where your project is located.
- Information on the status and spatial distribution of biological resources produced by MTNHP are intended to inform parties of the state-wide status, known occurrence, or the likelihood of the presence of those resources. **These products are not intended to substitute for field-collected data, nor are they intended to be the sole basis for natural resource management decisions.**
- MTNHP does not portray its data as exhaustive or comprehensive inventories of rare species or biological communities. **Field verification of the absence or presence of sensitive species and biological communities will always be an important obligation of users of our data.**
- MTNHP responds equally to all requests for products and services, regardless of the purpose or identity of the requester.
- Because MTNHP constantly updates and revises its databases with new data and information, products will become outdated over time. Interested parties are encouraged to obtain the most current information possible from MTNHP, rather than using older products. We add, review, update, and delete records on a daily basis. Consequently, we strongly advise that you update your MTNHP data sets at a minimum of every four months for most applications of our information.
- MTNHP data require a certain degree of biological expertise for proper analysis, interpretation, and application. Our staff is available to advise you on questions regarding the interpretation or appropriate use of the data that we provide. See Contact Information for MTNHP Staff
- The information provided to you by MTNHP may include sensitive data that if publicly released might jeopardize the welfare of threatened, endangered, or sensitive species or biological communities. This information is intended for distribution or use only within your department, agency, or business. Subcontractors may have access to the data during the course of any given project, but should not be given a copy for their use on subsequent, unrelated work.
- MTNHP data are made freely available. Duplication of hard-copy or digital MTNHP products with the intent to sell is prohibited without written consent by MTNHP. Should you be asked by individuals outside your organization for the type of data that we provide, please refer them to MTNHP.
- MTNHP and appropriate staff members should be appropriately acknowledged as an information source in any third-party product involving MTNHP data, reports, papers, publications, or in maps that incorporate MTNHP graphic elements.
- Sources of our data include museum specimens, published and unpublished scientific literature, field surveys by state and federal agencies and private contractors, and reports from knowledgeable individuals. MTNHP actively solicits and encourages additions, corrections and updates, new observations or collections, and comments on any of the data we provide.
- MTNHP staff and contractors do not enter or cross privately-owned lands without express permission from the landowner. However, the program cannot guarantee that information provided to us by others was obtained under adherence to this policy.

Suggested Contacts for Natural Resource Management Agencies

As required by Montana statute (MCA 90-15), the Montana Natural Heritage Program works with state, federal, tribal, nongovernmental organizations, and private partners to ensure that the latest animal and plant distribution and status information is incorporated into our databases so that it can be used to inform a variety of permitting and planning processes and management decisions. We encourage you to contact state, federal, and tribal resource management agencies in the area where your project is located and review the permitting overviews by the Montana Department of Environmental Quality, the Montana Department of Natural Resources and Conservation and the Index of Environmental Permits for Montana for guidelines relevant to your efforts. In particular, we encourage you to contact the Montana Department of Fish, Wildlife, and Parks for the latest data and management information regarding hunted and high-profile management species and to use the U.S. Fish and Wildlife Service's Information Planning and Consultation (IPAC) website regarding U.S. Endangered Species Act listed Threatened, Endangered, or Candidate species.

For your convenience, we have compiled a list of relevant agency contacts and links below:

Montana Fish, Wildlife, and Parks

Fish Species	Zachary Shattuck zshattuck@mt.gov (406) 444-1231 or Eric Roberts eroberts@mt.gov (406) 444-5334
American Bison Black-footed Ferret Black-tailed Prairie Dog Bald Eagle Golden Eagle Common Loon Least Tern Piping Plover Whooping Crane	Kristian Smucker KSmucker@mt.gov (406) 444-5209
Grizzly Bear Greater Sage Grouse Trumpeter Swan Big Game Upland Game Birds Furbearers	Brian Wakeling Brian.Wakeling@mt.gov (406) 444-3940
Managed Terrestrial Game and Nongame Animal Data	Smith Wells – MFWP Data Analyst smith.wells@mt.gov (406) 444-3759
Fisheries Data	Ryan Alger – MFWP Data Analyst ryan.alger@mt.gov (406) 444-5365
Wildlife and Fisheries Scientific Collector's Permits	https://fwp.mt.gov/buyandapply/commercialwildlifeandscientificpermits/scientific Kammi McClain for Wildlife Kammi.McClain@mt.gov (406) 444-2612 Kim Wedde for Fisheries kim.wedde@mt.gov (406) 444-5594
Fish and Wildlife Recommendations for Subdivision Development	Charlie Sperry CSperry@mt.gov (406) 444-3888 See https://fwp.mt.gov/conservation/living-with-wildlife/subdivision-recommendations
Regional Contacts  	Region 1 (Kalispell) (406) 752-5501 fwprg12@mt.gov Region 2 (Missoula) (406) 542-5500 fwprg22@mt.gov Region 3 (Bozeman) (406) 577-7900 fwprg3@mt.gov Region 4 (Great Falls) (406) 454-5840 fwprg42@mt.gov Region 5 (Billings) (406) 247-2940 fwprg52@mt.gov Region 6 (Glasgow) (406) 228-3700 fwprg62@mt.gov Region 7 (Miles City) (406) 234-0900 fwprg72@mt.gov

Montana Department of Agriculture
General Contact Information: https://agr.mt.gov/About/Office-Locations/Office-Locations-and-Field-Offices
Noxious Weeds: https://agr.mt.gov/Noxious-Weeds

Montana Department of Environmental Quality
Permitting and Operator Assistance for all Environmental Permits: https://deq.mt.gov/Permitting

Montana Department of Natural Resources and Conservation
Overview of, and contacts for, licenses and permits for state lands, water, and forested lands: http://dnrc.mt.gov/licenses-and-permits

Stream Permitting (310 permits) and an overview of various water and stream related permits (e.g., Stream Protection Act 124, Federal Clean Water Act 404, Federal Rivers and Harbors Act Section 10, Short-term Water Quality Standard for Turbidity 318 Authorization, etc.).
http://dnrc.mt.gov/divisions/cardd/conservation-districts/the-310-law

Flood and Fire Resources: http://dnrc.mt.gov/flood-and-fire

Bureau of Land Management

Montana Field Office Contacts:

Billings	(406) 896-5013
Butte	(406) 533-7600
Dillon	(406) 683-8000
Glasgow	(406) 228-3750
Havre	(406) 262-2820
Lewistown	(406) 538-1900
Malta	(406) 654-5100
Miles City	(406) 233-2800
Missoula	(406) 329-3914

United States Army Corps of Engineers
Montana Regulatory Office for federal permits related to construction in water and wetlands
https://www.nwo.usace.army.mil/Missions/Regulatory-Program/Montana/ (406) 441-1375

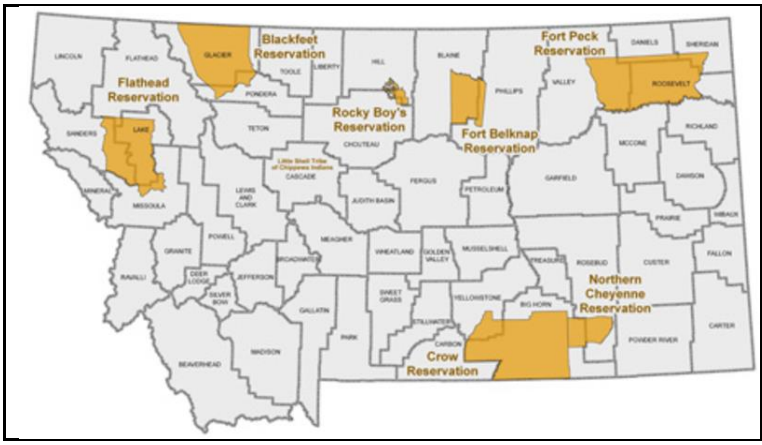
United States Environmental Protection Agency
Environmental information, notices, permitting, and contacts https://www.epa.gov/mt
Gateway to state resource locators https://www.envcap.org/srl/index.php

United States Fish and Wildlife Service
Information Planning and Conservation (IPAC) website: https://ecos.fws.gov/ipac/
Montana Ecological Services Field Office: https://www.fws.gov/montanafieldoffice/ (406) 449-5225

United States Forest Service

Regional Office – Missoula, Montana Contacts			
Wildlife Program Leader	Tammy Fletcher	tammy.fletcher2@usda.gov	(406) 329-3086
Wildlife Ecologist	Cara Staab	cara.staab@usda.gov	(406) 329-3677
Fish Program Leader	Scott Spaulding	scott.spaulding@usda.gov	(406) 329-3287
Fish Ecologist	Cameron Thomas	cameron.thomas@usda.gov	(406) 329-3087
TES Program	Lydia Allen	lydia.allen@usda.gov	(406) 329-3558
Interagency Grizzly Bear Coordinator	Scott Jackson	scott.jackson@usda.gov	(406) 329-3664
Acting Regional Botanist	Amanda Hendrix	amanda.hendrix@usda.gov	(651) 447-3016
Regional Vegetation Ecologist	Mary Manning	marry.manning@usda.gov	(406) 329-3304
Invasive Species Program Manager	Michelle Cox	michelle.cox2@usda.gov	(406) 329-3669

Tribal Nations



[Assiniboine & Gros Ventre Tribes – Fort Belknap Reservation]

[Assiniboine & Sioux Tribes – Fort Peck Reservation]

[Blackfeet Tribe - Blackfeet Reservation]

[Chippewa Creek Tribe - Rocky Boy's Reservation]

[Crow Tribe – Crow Reservation]

[Little Shell Chippewa Tribe]

[Northern Cheyenne Tribe – Northern Cheyenne Reservation]

[Salish & Kootenai Tribes - Flathead Reservation]

Natural Heritage Programs and Conservation Data Centers in Surrounding States and Provinces

[Alberta Conservation Information Management System]
[British Columbia Conservation Data Centre]
[Idaho Natural Heritage Program]
[North Dakota Natural Heritage Program]
[Saskatchewan Conservation Data Centre]
[South Dakota Natural Heritage Program]
[Wyoming Natural Diversity Database]

Invasive Species Management Contacts and Information

Aquatic Invasive Species

[Montana Fish, Wildlife, and Parks Aquatic Invasive Species staff]
[Montana Department of Natural Resources and Conservation's Aquatic Invasive Species Grant Program]
[Montana Invasive Species Council (MISC)]
[Upper Columbia Conservation Commission (UC3)]

Noxious Weeds

[Montana Weed Control Association Contacts Webpage]
[Montana Biological Weed Control Coordination Project]
[Montana Department of Agriculture - Noxious Weeds]
[Montana Weed Control Association]
[Montana Fish, Wildlife, and Parks - Noxious Weeds]
[Montana State University Integrated Pest Management Extension]
[Integrated Noxious Weed Management after Wildfires]
[Fire Management and Invasive Plants]

Introduction to Native Species

Within the report area you have requested, separate summaries are provided for: (1) Species Occurrences (SO) for plant and animal Species of Concern, Special Status Species (SSS), Important Animal Habitat (IAH) and some Potential Plant Species of Concern; (2) other observed non Species of Concern or Species of Concern without suitable documentation to create Species Occurrence polygons; and (3) other non-documented species that are potentially present based on their range, predicted suitable habitat model output, or presence of associated habitats. Each of these summaries provides the following information when present for a species: (1) the number of Species Occurrences and associated delineation criteria for construction of these polygons that have long been used for considerations of documented Species of Concern in environmental reviews; (2) the number of observations of each species; (3) the geographic range polygons for each species that the report area overlaps; (4) predicted relative habitat suitability classes that are present if a predicted suitable habitat model has been created; (5) the percent of the report area that is mapped as commonly associated or occasionally associated habitat as listed for each species in the Montana Field Guide; and (6) a variety of conservation status ranks and links to species accounts in the Montana Field Guide. Details on each of these information categories are included under relevant section headers below or are defined on our Species Status Codes page. In presenting this information, the Montana Natural Heritage Program (MTNHP) is working towards assisting the user with rapidly determining what species have been documented and what species are potentially present in the report area. We remind users that this information is likely incomplete as surveys to document native and introduced species are lacking in many areas of the state, information on introduced species has only been tracked relatively recently, the MTNHP's staff and resources are restricted by budgets, and information is constantly being added and updated in our databases. **Thus, field verification by professional biologists of the absence or presence of species and biological communities will always be an important obligation of users of our data.**

If you are aware of observation datasets that the MTNHP is missing, please report them to the Program Botanist apipp@mt.gov or Senior Zoologist dbachen@mt.gov. If you have animal observations that you would like to contribute, you can submit them to our Animal Observation Entry Tool You can also submit plant and animal observations via Excel spreadsheets posted at https://mtnhp.org/observations.asp or via the Montana Natural Heritage Observations project in iNaturalist

Observations

The MTNHP manages information on several million animal and plant observations that have been reported by professional biologists and private citizens from across Montana. The majority of these observations are submitted in digital format from standardized databases associated with research or monitoring efforts and spreadsheets of incidental observations submitted by professional biologists and amateur naturalists. At a minimum, accepted observation records must contain a credible species identification (i.e. appropriate geographic range, date, and habitat and, if species are difficult to identify, a photograph and/or notes on key identifying features), a date or date range, observer name, locational information (ideally with latitude and longitude in decimal degrees), notes on numbers observed, and species behavior or habitat use (e.g., is the observation likely associated with reproduction). Bird records are also required to have information associated with date-appropriate breeding or overwintering status of the species observed. MTNHP reviews observation records to ensure that they are mapped correctly, occur within date ranges when the species is known to be present or detectable, occur within the known seasonal geographic range of the species, and occur in appropriate habitats. MTNHP also assigns each record a locational uncertainty value in meters to indicate the spatial precision associated with the record's mapped coordinates. Only records with locational uncertainty values of 10,000 meters or less are included in environmental summary reports and number summaries are only provided for records with locational uncertainty values of 1,000 meters or less.

Species Occurrences

The MTNHP evaluates plant and animal observation records for species of higher conservation concern to determine whether they are worthy of inclusion in the Species Occurrence (SO) layer for use in environmental reviews; observations not worthy of inclusion in this layer include long distance dispersal events, migrants observed away from key migratory stopover habitats, and winter observations. An SO is a polygon depicting what is known about a species occupancy from direct observation with a defined level of locational uncertainty and any inference that can be made about adjacent habitat use from the latest peer-reviewed science. If an observation can be associated with a map feature that can be tracked (e.g., a wetland boundary for a wetland associated plant) then this polygon feature is used to represent the SO. Areas that can be inferred as probable occupied habitat based on direct observation of a species location and what is known about the foraging area or home range size of the species may be incorporated into the SO. Species Occurrences generally belong to one of the following categories:

Plant Species Occurrences

A documented location of a specimen collection or observed plant population. In some instances, adjacent, spatially separated clusters are considered subpopulations and are grouped as one occurrence (e.g., the subpopulations occur in ecologically similar habitats, and their spatial proximity likely allows them to interbreed). Tabular information for multiple observations at the same SO location is generally linked to a single polygon. Plant SO's are only created for Species of Concern and Potential Species of Concern.

Animal Species Occurrences

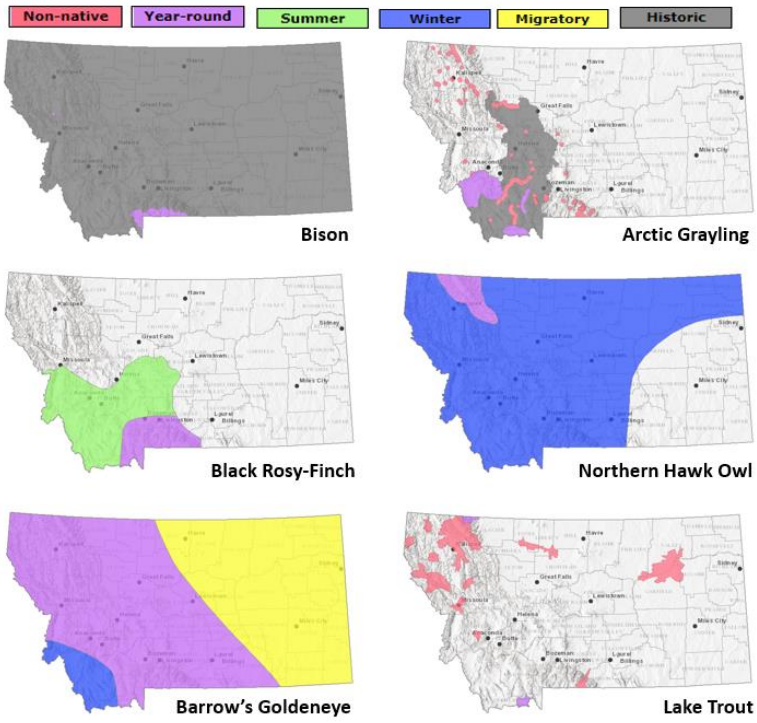
The location of a verified observation or specimen record typically known or assumed to represent a breeding population or a portion of a breeding population. Animal SO's are generally: (1) buffers of terrestrial point observations based on documented species' home range sizes; (2) buffers of stream segments to encompass occupied streams and immediate adjacent riparian habitats; (3) polygonal features encompassing known or likely breeding populations (e.g., a wetland for some amphibians or a forested portion of a mountain range for some wide ranging carnivores); or (4) combinations of the above. Tabular information for multiple observations at the same SO location is generally linked to a single polygon. Species Occurrence polygons may encompass some unsuitable habitat in some instances in order to avoid heavy data processing associated with clipping out habitats that are readily assessed as unsuitable by the data user (e.g., a point buffer of a terrestrial species may overlap into a portion of a lake that is obviously inappropriate habitat for the species). Animal SO's are only created for Species of Concern and Special Status Species (e.g., Bald Eagle).

Other Occurrence Polygons

These include significant biological features not included in the above categories, such as Important Animal Habitats like bird rookeries and bat roosts, and peatlands or other wetland and riparian communities that support diverse plant and animal communities.

Geographic Range Polygons

Geographic range polygons are still under development for most plant and invertebrate species. Native year-round, summer, winter, migratory and historic geographic range polygons as well as polygons for introduced populations have been defined for most vertebrate animal species for which there are enough observations, surveys, and knowledge of appropriate seasonal habitat use to define them (see examples to left). These native or introduced range polygons bound the extent of known or likely occupied habitats for non-migratory and relative sedentary species and the regular extent of known or likely occupied habitats for migratory and long-distance dispersing species; polygons may include unsuitable intervening habitats. For most species, a single polygon can represent the year-round or seasonal range, but breeding ranges of some colonial nesting water birds and some introduced species are represented more patchily when supported by data. Some ranges are mapped more broadly than actual distributions in order to be visible on statewide maps (e.g., fish).



Predicted Suitable Habitat Models

Predicted habitat suitability models have been created for plant and animal Species of Concern and are undergoing development for non-Species of Concern. For species for which models have been completed, the environmental summary report includes simple rule-based associations with streams for aquatic species and seasonal habitats for game species as well as mathematically complex Maximum Entropy models (Phillips et al. 2006, Ecological Modeling 190:231-259) constructed from a variety of statewide biotic and abiotic layers and presence only data for individual species for most terrestrial species. For the Maximum Entropy models, we reclassified 90 x 90-meter continuous model output into suitability classes (unsuitable, low, moderate, and optimal) then aggregated that into the one square mile hexagons used in the environmental summary report; this is the finest spatial scale we suggest using this information in management decisions and survey planning. Full model write ups for individual species that discuss model goals, inputs, outputs, and evaluation in much greater detail are posted on the MTNHP's Predicted Suitable Habitat Models webpage. Evaluations of predictive accuracy and specific limitations are included with the metadata for models of individual species. **Model outputs should not be used in place of on-the-ground surveys for species. Instead model outputs should be used in conjunction with habitat evaluations to determine the need for on-the-ground surveys for species.** We suggest that the percentage of predicted optimal and moderate suitable habitat within the report area be used in conjunction with geographic range polygons and the percentage of commonly associated habitats to generate lists of potential species that may occupy broader landscapes for the purposes of landscape-level planning.

Associated Habitats

Within the boundary of the intersected hexagons, we provide the approximate percentage of commonly or occasionally associated habitat for vertebrate animal species that regularly breed, overwinter, or migrate through the state; a detailed list of commonly and occasionally associated habitats is provided in individual species accounts in the Montana Field Guide We assigned common or occasional use of each of the ecological

systems mapped in Montana by: (1) using personal knowledge and reviewing literature that summarizes the breeding, overwintering, or migratory habitat requirements of each species; (2) evaluating structural characteristics and distribution of each ecological system relative to the species' range and habitat requirements; (3) examining the observation records for each species in the state-wide point observation database associated with each ecological system; and (4) calculating the percentage of observations associated with each ecological system relative to the percent of Montana covered by each ecological system to get a measure of numbers of observations versus availability of habitat. Species that breed in Montana were only evaluated for breeding habitat use, species that only overwinter in Montana were only evaluated for overwintering habitat use, and species that only migrate through Montana were only evaluated for migratory habitat use. In general, species were listed as associated with an ecological system if structural characteristics of used habitat documented in the literature were present in the ecological system or large numbers of point observations were associated with the ecological system. However, species were not listed as associated with an ecological system if there was no support in the literature for use of structural characteristics in an ecological system, even if point observations were associated with that system. Common versus occasional association with an ecological system was assigned based on the degree to which the structural characteristics of an ecological system matched the preferred structural habitat characteristics for each species as represented in the scientific literature. The percentage of observations associated with each ecological system relative to the percent of Montana covered by each ecological system was also used to guide assignment of common versus occasional association.

We suggest that the percentage of commonly associated habitat within the report area be used in conjunction with geographic range polygons and the percentage of predicted optimal and moderate suitable habitat from predictive models to generate lists of potential species that may occupy broader landscapes for the purposes of landscape-level planning. Users of this information should be aware that land cover mapping accuracy is particularly problematic when the systems occur as small patches or where the land cover types have been altered over the past decade. Thus, particular caution should be used when using the associations in assessments of smaller areas (e.g., evaluations of public land survey sections).

Introduction to Land Cover

Land Use/Land Cover is one of 15 Montana Spatial Data Infrastructure framework layers considered vital for making statewide maps of Montana and understanding its geography. The layer records all Montana natural vegetation, land cover and land use, classified from satellite and aerial imagery, mapped at a scale of 1:100,000, and interpreted with supporting ground-level data. The baseline map is adapted from the Northwest ReGAP (NWGAP) project land cover classification, which used 30m resolution multi-spectral Landsat imagery acquired between 1999 and 2001. Vegetation classes were drawn from the Ecological System Classification developed by NatureServe (Comer et al. 2003). The land cover classes were developed by Anderson et al. (1976). The NWGAP effort encompasses 12 map zones. Montana overlaps seven of these zones. The two NWGAP teams responsible for the initial land cover mapping effort in Montana were Sanborn and NWGAP at the University of Idaho. Both Sanborn and NWGAP employed a similar modeling approach in which Classification and Regression Tree (CART) models were applied to Landsat ETM+ scenes. The Spatial Analysis Lab within the Montana Natural Heritage Program was responsible for developing a seamless Montana land cover map with a consistent statewide legend from these two separate products. Additionally, the Montana land cover layer incorporates several other land cover and land use products (e.g., MSDI Structures and Transportation themes and the Montana Department of Revenue Final Land Unit classification) and reclassifications based on plot-level data and the latest NAIP imagery to improve accuracy and enhance the usability of the theme. Updates are done as partner support and funding allow, or when other MSDI datasets can be incorporated. Recent updates include fire perimeters and agricultural land use (annually), energy developments such as wind, oil and gas installations (2014), roads, structures and other impervious surfaces (various years): and local updates/improvements to specific ecological systems (e.g., central Montana grassland and sagebrush ecosystems). Current and previous versions of the Land Use/Land Cover layer with full metadata are available for download at the Montana State Library's Geographic Information Clearinghouse

Within the report area you have requested, land cover is summarized by acres of Level 1, Level 2, and Level 3 Ecological Systems.

Literature Cited

Anderson, J.R. E.E. Hardy, J.T. Roach, and R.E. Witmer. 1976. A land use and land cover classification system for use with remote sensor data. U.S. Geological Survey Professional Paper 964.

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological systems of the United States: A working classification of U.S. terrestrial systems. NatureServe, Arlington, VA.

Introduction to Wetland and Riparian

Within the report area you have requested, wetland and riparian mapping is summarized by acres of each classification present. Summaries are only provided for modern MTNHP wetland and riparian mapping and not for outdated (NWI Legacy) or incomplete (NWI Scalable) mapping efforts; described here. MTNHP has made all three of these datasets and associated metadata available for separate download on the Montana Wetland and Riparian Framework web page.

Wetland and Riparian mapping is one of 15 Montana Spatial Data Infrastructure framework layers considered vital for making statewide maps of Montana and understanding its geography. The wetland and riparian framework layer consists of spatial data representing the extent, type, and approximate location of wetlands, riparian areas, and deep water habitats in Montana.

Wetland and riparian mapping is completed through photointerpretation of 1-m resolution color infrared aerial imagery acquired from 2005 or later. A coding convention using letters and numbers is assigned to each mapped wetland. These letters and numbers describe the broad landscape context of the wetland, its vegetation type, its water regime, and the kind of alterations that may have occurred. Ancillary data layers such as topographic maps, digital elevation models, soils data, and other aerial imagery sources are also used to improve mapping accuracy. Wetland mapping follows the federal Wetland Mapping Standard and classifies wetlands according to the Cowardin classification system of the National Wetlands Inventory (NWI) (Cowardin et al. 1979, FGDC Wetlands Subcommittee 2013). Federal, State, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands differently than the NWI. Similar coding, based on U.S. Fish and Wildlife Service conventions, is applied to riparian areas (U.S. Fish and Wildlife Service 2009). These are mapped areas where vegetation composition and growth is influenced by nearby water bodies, but where soils, plant communities, and hydrology do not display true wetland characteristics. **These data are intended for use at a scale of 1:12,000 or smaller. Mapped wetland and riparian areas do not represent precise boundaries and digital wetland data cannot substitute for an on-site determination of jurisdictional wetlands.**

See a detailed overview, with examples, of both wetland and riparian classification systems and associated codes

Literature Cited

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service, FWS/OBS-79/31. Washington, D.C. 103pp.

Federal Geographic Data Committee. 2013. Classification of wetlands and deepwater habitats of the United States. FGDC-STD-004-2013. Second Edition. Wetlands Subcommittee, Federal Geographic Data Committee and U.S. Fish and Wildlife Service, Washington, D.C.

U.S. Fish and Wildlife Services. 2009. A system for mapping riparian areas in the western United States. Division of Habitat and Resource Conservation, Branch of Resource and Mapping Support, Arlington, Virginia.

Introduction to Land Management

Within the report area you have requested, land management information is summarized by acres of federal, state, and local government lands, tribal reservation boundaries, private conservation lands, and federal, state, local, and private conservation easements. Acreage for "Owned", "Tribal", or "Easement" categories represents non-overlapping areas that may be totaled. However, "Other Boundaries" represents managed areas such as National Forest boundaries containing private inholdings and other mixed ownership which may cause boundaries to overlap (e.g. a wilderness area within a forest). Therefore, acreages may not total in a straight-forward manner.

Because information on land stewardship is critical to effective land management, the Montana Natural Heritage Program (MTNHP) began compiling ownership and management data in 1997. The goal of the Montana Land Management Database is to manage a single, statewide digital data set that incorporates information from both public and private entities. The database assembles information on public lands, private conservation lands, and conservation easements held by state and federal agencies and land trusts and is updated on a regular basis. Since 2011, the Information Management group in the Montana State Library's Digital Library Division has led the Montana Land Management Database in partnership with the MTNHP.

Public and private conservation land polygons are attributed with the name of the entity that owns it. The data are derived from the statewide Montana Cadastral Parcel layer Conservation easement data shows land parcels on which a public agency or qualified land trust has placed a conservation easement in cooperation with the land owner. The dataset contains no information about ownership or status of the mineral estate. For questions about the dataset or to report errors, please contact the Montana Natural Heritage Program at (406) 444-5363 or mtnhp@mt.gov. You can download various components of the Land Management Database and view associated metadata at the Montana State Library's GIS Data List at the following links:

Public Lands
Conservation Easements
Private Conservation Lands
Managed Areas

Map features in the Montana Land Management Database or summaries provided in this report are not intended as a legal depiction of public or private surface land ownership boundaries and should not be used in place of a survey conducted by a licensed land surveyor. Similarly, map features do not imply public access to any lands. The Montana Natural Heritage Program makes no representations or warranties whatsoever with respect to the accuracy or completeness of this data and assumes no responsibility for the suitability of the data for a particular purpose. The Montana Natural Heritage Program will not be liable for any damages incurred as a result of errors displayed here. Consumers of this information should review or consult the primary data and information sources to ascertain the viability of the information for their purposes.

Introduction to Invasive and Pest Species

Within the report area you have requested, separate summaries are provided for: Aquatic Invasive Species, Noxious Weeds, Agricultural Pests, Forest Pests, and Biocontrol species that have been documented or potentially occur there based on the predicted suitability of habitat. Definitions for each of these invasive and pest species categories can be found on our Species Status Codes page.

Each of these summaries provides the following information when present for a species: (1) the number of observations of each species; (2) the geographic range polygons for each species, if developed, that the report area overlaps; (3) predicted relative habitat suitability classes that are present if a predicted suitable habitat model has been created; (4) the percent of the report area that is mapped as commonly associated or occasionally associated habitat as listed for each species in the Montana Field Guide; and (5) links to species accounts in the Montana Field Guide. Details on each of these information categories are included under relevant section headers under the Introduction to Native Species above or are defined on our Species Status Codes page. In presenting this information, the Montana Natural Heritage Program (MTNHP) is working towards assisting the user with rapidly determining what invasive and pest species have been documented and what species are potentially present in the report area. We remind users that this information is likely incomplete as surveys to document introduced species are lacking in many areas of the state, information on introduced species has only been tracked relatively recently, the MTNHP's staff and resources are limited, and information is constantly being added and updated in our databases. **Thus, field verification by professional biologists of the absence or presence of species will always be an important obligation of users of our data.**

If you are aware of observation or survey datasets for invasive or pest species that the MTNHP is missing, please report them to the Program Coordinator bmaxell@mt.gov Program Botanist apipp@mt.gov or Senior Zoologist dbachen@mt.gov. If you have observations that you would like to contribute, you can submit animal observations using our online data entry system at mtnhp.org/AddObs or via Excel spreadsheets posted at mtnhp.org/observations.asp

Additional Information Resources

- MTNHP Staff Contact Information
- Montana Field Guide
- MTNHP Species of Concern Report - Animals and Plants
- MTNHP Species Status Codes - Explanation
- MTNHP Predicted Suitable Habitat Models (for select Animals and Plants)
- MTNHP Request Information page
- Montana Cadastral
- Montana Code Annotated
- Montana Fisheries Information System
- Montana Fish, Wildlife, and Parks Subdivision Recommendations
- Montana GIS Data Layers
- Montana GIS Data Bundler
- Montana Greater Sage-Grouse Project Submittal Site
- Montana Ground Water Information Center
- Montana Index of Environmental Permits, 21st Edition (2018)
- Montana Environmental Policy Act (MEPA)
- Montana Environmental Policy Act Analysis Resource List
- Laws, Treaties, Regulations, and Agreements on Animals and Plants
- Montana Spatial Data Infrastructure Layers
- Montana State Historic Preservation Office Review and Compliance
- Montana Stream Permitting: a guide for conservation district supervisors and others
- Montana Water Information System
- Montana Web Map Services
- National Environmental Policy Act
- Penalties for Misuse of Fish and Wildlife Location Data (MCA 87-6-222)
- U.S. Fish and Wildlife Service Information for Planning and Consultation (Section 7 Consultation)
- Web Soil Survey Tool

APPENDIX C

U.S. Fish and Wildlife Service Information for Planning and Consultation Report

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Granite County, Montana

Local office

Montana Ecological Services Field Office

(406) 449-5225
(406) 449-5339

585 Shephard Way, Suite 1
Helena, MT 59601-6287

https://fws.gov/office/montana-ecological-services

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).

2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Canada Lynx Lynx canadensis There is **final** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/3652	Threatened
North American Wolverine Gulo gulo luscus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5123	Proposed Threatened

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Conifers and Cycads

NAME	STATUS
Whitebark Pine Pinus albicaulis Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/1748	Proposed Threatened

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON

Bald Eagle Haliaeetus leucocephalus — Breeds Jan 1 to Aug 31
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1626

Cassin's Finch Carpodacus cassinii — Breeds May 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9462

Evening Grosbeak Coccothraustes vespertinus — Breeds May 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Golden Eagle Aquila chrysaetos — Breeds Jan 1 to Aug 31
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1680

Rufous Hummingbird selasphorus rufus — Breeds Apr 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8002

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

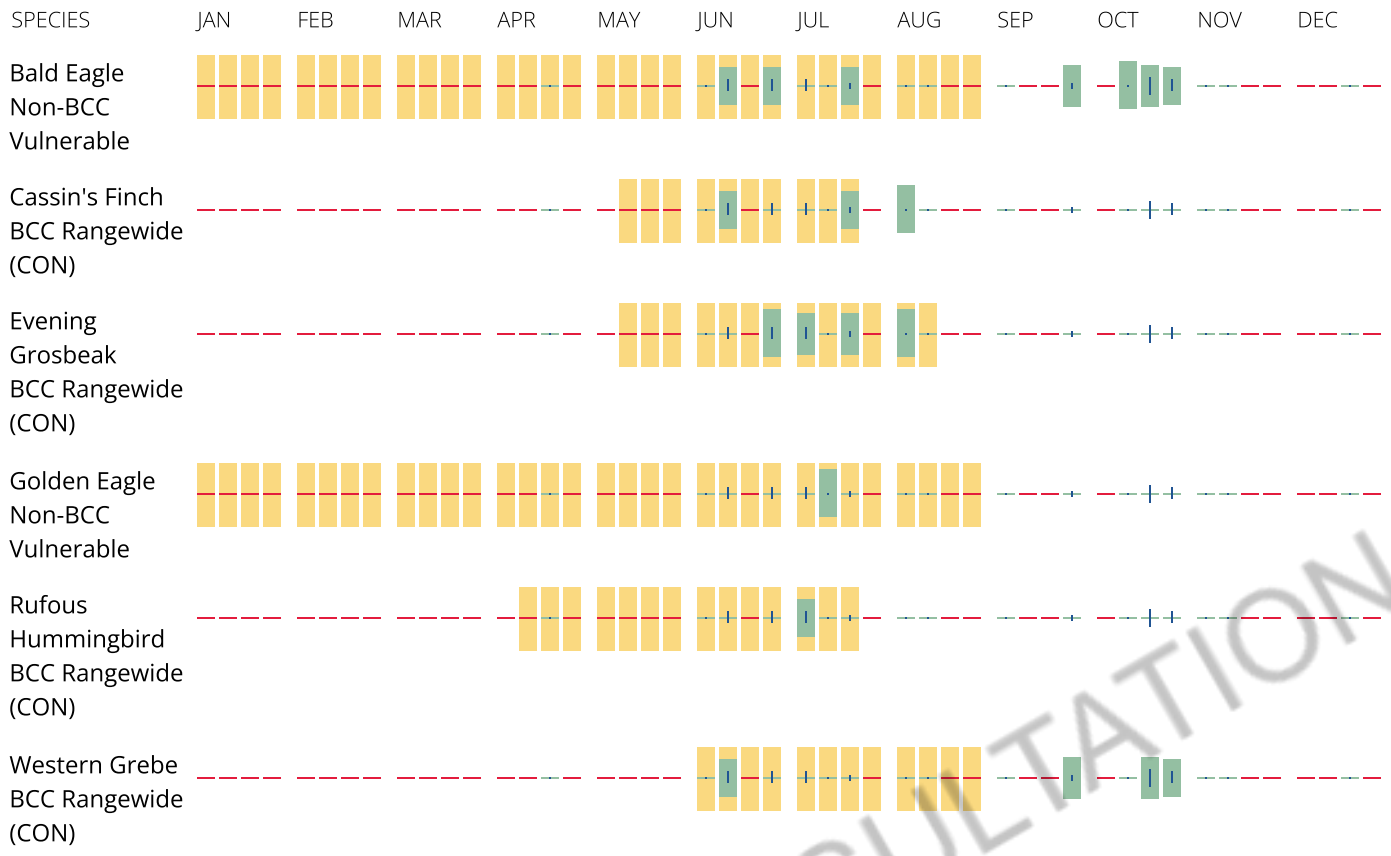
Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

▪ probability of presence ▪ breeding season | survey effort – no data



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact

Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Coastal Barrier Resources System

Projects within the John H. Chafee Coastal Barrier Resources System (CBRS) may be subject to the restrictions on federal expenditures and financial assistance and the consultation requirements of the Coastal Barrier Resources Act (CBRA) (16 U.S.C. 3501 et seq.). For more information, please contact the local Ecological Services Field Office or visit the CBRA Consultations website. The CBRA website provides tools such as a flow chart to help determine whether consultation is required and a template to facilitate the consultation process.

There are no known coastal barriers at this location.

Data limitations

The CBRS boundaries used in IPaC are representations of the controlling boundaries, which are depicted on the official CBRS maps. The boundaries depicted in this layer are not to be considered authoritative for in/out determinations close to a CBRS boundary (i.e., within the "CBRS Buffer Zone" that appears as a

hatched area on either side of the boundary). For projects that are very close to a CBRS boundary but do not clearly intersect a unit, you may contact the Service for an official determination by following the instructions here: https://www.fws.gov/service/coastal-barrier-resources-system-property-documentation

Data exclusions

CBRS units extend seaward out to either the 20- or 30-foot bathymetric contour (depending on the location of the unit). The true seaward extent of the units is not shown in the CBRS data, therefore projects in the offshore areas of units (e.g., dredging, breakwaters, offshore wind energy or oil and gas projects) may be subject to CBRA even if they do not intersect the CBRS data. For additional information, please contact CBRA@fws.gov.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER EMERGENT WETLAND

Palustrine

RIVERINE

Riverine

A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should

seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Granite County, Montana

Local office

Montana Ecological Services Field Office

(406) 449-5225
(406) 449-5339

585 Shephard Way, Suite 1
Helena, MT 59601-6287

https://fws.gov/office/montana-ecological-services

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).

2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Canada Lynx Lynx canadensis There is **final** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/3652	Threatened
Grizzly Bear Ursus arctos horribilis There is **proposed** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/7642	Threatened
North American Wolverine Gulo gulo luscus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5123	Proposed Threatened

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON

Bald Eagle Haliaeetus leucocephalus — Breeds Jan 1 to Aug 31
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1626

Cassin's Finch Carpodacus cassinii — Breeds May 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9462

Evening Grosbeak Coccothraustes vespertinus — Breeds May 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Golden Eagle Aquila chrysaetos — Breeds Jan 1 to Aug 31
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1680

Rufous Hummingbird selasphorus rufus — Breeds Apr 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8002

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

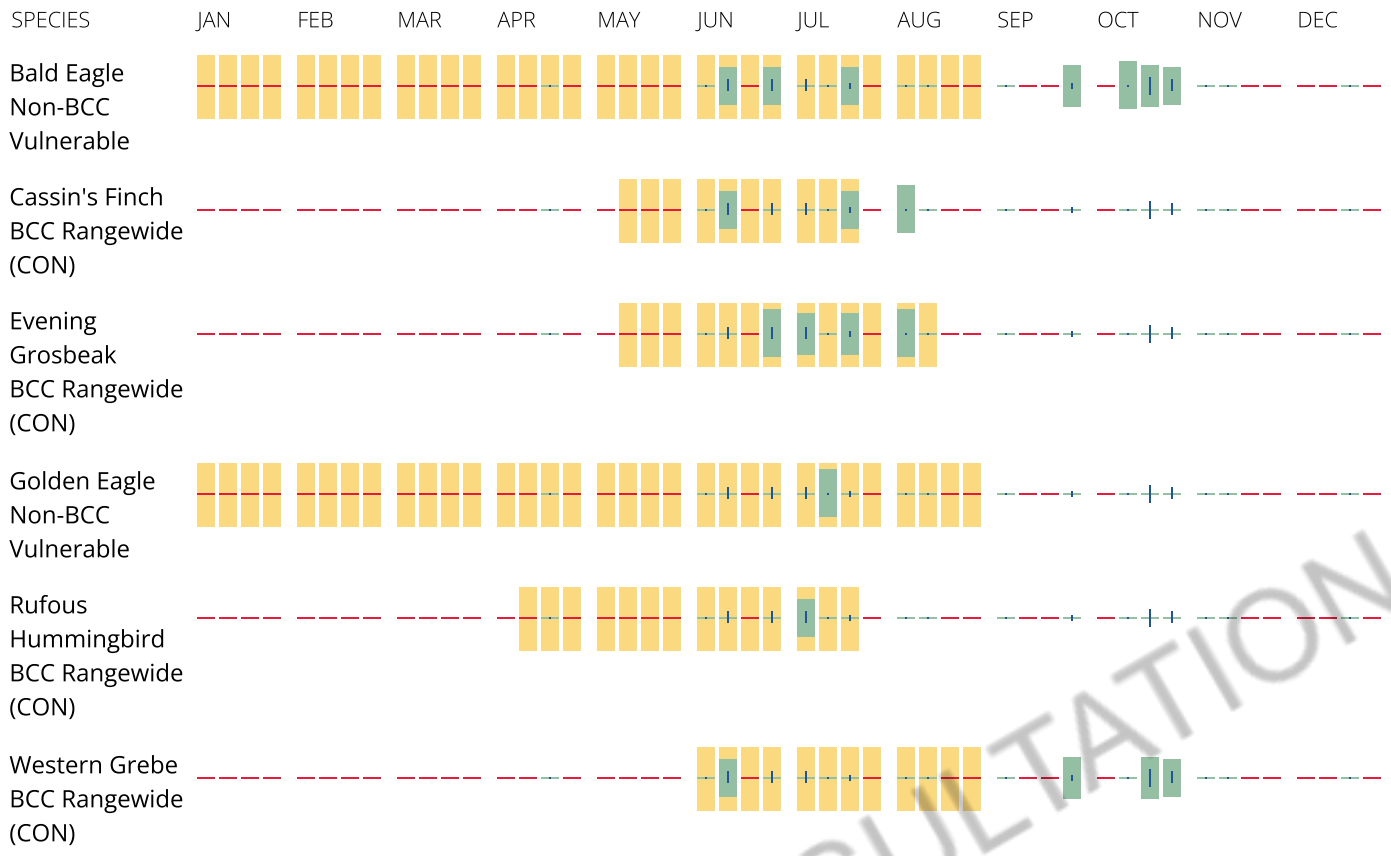
Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

▪ probability of presence ▪ breeding season | survey effort – no data



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact

Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Coastal Barrier Resources System

Projects within the John H. Chafee Coastal Barrier Resources System (CBRS) may be subject to the restrictions on federal expenditures and financial assistance and the consultation requirements of the Coastal Barrier Resources Act (CBRA) (16 U.S.C. 3501 et seq.). For more information, please contact the local Ecological Services Field Office or visit the CBRA Consultations website. The CBRA website provides tools such as a flow chart to help determine whether consultation is required and a template to facilitate the consultation process.

There are no known coastal barriers at this location.

Data limitations

The CBRS boundaries used in IPaC are representations of the controlling boundaries, which are depicted on the official CBRS maps. The boundaries depicted in this layer are not to be considered authoritative for in/out determinations close to a CBRS boundary (i.e., within the "CBRS Buffer Zone" that appears as a

hatched area on either side of the boundary). For projects that are very close to a CBRS boundary but do not clearly intersect a unit, you may contact the Service for an official determination by following the instructions here: https://www.fws.gov/service/coastal-barrier-resources-system-property-documentation

Data exclusions

CBRS units extend seaward out to either the 20- or 30-foot bathymetric contour (depending on the location of the unit). The true seaward extent of the units is not shown in the CBRS data, therefore projects in the offshore areas of units (e.g., dredging, breakwaters, offshore wind energy or oil and gas projects) may be subject to CBRA even if they do not intersect the CBRS data. For additional information, please contact CBRA@fws.gov.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Wetland information is not available at this time

This can happen when the National Wetlands Inventory (NWI) map service is unavailable, or for very large projects that intersect many wetland areas. Try again, or visit the NWI map to view wetlands at this location.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

APPENDIX D

Department of Environmental Quality – Assessment Record Summary (TMDL)

Assessment Record Summary

Reporting Cycle: 2020 **Assessment Record:** MT76E002_020 **Status:** Unassigned

WATER INFORMATION — Status: Unassigned

Reporting Cycle: 2020

Assessment Unit: MT76E002_020

Name: East Fork Rock Creek

Location Description: EAST FORK ROCK CREEK, East Fork Reservoir to mouth (Middle Fork Rock Creek)

Water Type:	Size (Miles/Acres)	Use Class:
RIVER	9.74 MILES	B-1

Trophic Status:

Trophic Trend:

1 - Hydrologic Unit Code: 17010202

2 - HUC Name: Flint-Rock

3 - Watershed: Pend Oreille

4 - Basin: Columbia

5 - TMDL Planning Area: Rock

6 - Ecoregion: Middle Rockies

7 - County: Granite County

8 - LAT/LONG AU Upstream: Start: 46.130474 / -113.381046

9 - LAT/LONG AU Downstream: End: 46.19993 / -113.500125

Water Quality Category: 4A - All TMDLs needed to rectify all identified threats or impairments have been completed and approved.

Assessment Record Summary

Reporting Cycle: 2020 **Assessment Record:** MT76E002_020 **Status:** Unassigned

Beneficial Use Support Information

Use Name	Fully Supporting	Not Fully Supporting	Threatened	Insufficient Information	Not Assessed
Aquatic Life		X			
Agricultural					X
Drinking Water					X
Primary Contact Recreation		X			

Assessment Information

Use Name	Assessment Type	Assessment Confidence
NA		

Use Name	Assessment Methods
NA	

Impairment Information

Use Name	Probable Causes	Probable Sources	TMDL Completed
Aquatic Life	Alteration in stream-side or littoral vegetative covers	Grazing in Riparian or Shoreline Zones	N
	Chlorophyll-a	Grazing in Riparian or Shoreline Zones	N
		Source Unknown	
	Sedimentation/Siltation	Forest Roads (Road Construction and Use)	Y
		Grazing in Riparian or Shoreline Zones	
		Impacts from Hydrostructure Flow Regulation/modification	
		Crop Production (Irrigated)	
	Temperature	Grazing in Riparian or Shoreline Zones	Y
		Impacts from Hydrostructure Flow Regulation/modification	
		Crop Production (Irrigated)	
	Nitrogen, Total	Grazing in Riparian or Shoreline Zones	Y
		Agriculture	
	Phosphorus, Total	Grazing in Riparian or Shoreline Zones	Y
		Agriculture	
	Flow Regime Modification	Impacts from Hydrostructure Flow Regulation/modification	N
		Crop Production (Irrigated)	
Primary Contact Recreation	Chlorophyll-a	Grazing in Riparian or Shoreline Zones	N
		Source Unknown	
	Nitrogen, Total	Grazing in Riparian or Shoreline Zones	Y
		Agriculture	
	Phosphorus, Total	Grazing in Riparian or Shoreline Zones	Y

Assessment Record Summary

Reporting Cycle: 2020 **Assessment Record:** MT76E002_020 **Status:** Unassigned

Primary Contact Recreation	Phosphorus, Total	Agriculture

Assessment Record Summary

Reporting Cycle: 2020 **Assessment Record:** MT76E002_020 **Status:** Unassigned

Use Name	Observed Effects
NA	

Delisting / Category Changes

Cause	Reason for Change	Change Date	Comments
Chlorophyll-a	Not caused by a pollutant (4C)	01/28/2008	The pollutant/non-pollutant effect designation was changed from pollutant to non-pollutant.
Sedimentation/Siltation	TMDL Approved or established by EPA (4A)	09/30/2013	Refer to the TMDL document (http://deq.mt.gov/wqinfo/TMDL/finalReports.mcpx). Also addresses Alteration in Streamside or Littoral Vegetative Covers.
Temperature	TMDL Approved or established by EPA (4A)	09/30/2013	Refer to the TMDL document (http://deq.mt.gov/wqinfo/TMDL/finalReports.mcpx). Also partially addresses low flow alterations.
Nitrogen, Total	TMDL Approved or established by EPA (4A)	09/30/2013	Refer to the TMDL document (http://deq.mt.gov/wqinfo/TMDL/finalReports.mcpx).
Phosphorus, Total	TMDL Approved or established by EPA (4A)	09/30/2013	Refer to the TMDL document (http://deq.mt.gov/wqinfo/TMDL/finalReports.mcpx). Also addresses chlorophyll a.
Nitrogen, Nitrate	Applicable WQS attained, according to new assessment method	01/08/2014	Nutrient Assessment Framework indicates non-impairment.

APPENDIX E

Flint Creek Water Project – Cultural Resource Inventory System (24GN0964)

DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
HISTORIC CULTURAL RESOURCE SITE FORM

I. IDENTIFICATION: Smithsonian No.: 24GN0964 update **Field No.:** GR-1
DNRC Project No: 2010-7-2 **Site Name:** Flint Creek Water Project

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II. LOCATION: State: MT **County:** Granite

Land Status: United States Forest Service (Deer Lodge National Forest) and Private

1:24,000 USGS Maps: Carpp Ridge, MT (1971), Drummond, MT (1971), Georgetown Lake, MT (1971), Hall, MT (1971), Nirling Hill, MT (1971), Phillipsburg, MT (1971), Potato Lakes, MT (1971), Storm Lake, MT (1971)

Legal Description:

Dam: S1/2NE1/4 Section 6, T4N R14W;
Spillway: W1/2W1/2SE1/4NE1/4 Section 6, T4N R14W;
Reservoir: W1/2 Section 5, E1/2 Section 6, NE1/4NE1/4 Section 7, Section 8, and the NE1/4NW1/4 Section 17, T4N R14W;
East Fork of Rock Creek Diversion Structure: SE1/4NE1/4NW1/4NE1/4 Section 6, T4N R14W;
Main Flint Creek Canal Headgate: SW1/4NE1/4NW1/4NE1/4 Section 6, T4N R14W;
Main Flint Creek Canal: N1/2N1/2 Section 6, T4N R14W; NW1/4NW1/4 Section 19 and S1/2SW1/4 Section 31, T5N R14W; SW1/4 Section 13, E1/2SE1/4 Section 14, Section 23, N1/2 Section 24, W1/2 Section 25, NE1/4 Section 26, and the N1/2 Section 36, T5N R15W
East Canal: N1/2 and N1/2SW1/4Section 4, E1/2 and SE1/4SW1/4 Section 5, SE1/4NE1/4 Section 7, NW1/4 Section 8, T5N R14W; SE1/4 Section 27, NW1/4NE1/4 SE1/4 Section 33, and W1/2 Section 34, T6N R14W
Metcalf Canal: W1/2W1/2 Section 5, E1/2E1/2 Section 7, NW1/4NW1/4 Section 8, T5N R14W; Section 29, E1/2 Section 31, T6N R14W
Marshall Canal: W1/2 Section 3, E1/2NE1/4 Section 4, W1/2 Section 10, NW1/4 Section 15, Section 16, W1/2W1/2 Section 21, W1/2W1/2 Section 28, and the W1/2NW1/4 Section 33, T6N R14W; S1/2 and NW1/4 Section 16, Section 21, E1/2 Section 28, E1/2E1/2 Section 33, and the W1/2SW1/4 Section 34, T7N R14W
Allendale Canal: W1/2 Section 3, N1/2 Section 4, SE1/4 Section 9, W1/2 Section 10, E1/2E1/2 Section 16, NE1/4NE1/4 Section 21, T9N R13W; S1/2 Section 3, W1/2 Section 10, W1/2W1/2 Section 15, E1/2SE1/4 Section 16, E1/2 Section 20, N1/2 Section 21, NW1/4NW1/4 Section 32, NE1/4NE1/4 Section 32, S1/2NW1/4 Section 33, and the SW1/4 Section 34, T10N R13W

UTM: Zone 12, Datum: NAD83 conus

Dam center: 316, 072 **mE;** 5,111, 329 **mN**
Spillway (north end): 315, 901 **mE;** 5,111, 179 **mN**
Main Flint Creek Canal Headgate: 315, 733 **mE;** 5,111, 650 **mN**
Main Flint Creek Canal (point of diversion): 315, 734 **mE;** 5,111, 625 **mN**
Main Flint Creek Canal (tail out): 314, 238 **mE;** 5,116, 333 **mN**
East Canal (point of diversion): 315, 551 **mE;** 5,119, 355 **mN**
East Canal (tail out): 320, 335 **mE;** 5,123, 642 **mN**
Metcalf Canal (point of diversion): 315, 326 **mE;** 5,118, 726 **mN**
Metcalf Canal (tail out): 317, 332 **mE;** 5,124, 356 **mN**
Marshall Canal (point of diversion): 317, 546 **mE;** 5,122, 426 **mN**
Marshall Canal (tail out): 318, 433 **mE;** 5,137, 480 **mN**
Allendale Canal (point of diversion): 328, 756 **mE;** 5,154, 789 **mN**
Allendale Canal (tail out): 331, 009 **mE;** 5,168, 339 **mN**

III. ACCESS: From Philipsburg, MT follow highway 1 south ca. 7 miles to the secondary highway 38 intersection. Generally follow that road ca. 6 miles southerly to the East Fork Reservoir Dam.

IV. TYPE: Zoned earth fill dam and associated concrete chute spillway, a small gatehouse located at the south end of the dam crest, a reinforced concrete outlet conduit, a reservoir, a main diversion canal (Flint Creek Canal) , the East Canal, the Marshall Canal, the Allendale Canal, and the Metcalf Canal. Included features are diversion structures, headgates, and a siphon.

V. APPARENT PERIOD OF SITE USAGE OR CONSTRUCTION: Constructed in 1938 and still in use.

VI. SITE DIMENSIONS: As defined here, the site (the Flint Creek Water Project) is composed of seven primary features-- the East Fork of Rock Creek Dam, the East Fork of Rock Creek Reservoir, and the main (Flint Creek) diversion canal, the East Canal, the Marshall Canal, the Allendale Canal, and the Metcalf Canal. The property was constructed in 1938. Site boundaries are arbitrarily established based on the visible extent of the dam, reservoir, canal, spillways and associated structures. The dam is oriented NE to SW and has a structural height of 105 ft, a hydraulic height of 88 ft, a crest length of 1,083 ft, and a crest width of 25 ft. The portion of the concrete spillway below the crest of the dam is a trapezoidal chute that measures 60.5 ft wide at the top end, and tapers to 8 ft wide at the base.

The East Fork of Rock Creek Reservoir is ca. 2 miles in length, 500 yards wide, stores 16,040 acre-feet at the spillway crest, 19,850 acre-feet at the dam crest, and collects water from a 32 square mile area of high timbered slopes along the Continental Divide.

The main diversion canal (Flint Creek Canal) is 7.7 miles in length, ca. 10 yards in width, and has a maximum capacity of 200 CFS. It takes its point of diversion from the East Fork of Rock Creek and tails out approximately 2 miles to the north into Trout Creek feeds four delivery canals that supply irrigation water to the greater Phillipsburg valley. Although the Flint Creek canal largely consists of an open trench, a 4,056 ft long segment of the canal is routed subsurface through a 48” diameter PVC pipeline (siphon). The siphon segment is situated at the canal's approximate midpoint where it crosses the Rock Creek valley. The siphon segment of the canal has its southern point in the NW1/4 of Section 36 and its northern point in the NE1/4SW1/4 of Section 36, T5N R15W.

The East Canal is approximately 5 miles in length, the Metcalf Canal is approximately 6 miles in length, the Marshall Canal is approximately 14 miles in length, and the Allendale Canal is approximately 13.5 miles in length.

Methods Used: Visual inspection, construction maps, literature review, and technical specifications.

Surface Visibility: 5%-100% **Depth of Cultural Remains:** N/A **Associated Sites:** N/A

VII. DESCRIPTION (integrity, previous disturbance, description of materials observed): The East Fork of Rock Creek dam, reservoir, spillway, outlet, East Fork of Rock Creek diversion structure, Main Flint Creek Canal headgate, and a portion of the Main Flint Creek Canal are located on public land in the Deer Lodge National Forest administered by the U.S. Forest Service. The main diversion canal traverses federal, state and privately owned lands. The project is operated under a U.S. Forest Service special-use permit. The dam and reservoir are located near the headwaters of the East Fork of Rock Creek-- a tributary of Rock Creek in Granite County. The East Fork Reservoir dam is about 13 miles south of Philipsburg, Montana and approximately 25 miles from the town of Anaconda, Montana. The Flint Creek Water Project is owned by the Montana Department of Natural Resources and Conservation. The Flint Creek Water Users Association operates and maintains the Flint Creek Water Project. This was one of the early projects of the State Water Conservation Board. It was first presented to the Board in February 1934. The project was approved by the Board and financed by a loan and grant from the Public Works Administration. The Board awarded the contract for the dam to the Inland Construction Company of Omaha, Nebraska on July 18, 1936. The contract for the canal system was awarded to Clifton and Applegate of Anaconda, Montana. Total project costs were $264,223.75. The project was completed on November 30, 1938 and was in operation for the irrigation season of 1939 (State Engineer's Office 1959).

The dam's outlet works consists of a seven-foot diameter gate tower with two 54-inch diameter valves (slide emergency gate upstream and a butterfly-operating gate downstream). The controls are located in the gate tower. The spillway head is a concrete chute having a 60.5-foot wide crest. The chute tapers to an 8-foot wide trapezoidal at its base with a flip bucket energy dissipater. The dam was partially reconstructed in 1996. The construction work consisted of removing and replacing part of the embankment, improving the seepage collection system, installing relief wells, lining the left toe drain pipe, and adding a number of monitoring wells.

Water from the reservoir is used for irrigation, stock water supply, water-based recreation, and maintaining in-stream flows. Water retained in the reservoir provides supplemental irrigation water for 25,000 acres of land in the Flint Creek valley (State Engineer's Office 1959). The main canal extends from the East Fork of Rock Creek, 7.7 miles to Trout Creek. The main canal includes a concrete headgate and a 48-inch, 4,056 foot-long underground PVC pipe siphon. The dam and reservoir are easily visible from two Forest Service roads; one, which crosses over the dam, and another that runs along the east side of the reservoir.

VIII. WATER (leave blank if more than 1 mile from the site):

Permanent (name): East Fork Rock Creek Reservoir/ East Fork Rock Creek

Elevation: 6000 ft/ 1828 m ASL **Distance and Direction from Site:** At the south side of the dam face

IX. TOPOGRAPHY: The landforms in the immediate area consist of rocky hills, benches, and high terraces. The moderate to steep mountain slopes are dissected by narrow stream valleys, with larger, more open valleys downstream along the canal.

Site Elevation: ca. 5700-6100 ft/1737-1859 m ASL

X. GEOLOGY AND SOILS: Major soils found in the area are alluvial in nature, with clayey and loamy soil types the most prevalent. Soils in the general site area are characteristically shallow and well drained.

XI. VEGETATION: Douglas fir and subalpine fir climax forests are common throughout the area. Other species found include quaking aspen, Englemann spruce, lodgepole pine, pinegrass, common beargrass, elk sedge, Idaho fescue, common snowberry, wild rose, Oregon grape, blue huckleberry and sage. Willow, dogwood, and cottonwood are commonly found at lower elevations along the canal route.

XII. MANAGEMENT DATA:

A. X **Recorded** **Collected** X **Mapped** **Shovel/Auger Probed** **Excavated**
Stabilized **Other (explain):**

Detail the level of testing or research carried out: A general visual inspection and a detailed literature review were carried out.

Artifact Repository: N/A

B. **Project Impacts:** Installation of a fish screen within the Flint Creek Canal will have No Effect to historic properties because the structure itself will be a minor visual intrusion that will in no way impede the flow of water through the canal. Further, all areas of the canal that will be disturbed with fish screen installation work will be restored to preconstruction conditions. In contrast, replacement of the existing diversion structure in the East Fork of Rock Creek, and replacement of the concrete spillway, will diminish the qualities of the site that make it potentially eligible for listing in the National Register of Historic Places, thereby constituting Adverse Effects to historic properties.

Because the Flint Creek Water Project is actively used and maintained, various levels of rehabilitation and improvement work will occur to site 24GN0964 over the life of the system. Future proposed developments should be reviewed, and effects assessed, on a case by case basis.

Other Impacts: None presently recognized.

C. National Register Eligibility: Recommended as eligible in association with Criterion A values, and for the integrity it retains.

Discussion of Significance: As indicated on page 12 of National Register Bulletin #15 (NRB 15) a property can be considered significant in association with Criterion A if a relationship between the site and a significant event or pattern of events within a defined time period can be demonstrated. Additionally, "Mere association with historic events or trends is not enough, in and of itself, to qualify under Criterion A (NRB 15:12)". The Flint Creek Water Project is generally associated with agricultural development in the west, in the sense that it is part of ongoing agricultural practices in the region. However, as with most of the SWCB irrigation projects, construction of the Reservoir did not cause people to settle and take up agriculture in the Flint Creek valley. The Flint Creek valley was being settled for several decades prior to the construction of the Flint Creek Project, and when the Project was completed most of those who had filed on earlier water rights to Rock Creek and Flint Creek transferred or refiled on water redistributed through the Flint Creek Project via the Flint Creek Water User's Association. Undoubtedly, construction of the Reservoir had some stabilizing effect on agriculture in the area by supplying a constant flow of water over the summer months. How great that effect has been is difficult to determine as the number of individuals utilizing water from the Flint Creek Water Project for agricultural purposes has not increased appreciably from the 1935's to 1959 (Water Resources Survey 1959). The significance of the site is that it is one of many projects associated with the PWA which arose during the FDR New Deal administration. Further, the Flint Creek Water Project is one of the early irrigation projects funded by the SWCB. The SWCB not only formed as a result of the PWA, but is also unique to Montana and Montana State water conservation efforts. Because of that latter connection, the site appears to be significant in association with Criterion A.

A property is considered significant in association with Criterion B if a link between the site and a person significant in local, regional, or national history or prehistory can be demonstrated (NRB 15:14). Because no such association can be made, the site is recommended as insignificant in association with Criterion B.

A property can be considered significant in association with Criterion C if it can be demonstrated to, "Embody distinctive characteristics of a type, period, or method of construction (NRB 15:18)." In order for a property to meet that requirement it must exhibit a sufficient number of "distinctive characteristics" representative of a particular method of construction. Further, "Characteristics can be expressed in terms such as form, proportion, structure, plan, style, or materials. They can be general, referring to ideas of design and construction such as basic plan or form... (NRB 15:18)". Although Criterion C may be the most subjective of the NR criteria, it is hard to imagine that common, small scale earthen dams and canals were intended to be considered architecturally significant. Further, no unusual aspects such as unique engineering feats, or ethnic or temporally specific architecture was used to construct the dam. Because of this, the site is recommended as insignificant in association with Criterion C.

Finally, a property is considered significant in association with Criterion D if it has yielded, or may be likely to yield, information important in prehistory or history (NRB 15:21). To date, no subsurface investigations have been carried out to identify remnants of an original project construction camp. However, even if deposits associated with a worker's camp were identified, it is unclear what relevant research questions could be addressed through any associated cultural materials to provide a better understanding of important or unknown aspects of activities associated with small scale dam construction. As such, the site is recommended as insignificant in association with Criterion D.

Discussion of Integrity: Integrity is the ability of a property to convey its significance. To be listed in the National Register of Historic Places (NR), a property must not only be shown to be significant under the NR criteria, but it also must have integrity. The evaluation of integrity is sometimes a subjective judgment, but it must always be grounded in an understanding of a property's physical features and how they relate to its significance.

Historic properties either retain integrity (that is, they convey their significance) or they do not. Within the concept of integrity, the NR criteria recognize seven aspects or qualities that, in various combinations, define integrity. Those seven aspects are: location, design, setting, materials, workmanship, feeling, and association. The site retains integrity of location, design, setting, materials, workmanship and association. Integrity of feeling, however, is not readily apparent, but assessment of feeling may vary from individual to individual. Based on the

previous analysis, the site is recommended as significant for its association with Criterion A, and it appears to retain sufficient integrity to make the site eligible for listing in the National Register of Historic Places.

D. Known Collections, Publications, or Reports Pertaining to this Site:

State Engineer's Office

1959 *Water Resources Survey: Granite County, Montana*. State Water Conservation Board. Helena, MT.

E. References Cited:

State Engineer's Office

1959 *Water Resources Survey: Granite County, Montana*. State Water Conservation Board. Helena, MT.

F. Update: C. Atkins and P. Rennie **Date:** 10-28-2010

G. Map: Attach Site Sketch map (if applicable) and Photocopy of 7.5' Quad

Looking SW along a segment of the East Fork Reservoir dam face at the small gatehouse.

Looking SW at the SW margin of the East Fork Reservoir dam face (24GN0964).

Looking NW at the SW margin of the East Fork Reservoir dam face (24GN0964).

View of the East Fork Reservoir outlet (24GN0964).

View 1 of the East Fork Reservoir Spillway (24GN0964).

View 2 of the East Fork Reservoir Spillway (24GN0964).

View 3 of the East Fork Reservoir Spillway (24GN0964).

View SE from the Dam crest of the East Fork Reservoir (24GN0964).

View SE at the downstream dam face in site 24GN0964.

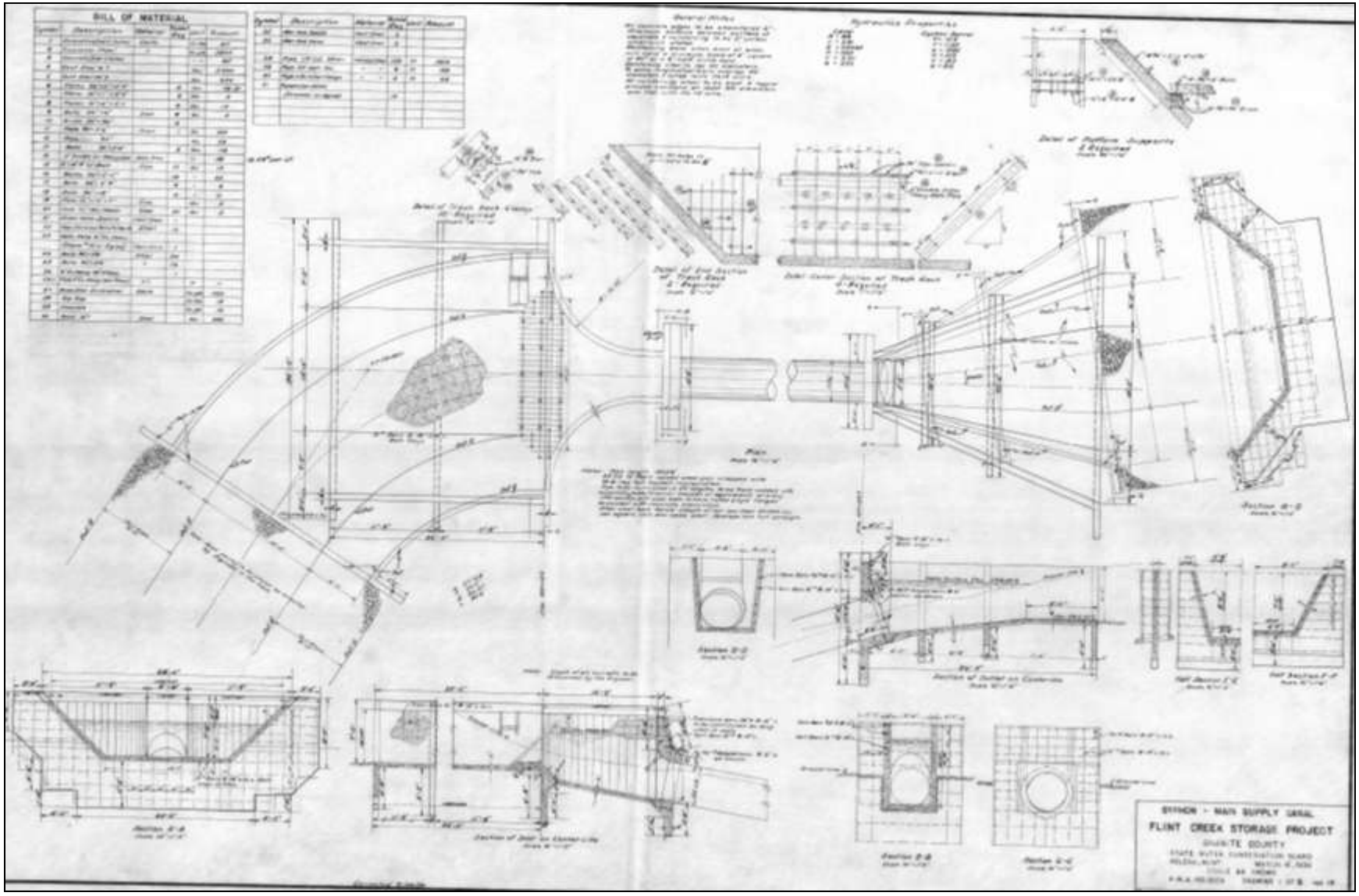
View NW at the upstream face of the headgate in site 24GN0964.

View W at the East Fork of Rock Creek diversion structure in site 24GN0964.

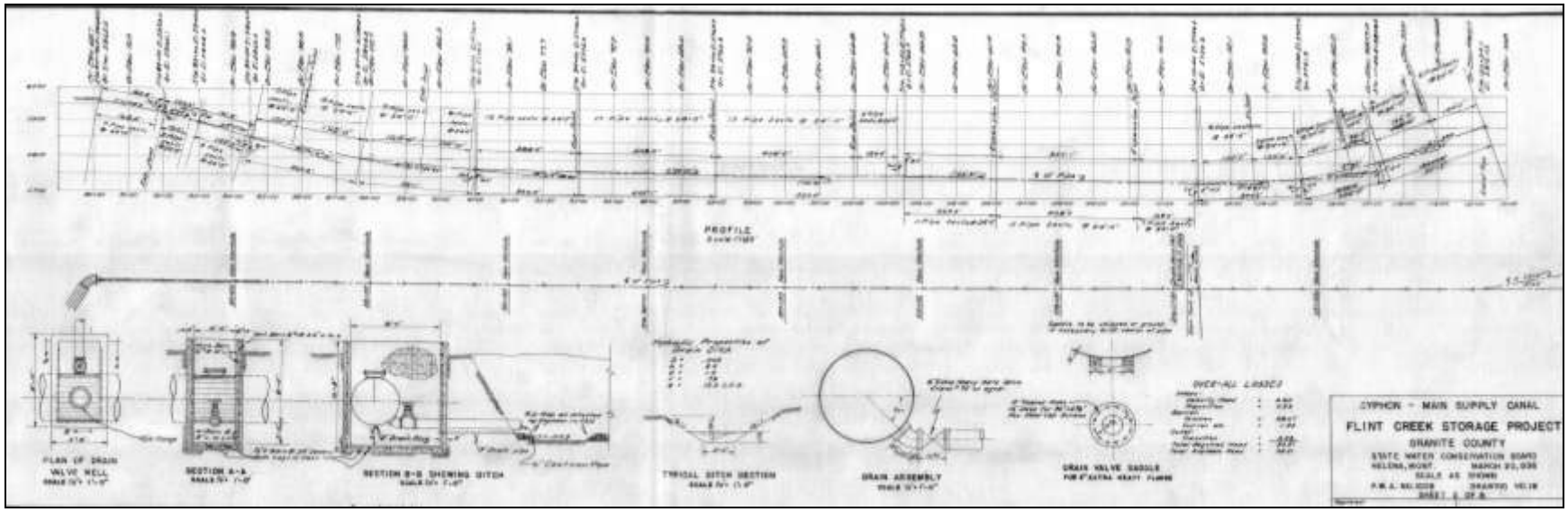
View E at the East Fork of Rock Creek diversion structure in site 24GN0964.


View N at the East Fork of Rock Creek diversion structure in site 24GN0964.

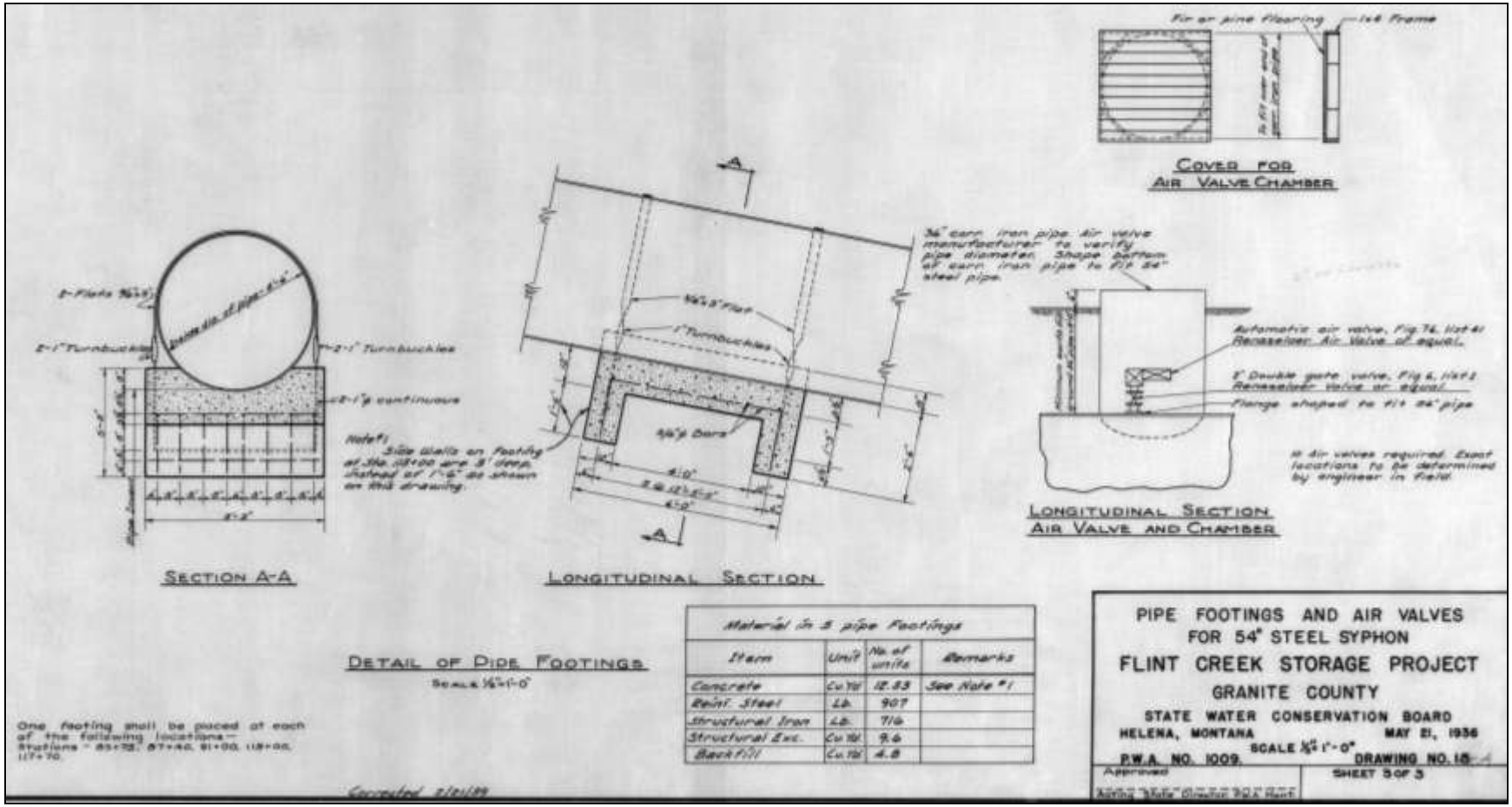
View NW at the Flint Creek Canal in site 24GN0964.



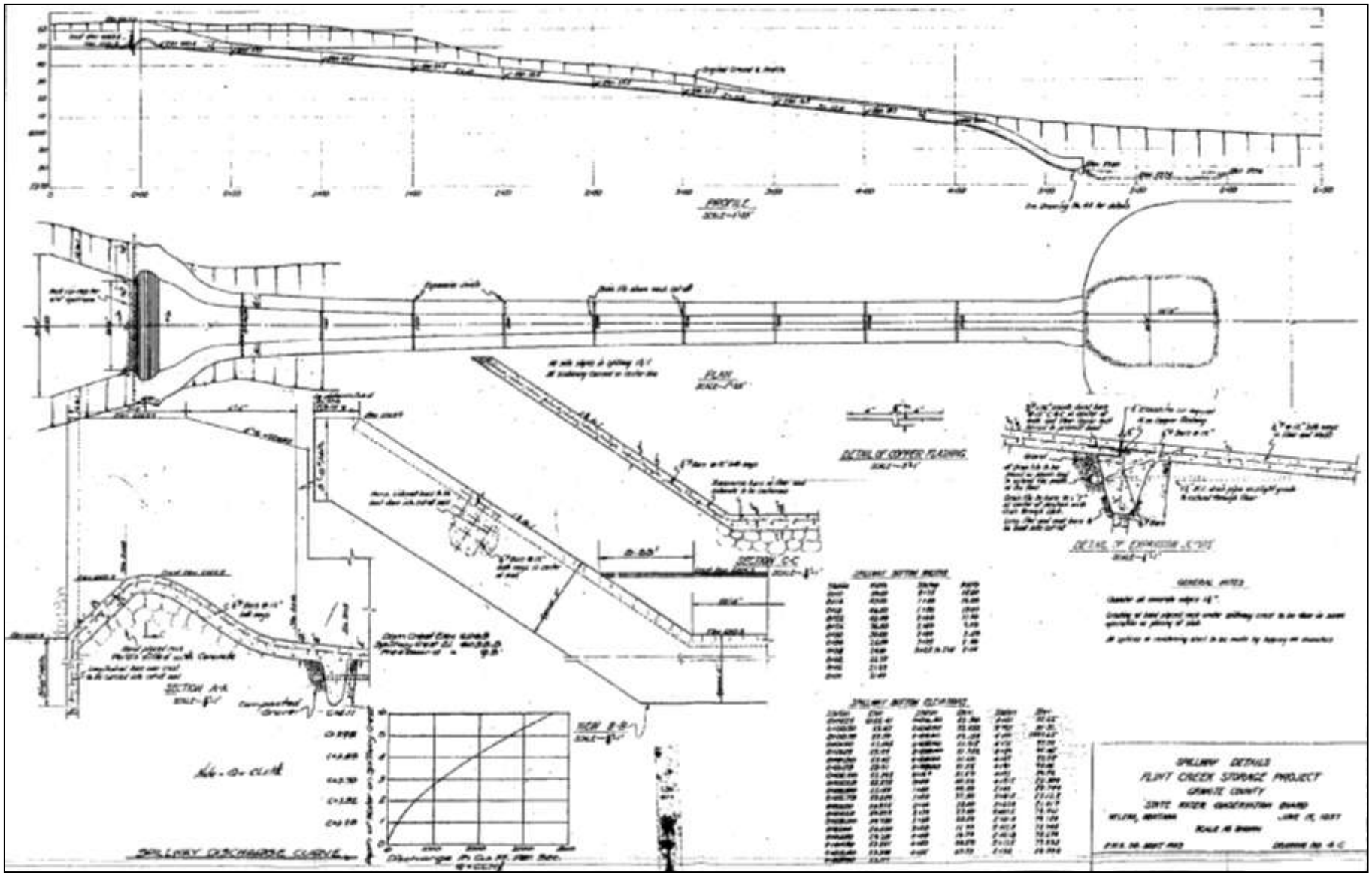
Technical drawing #1of siphon associated with 24GN0964.



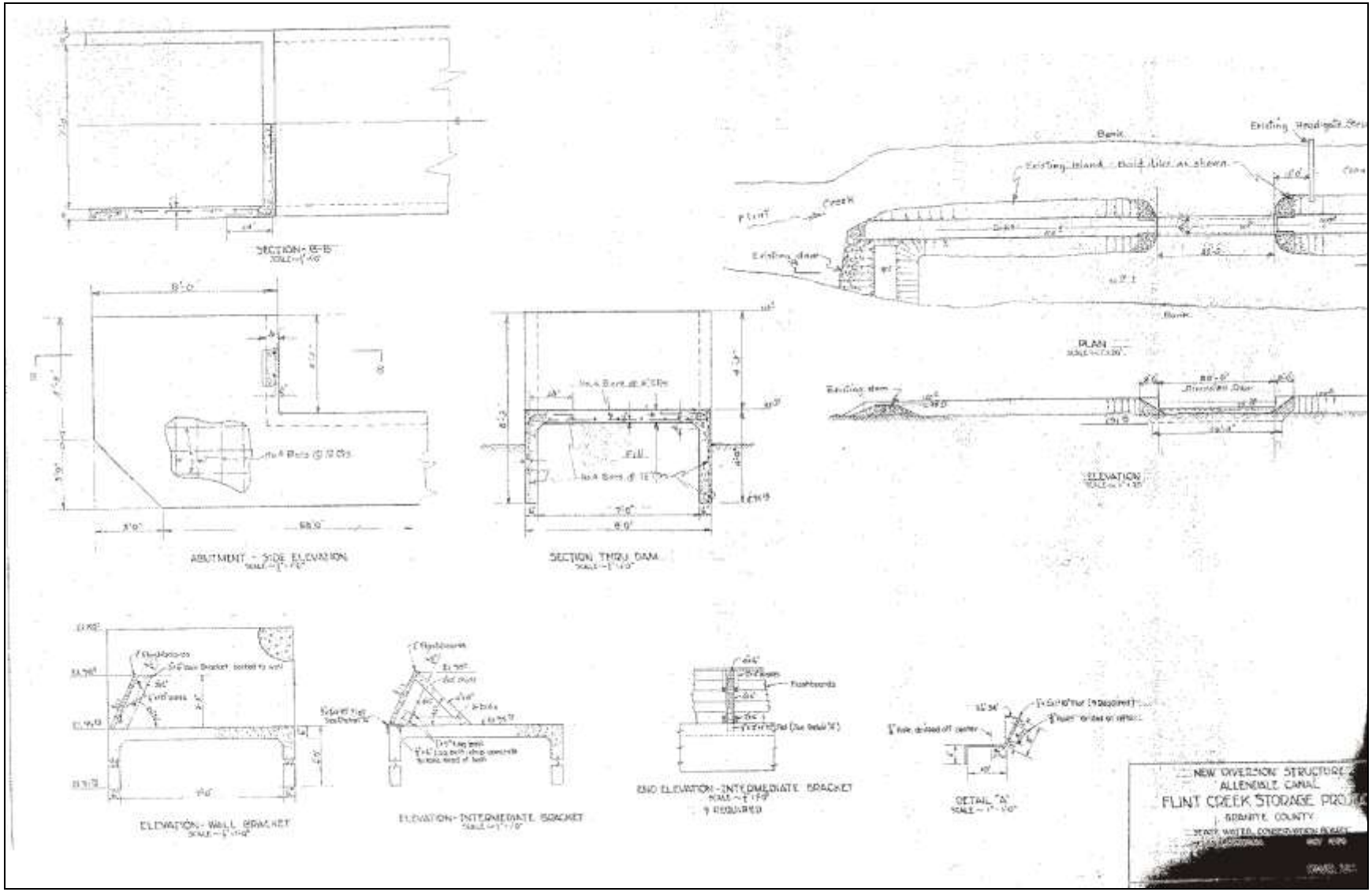
Technical drawing #2 of siphon associated with 24GN0964.



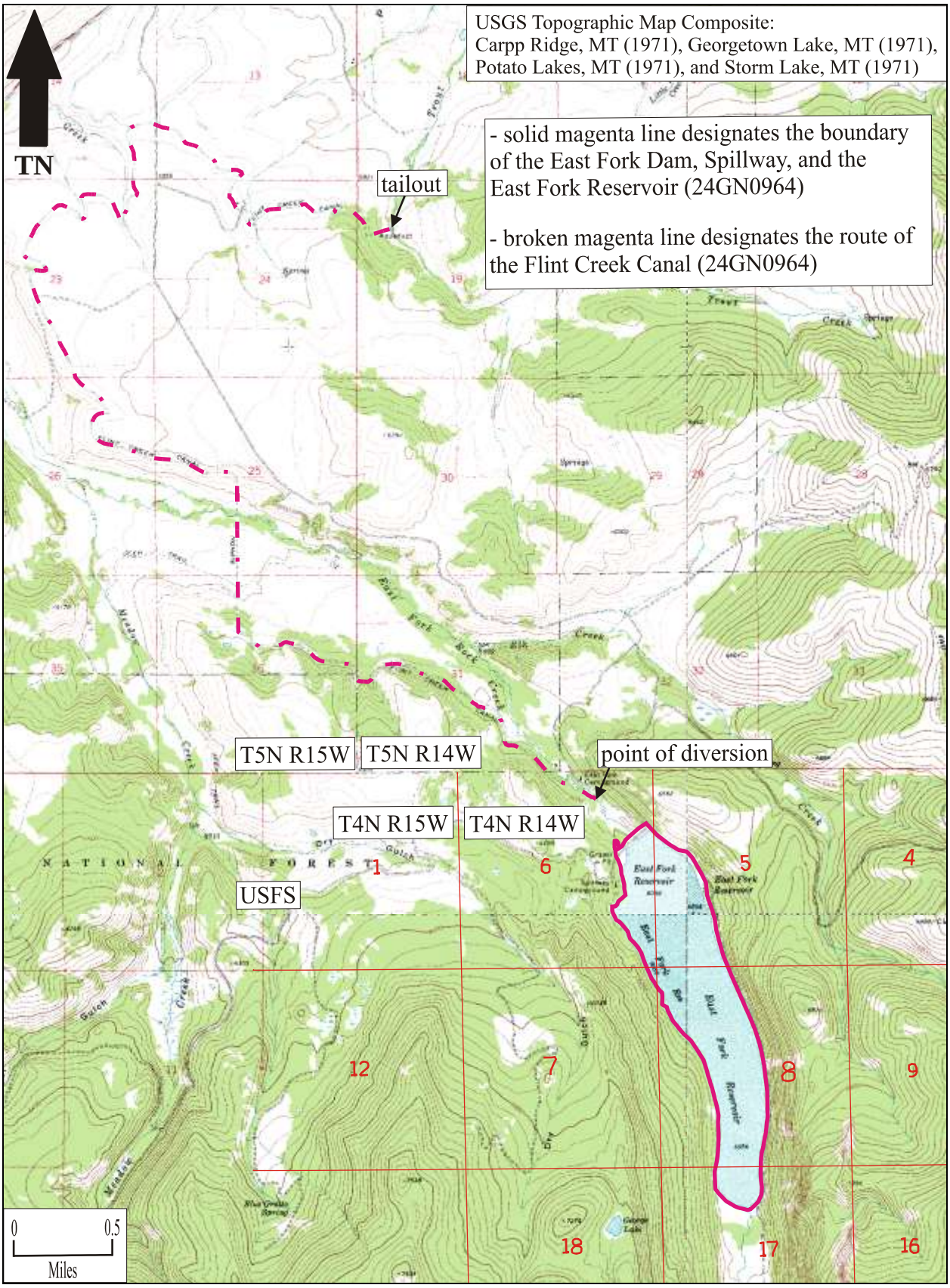
Technical drawing #3 of siphon associated with site 24GN0964.



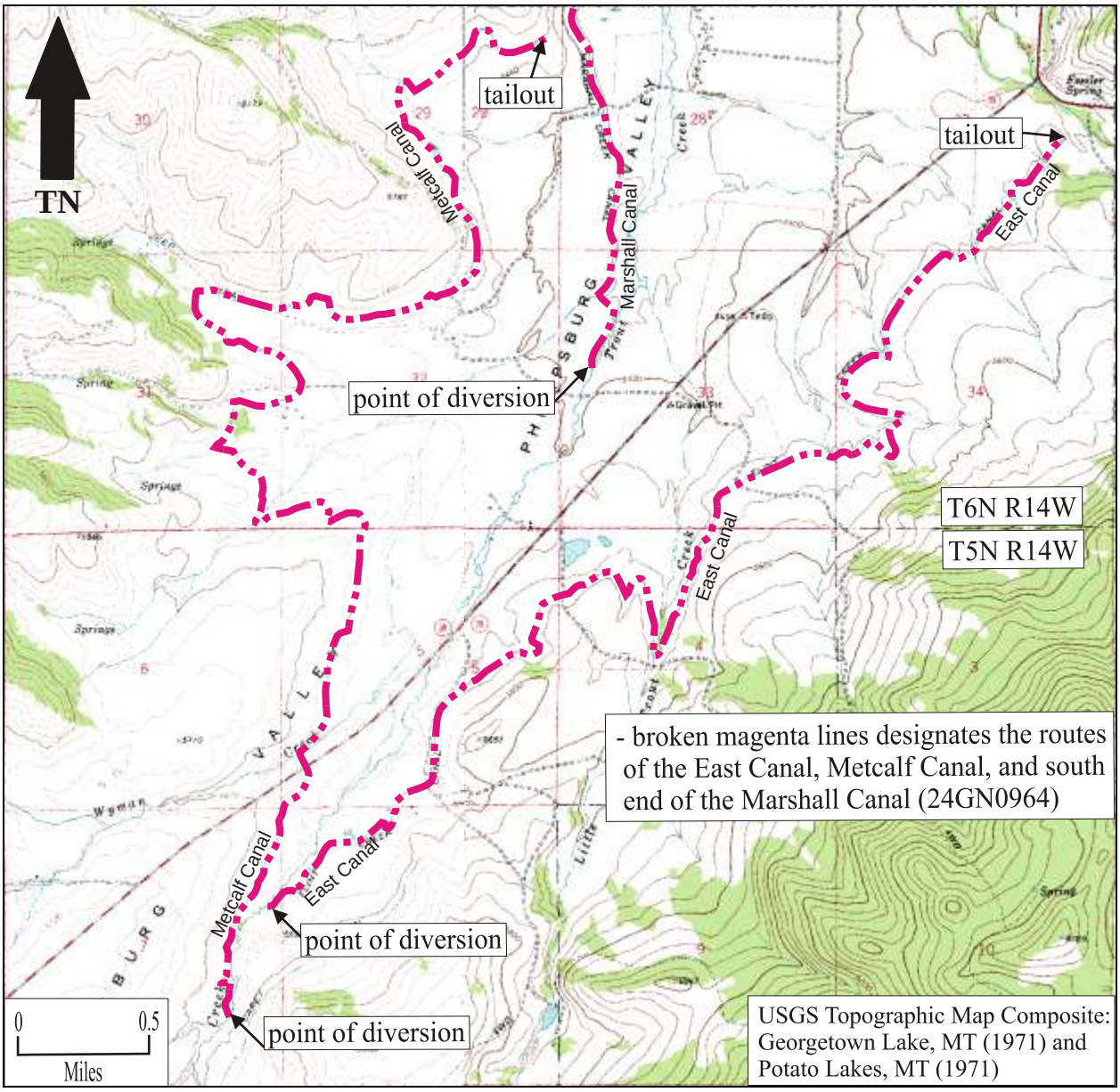
Technical drawing of the spillway associated with site 24GN0964.



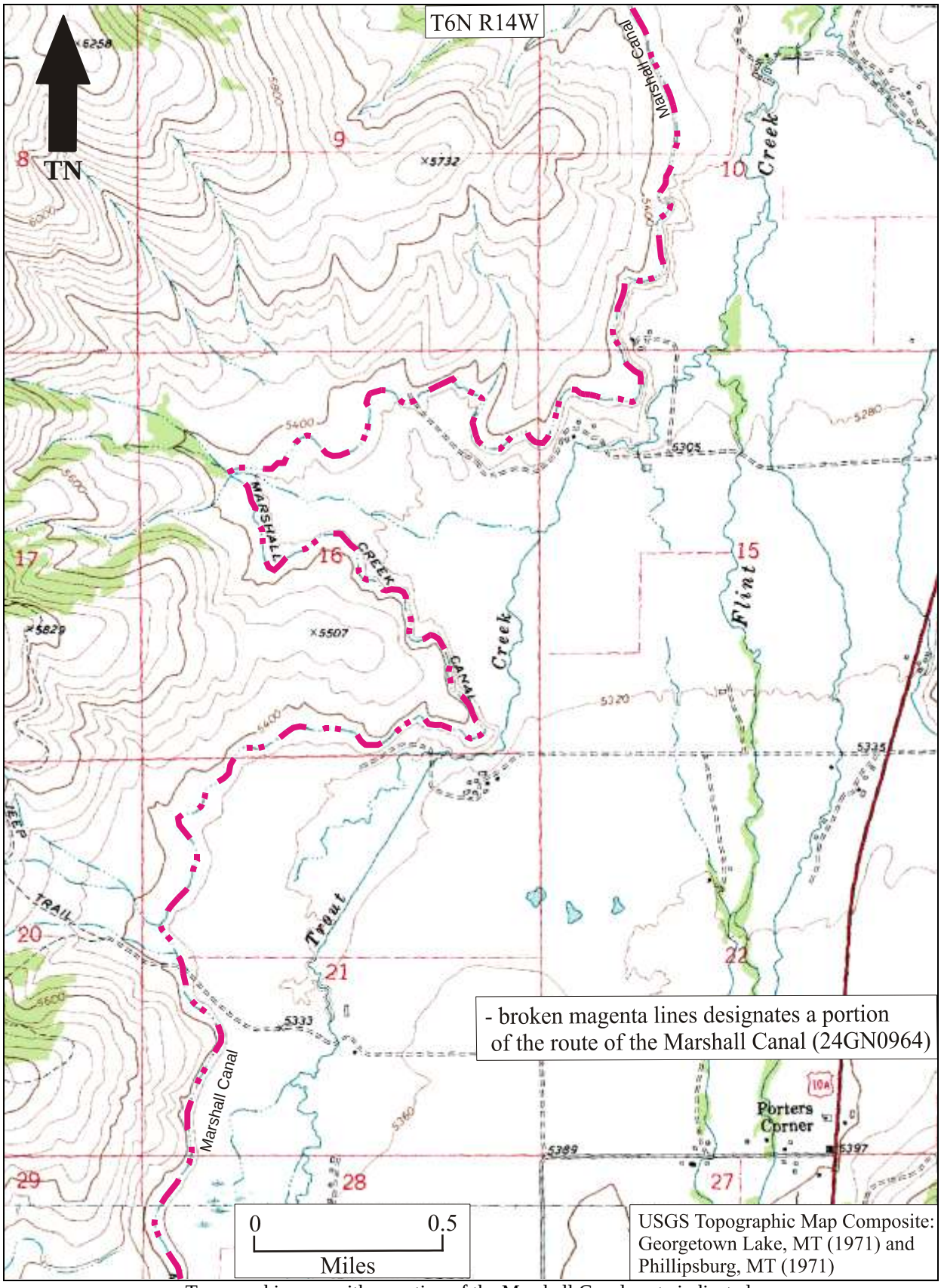
Technical drawing of the diversion structures associated with site 24GN0964.



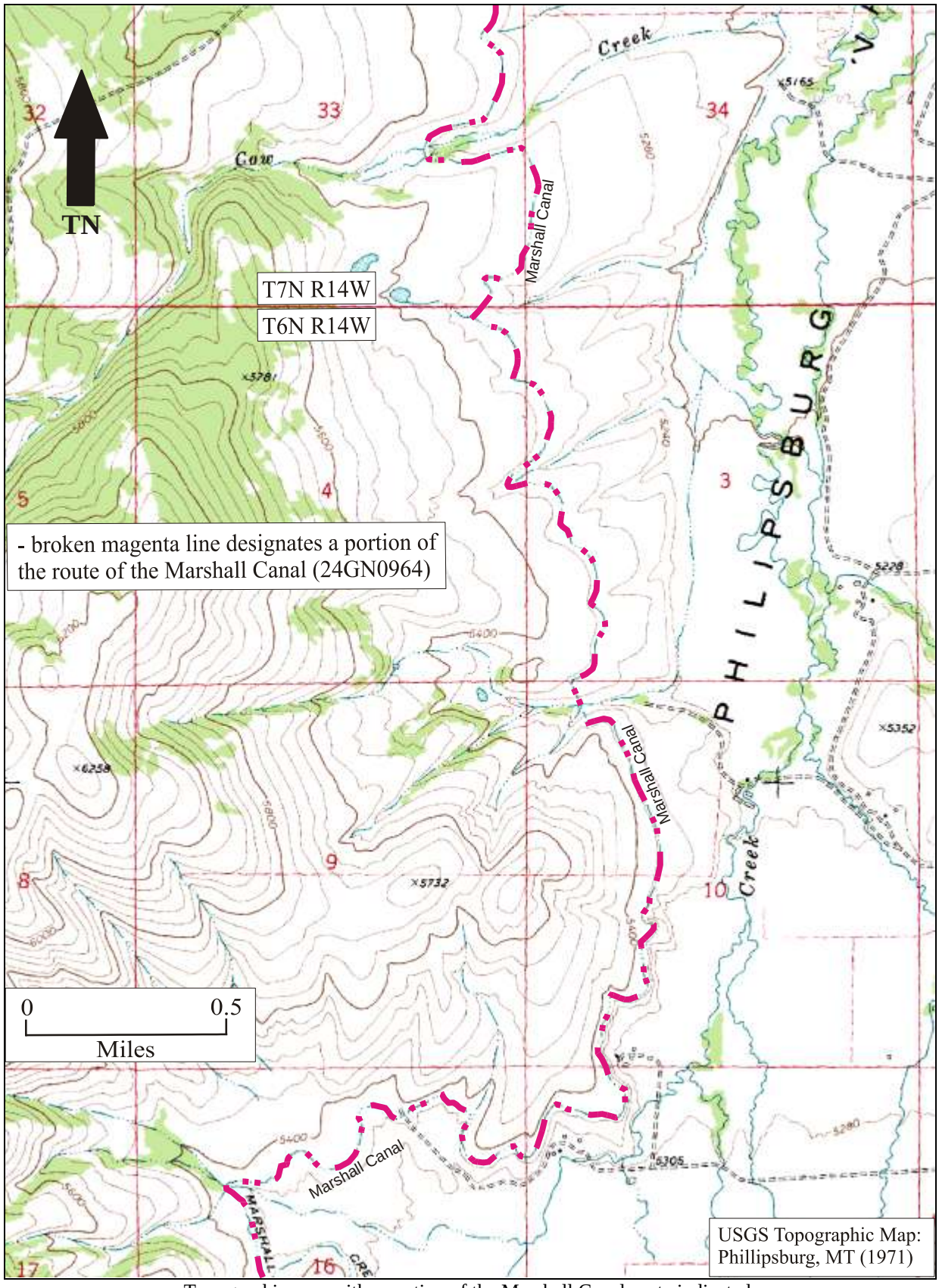
Topographic map with the location of the East Fork Dam and Reservoir and Main Flint Creek Canal route indicated.



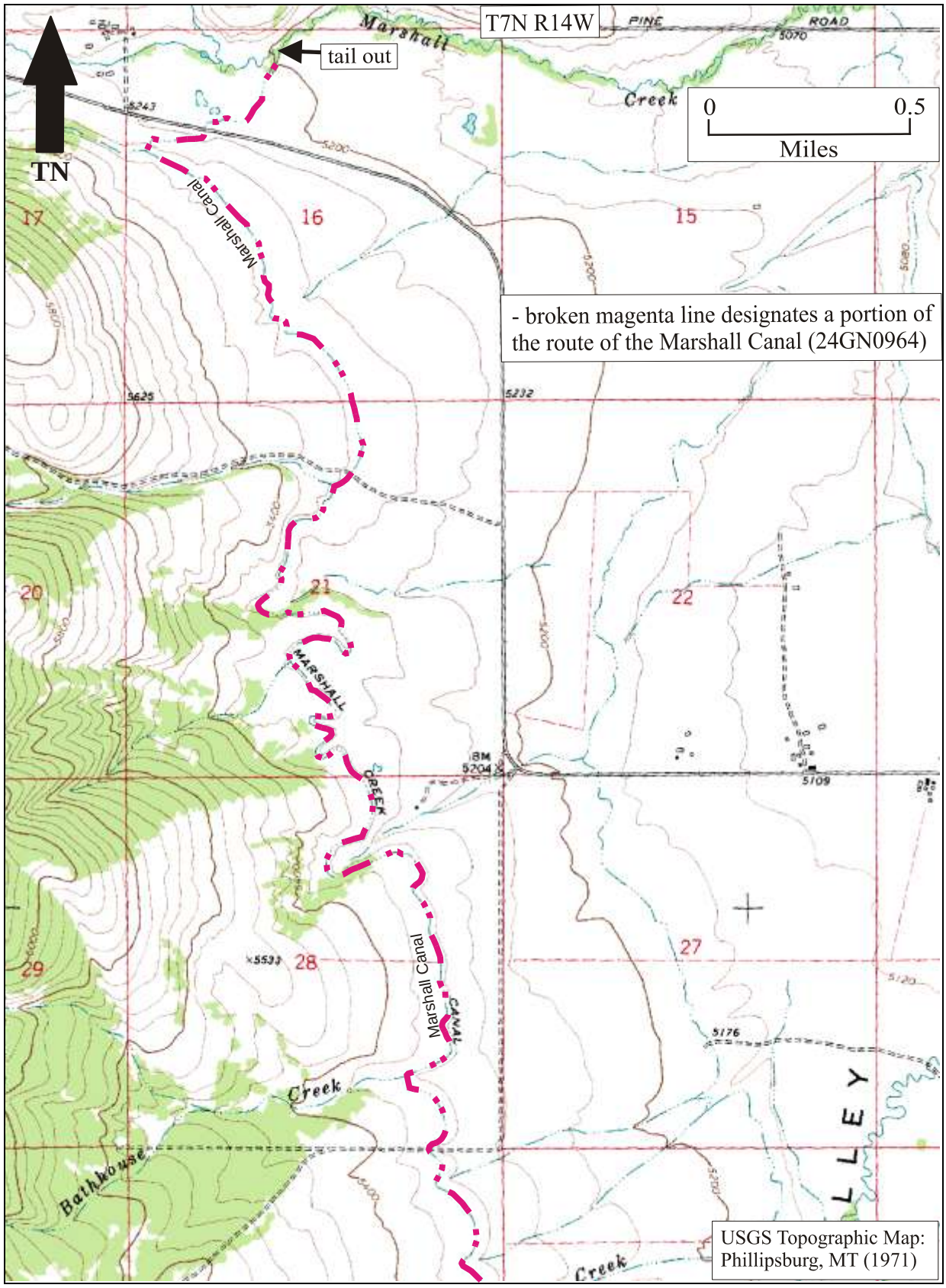
Topographic map with the locations of the East Canal, Metcalf Canal, and the south portion of the Marshall Canal route indicated.



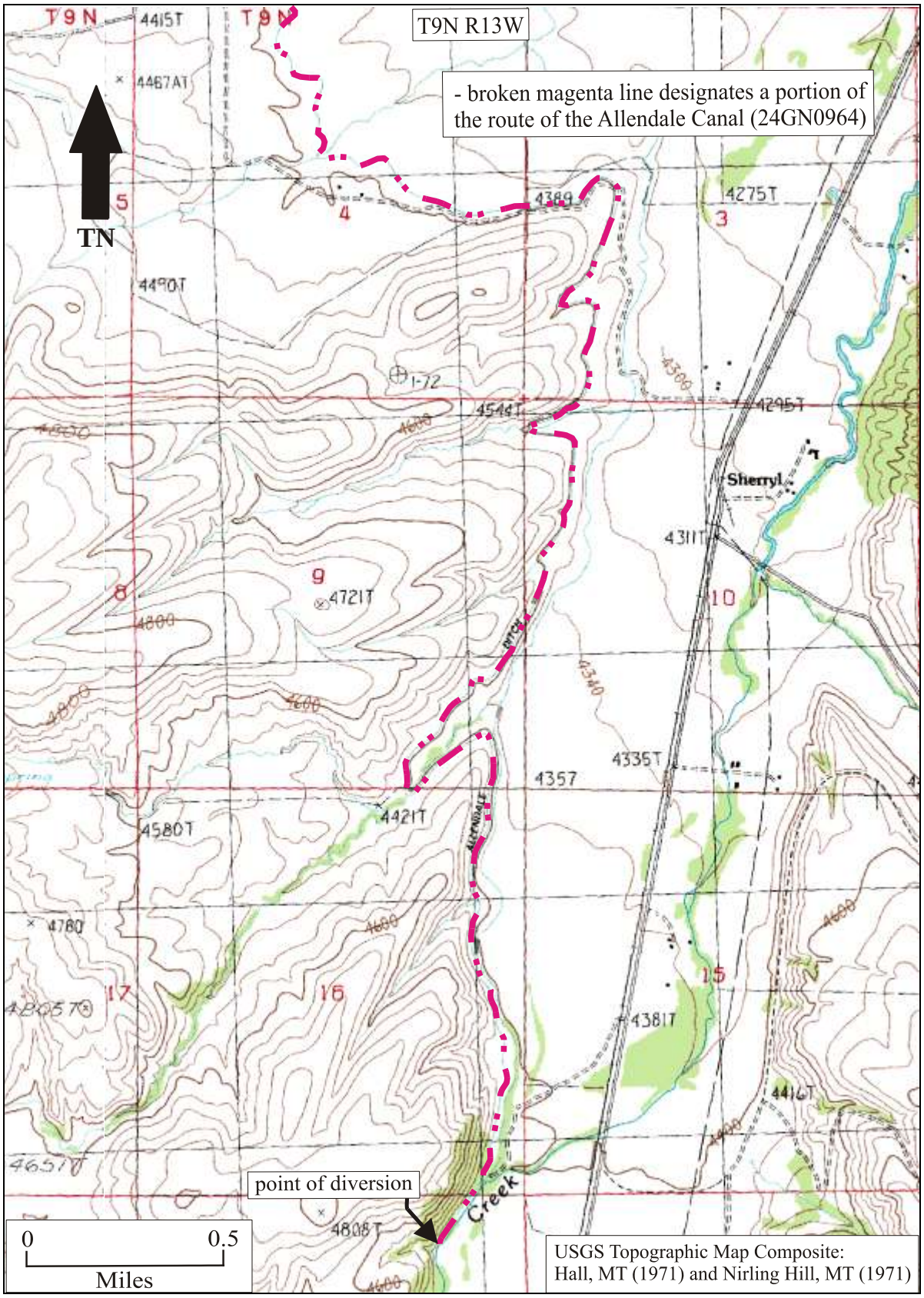
Topographic map with a portion of the Marshall Canal route indicated.



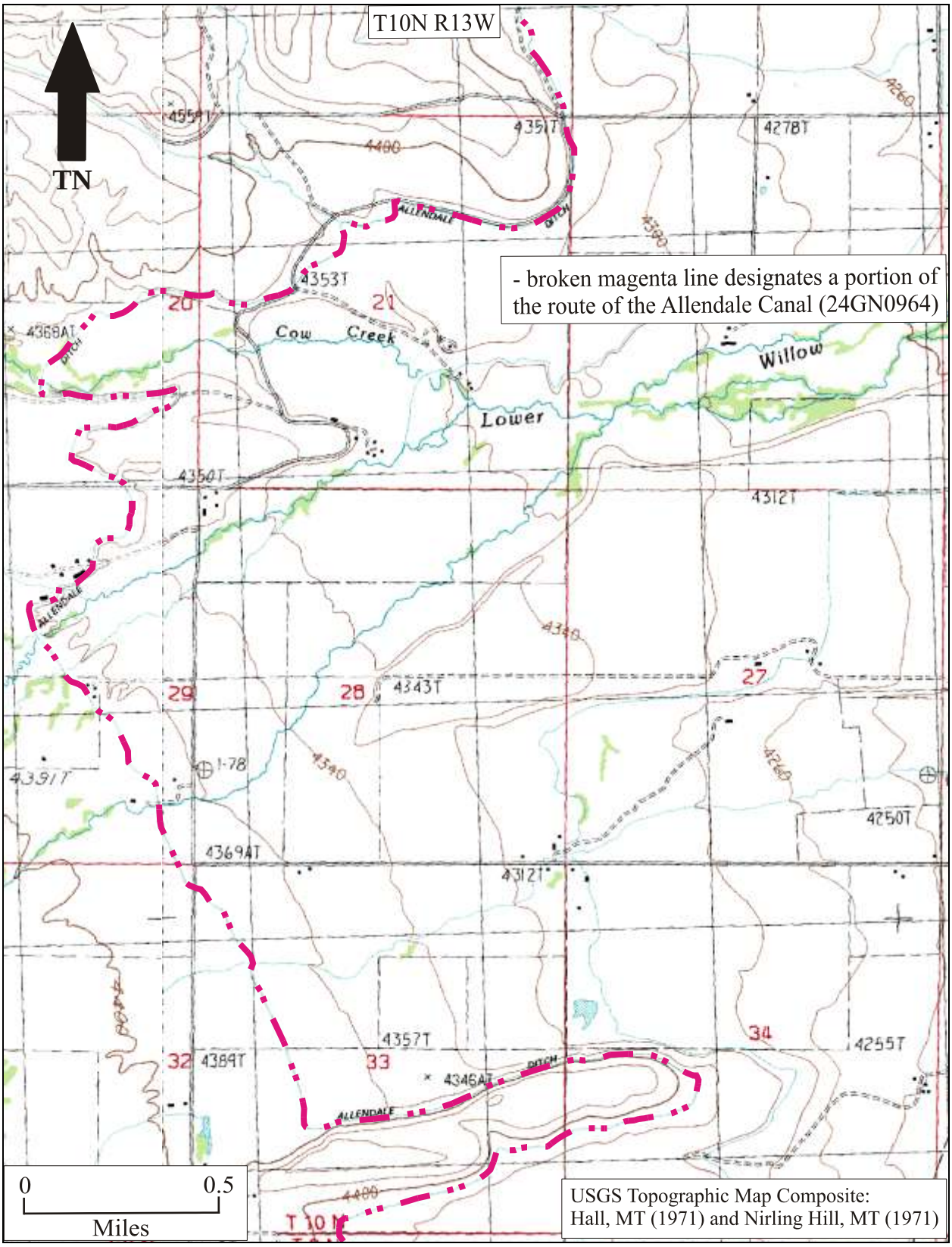
Topographic map with a portion of the Marshall Canal route indicated.



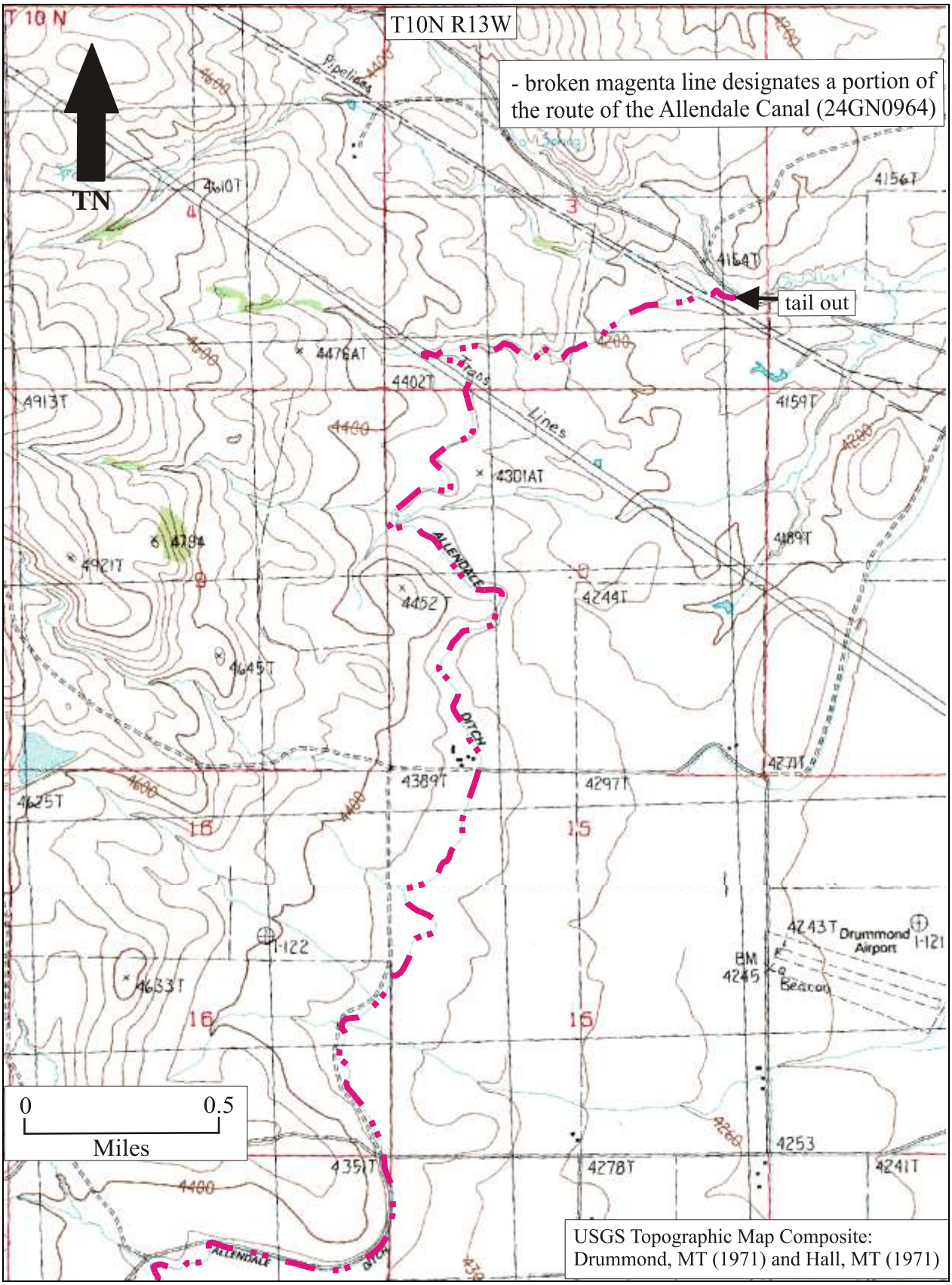
Topographic map with the north portion of the Marshall Canal route indicated.



Topographic map with the south portion of the Allendale Canal route indicated.



Topographic map with the middle portion of the Allendale Canal route indicated.



Topographic map with the north portion of the Allendale Canal route indicated.

MONTANA CULTURAL RESOURCES INFORMATION SYSTEM (CRIS) FORM

1. IDENTIFICATION

***required to receive Smithsonian number**

1.1 Smithsonian Number: 24GN0964 update 2017 **1.2 Field Designation:**

1.3 Project Name: Allendale Canal Improvements Project

1.4 Agency Project Number: 2017-2-2 **1.5 Consultant Project Number:**

2. LOCATION

***2.1 Township:** 9 N **Range:** 13 W **Section:** 16* ***2.2 County:** Granite
¼ Section(s): SESE1/4

Township: 9 N **Range:** 13 W **Section:** 21*
¼ Section(s): NENE1/4
**Segment of the Allendale Canal actually inspected with work reported on here*

***2.3 UTM Coordinates:** Zone 12 ***Datum used:** NAD 83 conus
Allendale Canal Diversion Structure: E 328,764m N 5,154,812m
Proposed Fish Screen: E 328,940m N 5,155,059m
Proposed weir/flume: E 329,001m N 5,155,260m

***2.4 Administrative/Surface Ownership:** State (School Trust Land administered by DNRC) and Private

***2.5 7.5' USGS Map Name, Date:** Hall, MT (1989 Provisional Edition)

2.6 Narrative of access: From Hall, MT, follow the Pintler Veterans Memorial Scenic Highway (State Highway 1) southerly approximately 4 miles to a ranch access trail. Follow the access trail ½ mile southwesterly to the project locale.

2.7 City/Town: **Vicinity of:** Hall, MT.

3. DESCRIPTION

***3.1 Site Category** (choose one)**:** ☐ Prehistoric ☒ Historic ☐ Paleontological ☐ Combination ☐ Other

***3.2 Site Type** (see recommended site type list, choose all that apply)**:** Historic Irrigation System: Flint Creek Water Project

3.3 Narrative Description of Site: The site (the Flint Creek Water Project) is composed of seven primary features--the East Fork of Rock Creek Dam, the East Fork of Rock Creek Reservoir, and the main (Flint Creek) diversion canal, the East Canal, the Marshall Canal, the Allendale Canal, and the Metcalf Canal. The property was constructed in 1938. Site boundaries are arbitrarily established based on the visible extent of the dam, reservoir, canals, spillways and associated structures.

A short segment (approximately 600 yards in length) of the Allendale Canal will be modified with work proposed. The Allendale Canal is approximately 13.5 miles in length and takes its point of diversion from Flint Creek in the NENE1/4 Section 21, T9N R13W.

3.4 Site Dimensions: See above description for the Allendale Canal. See previous site form update for size of the overall site.

Surface visibility: 25%.

3.5 Feature Descriptions: See Section 3.3 above.

3.6 Artifacts: (✔ all that apply) ☐Chipped Stone ☐Wood ☐Ground Stone ☐Ceramics ☐Bone ☐Trade ☐Other
Description: See Section 3.3 above.

3.7 Diagnostic Artifacts: None observed.

3.8 Subsurface Testing: None conducted.

3.9 Site function/interpretation: The site is associated with 20th Century water conservation and irrigation/agriculture development in the western United States.

4. PERIOD

4.1 Apparent Time Period of Site (use dropdowns)**:**
Prehistoric **Historic** 1930-1939 **Paleontological**

After Smithsonian number received, submit completed form to the Archaeological Records Office.

MONTANA CULTURAL RESOURCES INFORMATION SYSTEM (CRIS) FORM

5. ENVIRONMENTAL SETTING **Smithsonian Number:** 24GN0964 update 2017

5.1 Geographic Setting: The portion of the Allendale Canal inspected is situated at the junction of the relatively level Flint Creek valley and the toe slope of the steep valley wall (west margin of the valley bottom).

5.2 Contour: ☐ Known ☒ Approximate ☐ Unknown **5.3 Elevation:** 4390 ft ASL

5.4 View/Aspect (estimated direction and distance): The view is presently restricted in all directions due to surrounding mountainous terrain.

5.5 Sediments: Sediments are gravelly alluvium.

Deposition: ☐ Surface Only ☐ Buried Only ☐ Surface and Buried ☐ Redeposited ☐ Unknown

5.6 Available Water Sources (use dropdown)**:** Stream/River/Creek

5.7 Major River Drainage (name, distance, elevation): Clark Fork River, 10 miles northeasterly, 3937 ft ASL

5.8 Minor Drainage (name, distance, elevation): Flint Creek, at east side of canal in the project area, 4385 ft ASL

5.9 Local Vegetation: The dominant native flora is coniferous forest (primarily western larch, Douglas fir, ponderosa pine, grand fir, and lodgepole pine). Cottownwood appears in the drainage bottoms and more wet areas. Intermixed with the trees are numerous shrubs and sub-shrubs, and a lesser number of grasses and forbs.

Regional Vegetation: The dominant native flora is coniferous forest (primarily western larch, Douglas fir, ponderosa pine, grand fir, and lodgepole pine). Cottownwood appears in the drainage bottoms and more wet areas. Intermixed with the trees are numerous shrubs and sub-shrubs, and a lesser number of grasses and forbs.

6. ASSESSMENT, RECORDING & MANAGEMENT

6.1 Significance: The site has previously been determined eligible for listing in the National register of Historic Places.

6.2 Condition/Integrity: The resource retains adequate levels of integrity.

6.3 Possible impacts to site: Installation of a fish screen and weir within the Allendale Canal, as well as replacement of the diversion structure, will certainly have an effect on this Heritage Property. Because the diversion structure will be replaced with a very similar looking device, because the fish screen and weir will constitute minor visual intrusions and will in no way impede the flow of water through the canal, the effects of this proposed project will not be adverse. Further, all areas of the canal that will be disturbed with proposed work will be restored to preconstruction conditions. Because the Flint Creek Water Project is actively used and maintained, various levels of rehabilitation and improvement work will occur to site 24GN0964 over the life of the system. Future proposed developments should be reviewed, and effects assessed, on a case by case basis.

6.4 Evaluation: Does this property meet National Register criteria for eligibility?
☒ **Yes** ☐ **No** ☐ **Unevaluated**

Evaluation Procedures/Justification: The site has been recommended eligible for National Register listing.

6.5 Recording status: ☒ surface examination ☒ photo ☒ map ☐ subsurface tested

6.6 Recommendations: The property has been documented in detail, and the areas where known immediate and future modifications may occur have been thoroughly examined and photographed. No additional investigative or documentary work is recommended before the DNRC's proposed maintenance and improvement work occurs. The level of documentation provided in this site form update adds to the on-going level of documentation for this resource. It is also intended to lessen effects of the currently proposed development.

6.7 Site Located by: **Date Located:**

6.8 Site Recorded by: **Date Recorded:**

6.9 Site form update and revisions by: Patrick Rennie and Mark McNearney **Date updated:** 5/4/2017

6.10 Federal/State Permit No:

6.11 Publication(s)/Report(s) where site is described: None known

6.12 Artifact Repository: No artifacts were collected.

6.13 Field notes/maps/photos repository: DNRC, Helena, MT

6.14 Photographs: See attached

***6.15 Map: Attach a sketch map (if applicable) and photocopy of 7.5' Quad showing site location.**

After Smithsonian number received, submit completed form to the Archaeological Records Office.

MONTANA CULTURAL RESOURCES INFORMATION SYSTEM (CRIS) FORM

Looking SW toward Allendale Canal point of diversion in Section 21, T9N R13W.

Looking NE along Allendale Canal and Flint Creek in Section 21, T9N R13W.

After Smithsonian number received, submit completed form to the Archaeological Records Office.

MONTANA CULTURAL RESOURCES INFORMATION SYSTEM (CRIS) FORM

Looking N at the proposed weir/flume location in the Allendale Canal.

Example of weir/flume type structure to be installed in the Allendale Canal.

After Smithsonian number received, submit completed form to the Archaeological Records Office.

MONTANA CULTURAL RESOURCES INFORMATION SYSTEM (CRIS) FORM

Looking SW at the location of the proposed fish screen in the Allendale Canal.

Example of the type of fish screen proposed for the Allendale Canal.

After Smithsonian number received, submit completed form to the Archaeological Records Office.

MONTANA CULTURAL RESOURCES INFORMATION SYSTEM (CRIS) FORM

Looking SW at existing diversion structure in the Allendale Canal.

Looking W at existing diversion structure in the Allendale Canal.

After Smithsonian number received, submit completed form to the Archaeological Records Office.

MONTANA CULTURAL RESOURCES INFORMATION SYSTEM (CRIS) FORM

Looking NE at existing diversion structure and trash rack in the Allendale Canal.

Looking E at existing diversion structure in the Allendale Canal.

After Smithsonian number received, submit completed form to the Archaeological Records Office.

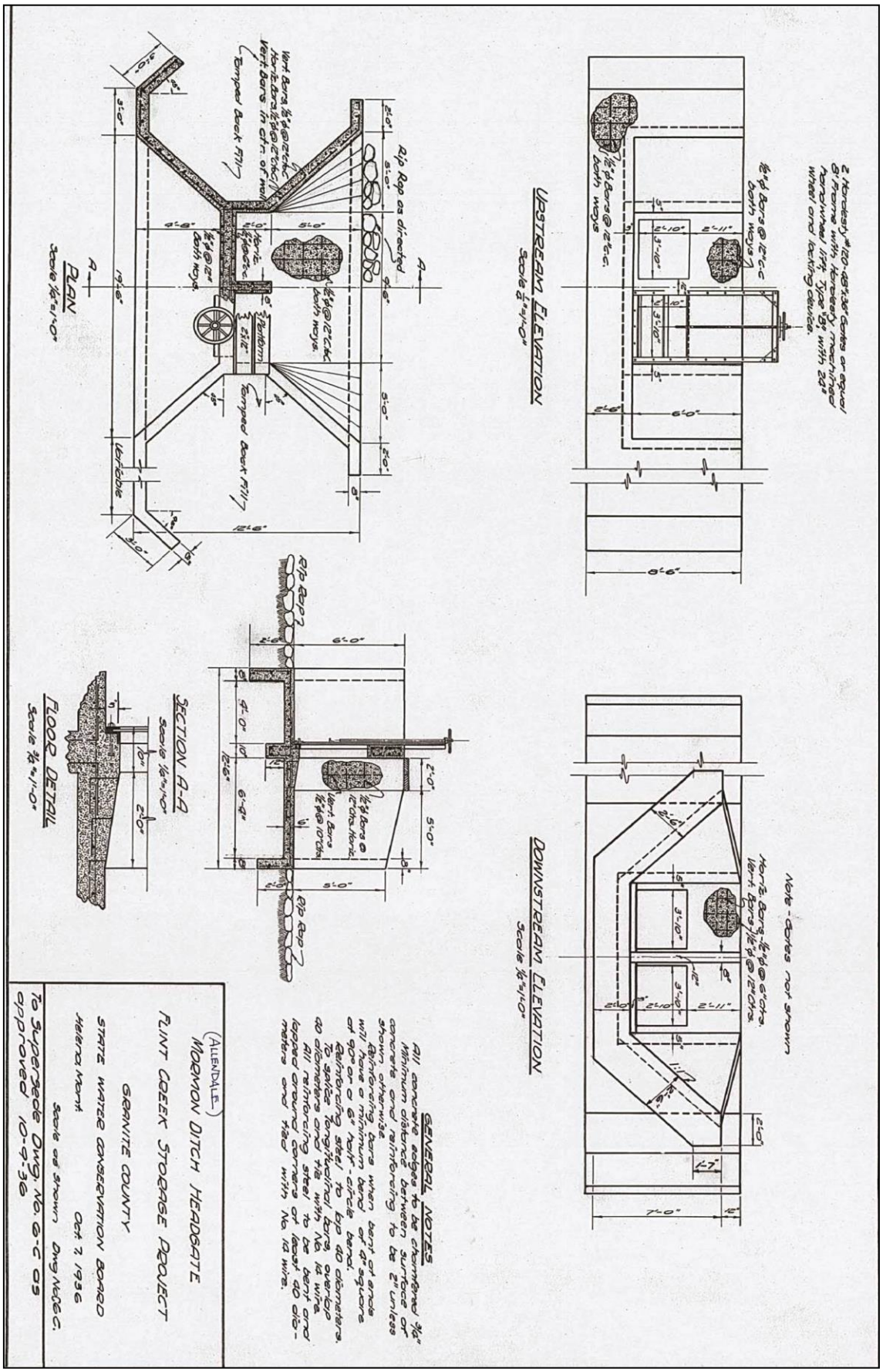
MONTANA CULTURAL RESOURCES INFORMATION SYSTEM (CRIS) FORM

Looking W at gate wheels of the existing diversion structure in the Allendale Canal.

Looking SW at existing diversion structure in the Allendale Canal.

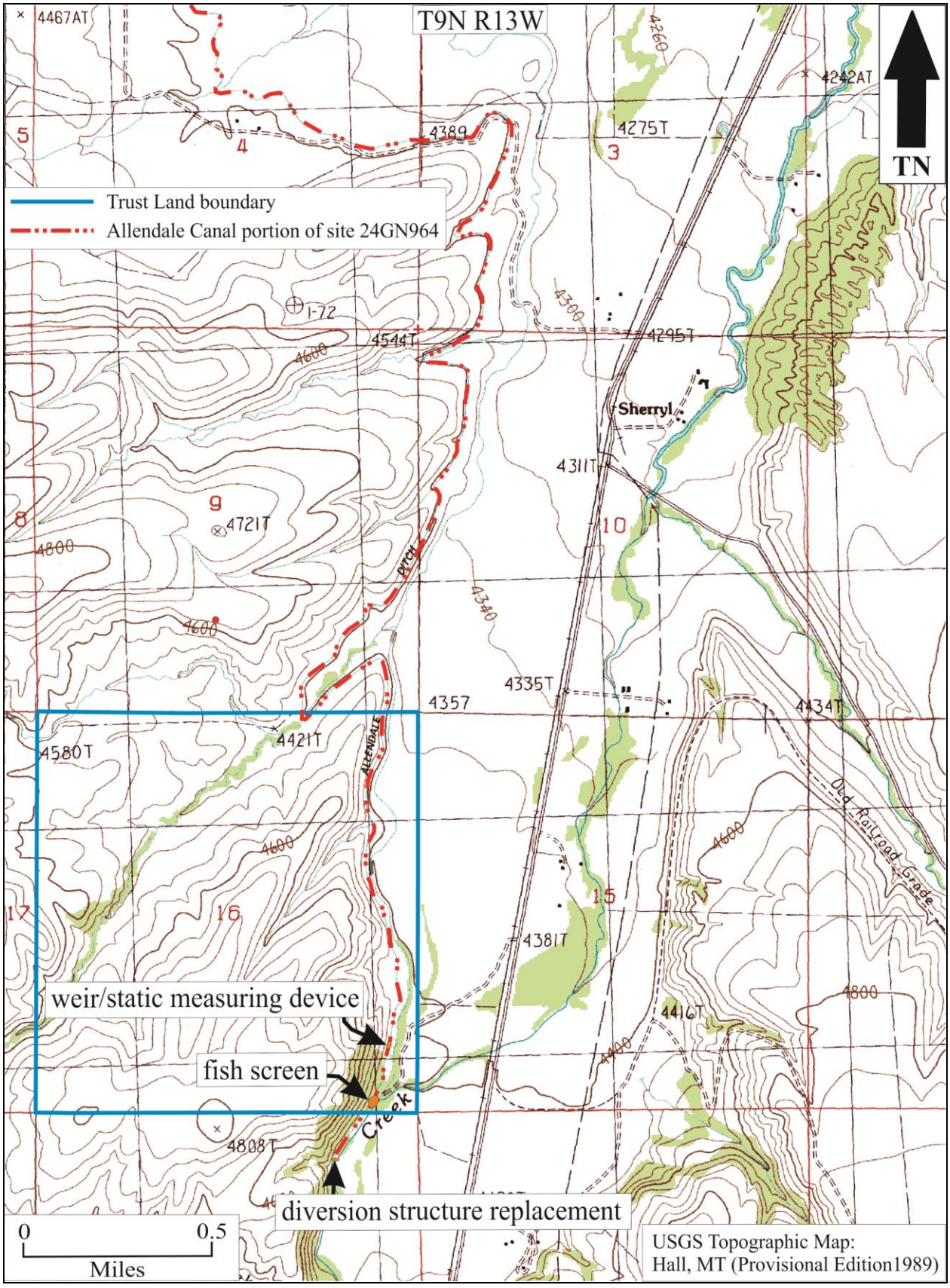
After Smithsonian number received, submit completed form to the Archaeological Records Office.

MONTANA CULTURAL RESOURCES INFORMATION SYSTEM (CRIS) FORM



Technical drawing of the existing diversion structure in the Allendale Canal.

After Smithsonian number received, submit completed form to the Archaeological Records Office.



Topographic map showing the south segment of the Allendale Canal and proposed development localities.

After Smithsonian number received, submit completed form to the Archaeological Records Office.