

Appendix 6

Landtype-Association (LTA) Descriptions for the Flathead Valley²

LTA-associated maps follow this narrative.

Section M333B Flathead Valley

This Section occurs in northwest Montana and northern Idaho. It includes a portion of the Continental Glaciated Mountains major geomorphic setting. Map unit descriptions are preceded by the following illustrations:

- **Figure 50:** Map showing location of M333B within the Northern Region
- **Figure 51:** M333B landscape photograph of Ashley Lake and Salish Mountains, Flathead National Forest
- **Figure 52:** Map showing distribution of LTAS within M333B
- **Figure 53:** Bar chart showing abundance of landform groups within M333B
- **Figure 54:** Bar chart showing abundance of geologic material groups within M333B

VALLEYS: RECENT COARSE ALLUVIUM

LTA10-M333B

LTA10-M333C

LTA10-M333D

Location

This LTA is located in the inter-mountain valleys of the Flathead, Clark Fork, and Kootenai River basins of northwest Montana.

Acreage by Section

Section	Acres
10-M333B	191,377
10-M333C	63,658
10-M333D	160,219

LTA Setting and General Characteristics

Differentiating Characteristics: This map unit occurs in a valley bottom landscape setting, which is composed of stream terraces, floodplains, and alluvial basins. Parent materials are unstratified to stratified deposits of sands, silts, and/or gravels underlain primarily by Proterozoic metasediments, Cenozoic siltstones, and/or glacial deposits.

Accessory Characteristics: The primary soils are deep with extremely gravelly coarse to medium textures. The vegetation is a mosaic of deciduous forest, coniferous forest, and wet meadow/shrubland. Mean annual precipitation ranges from 36 to 152 centimeters (14 to 60

² Excerpted from: Ford, Gary L., C. Lee Maynard, John A. Nesser, and Deorah S. Page-Dumrose. 1998. *Landtype Associations of the Northern Region 1997: A First Approximation*. USFS Rocky Mountain Research Station, General Technical Report RMRS-GTR-2-CD.

inches). The elevation range of this LTA is 758 to 1,970 meters (2500 to 6500 feet). The dominant slopes have gradients of 3 to 15 percent. This LTA is moderately dissected by streams with the dominant stream pattern being dendritic. Wetlands and river over-flow channels are a major component of this LTA.

LTA Components: This landtype association consists of stream terrace, floodplain, and alluvial basin landforms. Stream terraces are formed in coarse, stratified alluvium. These terraces have slope gradients that range from 0 to 15 percent. Soils on these landforms are deep, poorly developed, and mostly of sand and gravel. The soils vary from moderately well drained to well drained. The major soils on the moderately well-drained sites are Oxyaquic Udifluvents, Typic Ustifluvents, and Typic Udifluvents. The major soils on the well-drained sites are Dystric Eutrochrepts, Andic Dystrichrepts and Typic Xerochrepts. Rock outcrops occur less than 2 percent of the time. The dominant potential natural vegetation series are black cottonwood, Engelmann spruce, western redcedar, grand fir, Douglas-fir, and subalpine fir. This component represents 60 percent of the LTA. Floodplains and alluvial basins are formed in coarse stratified or unstratified alluvium. These areas have slope gradients that range from 0 to 10 percent. Soils on these landforms are deep, weakly developed and consist mostly of sand, gravel, and silt. These soils vary from moderately well drained to poorly drained. The major soils are classified as Typic Endoaquents, or Typic and Aeric Endoaquents. Rock outcrops occur less than 1 percent of the time. The dominant potential natural vegetation series includes subalpine fir, Engelmann spruce, and Drummond's willow. This component represents 40 percent of the LTA.

Compiled by: Dean Sirucek, Flathead National Forest; Skip Barndt, Lolo National Forest; Louis Kuennen, Kootenai National Forest.

VALLEYS: LACUSTRINE SEDIMENTS

LTA11-M333B

LTA11-M333C

LTA11-M333D

Location

This unit is located in the inter-mountain valleys of the Clark Fork, Flathead, and Kootenai River basins of northwest Montana.

Acreage by Section

Section	Acres
11-M333B	533,326
11-M333C	11,821
11-M333D	111,455

LTA Setting and General Characteristics

Differentiating Characteristics: This unit occurs in a valley bottom landscape setting, which is typically composed of glacial lacustrine deposits that have level to slightly undulating

topography. Parent materials consist of stratified lake sediments of very fine sands, silts, and clays.

Accessory Characteristics: The primary soils are deep with medium to moderately fine textures. The vegetation ranges from a continuous cover of coniferous vegetation on the well drained sites to wet meadow/shrubland on the poorly drained sites. Mean annual precipitation ranges from 36 to 152 centimeters (14 to 60 inches). The elevation range is 758 to 1,818 meters (2500 to 6000 feet). The dominant slopes have gradients of 2 to 20 percent. This map unit is slightly dissected by streams. Where present, the dominant stream pattern is dendritic. Wetlands and ponds are a major component of the unit.

LTA Components: This landtype association consists of lacustrine terraces and lacustrine basins. Lacustrine terraces and lacustrine basins are formed in stratified lake sediments. These landforms have dominant slope gradients ranging from 0 to 25 percent. Included with these landforms are terrace risers/scarps that have slopes that range from 40 to 70 percent. Soils on these landforms are deep, weak to moderately developed with medium and moderately fine textures. In northwestern Montana the major soils on the forested, well-drained sites are classified as Glossic Cryoboralfs or Typic Eutroboralfs, and Eutric Glossoboralfs. In Section M333B additional major soils are Andic/Typic Dystrochrept. The lower elevation, non-forested, valleys the soils are classified as Typic Natrixeralfs and Typic Xerochrept. The dominant potential vegetation series include western redcedar, subalpine fir, grand fir, and Douglas-fir. The major soils on the poorly drained sites are classified as Aeric Epiaquepts and Aquic Eutroboralfs with inclusions of Typic Borosaprists. Rock outcrop occurs on less than 2 percent of this landscape component. Engelmann spruce and Drummond's willow occur on the poorly drained sites.

Compiled by: Dean Sirucek, Flathead National Forest; Skip Barndt, Lolo National Forest; Louis Kuennen, Kootenai National Forest

VALLEYS: OUTWASH AND OTHER OLDER COARSE ALLUVIAL DEPOSITS

LTA12-M333B

LTA12-M333C

LTA12-M333D

Location

This map unit is located in the inter-mountain valleys of the Clark Fork, Flathead, and Kootenai River basins of northwest Montana.

Acreage by Section

Section	Acres
12-M333B	428,208
12-M333C	97,651
12-M333D	181,889

LTA Setting and General Characteristics

Differentiating Characteristics: This unit occurs in valley bottom landscape settings, which are typically composed of glacial outwash plains or outwash terraces that have undulating surfaces. Steep escarpments form the front of the some of the terraces. Parent materials consist of either stratified or unstratified glacial fluvial deposits of sand and gravel material. These deposits are typically underlain by glacial moraine deposits or Proterozoic metasedimentary bedrock.

Accessory Characteristics: The primary soils are deep with extremely gravelly coarse textures. These soils are typically excessively well drained with inclusions of poorly drained soils. The vegetation is primarily coniferous forest with areas of wet meadow/shrubland. Mean annual precipitation ranges from 36 to 140 centimeters (14 to 55 inches). The elevation range of this unit is 758 to 1,667 (2500 to 5500 feet). The dominant slopes have gradients of 2 to 20 percent. This map unit is moderate to highly dissected by streams or rivers with the dominant stream pattern being dendritic. Wetlands and riparian areas are important components of this unit.

LTA Components: This landtype association consists of glacial outwash plains and outwash terraces. These glacial outwash plains and outwash terraces are formed in coarse, stratified or unstratified glacial fluvial sediments. Slope gradients range from 0 to 25 percent with gradients up to 50 percent on the terrace risers. Soils on these landforms are deep, weakly developed with extremely gravelly coarse textures. The major soils are classified as Dystric Eutrochrepts, Typic Dystrochrept, Andic Dystrochrepts, and Andic Ustrochrepts. Rock outcrop occurs on less than 5 percent of this map unit. The dominant potential vegetation series include Douglas-fir, western redcedar, subalpine fir, and Engelmann spruce.

Compiled by: Dean Sirucek, Flathead National Forest; Skip Barndt, Lolo National Forest; Louis Kuennen. Kootenai National Forest

VALLEYS: RECENT FINE ALLUVIUM

LTA14-M333B

LTA14-M333C

Location

This LTA is located in the inter-mountain valleys of the Flathead River basin in northwest Montana.

Acreage by Section

Section	Acres
14-M333B	33,343
14-M333C	5,120

LTA Setting and General Characteristics

Differentiating Characteristics: This map unit occurs in a valley bottom landscape setting, which is composed of stream terraces, floodplains, and alluvial basins. Parent materials are

stratified deposits of fine sands, silts, and clays with or without gravels. These deposits are underlain primarily by Cenozoic siltstones and glacial deposits.

Accessory Characteristics: The primary soils are deep with medium or moderately fine textures. The vegetation is a mosaic of deciduous forest, coniferous savanna, grassland, and wet meadow/shrubland. Mean annual precipitation ranges from 30 to 51 centimeters (12 to 20 inches). The elevation range of this LTA is 745 to 1,067 (2460 to 3500 feet). The dominant slopes have gradients of 0 to 10 percent. This LTA is moderately dissected by streams with the dominant stream pattern being dendritic. Wetlands and river over-flow channels are a major component of this LTA.

LTA Components: This landtype association consists of stream terraces, floodplains, and alluvial basins. Stream terraces are formed in stratified alluvium. These terraces have slope gradients that range from 0 to 10 percent. Soils on these landforms are deep, poorly developed, and coarse to moderately fine textured. These soils are classified as Typic Ustifluvents, Udic Haploborolls, and Typic Eutrochrepts. Rock outcrops occur less than 1 percent of the time. The dominant potential natural vegetation series include ponderosa pine and rough fescue. This component represents 85 percent of the LTA. Floodplains and alluvial basins are formed in stratified recent alluvium. These areas have slope gradients that range from 0 to 10 percent. Soils on these landforms are deep, weakly developed with medium to moderately- fine textures. The major soils are classified as Fluvaquentic Haploxerolls, or Typic and Aeric Endoaquepts. Rock outcrops occur less than 1 percent of the time. The dominant potential natural vegetation series include ponderosa pine, Engelmann spruce, and Geyer willow. This component represents 15 percent of the LTA.

Compiled by: Dean Sirucek, Flathead National Forest

BREAKS: METASEDIMENTARY (BELT)

LTA20-M333B

LTA20-M333C

LTA20-M333D

Location

This unit is located in the Whitefish, Swan, Mission, Bitterroot, Purcell, Salish, Cabinet, and Flathead mountain ranges of the Clark Fork, Flathead, and Kootenai River basins in northwest Montana.

Acreage by Section

Section	Acres
20-M333B	212,411
20-M333C	163,793
20-M333D	1,000,850

LTA Setting and General Characteristics

Differentiating characteristics: This map unit occurs in both the upland and alpine landscape settings, which are typically composed of structural breakland and stream breakland landforms. Parent materials are volcanic ash overlying weakly-weathered, moderately metamorphosed, Proterozoic metasedimentary bedrock composed of argillites, siltites, quartzites, limestone and dolomites.

Accessory Characteristics: The primary soils are shallow to moderately deep with very gravelly medium textures. The vegetation is a mosaic of coniferous forest, and mountain shrub/grass lands. Mean annual precipitation ranges from 41 to 229 centimeters (16 to 90 inches). The elevation range is 697 to 2,590 (2300 to 8500 feet). The dominant slopes have gradients of 55 to 70 percent. This unit is slightly to moderately dissected by streams with the dominant stream patterns being sub-parallel and parallel. Major streams or rivers are typically located at the base of stream breaks. Lakes and ponds are a minor component of this unit.

LTA Components: This landtype association consists of structural and stream breaks. Structural breaks are formed in colluvial materials from weakly weathered metasedimentary bedrock. Slope gradients range from 50 to 100 percent. Soils on these landforms are shallow to moderately deep, weakly developed, with very gravelly medium textures. These soils are classified as Lithic, Typic and Andic Dystrochrepts, and Lithic, Typic, and Andic Cryochrepts on colder sites. Rock outcrop and talus occur on 20 to 80 percent of this landscape component. The dominant potential natural vegetation series on the warmer sites is Douglas-fir. On the cooler sites it is subalpine fir, or whitebark pine-subalpine fir. This component represents 80 percent of this unit. Stream breaks are formed in colluvial materials from weakly weathered metasedimentary bedrock. Slope gradients range from 50 to 90 percent. Soils on these landforms are shallow to moderately deep and weakly developed with very gravelly medium textures. These soils are classified as Lithic and Typic Dystrochrepts on the warmer sites; and Lithic, Typic and Andic Cryochrepts on the cooler sites. Rock outcrop and talus occur on 20 to 60 percent of this landscape component. The dominant potential natural vegetation series is Douglas-fir on the warmer sites and subalpine fir on the cooler sites. This component represents 20 percent of this unit.

Compiled by: Dean Sirucek, Flathead National Forest; Skip Barndt, Lolo National Forest; Louis Kuennen, Kootenai National Forest.

LTA40-M333B

LTA40-M333C

LTA40-M333D

STEEP GLACIATED MOUNTAIN SLOPES: METASEDIMENTARY (BELT)

Location

This map unit is located in the Bitterroot, Cabinet, Purcell, Salish, Swan, Mission, Flathead, and Whitefish Mountain ranges of the Clark Fork, Flathead and Kootenai basins in northwest Montana.

Acreage by Section

Section	Acres
40-M333B	221,169
40-M333C	1,637,034
40-M333D	222,209

LTA Setting and General Characteristics

Differentiating Characteristics: This map unit occurs in an upland and alpine landscape settings, which are primarily composed of glacial troughwall, cirque headwall, and cirque basin landforms. Parent materials are alpine glacial debris and colluvium derived from and underlain by moderately metamorphosed, Proterozoic metasediments composed of argillite, siltite, quartzite, limestone and dolomite bedrocks. Inclusions of other bedrocks such as granite occur in this map unit.

Accessory Characteristics: The primary soils are shallow to moderately deep, with cobbly or gravelly medium textures. The vegetation is a mosaic of coniferous forest, alpine meadows, and shrubland associated with avalanche chutes. Mean annual precipitation ranges from 102 to 305 centimeters (40 to 120 inches). The elevation range of this unit is 1,212 to 3,182 meters (4000 to 10,500 feet). The dominant slopes range from 50 to 90 percent. The cirque basin portion of the map unit has slopes that range from 5 to 40 percent. The troughwall landforms are moderately to highly dissected by streams with the dominant stream pattern being parallel. The cirque headwall and cirque basin landforms are weakly dissected by streams with the dominant stream pattern being parallel. Wetlands are associated with the cirque basins, and occur as a minor component of this unit.

LTA Components: This landtype association consists primarily of glacial troughwalls, cirque headwalls, and cirque basins. Glacial troughwalls are formed in glacial tills on the lower elevation slopes with volcanic ash influenced colluvium on the higher elevation slopes. Slope gradients range from 50 to 90 percent. Soils on the lower slopes of this landform are moderately shallow to deep and are moderate to highly developed, with cobbly medium textures. The major soils on the lower slopes are classified as Andeptic and Typic Cryoboralfs. Soils on the upper slopes of this landform are shallow to moderately deep, are moderately developed, and have gravelly medium textures. The major soils on the higher slopes are Andic, Typic, and Lithic Cryochrepts. Rock outcrops occupy up to 15 percent of the area. The dominant potential natural vegetation series are grand fir, western redcedar, Douglas-fir, and subalpine fir on the lower slopes; and subalpine fir and mountain hemlock on the upper slopes. This component represents 55 percent of the LTA. Cirque headwalls/cirque basins are formed in glacial till on the lower elevation slopes and volcanic ash influenced colluvium on the higher elevation slopes. Included in this alpine landscape setting are small areas of alpine ridge landforms. Slope gradients range from 5 to 90 percent. Soils on these landforms are shallow to moderately deep and weakly developed, with very gravelly medium textures. The major soils are classified as Lithic Cryochrepts and Andic Cryochrepts. Rock outcrops occupy more than 40 percent of the area. The dominant potential natural vegetation series include subalpine fir, and whitebark pine-subalpine fir. This component represents 45 percent of the LTA.

Compiled by: Dean Sirucek, Flathead National Forest; Louis Kuennen, Kootenai National Forest; Skip Barndt, Lolo National Forest

ALPINE TROUGHS AND TROUGHWALLS: METASEDIMENTARY (BELT)
LTA47-M333B

Location

This unit is located in the Purcell and Cabinet Mountains of the Kootenai, Pack River and Clarkfork River basins of northeast Idaho and northwest Montana.

Acreage by Section

Section	Acres
47-M333B	27,452

LTA Setting and General Characteristics

Differentiating characteristics: This map unit occurs at the higher elevations, in a gentle to steep alpine glacial setting, which is typically composed of alpine trough bottoms and troughwalls. Parent materials are surface volcanic ash overlying weakly weathered tills consisting of quartzites, siltites and argillites from Precambrian metasedimentary bedrock.

Accessory Characteristics: The primary soils are shallow to deep sandy loams and loams, with inclusions of rock outcrop, scree and avalanche chutes. The vegetation is a mosaic of coniferous forest. Mean annual precipitation ranges from 127 to 229 centimeters (50 to 90 inches). The elevation range of this unit is 1372 to 2286 meters (4500 to 7500 feet). The dominant slopes range from 1 percent in the trough bottoms to 85 percent on the steeper troughwalls. This unit is slightly to highly dissected by streams, with the dominant stream pattern being parallel. Wet sidehill areas and grassy parks are a component of this LTA.

LTA Components: This landtype association consists of glacial troughwalls and glacial trough bottoms. These moderately steep to steep glaciated troughwalls consist of glacial till from metasedimentary bedrock sources. The slope gradients range from 40 to 85 percent. Soils on these landforms are shallow to deep, weakly weathered and medium textured. The major soils on the well drained sites are classified as Vitric Haplocryands and Typic Cryochrepts. Lithic Cryochrepts are scattered throughout. Vitric Fulvicryands and Aquic Cryochrepts occur in the more poorly drained sites. Rock outcrop and scree occurs as an inclusion in this unit. The dominant potential natural vegetation is the subalpine fir series. This component represents about 70 percent of this unit. The trough bottoms consist of deep glacial tills and glacio-fluvial materials from metasedimentary bedrock sources. The slope gradients range from 1 to 40 percent. Soils on these landforms are moderately deep to deep, weakly weathered and medium textured. The major soils on the well drained sites are classified as Vitric Haplocryands and Typic Cryochrepts. Vitric Fulvicryands and Aquic Cryochrepts occur in depressional area and other poorly drained sites. The dominant potential natural vegetation is the subalpine fir series. This component represents about 30 percent of this unit.

Compiled by: Jerry Niehoff, Idaho Panhandle National Forests

GLACIATED MOUNTAIN SLOPES: METASEDIMENTARY (BELT)

LTA50-M333B

LTA50-M333D

Location

This map unit is located primarily in the Flathead, Clark Fork and Kootenai River basins of the Salish, Purcell, Bitterroot, and Cabinet Mountains of northwest Montana.

Acreage by Section

Section	Acres
50-M333B	2,681,456
50-M333D	66,747

LTA Setting and General Characteristics

Differentiating Characteristics: This map unit occurs in both valley and upland settings mainly within a continentally glaciated landscape. Parent materials are continental and/or alpine glacial debris underlain by Proterozoic metasediments composed of argillites, siltites, limestones, and quartzites.

Accessory Characteristics: The primary soils are moderately shallow to very deep, very gravelly coarse silt and fine sandy loams. The major vegetative cover is a dense coniferous forest with occasional grassy openings. Mean annual precipitation ranges from 36 to 178 centimeters (14 to 70 inches). The elevation range is 667 to 1667 meters (2200 to 5500 feet). The dominant slopes range from 20 to 50 percent. This map unit is slightly to moderately dissected by streams with the dominant stream pattern being dendritic. Bogs are a minor component of this map unit.

LTA Components: This landtype association has the classic subdued glacial landforms which are comprised of convex, scoured ridges and sideslopes, and valleys with deeper soils. The straight side slopes and valleys are composed of a rounded ridges and filled in valleys landform. These areas have slopes that range from 5 to 60 percent. The ridges were strongly scoured and then covered by glacial debris. The drainage bottoms were filled in. The landforms (straight mountain slopes and concave lower side slopes) have soils that are moderately deep to very deep consisting of rock, fine sand and coarse silt. The major soils are classified as Andic Dystrochrepts, Typic Dystrochrepts, Typic Eutrochrepts, Typic Ustrochrepts, Dystric Cryochrepts, and Andic Dystric Eutrochrept. Rock outcrops occupy less than 15 percent of the area. This landform is covered with a dense forest cover. The dominant potential natural vegetation series include western redcedar, western hemlock, subalpine fir, and Douglas-fir. This component represents 65 percent of the unit. The ridge top landform is comprised of the convex feature of the landscape. The soils on this part of the landscape are moderately shallow to shallow. The major soils are classified as Lithic, Typic, and Andic Cryochrepts. The dominant potential natural vegetation series is subalpine fir. This component represents 35 percent of the map unit.

Compiled by: Louis Kuennen, Kootenai National Forest and Skip Barndt, Lolo National Forest.

GLACIATED MOUNTAIN SLOPES: GRANITICS
LTA51-M333B

Location

This unit is located in the Purcell and Cabinet Mountains of the Kootenai and Pack River Basins of northeast Idaho.

Acreage by Section

Section	Acres
51-M333B	90,791

LTA Unit Setting and General Characteristics

Differentiating characteristics: This map unit occurs in a gentle to moderately steep valley bottom, mountain sideslope and ridge landscape setting at elevations that range from low to high. The unit is typically composed of dissected and non dissected mountain slopes, valleys and ridges comprised of alpine and continental till. Parent materials are surface volcanic ash overlying substratum materials of glacial tills derived from Cretaceous Kaniksu Batholith bedrock.

Accessory Characteristics: The primary soils are shallow to deep sands, with a small component of rock outcrop and scree. The vegetation is a mosaic of coniferous forest. Mean annual precipitation ranges from 64 to 127 centimeters (25 to 50 inches). The elevation range of this unit is 731 to 1737 meters (2400 to 5700 feet). The dominant slopes have gradients of 15 to 55 percent. This unit is slightly to highly dissected by streams, with the dominant stream pattern being parallel.

LTA Components: This landtype association consists of dissected and non-dissected, continentally glaciated, convex ridges and concave valleys. The glaciated convex ridges and mountain sideslopes were strongly scoured and then covered by varying thickness of glacial tills. The slope gradients range from near level to 60 percent. The drainage bottoms and toeslopes consist of deep glacial tills and glacio-fluvial materials. The slope gradients range from 0 to 40 percent. Soils on the ridge and mountain sideslopes landforms are shallow to deep, weakly weathered, and sandy textured. Soils in the drainage bottoms and toeslopes are deep, weakly weathered, and sandy textured. The major soils on the well drained sites are classified as Andic Cryochrepts and Andic Dystrochrepts, with Andic Xerochrepts on the drier sites. The areas with deeper ash caps are Vitric Haplocryands and Typic Udivitrands. Andic Cryumbrepts-Andic Haplumbrepts occur in the more poorly drained sites. Rock outcrop and scree occurs as an inclusion in the scoured ridge and mountain sideslope landforms. The dominant potential natural vegetation series on the well drained, high elevation sites is subalpine fir with western hemlock, western red cedar and Douglas-fir occurring at low to mid elevations. The dominant potential natural vegetation series on the poorly drained sites are subalpine fir at the higher elevations and in cold air pockets at lower elevations, and western red cedar at the mid and lower elevations.

Compiled by: Jerry Niehoff, Idaho Panhandle National Forest

GLACIATED MOUNTAIN SLOPES: SANDSTONES, SHALES, AND CARBONATES

LTA53-M333B

LTA53-M333C

LTA53-M332B

Location

This map unit is located in of the Swan, Mission, Flathead, and Whitefish mountain ranges of the Flathead, Clearwater, and Blackfoot River basins in northwest Montana.

Acreage by Section

Section	Acres
53-M333B	8,091
53-M333C	100,613
53-M332B	6,924

LTA Setting and General Characteristics

Differentiating Characteristics: This map unit occurs in both valley bottom and upland landscape settings, which are primarily composed of glacial moraine landforms. Parent materials are continental or alpine glacial debris with or without volcanic ash surface layers; underlain by Paleozoic and Mesozoic sandstone, shale, and limestone bedrocks. In the North Fork of the Flathead River areas of Tertiary siltstone are included in this map unit.

Accessory Characteristics: The primary soils are moderately deep to very deep, with gravelly medium and moderately fine textures. The major vegetative cover is a dense coniferous forest with occasional meadow openings. Mean annual precipitation ranges from 51 to 178 centimeters (20 to 70 inches). The elevation range is 1,036 to 2,316 (3400 to 7600 feet). The dominant slopes range from 5 to 50 percent. This map unit is moderately to highly dissected by streams, with the dominant stream pattern being dendritic. Wetlands are a minor component of this unit.

LTA Components: This landtype association consists primarily of glacial moraines. Glacially scoured ridge top landforms occur as a minor component. On the valley bottom landscape setting the glacial moraines occur on rolling hummocky topography, with slopes that range from 5 to 30 percent slope. On the upland landscape setting the glacial moraines occur on straight to slightly concave slopes, with range from 20 to 55 percent in gradient. These glacial moraines typically occur as the toe-slope associated with glacial troughwalls. Soils on these landforms are moderately deep to very deep, and are moderate to highly developed, with gravelly moderately-fine or fine textures. The major soils are classified as Typic Eutrochrepts and Andeptic Cryoboralfs. Rock outcrops occupy less than 15 percent of the area. The dominant potential natural vegetation is Douglas-fir and subalpine fir. A minor component of this map unit is glacially scoured ridge tops. Slope gradients range from 5 to 20 percent. Soils on these landforms are shallow to moderately deep, moderately developed, with gravelly medium textures. The major soils are classified as Andic Cryochrepts. Rock outcrops occupy less than 15 percent of the area. The dominant potential natural vegetation is subalpine fir and Douglas-fir. This component represents 15 percent of this map unit.

Compiled by: Dean Sirucek, Flathead National Forest

GLACIATED MOUNTAIN SLOPES: HIGHLY WEATHERED METASEDIMENTARY TILL

LTA58-M333B

LTA58-M333C

Location

This map unit is located in the Whitefish, Mission, Swan, Purcell, Salish, Cabinet, and Flathead mountain ranges of the Flathead, Kootenai, and Swan River basins in northwest Montana.

Acreage by Section

Section	Acres
58-M333B	164,491
58-M333C	20,031

LTA Setting and General Characteristics

Differentiating Characteristics: This map unit occurs in both upland and valley bottom landscape settings, which are typically composed of glacial moraine landforms. Parent materials are alpine or continental glacial debris deposited during Pre-Wisconsin glacial periods. These deposits are underlain by moderately metamorphosed, Proterozoic metasedimentary bedrock composed of argillites, siltites, dolomites, limestones, and quartzites; or Tertiary siltstones.

Accessory Characteristics: The primary soils are moderately deep to very deep very gravelly coarse silt/fine sandy loams. The major vegetative cover is a dense coniferous forest with occasional grassy openings. Mean annual precipitation ranges from 51 to 152 centimeters (20 to 60 inches). The elevation range of this LTA is 667 to 1,707 meters (2200 to 5600 feet). The dominant slopes range from 20 to 50 percent. This map unit is moderately to highly dissected by streams with the dominant stream pattern being dendritic. Wetlands are a minor component of this map unit.

LTA Components: This landtype association consists primarily of glacial moraines. The landscape setting for this map unit varies from a valley bottom to a moderately steep upland setting. In the valley bottom landscape setting the glacial moraines occur on rolling, hummocky topography, with slopes that range from 5 to 30 percent slope. In the upland landscape setting the glacial moraines occur on straight to slightly concave slopes that range from 20 to 55 percent in gradient. These glacial moraines typically occur as the toe-slope associated with glacial troughwalls. Soils on these landforms are moderately deep to very deep and are moderate to highly developed with gravelly moderately-fine or fine textures. The major soils are classified as Typic Glossoboralfs, Typic Eutroboralfs, and Andeptic Cryoboralfs. Rock outcrops occupy less than 5 percent of the area. The dominant potential natural vegetation series include western redcedar, grand fir, subalpine fir and Douglas-fir.

Compiled by: Dean Sirucek, Flathead National Forest; Louis Kuennen, Kootenai National Forest

MOUNTAIN SLOPES AND RIDGES: METASEDIMENTARY (BELT)

LTA60-M333B

LTA60-M333C

Location

This unit is located in the Whitefish, Swan, Purcell, Cabinet, Salish, Mission, and Flathead Mountain ranges of the Flathead, Kootenai, and Swan River basin in northwest Montana.

Acreage by Section

Section	Acres
60-M333B	497,972
60-M333C	114,155

LTA Setting and General Characteristics

Differentiating characteristics: This map unit occurs in both the upland and alpine landscape settings, which are typically composed of dissected mountain slope, glaciated mountain slope, and glacially scoured ridge top landforms. The geomorphic processes that occur on these areas include: colluvial, fluvial and glacial, erosion or deposition. Parent materials are volcanic ash overlying weakly weathered, moderately metamorphosed Proterozoic metasedimentary bedrock composed of argillites, siltites, quartzites, and limestones.

Accessory Characteristics: The primary soils are shallow to moderately deep with very gravelly medium textures. The vegetation is a mosaic of coniferous forest, mountain shrublands, and mountain grasslands. Mean annual precipitation ranges from 46 to 203 centimeters (18 to 80 inches). The elevation range is 758 to 2,286 meters (2500 to 7500 feet). The dominant slopes have gradients of 15 to 50 percent. This unit is moderate to strongly dissected by streams with the dominant stream patterns being dendritic and sub-parallel.

LTA Components: This landtype association consists of glacially scoured ridge tops and dissected mountain slopes (fluvial) with inclusions of glaciated mountain slopes. Glacially scoured ridge tops have been strongly modified by continental ice. The prominent features are ridge tops and ridge noses with exposed bedrock. These areas have slopes that range from 10 to 45 percent. Soils on these landforms are shallow to moderately deep and weak to moderately developed with medium textures. The major soils are classified as Lithic, Andic or Typic Cryochrepts, and Typic and Lithic Dystrochrepts. Rock outcrops occupy more than 50 percent of the area. The dominant potential natural vegetation series includes subalpine fir, subalpine fir-whitebark pine, and Douglas-fir. This landform component makes up 50 percent of the LTA. The dissected mountain slopes (fluvial) landscape is one that is weathering-in-place. It is chemical weathering further affected by colluvial action. Slope gradients range from 30 to 60 percent. Soils on these landforms are moderately deep to deep, with weak to moderate development, and gravelly medium textures. The major soils are classified as Andic Cryochrepts, Andeptic and Typic Cryoboralfs, and Typic or Argic Cryoborolls, Typic Haploborolls and Typic Dystrochrept. Rock outcrops occupy less than 10 percent of the area. The dominant potential natural vegetation

series includes Douglas -fir and subalpine fir. This landform component represents 50 percent of the LTA.

Compiled by: Dean Sirucek, Flathead National Forest; Louis Kuennen, Kootenai National Forest

MOUNTAIN SLOPES AND RIDGES: VOLCANIC

LTA64-M333B

Location

This LTA is located primarily in the Salish Mountain Range of the Flathead River Basin in northwest Montana.

Acreage by Section

Section	Acres
64-M333B	19,044

LTA Setting and General Characteristics

Differentiating characteristics: This LTA occurs in an upland landscape setting which is typically composed of dissected mountain slope, glaciated mountain slope, and glacially scoured ridge top landforms. Parent materials are Tertiary volcanic bedrock composed of welded tuff or basalt. This unit has inclusions of Tertiary intrusive bedrock composed on granodiorite of granite. The soil material is weathering in place.

Accessory Characteristics: The primary soils are shallow to moderately deep with very gravelly medium and moderately coarse textures. The vegetation is a mosaic of coniferous forest and mountain grasslands. Mean annual precipitation ranges from 41 to 102 centimeters (16 to 40 inches). The elevation range is 853 to 1,584 meters (2800 to 5200 feet). The dominant slopes have gradients of 15 to 55 percent. This unit is moderately to strongly dissected by streams with the dominant stream patterns being dendritic and sub-parallel.

LTA Components: This landtype association consists of glacially scoured ridge tops and dissected mountain slopes (fluvial) with inclusions of glaciated mountain slopes. Glacially scoured ridge tops have been strongly modified by continental ice. The prominent features are ridge tops and ridge noses with exposed bedrock. These areas have slopes that range from 10 to 45 percent. Soils on these landforms are shallow to moderately shallow, are weakly to moderately developed, and have medium and moderately fine textures. The major soils are classified as Lithic Cryochrepts, and Typic and Lithic Haploxerolls. Rock outcrops occupy more than 50 percent of the area. The dominant potential natural vegetation series include subalpine fir, rough fescue, and Douglas-fir. This landform component makes up 40 percent of the LTA. The dissected mountain slopes (fluvial) landscape is one that is weathering in place. It is chemical weathering further affected by colluvial action. Slope gradients range from 30 to 60 percent. Soils on these landforms are moderately deep to deep, with moderate to high development, and have gravelly to very gravelly medium textures. The major soils are classified as Typic Argixeroll, Glossic Eutroboralfs, and Typic Ustochrepts. Rock outcrops occupy less

than 10 percent of the area. The dominant potential natural vegetation series includes Douglas-fir and subalpine fir. This landform component represents 60 percent of the LTA.

Compiled by: Dean Sirucek, Flathead National Forest

MOUNTAIN SLOPES AND RIDGES: SANDSTONES, SHALES AND CARBONATES

LTA68-M333B

LTA68-M333C

LTA68-M333D

Location

This unit is located in the Whitefish, Swan, and Flathead mountain ranges of the Flathead, Clearwater, and Blackfoot River basins in northwest Montana.

Acreage by Section

Section	<i>Acres</i>
68-M333B	8,043
68-M333C	36,067
68-M333D	1,511

LTA Setting and General Characteristics

Differentiating characteristics: This map unit occurs in both upland and alpine landscape settings, which are typically composed of dissected mountain slopes, glaciated mountain slopes, and glacially scoured ridge top landforms. Colluvial, fluvial and glacial, erosional/depositional geomorphic processes occur in these areas. Parent materials are volcanic ash overlying weakly weathered Paleozoic and Mesozoic sandstone, shale, and limestone bedrock.

Accessory Characteristics: The primary soils are shallow to moderately deep with very gravelly medium and moderately fine textures. The vegetation is a mosaic of coniferous forest, mountain shrubland, and mountain grassland. Mean annual precipitation ranges from 51 to 177 centimeters (20 to 70 inches). The elevation range is 1,219 to 2,134 meters (4000 to 7000 feet). The dominant slopes have gradients of 55 to 70 percent. This unit is moderate to strongly dissected by streams with the dominant stream patterns being dendritic and sub-parallel.

LTA Components: This landtype association consists of glacially scoured ridge tops and dissected mountain slopes (fluvial) with inclusions of glaciated mountain slopes. Glacially scoured ridge tops have been strongly modified by continental ice. The prominent features are ridge tops and ridge noses with exposed bedrock. These areas have slopes that range from 10 to 45 percent. Soils on these landforms are shallow to moderately deep, weak to moderately developed with medium and moderately fine textures. The major soils are classified as Lithic Andic, or Typic Cryochrepts. Rock outcrops occupy more than 50 percent of the area. The dominant potential natural vegetation is subalpine fir-whitebark pine, and subalpine fir. This

landform component makes up 40 percent of the LTA. The dissected mountain slopes (fluvial) landscape is one that is weathering-in-place. It is chemical weathering further affected by colluvial action. Slope gradients range from 30 to 60 percent. Soils on these landforms are moderately deep to deep, weak to moderate development, with medium and moderately fine textures. The major soils are classified as Andic Cryochrepts, Andeptic and Typic Cryoboralfs, and Typic or Argic Cryoborolls. Rock outcrops occupy less than 10 percent of the area. The dominant potential natural vegetation is Douglas-fir and subalpine fir. This landform component represents 60 percent of the LTA.

Compiled by: Dean Sirucek, Flathead National Forest

FROST SHATTERED MOUNTAIN RIDGE TOPS: METASEDIMENTARY (BELT)

LTA70-M333B

LTA70-M333C

LTA70-M333D

Location

This unit is located in the Whitefish, Cabinets, Purcell, Salish, Bitterroot, Swan, Mission, and Flathead Mountain ranges of the Clark Fork, Pack River, Kootenai, and Flathead River basins in northwest Montana and north Idaho.

Acreage by Section

Section	<i>Acres</i>
70-M333B	153,508
70-M333C	60,686
70-M333D	518,308

LTA Setting and General Characteristics

Differentiating Characteristics: This map unit occurs in an alpine landscape setting and is typically composed of a ridge top landform which has formed by frost shattering. Parent materials are volcanic ash overlying weakly weathered, moderately metamorphosed, Proterozoic metasedimentary bedrock composed of argillites, siltites, quartzites, dolomites, and limestones. There are inclusions of other types of bedrock such as granite in this map unit.

Accessory Characteristics: The primary soils are shallow to moderately deep with very gravelly medium textures. The vegetation is a mosaic of coniferous forest, mountain shrubland, and mountain grasslands. Mean annual precipitation ranges from 102 to 279 centimeters (40 to 110 inches). The elevation range is 1,341 to 2,758 (4400 to 9100 feet). The dominant slopes have gradients of 20 to 60 percent. This map unit is undivided to slightly dissected by streams, with the pattern being dendritic or parallel where present.

LTA Components: This landtype association consists of glacially scoured, frost shattered ridge tops. Glacially scoured, frost shattered ridge tops have been strongly modified by continental ice,

alpine ice, and frost action. The prominent features are ridge tops that have been rounded or scoured by the previously mentioned actions. Exposed bedrock comprises 10 to 40 percent of the area. These areas have slopes that range from 5 to 70 percent. Soils on these landforms are shallow to moderately deep and weakly developed with very gravelly medium textures. The major soils are classified as Lithic Cryochrepts, Lithic Haplocryands, Vitric Haplocryands, and Andic Cryochrepts. Vitric Fulvicryands and Andic Cryumbrepts occur in the poorly drained sites. The dominant potential natural vegetation includes subalpine fir, mountain hemlock, and whitebark pine-subalpine fir series. This landform component makes up 90 percent of the map unit. There are up to 10 percent inclusions of nivation hollows that occur in this map unit.

Compiled by: Dean Sirucek, Flathead National Forest; Louis Kuennen, Kootenai National Forest; Skip Barndt, Lolo National Forest, Jerry Niehoff, Idaho Panhandle National Forests

FROST SHATTERED MOUNTAIN RIDGE TOPS: WEAKLY WEATHERED GRANITICS

LTA72-M333B

LTA72-M333A

LTA72-M333D

Location

This unit is located in the Selkirk, Purcell and Cabinet Mountains of the Priest, Kootenai, Pack River and Clark Fork River basins of northeast Idaho and northwest Montana. This unit is also located in the St. Joe Mountains of the Bitterroot Range, which is part of the St. Joe and Little North Fork of the Clearwater River basins of northern Idaho.

Acreage by Section

Section	<i>Acres</i>
72-M333A	4,337
72-M333B	967
72-M333D	17,671

LTA Setting and General Characteristics

Differentiating Characteristics: This map unit occurs in a high elevation, gentle to moderately steep sloping, mountain sideslope and ridge landscape setting, which is typically composed of weakly to non dissected mountain slopes, and associated ridges comprised of colluvium and residuum. Parent materials are surface volcanic ash overlying weakly weathered granitics from Cretaceous Kaniksu Batholith and Idaho Batholith.

Accessory Characteristics: The primary soils are shallow to deep sands, sandy loams and loams, with up to 30 percent rock outcrop and scree on some units. The vegetation is a mosaic of coniferous forest. Mean annual precipitation ranges from 114 to 178 centimeters (45 to 70 inches). The elevation range of this unit is 1433 to 1981 meters (4700 to 6500 feet). The dominant slopes have gradients of 20 to 55 percent. This unit is weakly to non-dissected by streams, with the dominant stream pattern being parallel when they occur.

LTA Components: This landtype association consists of weakly to non-dissected mountain slopes and associated ridges, Weakly to non-dissected mountain slopes and ridges occur on gentle to moderately steep slopes and are formed in batholith that consists of granite, granodiorite or other rocks of similar composition. The slope gradients range from 10 to 60 percent. Soils on these landforms are shallow to deep, weakly weathered and coarse to medium textured. The major soils are classified as Vitric Haplocryands and Andic Cryochrepts. These soils make up the majority of the unit and occur on the well drained sites. Vitric Fulvicryands and Andic Cryumbrepts occur in the poorly drained sites. The shallow soils are classified as Lithic Haplocryands and Lithic Cryochrepts. The dominant potential natural vegetation series over most of the area is subalpine fir, but mountain hemlock is dominant in the St. Joe and Little North Fork of the Clearwater River basins. Minor Douglas-fir occurs on the very dry sites.

Compiled by: Jerry Niehoff, Idaho Panhandle National Forests

MASS WASTED SLOPES: MIXED GEOLOGY

LTA90-M333B

LTA90-M333C

Location

This unit is located in the Swan, Salish, Flathead, Mission, and Whitefish Mountain ranges of the Swan and Flathead River basins in northwest Montana.

Acreage by Section

Section	Acres
90-M333B	1,358
90-M333C	58,472

LTA Setting and General Characteristics

Differentiating characteristics: This map unit occurs in both upland and alpine landscape settings. Typically landslide areas are associated with structural breakland, stream breakland, glacial troughwall, and glacial moraine landforms. Parent materials are typically glacial tills underlain by Paleozoic and Mesozoic sandstone and shale bedrock; or Proterozoic argillite, siltite, quartzite, dolomite and limestone.

Accessory Characteristics: The primary soils are moderately deep to deep with gravelly medium to moderately fine textures. The vegetation is primarily coniferous forest with inclusions of shrublands. Mean annual precipitation ranges from 51 to 229 centimeters (20 to 90 inches). The elevation range is 914 to 2,316 meters (3000 to 7600 feet). The dominant slopes have gradients of 20 to 60 percent. This unit is slightly to moderately dissected by streams with the dominant stream pattern being deranged. Wetlands and small ponds are a major component of this unit.

LTA Components: This landtype association consists of surficial landslides and bedrock landslides. Surficial landslide deposits are formed in glacial till and colluvium parent materials. Slope gradients range from 20 to 50 percent. Soils on these landforms are moderately deep to deep and moderately developed with gravelly medium textures. These soils are classified as Typic and Andeptic Cryoboralfs and Typic Eutroboralfs. Rock outcrop occurs on less than 10 percent of this landscape component. The dominant potential natural vegetation includes

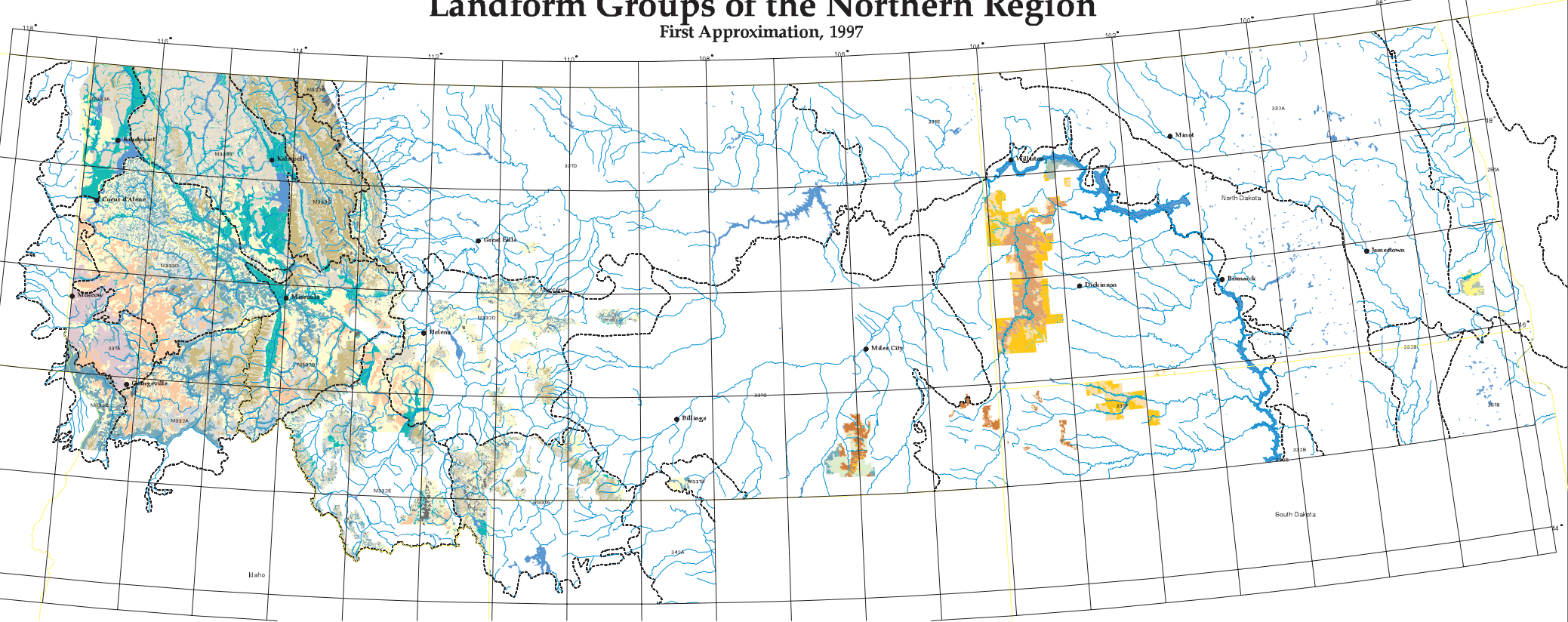
subalpine fir and western red cedar series. This component represents 60 percent of this unit. Bedrock landslide landforms are formed in residual and colluvial parent materials derived from native bedrock formations. Slope gradients range from 30 to 50 percent. Soils on these landforms are shallow to deep and moderately developed with gravelly medium and moderately fine textures. These soils are classified as Typic and Andeptic Cryoboralfs, Typic Eutroboralfs, and Andic Cryochrept. Rock outcrop occurs on about 15 percent of this landscape component. The dominant potential natural vegetation includes subalpine fir, Douglas-fir, and western red cedar series. This component represents 40 percent of this unit.

Compiled by: Dean Sirucek, Flathead National Forest

Landtype-Association maps appear on the pages that follow.

Landform Groups of the Northern Region

First Approximation, 1997



Region 1, U.S. Forest Service

Section Level Ecological Units (scale of origin 1:500k) and Landtype Association Map Units (scale of origin 1:100k)

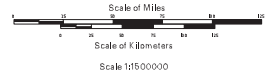
This map depicts subregional ecological units developed according to the classification scheme of the National Hierarchical Framework of Ecological Units (Avers, et. al., 1986). The map represents the first iteration of geographic Associations for the Northern Region.

These Landtype Associations were compiled at a scale of 1:100,000. Map sources included geologic, soil survey, and topographic maps, and the knowledge of soil scientists, geologists and others from the Forest Service and Natural Resources Conservation Service.

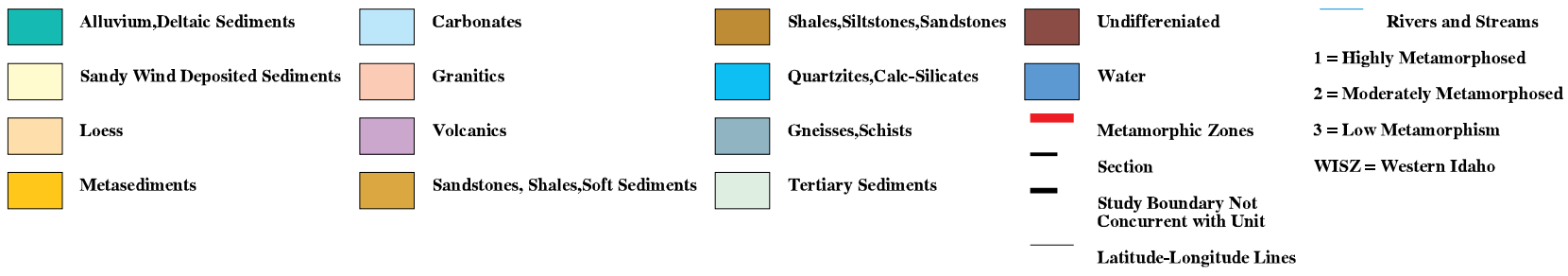
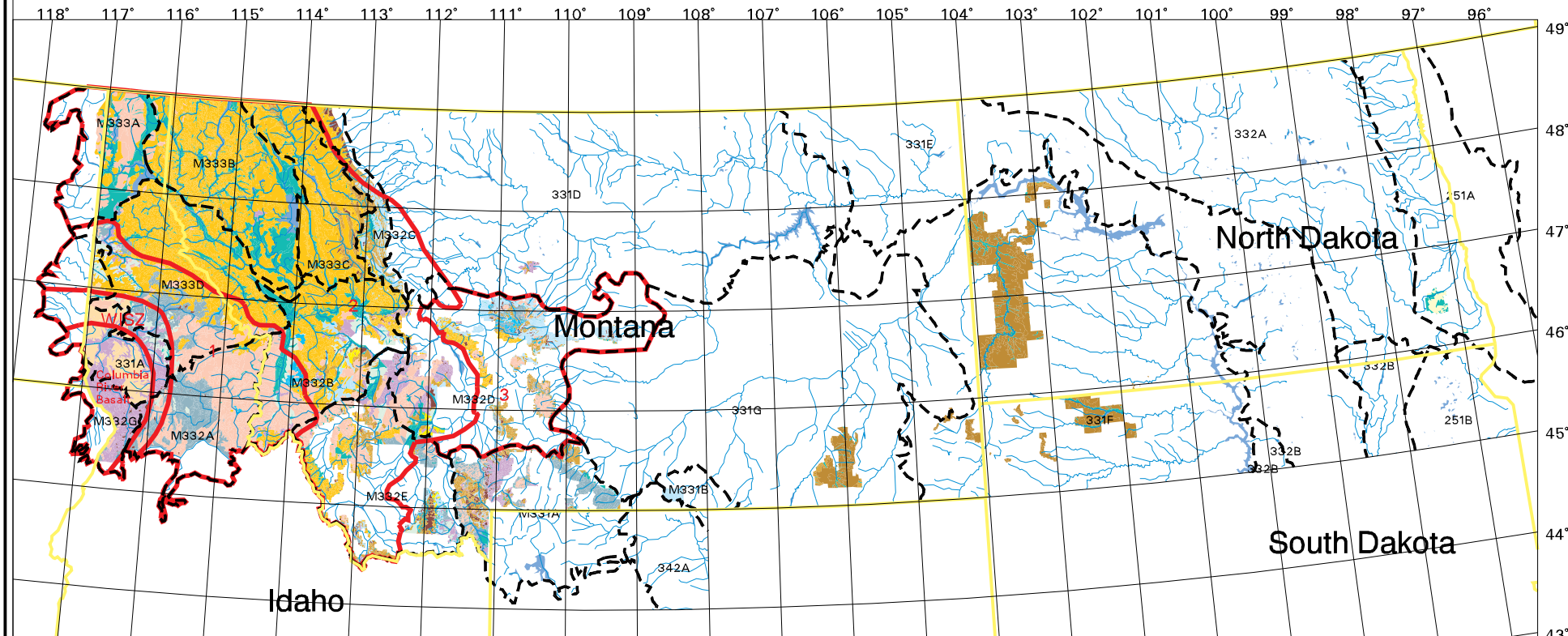
1997-1998
 This map depicts subregional ecological units developed according to the classification scheme of the National Hierarchical Framework of Ecological Units (Avers, et. al., 1986). The map represents the first iteration of geographic Associations for the Northern Region.

Landform Legend:

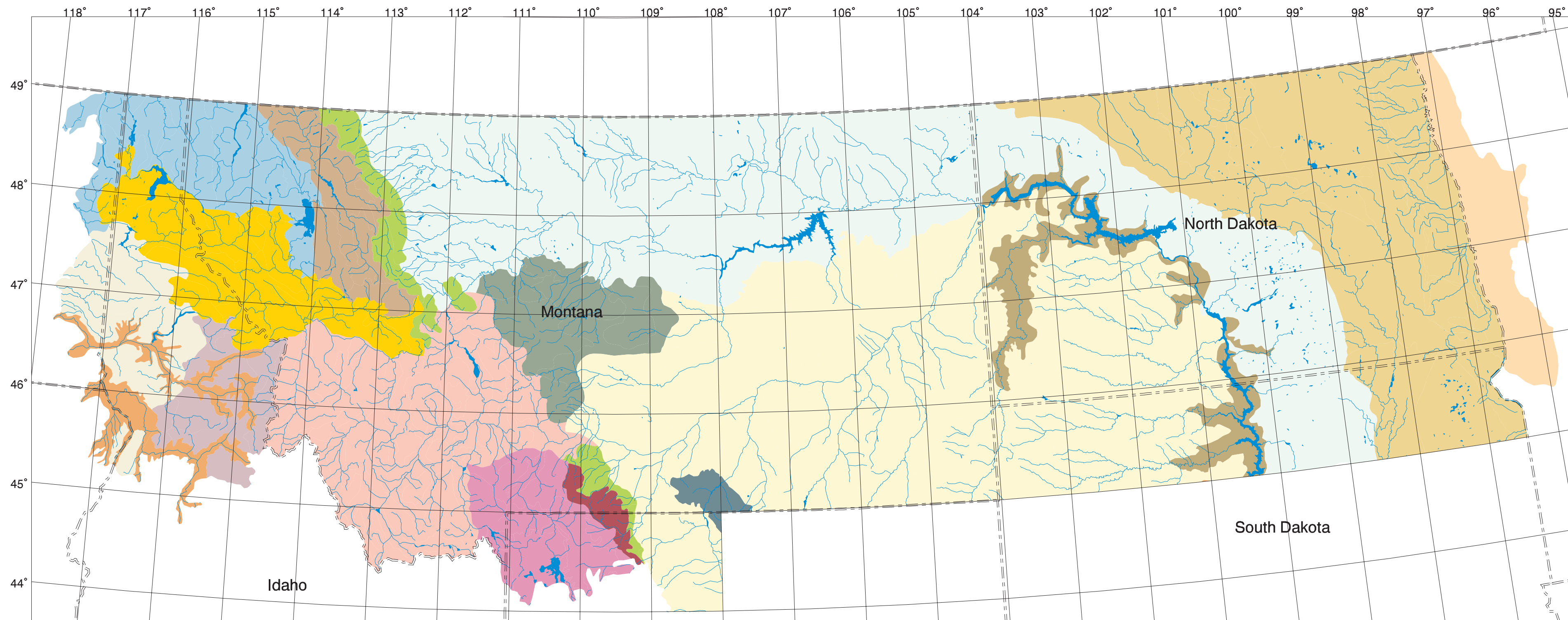
- | | | |
|--------------------------------------|------------------------------------------|----------------------------------------|
| Valleys | Steep Glaciated Mountain Slopes | Sand Hills and Sand Dunes |
| Basins | Non-Washed Slopes and Colluvial Deposits | Eroded Plateaus and Buttes |
| Low Relief Hills | Plains | Water |
| Hills and Plateaus | Dissected Plains | Section |
| Mountain Slopes and Ridges | Glaciated Plains | State Boundary Not Consistent with UTM |
| Frost-Shattered Mountain Ridges | Badlands | Rivers and Streams |
| Glaciated Mountain Slopes and Ridges | Eroded Uplands | State Border |



GEOLOGIC MATERIAL-Metamorphic Units for Northern Region



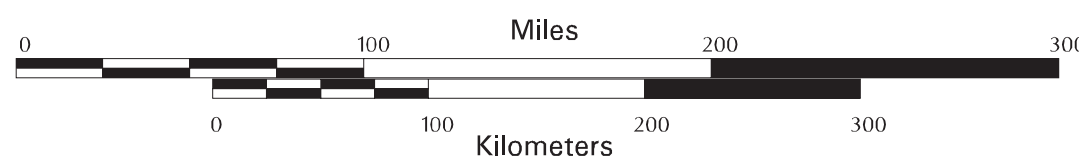
Geomorphic Overview of the Northern Region




















Compiled and edited by John A. Nesser, Gary L. Ford, C. Lee Maynard,
 US Forest Service, Northern Region
 Intermountain Research Station
 Cartographic Production by Duane F. Lund
 Natural Resource Information System
 This GIS product was compiled from various sources and may be
 corrected, updated, modified, or replaced at any time.
 For more information contact:
 U.S.D.A. Forest Service, Northern Region

Map Scale: 1:3,500,000

Albers Equal Area Projection

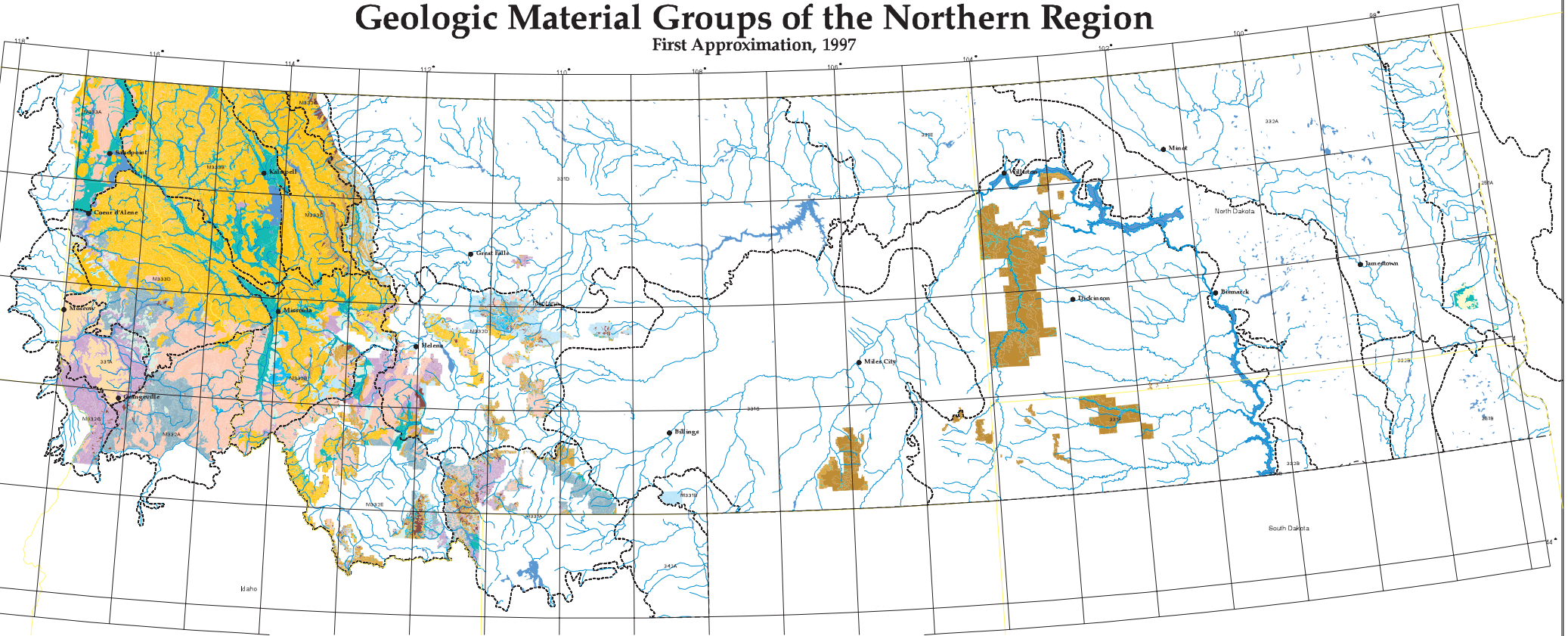


- | | | | |
|---------------------------------------------------------------------------------------|---------------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
|  | Pryor Mountains |  | Continental Glaciated Mountains |
|  | Yellowstone Volcanic Plateau |  | Metasedimentary Mountains |
|  | Beartooth Plateau |  | Columbia River Basalts |
|  | Non Glaciated Plains |  | Idaho Batholith Uplands |
|  | Northern Glaciated Plains |  | Idaho Canyon Lands |
|  | Rocky Mountain / Beartooth Front |  | Badlands and Breaks |
|  | Central Montana Island Mountains |  | Prairie Potholes |
|  | Southwest Montana, Mountains and Valleys |  | Red River Valley |
|  | Alpine Glaciated Metasedimentary Mountains | | |



Geologic Material Groups of the Northern Region

First Approximation, 1997



Region 1, U.S. Forest Service

Section Level Ecological Units (scale of origin 1:500k) and Landtype Association Map Units (scale of origin 1:100k)

This map depicts subregional ecological units developed according to the classification scheme of the National Hierarchical Framework of Ecological Units (Auer, et al., 1996). This map represents the best available geologic Landtype Associations for the Northern Region.

These Landtype Associations were compiled at a scale of 1:100,000. Map sources included geologic, soil survey, and topographic maps and the knowledge of soil scientists, geologists and others from the Forest Service and the U.S. Geological Survey.

REVISIONS:
10/19/97: This map was updated to reflect the most current data available from the U.S. Geological Survey and the U.S. Forest Service. It was revised to reflect the most current data available from the U.S. Geological Survey and the U.S. Forest Service. It was revised to reflect the most current data available from the U.S. Geological Survey and the U.S. Forest Service.

Line Legend:

- Section
- - - Study Boundary Not Contiguous with USFS
- Rivers and Streams
- State Border

Geologic Material Legend:

- | | |
|--------------------------------|------------------------------------|
| Alluvial/Deltaic Sediments | Sandstones, Shales, Silt Sediments |
| Sandy Wind Deposited Sediments | Shales, Siltstones, Sandstones |
| Loess | Quartzites, Calc-Siltites |
| Metasediments | Gneisses, Gabbros |
| Carbonates | Tertiary Sediments |
| Granites | Unidentified |
| Volcanics | Water |



Section M333C NORTHERN ROCKIES

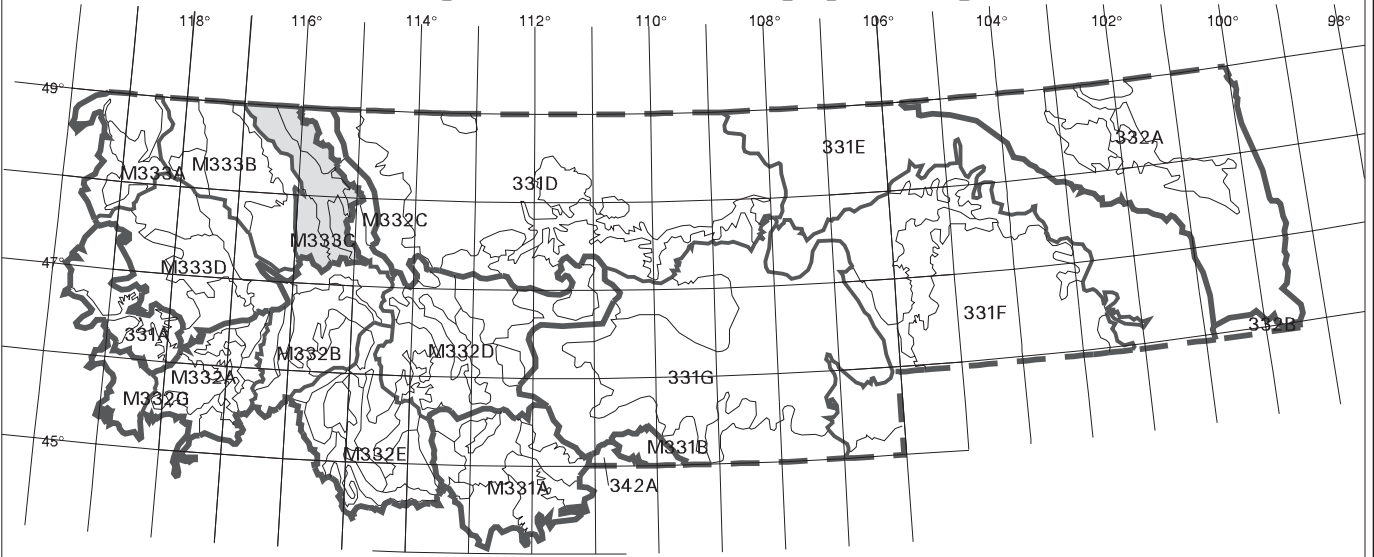
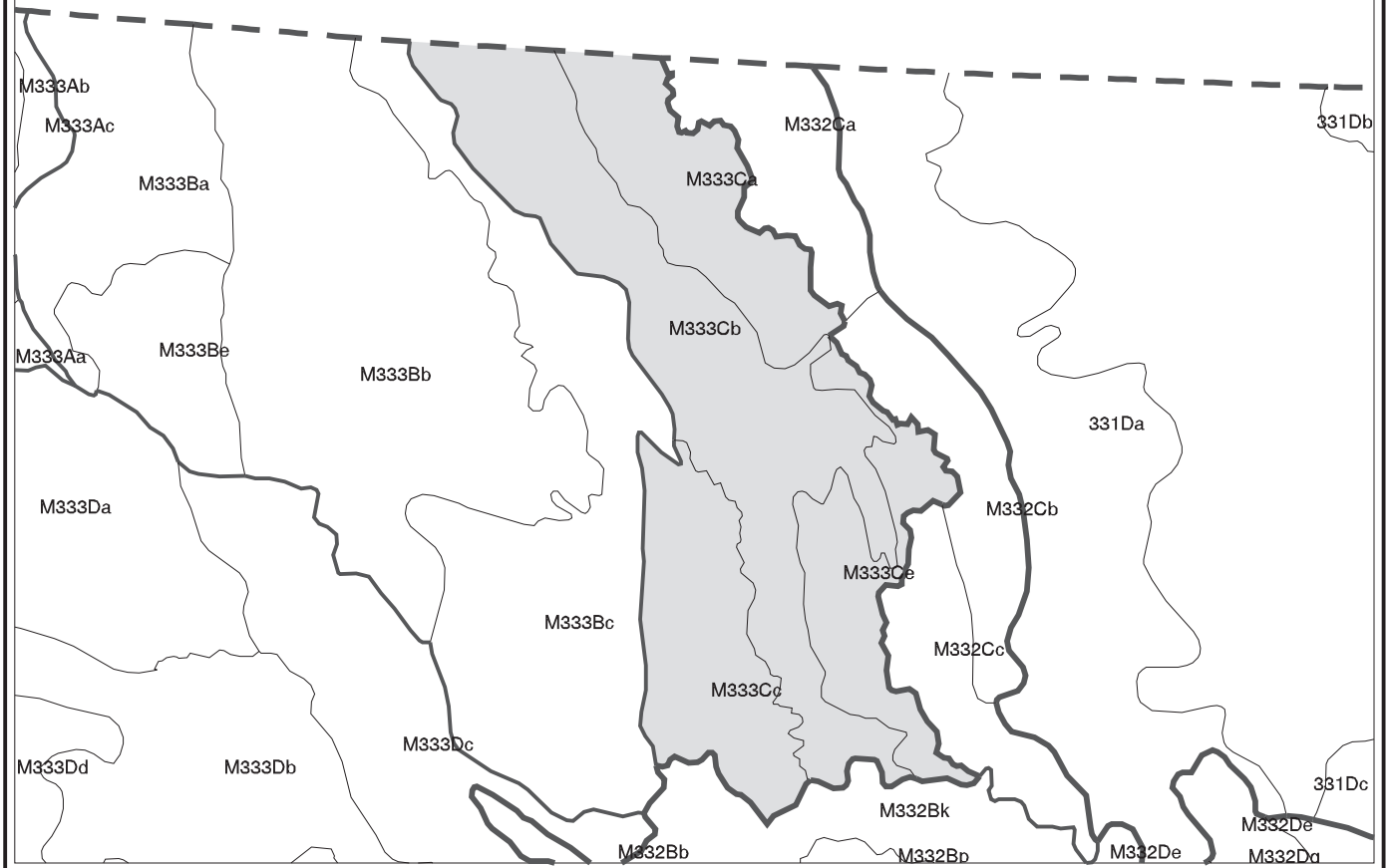


Figure 55

Subsections of Section M333C



Section M333B FLATHEAD VALLEY

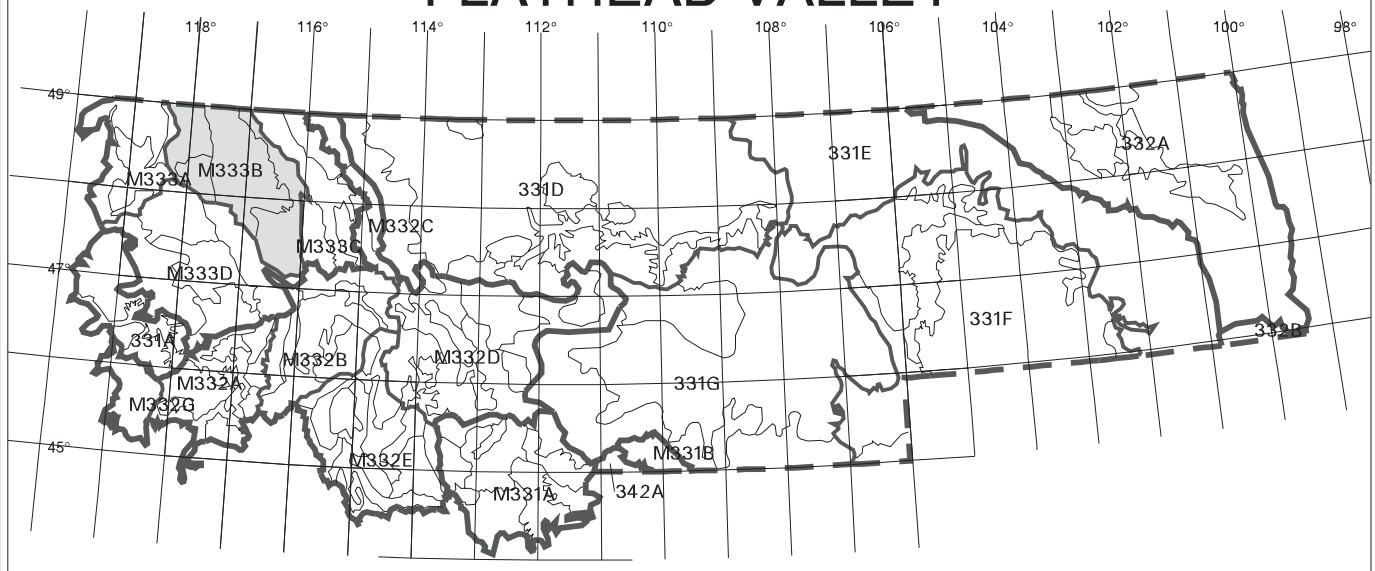
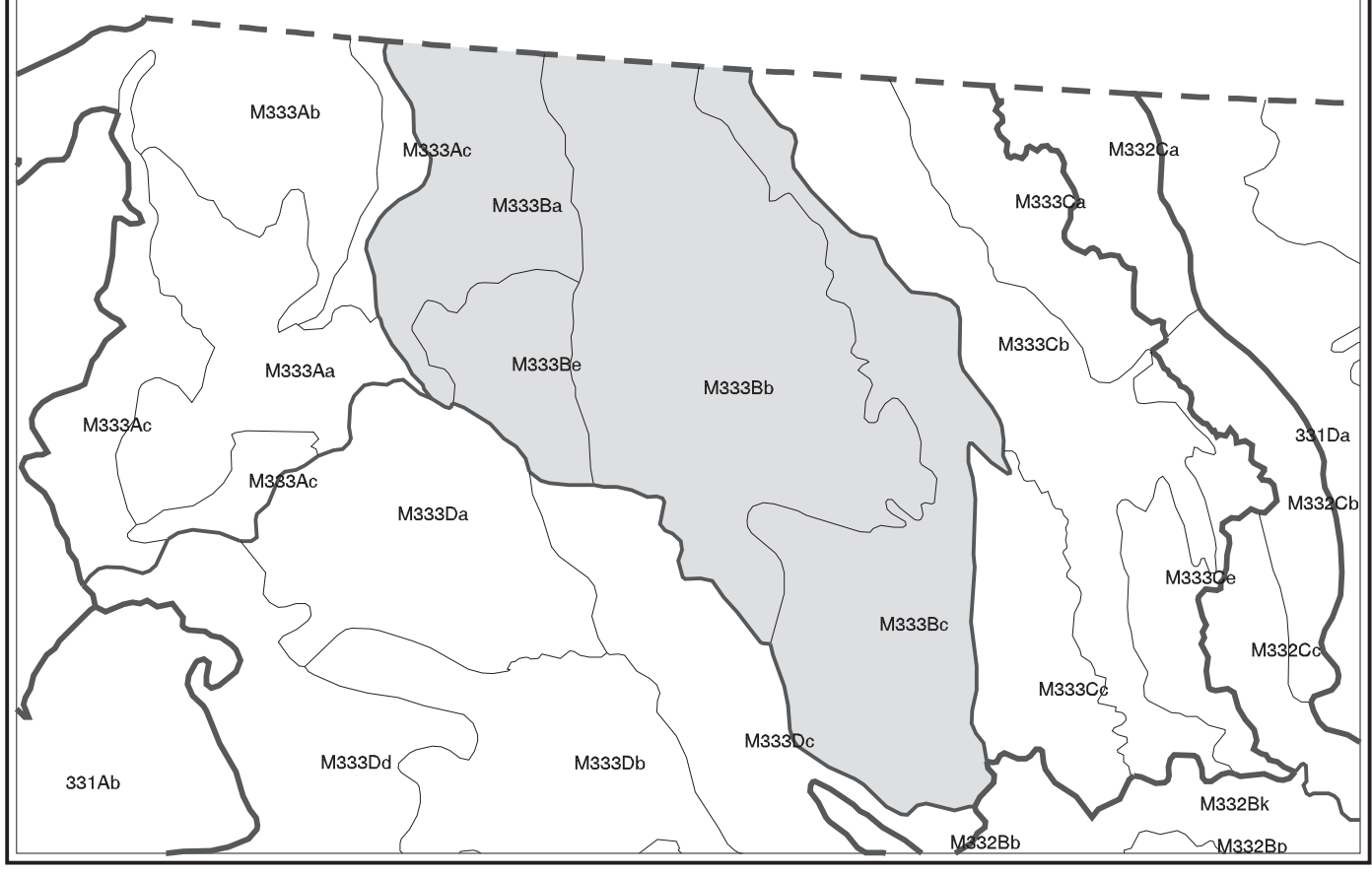











Figure 50

Subsections of Section M333B












Geologic Material Landform Categories












BELT SERIES

-  20 Breaks
-  28 Dissected Breaks
-  60 Mountain Slopes and Ridges
-  70 Mountain Ridge Tops
-  80 Rolling Hills
-  40 Steep Mountain Slopes, Glaciated
-  50 Mtn Slopes and Ridges, Glaciated
-  47 Glacial Trough Walls
-  58 Glacial Till, Highly WX








GNEISS and SCHISTS

-  23 Breaks
-  26 Breaks, Mod. WX
-  63 Mountain Slopes and Ridges
-  59 Mountain Slopes and Ridges
-  77 Mountain Ridge Tops
-  84 Rolling Hills, Highly WX
-  85 Rolling Hills, Mod. WX
-  39 Steep Mtn Slopes, Glaciated
-  57 Mtn Slopes and Ridges, Glaciated





GRANITICS

-  21 Breaks, Highly WX
-  22 Breaks, Weakly WX
-  61 Mtn Slopes and Ridges, Highly WX
-  71 Mountain Ridge Tops, Highly WX
-  81 Rolling Hills
-  62 Mtn Slopes and Ridges, Weakly WX
-  72 Mountain Ridge Tops, Weakly WX
-  41 Steep Mtn Slopes, Glaciated
-  51 Mtn Slopes and Ridges, Glaciated
-  46 Glaciated Trough Walls
-  45 Mtn Slopes, Weakly Glaciated

VOLCANICS













-  24 Breaks
-  34 Steep Mountain Slopes
-  64 Mtn Slopes and Ridges
-  73 Mountain Ridge Tops
-  82 Rolling Hills
-  42 Steep Mtn Slopes, Glaciated
-  54 Mtn Slopes and Ridges, Glaciated

QUARTZITES and CALC - SILICATES





-  29 Breaks
-  67 Mtn Slopes and Ridges, Highly WX
-  75 Mountain Ridge Tops
-  35 Mtn Slopes and Ridges, Weakly Glaciated

Geologic Material Landform Categories

ALLUVIUM/DEPOSITIONAL

-  10 Recent Deposits, Coarse
-  14 Recent Deposits, Fine
-  11 Lacustrine
-  12 Glacial Terraces, Fans, Outwash, Coarse
-  13 Glacial Terraces, Fans, Outwash, Fine
-  17 Loess Deposits
-  83 Tertiary Sediments, Fine
-  88 Tertiary Sediments, Coarse
-  69 Pediment, Undifferentiated
-  8 Glacial Deltaic Sediments
-  9 Sand Hills and Sand Dunes
-  99 Lakes and Reservoirs








CARBONATES

-  27 Breaks
-  37 Steep Mountain Slopes
-  66 Mountain Slopes and Ridges
-  43 Steep Mtn Slopes, Glaciated



SHALES, SILTSTONES, SANDSTONES

-  1 Rolling Plains
-  2 Rolling Plains, Glaciated
-  3 Dissected Plains
-  4 Dissected Plains, Glaciated
-  5 Badlands
-  6 Eroded Uplands (Volcanic Tuffs)
-  7 Plateaus and Buttes

SANDSTONES and SHALES

-  25 Breaks
-  36 Steep Mountain Slopes
-  68 Mountain Slopes and Ridges
-  65 Mountain Slopes and Ridges, Soft Sedimentary
-  74 Mountain Ridge Tops
-  44 Steep Mtn Slopes, Glaciated
-  53 Mtn Slopes and Ridges, Glaciated

MASS FAILURE

-  90 Mass Wasted
-  92 Colluvial Deposits

Section M333B FLATHEAD VALLEY

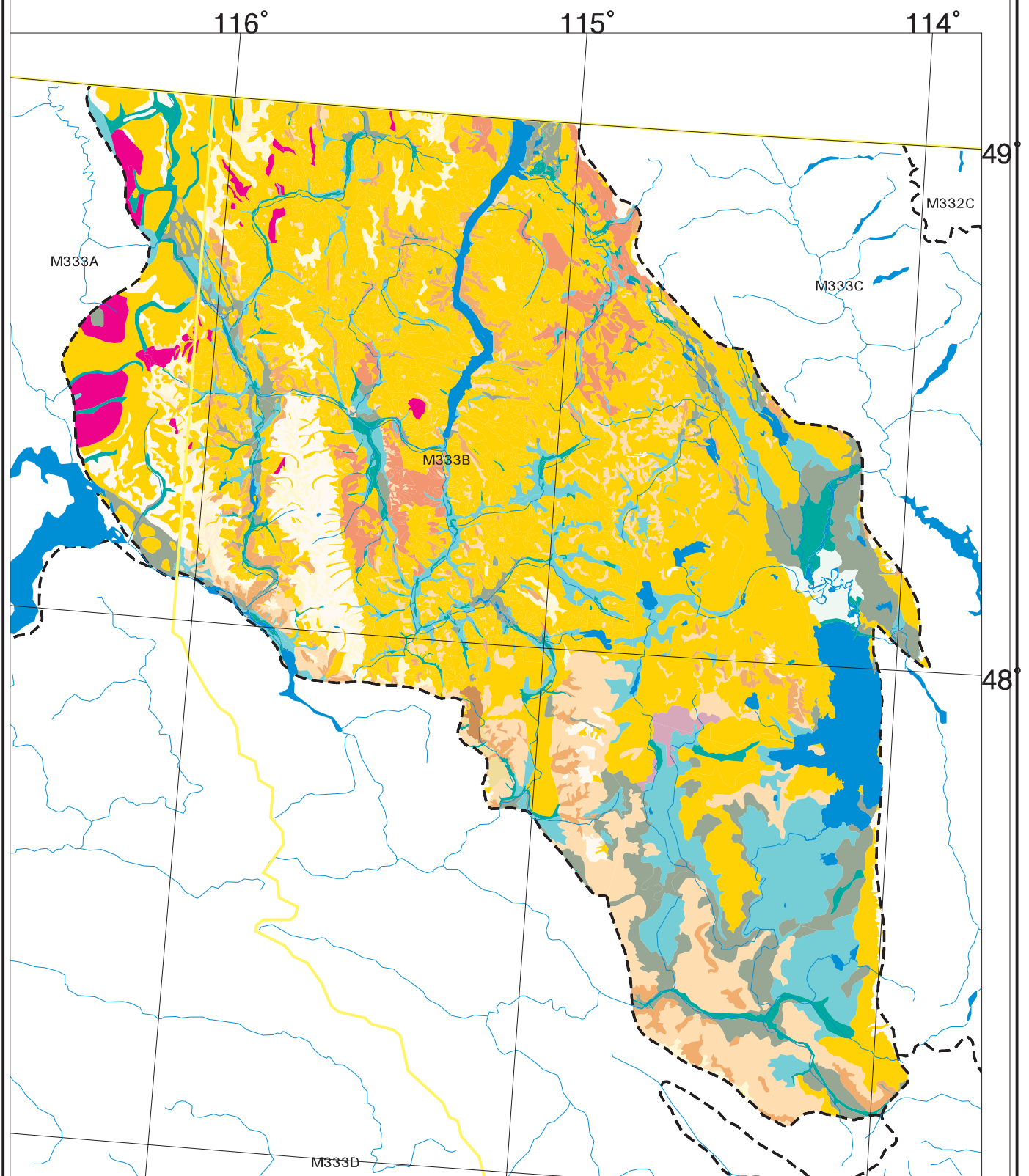


Figure 52

Section M333C NORTHERN ROCKIES

115°

114°

113°

49

48

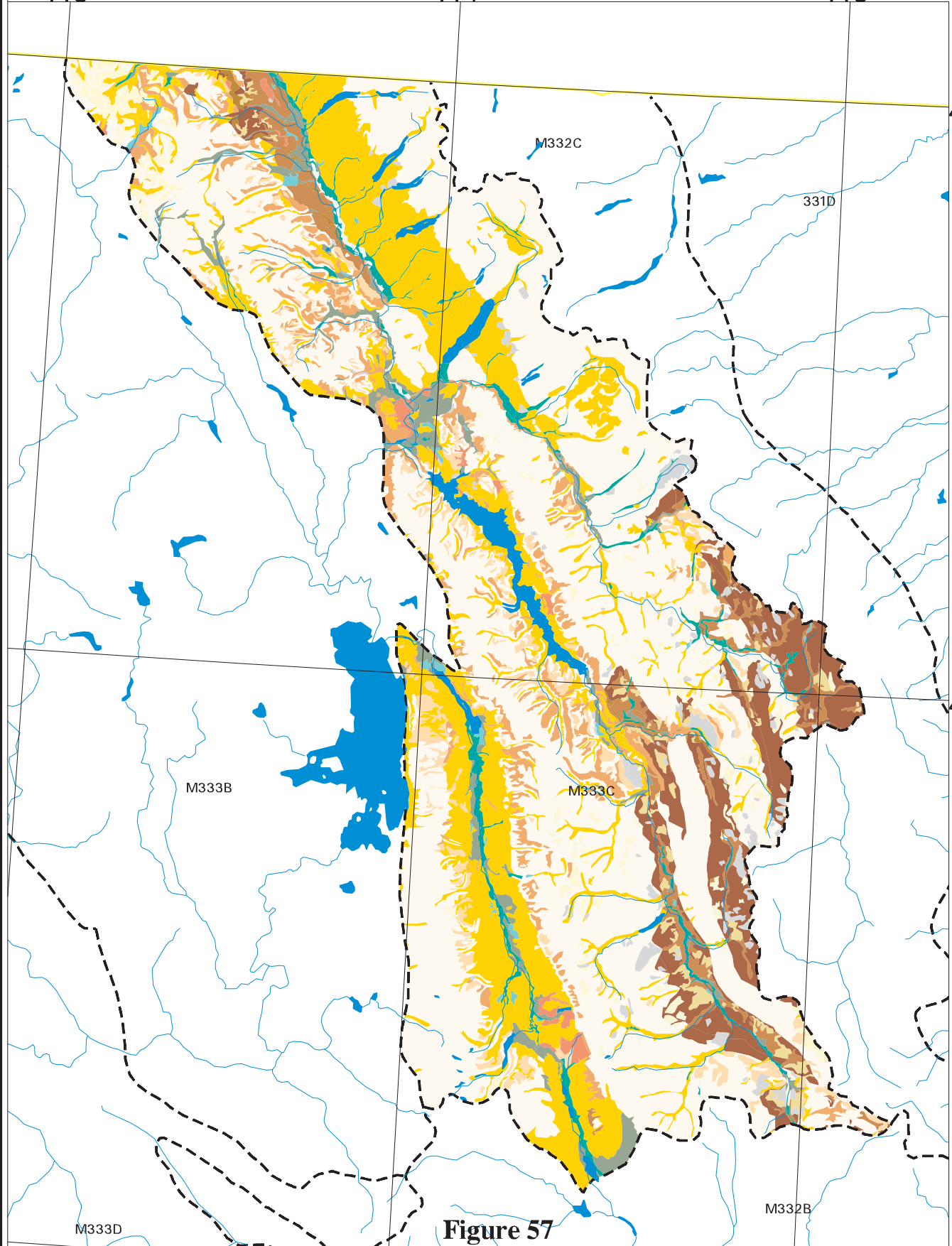


Figure 57