100K Series: Kldr - 1

Areas of Landslides
Killdeer 100K Sheet, North Dakota

Watford City	Parshall	Garrison
Grassy Butte		Hazen
Belfield	Dickinson	Glen Ullin

Adjoining 100 K Maps

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General Information on Landslides

Landslides are masses of rocks that have tumbled or slid down a slope under their own weight. These geologic hazards can damage buildings, roads, railroad tracks, pipelines, transmission lines, and other types of infrastructure. Landslides are generally characterized in the field by steep, near-vertical slopes (the scarp) that are underlain by a mound of displaced rock (the body). The body of the slide may be relatively intact or it may be severely fragmented. Recent or relatively new landslides are generally characterized by a fresh (well -exposed rock) scarp and a sparsely vegetated body. Older slides are typically more difficult to ide ntify in the field because the scarps may be covered with vegetation and the landslide bodies are often well - vegetated, covered by mature trees.

Landslides are most readily identifiable from the air. The landslides mapped on the Killdeer Sheet were identified from two sets of aerial photographs (1:20,000 scale) the first was flown in July and August of 1958 and the second in the fall of 1981. It is unfortunate that both flight lines were flown when leaves were on the trees because groves of leaf-bearing trees tend to obscure landslides, especially small ones. On the other hand, leaves can also make it easier to identify these features. Trees and bushes are often aligned within very distinct parallel-, transverse-, and/or semi-circular-depressions that generally occur within the body of the landslide.

Slopes fail for various reasons including the steepness or angle of the slope, rock type, bedding, and moisture content of the rocks. Most landslides in western North Dakota are rotational slumps that have a well defined head and toe. Typically, the part of the slope that breaks apart slides down the slope as a single unit and the beds tilt back in the direction of the slope. The failed mass of rock is, however, almost never a cohesive unit; tension cracks generally cause the failed material to splinter into smaller portions. Successive landslides may occur at the same location. Over time, the accumulated material from multiple, adjacent landslides can cover an area that is several thousand feet wide and several miles long.

The Killdeer Sheet

With the exception of the Killdeer Mountains, capped by tuffaceous freshwater carbonates, most of the area of the Killdeer Sheet is underlain by either the Golden Valley or Sentinel Butte Formations, which consists of alternating beds of sandstone, siltstone, mudstone, claystone, clinker, and lignite. A veneer of glacial deposits covers much of the upland areas north of the Knife River and west of Highway 22.

In this area, landslides are most prevalent within the Little Missouri River Badlands and the slopes of the Killdeer Mountains. The rocks in the Little Missouri River badlands are no different than those in the relatively stable badland topography north of the Crooked Creek Escarpment and the rugged topography along the eastern one-third of this sheet. Landslides are most prevalent along the Little Missouri River Valley because it was carved relatively quickly (in geologic terms) when glacial ice diverted the Little Missouri and Missouri River into these areas. Approximately 600,000 years ago, glaciers blocked the path of the north-flowing ancestral Little Missouri River near the west border of the North Unit of the Theodore Roosevelt National Park. The glacier forced the river to turn east and carve the steep, rugged badlands in this area. These steep slopes are very susceptible to landslides.

The Killdeer Mountains consist of two mesas. These mesas are erosional remnants of rocks that 25 million years ago (during Miocene time) were deposited across this map sheet. Tens of millions of years of erosion created the steep-sided slopes of the Killdeer Mountains. These slopes have failed by both rotational slumping and the calving of the well-cemented caprock.

Over120 landslides were identified and are plotted on the Killdeer Sheet. These slides cover an area of 4,054 acres or less than one percent of the total land mass of this map. More locally, landslides occupy up to 30 or 40% of the Little Missouri River Badlands. Many of these slides are complexes that contain multiple landslides that may have occurred over a long period of time. The largest of these slide complexes occur in the Killdeer Mountains, approximately 600 acres in size, where roughly half of the slopes contain landslides. Although some landslides in the Little Missouri River Badlands may exceed 100 acres, most slides on this sheet extend over an area of less than 20 acres. Most of these landslides are well-vegetated indicating they are quite old, perhaps tens, if not hundreds, of thousands of years old in the Little Missouri River Badlands; occurring relatively quickly after the steep-sided slopes had formed. Careful consideration is required prior to construction to avoid landslide prone areas in the Little Missouri River Badlands and the slopes of the Killdeer Mountains.

UNIT DESCRIPTIONS

GU **Surface geology undifferentiated**

QUATERNARY

RECENT/PLEISTOCENE

Qls **Landslide**

A mass of sediment and/or rock that have slid or tumbled down slope. A pink area on the map my represent dozens of individual landslides.

Other Features

- Water
- Water - Intermittent
- River/Stream
- Stream - Intermittent
- Section Corner
- County Boundary
- Tribal Boundary
- State Highway
- Paved Road
- Unpaved Road

Geologic Symbols

Known contact between two geologic units

The North Dakota Geological Survey compiled this map according to conventional cartographic standards, using what is thought to be the most reliable information available. The North Dakota Geological Survey does not guarantee freedom from errors or inaccuracies and disclaims any legal responsibility or liability for thereon. The text for the general information on landslides section was modified only slightly from the Parshall 100K landslides sheet.

Scale 1:100,000

0 1 2 3 4 Miles

Mercator Projection 1927 North American Datum

Standard parallel 47° 15 Central meridian 102° 30

Shaded Relief - Vertical Exaggeration 9x

Cartographic Compilation: Elroy L. Kadrmas