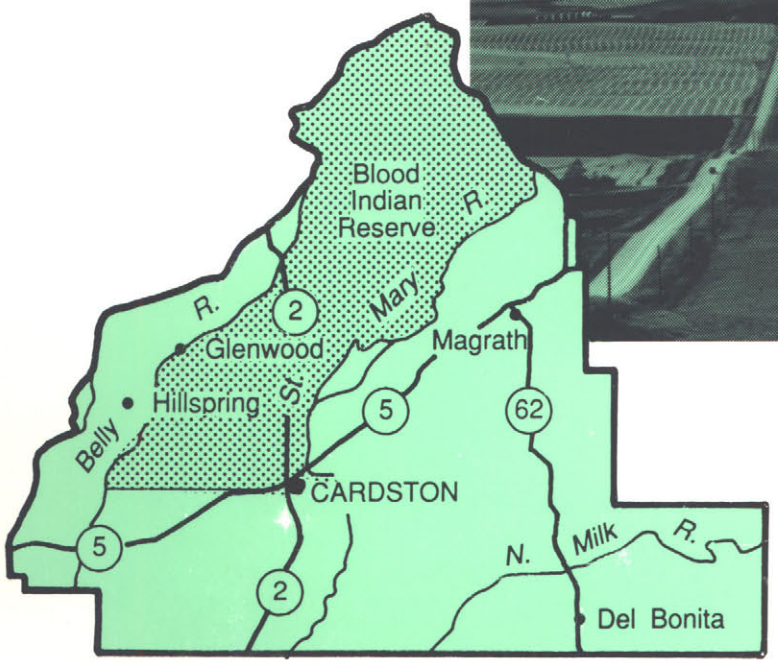
Agriculture Canada

Research Branch

Direction générale de la recherche

Soil survey of the M.D. of Cardston, Alberta

Report No. 48
Alberta Soil Survey 1991



Canada

SOIL SURVEY OF

THE MUNICIPAL DISTRICT OF CARDSTON

(M.D. No. 6)

ALBERTA

by

J.A. BRIERLEY, A.T. RODVANG and W.W. PETTAPIECE

AGRICULTURE CANADA, EDMONTON, ALBERTA

Soil mapping by :

V. Anderson, J.A. Brierley, P. Holowath, J. Miller, G.T. Patterson,
W.W. Pettapiece, A.T. Rodvang, J. Tajek, B.D. Walker.

Alberta Institute of Pedology
Report No. S–86–48
1991

Land Resource Research Contribution No. 87–62.

Copies of this publication are available from:

Agriculture Canada - Soil Survey
653 Terrace Plaza Tower
4445 Calgary Trail South
Edmonton, Alberta
T6H 5R7

HOW TO USE THIS SOIL SURVEY REPORT

The soil survey report for the Municipal District of Cardston consists of four chapters, five appendices as well as 23 soil maps displayed on photomosaic bases with an accompanying legend. Part 1 provides a general description of the survey area. Part 2 describes the procedures used in the development of the soil map as well as map unit and symbol definitions. The remainder of this chapter contains the descriptions of the principal soils and their respective soil map units. In Part 3, the rationale and actual ratings of the map units for dryland agriculture, grazing productivity and irrigation capability are explained and displayed. Part 4 initially describes the areal extent of erosion and salinity within the M.D. and then impacts of erosion, factors influencing soil degradation and possible management techniques are discussed.

The five appendices include: a brief explanatory section on soil formation and classification for the uninitiated user; analytical procedures employed for determining the physical and chemical properties of the soil series; the areas of the individual soil map units; a glossary of terms used in the report and a key to the soil series used on the soil maps.

In order to extract information about the soils and associated interpretive ratings from the soil map sheets for specific areas within the M.D., the following steps are suggested:

1. Consult the Index to Map Sheets (Figure 54) and select the map sheet which contains the specific area of interest.

2. Locate the area on the appropriate map sheet. Note the map unit symbol(s) for the region. Symbols in the legend are listed in alphabetical and numerical order. The composition and landscape characteristics of each soil map unit symbol are described in the accompanying legend.

3. In order to find the interpretive ratings for a soil map unit consult Table 6 found in Part 3. The soil map unit symbols are listed alphabetically and numerically. A brief explanatory section describing the rationale and methodology employed in determining the individual interpretive ratings, precedes Table 6.

4. For a more detailed description of individual soil map units and characteristics of the individual named soils than is supplied in the legend refer to Part 2.3 in the report. Soils are listed alphabetically by soil name (not symbol) and soil map units occur under the dominant soil name. For example the BZCT soil map units are found under Beazer soils.

PREFACE

Soil surveys have been an ongoing endeavour in Alberta since the early 1920's. Their purpose is to provide basic information on the provinces soil resources. Although most of the settled portions of Alberta have been covered by reconnaissance soil surveys, many areas require resurvey and updating to current standards, particularly the areas covered by earlier surveys. In recent years resurveys have been conducted at the detailed reconnaissance scale, within the boundaries of local administrative units, usually the county or municipal district.

The M.D. of Cardston was included in the 1939 Soil Survey of the Lethbridge and Pincher Creek sheets (Wyatt et al 1939). These soil maps were published at a scale of 1:190,000. The current soil survey of the M.D. of Cardston is at the detailed reconnaissance level (Soil Intensity Level 3, scale 1:50,000). This survey project was initiated in the spring of 1982 with the field work being completed in 1984.

ACKNOWLEDGEMENTS

The soil survey of the Municipal District of Cardston was conducted by the Soil Survey Unit of Agriculture Canada in cooperation with the Terrain Sciences Dept. of Alberta Research Council and the Dept. of Soil Science at the University of Alberta.

The following people and organizations are recognized for their assistance and cooperation during the course of the survey project:

People who assisted in the field during mapping and sampling were: Connie Tomas, Maureen Jameson, Kent McIver, Connie Smith, Val Anderson, Keith Boyes, Paula Holowath, Jim Miller, Faye Zasadny and Jennifer Payne.

J. Beres, W.C. McKean and A. Schwarzer conducted the physical and chemical analyses.

J. Lutz and G. Cormin assisted in the compilation and drafting of the preliminary maps.

J. Lutz and C. Lirette typed the legend and report manuscript.

A.A. Kjearsgaard helped with initial legend development and correlation.

The Land Classification Branch, Alberta Agriculture in Lethbridge made available the use of their deep drill truck and operator.

G. Patterson made helpful suggestions in computer applications, and J. Hiley derived interpretive maps from SIDMAP technology. The contribution of Alberta Agriculture is also acknowledged.

J.A. Shields and G.M. Coen of Land Resource Research Institute made helpful suggestions during correlation trips and reviewed the manuscript.

J. Hermans, Alberta Agriculture, Edmonton for his contribution included in Part 4.2.

Information Systems Unit, Land Resource Research Centre, Ottawa prepared the initial photo mosaics and soil maps for printing.

The Henry family in Del Bonita who kindly rented their house to the soil survey party for two summers. Also L. Fisk who rented us a house in the town of Cardston for the final field season.

Four soil temperature instrumentation sites were installed and monitored for three years. The cooperation of the respective landowners, for allowing placement of the instruments and monitoring during the winter is acknowledged: in Cardston-Laverne Vadnais and in Mountain View-Morgan MacKenzie. The Del Bonita site, near the Canada Customs border crossing, was read by Ed Mackle. The site in Poll Haven community pasture was monitored by Alberta Environment personnel.

Ron St. John and Lucie Routhier, Land Resource Research Centre, Ottawa, formatted the report for publication.

Printing of this report was funded in part by the Canada/Alberta Soil Conservation Initiative.

SUMMARY

The Municipal District of Cardston is located in the south west corner of Alberta and is approximately 336,000 ha.in size. Three recognized physiographic regions: the Rocky Mountain Foothills, Southern Alberta Uplands, and Western Alberta Plains, occur within the M.D.. Tertiary aged sandstone, siltstone and shale bedrock underlies the study area.

Till is the principal parent material occurring extensively throughout the M.D., except on the Del Bonita Plateau and on portions of the Cardston Plain and Milk River Plain. In the Foothills, west of Lee Creek, the morainal material is of dominantly Cordilleran or mountain origin. East of Lee Creek, throughout the remainder of the M.D. the morainal material is of Laurentide or continental origin. On the Cardston Plain and the Milk River Plain, glaciolacustrine deposits are present in varying amounts. The soil parent materials on the Del Bonita plateau are described as cryoturbated eolian. This plateau is an unglaciated region within southern Alberta.

Dominant soils in the M.D. are Black Chernozemics. On the western edge of the M.D., the thick Black Chernozemics grade to Luvisolics, as forest vegetation becomes more dominant. Along the eastern side of the M.D., Dark Brown Chernozemic soils are present in association with the mixed grass prairie vegetation. The variability of soil types and associated vegetation is indicative of the difference in moisture availability and frost free period, as one proceeds from east to west across the study area.

Approximately half of the M.D. is cultivated, primarily for the production of barley and wheat. The remainder of the area is dominantly unimproved pastureland, grazed extensively by cattle and some sheep. Forestry is a minor land use, and is restricted to the south-western fringe of the M.D..

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

LIST OF FIGURES

LEGEND

11	Blackfoot and Calgary sheet
12	Rosebud and Banff sheet
13	Wainwright and Vermilion sheet
14	Peace Hills sheet
15	Rycroft and Watino sheet
16	Red Deer sheet
17	High Prairie and McLennan sheet
18	Grand Prairie and Sturgeon Lake sheet
19	Rocky Mountain House sheet
20	Beaverlodge and Blueberry Mountain sheet
21	Edmonton sheet
22	St. Mary and Milk River project
23	Cheery Point and Hines Creek area
24	Buck Lake and Wabamun Lake area
25	Grimshaw and Notikewin area
26	Hitchkiss and Keg River area
27	Whitecourt and Barrhead area
28	Chip Lake area
29	Tawatinaw map sheet 831
30	Mount Watt and Fort Vermilion ara
31	Hinton-Edson area 83F
31a	North Saskatchewan River Valley
33	Waterton Lakes National Park
34	Sand River sheet
35	Two Hills county
36	Oyen sheet
38	Elk Island National Park
39	Wapiti Map area
40	Brazeau Dam
41	Newell county
42	Athabasca oil sands area
43	Iosegun sheet
44	Banff-Jasper National Parks
45	Calgary Urban Perimeter
46	Warner county
47	County of Beaver
48	Cardston M.D.
49	County of Paintearth
50	Pincher Creek-Crowsnest Pass area
51	County of Flagstaff
52	County of St. Paul
82H/NW	Lethbridge
82H/NE	Lethbridge
72L	Medicine Hat (maps)
58-1	Preliminary
59-1	Preliminary
60-1	Preliminary
61-1	Preliminary
62-1	Preliminary
63-1	Preliminary
64-1	Preliminary
64-2	Preliminary

Note: Reports published prior to 1942 are out of print but may be obtained on loan from the Alberta Soil Survey.

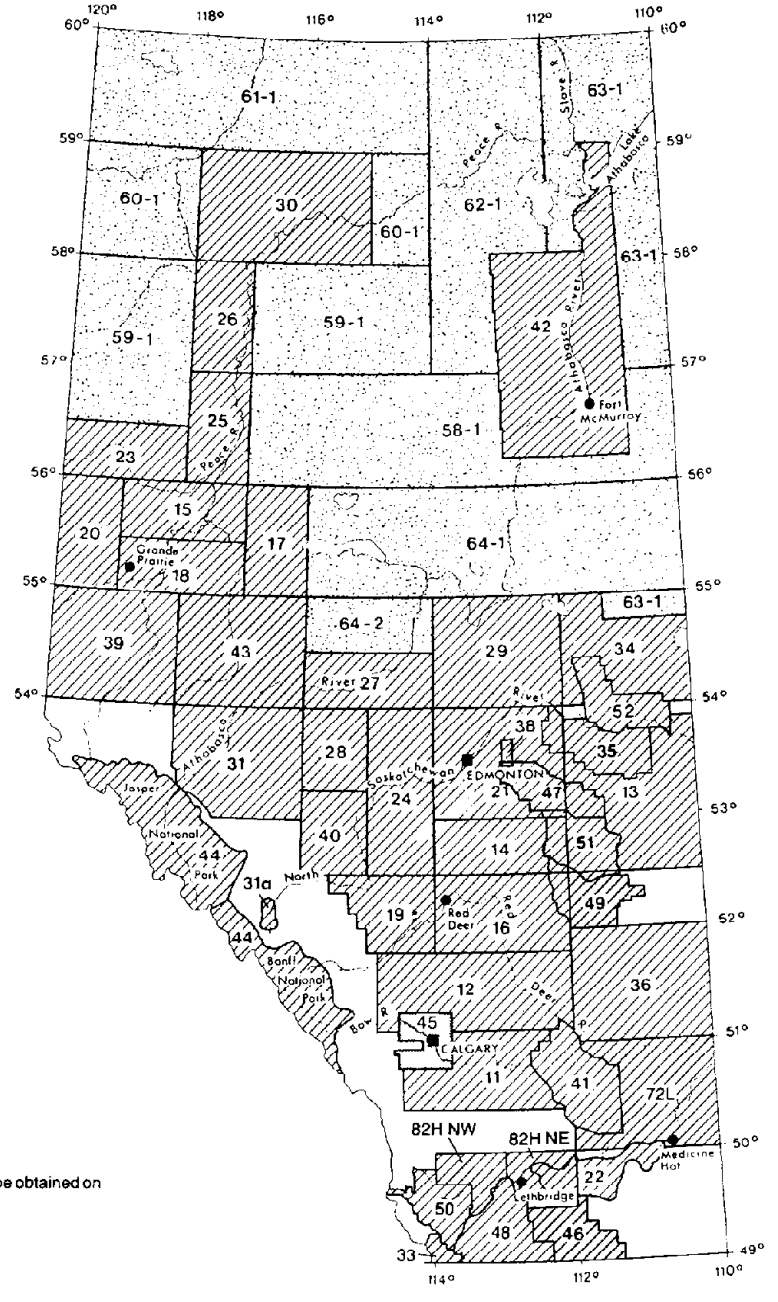


Figure 1. Location map of the soil survey areas in Alberta, relative to the M.D. of Cardston.

PART 1.GENERAL DESCRIPTION OF THE AREA.

1.1. REGIONAL SETTING.

The M.D. of Cardston is located in the south west corner of Alberta (Figure 1) and is approximately 336 000 ha in size. The M.D. is bordered by the County of Warner to the east, the United States of America to the south, Waterton National Park and the M.D. of Pincher Creek to the west, and the Blood Indian Reserve to the north. The area is bracketed by longitude 112°25' and 113°40'W, latitude 49°00' and 49°30'N.

Major geographic features within the M.D. are the Rocky Mountain Foothills, the Plains area around the towns of Cardston and Magrath, as well as most of the Milk River Ridge. An overview of the different landscape features as well as the distribution of soil and climatic zones, which are associated with the various physiographic areas, are schematically represented in Figure 2.

1.2 POPULATION, AND LAND USE.

The population of the M.D. of Cardston was 9,594 in 1981. The four largest towns or villages are Cardston with a population of 3267, Magrath with 1576, Glenwood with 259 and Hillspring with 200. (Alberta Agriculture Statistics Branch (A.A.S.B.) pers. comm. 1984).

Of the 723 farms in the M.D., 80% are family farm operations. Land use is divided evenly between small grain and forage production. Only 10% of the forage production originates from improved or tame pasture, while native range provides the remainder of the grazed land base. Barley accounts for 50% of the cropland and wheat for 30%. Oats, rye, canola, and sugar beets, as well as summer fallow account for the remaining 20% of annually cultivated land. (A.A.S.B. 1982).

Approximately 10,000 ha or 3% of the M.D. is under irrigation. The majority is irrigated by sprinkler systems, while the remainder is flood irrigated (A.A.S.B. 1982).

Irrigation has been historically important in the M.D. of Cardston. Early Mormon settlers had 800 acres under flood irrigation by 1889. By 1890 the Canadian North West Irrigation Company had completed its main canal and water from the St. Mary River was being delivered to the Magrath area. However, widespread adoption of irrigation was hampered by alternating wet and dry climatic cycles. In fact, such a wet spell ensued after completion of the main canal that farmers complained they needed drainage, not irrigation (den Otter 1975).

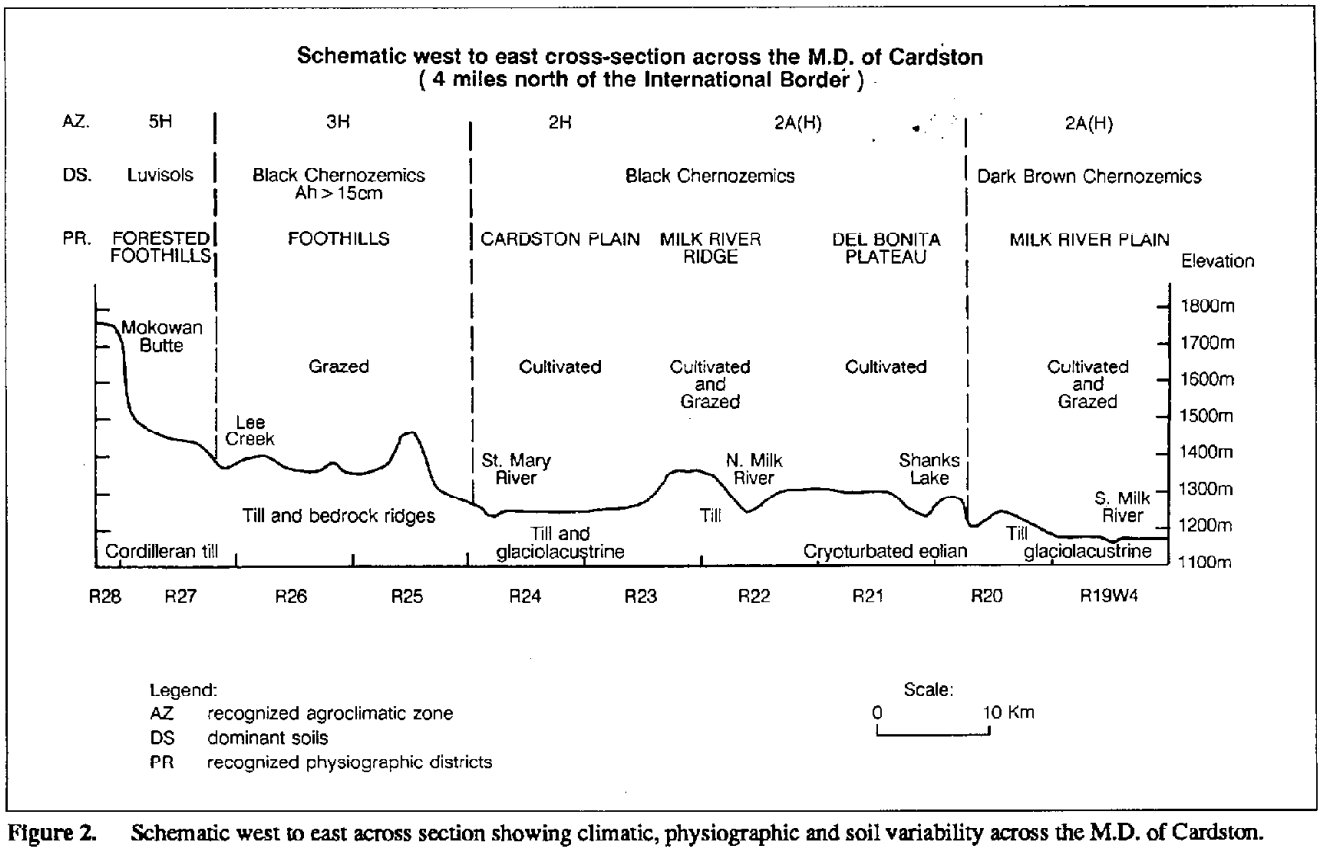


Figure 2. Schematic west to east across section showing climatic, physiographic and soil variability across the M.D. of Cardston. Cross section located 4 miles north of the International border.

1.3 CLIMATE.

The M.D. of Cardston has a continental climate somewhat different from that of the rest of the western plains. It features short summers with warm days and cool nights, and long cold winters. However, the severe cold of winter is moderated to a large degree by frequent chinook winds. Therefore, winter temperatures are milder in this area than further to the east or north.

The southwest corner of Alberta is famous for it's frequent, strong, westerly winds. Data for the Lethbridge airport shows that there are only 15 calm days annually as compared to 27 in Medicine Hat. Winds are strongest in the late fall and winter. Lethbridge airport has recorded wind gusts up to 171 km/hr, and hourly wind speeds in excess of 120 km/hr. The mean annual wind speed at Lethbridge is 20.4 km/hr while at the Edmonton International Airport the mean annual wind speed is 13.6 km/hr.

Temperature and precipitation values vary across the M.D.. The Agroclimatic Map of Alberta (Bowser 1967), groups areas of similar climatic characteristics important to agriculture, on a province wide basis. In southern Alberta there is a correlation between agroclimatic regions and soil zones. This correlation may be observed by comparing the distribution of the agroclimatic and soil zones as indicated on the respective maps (Figures 3 and 4). The 3H agroclimatic zone is an additional area not recognized on the provincial scale agroclimatic map. Within this M.D., the areal extent of the 3H zone is related to the occurrence of thick (Ah > 15 cm) Black Chernozemic soils.

Agroclimatic zone 2A represents the warmest and driest part of the M.D.. The records from the Raymond, Magrath and Lethbridge stations are good climatic indicators of this climatic zone (Table 1 & Figure 5). Rainfall varies from 260 mm/year at Raymond to 290 mm/year at Magrath. Frost free period varies from 116 days at Magrath to 124 days at

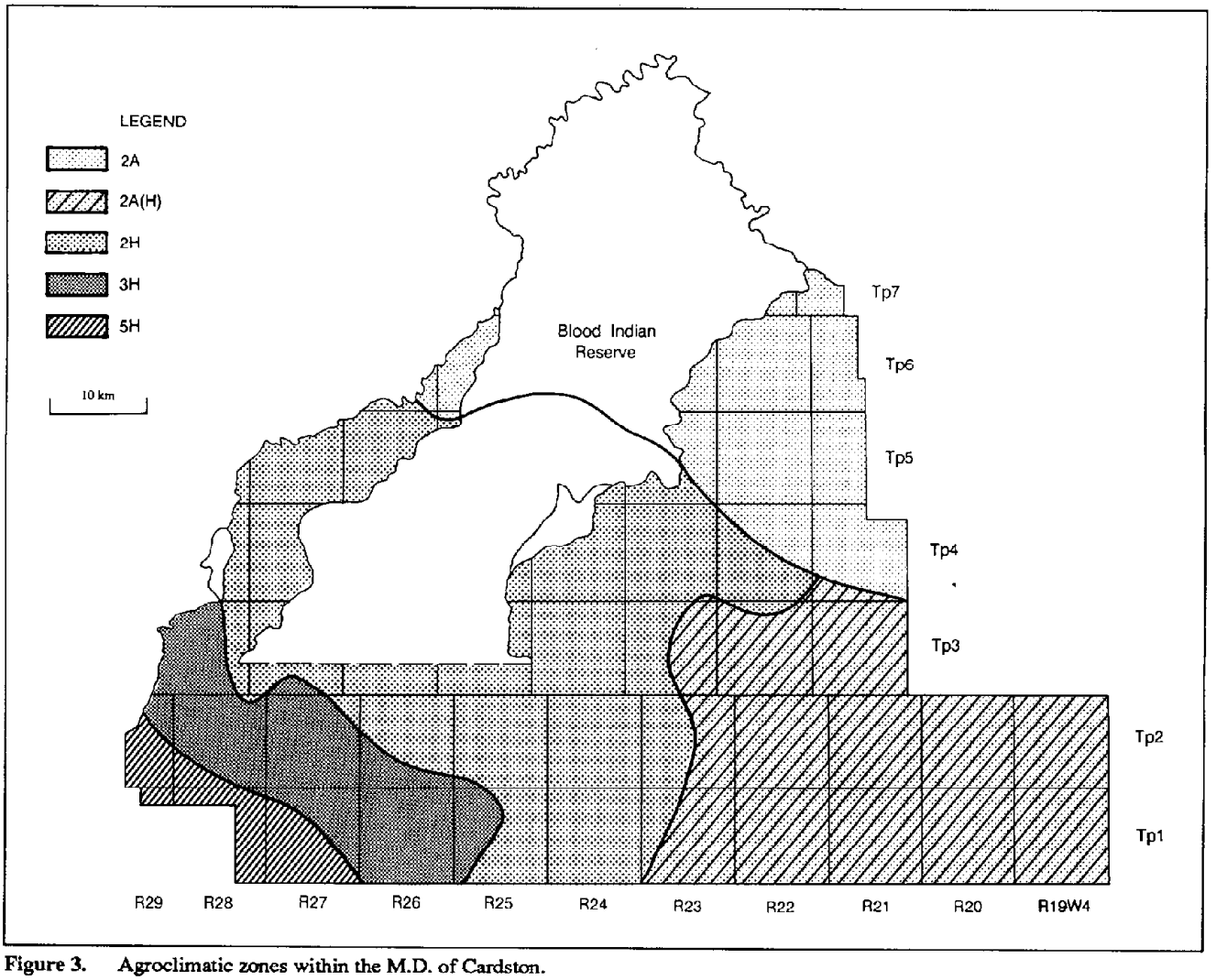


Figure 3. Agroclimatic zones within the M.D. of Cardston.

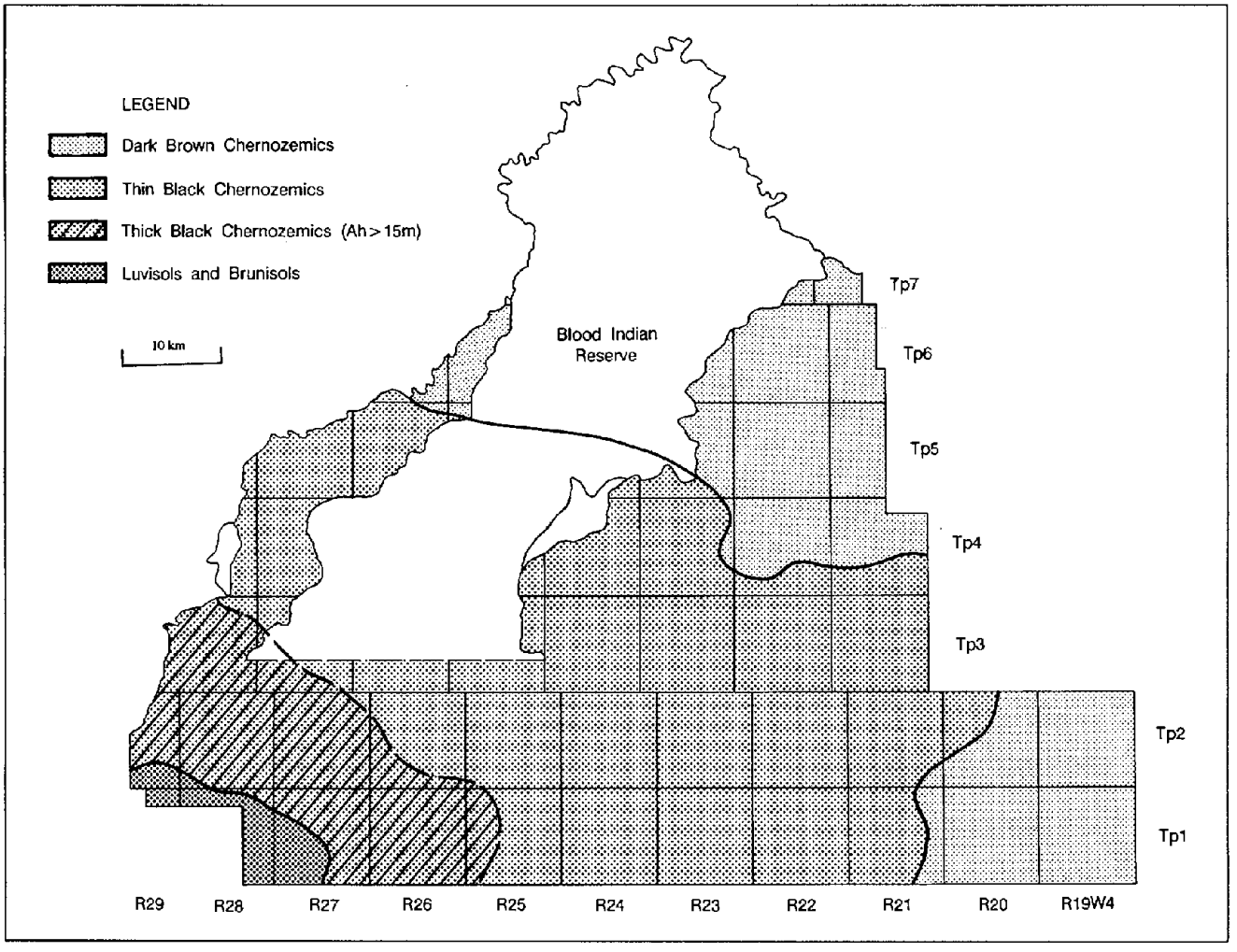


Figure 4. Soil zones within the M.D. of Cardston

the Lethbridge airport. Wheat is the preferred grain crop of this zone. Along the 2A-2H boundary, south and west of Magrath, barley becomes an equally as common crop as wheat.

The 2H agroclimatic zone is cooler and moister than the 2A zone. The Cardston, and the two Pincher Creek stations provide an indication of the climate for this zone. Rainfall is in the range of 300–350 mm and the frost free period is around 110 days in the region. The 2H zone averages between 1400 and 1450 growing days above 5° C, not the 1540 growing degree days indicated by the Cardston climatic station. The Cardston station is located in town and reflects a warmer microclimate. The fewer frost free days and more total precipitation is the reason barley is the dominant grain crop in this zone.

The 2A(H) agroclimatic zone is a hybrid zone between the 2A and 2H zones. As may be seen from Table 1, the mean annual daily temperatures of 2A(H) stations are similar to the stations in the 2H zone, while the total precipitation values are more comparable to the 2A stations. The Del Bonita and Whiskey Gap stations are used to represent the climatic characteristics of this zone. However, the Whiskey Gap station is in the valley of the North Milk River and it appears to be affected by cold air drainage. Therefore, the reported frost free period of 88 days is possibly low for the 2A(H) zone. Wheat and barley are viable crops grown on a regular basis in this zone. However, the number of degree days, the length of the frost free period, and the amount of moisture, may all impose some limitations for grain production to various degrees.

The 3H agroclimatic zone is definitely cooler than the previously mentioned zones. Rainfall varies from 270 mm at Carway to 355 mm at Caldwell. The growing season is short, ranging from 87 days at Carway to 96 days at Caldwell. The short, cool growing season of the 3H agroclimatic zone makes forages the most attractive crop choice for this region. Within the M.D., the 3H zone line was drawn on the basis of land use practices as well as the presence of 'thick' Black Chernozemic soils (ie. Dunvargan soils - DVG).

Table 1. Summary of climatic data for selected stations within southwest Alberta. (Location of stations - Figure 5)

Agro-Climate Zone	Station	Mean daily temp. (°C)	Precip. as rain (mm.)	Total precip. (mm.)	Degree days (>5°C)	Frost free period (days)	Max. hourly wind speed (km/hr)	Mean annual wind speed (km/hr)
2A	Milk River	5.2	226	316	1788	124		
	Raymond	5.2	260	420	1736	120		
	Lethbridge A.	5.2	270	423	1775	124	122	20.4
	Magrath	5.4	293			116		
2H	Cardston	4.8	321	550	1543	111		
	Pincher Cr. Town	4.1	347	589	1396	106	137	19.8
	Pincher Cr.	4.4	298	543	1455			
2A(H)	Del Bonita	4.3		397	1390			
	Whiskey Gap	3.8	275	452	1321	88		
3H	Carway	3.8	272	515	1301	87		
	Caldwell	4.2	356	723	1370	96		
	Mountain View		325	687				
5H	Waterton R. Cabin		423	853		61		
	Waterton/Belly R.		435	961				

Data compiled from Atmospheric Environment Service (1951-1980 Normals)
Del Bonita data compiled from Annual Climatological Summary from National Climatic Data Centre, Asheville, North

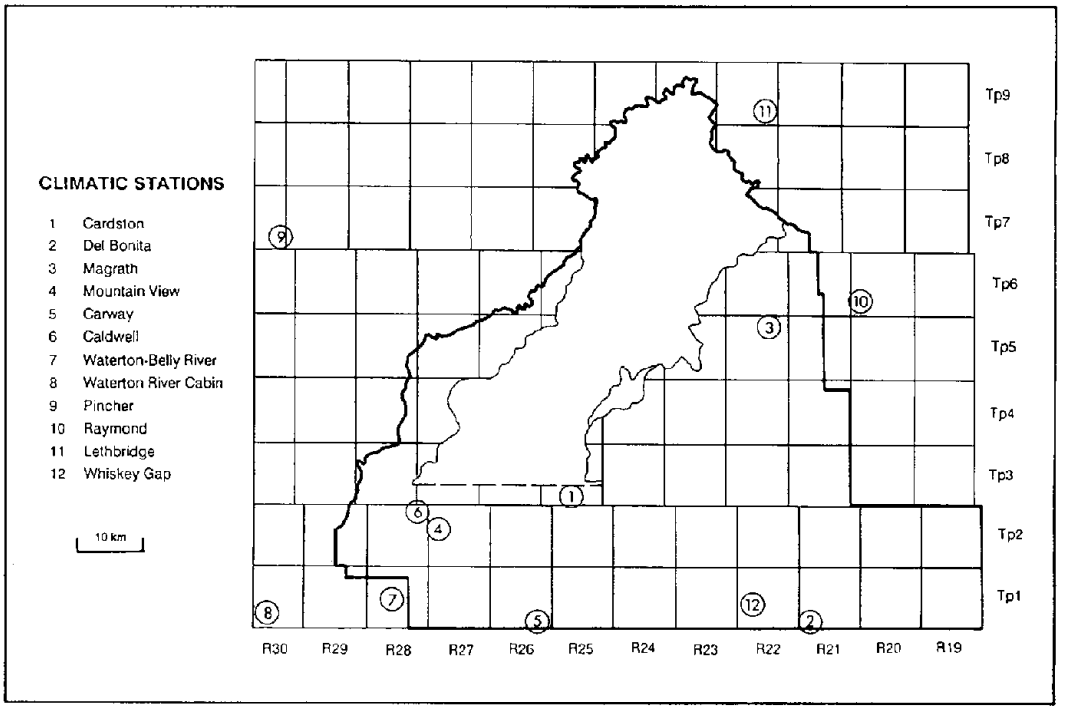


Figure 5 Location of selected climatic stations within south west Alberta.

The 5H agroclimatic zone is the coolest and wettest of the recognized zones within the M.D.. This area receives more than 850 mm of total precipitation, with half of this amount occurring in the form of rain. Temperature data for the zone is scarce, but the frost free period is probably less than 60 days. Aspen and Lodgepole pine vegetative cover characterize this 5H agroclimatic zone.

1.4 Vegetation.

The M. D. of Cardston can be divided into 4 vegetative cover type zones (Strong and Leggat 1981). These zones reflect the changing climatic conditions across the municipality. The distribution of these regions is shown in Figure 6.

The mixed grass prairie occurs in the eastern and northern segments of the M.D.. Native range, in good condition, consists mainly of speargrass (Stipa spartea var. curtiseta) and wheatgrass (Agropyron trachycaulum). June grass (Koeleria gracilis) and green needlegrass (Stipa viridula) are also commonly abundant. Dark Brown Chernozemic soils are dominant in this zone.

Rough fescue prairie covers the majority of the uncultivated land in the municipality. Native range in good condition is dominated by rough fescue (Festuca scabrella). With overgrazing lupine (Lupinus argenteus) appears to be the main increaser on the Milk River Ridge, while shrubby cinquefoil (Potentilla fruticosa) is the dominant increaser further west, in the Foothills. Black Chernozemics are the dominant soils.

Aspen - willow parkland occupies a narrow transition zone between the rough fescue grassland and the Lodgepole pine forest. Within this region the vegetative cover grades from rough fescue prairie interspersed with willow stands on the north eastern side to nearly continuous aspen near the south western boundary. Soils similarly grade from Orthic Black Chernozemics to Dark Gray Chernozemics to Dark Gray Luvisols within this zone.

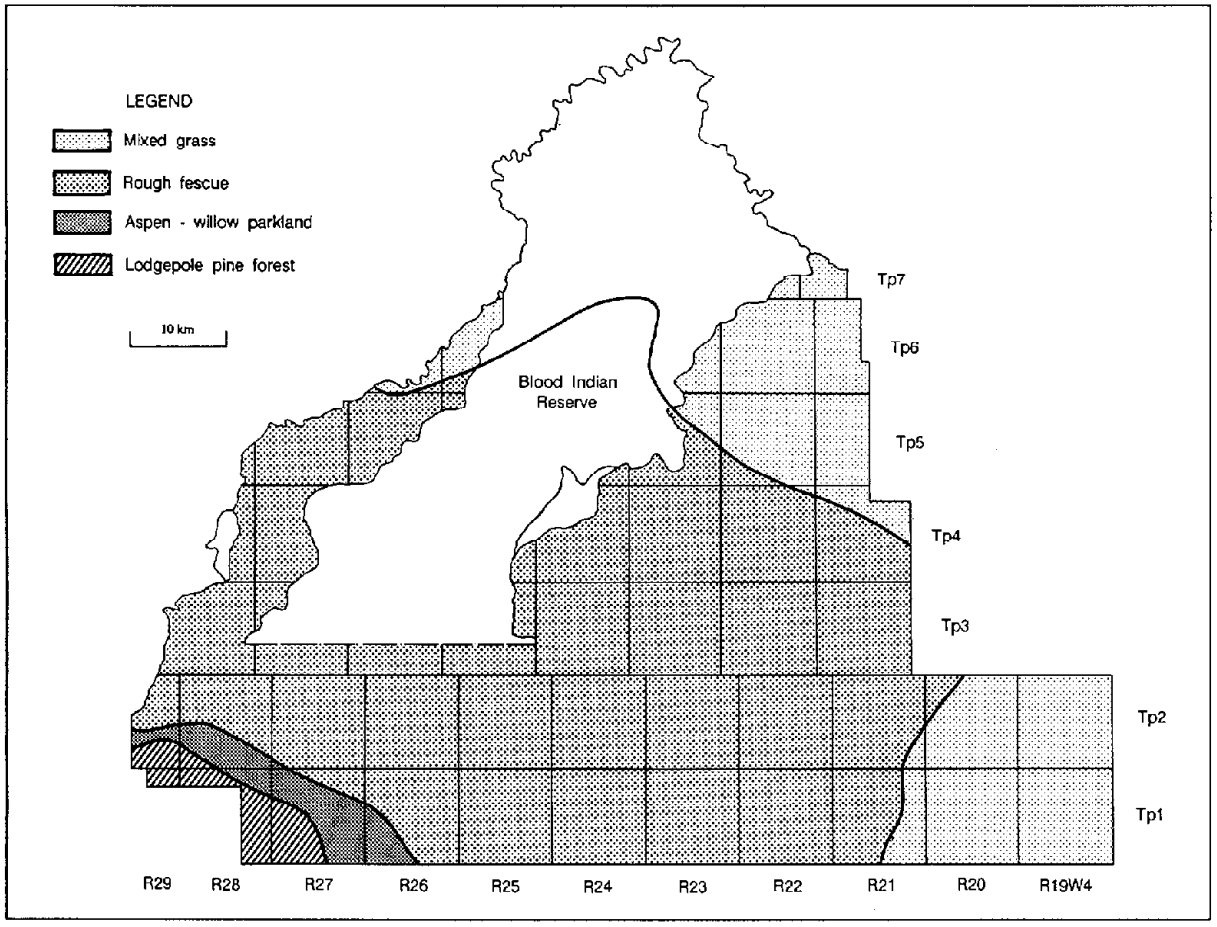


Figure 6. Vegetation cover type zones within the M.D. of Cardston. (adapted from Strong and Leggat 1981)

Lodgepole pine forest occupies the southwest corner of the M.D.. This forested region occurs at elevations above the 1400 m asl contour line. Lodgepole pine (Pinus contorta) is the dominant tree species. Aspen (Populus tremuloides), Douglas fir (Pseudotsuga menziesii), Alpine fir (Abies lasiocarpa) and Limber pine (Pinus flexilis) are also found in this region. The understory consists of salmonberry (Rubus spectabilis), bunchberry (Cornus canadensis) and wintergreen (Pyrola sp.). Orthic Gray Luvisols are the dominant soils in this region.

On exposed locations at high elevations within the Lodgepole pine forest region, Montane-like vegetation may occur. The south facing slopes of Birdseye Butte is an example of such a site. These areas are characterized with open stands of Limber pine interspersed with rough fescue and Kinnikinnick (Arctostaphylos uva-ursi). The soils associated with this vegetation are dominantly Orthic Eutric Brunisols.

1.5 Physiography and Surficial Materials.

Parts of three broad physiographic regions; the Rocky Mountain Foothills, the Southern Alberta Uplands and the Western Alberta Plains occur within the M.D. of Cardston (Pettapiece 1986). These regions are roughly orientated in a northwest -southeast direction. The Foothills occur in the southwest portion of the survey area; the Southern Alberta Uplands (Cardston Plain, Milk River Ridge Upland) occur to the east extending to the southeast corner; and the Western Alberta Plains (Three River Plain, Verdigris Plain) occur in the north east portion of the M.D.. Subdivision of these regions in to sections and districts is primarily on the basis of elevation, parent material type and thickness, as well as surface expression. Further subdivision of the districts and modification of some lines from the physiographic map of Alberta were possible due to the intensity of this survey (Figure 7).

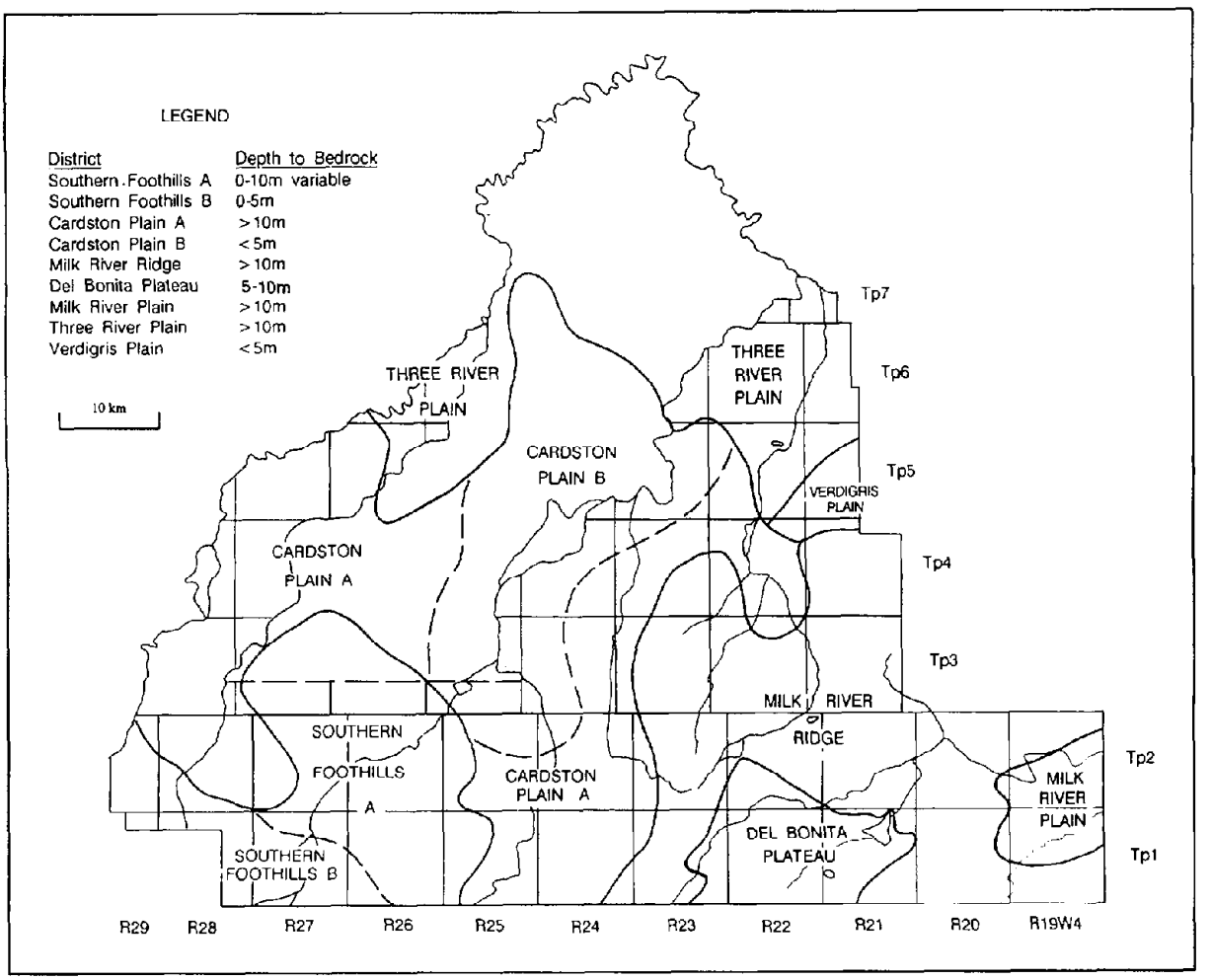


Figure 7. Physiographic areas within the M.D. of Cardston (adapted from Pettapiece 1986).

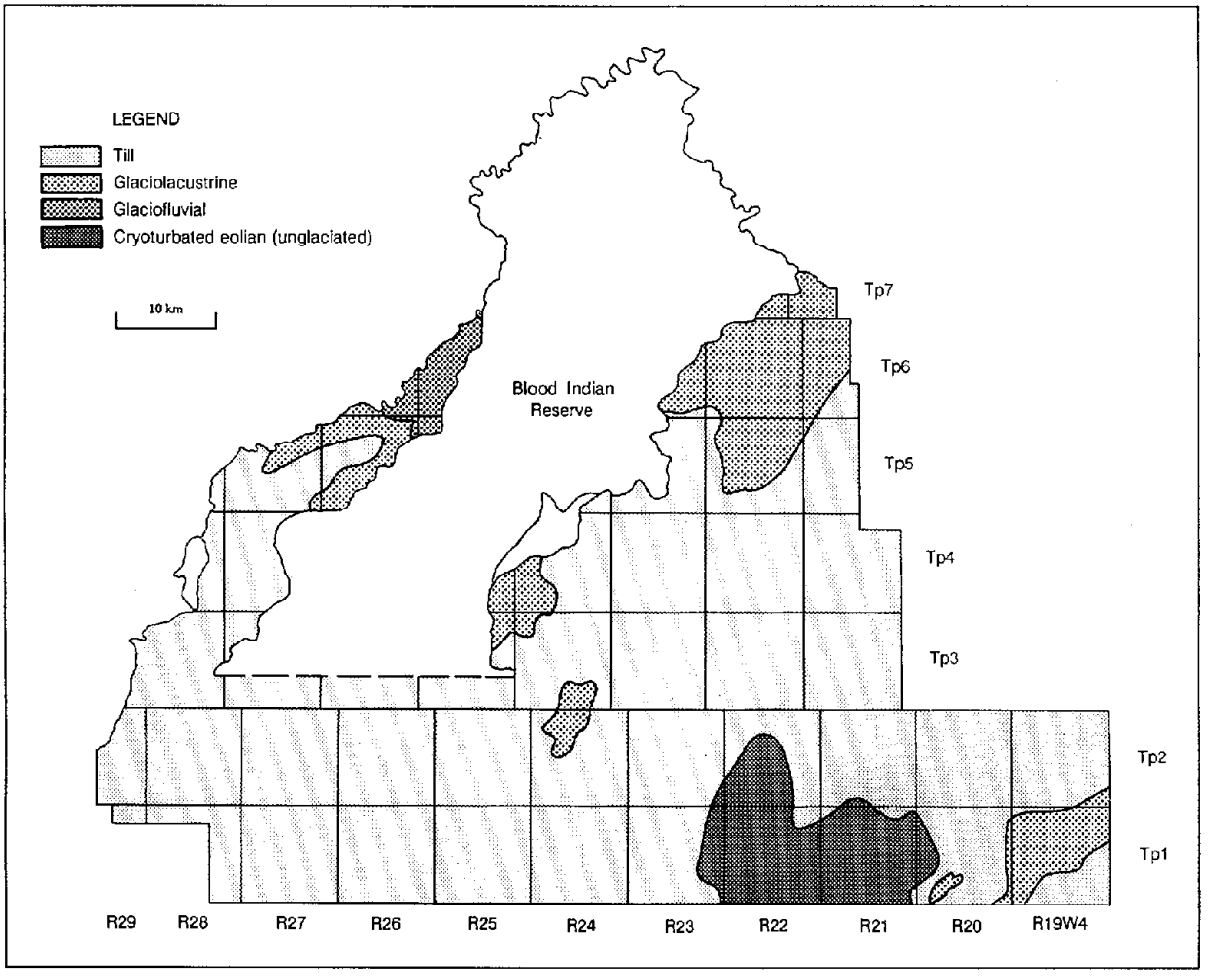


Figure 8. The distribution of the dominant surficial materials within the M.D. of Cardston.

Till is the dominant parent material of the soils within the M.D. of Cardston (Figure 8). The glaciolacustrine deposits occur where ice marginal, glacial lakes previously existed (Horberg 1954). For example, the fine textured glaciolacustrine deposits on the Cardston Plain, in the vicinity of the St. Mary Reservoir, correspond to the location of Lake Cardston. Similarly, the other large glaciolacustrine deposits on the Three Rivers Plain and the Milk River Plain correspond to Lake Magrath and Lake Twin River, respectively (Horberg 1954). The surficial material present on the unglaciated Del Bonita Plateau is described as cryoturbated eolian, based upon some recent findings (Brierley 1988).

The Rocky Mountain Foothills region within the Municipal District ranges from 1200 - 1800 m asl (above sea level). The Southern Rocky Mountain Foothills district is characterized by the presence of a series of ridges which are orientated in a northwest -southeast direction. These hogback ridges are most conspicuous on the eastern edge of this region (Figure 9).

Figure 9. Okey Ridge, a characteristic hogback ridge of the Southern Rocky Mountain Foothills.

The Foothills region is subdivided into two subregions (Figure 7). This subdivision is based on the origin of the till and the degree of bedrock control. Subdivision A delimits the eastern portion of the Foothills where till of continental origin is dominant. It is believed that the Laurentide ice sheets did not extend westward above the 1400 m asl contour (Horberg 1954). Subdivision B represents the portion of the Foothills where Cordilleran till is dominant. Steeply incised valleys containing north-easterly flowing creeks and rivers, away from the Rocky Mountains, characterize this subregion.

Mokowan Butte, which occurs in township 1-28, is the highest point within the Southern Foothills at 1750 m asl. It is believed that this butte escaped glaciation during the last (Wisconsin) ice age (Horberg 1954, Karlstrom pers. comm.[1]). The morainal material, of Illinoian or Kansan age, is characterized by having a higher coarse fragment content and is more deeply weathered than the neighbouring Wisconsin-aged till.

To the east and north of the Foothills lies the Cardston Plain District. Elevations of this plain range between 1050 - 1300 m asl. Glacial drift and glaciolacustrine deposits with an undulating to hummocky surface form are the dominant parent materials. These deposits are generally over 10 meters thick. The subdistrict B indicated by the dotted lines delineates a portion of the Plain where bedrock is within 5 m of the surface, and occasionally outcrops at the surface. This area was recognized during the course of the survey by means of deep drilling and observations made from road cuts.

To the east of the Cardston Plain, the land rises in elevation to the bedrock controlled physiographic section called the Milk River Uplands where elevations range from 1100 - 1400 m asl. Within this section three districts are recognized; the Milk River Ridge, the Del Bonita Plateau and the Milk River Plain.

The Milk River Ridge district has distinct boundaries with the Cardston Plain to the west and north (Figure 10). The surface form of this remnant upland is generally that of a hummocky moraine superimposed over broad preglacial valleys and uplands. Till is generally greater than 10 m thick, except around the edges of the Upland and in association with prominent bedrock ridges. In some isolated upland situations Tertiary gravels underlie the till.

Figure 10. Looking across the Cardston Plain from the western edge of the Milk River Upland

The Del Bonita Plateau is an unglaciated area which occurs at an elevation of approximately 1300 m asl. There are additional unglaciated outliers, north of the Plateau, occurring at elevations above 1400 m asl. These areas were nunataks during the Wisconsin ice age (Calhoun 1906, Alden 1912, Stalker 1963, Shetsen 1980). Deposits of medium textured loess up to 2m thick, are associated with these unglaciated landscapes. Tertiary aged, quartzitic gravels underlie the loess. These gravels are up to 5 m thick over the underlying bedrock (Shetsen 1980). Periglacial processes have dramatically altered the surficial materials on the Plateau (Figure 11). The presence of quartzitic gravels within the upper loess is also a product of cryogenic processes. The surface form of the Plateau is characteristically flat (Figure 12). Asymmetric valleys as well as Shanks Creek however dissect the level surface of the Plateau. Steep erosional scarps delimit the northern and eastern extent of this area from the surrounding morainal landscapes.

The last distinct district within the Milk River Upland is the Milk River Plain, and it occurs along the southeastern border of the M.D.. This plain lies between the North and South forks of the Milk River at an elevation ranging from 1090-1160 m asl. The parent material of the area is dominantly glaciolacustrine. Coarser textured glaciofluvial deposits occur in areas adjacent to the north fork of the Milk River. The surface form of the glaciolacustrine areas is undulating, but ridged terrain is associated with the fluvial deposits. Depth to bedrock is greater than 10 m.

1. Dr. Karlstrom, Dept. of Geography, N. Arizona University, Arizona.

Figure 11. The Del Bonita Plateau surficial materials have been altered by periglacial processes. Ice wedge casts, involutions and stones within the upper surface loess are all products of cryogenic activity.

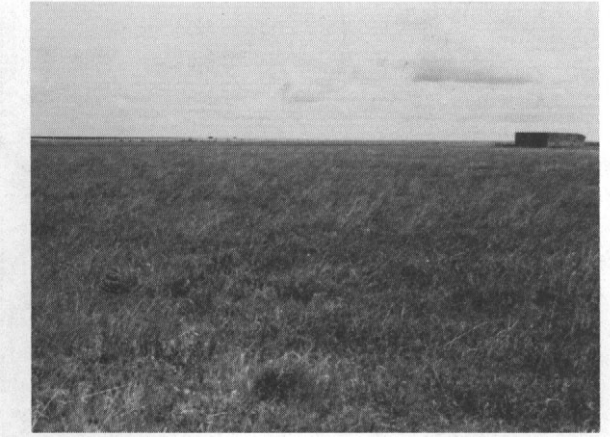


Figure 12. The level surface form of the Del Bonita Plateau.

The Three River Plain and Verdigris Plain districts of the Western Alberta Plains occupy the northern portion of the Municipal District. The elevation of these Plains ranges from 900 - 1050 m asl. Glaciolacustrine deposits with an undulating surface form characterize the Three River Plain. Depth to bedrock is greater than 10 m.

The areal extent of the Verdigris Plain is limited within the survey area. This plain occurs just north of the Milk River Upland, on the eastern edge of the M.D.. Undulating to hummocky morainal materials characterize this Plain. The contact between till and bedrock is generally within 5 m of the surface.

1.6 Bedrock Geology

The recognized bedrock formations within the M.D. of Cardston consist of argillaceous and arenaceous, Upper Cretaceous to Tertiary aged sedimentary rocks (Figure 13). The bedrock generally dips to the west and the strike between beds is in a north - south direction, roughly parallel to the Rocky Mountains (Green 1972).

Within the Rocky Mountain Foothills, which occur in the western portion of the survey area, the bedrock stratigraphy is very complex. The Brazeau formation is dominant with some minor exposures of the Alberta group. The Alberta group, the oldest strata, consists of Cretaceous aged shales. Outcrops of the Alberta group are confined to the Foothills, where they were uplifted to the present day surface during the development of the Rocky Mountains. The Brazeau formation is of Tertiary age and is composed of dominantly sandstone. Strata of the other formations (ie. Willow Creek, St. Mary & Bearpaw) are associated with the Brazeau formation. The complex distribution of these formations within the Foothill region is the result of thrust faulting and folding which occurred during the uplifting of the Rocky Mountains. The remnants of these thrust planes or of the imbricate fault structures exist today as hogback ridges, a characteristic feature of the Foothills area (Douglas 1970, Beaty 1975, Green 1972).

The six remaining formations within the survey area all consist of sandstone and shales varying from Upper Cretaceous to Tertiary. The age of the bedrock types increases sequentially from west to east across the M.D.. These formations differ in terms of their proportion of sandstone and shales, and in their degree of resistance to weathering. The colour of the bedrock also varies between formations, the pinkish coloured shales of the Willow Creek formation being the most striking. The Bearpaw shales are formed of fine marine sediments, and the Blood Reserve formation consists of sediments deposited in marine and non marine environments. The rest of the formations consist of non marine constituents (Russell & Landes 1940, Irish 1967).

1.7 Relief and Drainage.

The M.D. of Cardston is separated by a great divide into two major watersheds, the Hudson Bay Drainage System and the Gulf of Mexico Drainage System. The divide enters the M.D. in the southwest corner of Twp. 1 R. 23 at an elevation of 1372 m asl runs diagonally northeast across the Milk River Upland and leaves near the east centre of Twp. 4 R. 21 at an elevation of 1280 m asl (Figure 14).

Within the M.D. of Cardston, the rivers of the different drainage systems exhibit distinguishing

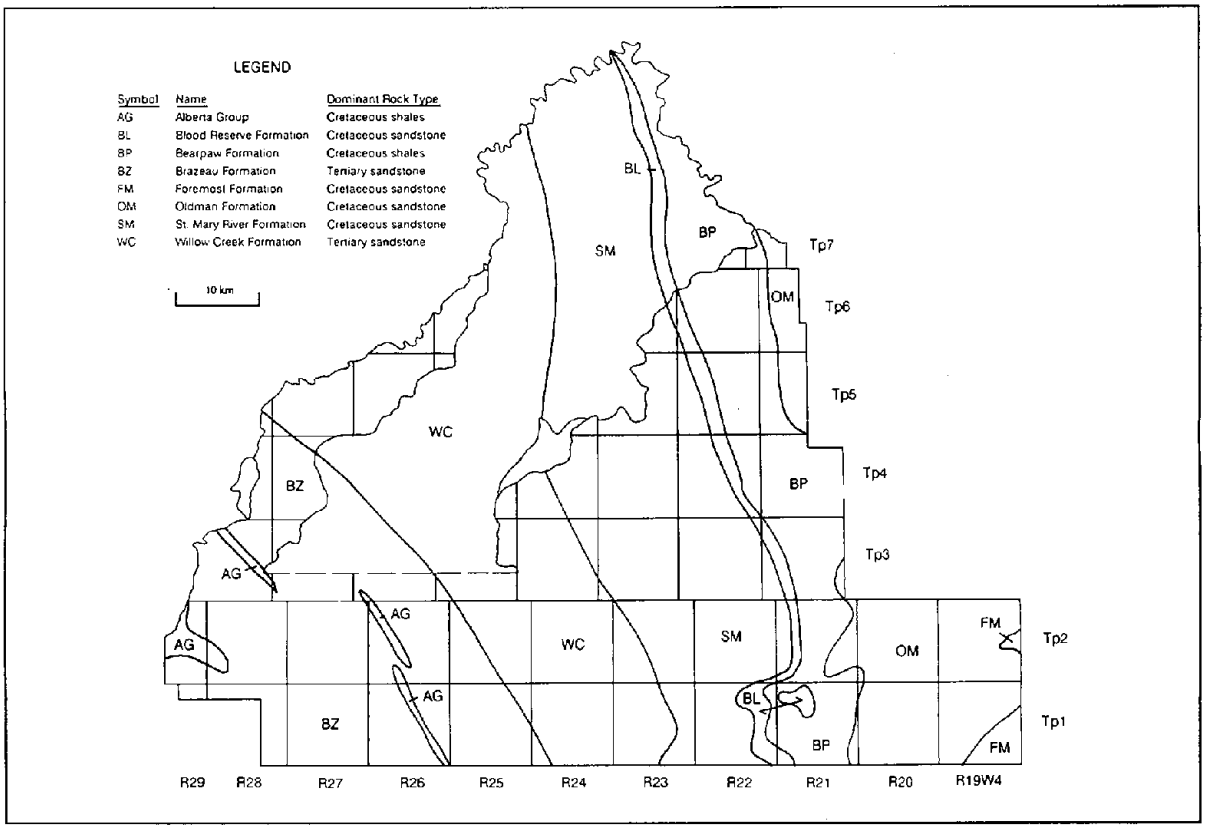


Figure 13. Generalized bedrock geology of the M.D. Cardston (from Green 1972).

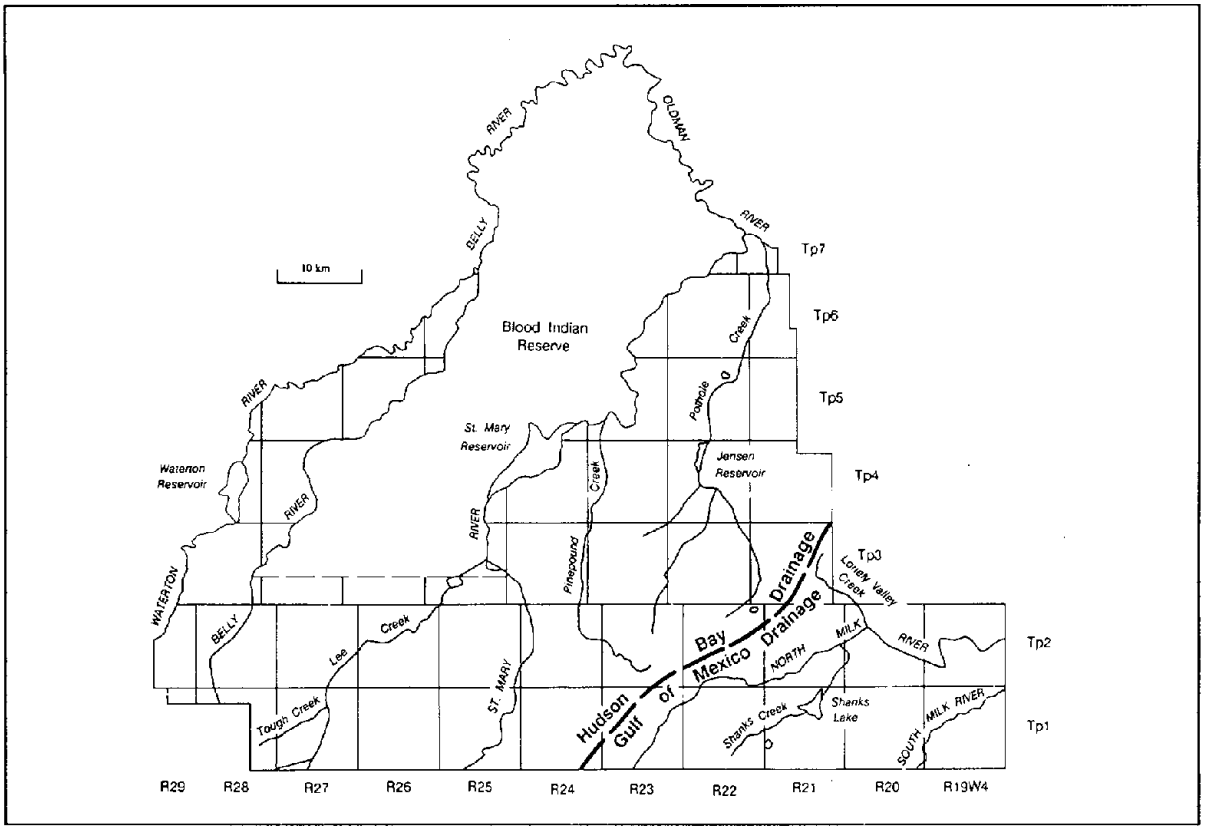


Figure 14. The location of the Hudson Bay - Gulf of Mexico Watershed Divide and the major creeks and rivers of the respective drainage systems within the M.D. of Cardston.

characteristics. Rivers of the Hudson Bay watershed, such as the St. Mary River, tend to be more deeply incised (Figure 15) than the north and south forks of the Milk River (Figure 16). On the Milk River Ridge, the North Milk River occupies a U-shaped valley of a glacial meltwater channel.

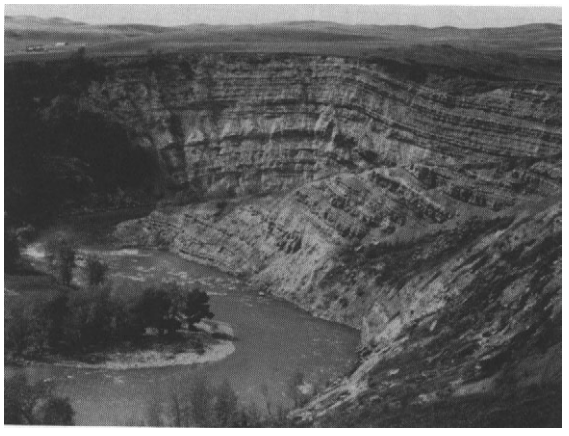


Figure 15. A deeply incised valley associated with the St. Mary River.

Figure 16. The meandering drainage pattern of the North Milk River.

The north and south forks of the Milk River are the major rivers of the Gulf of Mexico watershed, within the M.D.. Other tributaries, principally Shanks Creek and Lonely Valley Creek contribute to the north fork of the Milk River. Elevations range from over 1400 m asl on the west side of the Milk River Upland to under 1100 m asl in the two valleys of the Milk River forks, on the east side of the municipality.

The north and west portion of the M.D. is within the Hudson Bay watershed. Major rivers flowing through this portion of the M.D. are the Waterton, Belly and St. Mary Rivers. The eastern slopes of the Rocky Mountains are the headwaters of these rivers, as well as Lee Creek. The elevation of the Hudson Bay Watershed within the M.D., varies from 1800 m asl on Mokowan Butte, to less than 880 m asl at the junction of the Oldman and St. Mary Rivers.

Two other smaller creeks in the Hudson Bay system include Pothole Creek and Pinepound Creek. These watersheds originate from the Milk River Upland.

The Waterton River provides a natural boundary between the M.D. of Cardston with the M.D.'s of Pincher Creek and Willow Creek. The Blood Indian Reserve is also delineated by rivers on the two sides within the M.D. of Cardston. The Belly River delimits the western extent of the Reserve, while the St. Mary River, the eastern boundary.

There are two major onstream reservoirs within the M.D.. These include the Waterton Reservoir, just west of Hillspring on the Waterton River, and the St. Mary Reservoir, north of Cardston on the St. Mary River. The Jensen Reservoir, which is about 6 miles south of Magrath on Pothole Creek, is fed by an irrigation canal from St. Mary Reservoir. These reservoirs form part of the irrigation water storage network for southern Alberta Irrigation Districts.

Part 2. MAPPING PROCEDURES, SOIL SERIES AND SOIL MAP UNIT DESCRIPTIONS.

Soil map compilation procedures and a description of the principal components, soil series and soil map unit concepts, are described in this chapter. The procedure portion provides an overview of the field mapping and office methodology used in the compilation of the soil maps. The second portion of this chapter, contains detailed descriptions of the soil series and soil map units, which are displayed on the soil maps.

2.1 Soil Map Unit Definition.

Soil map units describe the distribution of specific soil series within delineations on the soil maps. A soil map unit consists of two components; the soil unit and the topographic descriptor. Each unique soil map unit differs with respect to one of these factors.

A soil unit is a geographic grouping of soil series representing similar soil landscapes. The soils within these landscapes are described in terms of their relative proportions.

Soil units are initially identified on the basis of the major soil within a specific unit. Complex soil units contain two identified soil series which occur in dominant or significant proportions. Also a soil unit number (1-8) is used to identify Additional information about the distribution and/or composition of the major soils. The soil unit numbers allow the mapper to account for the many intergrades or variants of the principal soil/soils that are present within the delineated landscape segment. In complex soil units, the unit numbers may refer to both named soil members.

Within the M.D. of Cardston soil survey, the following soil unit number concepts were used. These numbers do not apply to miscellaneous map units such as AV's or RB's.

Soil Unit Number.	Explanation.
1	The dominant or significant soils account for the large proportion of the soil unit
2	The soil unit contains Gleyed soils, Gleysolics and water in significant amounts.
3	The soil unit contains saline soils in significant amounts.
4	The soil unit contains Rego and Calcareous Chernozemic soils in significant amounts.
5	The soil unit contains finer textured soils in significant amounts.
6	The soil unit contains coarser textured soils in significant amounts.
7	The soil unit contains Solonetzic soils in significant amounts.
8	The soil unit contains Gleyed soils, Gleysolics and water as well as Rego and Calcareous soils in significant amounts.

The topographic descriptor of the soil map unit occurs in the denominator of the map symbol. The denominator term represents a slope class. Each class describes a range of slope angle percentages. For example, class 2 topography is used for landscapes where the dominant slopes are between 0-2%, whereas class 6 topography contains slopes in the range of 15-30%.

To describe some landscapes a slope modifier term is used in conjunction with the slope class factor. This modifier provides additional information about the landscape which is crucial for some interpretations. For example, the letter D placed after the slope class number denotes a gullied or dissected landscape.

2.2 Mapping Procedures.

During the course of a soil survey, personnel systematically subdivide the landscape into repeating soil map units, based upon distribution of soils and associated topography. These units are then drawn on a map and ultimately interpreted in terms of their suitability for certain land uses. The map compilation methodology of is briefly explained in this section.

Soils were examined to a one meter depth, at a rate of about 100-120 sites per township, or 2-3 shared digs per quarter section. Soil characteristics, including horizon type, thickness and arrangement, texture, structure, color and the mode of parent material deposition, were noted at each site. With this information soils were classified according to the 1978 Canadian System of Soil Classification. (Refer to Appendix A - for a more detailed explanation of Soil Formation and Classification). For convenience soil names were attached to the dominantly occurring types of soils. Site specific information including relief, aspect, slope length and steepness, site position on the slope and vegetation were recorded for each site. In addition the areal extent of erosion, salinity, surface stoniness, seepage, as well as depth to watertable and bedrock were noted, where applicable.

With the aid of the above information, landscapes with similar combinations of soils on similar slope classes were delineated and labeled. For example, an area containing mostly Orthic Black Chernozemic soils developed on medium textured till (Beazer soil series) on an undulating surface form with slopes ranging between 2-5% (slope class 3), would be delineated and labeled with the soil map unit symbol - BZR1/3. BZR1 is the soil unit which describes the

specific distribution of soils within the delineated landscape. The denominator term, 3, is the topographic descriptor. Class 3 represents landscapes where the dominant slope gradients are between 2-5%. The soil unit and slope gradient classes are therefore the building blocks of the soil map unit symbol. The components of all soil map units are described in the legend as well as in the following Soil Series, Soil Unit and Soil Map Unit Descriptions section of this chapter, in a complete and expanded format.

Delineations were drawn while in the field on 1:30,000 aerial photographs and transferred to 1:30,000 photo based township plans. Delineation size, legal location, dominant soils (40-90% of total) significant soils (20- 50% of total), inclusions (less than 20% of total soil component), slope class, surface form, as well as special remarks were recorded for each delineation. Once mapped, the township plans were checked for accuracy and consistency as well as correlated to neighbouring townships, while in the field.

Orientated transects were used in this project as a problem solving technique. They were used to develop soil map unit concepts in unique areas, such as the Del Bonita Plateau, as well as to check the predicted components within some established map units.

During the course of the survey, soil samples were collected and subsequently analyzed to further characterize the soils. A total 136 of sites, 43 detailed descriptions and 93 random sites were sampled and analyzed in the lab. The specific analytical methods that were employed are documented in Appendix B.

At selected sites across the study area, information regarding the depth and nature of the parent materials was obtained from deep drilling, using the Alberta Agriculture drill truck. This information was used to refine some of the physiographic lines within the M.D., as well as being incorporated in the soil map unit descriptions.

In the office, the map delineations were scrutinized with regard to content and total areas. Soil map units of similar composition were combined. Others, which covered very little area were usually assigned to the most similar soil map unit. For example, there was only 1 area about 50 ha. in size of a KSR1/3 soil map unit (the 1 indicates a relatively pure unit of Kessler soils). This soil map unit was combined with a KSR4/3 map unit, which is still dominantly KSR soils with the same topography, but includes 20-30% eroded soils. The primary concern in the map unit consolidation process was the degree to which a compromise would affect the resulting land use interpretation. Where a compromise was not possible the unique soil map unit was retained. The KGT1/2 map unit occupying 34 ha (150 acres) in total area is an example of this latter scenario.

With the legend finalized, soil lines and labels from the township plans were transferred to twenty-three 1:50,000 scale photomosaic base maps and to four 1:50,000 scale planimetric base maps. The photomosaic maps are included in the report. The planimetric maps have been digitized and copies are available upon request through the Alberta Soil Survey Unit, Edmonton.

2.3 Soil Series, Soil Unit and Soil Map Unit Descriptions.

The characteristics of individual soil series and the composition (distribution of soils and landscape characteristics) of soil map units are described in detail, within the remainder of this chapter.

2.3.1 Alluvial Miscellaneous Map Units.

AV1

This azonal miscellaneous map unit contains a wide variety of soil types, the majority of which are developed on medium textured fluvial parent material. Cumulic Humic Regosols (soils with several buried Ah horizons interspersed with calcareous layers) developed on primarily medium textured fluvial deposits dominate these map units. Dark Brown and Black Chernozemic soils on similar fluvial materials also occur in significant amounts. Gleyed soils and Gleysolic soils are commonly present in most delineations, in minor amounts.

The landform of the AV1 map unit consists of dominantly flat bottomed drainage channels usually bordered by steep sides. The flat portion or floodplain which occupies more than 50% of the delineation (Figure 17). This area is terraced and dissected by a

Figure 17. An example of an AV1 miscellaneous map

meandering river or creek. Although topography and delineation size generally limit annual cultivation practices, suitable areas for crop production may be found within some delineations. Grazing is the major land use. In their natural state, AV1 delineations have a diverse floral component and provide excellent wildlife habitat.

AV6

This azonal miscellaneous map unit contains a variety of soil types which are developed on gravelly, coarse textured fluvial parent material with more than 30% coarse fragments. Orthic Regosols and Cumulic Humic Regosols are the dominant and significant soils present on the 'active' floodplain portion of this unit. Minor proportions of Dark Brown and Black Chernozemic soils are present on the less active, more stable, portions of the fluvial floodplain in delineations occurring within the Plains region of the M.D.

The AV6 map unit is confined to the active floodplain of rivers and neighbouring terraces of the well established rivers and creeks. The bordering steep slopes are generally separated from the unit where possible. Along the upper reaches of Lee Creek, and Crooked Creek, the steep side slopes are included within the delineations. Stands of Balsam poplar cover a large proportion of these units, bordering the active floodplain. Spruce and pine trees occupy similar locations within delineations in the Foothills.

This unit is used for grazing, but the carrying capacity is low due to the coarse texture of the soils. These delineations provide good wildlife habitat.

2.3.2 Beauvais (BVA) soil description.

Beauvais is an Orthic Dark Gray Chernozemic soil developed on medium textured till. These soils were mapped in the Rocky Mountain Foothills, in the 5H agroclimatic zone.

Special Notes: Beauvais soils were found primarily under aspen forests, occasionally under Lodgepole pine. The litter layer of these soils is usually less than 2 cm thick. The Ahe has generally been thoroughly mixed by earthworms, which are prevalent in this area of the province. The soil organic matter content and pH values of the Ahe horizons associated with pine forest vegetation are lower than under aspen vegetation.

Beauvais Soil Units and Map Units.

BVA6

This soil unit contains dominantly (40-60%) Beauvais soils with significant amounts (20-40%) of stony and coarser textured soils developed on ice-contact material. The texture of the ice-contact material is variable ranging from sand to clay loam. The coarse fragment content is commonly between 20-30%. Orthic Black Chernozemic soils developed on till and ice-contact material occur in minor amounts. The coarser textured parent materials are associated with upper slope positions and tops of ridges.

Vegetative cover of this soil unit consists of aspen forest interspersed with open grassland areas. The latter are primarily confined to south aspect, upper slope positions as well as the crests of knolls and ridges.

One topographic phase of this unit was recognized.

BVA6/4-6 - Mapped on hummocky and ridged landscapes where slopes vary between 5-30%. Areas are used for grazing.

BVLT1

This soil unit contains 40-60% Beauvais soils and 20-50% Dark Gray Luvisolic soils developed on medium textured till - Leighton Centre. Minor amounts of Orthic Black Chernozemic soils developed on till and on ice - contact material are present. Dark Gray Chernozemics and Dark Gray Luvisols on till veneer over residual material also occur at the inclusion level.

Selected characteristics of BVA (ranges in brackets).

	Horizons				
	Ahe	AB	Bt	BC	Ck
thickness,cm	15 (12-23)	5 (0-10)	45(30-60)	50 (40-60)	@115
textural class	L (SL-CL)	L (SL-CL)	CL (L-C)	CL (L)	CL
*c.f.content,%	<15	<15	<15	<15	<15
pH	5.7(5.1-6.3)	-	6.3(5.7-6.7)	6.6(6.0-7.0)	7.4
organic matter,%	15 (5-25)	5	-	-	-

* Coarse fragment content by volume.

Vegetative cover of the unit consists of aspen forest with some open grassland areas interspersed throughout.

One topographic phase of this map unit was recognized.

BVLT1/3-4 - Mapped on undulating to rolling and hummocky landscapes where the majority of the slopes are between 2-9%.

BVNF1

This soil unit contains 40-60% Beauvais soils with significant amounts (20-40%) of Orthic Eutric Brunisolic soils developed on a medium textured till veneer over residual material - North Fork. North Fork soils are generally found in upper slope,"shedding" landscape positions. The texture of the residual material is variable but sandy loam is dominant. Orthic Black Chernozemics and Dark Gray Luvisols developed on till are present in minor amounts.

Vegetative cover of this soil unit consists of aspen forest interspersed with open grassland areas.

One topographic phase of this soil unit was recognized.

BVNF1/5-6 - Mapped on hummocky to rolling landscapes where slopes range between 9-30%. Areas are used for grazing.

Figure 18. BZR soil profile.

2.3.3 Beazer (BZR) soil description.

Beazer is an Orthic Black Chernozemic soil developed on medium textured, moderately calcareous till (Figure 18). Beazer soils are developed under rough fescue grassland. These soils were mapped on the Milk River Ridge, the Cardston Plain, and in the Rocky Mountain Foothills, in the 2A(H) and 2H agroclimatic zones (Figure 19).

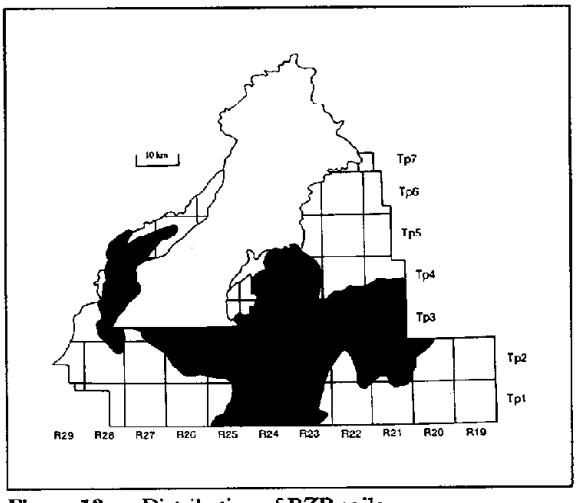


Figure 19. Distribution of BZR soils.

Selected characteristics of BZR (ranges in brackets)

	Topsoil (Ap/Ah)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness,cm	15 (10-20)	35 (30-50)	@50 (40-70)
textural class	L (SiL-CL)	CL(L-SiCL)	CL (L-SiCL)
*c.f. content,%	5 (<15)	5 (<15)	5 (<15)
pH	6.3 (5.7-7.0)	6.5(6.0-7.0)	7.5
organic matter %	8 (6-10)	0-2	-
$CaCO_3$ equiv.%	-	-	13 (10-15)

* Coarse fragment content by volume.

Beazer Soil Units and Map Units.

BZR1

This soil unit contains 60-90% Orthic Black Chernozemic soils developed on medium textured till - Beazer. Additional soils present in minor amounts include: soils developed on fine textured lacustro-till - Cardston; ice-contact material of variable textures containing more than 15% coarse fragments; thin

eroded, or Rego Chernozemic profiles on knolls and Gleysolic soils associated with sloughs in depressional areas. The Cardston soils are common inclusions in delineations of this soils unit where the topography is less than 10%. Gravelly and stony phases of BZR soils are associated with landscapes where the slopes are greater than 10%. The percentage of eroded or Rego profiles is more prevalent within areas that are annually cultivated and in delineations of steep topography, (class 5 or more).

Delineations of this soil unit near the Dark Brown-Black zone line, where the climate is drier, contain minor amounts of Dark Brown Chernozemic soils - Purescape. Conversely, on the western limits of the 2H agroclimatic zone, where the climate is cooler and wetter, the surface horizons are thicker and Dunvargan soils are present.

Six topographic phases of the BZR1 soil unit were recognized.

BZR1/3 - Mapped on undulating topography with slopes between 2-5%. Areas are used for grain production and grazing.

BZR1/4 - Mapped on hummocky morainal landscapes, with slopes between 5-9%. Areas are used for grain production and grazing.

BZR1/4D - Mapped on inclined and dissected landscapes with slopes between 5-9%. Areas are used for grain production and grazing.

BZR1/5 - Predominantly mapped on hummocky landscapes. Some delineations have rolling and/or inclined topography 9-15%. Areas are grazed with some used for grain production.

BZR1/5-6D - Mapped on inclined and dissected slopes of 10-30%. Slopes are generally 100 meters and 18%. Areas are used for grazing.

BZR1/6 - Predominantly mapped on hummocky to rolling landscapes. Slopes are over 15%. Areas are used for grazing.

BZR2

This soil unit contains 60-80% Orthic Black Chernozemic soils developed on medium textured till - Beazer. Significant amounts (15-30%) of Gleysolic soils associated with sloughs and depressional areas within the hummocky morainal landscape are present. Soils containing more than 15% coarse fragments may occur in minor amounts, generally in upper slope locations. In similar locations thin, eroded or Rego profiles are also present in small amounts, primarily in cultivated areas. Some medium textured lacustrine materials are associated with the larger depressional areas between hummocks.

Delineations of this soil unit near the Dark Brown - Black zone line, where the climate is drier, contain minor amounts of Dark Brown Chernozemic soils - Purescape. Conversely, on the western limits of the 2H agroclimatic zone, where the climate is slightly cooler and wetter, the surface horizons are thicker and Dunvargan soils are found. The proportions of these soils are variable, generally less than 20%.

Two topographic phases of the BZR2 soil unit were recognized.

BZR2/4 - Mapped on hummocky morainal landscapes with slopes between 5-9%. Delineations are used for grain production as well as for grazing.

BZR2/5 - Mapped on hummocky morainal landscapes with slopes between 9-15%. Some delineations have slopes exceeding 15%. Areas are primarily grazed but some are used for grain production.

BZR4

This soil unit contains 50-70% Orthic Black Chernozemic soils developed on medium textured till - Beazer and 20-40% eroded, thin or Rego Black Chernozemic soils on the same parent material - Parsons. These Rego profiles occur in upper slope positions, on crests of knolls as well as on west facing slopes. When the land is dry and bare these soils show up as lighter coloured patches (Figure 20). In delineations where the slopes are less than 10% (ie. class 4) soils developed on glaciolacustrine parent materials are present in minor amounts. Also, Gleysolic soils which are associated with sloughs occur in amounts less than 15%. In the 6D topography map unit, bedrock outcrops and soils developed on a till veneer over bedrock occur as inclusions.

Figure 20. The landscape associated with a BZR4/5 map unit. Note eroded knoll where crop growth is retarded and surface colour is lighter.

Three topographic phases of the BZR4 soil unit were recognized.

BZR4/4 - Mapped on hummocky to rolling landscapes with predominant slopes between 6-9%. Areas are used for grain production.

BZR4/5 - Mapped on hummocky to rolling landscapes with predominant slopes between 9-15%. Areas are used primarily for grain production.

BZR4/6D - Mapped on inclined and dissected landscapes. Slopes are over 15%. Delineations of this unit are used extensively for grazing.

BZR6

This soil unit contains 50-80% Orthic Black Chernozemic soils developed on medium textured till - Beazer and 20-40% of stony and coarser textured soils developed on ice-contact material. The texture of the ice-contact material is variable, ranging from sand to clay loam while the coarse fragment content ranges from 15-50% by volume. It is commonly between 20-30%. The ice-contact material of the unit is associated with tops of knolls and ridges (Figure 21). Recognizable eskers and kames may be present and these features are generally a good source of gravel. Eroded, thin or Rego profiles on the dominant parent materials of this unit occur in minor amounts in upper slope positions of the landscape.

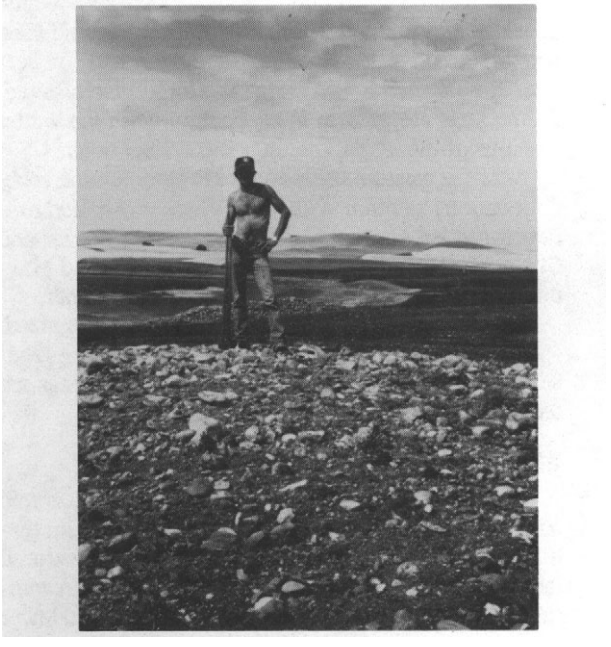


Figure 21. A stony, cultivated surface within a BZR6 soil unit.

Three topographic phases of the BZR6 soil unit were recognized.

BZR6/4 - Mapped on hummocky and ridged topography with slopes between 6-9%. Areas are used for grain production and grazing.

BZR6/5 - Mapped on hummocky and ridged topography with slopes between 9-15%. Areas are used primarily for grazing. Some delineations are cultivated.

BZR6/5-6D - Mapped on hummocky, inclined and dissected landscapes with slopes ranging between 9-30%. Areas are used for grazing.

BZR8

This soil unit contains 40-60% Orthic Black Chernozemic soils developed on medium textured till - Beazer, 20-40% eroded, thin or Rego Black Chernozemic soils developed on the same parent material - Parsons, as well as 15-30% Gleysolic soils which are associated with depressional areas. The Rego profiles occur on the crests of knolls and in upper slope positions. When the land is dry and bare these soils show up as lighter coloured patches across the landscape. Soils developed on fine and medium textured glaciolacustrine material may occur in minor amounts. These latter soils are found in lower slope positions of the landscape.

Delineations are confined to the extensively cultivated portions of the Cardston Plain.

One topographic phase of this soil unit was recognized.

BZR8/4 - Mapped on hummocky morainal landscapes where predominant slopes are between 5-9%. Areas are used for growing barley and wheat.

BZCT1

This soil unit contains Orthic Black Chernozemic soils developed on medium textured till - Beazer, and on fine textured lacustro-till - Cardston. These soils occur in roughly equal proportions (30-50%), and they are intimately and randomly associated throughout the unit. Ap horizons within this unit are generally clay loam textured. Eroded, thin or Rego profiles and Solonetzic soils developed on similar parent materials to Beazer and Cardston occur as inclusions, in most delineations.

One topographic phase of this soil unit was recognized.

BZCT1/3 - Mapped on undulating topography with slopes ranging between 2-5%. Wheat and barley production are the dominant crops grown on this unit.

BZCT2

This soil unit contains Orthic Black Chernozemic soils, 30-50% often developed on medium textured till - Beazer and 20-40% developed on fine textured la-

custro-till - Cardston. Gleysolic soils are also present in significant amounts (15-30%). They are associated with depressional areas. The Beazer and Cardston soils occur in an intimate and random association throughout the unit. Eroded, thin or Rego profiles and Solonetzic soils developed on similar parent materials to Beazer and Cardston, are present in most delineations, in minor amounts.

One topographic phase of this soil unit was recognized.

BZCT2/3 - Mapped on undulating topography with slopes ranging between 2-5%. Areas are used for grain production.

BZCT3

This soil unit contains 30-50% Orthic Black Chernozemic soils developed on medium textured till - Beazer and 20-40% Orthic Black Chernozemic developed on fine textured lacustro-till - Cardston. In addition there are significant amounts (15-30%) of saline soils. These saline soils typically occur in lower slope and depressional landscape positions. Solonetzic soils developed on fine textured materials occur in minor amounts within some delineations. Near the western limits of the 2H agroclimatic zone delineations contain soils with thicker surface horizons - Dunvargan soils in variable amounts.

One topographic phase of this soil unit was recognized.

BZCT3/3 - Mapped on undulating topography with 2-5% slopes predominating. Areas are used for grain and forage production.

BZCT4

This soil unit contains Orthic Black Chernozemic soils, 30-50% of them are developed on medium textured till - Beazer and 20-40% developed on fine textured lacustro-till - Cardston. In addition, there are significant amounts of (20-40%) eroded, thin or Rego Black Chernozemic soils (Parsons and Cowley) and Regosolic soils. These latter soils are found on the tops of knolls and upper slope landscape positions. When the land is dry and bare, eroded soils show up as lighter coloured patches.

One topographic phase of this soil unit was recognized.

BZCT4/4 - Mapped on hummocky and inclined landscapes where slopes are 5-9%. Inclined slopes of 6% and 100 meters in length are typical for this unit. Areas are used for grain production.

BZSO1

This soil unit contains Orthic Black Chernozemic soils, 40-60% of them are developed on medium textured till - Beazer and 30-50% on medium textured lacustrine blanket-veneer over till - Standoff. The Standoff soils are associated with the depressional areas in between the undulations. Eroded, thin or Rego Black Chernozemic soils on till, as well as Gleysolic soils associated with sloughs are present in minor amounts. Occasionally, Black Chernozemic soils developed on medium textured lacustrine veneer overlying fluvial sand may be found in some delineations of this unit.

One topographic phase of this soil unit was recognized.

BZSO1/3-4 - Mapped on undulating to hummocky landscapes where slopes range between 2-9%. Areas are used for grain and forage production as well as for grazing.

BZSO2

This soil unit contains Orthic Black Chernozemic soils, 30-50% of them are developed on medium textured till - Beazer, and 20-40% on medium textured lacustrine blanket-veneer over till - Standoff. In addition, Gleysolic soils associated with sloughs or depressional areas occur in significant amounts (15-30%). Standoff soils are usually associated with the depressional areas between undulations. Other soils which occur in minor amounts are Black Chernozemic soils developed on a medium textured lacustrine veneer over fluvial sands and coarse textured glaciofluvial. Saline soils are present in association with the wetter portions of the landscape, in some delineations.

Near the western limit of the 2H agroclimatic zone, delineations contain soils with thicker Ah horizons developed on similar parent materials as Beazer and Standoff. The equivalent soils, Dunvargan and Maycroft, are present in minor to significant amounts.

One topographic phase of this unit was recognized.

BZSO2/2-3 - Mapped on level to undulating landscapes where slopes range between 0-5%. Areas are used for grain production.

BZSO3

This soil unit contains Orthic Black Chernozemic soils, 30-50% of them are developed on medium textured till - Beazer, and 20-40% on medium textured lacustrine blanket-veneer over till - Standoff. In addition saline soils associated with depressional and lower slope areas occur in significant amounts between 15-30%. Delineations of this unit occur near the Black - Dark Brown soil zone line. Therefore, Orthic Dark Brown Chernozemic soils developed on similar parent materials - Purescape and Lupen, are present in minor amounts.

One topographic phase of this soil unit was recognized.

BZSO3/3 - Mapped on undulating landscapes where slopes range between 2-5%. Areas are used for forage production and grazing.

BZOK1

This soil unit contains Orthic Black Chernozemic soils, 40-60% of them are developed on medium textured till blankets - Beazer and 15-30% developed on till veneer over medium to coarse textured residual material - Ockey. Other soils which are present in minor amounts are eroded, thin or Rego Black Chernozemics and Regosols developed on till of varying depth over bedrock and soils with over-thickened Ah horizons - Porcupine. Porcupine soils, the product of eolian and slopewash processes, occur on the steep east-facing slopes within these delineations. Bedrock outcrops are a distinctive minor feature of this unit.

Delineations are primarily confined to the eastern edge of the Foothills where the "hogback" ridges occur.

One complex topographic phase of this soil unit was recognized.

BZOK1/5-6 - Mapped on ridged and rolling bedrock controlled landscapes where slopes vary between 10-30%. Areas are used for grazing.

BZOK4

This soil unit contains Orthic Black Chernozemic soils, 30-50% of them are developed on medium textured till blankets - Beazer and 15-30% of them are developed on a till veneer over residual material of variable textures - Ockey. In addition, eroded, thin or Rego Black Chernozemic soils and Regosols on similar parent materials are present in significant amounts (20-40%) in upper slope positions of the landscape. Orthic and Rego Chernozemic soils developed on residual material as well as bedrock outcrops occur in variable amounts, generally less than 20% in total.

In the delineations around Whiskey Gap (Twp.1 Rge.23) the underlying bedrock (Willow Creek Formation) is fine textured and is prone to slumping. Therefore, the soils in this area are very weakly developed.

Two topographic phases of this soil unit were recognized.

BZOK4/4 - Mapped on rolling and inclined bedrock controlled terrain with 6-9% slopes predominanting. Areas are used for grain and forage production.

BZOK4/6D - Mapped on inclined and dissected landscapes where slopes are greater than 15%. These slopes are often greater than 100 meters in length (Figure 22). Areas are used for grazing.

Figure 22. The landscape associated with the BZOK4/6D soil map unit.

2.3.4 Birdseye (BDY) soil description.

Birdseye is an Orthic Dark Gray Chernozemic developed on medium textured till veneer over coarse to fine textured residual bedrock. These soils were mapped in the Rocky Mountain Foothills, in the 5H agroclimatic zone.

Selected characteristics of BDY (ranges in brackets).

	Horizons		
	Ahe	Bt	II Bt/II BC
thickness, cm	15 (10-20)	35 (10-60)	@ 50 (25-80)
textural class	L (SiL-SL)	CL (SiCL-C)	SiCL (SL-SiC)
*c.f. content, %	10 (5-20)	10 (5-20)	-
pH	5.7 (5.1-6.3)	6.3(5.7-6.7)	6.6 (6.0-7.0)
organic matter, %	15 (5-25)	-	-

* Coarse fragment content by volume

Special Notes: Birdseye soils were found primarily under aspen, vegetation, occasionally under Lodgepole pine. These soils have a litter layer (LFH) which is usually less than 2 cm thick. The Ahe is typically a mull horizon, that has been mixed by the activity of earthworms.

The organic matter and pH values are generally lower for the soils developed under pine vegetation in comparison to the ones under aspen vegetation. Lime is usually not encountered within the upper meter. Residual bedrock is generally encountered at a depth of 50 cm, but ranges from 25-100 cm. The bedrock is paralithic within the control section.

Birdseye Soil Units and Map Units.

BDY1

This soil unit contains 50-70% Birdseye soils. Soils which occur in minor amounts include, Orthic Dark Gray and Black Chernozemics developed on deep deposits of till, as well as Dark Gray Luvisols on till of variable thickness. The texture of the weathered residual material within this unit is variable, however it is dominantly sandy loam to loam.

The vegetative cover of this unit consists of dominantly aspen forest with interspersed open grassland areas.

One topographic phase of the BDY1 soil unit was recognized.

BDY1/3-4 - Mapped on undulating to rolling bedrock controlled landscape where the predominant slopes range between 2-9%. Areas are used for grazing.

BDCC1

This soil unit contains 30-50% Birdseye soils and 20-40% Dark Gray Luvisolic soils developed on medium textured till veneer over residual material - Crooked Creek. The underlying bedrock in this unit weathers to material of variable texture, but is dominantly sandy loam to loam. Similar soils developed on deeper deposits of till are present as inclusions (%).

The vegetative cover associated with this soil unit consists of aspen forest interspersed with open grassland areas.

One topographic phase of this soil unit was recognized.

BDCC1/4-5 - Mapped on rolling and inclined bedrock controlled landscapes where the predominant slopes range between 5-15%. Areas are used for grazing.

BDNF1

This soil unit contains 30-50% Birdseye soils and 20-40% Orthic Eutric Brunisols developed on medium textured till veneer over residual material - North Fork. The texture of the weathered residual material is variable but sandy loam to loam textures are dominant. Orthic Dark Gray and Black Chernozemic soils developed on deeper deposits of till occur in variable amounts up to 20%. Also Dark Gray Luvisols developed on till of variable thickness occur in minor amounts.

The unit is dominantly covered with aspen forest with some pine and spruce interspersed. Open grassland areas occur on slopes with southern aspects.

One topographic phase of this soil unit was recognized.

BDNF1/6-7 - Mapped on rolling, ridged and inclined bedrock controlled landscapes with slopes ranging between 15-45%. Areas are used for grazing.

2.3.5 Blackfoot (BFT) soil description.

Blackfoot is an Orthic Black Chernozemic soil developed on a medium textured fluvial veneer greater than 30 cm thick over gravelly, coarse textured fluvial deposits (Figure 23). These soils were mapped on the Cardston Plain and the Milk River Ridge, in the 2A(H) and 2H agroclimatic zones.

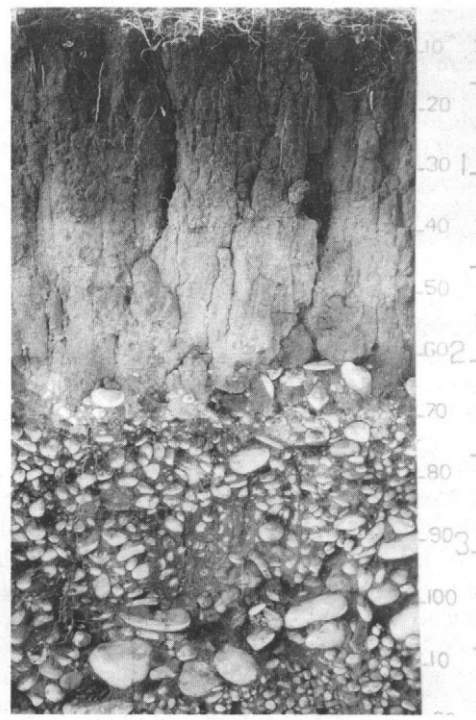


Figure 23. BFT soil profile.

Selected characteristics of BFT (ranges in brackets)

	Topsoil (Ah/Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	10(8-15)	20(15-30)	@ 30 (30-50)
textural class	L(SiL,SiCL,CL)	L(SiL,SiCL,CL)	LS (SL-S)
*c.f. content, %	-	-	20% in gravel layer
depth to gravel,cm	-	-	50 (30-100)
pH	6.5 (5.9-7.0)	6.8 (6.0-7.0)	7.5
organic matter %	6 (5-8)	-	-
$CaCO_3$ equiv. %	-	-	12 (8-15)

* Coarse fragment content by volume.

Blackfoot Soil Units and Map Units

BFT1

This soil unit contains 60-90% Blackfoot soils. Similar soils developed on deep deposits of medium textured lacustrine and on gravelly, coarse textured fluvial materials are present in minor amounts.

One topographic phase of this soil unit was recognized.

BFT1/3 - Mapped on level to undulating terrace tread areas where slopes range between 2-5%. Sharp breaks are common between terraces. Areas are used for grain and forage production.

BFRN1

This soil map unit contains approximately equal amounts (30-50%) of Blackfoot soils and Orthic Black Chernozemic soils developed on gravelly coarse textured fluvial deposits - Rinard. Blackfoot and Rinard soils are developed on closely related parent materials, therefore, they occur randomly throughout delineations of this soil unit. Similar soils developed on deep deposits of medium textured lacustrine and coarse textured fluvial occur in minor amounts.

One topographic phase of this soil unit was recognized.

BFRN1/3 - Mapped on level to undulating terrace tread areas where slopes range between 2-5%. Steeper slopes are present on areas between terraces (Figure 24). Areas are used for forage and grain production.

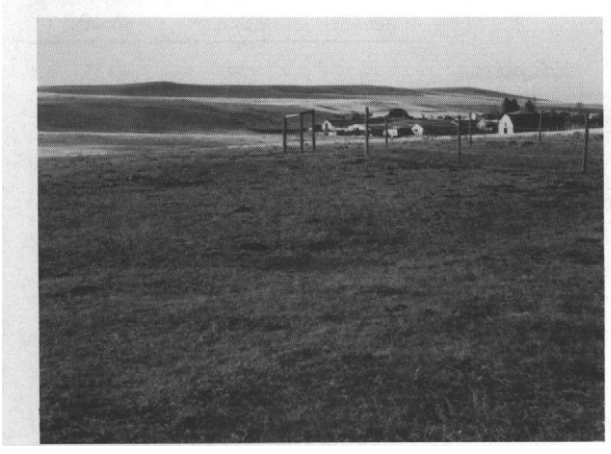


Figure 24. The terraced landscape associated with a BFRN1/3 soil map unit.

2.3.6 Cardston (CTN) soil description.

Cardston is an Orthic Black Chernozemic soil developed on fine textured, moderately to strongly calcareous lacustro-till (glaciolacustrine) (Figure 25). These soils were mapped in the 2H agroclimatic zone, on the Cardston Plain (Figure 26).

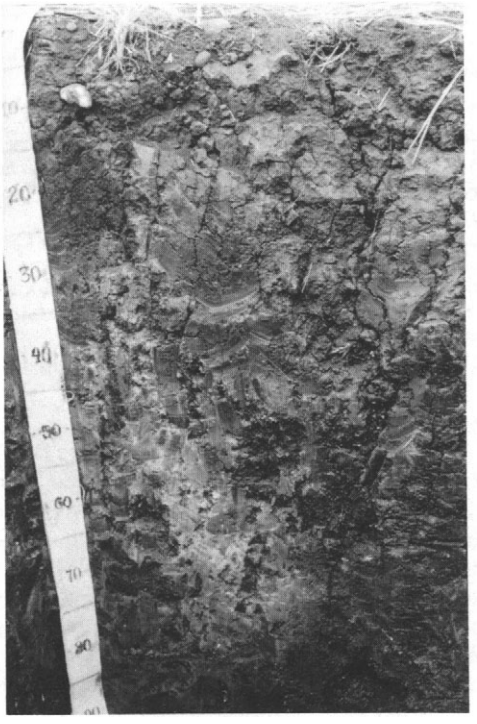


Figure 25. CTN soil profile.

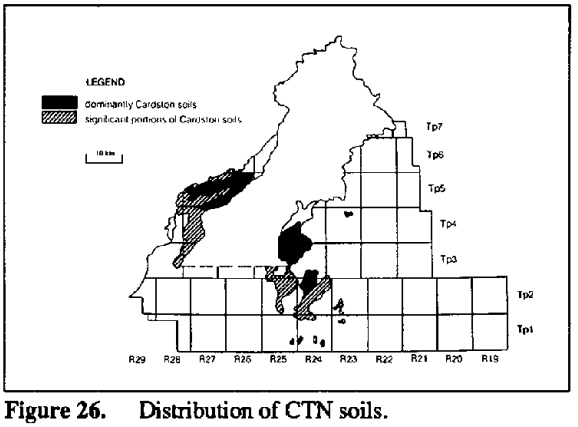


Figure 26. Distribution of CTN soils.

Selected characteristics of CTN (ranges in brackets).

	Topsoil (Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	15(10-20)	30(20-40)	@45 (30-60)
textural class	CL(SiCL-SiC)	C (SiCL-HC)	C (SiCL-HC)
pH	6.0 (5.7-6.3)	6.0 (5.7-6.5)	7.5

	Topsoil (Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)
organic matter,%	5 (4-7)	-	-
$CaCO_3$ equiv., %	-	-	12 (8-15)

Special Notes: Cardston soils have high shrink-swell potentials due to their high clay content. Cracks up to 3 cm wide and 1 meter deep form as the profile dries out, allowing topsoil to fall in, blurring horizon boundaries. The lacustro-till (glaciolacustrine) deposits on which Cardston soils have developed are generally between 1 and 2 m thick, but may be as shallow as 50 cm over till, and sometimes bedrock.

Cardston Soil Units and Map Units.

CTN1

This soil unit contains 60-90% Orthic Black Chernozemic soils developed on fine textured lacustro-till - Cardston. Eroded, thin or Rego Black Chernozemic soils on similar materials commonly occur in amounts less than 20%. Other Chernozemic soils developed on medium textured till as well as Black Solodized Solonetz on fine textured lacustro-till may occur in minor amounts.

One topographic phase of the CTN1 soil unit was recognized.

CTN1/2-3 - Mapped on level to undulating landscapes. Slopes vary between 0-5% but the majority of the areas are in the range of 1-3%. Delineations are used primarily for grain production.

CTN3

This soil unit contains 60-80% Orthic Black Chernozemic soils developed on fine textured lacustro-till - Cardston and 20-30% saline soils. The saline soils are usually associated with the lower slope positions of the landscape. Black Chernozemic soils developed on medium textured till blanket and veneer over weathered bedrock occur in minor amounts.

One topographic phase of the unit was recognized.

CTN3/3 - Mapped on undulating and inclined landscapes. There are two delineations of this unit, the one in 5-27 is on a 100 m long inclined slope of 5% and the one in 4-23 is in a basin like area where slopes range from 2-5%. Both areas are used for grain production.

CT:L4

This soil unit contains 40-60% Orthic Black Chernozemic soils developed on fine textured lacustro-till veneer over weathered bedrock - lithic phase of Cardston, and 20-40% Rego Black Chernozemic soils developed on similar materials. The paralithic residual material is fine to medium textured. Chernozemic soils developed on thicker deposits of lacustro-till are present in minor amounts. Rego Chernozemic and Regosolic soils on residual material are also present in small amounts.

One topographic phase of the CT:L4 soil unit was recognized.

CT:L4/4 - Mapped on rolling bedrock controlled landscape where slopes are between 5-9%. Barley and wheat are grown in the one delineation of this unit.

CTPG1

This soil unit contains 60-80% Orthic Black Chernozemic soils developed on fine textured lacustro-till - Cardston and 20-40% Black Solodized Solonetzic soils also developed on lacustro-till - Peigan. Other Black Solonetzic soils developed on similar materials as Cardston are common inclusions. Gleysolic and saline soils associated with the lower lying areas are present in minor amounts.

One topographic phase of this soil unit was recognized.

CTPG1 - Mapped on level to undulating topography with 0-5% slopes. Delineations are used for grain production.

2.3.7 Carway (CRW) soil description.

Carway is an Orthic Black Chernozemic soil developed on coarse textured glaciofluvial. These soils were mapped in the Rocky Mountain Foothills, in the 3H agroclimatic zone.

Selected characteristics of CRW (ranges in brackets).

	Topsoil (Ah/Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	25	30	@ 55
textural class	SL (LS)	SL (LS)	SL (LS)
*c.f. content, %	<15	<15	<15
pH	6.3(6.0-6.8)	6.3(6.0-6.8)	7.4
organic matter, %	10	-	-
$CaCO_3$ equiv., %	-	-	12

* Coarse fragment content by volume.

Carway Soil Units and Map Units.

CRW1

This soil unit contains 60-80% Carway soils. Other Black Chernozemic soils developed on gravelly, coarse textured glaciofluvial, as well as on medium textured till and lacustrine may be present in minor amounts.

One topographic phase of this unit was recognized.

CRW1/4 - Mapped on hummocky glaciofluvial landscapes where slopes are between 5-9%. Areas are used for grazing and forage production.

CRLN1

This soil unit contains 40-60% Carway soils and 30-50% Orthic Black Chernozemic soils developed on gravelly, coarse textured glaciofluvial - Lundbreck. Gleysolic soils associated with sloughs in depressional areas as well as Black Chernozemic soils developed on medium textured till are present as inclusions (less than 15% each). Within landscapes of 5-6 topography, soils developed on gravelly, medium textured till or ice-contact material may be present in minor amounts.

Two topographic phases of this soil unit were recognized.

CRLN1/4 - Mapped on hummocky and ridged glaciofluvial landscapes where slopes are between 5-9%. Delineations are primarily used for grazing but some are used for growing forage.

CRLN1/5-6 - Mapped on hummocky and ridged glaciofluvial landscapes where slopes vary between 9-30%. Areas are used for grazing.

2.3.8 Coaldale (CLD) soil description.

Coaldale is an Orthic Dark Brown Chernozemic soil developed on fine textured lacustrine (glaciolacustrine) parent material. These soils are mapped on the Three Rivers Plain, in the 2A agroclimatic zone.

Selected characteristics of CLD (ranges in brackets)

	Topsoil (Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	15	35	@ 50
textural class	CL (SiCL)	SiC(SiCL-C)	SiC(SiCL-C)
pH	6.6(6.0-7.0)	7.0	7.5
organic matter %	4.0	-	-
$CaCO_3$ equiv. %	-	-	12 (8-15)

Special Note: Parent material investigations have revealed the existence of discontinuous sand lenses at depth throughout the lacustrine basin around Magrath, where Coaldale soils are mapped.

Coaldale Soil Unit and Map Unit.

CLLE1

This soil unit contains 50-70% Coaldale soils and 30-50% Orthic Dark Brown Chernozemic soils developed on medium textured lacustrine - Lethbridge. Soils developed on a medium textured, lacustrine veneer over till are present within the soil unit in variable proportions. Rego Dark Brown Chernozemic soils developed on the previously mentioned parent materials are also common inclusions.

One topographic phase of this soil unit was recognized.

CLLE1/2 - Mapped on level to very gently undulating landscapes with slopes less than 2%. Areas are primarily used for growing grain and for the production of cash crops such as sugarbeets, when irrigated.

2.3.9 Cradduck (CRD) soil description.

Cradduck is an Orthic Dark Brown Chernozemic soil developed on medium textured, moderately calcareous till. Cradduck soils were mapped in the 2A agroclimatic zone, on the Three Rivers and Verdigris Plains (Figure 27).

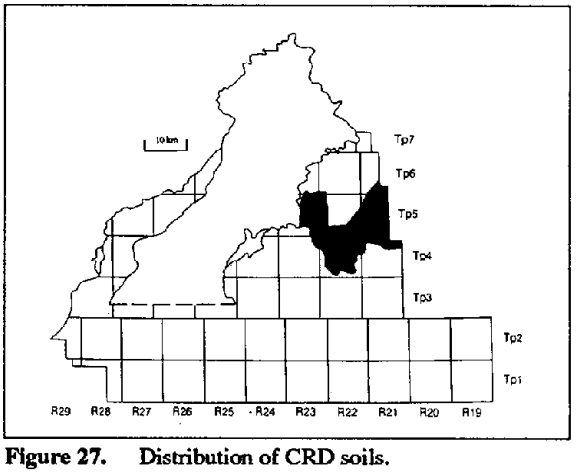


Figure 27. Distribution of CRD soils.

Selected characteristics of CRD (ranges in brackets)

	Topsoil (Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	15 (10-20)	25 (10-40)	@40 (20-60)
textural class	L (SiL-CL)	CL (L-SiCL)	CL (L-SiCL)
*c.f. content, %	<15	<15	<15
pH	6.5	6.5	7.4
organic matter, %	5 (4-6)	-	-
$CaCO_3$ equiv., %	-	-	12 (10-15)

* Coarse fragment content by volume.

Cradduck Soil Units and Map Units.

CRD1

This soil unit contains dominantly (60-90%) Orthic Dark Brown Chernozemic soils developed on medium textured till - Cradduck. Gleysolic soils associated with depressional areas are common inclusions. Additional soils present in minor amounts include Dark Brown Chernozemic soils developed on lacustrine veneers over till and on lacustro-till materials. Eroded, thin or Rego Dark Brown Chernozemic soils developed on the previously mentioned parent materials may also be found on some exposed locations (ie. crests of knolls).

Two topographic phases of this soil unit were recognized.

CRD1/3 - Mapped on undulating morainal landscapes where slopes are between 2-5%. Areas are used for grain production.

CRD1/4 - Mapped on hummocky morainal landscapes where slopes range between 5-9%. Areas are used for grain production.

CRD2

This soil unit contains 60-80% Orthic Dark Brown Chernozemic soils developed on medium textured till - Cradduck and 15-30% Gleysolic soils associated with sloughs in depressional areas. Eroded, thin or Rego profiles on the tops of knolls, may be present in amounts up to 20%.

One topographic phase of the CRD2 soil unit was recognized.

CRD2/4 - Mapped on hummocky morainal landscapes where the dominant slopes range between 5-9%. Areas are used for grain production and grazing.

CRD3

This soil unit contains 60-80% Orthic Dark Brown Chernozemic soils developed on medium textured till - Cradduck and 15-30% saline soils. These saline soils typically occur in the lower slope to depressional landscape positions. Similar soils developed on till veneers over weathered bedrock are present in minor amounts. Also thin, eroded, or Rego profile soils on these parent materials occur in small amounts and are usually associated with crests of knolls or ridges.

One topographic phase of this soil unit was recognized.

CRD3/3 - Mapped on undulating and inclined topography where slopes are between 2-5%. Areas are primarily used for grain production.

CRD4

This soil unit contains 60-80% Orthic Dark Brown Chernozemic soils developed on medium textured till - Cradduck and 20-40% Rego Dark Brown Chernozemic soils on similar materials - Verburg. The Rego profiles occur on crest of knolls and appear as lighter coloured patches, when the land is dry and bare. Dark Brown Chernozemic soils developed on lacustro-till and Gleysolic soils associated with sloughs occur in amounts less than 15-20%. On slope class 4 topography, Orthic and Rego Dark Brown Chernozemic soils developed on till veneers over weathered bedrock occur in minor amounts. These soils are associated with upper slope landscape positions within these delineations.

Two topographic phases of this soil unit was recognized.

CRD4/3 - Mapped on undulating morainal landscapes where slopes vary between 2-5%. Delineations are used for grain production.

CRD4/4 - Mapped on hummocky moraine where slopes are dominantly between 5-9%. Delineations are used for grain production.

CRMG1

This soil unit contains Orthic Dark Brown Chernozemic soils, 40-60% of them are developed on medium textured till - Cradduck and 30-50% on fine textured lacustro-till - Magrath. These soils occur intimately and randomly throughout delineations of this unit. Similar soils developed on till veneers over weathered bedrock and on medium textured lacustrine are also found in minor amounts. Rego profiles on all previously mentioned parent materials are common inclusions, generally associated with the crests of knolls. Some saline soils occur in the lower depressional areas.

One topographic phase of this soil unit was recognized.

CRMG1/3 - Mapped on an undulating landscape where slopes are between 2-5%. This map unit is used extensively for grain production.

CRMG4

This soil unit contains Orthic Dark Brown Chernozemic soils, 30-50% of them are developed on medium textured till - Cradduck and 20-40% on fine textured lacustro-till - Magrath. In addition, Rego Dark Brown Chernozemic soils on similar materials - Verburg and Welling respectively, are present in significant proportions 20-40%. These parent materials occur randomly and intimately throughout the delineations of this unit. However, the Rego profiles are generally confined to the tops of undulations and hum-

mocks, and appear as lighter coloured patches on bare and dry land. Dark Brown Chernozemic soils developed on medium textured lacustrine and Gleysolic soils associated with sloughs and depressional areas are present in minor amounts.

Three topographic phases of this unit were recognized.

CRMG4/3 - Mapped on undulating landscapes where slopes are between 2-5%. Areas are used for growing wheat and barley.

CRMG4/4 - Mapped on hummocky topography where dominant slopes are 5-9%. Areas are used for grain production.

CRMG4/5 - Mapped on hummocky landscapes with the dominant slopes being between 9-15%. Delineations of this unit are used for grain production and some grazing.

CRVA1

This soil unit contains Orthic Dark Brown Chernozemic soils, 40-60% of them are developed on medium textured till - Cradduck and 30-50% on a till veneer over weathered bedrock - Van Cleeve. The Van Cleeve soils are generally found in upper slope positions. Inclusions of Rego Dark Brown Chernozemic soils developed on these materials are present in minor amounts, usually on the tops of ridges and knolls. At the base of long inclined slopes, saline soils may be found in small amounts.

One topographic phase of the CRVA1 soil unit was recognized.

CRVA1/3 - Mapped on inclined bedrock controlled landscapes which contain some undulations and dominant slopes are between 2-5%. Areas are used grain production.

CRVA4

This soil unit contains Orthic Dark Brown Chernozemic soils, 30-50% of them are developed on medium textured till - Cradduck and 20-40% on a till veneer over weathered bedrock - Van Cleeve. Rego Dark Brown Chernozemic and Regosolic soils developed on these materials also occur in significant amounts (20-40%). These eroded and weakly developed profiles are found on the tops of knolls and ridges, and appear as lighter coloured patches on bare and dry land. The Van Cleeve soils are also associated with upper slope landscape positions. At the base of the long slopes, some saline soils may occur in small amounts.

One topographic phase of this soil unit was recognized.

CRVA4/4 - Mapped on complex landscapes of inclined slopes containing hummocks and ridges. Dominant slopes are between 5-9%. Areas are used for grain production.

2.3.10 Crooked Creek (CCR) soil description.

Crooked Creek is a Dark Gray Luvisol developed on a medium textured till veneer over residual bedrock. These soils were mapped in the 5H agroclimatic zone, in the Rocky Mountain Foothills.

Selected characteristics of CCR (ranges in brackets).

	Horizons.			
	Ahe	Ae	Bt	IIBC
thickness, cm	10	10	30	@50
textural class	L	L	CL	L (SL C)
*c.f. content, %	15	15	15	20 (10-50%)
pH	5.8 (5.4-6.4)	5.5 (5-6)	5.7 (5.4-6.4)	6.
organic matter,%	12 (10-15)	4 (2-5)	1	-

*Coarse fragment content by volume.

Special Notes: Crooked Creek soils were found under both aspen and pine vegetation. The litter (leafmat) layer is usually less than 2 cm thick. The Ahe horizon is generally well mixed by earthworms. The coarse fragment content of the till is extremely variable, however it is generally in the range of 15%. Paralithic bedrock is generally encountered at a depth of 50 cm but varies from 30-100cm. Lime is usually not encountered above 130 cm.

Crooked Creek Soil Units and Map Units.

CCBD1

This soil unit contains 30-50% Crooked Creek soils and 20-40% Orthic Dark Gray Chernozemic soils on similar parent materials - Birdseye. The underlying bedrock in this unit weathers to residual material of variable texture, however dominantly sandy loam to loam. Similar soils developed on thicker deposits of till occur as inclusions. Orthic Gray Luvisolic soils developed on morainal material of variable thickness also occur in small amounts on slopes with north aspects and in the western most portions of some delineations.

This unit is dominantly covered with aspen forest with a significant proportions of pine and spruce, particularly on north aspect slopes.

One topographic phase of this soil unit was recognized.

CCBD1/5-6 - Mapped on a rolling, ridged and inclined, bedrock controlled landscape, with slopes ranging between 9-30%. Some portions of this unit occurring within the Poll Haven community pasture are cleared and used as improved range. However, the majority of the areas are grazed in their natural state.

CCNF1

This soil unit contains equal proportions (30-50%) of Crooked Creek soils and Orthic Eutric Brunisols developed on similar parent materials - North Fork. These soils occur randomly throughout the unit, however the Brunisolic soils occur in upper slope landscape positions. Orthic Dark Gray Chernozemic soils developed on morainal blanket and veneer over residual materials are commonly found inclusions in this unit. Dark Gray Luvisolic soils developed on deep morainal material and Orthic Eutric Brunisolic soils developed on residual material occur in small amounts.

Vegetative cover of this unit consists of aspen forest interspersed with open rough fescue grassland areas.

One topographic phase of this soil unit was recognized.

CCNF1/5-6 - Mapped on rolling, ridged and inclined bedrock controlled landscapes with slopes ranging between 9-30%. Areas used for grazing.

2.3.11 Crowfoot (CFT) soil description.

Crowfoot is an Orthic Dark Brown Chernozemic soil developed on a medium textured glaciofluvial veneer over gravelly, coarse textured glaciofluvial. Crowfoot soils were mapped on the Milk River Plain and Three River Plain, in the 2A(H) and 2H agroclimatic zones.

Selected characteristics of CFT (ranges in brackets).

	Topsoil (Ah/Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	10 (9-15)	20 (10-25)	@ 30 (20-50)
textural class	L (SiL-CL)	L (SiL-CL)	LS (SL-S)
*c.f. content, %	-	-	20% in gravel layer
depth to gravel cm	-	-	50 (30-150)
pH	6.5 (6-7)	6.5 (6-7)	7.4
organic matter, %	4 (3-5)	-	-
$CaCO_3$ equiv. %	-	-	12 (8-15)

* Coarse fragment content by volume.

Crowfoot Soil Units and Map Units.

CFT4

This soil unit contains dominantly (50-70%) Crowfoot soils and 20-40% thin eroded or Rego Dark Brown Chernozemic and Regosolic soils developed on similar parent materials as Crowfoot. These eroded soils are associated with the crests of exposed undulations. Soils developed on gravelly, coarse textured glaciofluvial and medium textured lacustrine are present in minor amounts.

The delineation which occurs in the valley east of the Del Bonita Plateau (Twp.1 Rge.21) is an anomaly. The material over the gravel is fine instead of medium textured.

One topographic phase of this soil unit was recognized.

CFT4/2-3 - Mapped on level to undulating glaciofluvial terraces where slopes range between 0-5%. Delineations are used for grain and forage production.

CFNE1

This soil unit contains approximately equal proportions of Crowfoot soils and Orthic Dark Brown Chernozemic soils developed on gravelly, coarse textured glaciofluvial - New Dayton. In total the Crowfoot and New Dayton account for 60-80% of the soils found in this soil unit. Since the materials are extremely variable within glaciofluvial areas, minor amounts of many different soils occur in minor amounts. Dark Brown Chernozemic soils developed on coarse textured glaciofluvial and medium textured lacustrine are the most common inclusions.

One topographic phase of this soil unit was recognized.

CFNE1/3-4 - Mapped on undulating to hummocky glaciofluvial terraces. Slopes range between 2-9% with the steeper topography occur on areas between the terraces. Areas are used for pasture and grain production.

2.3.12 Del Bonita (DLB) soil description.

Del Bonita is an Orthic Black Chernozemic soil developed on medium textured, strongly calcareous, loessial material (Figure 28). These soils are confined to the Del Bonita Plateau and vicinity, within the 2A(H) agroclimatic zone (Figure 29).

Figure 28. DLB soil profile.

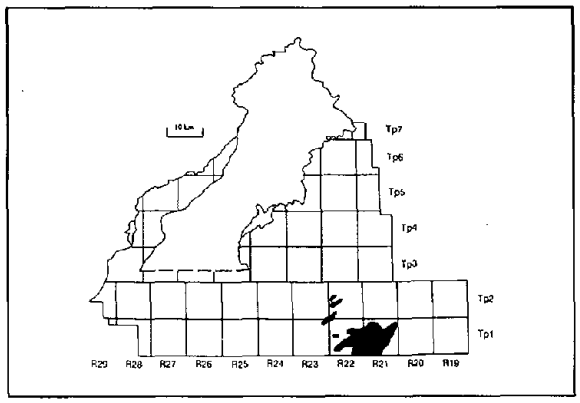


Figure 29. Distribution of DLB soils.

Selected characteristics of DLB (ranges in brackets).

	Topsoil (Ah/Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	12 (10-30)	15 (10-20)	@ 27 (20-50)
textural class	L (SiL-CL)	CL (L-SCL)	CL (L-SCL)
*c.f. content, %	<15	<15	<15
pH	6.4 (5.7-6.7)	6.2 (5.7-6.4)	7.5
organic matter, %	8 (5-11)	2 (1-3)	-
$CaCO_3$ equiv., %	-	-	25 (18-30)

* Coarse fragment content by volume.

Special Notes: The quartzitic, gravel sized coarse fragments within the control section are a product of periglacial processes. During the Wisconsin Ice Age, the coarse fragments were "uplifted" from the underlying Flaxville gravels into the loess. The percentage of coarse fragments within the present day soil profiles ranges from 0-15%, however, gravels may cover 5-30% of the cultivated surface (Figure 30).

Figure 30. The cultivated surface of the Del Bonita soils.

Ah horizons are generally 12 cm thick, but two to three times within a horizontal meter the Ah material tongues into the Bm horizon, occasionally to the Ck. The variability of the Ah thickness is the result of surface material sloughing into present day desiccation cracks.

Del Bonita Soil Units and Map Units.

DLB1

This soil unit contains 80-100% Del Bonita soils. Rego Black Chernozemic soils developed on similar materials occur in minor amounts. Black Chernozemic soils developed on medium textured slopewash materials of variable coarse fragment content are found in small amounts. These soils are associated with breaks in slope and near the edges of the delineations.

One topographic phase of the DLB1 soil unit was recognized.

DLB1/2 - Mapped on level plateau areas where slopes are 0-2%. Areas are primarily used for grain production.

DLHL1

This unit contains 50-70% Del Bonita soils and 20-40% Orthic Black Chernozemic soils developed on medium textured slopewash material - Hillmer. The Hillmer soils are associated with the inclined portions of the Plateau landscape. Other Black Chernozemic soils developed on gravelly, medium textured slopewash, and on medium textured residual material are common inclusions. Thin, eroded or Rego Black Chernozemic and Regosolic soils developed on the various parent materials may occur in minor amounts.

One topographic phase of this soil unit was recognized.

Figure 31. The landscape of a DLHL1/3 map unit in association with an RB1 miscellaneous map unit, within an asymmetric valley, a characteristic feature of the Del Bonita Plateau. The cultivated portion on the left, is the DLHL1 map unit.

DLHL1/3 - Mapped on undulating and inclined landscapes where slopes range from 2-5% (Figure 31). Areas are used for grain and forage production.

2.3.13 Dunvargan (DVG) soil description.

Dunvargan is an Orthic Black Chernozemic soil developed on medium textured till of continental and cordilleran origin. These soils were mapped primarily in the Rocky Mountain Foothills and to a lesser extent on the Cardston Plain, in the 3H agroclimatic zone (Figure 32).

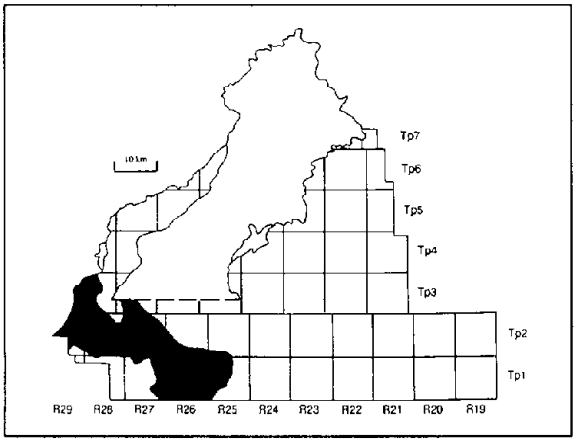


Figure 32. Distribution of DVG soils.

Selected characteristics of DVG (ranges in brackets)

	Topsoil (Ah)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	25 (20-35)	50 (30-70)	@ 75 (50-100)
textural class	L (SiL-CL)	CL (L)	CL (L-C)
* c.f content, %	<15	<15	<15
pH	6.1(5.3-6.5)	6.2(5.8-6.7)	7.4 (7.3-7.8)
organic matter, %	12 (10-14)	1	-
$CaCO_3$ equiv., %	-	-	12 (8-15)

*Coarse fragment content by volume.

Dunvargan Soil Units and Map Units.

DVG1

This soil unit contains between 60-90% Orthic Black Chernozemic soils developed on medium textured till - Dunvargan. Black Chernozemic soils developed on till veneers over weathered and/or consolidated bedrock as well as on medium textured lacustrine are present in minor amounts. Gleysolic soils associated with sloughs are also a common inclusion in this unit. In the delineations of 4D topography, Solonetzic soils developed on till and lacustrine materials are found in association with the dissections, in small amounts.

The proportion of soils developed on till with thinner Ah's - Beazer, increases within the transitional area associated with the 3H and 2H agroclimatic zone line. This area corresponds to the most eastern and northern extent of the DVG1 soil unit delineations. Conversely, the proportion of Dark Gray Chernozemic soils - Beauvais, increases near the 3H, 5H agroclimatic zone line, on the western extent of DVG1 soil unit delineations.

Five topographic phases of this soil unit were recognized.

DVG1/3 - Mapped on undulating landscapes with 2-5% slopes. Areas are used for forage production and grazing.

DVG1/4 - Mapped on hummocky and/or inclined landscapes where slopes are between 5-9%. Delineations are primarily used for forage production and grazing.

DVG1/4D - Mapped on inclined and dissected landscapes in areas associated with the valleys between bedrock ridges in the Foothills (Figure 33). The majority of slopes are between 5-9%. Areas are principally used for grazing.

Figure 33. The landscape associated with a DVG1/4D soil map unit. Note the bedrock ridge in the background.

DVG1/5 - Mapped on hummocky to rolling terrain where slopes are between 9-15%. Areas are used for grazing.

DVG1/6 - Mapped on ridged and rolling terrain with 15-30% slopes. Areas are used for grazing.

DVG2

This soil unit contains 60-80% Orthic Black Chernozemic soils developed on medium textured till - Dunvargan and 15-30% Gleysolic soils. These wet soils are associated with sloughs in depressional areas. Other Black Chernozemic soils developed on medium textured lacustrine and on fine textured lacustro-till are common inclusions.

Two complex topographic phases of this unit were recognized.

DVG2/3-4 - Mapped on an undulating to hummocky pitted morainal landscape with slopes ranging between 3-9%. Delineations are used for forage production and some grazing.

DVG2/4-5 - Mapped on a hummocky landscape where slopes range between 6-15%. Areas are used primarily for grazing.

DVG6

This soil unit contains 60-80% Orthic Black Chernozemic soils developed on medium textured till - Dunvargan and 20-40% similar soils developed on stony, medium and coarse textured ice-contact material. The texture of the ice-contact material is variable ranging from sand to clay loam. Also, the coarse fragment content ranges from 15-50% by volume, but is commonly between 20-30%. The ice-contact material is associated with the tops of knolls and ridges within the soil unit. Distinct eskers and kames may be sometimes recognized.

Two topographic phases of this soil unit were recognized.

DVG6/4-5 - Mapped on hummocky landscapes with slopes ranging between 6-15%. Areas are used for grazing.

DVG6/5-6 - Mapped on hummocky landscapes with 9-30% slopes. Areas are used for grazing.

DVG7

This soil unit contains 60-80% Orthic Black Chernozemic soils developed on medium textured till - Dunvargan and 20-30% Solonetzic soils. The Solonetzic soils occur in the lower slope and depressional landscape positions. In similar locations Gleysolic soils and Black Chernozemic soils developed on fine textured lacustrine may be found in minor amounts.

One topographic phase of the DVG7 soil unit was recognized.

DVG7/3-4 - Mapped on undulating to hummocky terrain with 2-8% slopes. Areas are primarily used for forage production and grazing.

DVOK1

This soil unit contains 50-70% Orthic Black Chernozemic soils developed on medium textured till - Dunvargan and 20-40% Orthic Black Chernozemic soils developed on a veneer of medium textured till over weathered and/or competent bedrock - Ockey. Sandstone bedrock outcrops are common features in delineations of this unit, where the topography is greater than slope class 5. Within delineations consisting of prominent bedrock controlled ridges, soils with over-thickened Ah horizons - Porcupine, are found in minor amounts. Porcupine soils, a product of eolian - slopewash processes, are always associated with the steep east facing ridge slopes of these "hogback" ridges. Eroded, thin, Rego Chernozemic and Regosolic soils are common inclusions (%).

Three complex topographic phases of this soil unit were recognized.

DVOK1/4-5 - Mapped on ridged and rolling bedrock controlled terrain with 5-15% slopes. Areas are used for grazing.

DVOK1/5-6 - Mapped on ridged and rolling bedrock controlled landscapes where the dominant slopes are between 9-30%. Delineations are used for grazing.

DVOK1/5-7 - Mapped on ridged and rolling bedrock controlled terrain where the dominant slopes are between 9-45%. Delineations consist of a series of ridges, with associated valleys between the ridges (Figure 34). Areas are used for grazing.

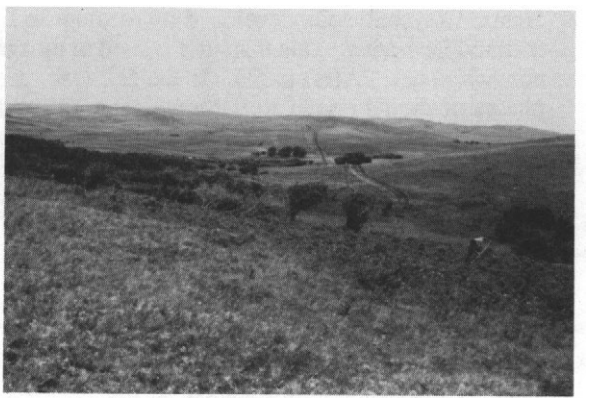


Figure 34. The landscape associated with a DVOK1/5-7 soil map unit.

2.3.14 Fish Creek (FSH) soil description.

Fish Creek is an Orthic Black Chernozemic soil developed on fine textured lacustro-till (glaciolacustrine). These soils were mapped in the Foothills, in the 3H agroclimatic zone.

Selected characteristics of FSH (ranges in brackets)

	Topsoil (Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	20 (15-25)	40 (30-50)	@ 60 (45-80)
textural class	CL (SICL-SIC)	C (SIC)	C (SIC)
pH	6	6	7
organic matter, %	10	-	-
$CaCO_3$ equiv. %	-	-	12 (8-15)

Fish Creek Soil Unit and Map Unit.

FSH7

This soil unit contains dominantly (50-80%) Fish Creek soils and 20-30% Solonetzic soils. The Solonetzic soils are found in the lower slope positions of the landscape along with Gleysolic soils. Gleysolic soils are present in minor amounts. Other soils present as inclusions are Black and Dark Gray Chernozemic soils developed on medium textured till.

One topographic phase of this soil unit was recognized.

FSH7/3 - Mapped on undulating landscapes with slopes between 2-5%. Areas are used for grazing.

2.3.15 Gleysolic (G) Miscellaneous Soil Map Unit.

This miscellaneous map unit is used to depict the numerous, small, poorly drained areas, such as sloughs and potholes, where Gleysolic soils occur. The majority of the G areas contain Orthic and Rego Humic Gleysolic soils developed on medium to fine textured lacustrine. This map unit is used in all agroclimatic zones, 2A(H) to 5H. In the 5H zone, peaty phases of the Gleysolic soils become significant, reflecting the cooler temperatures. Sedges and some willows dominate the vegetative component of all G areas. These areas are used for forage production and grazing.

2.3.16 Heartbreak (HRK) soil description.

Heartbreak is an Orthic Dark Brown Chernozemic soil developed on coarse textured glaciofluvial materials. These soils were mapped on the Milk River Plain, in the 2A(H) agroclimatic zone.

Selected characteristics of HRK (ranges in brackets).

	Topsoil (Ah/Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	10 (7-15)	20 (10-35)	@30 (20-40)
textural class	SL (LS)	LS (S)	LS (S)
*c.f. content, %	<15	<15	<15
pH	6.8	6.8	7.4
organic matter	3 (2-4)	-	-
$CaCO_3$ equiv., %	-	-	10

* Coarse fragment content by volume.

Heartbreak Soil Unit and Map Units.

HRNE1

This soil unit contains 40-60% Heartbreak soils and 30-50% Orthic Dark Brown Chernozemic soils developed on gravelly, coarse textured glaciofluvial - New Dayton. The coarse fragment content of New Dayton soils varies between 20-50%. Surface stones are a common impedance to cultivation within delineations of this unit. Other soils present in minor amounts include Dark Brown Chernozemic soils developed on medium textured till and medium textured fluvial veneers over gravel.

Two topographic phases of this soil unit were recognized.

HRNE1/3-4 - Mapped on undulating to hummocky and ridged landscapes with slopes ranging between 2-9%. The majority of the topography is at the lower end of this range. Areas are primarily used for grazing, minor portions are cultivated.

HRNE1/5 - Mapped on hummocky and ridged glaciofluvial deposits with 9-15% slopes. Areas are used for grazing.

2.3.17 Hegson (HEG) soil description.

Hegson is an Orthic Dark Brown Chernozemic soil developed on fine textured lacustro-till (glaciolacustrine). These soils were mapped on the Milk River Plain, in the 2A(H) agroclimatic zone (Figure 35).

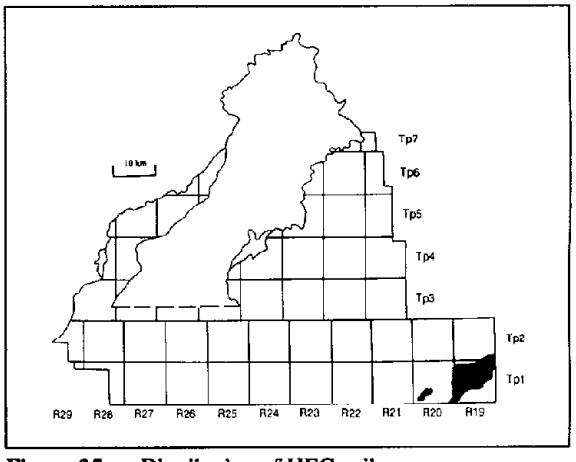


Figure 35. Distribution of HEG soils.

Selected characteristics of HEG (ranges in brackets).

	Topsoil (Ah/Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	10 (8-14)	20 (20-30)	@ 30 (25-40)
textural class	SiCL (CL-SiC)	SiC (C)	SiC (C)
*c.f. content %	<5	<5	<5
pH	6.5	6.5	7.4
organic matter, %	5 (4-6)	-	-
$CaCO_3$ equiv., %	-	-	10 (3-15)

* Coarse fragment content by volume.

Hegson Soil Units and Map Units.

HEG1

This soil unit contains dominantly (70-90%) Hegson soils. Orthic Dark Brown Chernozemic soils developed on medium textured till and medium textured lacustrine veneers over till are common inclusions. Solonetzic soils are also present in small amounts, especially in delineations which contain small dissections or gullies.

One topographic phase of this soil unit was recognized.

HEG1/3 - Mapped on undulating and inclined landscapes with the dominant slopes between 2-5%. Delineations bordering the South Milk River, contain long inclined slopes. Slope lengths are in excess of 300 meters. Areas are used for grain production and grazing.

HEG2

This soil unit contains dominantly (60-80%) Hegson soils and 15-30% Gleysolic soils. These wet soils are associated with sloughs in depressional areas. Thin, eroded or Rego Chernozemic soils and Solonetzic soils developed on glaciolacustrine materials may also be present in minor amounts. Orthic Dark Brown Chernozemic soils developed on medium textured till are common inclusions.

One topographic phase of the HEG2 soil unit was recognized.

HEG2/3-4 - Mapped on undulating to hummocky landscapes with dominant slopes of 2-9%. Delineations are used for grain production and grazing.

HEG7

This soil unit contains 60-80% Hegson soils and 20-40% Solonetzic soils. The Solonetzic soils occur randomly throughout the delineations. However, the majority are associated with areas parallel to dissections or gullies. Orthic Dark Brown Chernozemic soils developed on medium textured till are present in minor amounts.

One topographic phase of this unit was recognized.

HEG7/3D - Mapped on inclined and dissected landscapes with the dominant slopes ranging between 1-4%. Slopes often exceed 400 meters in length. Areas are used for grazing.

2.3.18 Hillmer (HLM) soil description.

Hillmer is an Orthic Black Chernozemic soil developed on medium textured slopewash derived from loessial material. Significant areas of Hillmer are found only in unglaciated regions where downcutting and backcutting due to erosional processes have produced fans and aprons. These soils were mapped on the Del Bonita Plateau, in the 2A(H) agroclimatic zone (Figure 36).

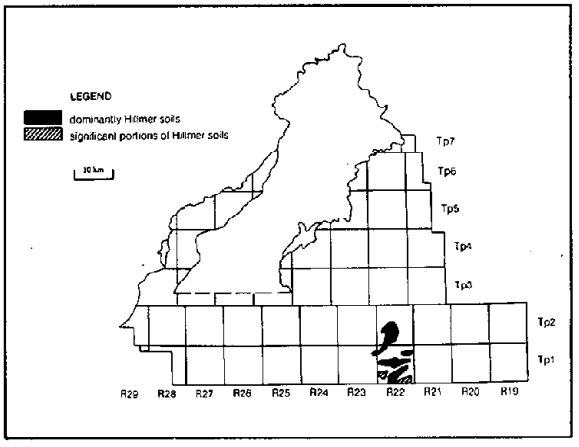


Figure 36. Distribution of HLM soils.

Selected characteristics of HLM (ranges in brackets)

	Topsoil (Ah)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	10 (8-20)	40 (25-50)	@ 50 (35-70)
textural class	L (SiL-L)	L (SiL-SiCL)	L (SiL-SiCL)
*c.f. content, %	10	10	10 (8-15)
pH	6.4 (5.9-6.8)	6.2 (5.7-6.8)	7.4
organic matter, %	10 (7-15)	-	-
$CaCO_3$ equiv., %	-	-	12

* Coarse fragment content by volume.

Hillmer Soil Units and Map Units.

HLM1

This soil unit contains 60-90% Hillmer soils. Orthic Black Chernozemic soils developed on gravelly phases of Hillmer parent material and on medium textured residual material are present in minor amounts. Orthic Black Chernozemic soils developed on loessial material - DLB are associated with the level (% slope) topographic areas within delineations of this soil unit.

Two topographic phases of this soil unit were recognized.

HLM1/3 - Mapped on inclined landscapes with slopes of 2-5%. Slope length is greater than 100 meters. Areas are used for grain and forage production.

HLM1/4 - Mapped on inclined landscapes with slopes of 5-9%. Slopes are greater than 100 meters, sometimes up to 400 meters in length. Areas are used for grain and forage production.

HLM6

This soil unit consists of dominantly (40-60%) Hillmer soils and 30-50% gravelly phase of Hillmer soils. These gravelly soils contain between 20-50% coarse fragments and generally occur in upper slope landscape positions, near breaks in slope. Orthic Black Chernozemic soils developed on medium textured residual material occur in minor amounts. Bedrock outcrops are sometimes associated with these latter soils.

One topographic phase of the HLM6 soil unit was recognized.

HLM6/4D - Mapped on inclined and dissected landscapes where the predominant slopes are between 5-9%, however steeper topography often present. The unit is associated with the side slopes of the erosional asymmetric valleys, a characteristic feature of the Del Bonita Plateau. Areas are used primarily for forage production and grazing.

2.3.19 Joanto (JAT) soil description.

Joanto is a Rego Humic Gleysol developed on medium to fine textured lacustrine. These wet soils occupy the depressional lowland areas of the landscape, such as sloughs and the level areas of broad valleys. Sedges and rushes (Caryx sp. and Juncus sp.) dominate the plant community in these locations. Joanto soils were mapped in the 2A(H) and 2H agroclimatic zones within the Dark Brown and Black soil zones, on the Milk River Ridge and Cardston Plain.

Selected characteristics of JAT (ranges in brackets).

	Topsoil (Ahg)	Parent Material (Ckg)
thickness, cm	15 (10-30)	@ 15
textural class	SiL (L-SiCL)	SiCL (L-SiC)
organic matter, %	15 (10-20)	-
pH	7.0	7.5
$CaCO_3$ equiv., %	0 (0-2)	15 (10-20)

Joanto Soil Units and Map Units.

JAT1

This soil unit contains dominantly (60-80%) Joanto soils with significant amounts of Orthic Humic Gleysolic soils developed on medium to fine textured lacustrine. In valley situations, such as adjacent to Shanks Creek, the lacustrine deposits are often underlain with coarse and gravelly, coarse textured glaciofluvial material. Saline and Solonetzic soils may be found in minor amounts. Black Chernozemic soils developed on lacustrine and till are present as inclusions.

One topographic phase of the JAT1 soil unit was recognized.

JAT1/2-3 - Mapped on level to undulating depressional and valley bottom areas where the dominant slopes are between 1-4%. Delineations are used for forage production and grazing.

JAT3

This soil unit contains 40-60% Joanto soils and 15-30% saline soils developed on the same parent materials. Orthic Humic Gleysolic soils developed on medium to fine textured lacustrine are also commonly present. Black Chernozemic soils developed on lacustrine and till are common inclusions.

One topographic phase of this unit was recognized.

JAT3/2-3 - Mapped on level to undulating depressional and valley bottom areas with 1-4% slopes. Delineations are used for grazing.

2.3.20 Kessler (KSR) soil description.

Kessler is an Orthic Dark Brown Chernozemic soil developed on coarse textured, glaciofluvial parent material. Kessler soils were mapped on the Three River Plain and the Milk River Plain, in the 2A and 2A(H) agroclimatic zones.

Selected characteristics of KSR (ranges in brackets).

	Topsoil (Ah)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness,cm	15 (10-18)	35	@ 50
textural class	SL	SL	SL
*c.f. content, %	<15	<15	<15
pH	6.5	6.5	7.5
organic matter, %	3	-	-
$CaCO_3$ equiv., %	-	-	7

* Coarse fragment content by volume.

Kessler Soil Units and Map Units.

KSR4

This soil unit contains dominantly (60-80%) Kessler soils and 20-40% eroded, thin or Rego Chernozemic and Regosolic soils developed on similar materials. These eroded soils are associated with the tops of knolls and appear as lighter coloured patches when the land is bare and dry. Orthic Dark Brown Chernozemic soils developed on medium textured lacustrine blanket and veneer over coarse textured glaciofluvial are present in minor amounts.

One topographic phase of this soil unit was recognized.

KSR4/3 - Mapped on undulating topography with slopes between 2-5%. Cultivated areas are susceptible to wind erosion. Delineations are extensively used for grain production.

KSHR1

This soil unit contains approximately equal amounts (30-50%) of Kessler soils and Orthic Dark Brown Chernozemic soils developed on coarse textured glaciofluvial - Heartbreak. Kessler soils are sandy loam in texture, while Heartbreak soils are loamy sand to sand. Eroded, thin or Rego Dark Brown Chernozemic soils on these materials are present in minor amounts. Orthic Dark Brown Chernozemic soils developed on gravelly, coarse textured glaciofluvial are also common inclusions.

One topographic phase of the KSHR1 soil unit was recognized.

KSHR1/3-4 - Mapped on undulating and hummocky landscapes with 2-9% slopes. Areas are used for grazing primarily.

KSNE1

This soil unit contains dominantly (40-60%) Kessler soils with significant amounts (30-50%) Orthic Dark Brown Chernozemic soils developed on gravelly, coarse textured glaciofluvial - New Dayton. The coarse fragment content of the New Dayton soils is between 20-50%. Surface stoniness is a problem when areas are cultivated. Orthic Dark Brown Chernozemic soils developed on a medium textured glaciofluvial veneer over gravels are also present in minor amounts.

One topographic phase of this soil unit was recognized.

KSNE1/3 - Mapped on undulating and slightly ridged glaciofluvial deposits where the dominant slopes are 2-5%. Areas are used for grazing.

2.3.21 Klemengurt (KGT) soil description.

Klemengurt is a Black Solonetz developed on fine textured lacustrine. These soils were mapped in the 2A(H) and 2H agroclimatic zones, on the Milk River Ridge and Cardston Plain. Klemengurt soils have a thin Ah horizon, usually about 5 cm thick. This horizon is underlain by an intractable Bnt horizon, which is very hard when dry, and swells to a sticky mass when wet. The clay textured parent material is generally weakly calcareous and weakly to moderately saline.

Klemengurt Soil Unit and Map Unit.

KGT1

This soil unit contains 60-80% Klemengurt soils. Gleysolic or wet soils are found in variable amounts generally less than 15%. Orthic Black Chernozemic soils developed on glaciolacustrine and till may occur in small amounts.

One topographic phase of the KGT1 soil unit was recognized.

KGT1/2 - Mapped on level landscapes generally confined to valley bottom areas. Slopes are less than 2%. Grazing is the only land use.

2.3.22 Knight (KNT) series description.

Knight is an Orthic Black Chernozemic soil developed on coarse textured glaciofluvial parent material. These soils were mapped on the Milk River Ridge and the Cardston Plain, in the 2A(H) and 2H agroclimatic zones.

Selected characteristics of KNT (ranges in brackets).

	Topsoil (Ah/Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	15 (10-20)	35	@ 50
textural class	SL	SL	SL (LS)
*c.f. content, %	<5	<5	<5
pH	6.2(5.8-6.9)	6.5(6.2-7.0)	7

	Topsoil (Ah/Ajp)	Subsoil (Bm)	Parent Material (Cca/Ck)
organic matter, %	6	-	-
$CaCO_3$ equiv.,	-	-	7-8

* Coarse fragment content by volume.

Knight Soil Units and Map Units.

KNT1

This soil unit contains dominantly (60-80%) Knight soils. Orthic Black Chernozemic soils developed on gravelly, coarse textured glaciofluvial as well as on medium textured lacustrine materials occur in minor amounts (%). Thin, eroded, Rego Black Chernozemic and Regosolic soils associated with tops of knolls, occur as inclusions (%).

One topographic phase of the KNT1 soil unit was recognized.

KNT1/4 - Mapped on hummocky landscapes with 5-9% slopes. Areas are used for grazing primarily.

KNT4

This soil unit contains 50-70% Knight soils and 20-50% thin, eroded Rego Black Chernozemic and Regosolic soils on the same parent material. The eroded soils are associated with upper slope positions and tops of knolls within the landscape. When the land is bare and dry these soils show up as lighter coloured patches. Orthic Black Chernozemic soils developed on a medium textured lacustrine veneers over coarse textured glaciofluvial as well as over till, are common inclusions.

Two topographic phases of this soil unit were recognized.

KNT4/3 - Mapped on undulating to inclined 2-5% slopes. Areas are cultivated and used for producing grain.

KNT4/5 - Mapped on hummocky glaciofluvial deposits with 9-15% slopes. Areas are presently used for grain production.

KNRN1

This soil unit contains 40-60% Knight soils and 30-50% Orthic Black Chernozemic soils developed on gravelly, coarse textured glaciofluvial - Rinard. These soils are intimately related so their distribution is random. The coarse fragment content of the Rinard soils varies from 20-50%. Other Orthic Black Chernozemic soils developed on medium textured glaciofluvial veneers over gravel and on medium textured till may occur in minor amounts.

One topographic phase of the KNRN1 soil unit was recognized.

KNRN1/4 - Mapped on hummocky glaciofluvial deposits where the dominant slopes are between 5-9%. Some delineations contain some steeper topography. Majority of the areas are used for grazing.

2.3.23 Leighton Centre (LTC) soil description.

Leighton Centre is a Dark Gray Luvisol developed on medium textured till of continental and Cordilleran origin. These soils were mapped in the Rocky Mountain Foothills, in the 5H agroclimatic zone.

Selected characteristics of LTC (ranges in brackets).

	Horizons			
	Ahe	Ae	Bt	BC
thickness, cm	10	10	50	@ 70
textural class	L	L	CL	CL(L-SiCL)
*c.f. content %	5	5	10 (5-15)	10 (5-20)
pH	5.8 (5.0-6.5)	5.4(5.0-6.0)	5.7(5.4-6.4)	6.3
organic matter, %	12 (10-15)	4 (2-5)	1	-

*coarse fragment content by volume.

Special Notes: Leighton Centre soils occur mainly under aspen vegetation (Figure 37) and to a lesser extent under balsam poplar and lodgepole pine. The litter (leafmat) layer is generally less than 2 cm thick. The Ahe horizon is generally well mixed by earthworms. Lime is not encountered within the control section.

Figure 37. Typical vegetation associated with LTC soils.

Leighton Centre Soil Unit and Map Unit.

LTC2

This soil unit contains dominantly (40-60%) Leighton Centre soils and 15-30% Gleysolic soils. These wet soils are associated with depressional areas. Orthic Dark Gray and Black Chernozemic soils developed on medium textured till are found in minor

amounts. Similar soils on gravelly, medium textured ice-contact material of variable coarse fragment content are also present. The Black Chernozemic soil inclusions are associated with the areas of open rough fescue grassland vegetation.

One topographic phase of this unit was recognized.

LTC2/4-5 - Mapped on hummocky and inclined landscapes with slopes between 5-15%. Steeper topography is often present within delineations. Areas are mainly covered with aspen forest, so grazing is the only land use.

2.3.24 Lethbridge (LET) soil description.

Lethbridge is an Orthic Dark Brown Chernozemic soil developed on medium textured lacustrine. Lethbridge soils were mapped on the Three River Plain, in the 2A agroclimatic zone.

Selected characteristics of LET (ranges in brackets)

	Topsoil (Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness,	15 (13-25)	25 (17-35)	@ 40 (30-60)
textural class	L (SiL-CL)	CL (L-SiCL)	CL (L-SiCL)
pH	6.3	6.3	7.4
organic matter, %	4 (3-5)	-	-
$CaCO_3$ equiv., %	-	-	12

Lethbridge Soil Units and Map Units.

LET1

This soil unit contains dominantly (60-80%) Lethbridge soils. Dark Brown Chernozemic soils developed on fine textured lacustrine, medium textured till and intergrades of these materials, are all present in minor amounts.

One topographic phase of this soil unit was recognized.

LET1/3 - Mapped on undulating to level landscapes with 2-5% slopes. Delineations are used for producing grain. This unit is ideally suited for irrigation.

LEOA1

This soil unit contains 50-70% Lethbridge soils and 20-40% Orthic Dark Brown Chernozemic soils developed on medium textured lacustrine veneer over coarse textured glaciofluvial - Oasis. Oasis soils are associated with the topographic highs within delineations of this unit. Thin, eroded or Rego Dark Brown Chernozemic soils on these parent materials are present in minor amounts. Also, Orthic Dark Brown Chernozemic soils developed on fine textured lacustrine are also common inclusions.

One topographic phase of this soil unit was recognized.

LEOA1/2-3 - Mapped on level to undulating landscapes with 0-5% slopes. Areas are primarily used for grain production.

2.3.25 Lonely Valley (LVY) soil description.

Lonely Valley is an Orthic Black Chernozemic soil developed on medium textured fluvial parent material. These soils were mapped on fans and terraces within spillways, on the Milk River Ridge, in the 2A(H) agroclimatic zone.

Lonely Valley soils have an Ah horizon 15 cm thick and the depth to lime is usually between 50 to 60 cm. Textures in all horizons vary from loam to sandy loam. Stone lines may be present within the profile.

Lonely Valley Soil Unit and Map Unit.

LVY7

This soil unit is restricted in areal extent to the Lonely Valley within the Milk River Upland. This broad glacial meltwater channel is a remnant feature of the last glaciation. The dominant (40-60%) soils are Lonely Valley with significant (30-50%) amounts of Black Solonetzic soils developed on medium to fine textured lacustrine - Klemengurt. The Klemengurt soils are present since the valley bottom area serves as a local groundwater discharge area for the neighbouring upland areas. Black Chernozemic soils developed on till and coarse textured glaciofluvial materials with variable coarse fragment content are present in small amounts. Gleysolic soils occur in association with the present-day meandering stream channel and relict oxbows.

One topographic phase of this soil unit was recognized.

LVY7/3 - Mapped on level to undulating channel bottom areas where slopes are between 1-5%. Delineations are used for grazing.

2.3.26 Lundbreck (LNB) soil description.

Lundbreck is an Orthic Black Chernozemic soil developed on gravelly, coarse textured glaciofluvial. These soils were mapped in the Rocky Mountain Foothills, in the 3H agroclimatic zone.

Selected characteristics of LNB (ranges in brackets)

	Topsoil (Ah)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	20 (15-25)	40 (30-50)	60 (45-75)
textural class	GSL (GSL-GS)	GLS (GSL-GS)	Gravel
depth to gravel, cm	-	-	<30
*c.f. content, %	20 (10-50)	30 (20-50)	60 (35-80)
organic matter, %	9 (8-10)	-	-
$CaCO_3$ equiv., %	-	-	10

* Coarse fragment by volume.

Special Note: The coarse fragment content is greater than 50%, on a weighted average basis, for the control section.

Lundbreck Soil Units and Map Units.

LNB1

This soil unit contains dominantly (50-70%) Lundbreck soils. Orthic Black Chernozemic soils developed on medium textured glaciofluvial veneers (30 cm thick) over gravel are present in variable amounts, up to 40% within delineations of this unit. Other Orthic Black Chernozemic soils developed on medium textured till of variable coarse fragment content and on coarse textured glaciofluvial materials are also present in minor amounts (%).

Two topographic phases of this soil unit were recognized.

LNB1/3 - Mapped on undulating glaciofluvial terraces with 2-5% slopes. Areas are used for grazing.

LNB1/4 - Mapped on hummocky glaciofluvial deposits. Slopes generally range from 5-9%. Areas are used for grazing.

LNB2

This soil unit contains 40-60% Lundbreck soils and 15-30% Gleysolic soils. These wet soils occupy depressional areas within this pitted landscape. The parent material of the Gleysolic soils is medium to fine textured lacustrine. In some delineations the Gleysolic soils have a layer of organic rich or peaty material up to 40 cm thick. Also, Orthic Black Chernozemic soils developed on medium textured lacustrine veneer over gravels are present in variable amounts, up to 30%. Similar soils developed on till may be found at the inclusion level, less than 15%.

One topographic phase of this soil unit was recognized.

LNB2/3 - Mapped in glacial outwash channels where surface expression ranges from undulating to terraced. Dominant slope of the unit is 2-5%. Areas are used primarily for grazing.

2.3.27 Lupen (LUP) soil description.

Lupen is an Orthic Dark Brown Chernozemic soil developed on medium textured lacustrine veneers over medium textured till. These soils were mapped on the Milk River Ridge, in the 2A(H) agroclimatic zone.

Selected characteristics of LUP (ranges in brackets)

	Topsoil (Ah)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	10	30	@ 40
textural class	L	CL	CL
pH	6.5	7	8
organic matter, %	5	-	-
$CaCO_3$ equiv.,%	-	-	15

Lupen Soil Units and Map Units.

LUP1

This soil unit consists of dominantly (60-80%) Lupen soils. Delineations are usually confined to lacustrine basin areas within hummocky morainal uplands. The underlying till occasionally reaches the surface. Therefore, Orthic Dark Brown Chernozemic soils developed on till are generally present. Gleysolic soils associated with depressional areas occur in minor amounts.

One topographic phase of this soil unit was recognized.

LUP1/3 - Mapped on undulating landscapes. Slopes are between 2-5%. Areas are used for grain production and grazing.

LUP2

This soil unit contains 50-70% Lupen soils with significant (15-30%) portions of Gleysolic soils which are associated with sloughs in depressional areas. Delineations of this unit generally occur in the lowland areas of glacial meltwater channels where parent material composition is complex. Dark Brown Chernozemic soils developed on till and coarse textured glaciofluvial materials of variable coarse fragment content are common inclusions (less than 15% each).

One topographic phase of this soil unit was recognized.

LUP2/3 - Mapped on undulating to level landscapes with 2-5% slopes. Areas are used for both grain production and grazing.

2.3.28 Magrath (MGT) soil description.

Magrath is an Orthic Dark Brown Chernozemic developed on fine textured lacustro-till (glaciolacustrine). These soils were mapped on the Three Rivers Plain, in the 2A agroclimatic zone (Figure 38).

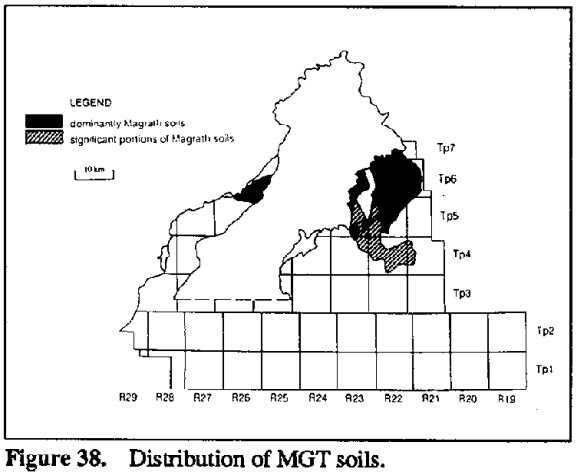


Figure 38. Distribution of MGT soils.

Selected characteristics of MGT (ranges in brackets)

	Topsoil (Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	15 (10-20)	35 (15-45)	@ 50 (30-60)
textural class	SiCL(CL-SiC)	SiC(SiCL-C)	SiC(SiCL-C)
pH	6.5	6.5	7.5
organic matter, %	4 (3-5)	1 (0-2)	-
$CaCO_3$ equiv., %	-	-	15 (10-17)

Special Notes: Magrath soils generally contain between 1-5% gravels and cobbles in the profile, and noticeably more on the surface. The control section has more than 40% clay, by weighted average. Magrath soils are susceptible to wind erosion due to the high percentage of the silt size fraction within the parent material.

Magrath Soil Units and Map Units.

MGCL1

This soil unit contains roughly equal proportions (30-50%) of Magrath soils and Orthic Dark Brown Chernozemic soils developed on fine textured lacustrine - Coaldale. Interspersed throughout the unit, in minor amounts, are Orthic Dark Brown Chernozemic soils developed on medium textured till. Thin, eroded or Rego Dark Brown Chernozemics on till and glaciolacustrine materials are also present as inclusions.

One topographic phase of this soil unit was recognized.

MGCL1/2-3 - Mapped on level to undulating landscapes with 0-4% slopes. Areas are used for grain production.

MGCL3

This soil unit contains roughly equal proportions (30-50%) of Magrath soils and Orthic Dark Brown Chernozemic soils developed on fine textured lacustrine - Coaldale. Saline phases of these soils are present in significant amounts (20-40%). Gleysolic soils, associated with depressional areas, occur in the vicinity of the saline soils, but occupy less than 15% of the area. Dark Brown Chernozemic soils developed on medium textured till and lacustrine soils are present in minor amounts.

One topographic phase of the MGCL3 soil unit was recognized.

MGCL3/2-3 - Mapped on level to undulating landscapes with 0-5% slopes. Areas are used primarily for grain production.

MC:S

This soil unit contains 40-70% saline phases of Orthic Dark Brown Chernozemic soils developed on fine textured lacustro-till and lacustrine - Magrath and Coaldale soils respectively. Unsalinized phases of Magrath and Coaldale soils are present in amounts of less than 30%, each. Gleysolic soils, associated with the depressional areas, and Orthic Dark Brown Chernozemic soils developed on medium textured till are common inclusions.

Delineations of this unit occupy groundwater discharge areas of the landscape. The salinity problem of these areas is being controlled by the use of subsurface tile drainage in combination with certain agronomic practices, such as growing alfalfa in the upland recharge areas.

One topographic phase of this soil unit was recognized.

MC:S/2-3 - Mapped on level to undulating landscapes with 0-5% slopes. Until reclaimed, the area is best suited for grazing.

MGLE4

This soil unit contains roughly equal (30-50%) proportions of Magrath soils and Orthic Dark Brown Chernozemic soils developed on medium textured lacustrine - Lethbridge, with significant 20-50% thin, eroded or Rego Dark Brown Chernozemic and Regosolic soils on similar materials. These eroded soils show up as lighter coloured patches when the land is dry and bare. Eroded soils are primarily confined to the tops of undulations. Dark Brown Chernozemic soils developed on medium textured till and fine tex-

tured lacustrine as well as Gleysolic soils associated with depressional areas are present in minor amounts.

The major soils of this unit have a high silt content and are thus susceptible to wind erosion. For this reason, the proportion of eroded profiles in this soil unit may approach 50%.

One topographic phase of this soil unit was recognized.

MGLE4/2-3 - Mapped on level to undulating landscapes with 0-4% slopes. Areas are extremely used for grain production.

2.3.29 Maycroft (MFT) soil description.

Maycroft is an Orthic Black Chernozemic soil developed on medium textured lacustrine. These soils were mapped in the Rocky Mountain Foothills, in the 3H agroclimatic zone.

Selected characteristics of MFT (ranges in brackets)

	Topsoil (Ah)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	25 (15-35)	60 (50-90)	@ 85 (75-120)
textural class	L (SiL-CL)	L (SiL-SiCL)	L (SiL-SiCL)
pH	6.0(5.7-6.5)	6.0(5.7-6.5)	7.4
organic matter, %	14 (10-17)	3 (1-4)	-
$CaCO_3$ equiv., %	-	-	12 (10-15)

Maycroft Soil Unit and Map Unit.

MFT2

This soil unit contains 60-80% Maycroft soils and 15-30% Gleysolic soils. These wet soils are associated with sloughs. Most delineations are near major drainage channels or occupy previous meltwater channels. Therefore, the parent materials found within these delineations are variable in origin and texture. Black Chernozemic soils developed on till and coarse textured glaciofluvial material of variable coarse fragment content are common inclusions. Solonetzic soils are occasionally present in delineations occupying the bottomland of valleys.

One topographic phase of this soil unit was recognized.

MFT2/2-3 - Mapped on level to undulating landscapes with 0-5% slopes. Areas are used for grazing.

2.3.30 Milk River (MKR) soil description.

Milk River is a Cumulic Regosol developed on coarse textured, moderately calcareous fluvial deposits. These soils were mapped on the Milk River Ridge, in the 2A(H) agroclimatic zone. Milk River soils have weakly developed Ah horizons, less than 10 cm thick. The texture of this surface layer is generally sandy loam to loamy sand. The profile below the surface Ah consists of layers of sandy loam to loamy sand, interspersed by buried Ah horizons, and other sandy silty or gravelly layers. Gravel is often encountered below 1 meter.

Milk River Soil Units and Map Units.

MKR1

This soil unit contains 40-60% Milk River soils. Orthic Regosolic soils developed on coarse textured fluvial materials are present in variable amounts, less than 30%. Orthic Dark Brown, Black Chernozemic and Cumulic Humic Regosolic soils developed on medium textured fluvial veneer over gravel and on coarse textured fluvial materials of variable coarse fragment content occur in minor amounts.

This unit is limited in extent to the North and South forks of the Milk River.

One topographic phase of this soil unit was recognized.

MKR1/3 - Mapped on level and terraced river valley bottoms which are cut up by a meandering stream course. Slopes are between 2-5%. Delineations are used for grazing.

MKR5

This unit contains roughly equal proportions (30-50%) of Milk River soils and Orthic Dark Brown Chernozemic soils developed on medium textured fluvial blanket - veneers over gravel. Cumulic Humic Regosolic and Gleysolic soils associated with depressional areas are present in minor amounts.

The MKR5 unit is used to delineate portions of a river valley which have finer textured parent materials and where the river is more confined to its present floodplain. Therefore, the proportion of Chernozemic profiles is greater than in the MKR1 unit.

One topographic phase of the MKR5 soil unit was recognized.

MKR5/3 - Mapped on level and terraced river valley bottoms. The dominant slopes are between 2-5%. Portions of the delineations are cultivated for forage production with the remainder being used for grazing.

2.3.31 New Dayton (NED) soil description.

New Dayton is an Orthic Dark Brown Chernozemic soil developed on gravelly, coarse textured glaciofluvial. New Dayton soils were mapped on the Milk River Plain, in the 2A(H) agroclimatic zone.

Selected characteristics of NED (ranges in brackets)

	Topsoil (Ah)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	10 (8-15)	20 (17-35)	@ 30 (25-50)
textural class	SL (GL-GLS)	GLS (GSL-GS)	Gravel
*c.f. content, %	25 (10-50)	25 (10-50)	65 (50-80)
organic matter, %	4 (3-5)	-	-
pH	6.5	6.5	7.4
$CaCO_3$ equiv., %	-	-	15 (10-20)

*Coarse fragment content by volume.

Special Note: The coarse fragment content is greater than 50%, on a weighted average basis, for the control section.

New Dayton Soil Unit and Map Unit.

NED1

This unit contains dominantly (60-80%) New Dayton soils. Dark Brown Chernozemic soils, developed on medium textured fluvial veneers over gravel, and on coarse textured glaciofluvial materials, containing less than 10% coarse fragments, occur as inclusions.

One topographic phase of the NED1 soil unit was recognized.

NED1/3 - Mapped on ridged glaciofluvial terraces with dominant slopes ranging between 2-5%. Areas are used for grazing.

2.3.32 North Fork (NFK) soil description.

North Fork is an Orthic Eutric Brunisol developed on a medium textured till veneer over paralithic, medium to coarse textured, residual material. These soils were mapped in the Rocky Mountain Foothills, in the 5H agroclimatic zone.

These soils have a thin litter layer of 1-3 cm, an equally thin loam textured Ah horizon over loam to clay loam textured Bm horizons. Depth to lime or CaCO3 is usually 50-60 cm from the surface. Residual material usually occurs at depths ranging from between 80-100 cm.

North Fork soils were mapped as significant members in the following soil map units: BDNF1/6-7; BVNF1/5-6; and CCNF1/5-6.

2.3.33 Oasis (OAS) soil description.

Oasis is an Orthic Dark Brown Chernozemic soil developed on a medium textured lacustrine veneer over coarse textured glaciofluvial. These soils were mapped in the 2A agroclimatic zone, on the Three River and Verdigris Plains.

Oasis soils characteristically have a 10-15 cm, loam textured Ah or Ap horizon over loam textured Bm horizons. Lime is present between 30 - 50 cm beneath the surface. Loamy sand to sand textured glaciofluvial material occur at depths of between 30-80 cm.

Oasis soils were mapped as significant members in association with Lethbridge (LET) soils. The map unit is LEOA1/2-3.

2.3.34 Ockey (OKY) soil description.

Ockey is an Orthic Black Chernozemic soil developed on a medium textured till veneer over medium to coarse textured, paralithic, residual material. Ockey soils were mapped on the Milk River Ridge, Cardston Plain and in the Rocky Mountain Foothills, in the 2A(H), 2H, and 3H agroclimatic zones.

Selected characteristics of OKY (ranges in brackets)

	Topsoil (Ah	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	15 (10-20)	30 (20-40)	@ 45 (30-60)
textural class	L (SiL-CL)	L (SiL-CL)	SiL (L-CL)
pH	6.4	6.4	7.5
organic matter, %	7 (5-8)	1 (0-2)	-
$CaCO_3$ equiv.,%	-	-	20 (10-25)

Special Notes: Paralithic bedrock is encountered at depths ranging between 30 - 100 cm.

Ockey Soil Unit and Map Unit.

OKPP1

This soil unit contains 30-50% Ockey soils with significant (20-30%) amounts of Orthic Black Chernozemic soils developed on medium textured colluvium (slopewash), with an approximately 50 cm thick Ah - Porcupine and on medium textured till - Dunvargan. The Porcupine soils are found on the steeper, east facing slopes of these roughly northwest, southeast aligned bedrock controlled units. The Dunvargan soils are found on the lower slope positions of the east and west slopes. Along the ridge crests, sandstone bedrock outcrops and Regosolic soils developed on weathered bedrock are often encountered.

The dominant vegetation of the unit consists of rough fescue grassland interspersed with some Limber pine trees.

One complex and broad topographic phase of the OKPP1 soil unit was recognized.

OKPP1/6-8 - Mapped on thrust faulted bedrock ridges where slopes range from 15-70% (Figure 39). The majority of the topography is concentrated at the lower end of this slope range. Areas are used for grazing, however the steep topography limits accessibility.

Figure 39. The landscape and vegatation associated with a OKP0P1/6-8 soil map unit.

2.3.35 Organic (ORG) Miscellaneous Soil Map Unit.

Terric Mesisols are the dominant soils of this miscellaneous soil unit. An organic veneer of moderate or mesic decomposition, more than 80 cm thick, characterize the soils of this unit. The underlying mineral material, generally medium to fine textured lacustrine, is encountered within 120 cm of the surface. Other soils found as inclusions in this unit include, peaty phases of Gleysolic soils and Orthic Humic Gleysols.

The vegetation of this organic soil map unit consists of dominantly sedges (Caryx sp.), rushes (Juncus sp.), willows and some shrubby cinquefoil. The topography of this unit is level but slopes up to 4% occur around the perimeter. The microtopography may be rough due to the sedge tuffs which may be 40 cm high and 40 cm apart. The bearing strength of organic soils is low due to the close proximity of the watertable. However, these units are used for grazing cattle.

The areal extent of this soil map unit is confined to the Rocky Mountain Foothills physiographic region, primarily in the 3H agroclimatic zone.

2.3.36 Outpost (OTP) soil description.

Outpost is an Orthic Black Chernozemic soil developed on gravelly, medium textured glaciofluvial parent material. These soils were mapped in the Rocky Mountain Foothills, in the 3H agroclimatic zone.

Selected characteristics of OTP (ranges in brackets)

	Topsoil (Ah)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	20 (15-25)	30 (20-40)	@ 50 (35-65)
textural class	L (L-CL)	CL (L-SiCL)	CL (L-SiCL)
***c.f. content, %**	15 (10-25)	25 (15-35)	35 (25-50)
pH	6.3(5.7-6.6)	6.3(5.7-6.6)	7.4
organic matter, %	10 (8-12)	2 (1-3)	-
CaCO3 equiv., %	-	-	12

*Coarse fragment content by volume.

Special Notes: The coarse fragment content is 30% or more, on a weighted average basis, for the control section. These fragments range in size from gravel to boulders.

Outpost Soil Unit and Map Unit.

OTP1

This soil unit contains dominantly (60-80%) Outpost soils. Orthic Black and Dark Gray Chernozemic soils developed on medium textured till are common inclusions.

One topographic phase of this soil unit was recognized.

OTP1/3-4 - Mapped on undulating to hummocky landscapes with the majority of slopes being in the range of 2-9%. Areas are used for grazing.

2.3.37 Owendale (OWD) soil description.

Owendale is an Orthic Black Chernozemic soil developed on medium textured, paralithic, siltstone residual material. Owendale soils were mapped in the Del Bonita Plateau physiographic area, in the 2A(H) agroclimatic zone.

Selected characteristics of OWD (ranges in brackets)

	Topsoil (Ap)	Subsoil (Bm)	Parent Material (Cca)
thickness, cm	10	20	@30
textural class	SiL(L)	SiL	SiL
pH	7.0	7.3	8.0
organic matter, %	7	-	-
$CaCO_3$ equiv., %	-	-	25 (20-30)

Special Notes: The bedrock is paralithic but generally one meter below the surface, it is competent. Owendale soils

are very susceptible to wind erosion due to the high silt content of the parent material.

Owendale Soil Unit and Map Units.

OWHL4

This soil unit contains roughly equal (30-50%) amounts of Owendale soils and Orthic Black Chernozemic soils developed on medium textured slopewash - Hillmer, with significant (20-40%) amounts of Rego Black Chernozemic and Orthic Regosolic soils. These eroded soils are associated with the upper slope positions of the landscape on primarily Owendale - like material. The eroded soils appear as lighter coloured patches when the land is dry and bare. Under virgin conditions, in the upper slope positions, Calcareous Black Chernozemic soils may be found as inclusions. Other inclusions include; Gleysolic soils associated with depressional areas, and soils developed on gravelly, medium textured slopewash material. Occasionally, slabs of bedrock litter the surface of a cultivated field.

Two topographic phases of this soil unit were recognized.

OWHL4/4 - Mapped on long inclined slopes of 5-9%. The slopes are typically greater than 100 m in length. This landscape feature coupled with the silty Owendale soils has rendered this map unit highly susceptible to erosion. Areas which were once cultivated for grain production are now used for producing forage.

OWHL4/5D - Mapped on long inclined and dissected slopes of 9-15%. As previously mentioned, this unit has a high erosion potential. Areas are presently used for forage production and grazing.

2.3.38 Peigan (PGN) soil description.

Peigan is a Black Solodized Solonetz developed on fine textured lacustro- till (glaciolacustrine). These soils were mapped on the Cardston Plain, in the 2H agroclimatic zone.

Peigan soils generally have a 10cm thick Ap horizon underlain by a thin Ae. The dense Bnt horizon is very hard when dry, but becomes sticky when wet. Salts and lime are generally encountered at depths between 40 and 60cm beneath the surface.

2.3.39 Pincher (PNR) soil description.

Pincher is an Orthic Black Chernozemic soil developed on fine textured lacustrine. These soils were mapped on the Milk River Ridge and Cardston Plain, in the 2A(H) and 2H agroclimatic zones.

Selected characteristics of PNR (ranges in brackets)

	Topsoil (Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	15 (10-25)	35 (30-40)	@ 50 (40-65)
textural class	SiCL(CL-SiC)	SiC(C-HC)	SiC(C-HC)
pH	6.3(5.7-6.6)	6.5(5.7-6.6)	7.4
organic matter, %	8 (6-10)	2 (1-3)	-
$CaCO_3$ equiv., %	-	-	12 (10-15)

Pincher Soil Unit and Map Unit.

PNSO2

This soil unit contains approximately equal amounts of Pincher soils and Orthic Black Chernozemic soils developed on medium textured lacustrine - Standoff. In addition, Gleysolic soils, associated with depressional areas, are present in significant amounts (15-30%). Solonetzic and saline phases of these soils are also common inclusions, in some delineations.

One topographic phase of this soil unit was recognized.

PNSO2/2-3 - Mapped on level to undulating lacustrine basin areas with 0-5% slopes. Areas are used for grain production.

2.3.40 Porcupine (PPE) soil description.

Porcupine is an Orthic Black Chernozemic soil developed on medium textured colluvial (slopewash) material. These soils are found on the leeward side slopes of bedrock ridges. The parent material is the product of wind action, which has been subsequently modified by slopewash flow and surface creep, due to gravity. Porcupine soils were mapped in the Rocky Mountain Foothills, in the 2H and 3H agroclimatic zones.

Porcupine soils characteristically have a very thick, usually greater than 50cm, loam textured, stone free, Ah horizon over a clay loam textured, Bm horizon. Lime is generally not encountered within the control section.

Porcupine soils were mapped in association with Ockey soils. The specific soil map unit is OKPP1/6-8.

2.3.41 Pothole (POT) soil description.

Pothole is an Orthic Humic Gleysol developed on fine textured lacustrine. These soils were mapped in the Rocky Mountain Foothills, in the 3H and 5H agroclimatic zones.

Pothole soils characteristically have a 20-40 cm thick, clay loam textured, Ah and/or Ahg horizon complex over clay textured Bg horizons. The clay textured, weakly to moderately calcareous, CKg horizon generally occurs at depths greater than 70 cm. The parent material is usually stone-free. The coarse fragment content is less than 5%.

Pothole Soil Unit and Map Unit.

POT1

This soil unit contains dominantly (60-80%) Pothole soils. Rego Humic Gleysols, on medium and fine textured lacustrine, are commonly associated with Pothole soils, in variable amounts. Some delineations have carbonated phases of these soils due to local groundwater influence. Also, Gleysolic soils with an organic (peaty) layer less than 80 cm thick, may occur in minor amounts.

One topographic phase of this soil unit was recognized.

POT1/2-3 - Mapped on level wet landscapes, usually in depressional basin areas. Areas are used for producing forage as well as being extensively grazed.

2.3.42 Purescape (PUR) soil description.

Purescape is an Orthic Dark Brown Chernozemic soil developed on medium textured, moderately calcareous till. These soils were mapped on the Milk River Ridge, in the 2A(H) agroclimatic zone (Figure 40).

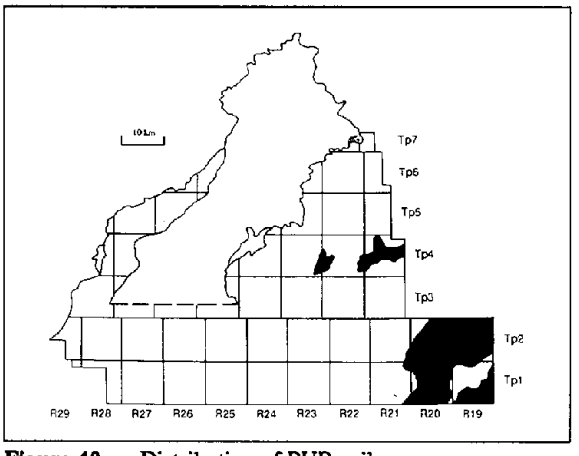


Figure 40. Distribution of PUR soils.

Selected characteristics of PUR (ranges in brackets)

	Topsoil (Ap/Ah)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	10 (9-12)	15 (9-28)	@ 25 (18-40)
textural class	L (SiL-CL)	CL (L-SiCL)	CL (L-SiCL)
* c.f. content, %	5 (<15)	5 (<15)	5 (<15)
pH	6.2(5.6-6.7)	6.9(6.1-7.5)	7.6
organic matter, %	5.5(4.6-6.5)	-	-
$CaCO_3$ equiv., %	-	-	15 (10-18)

*Coarse fragment content by volume.

Purescape Soil Units and Map Units.

PUR1

This soil unit contains 60-80% Purescape soils. Rego Dark Brown Chernozemic soils developed on medium textured till and Gleysolic soils associated with depressional areas are common inclusions in all topographic phases of this soil unit. On landscapes where the topography is less than 10%, Orthic Dark Brown Chernozemic soils on fine textured lacustro-till, and Solonetzic soils on various parent materials, are encountered in minor amounts. On the steeper topography (slopes greater than 10%) Dark Brown Chernozemic soils on gravelly, medium textured till or ice-contact material may be present in minor amounts.

Four topographic phases of this soil unit were recognized.

PUR1/3 - Mapped on an undulating morainal landscape with 2-5% slopes. Areas are used for grain production.

PUR1/4 - Mapped on hummocky landscapes where slopes range between 5-9%. Areas are used for grain production and grazing.

PUR1/4D - Mapped on hummocky, inclined and dissected landscapes where the dominant slopes are between 5-9%. Areas are used primarily for grazing.

PUR1/5 - Mapped on hummocky morainal landscapes with dominantly 9-15% slopes. Areas are used for grazing.

PUR2

This soil unit contains 50-70% Orthic Dark Brown Chernozemic soils developed on medium textured till - Purescape, and 15-30% Gleysolic or wet soils, which are associated with sloughs. Rego Dark Brown Chernozemic soils on till, located on the tops of some knolls, occur in minor amounts. Dark Brown Chernozemic soils developed on medium textured lacustrine blanket-veneers and fine textured lacustro-till are present as inclusions. In map units where the slopes are greater than 10%, similar soils developed on grav-

elly, medium textured till or ice-contact material may be encountered, in minor amounts.

Two topographic phases of the PUR2 soil unit were recognized.

PUR2/4 - Mapped on hummocky, pitted morainal landscapes where the dominant slopes range between 5-9%. Areas are used for grain production and grazing. In the delineations which are extensively cultivated, the areal extent of eroded or Rego profile soils may approach 20%.

PUR2/5 - Mapped on hummocky, pitted morainal landscapes with 9-15% slopes. Areas are primarily used for grazing.

PUR4

This soil unit contains up to 60% Orthic Dark Brown Chernozemic soils developed on medium textured till - Purescape and 20-50% thin, eroded or Rego Dark Brown Chernozemic and Regosolic soils developed on the same parent material. These eroded soils are associated with the crests and upper slope positions of knolls and ridges. They appear as lighter coloured patches when the land is bare and dry. Gleysolic soils, associated with sloughs and depressional areas, occur as inclusions. Some bedrock outcrops are present within soil units of 6D topography.

Three topographic phases of this soil unit were recognized.

PUR4/4 - Mapped on hummocky landscapes where slopes range between 5-9%. Majority of the delineations are used for grain production.

PUR4/5 - Mapped on hummocky morainal landscapes with 9-15% slopes. Areas are primarily used for forage production and grazing.

PUR4/6D - Mapped on inclined and dissected or gullied landscapes with slopes ranging between 15-30%. Slopes immediate to the gullies are often steeper than 30%. Areas are used for grazing.

PUR6

This soil unit contains 60-80% Orthic Dark Brown Chernozemic soils on medium textured till - Purescape and 20-40% on gravelly, medium textured ice-contact material. The ice-contact material occurs sporadically throughout the unit, but is generally associated with esker and kame landform features. The coarse fragment content of the sandy loam to loam textured ice-contact material varies from 15-50%. The coarse fragments are of variable sizes, however cobbles are rare. Rego Dark Brown Chernozemics on these parent materials and Gleysolic soils, associated with depressional areas, are common inclusions.

Two topographic phases of this soil unit were recognized.

PUR6/4 - Mapped on ridged and hummocky landscapes with slopes ranging between 5-9%. Areas are used for forage production and grazing.

PUR6/5 - Mapped on ridged and hummocky landscapes with dominantly 9-15% slopes. Areas are primarily used for grazing.

PUR7

This soil unit contains 50-70% Orthic Dark Brown Chernozemic soils on medium textured till - Purescape and 20-40% Solonetzic soils on till and lacustrine materials. The Solonetzic soils are generally associated with lower slope positions. Distinctive features of the unit are the presence of eroded pits and uneven growth of the native vegetation. Orthic Dark Brown Chernozemic soils, developed on a medium textured lacustrine veneer over till, and saline soils are present in minor amounts.

One topographic phase of this soil unit was recognized.

PUR7/3 - Mapped on undulating landscapes with 2-5% slopes. Delineations of this unit are within the Twin River Grazing Reserve, therefore grazing is the dominant land use.

PUBZ1

This soil unit contains 50-80% Orthic Dark Brown Chernozemic soils - Purescape and 20-50% Orthic Black Chernozemic soils - Beazer. Both soils are developed on medium textured till. Delineations of this soil unit are mapped in the transitional area bordering the Dark Brown - Black soil zone line. The Beazer soils are generally found on north facing slopes and in lower slopes positions. Rego Dark Brown Chernozemics on till are present on the upper slopes and crests of some knolls in minor amounts. Cultivated areas usually have a greater proportion of these eroded soils, but they occupy less than 20% of the area. Gleysolic soils associated with sloughs are also common inclusions.

Two topographic phases of this soil unit were recognized.

PUBZ1/4 - Mapped on hummocky morainal landscapes where slopes range between 5-9%. Areas are used for grain production.

PUBZ1/5 - Mapped on hummocky landscapes with 9-15% slopes. Areas are dominantly used for grazing, some minor portions are cultivated.

PUBZ2

This soil unit contains 40-60% Orthic Dark Brown Chernozemic soils on medium textured till - Purescape, 20-40% Orthic Black Chernozemic soils on till - Beazer, and 15-30% Gleysolic soils, which are associ-

ated with sloughs. Delineations of this soil unit are mapped in the transitional area bordering the Dark Brown - Black soil zone line. The Beazer soils are generally found on north facing slopes and in lower slope positions. Rego Dark Brown Chernozemics on till are present on the upper slopes and crests of some knolls in minor amounts. Cultivated areas usually have a greater proportion of these eroded soils, but they occupy less than 20% of the area.

One topographic phase of the PUBZ2 soil unit was recognized.

PUBZ2/5 - Mapped on hummocky pitted morainal landscapes with 9-15% slopes. Grazing is the dominant land use. Some portions of these map units are cultivated.

PUBZ4

This soil unit contains 50-70% Orthic Dark Brown Chernozemic soils developed on medium textured till - Purescape, 20-30% Orthic Black Chernozemic soils on till - Beazer, and 20-40% eroded, thin or Rego Dark Brown Chernozemic soils. These eroded soils occur on the tops and upper slopes of the knolls. Delineations of this soil unit are mapped in the transitional area bordering the Dark Brown - Black soil zone. Beazer soils are generally found on north facing slopes and in lower slope positions. Dark Brown Chernozemic soils, developed on till veneers over weathered bedrock, are present as inclusions. These latter soils are generally restricted to upper slope positions of the landscape.

One topographic phase of this unit was recognized.

PUBZ4/4 - Mapped on hummocky and/or inclined landscapes where slopes generally range between 5-9%. Areas are primarily used for grain production.

PUHE1

This soil unit contains 40-60% Orthic Dark Brown Chernozemic soils, developed on medium textured till - Purescape and 30-50% on fine textured lacustro-till - Hegson. On gently undulating landscapes, Purescape soils are generally found on the upper slope positions. On long inclined slopes, Purescape and Hegson soils are sporadically intermixed within the delineation. Gleysolic soils, associated with depressional areas, occur in minor amounts. Dark Brown Chernozemic soils developed on a medium textured lacustrine veneer over till as well as Rego Dark Brown Chernozemics developed on all of these parent materials, are each present in amounts occupying less than 10% of the delineation.

One topographic phase of this soil unit was recognized.

PUHE1/3 - Mapped on undulating and inclined landscapes with 2-5% slopes. Areas are used for grain production. Delineations on the Twin River Grazing Reserve are used for grazing.

PUHE2

This soil unit contains Orthic Dark Brown Chernozemic soils, 40-60% developed on medium textured till - Purescape, and 20-40% on fine textured lacustro-till - Hegson, as well as 15-30% Gleysolic soils. These wet soils are associated with the depressional areas. Purescape soils generally occupy the higher landscape positions while Hegson soils are found in the lower slope positions. In delineations which are cultivated, Rego Dark Brown Chernozemic soils, developed on these parent materials, may be present in minor amounts.

One topographic phase of this soil unit was recognized.

PUHE2/4 - Mapped on hummocky landscapes where slopes range between 5-9%. Areas are primarily used for grain production.

PULU7

This soil unit contains Orthic Dark Brown Chernozemic soils 40-60% developed on medium textured till - Purescape and 20-40% on medium textured lacustrine veneer over till - Lupen, as well as 20-40% Solonetzic soils, also developed on these parent materials. Purescape and Lupen are found randomly throughout the delineations. The Solonetzic soils are associated with the small drainage ways, which are a common feature of this unit. Gleysolic soils occur within these drainage ways, in minor amounts.

One topographic phase of this soil unit was recognized.

PULU7/3D - Mapped on inclined and dissected landscapes on the benches bordering the South Milk River. Areas are used for grazing, primarily because delineations occur within the Twin River Grazing Reserve.

2.3.43 Rinard (RND) soil description.

Rinard soils are Orthic Black Chernozemics developed on gravelly, coarse textured glaciofluvial material (Figure 41). These soils are usually confined to terraced, bench areas within river valleys. Rinard soils were mapped on the Milk River Upland, Cardston Plain and in the Rocky Mountain Foothills, in the 2A(H) and 2H agroclimatic zones.

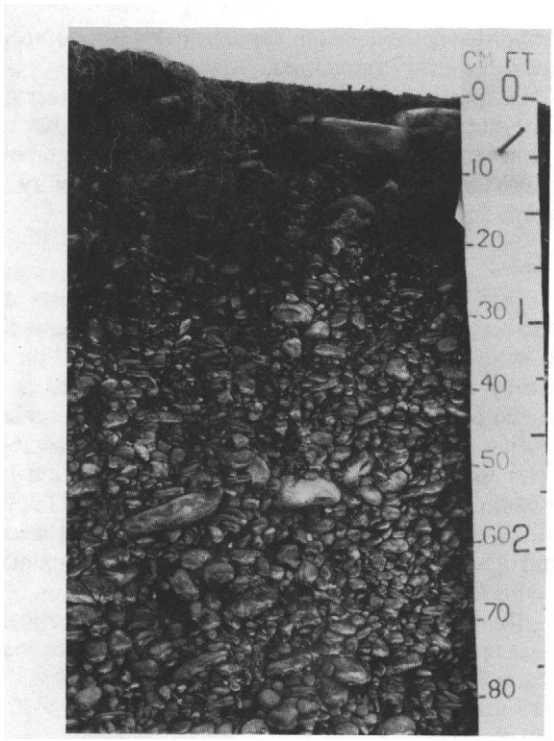


Figure 41. RND soil profile.

Selected characteristics of RND (ranges in brackets).

	Topsoil (Ah/Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	10 (8-13)	20 (17-17)	@ 30 (25-40)
textural class	GLS (GS-GSL)	GLS (GS-GSL)	Gravel
*c.f. content, %	15 (0-25)	30 (20-60)	60 (45-80)
pH	6.3	6.3	7.4
organic matter, %	8	-	-
$CaCO_3$ equiv., %	-	-	7

* Coarse fragment contents by volume.

Special Note: The coarse fragment content is greater than 50%, on a weighted average basis, for the control section.

Rinard Soil Unit and Map Units.

RND1

This soil unit contains 60-80% Rinard soils. Orthic Black Chernozemic soils developed on a medium textured glaciofluvial veneer (30cm) over gravel - Blackfoot, occur in amounts varying from 10-30%. Blackfoot soils are usually associated with lower landscape positions. However, on gently undulating landscapes these two soils are randomly intermixed. Other Black Chernozemic soils present in minor amounts include soils developed on a medium textured lacustrine blanket and on coarse textured glaciofluvial materials.

Two topographic phases of this soil unit were recognized.

RND1/3 - Mapped on terraced landscapes which are generally level to undulating on the tread areas. Slopes range between 2-5%. Steeper slopes are associated with the risers. (ie. slopes between different terraces). Forage production is the main land use, although some areas are used for grain production.

RND1/4 - Mapped on terraced landscapes which are hummocky on the terraced portions. The dominant slopes range between 5-9%. Steeper slopes are associated with the risers (slopes between different terraces). Areas are primarily used for forage production.

2.3.44 Rockford (RFD) soil description.

Rockford soils are Orthic Black Chernozemic soils developed on gravelly, medium textured glaciofluvial or ice-contact material. These soils were mapped on the Milk River Upland, Cardston Plain and in the Rocky Mountain Foothills, in the 2A(H) and 2H agroclimatic zones.

Selected characteristics of RFD (ranges in brackets)

	Topsoil (Ah/Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	12 (9-15)	20	@ 35
textural class	L	GL	GL (GLS-GCL)
*c.f. content, %	15 (10-35)	25 (5-35)	35 (30-50)
pH	6 (5-7)	-	-
organic matter, %	8 (6-10)	-	-
$CaCO_3$ equiv., %	-	-	13 (9-15)

* Coarse fragment content by volume.

Special Note: The coarse fragments vary in size between 10-35 cm in diameter (cobbles and stones). The coarse fragment content is 35% or more, based upon a weighted average basis for the control section.

Rockford Soil Unit and Map Unit.

RFD1

This soil unit contains dominantly (60-80%) Rockford soils. Other Black Chernozemic soils present in minor amounts include soils developed on medium textured till, and on till or ice-contact materials, in which the coarse fragment content is between 15-35%. Rego Black Chernozemic soils developed on these materials occur in small amounts, especially on the tops of knolls in cultivated areas.

One topographic phase of this soil unit was recognized.

RFD1/3-4 - Mapped on undulating to hummocky landscapes with 3-9% slopes. Areas are used for grazing and crop production. Upon cultivation, surface stoniness is a severe hindrance.

2.3.45 Rough Broken Miscellaneous Map Units.

RB1

The RB1 miscellaneous azonal map unit consists of roughly equal proportions (40-60%) of Orthic and Rego Chernozemic soils, developed on a variety of parent materials, generally morainal and fluvial deposits. Black and Dark Brown Chernozemic profiles are present in varying amounts, depending upon the geographic location of the delineation in relation to the soil zone line. Regosolic soils and bedrock outcrops are present in minor amounts, less than 20% each.

This undifferentiated azonal map unit is used for describing the steep slopes associated with river, stream and spillway valleys. The slopes within these units are variable, but they are greater than 10%. These side slopes are generally stable since they are covered with grass and shrub vegetation. However, minor portions of this unit are susceptible to downslope creep, especially the steeper slopes which are associated with active gullies. These erodible areas are unvegetated and the soils are weakly developed.

Delineations of this map unit are used for grazing. The carrying capacity is low and the excessive topography may limit accessibility.

RB2

The RB2 miscellaneous azonal map unit consist of Rego Chernozemic soils 40-60% developed on a variety of parent materials, generally morainal and fluvial deposits. Bedrock outcrops, the differentiating characteristic of RB2 from RB1 units, are present in proportions varying between 20-70%. Orthic Chernozemic soils occur in minor amounts. Black and Dark Brown Chernozemic profiles are present in varying amounts depending upon the geographic location of the delineation in relation to the soil zone line. Regosolic soils are present in minor amounts, less than 20% each.

This undifferentiated azonal map unit is used for describing the steep slopes associated with river, stream and spillway valleys. The slopes within these units are variable, but they are greater than 10% and the majority are greater than 30%. These slopes are stable, but the proportion of bare unvegetated spots is greater than on the RB1 units. Therefore, a larger proportion of the unit is susceptible to downslope creep and other erosive processes.

Delineations of this map unit are used for grazing. Carrying capacity is lower than RB1 areas due to greater amounts of bedrock outcrops. The topography is also more excessive on RB2 areas so accessibility is worse than RB1 units.

RB4

This miscellaneous azonal map unit consists of dominantly (30-50%) Rego Chernozemic soils with 20-40% Orthic Chernozemic soils developed on a variety of parent materials, generally morainal and fluvial deposits. Dark Brown and Black Chernozemic profiles are present in varying amounts depending upon the geographic location of the delineation in relation to the soil zone line. Gleyed soils and Gleysolics, which are associated with depressional areas and ephemeral streams, are present in minor amounts. Bedrock outcrops are also common inclusions.

This undifferentiated azonal map unit is restricted to steep sided V shaped drainage ways or erosional channels. The RB4 map unit is different from the AV1 map unit in that the flood plain is narrower in width, and occupies less than 50% of the delineation.

RB4 areas are used primarily for grazing.

2.3.46 Sakalo (SAK) soil description.

Sakalo is an Orthic Black Chernozemic soil developed on a medium textured lacustrine veneer over coarse textured glaciofluvial material. These soils were mapped on the Milk River Upland and Cardston Plain, in the 2A(H) and 2H agroclimatic zones.

Selected characteristics of SAK (ranges in brackets)

	Topsoil (Ah/Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	12 (10-15)	25 (20-35)	@ 37 (30-50)
textural class	L (CL)	L (SL-CL)	LS (SL-S)
pH	6.5 (6-7)	6.5 (6-7)	7.6 (6.5-8.0)
organic matter, %	7 (5-8)	-	-
$CaCO_3$ equiv., %	-	-	8 (5-12)

Sakalo Soil Units and Map Units.

SAKN1

This soil unit contains 40-60% Sakalo soils and 20-40% Orthic Black Chernozemic soils developed on coarse textured glaciofluvial - Knight. Other Orthic Black Chernozemic soils developed on medium tex-

tured lacustrine and till occur in minor amounts. Eroded or Rego Black Chernozemic soils on these parent materials are present in minor amounts.

One topographic phase of this soil unit was recognized.

SAKN1/3 - Mapped on undulating landscapes with dominantly 2-5% slopes. Some steeper topography may occur at the inclusion level. Delineations are primarily used for forage production.

SASO1

This soil unit contains 40-60% Sakalo soils and 30-50% Orthic Black Chernozemic soils developed on medium textured lacustrine - Standoff. Standoff soils generally occur in the lower slope portions of the landscape, while Sakalo soils are present in the higher landscape positions. Also on the knolls, Orthic and Rego Black Chernozemic soils, developed on coarse textured glaciofluvial materials, are present in minor amounts. In depressional areas, Gleysolic soils are found in small amounts.

One topographic phase of the SASO1 soil unit was recognized.

SASO1/3 - Mapped on undulating landscapes with slopes ranging between 2-5%. Areas are used for forage production.

SASO4

This soil unit contains approximately equal proportions (30-50%) of Sakalo soils, and Orthic Black Chernozemic soils developed on medium textured lacustrine - Standoff. Eroded, thin or Rego Black Chernozemic and Regosolic soils on similar materials also occupy 20-40% of the delineation. These eroded or weakly developed soils occur randomly throughout delineations. Other common inclusions are Orthic Black Chernozemic soils developed on medium textured lacustrine veneer over gravel and on coarse textured glaciofluvial. In delineations near the Dark Brown - Black soil zone line, some equivalent Dark Brown soils on the previously mentioned parent materials are present.

One topographic phase of the SASO4 soil unit was recognized.

SASO4/3 - Mapped on undulating landscapes with 2-5% slopes. Areas are used for grain production.

2.3.47 Saline (S) Miscellaneous Map Unit.

This miscellaneous azonal map unit includes 60-80% saline soils developed on various parent materials (ie. lacustrine, till or glaciofluvial). Saline soils contain concentrations of soluble salts which result in the soil having an electrical conductivity value of greater than 4mS. These areas may be recognized in the field by the presence of white salt crusts on the surface, especially in areas devoid of a vegetative cover. The presence of salt tolerant vegetation, such as kochia and foxtail barley, also indicate the existence of salts within the soil profile.

The S spot symbols are used to identify saline areas smaller than 5 ha in size. Areas greater than 5 ha, are delineated and labeled with an S symbol or amalgamated within "3" soil map units.

Within the M.D. of Cardston, saline areas occur primarily in the vicinity of Magrath, the Leavitt valley and isolated areas on the Cardston Plain (ie. the Woolford area).

Saline areas are of limited agricultural use.

2.3.48 Sexton (SXT) soil description.

Sexton is an Orthic Humic Regosol developed on medium to coarse textured glaciofluvial. These soils were mapped in areas associated with coulee or spillway landforms, thus the textures of the parent material is extremely variable. These soils were mapped on the Verdigris Plain, in the 2A agroclimatic zone.

Sexton soils have a weakly developed, sandy loam to loam textured Ah horizon, roughly 10-20 cm thick. Calcareous, sandy loam to loamy sand textured parent material directly underlies the surface Ah horizon. Some profiles exhibit cumulic characteristics.

Sexton Soil Unit and Map Unit.

SXT3

This map unit consists of roughly equal proportions, 30-50% Sexton soils and Cumulic Humic Regosols developed on similar parent materials. Saline phases of these Humic Regosols occur in significant (20-40%) proportions. Orthic and Rego Dark Brown Chernozemic soils are present in minor amounts. Some of these Chernozemic soils may be salinized.

One topographic phase of this soil unit was recognized.

SXT3/2-3 - Map unit confined to the coulee or spillway bottom land areas of Middle Coulee, where the slopes are less than 5%. These areas are of little agricultural significance, due to the presence of salts, low natural fertility and low moisture holding capacity. Grazing is the dominant land use.

2.3.49 Shandor (SND) soil description.

Shandor is an Orthic Black Chernozemic soil developed on fine textured slopewash material derived from shale bedrock. These soils were mapped on the Milk

River Upland and Cardston Plain, in the 2A(H) and 2H agroclimatic zones.

Selected characteristics of SND (ranges in brackets)

	Topsoil (Ap/Ah)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	10 (9-15)	25 (20-40)	@ 35 (30-50)
textural class	SiC	SiC	SiC
pH	6.5	7.0	7.0
organic matter, %	6	-	-
$CaCO_3$ equiv., %	-	-	10 (5-15)

Special Note: The parent material contains less than 5% coarse fragments by volume.

Shandor Soil Units and Map Units.

SND2

This soil unit contains dominantly (50-70%) Shandor soils and 15-30% Gleysolic soils. These wet soils are associated with depressional areas. Eroded, or Rego Black Chernozemic soils are present in minor amounts. Shale bedrock outcrops occur in some delineations, in amounts of less than 10%. Saline soils are sometimes associated downslope of these outcrops. In delineations near the Dark Brown - Black soil zone line, equivalent Dark Brown Chernozemic soils are present in variable amounts.

One topographic phase of this soil unit was recognized.

SND2/3 - Mapped on undulating landscapes with 2-5% slopes. Areas are used for grain and forage production.

SND4

This soil unit contains 50-70% Shandor soils and 20-40% eroded, thin or Rego Black Chernozemic and Regosolic soils, developed on similar materials. These eroded soils are found randomly throughout delineations of this soil unit. Shale bedrock is close to the surface and outcrops are present in most delineations. Gleysolic and Solonetzic soils, which are associated with depressional areas and drainage ways, occur in minor amounts. In delineations near the Dark Brown - Black soil zone line, equivalent Dark Brown Chernozemic soils are present in variable amounts.

One topographic phase of this soil unit was recognized.

SND4/3 - Mapped on undulating generally bedrock controlled landscapes with slopes ranging between 2-5%. Areas are primarily used for forage production.

SNHL1

This soil unit contains approximately equal (30-50%) proportions of Shandor soils and Orthic Black Chernozemic soils developed on medium textured slopewash material - Hillmer. Eroded, Rego Black Chernozemic soils developed on similar materials are present in minor amounts. In delineations near the Dark Brown - Black soil zone line, equivalent Dark Brown Chernozemic soils are present in variable amounts.

One topographic phase of the SNHL1 soil unit was recognized.

SNHL1/4D - Mapped on inclined and dissected landscapes with 5-9% dominant slopes. Some steeper topography may be associated with drainageways or dissections. Areas are primarily used for grazing, some for grain production.

2.3.50 Standoff (SOF) soil description.

Standoff is an Orthic Black Chernozemic developed on medium textured lacustrine. Standoff soils were mapped on the Milk River Upland and the Cardston Plain, in the 2A(H) and 2H agroclimatic zones.

Selected characteristics of SOF (ranges in brackets)

	Topsoil (Ah/Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)
thickness, cm	17 (11-23)	40 (35-45)	@ 60 (50-80)
textural class	L (SiL-CL)	L (SiL-SiCL)	CL (SiL-SiC)
pH	5.8(5.7-6.3)	6.0(5.8-6.3)	7.4
organic matter, %	9 (7-14)	2 (0-4)	-
$CaCO_3$ equiv., %	-	-	14 (10-18)

Standoff Soil Units and Map Units.

SOF1

This soil unit contains dominantly (70-90%) Standoff soils. Other soils which are present in minor amounts include Orthic Black Chernozemics developed on medium textured till and medium textured lacustrine over gravel. These inclusions are generally found near the edge of the delineations where lacustrine material becomes shallower and the underlying till or gravel occur within the control section, or at the surface. Gleysolic soils, associated with the depressional areas, occur in minor amounts.

One topographic phase of this soil unit was recognized.

SOF1/3 - Mapped on undulating to level landscapes with 2-5% slopes. Areas are used for forage and grain production.

SOF2

This soil unit contains 60-80% Standoff soils and 15-30% Gleysolic soils. These wet soils are associated with depressional areas and drainage channels. Orthic Black Chernozemic soils developed on medium textured till are present as inclusions. These inclusions are generally found near the edge of the delineations, where the lacustrine material becomes shallower and the underlying till occurs at the surface or within the control section. Saline soils are also present in minor amounts.

One topographic phase of this soil unit was recognized.

SOF2/3 - Mapped on undulating landscapes. Slopes range from 2-5%. Areas are used primarily for forage production.

2.3.51 Spruce Ridge (SPR) soil description.

Spruce Ridge soils are Orthic Gray Luvisols developed on medium textured, moderately calcareous till. The till is dominantly of Cordilleran origin. These soils were mapped in the Rocky Mountain Foothills, in the 5H agroclimatic zone.

Selected characteristics of SPR (ranges in brackets).

	Horizons.		
	Ae	Bt	BC
thickness, cm	16 (8-25)	50 (20-80)	@ 70 (50-100)
textural class	SL (L)	CL (CL-C)	L (LS-C)
*c.f. content, %	5	10 (5-20)	20 (10-60)
pH	5	5 (5-6)	6.5 (5-7.5)
organic matter, %	4.5(3.5-5.9)	2.4 (1.8-2.8)	-

*Coarse fragment content by volume.

Additional Soil Notes: The mineral surface is covered with a litter layer which is usually 5-10 cm thick. The Bt horizons are well developed, having moderate angular blocky structure and many thick clay skins. Within the control section, calcareous horizons were not encountered, but the parent material does contain CaCO3.

The lithology of the underlying bedrock is complex in the Foothills area where Spruce Ridge soils were mapped. Rock types include sandstone, siltstone and shale. The weatherability and proximity of the bedrock to the surface influences the texture of the till on which these soils are developed. Therefore, the textural range of the BC horizon is extremely variable.

Similarly, the coarse fragment content of the till is extremely variable. The content ranges from 10-60%. A similar range of the coarse fragment percentage for the till was noted in Waterton Park (Coen et al. 1974). Generally the coarse fragment content of the Spruce Ridge soils is approximately 20%.

Spruce Ridge Soil Units and Map Units.

SPR1

This soil unit contains dominantly (50-70%) Spruce Ridge soils. Orthic Gray Luvisolic soils developed on a till veneer over bedrock and Dark Gray Luvisolic soils on till are common inclusions. On slopes with a southern aspect, Orthic Eutric Brunisolic soils developed on a till veneer over bedrock occur in minor amounts.

One topographic phase of this soil unit was recognized.

SPR1/4-5 - Mapped on rolling to inclined landscapes where dominant slopes range between 6-15%. The areas are used for grazing, but the carrying capacity is low due to the relatively dense forest cover of pine and spruce trees.

SP:F

This soil unit contains 40-60% Spruce Ridge soils. The remaining portion of the soils consists of Regosolic or Brunisolic-like soils developed on medium textured slopewash, colluvium or mass-wasted till. These soils are influenced by the action of gravity. Therefore, these soils are weakly or poorly developed and the disrupted horizons are difficult to identify. At lower elevations where slopes are more stable, Dark Gray Luvisolic soils on medium textured till occur as inclusions.

A visually distinguishing feature of this delineation is the presence of gullies, slumps and seepage tracts where Rubus sp. and aspen are prevalent. The forest cover of the remaining portion, between tracts, consists of dominantly pine and spruce trees.

One topographic phase of this soil unit was recognized.

SP:F/7-8 - Mapped on strongly inclined, unstable landscapes where slopes range between 30-70%.

2.3.52 Tough Creek (TUC) soil description.

Tough Creek soils are Orthic Gray Luvisols developed on a medium textured, moderately calcareous till veneer over paralithic bedrock of various lithologies. The till is dominantly of Cordilleran origin. These soils are confined to the Rocky Mountain Foothills physiographic region, in the 5H agroclimatic zone (Figure 42).

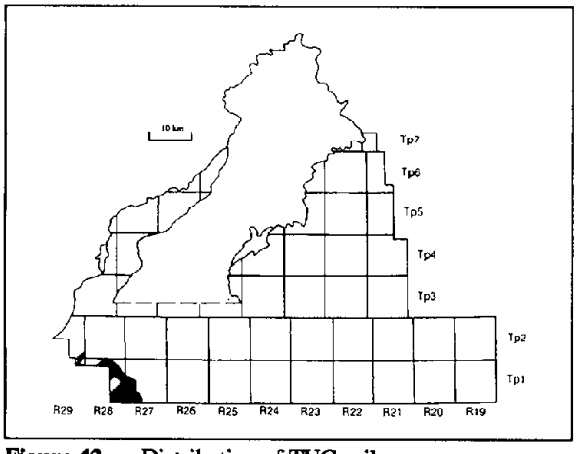


Figure 42. Distribution of TUC soils.

Selected characteristics of TUC (ranges in brackets).

	Horizons.		
	Ae	Bt	II BC
thickness, cm	14 (8-20)	50 (20-80)	@ 70 (50-100)
textural class	L (SL)	C (CL-C)	SL (LS-C)
*c.f. content, %	5	10 (5-20)	20 (10-60)
pH	5	5 (5-6)	6.5 (5-7.5)
organic matter, %	4.5(3.5-5.9)	2.4 (1.8-2.8)	-

* Coarse fragment content by volume.

Additional Soil Notes: The mineral surface is covered with a litter layer which is usually 5-10 cm thick. The Bt horizons are well developed, having moderate angular blocky structure and many thick clay skins.

The lithology of the underlying bedrock is complex in the Foothills area, where Tough Creek soils were mapped. Bedrock types include sandstone, siltstone and shale. The weatherability and proximity of the bedrock to the surface influences the texture of the till on which these soils are developed. Therefore, the textural range and coarse fragment content of the IIBC horizon is extremely variable. Horizons developed in the residual material are often non calcareous within the control section (100 cm of the surface).

Tough Creek Soil Units and Map Units.

TUC1

This unit contains 50-70% Tough Creek soils. Orthic Gray Luvisols developed on medium textured till - Spruce Ridge, commonly occur in amounts up to 20-30%. These latter soils may be randomly distributed throughout the delineations, although they are generally associated with mid to lower slope positions. Orthic Eutric Brunisolic soils developed on a medium textured till veneer over weathered bedrock are usually present, on tops of ridges. Dark Gray Luvisolic soils developed on till of variable thickness are also found in minor amounts, usually associated with areas of aspen forest cover and open shrub vegetation.

One topographic phase of the TUC1 soil unit was recognized.

TUC1/5-6 - Mapped on inclined to rolling bedrock controlled landscapes with the predominant slopes ranging between 9-30%. Delineations are covered with a pine forest with some aspen. Areas are used for grazing, but have a low carrying capacity.

TUSP1

The soils of this unit are diverse and complex in terms of their composition and spatial arrangement. The dominant soils are Tough Creek and Orthic Gray Luvisolic soils developed on thick deposits of medium textured till - Spruce Ridge. The areal extent of these soils is approximately 20-40% each, within the delineations.

The other soils found in delineations of this map unit occur in characteristic landscape positions. The landscapes consist of a series of bedrock controlled ridges. In the valleys, Gleysolic soils developed on fluvial deposits of variable texture are found in association with the floodplain of the creeks. These soils occupy a relatively minor proportion of the unit, but are important from a land use perspective. On the long side slopes of the ridges, there are ephemeral streams and seepage tracts where the shrub vegetation cover is abundant. The soils in these areas consist of slopewash material. Soils associated with these tracts have thick, organic rich surface horizons often 30-40 cm thick. Also present on these side slopes in minor amounts, are Dark Gray Luvisolic soils on till of variable thickness. On the tops of the ridges, Orthic Eutric Brunisolic soils developed directly on residual material and/or a till veneer over weathered bedrock occur in minor amounts. Also, bedrock outcrops may be present in small amounts. Orthic Gray Luvisolic soils developed on stony, medium textured, Cordilleran till - Westcastle, are present at elevations above 1700 m.

Forest cover consists of pine, spruce and aspen trees.

One topographic of this soil unit was recognized.

TUSP1/6-7 - Mapped on ridged, hummocky and inclined landscapes where slopes dominantly range between 15-45%. Portions of the areas are used for grazing, however the carrying capacity is low.

2.3.53 Van Cleeve (VAC) soil description.

Van Cleeve soils are Orthic Dark Brown Chernozemics developed on a medium textured, moderately calcareous till veneer over paralithic bedrock (Figure 43). Van Cleeve soils were mapped on the Verdigris and Three River Plains and is confined to the 2A agroclimatic zone.

Figure 43. VAC soil profile. Consists of a till veneer over residual material of 45 cm. Competent bedrock is at 75 cm.

Selected characteristics of VAC (ranges in brackets)

	Topsoil (Ah/Ap)	Subsoil (Bm)	Parent Material (Cca/Ck)	Residual (IICk)
thickness, cm	10(8-17)	25(10-35)	@35(20-50)	@70(35-95)
textural class	L(SiL-CL)	L(SiL-CL)	SiCL(L-SiCL)	L(SL-SiCL)
* c.f. content, %	5 (<15)	<15	<15	-
pH	7.5 (6-8)	7.5 (6.5-8)	(7.5-9)	8
organic matter, %	6 (5-7)	2 (0-4)	-	-
$CaCO_3$ equiv., %	-	-	15	20

* Coarse fragment content by volume.

Van Cleeve Soil Unit and Map Unit.

VAC4

This soil unit contains 40-60% Van Cleeve soils and 20-40% Rego Dark Brown Chernozemic and Regosolic soils developed on similar parent materials. These eroded or weakly developed profiles occur near the crests of ridges or on exposed knolls. They appear as lighter coloured patches when land is bare and dry. Orthic Dark Brown Chernozemic soils developed on medium textured till occur in amounts up to 20%. Bedrock outcrops are also present in minor amounts.

One topographic phase of this soil unit was recognized.

VAC4/5 - Mapped on ridged and inclined bedrock controlled landscapes where slopes range from 9-15%. Areas are used for grain and forage production.

2.3.54 Westcastle (WCT) soil description.

Westcastle soils are Orthic Gray Luvisols developed on stony, medium textured till. These soils were mapped on the Mokowan Butte and at elevations above 1750 meters. Their areal extent are confined to the Rocky Mountain Foothills physiographic region, in the 5H agroclimatic zone.

Selected Characteristics of WCT (ranges in brackets)

	Horizons.	
	Ae	Bt
thickness, cm	15 (12-21)	45 (35-65)
textural class	SL (L)	L (CL)
*c.f. content, %	40	50 (40-70)
pH	4.3	5 (4.5-5.5)
organic matter, %	3 (2-5)	-

* Coarse fragment content by volume.

Additional Soil Notes: The mineral surface is covered with a LFH layer varying in thickness from 2-10 cm. The Bt horizons are well developed having medium, moderate angular blocky structure and thick clay skins. Calcareous horizons are not encountered within 150 cm of the surface.

The parent material of Westcastle soils is Cordilleran till of Illinoian or Kansan age (Horberg 1954, Karlstrom pers. comm. 1984)[1]. This till is unique in that the material has a distinctive pinkish tinge and the majority of the coarse fragments are greater than 25 cm in diameter.

Westcastle Soil Unit and Map Unit.

WCT1/3-4

This soil unit is confined to the plateau area on Mokowan Butte, in this M.D.. The unit contains dominantly (70-90%) Westcastle soils. Eutric Brunisols developed on similar materials may be present in minor amounts.

One topographic phase of this soil unit was recognized.

WCT1/3-4 - Mapped on an undulating to hummocky landscape with 3-9% slopes. Delineations may be used for grazing. However, the carrying capacity is low and accessibility to the area is very poor.

PART 3. INTERPRETATIONS.

This chapter describes the rationale and factors involved in the rating of soil map units for three agricultural land use practices. Relevant data specific to soil series for engineering interpretations are also included in the second portion of this chapter.

3.1 Agricultural Land Use Interpretations.

The soil map units in the M.D. of Cardston were rated for dryland agriculture, irrigation capability and grazing productivity. The generalized interpretive ratings for each map unit are listed in Table 6. The ratings for each land use practice are based on a seven class system. Class 1 has no limitations, while class 7 areas are unsuitable for any form of agricultural use. The additional alphabetical symbols indicate the most limiting factors for specific ratings. The symbols are:

B - excessive brush cover
C - climatic limitations - either insufficient precipitation or shortened growing season.
D - undesirable soil structure
E - erosion damage - shallow depth to lime layer, surface horizon permanently lost.
F - low natural fertility
G - steep slopes (specific to Land Class Branch)
J - small field size (specific to Land Class Branch)
M - low moisture holding capacity
N - excessive salinity
P - excessive stoniness
R - shallow depth to bedrock
T - adverse topography
W - excessive wetness

3.1.1 Soil Capability for Dryland Agriculture.

The dryland agricultural capability rating system of soil map units in the M.D. of Cardston is based on the classification scheme derived for the Canada Land Inventory (CLI). The guidelines and classes are outlined in Soil Capability for Agriculture in Alberta, (Alberta Environment 1977).

Climate is the initial stratification factor considered, then soil map unit characteristics are assessed, in the determination of dryland agriculture capability ratings. Five agroclimatic zones are recognized in the M.D., as shown in Figure 3. These zones are approximately the same as on the provincial agroclimatic map (Bowser 1967), with the addition of the 3H zone. This additional zone is restricted to the non-forested portion of the Foothills physiographic region, where the frost free period and number of growing degree days are less than to the east. Production of forage crops and grazing are the diagnostic land use practices of the 3H zone.

After the agroclimate has been considered, then additional soil map unit characteristics, such as texture, surface stoniness, topography etc., are accounted for in the determination of the final capability rating.

The extent of the different agricultural capability classes within the M.D. is shown in Table 2.

Table 2. Areal extent of dryland agricultural capability classes in the M.D. of Cardston.

Class	Definition	Area	%
1	These soils have no significant limitations to use for common cultivated crops.	0	0
2	These soils have moderate limitations that restrict the range of crops or require moderate conservation practices.	84007 ha	25
3	These soils have moderately severe limitations that restrict the range of crops or require special conservation practices.	120970 ha	36
4	These soils have severe limitations that restrict the range of crops that can be grown or require speical conservation practices or both.	60485 ha	18
5	These soils have very severe limitations that restrict their capability to producing perennial forage crops and improvement practices are feasible.	30243 ha	9
6	These soils are only capable of producing perennial forage crops and improvement practices are not feasible.	36963 ha	11

A generalized map depicting the distribution of the dryland capability ratings for the M.D. is shown in Figure 44.

3.1.2 Soil Capability Ratings For Irrigation.

Soil capability of soil map units for irrigation was determined in two ways. Ratings from both approaches are included in Table 6. The Land Classification Branch ratings were determined following the guidelines outlined in the Procedures Manual for Land Irrigabilty Classification in Alberta (1983). This approach considers solely soil and landscape limitations. The other approach (Irrigation Capability) considers climatic limitations, before soil and landscape factors. Subsequently, there is a difference between the two

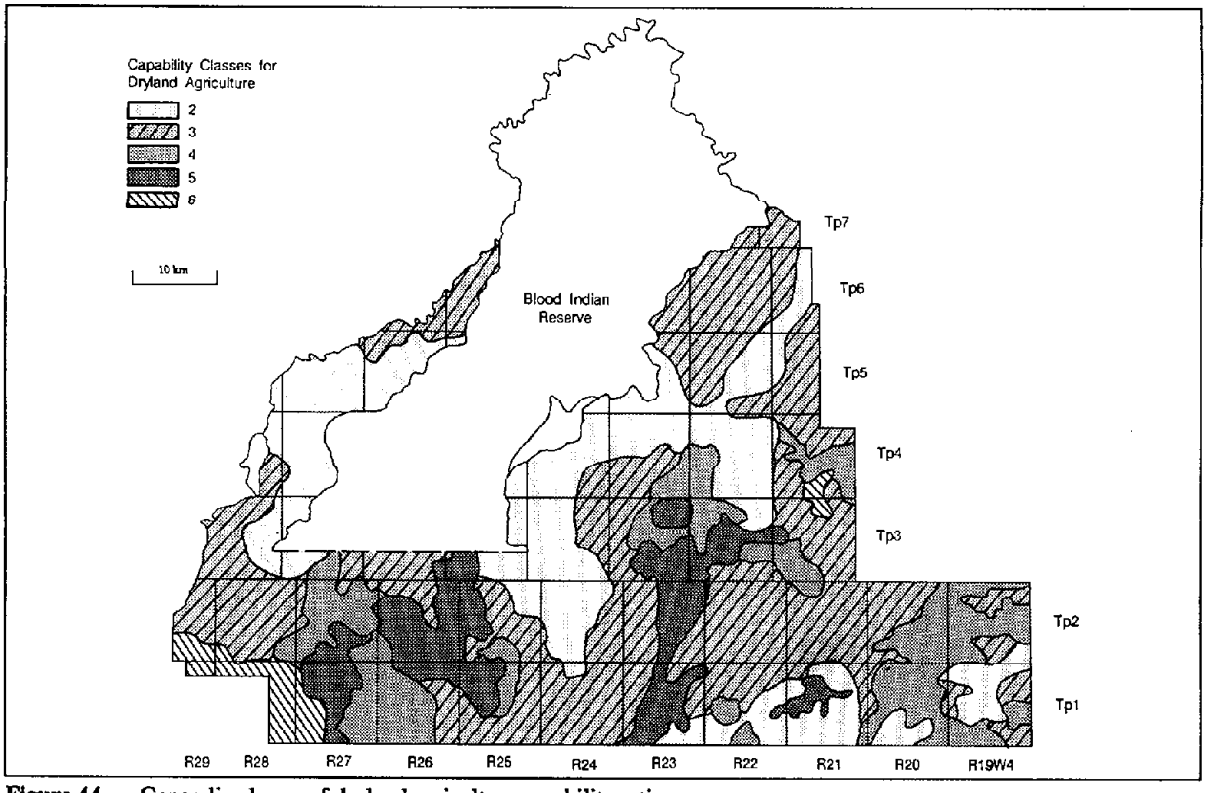


Figure 44. Generalized map of dryland agriculture capability ratings.

ratings. Climatic restrictions are important, since the length of the frost free period limits the feasibility of cropping options. Different crops have variable economic returns. Therefore, because forage crops are less lucrative than vegetable crops, the benefits of installing expensive irrigation systems in the Foothills may be more difficult to justify than on the Plains around Lethbridge. Table 3 is the correlation table used as a preliminary stratification in determining irrigation capability ratings.

Table 3. Correlation between agroclimatic zone and irrigation capability class for climate.

Agroclimatic zone	Climate rating for irrigation capability
2A	2C
2AH,2H	3C
3H	5C
5H	NI (non irrigable)

The irrigation suitability ratings in Table 6 are broad in scope, intended for the estimation of the regional distribution of irrigable and non irrigable land. The rating of individual parcels of land would require the collection of more detailed on-site information. The collection of such site specific data is beyond the scope of this soil survey.

The areal extent of the irrigation capability classes are summarized in Table 4.

Table 4. Areal extent of irrigation capability classes within the M.D. of Cardston.

Class	Definition	Area	%
2	Good irrigation land with moderate	16801 ha	5
3	Fair irrigation land with moderately severe limitations.	141132 ha	43
4	Land in this class has severe limitations for irrigation and requires irrigation and requires special crop, soil and water management practices.	20162 ha	6
5	Land in this clas is considered not suitable for irrigation under existing conditions but has sufficient potential to warrant additional investigation or improvement.	87367 ha	26
6	Non irrigable land.	53765 ha	16

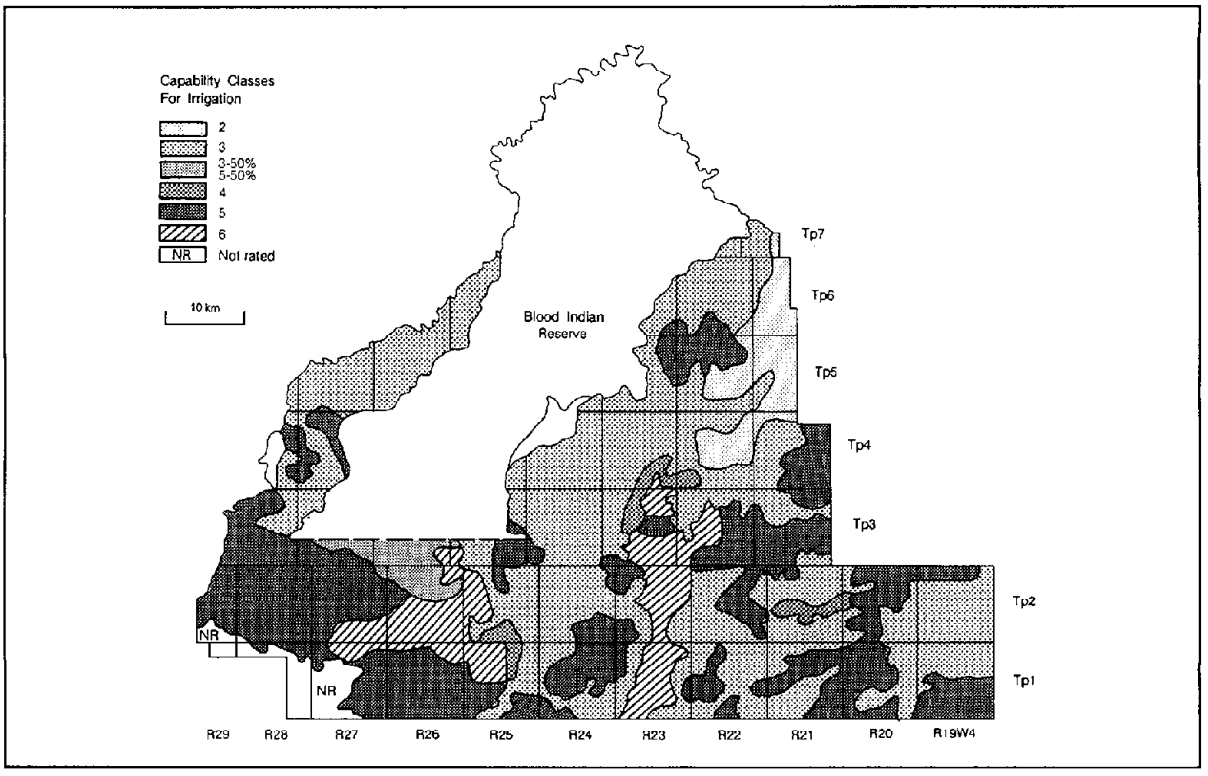


Figure 45. Generalized map of irrigation capability ratings.

The remaining 4% of the M.D. occurs in the 5H agroclimatic zone and was not rated for irrigation due to climatic limitations.

A generalized map of the irrigation capability ratings for the M.D. is shown in Figure 45.

3.1.3 Grazing Productivity Rating System.

The capability rating system for estimating the grazing productivity is based on the inherent ability of the soils in a map unit to produce forage. The grazing productivity ratings are qualitative estimates based on indirect measurements of soil characteristics, topography, the proportion and type of vegetation and climate. Climate, specifically the amount of precipitation, is the initial factor considered in determining the carrying capacity of a map unit.

The potential carrying capacities and productivity values for each map unit was determined using regression equations developed by Cannon and Nielsen (1984). These equations relate rainfall and soil characteristics to dry matter yield. These dry matter yield estimates were compared with yield values determined from the predicted stocking rates listed in the Guide to Range Conditions and Stocking Rates for Alberta (1976). For convenience the range in carrying capacities and productivity values were subdivided into 7 classes, comparable to the CLI class system. The classes and the respective range in stocking rates and yield values are listed in Table 5.

Table 5. Grazing capability classes in terms of stocking rate and dry matter yield.

1	<5ha/AUY **	1550 kg/ha
2	5-10	1550-775
3	10-16	775-500
4	16-24	500-325
5	24-36	325-220
6	36-60	220-130
7	>60 ha/AUY	<130

* assumptions - 1 animal unit consumes 12 kg/day
- that range is in "good" condition
- a 45% vegetative cover carry over maintained

** hectares per animal unit year, - to convert to acres/AUM divide by 5.

Within the M.D. of Cardston, the majority of the land used for grazing is confined to the Milk River Ridge and the Foothills Region. Even though the remainder of the M.D. is annually cultivated, the po-

tential carrying capacities were determined so the total grazing potential may be obtained.

Figure 46 is a generalized map depicting the distribution of grazing productivity class ratings in the M.D.. Areal extent of the different classes was not determined. Grazing productivity ratings for the individual soil map units are listed in Table 6.

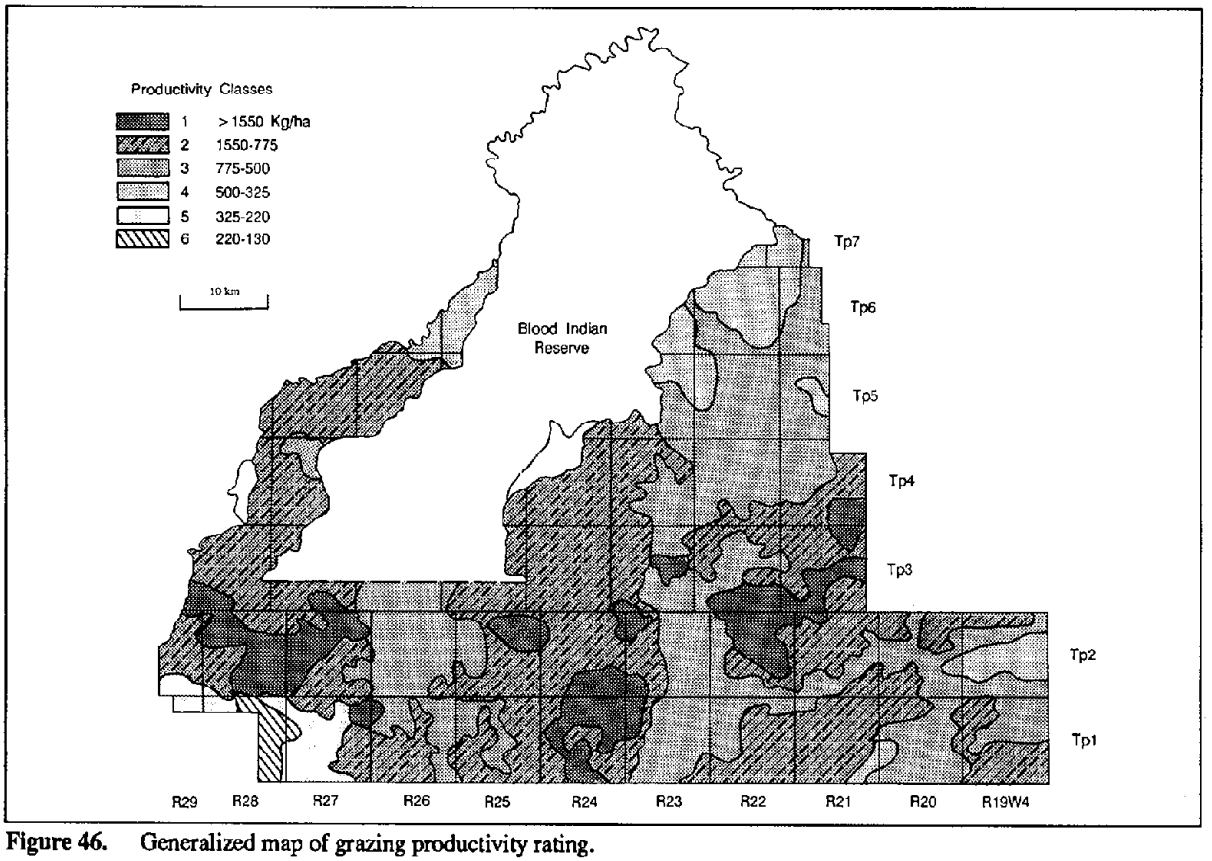


Figure 46. Generalized map of grazing productivity rating.

Table 6. Agricultural land use interpretations for all soil map units of the survey area.

MAP UNIT SYMBOL	DRYLAND CAPABILITY	LAND CLASSIFICATION BRANCH RATINGS	IRRIGATION CAPABILITY	GRAZING PRODUCTIVITY
AV1	$3T^{50}6T^{50}$	6GJ	5T	3ET
AV6	$5M^{70}6T^{30}$	6MG	6MT	5M
BDCC1/4-5	5TD	6BG	NOT RATED	5BR
BDNF1/6-7	6T	6G	NOT RATED	6TB
BDY1/3-4	5C	5B	NOT RATED	4B
BFRN1/3	4M	5PM	5PM	3M
BFT1/3	4M	3M	3C	3M
BVA6/4-6	5CTP	6G	6TP	4B
BVLT1/3-4	5C	5B	NOT RATED	48
BVNF1/5-6	6T	6G	NOT RATED	4B
BZCT1/3	2C	2G	3C	2C
BZCT2/3	$2C^{80}5W^{20}$	5WJ	5WT	1
BZCT3/3	$2C^{80}5NW^{20}$	5NW	5NW	2C
BZCT4/4	3TE	2GE	3C	2C
BZOK1/5-6	6TR	6GR	6T	3R
BZOK4/4	3TR	5R	5R	3R
BZOK4/6D	6TR	6G	6T	4TR
BZR1/3	2C	2G	3C	2C
BZR1/4	3T	2G	3C	2C
BZR1/4D	4T	4G	4T	2C
BZR1/5	4T	4G	4T	2C
BZR1/5-6D	6T	6G	6T	3T
BZR1/6	6T	6G	6T	2C
BZR2/4	$3T^{80}6W^{20}$	5WJ	5WT	1
BZR2/5	$4T^{80}6W^{20}$	5WJ	5WT	1
BZR4/4	3TE	3E	3C	2C
BZR4/5	4TE	4GE	4TE	2C
BZR4/6D	6TE	6G	6T	3T
BZR6/4	3TP	3PG	3C	2C
BZR6/5	4TP	4PG	4TP	2C
BZR6/5-6D	6TP	6G	6T	3T
BZR8/4	$3T^{80}6W^{20}$	3EG	3ET	1
BZSO1/3-4	2CT	2G	3C	2C
BZSO2/2-3	$2C^{80}SW^{20}$	5WJ	5WT	1
BZSO3/3	$2C^{80}5NW^{20}$	5NW	5NW	2C
CCBD1/5-6	6TD	6G	NOT RATED	5B
CCNF1/5-6	6TR	6G	NOT RATED	5B
CFNE1/3-4	5M	5PM	5PM	4M
CFT4/2-3	4ME	3M	3M	4M
CLLE1/2	2C	1	2C	3C

CRD1/3	3M	2G	2C	3C
CRD1/4	3M	2G	2C	3C
CRD2/4	$3M^{80}6W^{20}$	5WJ	5WT	2
CRD3/3	4N	5N	5N	3C
CRD4/3	3ME	3E	3E	3C
CRD4/4	4EM	3E	3E	3C
CRLN1/4	4M	4MP	4MP	3M
CRLN1/5-6	6MT	6G	6T	3M
CRMG1/3	2C	2G	2T	3C
CRMG4/3	3E	3E	3E	3C
CRMG4/4	3E	3E	3E	3C
CRMG4/5	4T	4G	4T	3C
CRVA1/3	3MR	5R	5R	4R
CRVA4/4	3MR	5R	5R	4RE
CRW1/4	3C	4M	5C	2C
CT:L4/4	3RT	5R	5R	3RE
CTN1/2-3	2C	2G	3C	2C
CTN3/3	3N	5N	5N	2C
CTPG1/2-3	3DN	5DN	5DN	2C
DLB1/2	2C	1	3C	2C
DLHL1/3	2C	2G	3C	2C
DVBV1/4-5	4T	5B	5C	2C
DVFS1/3	3C	2G	5C	2C
DVG1/3	3C	2G	5C	2C
DVG1/4	3C	2G	5C	2C
DVG1/4D	4T	4G	5C	2C
DVG1/5	4T	4G	5C	2C
DVG1/6	5T	6G	6T	2C
DVG2/3-4	$3C^{80}6W^{20}$	5WJ	5C	1
DVG2/4-5	$4T^{80}6W^{20}$	5WJ	5C	1
DVG6/4-5	4TP	5PG	5C	2C
DVG6/5-6	5TP	6GP	6TP	2C
DVG7/3-4	4D	3DN	5C	2C
DVOK1/4-5	4TR	5R	5C	3R
DVOK1/5-6	5TR	6RG	6RT	3R
DVOK1/5-7	6TR	6RG	6RT	3R
FSH7/3	4D	3DN	5C	2C
G	5W	6W	6W	2-4
HEG1/3	2C	2G	3C	3C
HEG2/3-4	$3T^{80}5W^{20}$	5WJ	5WT	2
HEG7/3D	3D	3D	3C	3C
HLM1/3	2C	2G	3C	2C
HLM1/4	3T	2G	3C	2C
HLM6/4D	4TP	4MPG	4MPT	3M
HRNE1/3-4	5M	5PM	5PM	4M
HRNE1/5	5TMP	5MG	5MT	4M

JAT1/2-3	5W	6W	6W	1
JAT3/2-3	5WN	6NW	6NW	2N
KGT1/2	5D	6D	6D	3D
KNRN1/4	4M	4MP	4MP	3M
KNT1/4	3M	3M	3C	3M
KNT4/3	3M	4ME	4ME	3M
KSHR1/3-4	4MT	3M	3M	4M
KSNE1/3	4MP	5PM	5PM	4M
KSR4/3	4M	3EM	3EM	4M
LEOA1/2-3	3M	1	2C	3C
LET1/3	3M	2G	2C	3C
LNB1/3	4MP	5MP	5C	4M
LNB1/4	4MP	5MP	5C	4M
LNB2/3	$4M^{80}5W^{20}$	5WP	5C	3M
LTC2/4-5	$5C^{80}6W^{20}$	6B	NOT RATED	5B
LUP1/3	3M	2G	3C	3C
LUP2/3	$3M^{80}5W^{20}$	5W	5W	2
LVY7/3	5DN	5DN	5DN	3C
MC:S/2-3	6N	6N	6N	4N
MFT2/2-3	$3C^{80}5W^{20}$	5W	5C	1
MGCL1/2-3	2C	2G	2C	3C
MGCL3/2-3	3N	5N	5N	3C
MGLE4/2-3	3EM	3E	3E	4E
MKR1/3	6MT	5JP	5TP	4M
MKR5/3	5TM	5J	5T	3C
NED1/3	5MP	6P	6P	5M
OKPP1/6-8	6TR	6G	6T	4RT
ORG	0	6W	6W	5W
OTP1/3-4	4P	4P	5C	2C
OWHL4/4	4ER	5R	5R	3RE
OWHL4/5D	5TE	6GR	6T	3RE
PNS02/2-3	$2C^{80}5W^{20}$	3W	3W	1
POT1/2-3	6W	6W	6W	3W
PUBZ1/4	3M	2G	3C	3C
PUBZ1/5	4T	4G	4T	3C
PUBZ2/5	$4T^{80}6W^{20}$	5WJ	5WT	2
PUBZ4/4	4E	3E	3C	3C
PUHE1/3	2C	2G	3C	3C
PUHE2/4	$2C^{80}6W^{20}$	5W	5W	2
PULU7/3D	3D	3D	3C	3C
PUR1/3	3M	2G	3C	3C
PUR1/4	3M	2G	3C	3C
PUR1/4D	4T	4G	4T	3C
PUR1/5	4T	4G	4T	3C
PUR2/4	$3M^{80}6W^{20}$	5WJ	5WT	2
PUR2/5	$4T^{80}6W^{20}$	5WJ	5WT	2

PUR4/4	4E	3E	3C	3C
PUR4/5	4TE	4GE	4TE	3C
PUR4/6D	6T	6G	6T	4T
PUR6/4	3M	3MP	3C	3C
PUR6/5	4MT	4MP	4MP	3C
PUR7/3	4D	3D	3C	3C
RB1	6T	6G	6T	4T
RB2	6T	6G	6T	5TR
RB4	6T	6G	6T	3T
RFD1/3-4	4MP	5P	5P	3M
RND1/3	5MP	6MP	6MP	4M
RND1/4	5MP	6MP	6MP	4M
S	6N	6N	6N	5N
SAKN1/3	3M	3M	3M	2C
SASO1/3	2C	2G	3C	2C
SASO4/3	3E	3E	3E	2C
SND2/3	3WDN	5WD	5WD	1
SND4/3	3ED	3D	3D	2C
SNHL1/4D	4T	5G	5G	2C
SOF1/3	2C	2G	3C	2C
SOF2/3	$2C^{80}5W^{20}$	5W	5W	1
SP:F/7-8	6T	6G	NOT RATED	6TB
SPR1/4-5	5CT	6B	NOT RATED	5B
SXT3/2-3	5NM	5N	5N	5M
TUC1/5-6	6T	6GB	NOT RATED	5B
TUSP1/6-7	6T	6G	NOT RATED	6BT
VAC4/5	5RTE	6R	6R	4R
WCT1/3-4	6P	4P	NOT RATED	5B

3.2 Engineering Interpretations.

Soil information compiled in this report may be used for purposes other than agriculture. Engineers and planners are interested in soil properties which affect the construction and maintenance of a variety of projects such as roads, airports, sewage-disposal systems and pipelines to name a few. To provide this information subsoil samples were collected from sites chosen to represent the major soils and parent materials recognized in the county. These samples were subjected to various standard engineering soil tests (Table 7).

This engineering data must be utilized with some caution. The information has limitations related to the scale of mapping, presence of additional soil components with different properties within map units, as well as the relatively small number of samples analyzed. On site investigations and additional analysis would be required to obtain more detail for specific interpretations. The "Guide Book for use with Soil Survey Reports of Alberta Provincial Parks and Recreation Areas", (Greenlee 1981) provides guidelines to assess soils for specific interpretations requiring engineering data.

Table 7. Engineering data for selected series.

Series	Parent Material	% Passing Sieve #4	% Passing Sieve #200	Liquid Limit	Plastic Limit	Plasticity Index	Unified class.	Susceptibility to frost **
Cradduck	till	89	67	35	18	17	CL	F4
Purescape		97	70	38	17	21	CL	F4
Beazer		97	58	35	16	19	CL	F4
Dunvargan							CL*	F4
Spruce Ridge		72	40	36	18	18	SC	F3
Magrath	glaciolacustrine	99	83	43	22	21	CL	F4
Cardston		100	89	51	20	31	CH (CL)	F4
Hegson		100	99	44	20	24	CL (CH)	F4
Del Bonita	cryoturbated	54	38	31	18	13	SC	F3
Knight	ice-contact	95	3	NP	NP		SP	F2
Carway							SP*	F2
Rockford		85	27	20	14	6	SC	F3

*estimated Unified Soil Classification System values.

**Ratings for Susceptibility of Soils to Frost action from U.S. Army Corps of Engineers. 1962.
F1 is slightly susceptible to frost action
F4 is highly susceptible to frost action.

PART 4. SOIL DEGRADATION.

This chapter is subdivided into two sections. The first section considers the areal extent and occurrence of eroded and saline soils, as well as how these soils are described within map units. The second section of this chapter is written by John Hermans, Soil Conservation and Development Branch, Alberta Agriculture. Impacts of erosion on crop production from a yield decline, and economic perspective are briefly considered. Also some soil factors which influence erosion are described. Finally, possible conservation management practices to arrest soil degradation processes are documented.

4.1 Extent of Erosion & Salinity within the M.D. of Cardston.

Soil degradation due to wind and water erosion and to salt affected or saline soils is a major concern in southern Alberta. In the M.D. of Cardston eroded soils are more extensive than saline soils. Approximately 15% or 50,000 ha of the M.D. show significant soil erosion on cultivated areas. This figure does not include areas of naturally eroded soils on steep topography or native range. Salt affected and saline soils occupy roughly 0.6% or 2,000 ha of the survey area.

The majority of the saline areas are associated with landscapes at the base of bedrock ridges such as those around Magrath, Leavitt and Hill Spring (Figure 47). Salts are leached from the bedrock into the groundwater system and subsequently concentrated within the soil profile in downslope discharge areas. During the course of the survey, the extent of saline areas was determined by surface indicators such as the presence of salt tolerant vegetation, patchy crop growth as well as visible salt accumulations on the surface (Figure 48). In addition, soil profiles were carefully examined for the presence of salt crystals at depth. In areas of concern, additional samples for specific salinity related problems were taken to determine salinity levels. With this information, landscapes with dominant and significant proportions of saline soils were delineated and labeled appropriately (:S or 3 map unit designations). Site specific patches of salts, generally less than 10 ha, in size were labeled with S spot symbols.

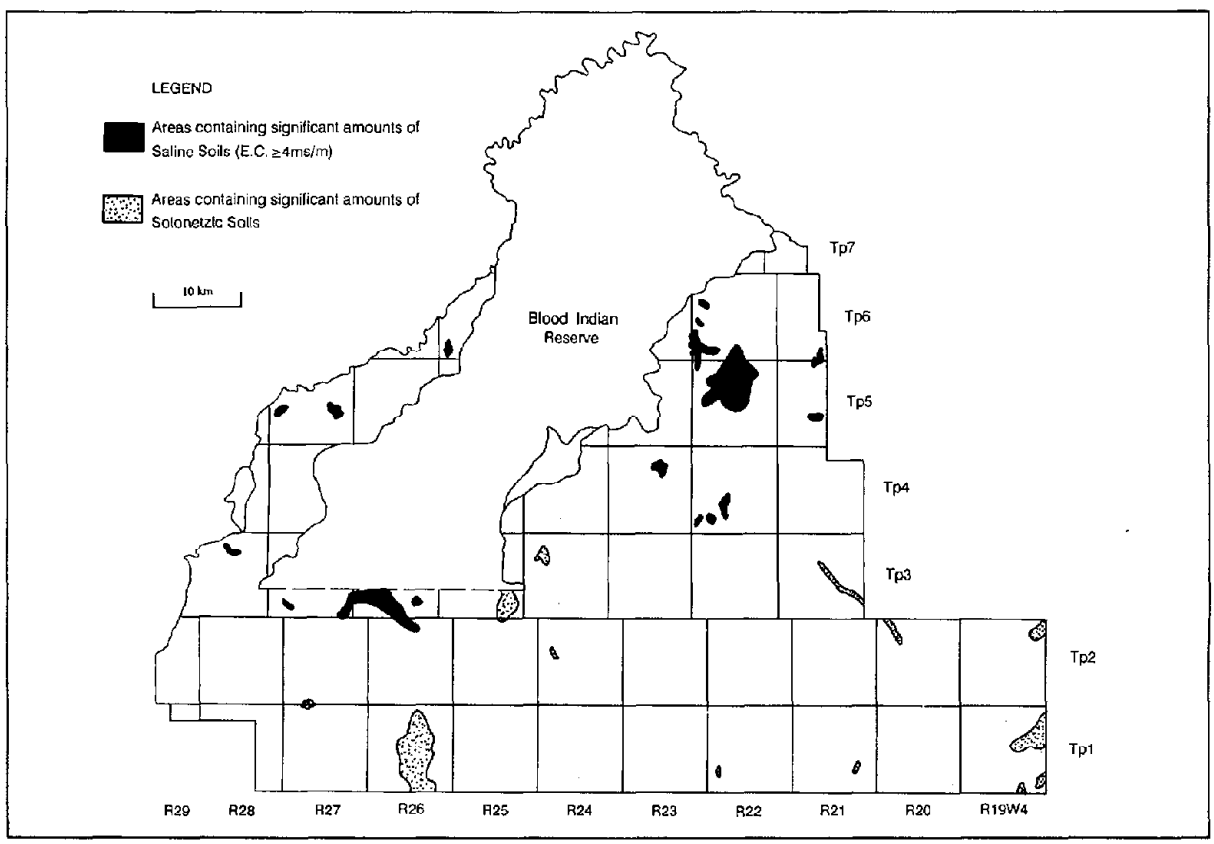


Figure 47. Distribution of salt-affected soils.

Figure 48. Visible salt accumulations at soil surface, an area north of Magrath.

Figure 50. Wind erosion in progress.

Soils in the M.D. of Cardston have eroded principally due to wind action. They are confined to the cultivated plains area east of the Foothills (Figure 49). Even from level, bare cultivated fields, winds easily pick up loose surface soil particles (Figure 50) and deposit them as drift along fences and road side ditches (Figure 51). During the course of the survey, "eroded" soils were recognized by the presence of calcareous parent material at the surface, where the topsoil and subsoil layers have been removed. These soils appear whitish in colour on aerial photographs, as well as in the field when the soil is dry. They are usually con-

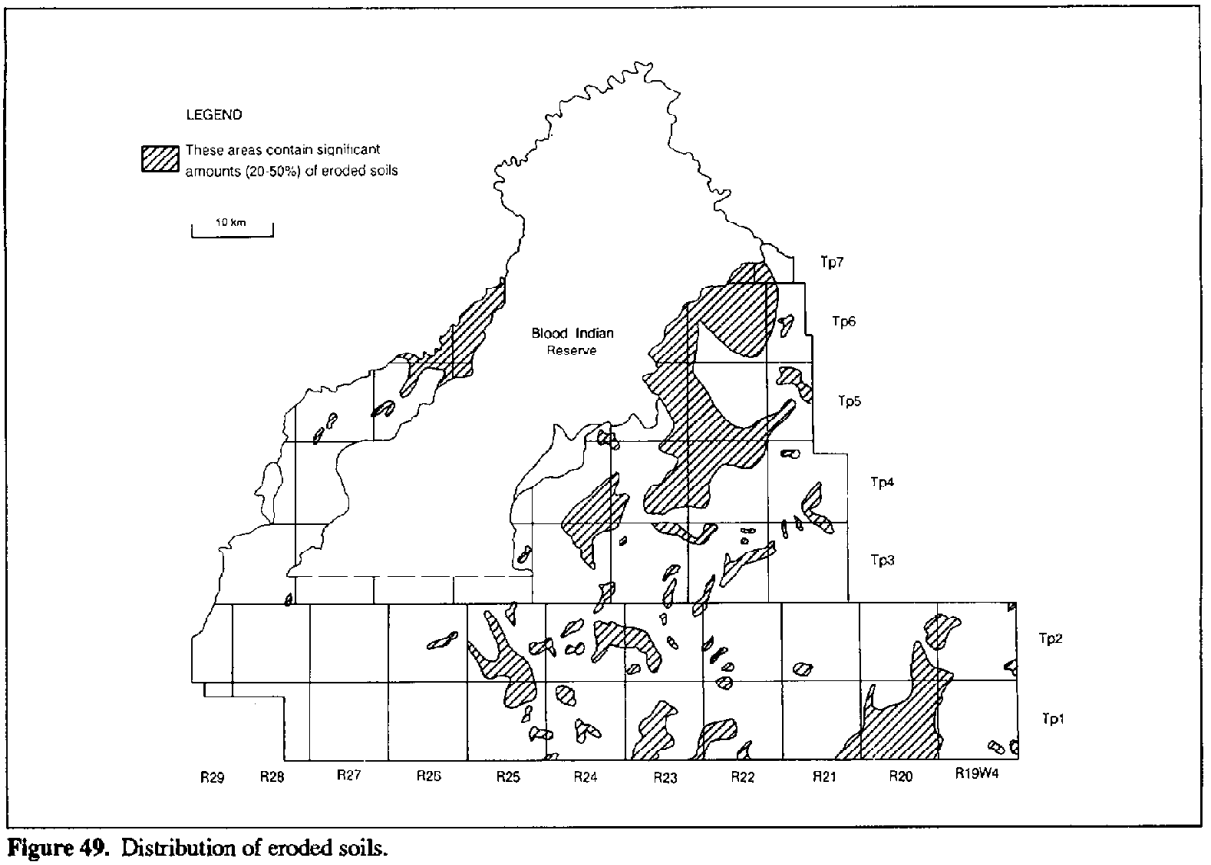


Figure 49. Distribution of eroded soils.

Figure 51. The product of wind erosion, drift accumulations in the ditches.

fined to the tops and upper slopes of knolls. In addition, "thin" soils which are recognized by the presence of an abnormally thin Bm horizon (i.e., 5 cm), were distinguished and noted. These soils have lost their surface topsoil and the subsoil layer is presently being cultivated. Within the landscape, eroded, thin, and normal soil profiles all occur in a complex association. Areas where eroded soils occurred in significant amounts (occupy 20-50% of the area) were delineated and given separate designations ('4' map units). These units describe about 1/3 of the farmland within the MD.

4.2 Soil Degradation: Impacts, Factors and Conservation Management Techniques.

by: John Hermans, Soil Conservation and Development Branch, Alberta Agriculture, Edmonton.

4.2.1 Impacts of erosion on Crop Production.

The negative effects of erosion on crop production stem largely from the loss of part, or all, of the topsoil. Indeed on some parts of fields, such as eroded knolls, we have been cropping subsoils or soils with a shallow layer of topsoil for some time. Highly eroded soils or subsoils do not produce as well primarily because they are low in organic matter. Organic matter is important because it keeps soil loose and friable permitting water movement, air movement and root growth. Organic matter increases the water-holding capacity by as much as 30%. Decaying organic matter releases plant nutrients such as nitrogen and phosphorus. Surface horizons of the soils in the Cardston area contain 4-8% organic matter by weight, while highly eroded soils contain 2% or less. In addition, highly eroded soils may be high in free lime. As a result, many nutrients such as phosphorus become insoluble and are not available for uptake by plants.

The economic impacts of erosion are difficult to assess, however, research has demonstrated that only a portion of the topsoil needs to be removed to reduce the productivity level of the soil. That is, subsoil does not have to be exposed before yields begin to decline. It has been demonstrated that erosion of one inch of topsoil removes as much nitrogen and phosphorus as 500 bushels of wheat. Long-term studies in Alberta have also shown that wheat yields can decline 3-4 bushels per acre for each inch of topsoil removed. This loss continues year after year.

A recent study at Lethbridge documented the amount of fertilizer required to offset the effects of erosion (Figure 52). Increasing fertilizer did increase yields, but where excessive erosion occurred full productivity could not be restored. This serves to demonstrate that additional inputs can offset only a portion of the production loss caused by erosion and at a very significant cost. It has been estimated that on normal Chernozemic soils, it could cost as much as $85,000/ha to replace nutrients lost by wind erosion.

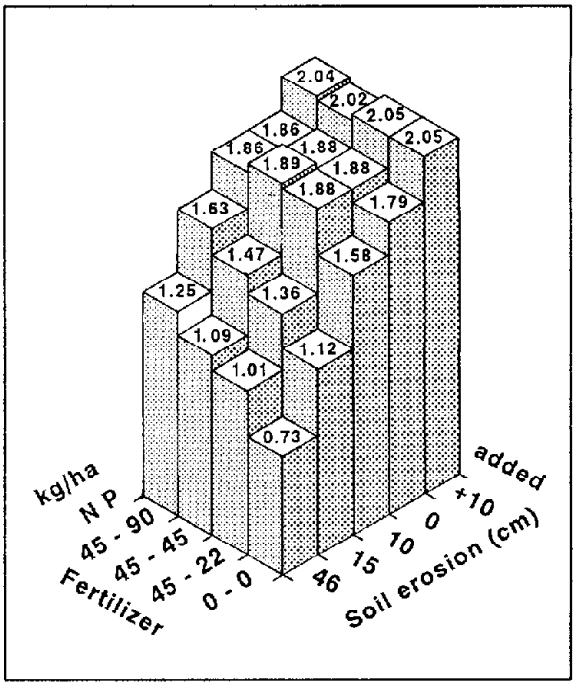


Figure 52. The effect of artificial erosion on wheat yields, (t/ha) 1967-1979 (from Lindwall and Doormar pers. comm. 1989.

The loss of topsoil impacts other aspects of crop production that are difficult to evaluate, but all combined will significantly increase input costs. The poorer tilth associated with eroded soils may result in greater power requirements for tillage operations. Poor surface structure may also result in a poorer

seedbed and/or crusting producing uneven or reduced germination and lower yields. In addition, infiltration and storage of moisture are also reduced, leaving crops prone to moisture stress even in normal years.

4.2.2 Factors Influencing Erosion.

Factors which cause the soil surface to be dry, loose and exposed will contribute to the vulnerability of any soil and subsequent damage by wind erosion.

1. TILLAGE to control weeds, incorporated fertilizers and herbicides and for seedbed preparation reduces protective crop residue cover and pulverizes the soil making it more erodible. Summerfallowed fields which are cultivated repeatedly are often left with insufficient crop residue cover and are particularly susceptible to erosion. The kind of equipment used also influences the amount of residue cover retained during tillage. (Table 8).

Table 8. Amount of residue cover lost by different tillage methods.

Equipment	Approximate Proportions of Residue Buried Per Tillage Operation
Wide-blade cultivator	10%
Cultivator and rodweeder	15%
Cultivator	20%
Discer	40%
One-way disc	50%
Plow	100%

2. SOIL TEXTURE influences how readily soil particles will combine during tillage to form clods. Coarse-textured soils do not form aggregates and are therefore highly susceptible to wind erosion. Fine-textured soils with large proportions of clay form clods that tend to break down easily and are also highly prone to erosion.

3. ORGANIC MATTER gives the topsoil its darker colour and binds the mineral particles into stable aggregates that more easily resist erosion. The Dark Brown and Brown soil of southern Alberta are naturally low in organic matter (2-4%)and over years of cultivation are estimated to have lost 38-47% of their original organic matter.

4. SOIL MOISTURE affects the ability of soil particles to cling together. A moist soil surface will not erode.

5. WIND VELOCITY determines the severity of erosion. Wind speeds as low as 8 mph (13 km/h) can erode highly susceptible soils while wind speeds between 13 and 30 mph (21 and 48 km/h) can erode most unprotected soils. Vegetation or surface roughness can reduce wind velocities at the soil surface, thus decreasing soil particle movement.

Strong, frequent winds and low precipitation characterize the climate of southern Alberta. In particular, chinook winds are especially damaging as they evaporate protective snow cover and dry out the soil surface. The freeze-thaw and drying cycles associated with the chinook winds break down soil aggregates, making the soil much more erodible.

4.2.3 Conservation Management Techniques.

Much of the topsoil loss in these areas occurred during the "Dirty 30's". Fortunately, topsoil loss in recent years has been significantly reduced by new farming techniques as well as a renewed appreciation for the value of some of the older conservation management techniques.

The most effective way to reduce soil erosion losses is to protect the soil from the wind. Soil erosion prevention should be integrated in all farm cultural practices as part of an overall conservation approach to farming. Some of the following measures to reduce losses include:

1. CONSERVATION TILLAGE, that is maintaining sufficient crop residue cover on the soil surface at all times, especially during summerfallow, can reduce much of Alberta's current soil erosion. The benefits of residue cover are reduced wind velocity at the soil surface, snow capture which increases soil moisture content and increased soil organic matter content for formation of soil aggregates. For crop residues to be most effective, stubble should be upright and about 12 inches (30 cm) long.

The amount of crop residue cover needed to prevent erosion depends on soil texture. For an average wind speed, a medium-textured loam requires about 1500 lb/acre (1680 kg/ha) and coarser or finer textured soils require more. As a rule of thumb, about 1.5 lb of residue are produced for each pound of wheat or cereal grain harvested. In dry areas and seasons, usually not more than 1500 lb/acre of residue is produced. Burying some of this low amount of residue by even one or two tillage operations will leave the soil unprotected.

2. STRIP FARMING, that is, the growing of crops in strips alternately with strips of summerfallow, reduces wind erosion by interrupting the cumulative eroding effect of soil movement. To be effective, the strips must be at right angles to the prevailing winds and the summerfallowed strips should be protected by crop residue. The width of the strips necessary to reduce

soil erosion depend on the erodibility of the soil. The following table shows the recommended strip widths for soils of various textures.

Soil Texture	Strip Width
Fine sand, fine sandy loam clay	80 ft (25 m)
Loam, silty loam	160 ft (80 m)
Clay loam, silty clay loam	330 ft (100 m)

3. COVER CROPS, usually oats, barley, fall rye, winter wheat or clover, can be seeded in mid-summer to reduce soil erosion during the winter, and to provide pasture or a saleable crop. Of these cover crops, winter wheat, seeded in either spring or summer, if often preferred because it provides cover and pasture and regrows well. A cover crop seeded in summer killed by spraying, tillage or frost, by the time it is 8 to 12 inches (20 to 30 cm) tall, will not have seriously depleted soil moisture. Weeds or volunteer grain also can serve as cover crops. Cover crops are especially useful on sandy soils where low rainfall limits recropping.

4. WIND BREAKS such as field shelterbelts and barrier strips, help prevent soil erosion by reducing wind velocity over a distance equal to 10 to 20 times their height. In addition, shelterbelts and especially barrier strips trap snow to increase soil moisture and protect soil from aggregate destruction due to alternating freezing and thawing. Increased soil moisture content can increase crop yields and therefore the amount of protective crop residue cover and organic matter returned to the soil.

Field shelterbelts are single rows of trees such as poplar, willow or spruce, or hedges of caragana or lilac. Rows of trees should be planted about every 1000 ft (300 m) and hedges about every 500 ft (150 m). Barrier strips are one or two rows of tall-growing grass, such as tall wheatgrass or an annual such as flax or corn seeded every 50 to 80 feet (15 to 25 m) perpendicular to the direction of the prevailing wind.

4.2.4 Summary.

Soil erosion must be recognized as a problem with serious short and long term effects on soil quality. The methods to reduce erosion, developed since erosion was first recognized as a problem at the beginning of the century, should continue to be used in present day agriculture to prevent a reoccurrence of the serious erosion in the 1920's and 1930's. Changes in farming over the years has resulted in a greater need to plan the incorporation of these methods in everyday practices. An overall conservation attitude toward farming must be adopted to control soil erosion and to ensure protection of our valuable soil resource.

REFERENCES

Alberta Agriculture. 1982. Census of agriculture by I.D., M.D., and County data by region. Statistics Branch, Alberta Agriculture. Edmonton, Alberta. 217pp.

Alberta Environment. 1977. The Canada Land Inventory, soil capability for agriculture in Alberta. Prepared by L.K. Brocke, Pedology Consultants. 24pp.

Alberta Environment. 1982. Geology and soils of the Lee Creek watershed. Prepared by G.L. Steed. 77pp and map.

Alden, W.C. 1912. Pre-Wisconsin glacial drift in the region of Glacier National Park, Montana. G.S.A. Bull. 23: 687-708.

Bascomb, C.L. 1961. A calcimeter for routine use on soil samples. Chemistry and Industry. Nov.11,1961 : 1826-27.

Beaty, C.B., and Young, G.S. 1975. Landscapes of southern Alberta. University of Lethbridge Production Services. 95pp.

Bowser, W.E. 1967. Agroclimatic areas of Alberta - Map. Alberta Institute of Pedology, University of Alberta, Edmonton, Alberta.

Brierley, J.A. 1988. A comparison of two soils from the Milk River Ridge, southwest Alberta. M.Sc. thesis. University of Alberta, Edmonton, Alberta. 183pp.

Calhoun, F.H.H. 1906. The Montana lobe of the Keewatin ice sheet. U.S.G.S. Prof. Paper No. 50. 60pp.

Canada Department of Agriculture. 1976. Glossary of terms in soil science. Publ.1459. 44pp.

Cannon, M.E., and Nielsen, G.A. 1984. Estimating production of range vegetation from easily measured soil characteristics. Soil Sci. Soc. Am. J. 48: 1393-97.

Coen, G.M. and Holland, W.D. 1974. Soils of Waterton Lakes National Park, Alberta. Report and maps. Alberta Institute of Pedology. S-73-33. Edmonton, Alberta. 116pp.

Del Bonita Historical Society. 1981. Heritage of the high country - A history of Del Bonita and surrounding districts. Published by the Del Bonita Historical Society, Del Bonita, Alberta. 606pp.

den Otter, A.A. 1975. Irrigation in southern Alberta 1882-1901. Occasional Paper No.5, Whoop-up Country Chapter Historical Society of Alberta, Lethbridge Alberta. 24pp.

Douglas, R.J.W. 1970. Geology and economic minerals of Canada. Economic Geology Report No.1. Geological Survey of Canada. Ottawa, Ontario. 838pp.

Dreimanis A. 1979. The problems of waterlain tills. In Ch. Schluchtre (ed.) Moraines and Varves, Origin / Genesis / Classification. Proceedings of INQUA Symposium on Genesis and Lithology of Quaternary Deposits. Zurich, 1978.

E.C.S.S. (Expert Committee on Soil Survey) 1987. The Canadian system of soil classification. 2nd ed. Agriculture Canada Publication 1646. 164pp.

Environment Canada. N.D. Canadian climate normals 1951-1980. Temperature and precipitation. Environment Canada, Atmospheric Environment Service, Edmonton, Alberta.

Environment Canada. N.D. Canadian climate normals 1951-1980. Volume 5. Wind. Environment Canada, Atmospheric Environment Service, Edmonton, Alberta.

Environment Canada. N.D. Canadian climate normals 1951-1980. Volume 6. Frost. Environment Canada, Atmospheric Environment Service, Edmonton, Alberta.

Environment Canada. 1972. Soil capability classification for agriculture. The Canada Land Inventory report No. 2. Environment Canada, Ottawa, Ontario. 16pp.

Gary, M., McAfee, Jr. R., and Wolf, C.L. (eds.) 1972. Glossary of geology. American Geological Institute. Washington, D.C. 805pp.

Gee, G.W., and Bauder, J.W. 1979. Particle size analysis by hydrometer: A simplified method for routine textural analysis and sensitivity test of measurement parameters. Soil Sci. Soc. Am. J. 43: 1004-1007.

Green, A.J. and Lord, T.M. 1979. Soils of the Princeton Area of British Columbia. Map sheet 92H/SE. Report No.14. British Columbia Soil Survey, Research Branch, Agriculture Canada. 134pp.

Green, R. 1972. Geological map of Alberta (scale 1:1,267,000). Map 35. Research Council of Alberta, Edmonton, Alberta.

Greenlee, G.M. 1981. Guide book for use with soil survey reports of Alberta provincial parks and recreation areas. Earth Sciences Report 81-1, Alberta Research Council. 66pp.

Horberg, L. 1954. Rocky Mountain and Continental Pleistocene Deposits in the Waterton Region Alberta, Canada. Geological Society of America Bull. 65. 1093-1150.

Irish, E.J.W. 1967. Bedrock geology of Lethbridge, Alberta (scale 1:253,440). Map 20. Geological Survey of Canada. Ottawa, Ontario.

Kjearsgaard A.A., Tajek, J., Pettapiece, W.W. and McNeil, R.L. 1986. Soil survey of the County of Warner, Alberta. Agriculture Canada Research Branch, Alberta Soil Survey Report No. 46. Alberta Institute of Pedology. Report No. S-84-46. 108pp. and maps.

Land Classification Branch Staff. 1983. Procedures manual for land irrigability classification of Alberta. Irrigation Branch Resource Planning Division, Alberta Agriculture. Lethbridge, Alberta. 100pp.

MacMillan, R.A. 1987. Soil survey of the Calgary urban perimeter. Alberta Soil Survey Report No. 45. Alberta Research Council Bull. No. 54. Edmonton, Alberta. 244pp. and maps.

McKeague, J.A., ed. 1978. Manual on soil sampling and methods of analysis. 2nd ed. Can. Soc. Soil Sci. (Land Resource Research Institute, Ottawa, Ontario) 212pp.

Mitchell, C.W. 1973. Soil classification with particular reference to the Seventh Approximation. J. of Soil Sci. Vol. 24 No. 4: 411-420.

Osborne, E.A. 1982. Magrath irrigation district, blocks A, B, and C, Level III, Land Irrigability Classification Report. Land Classification Branch, Irrigation Division, Alberta Agriculture. Lethbridge, Alberta. 20pp and maps.

Peters, T.W. 1963. Soil and topography map of the Blood Indian Reserve, Alberta. (Scale 1:126,720). Canada Department of Agriculture, Soil Research Institute.

Pettapiece, W.W. 1986. Physiographic subdivisions of Alberta (scale 1:1.5 million). Agriculture Canada Research Branch. Edmonton, Alberta. Map.

Reeder, S.W. and Odynsky, Wm. 1969. Reconnaissance soil survey of the Hotchkiss and Keg River area. Alberta Soil Survey Report No. 26. University of Alberta, Edmonton, Alberta. 90pp. and maps.

Richards, L.A. ed. 1954. Diagnosis and improvement of saline and alkali soils. United States Department of Agriculture Handbook No. 60. 160pp.

Rowe, J.S. 1972. Forest regions of Canada. Canadian Forestry Service, Publication No. 1300. 172pp.

Russell, L.S. and Landes, R.W. 1940. Geology of the southern Alberta plains. Geological Survey of Canada Memoirs 221. 182pp.

Shetsen, I. 1980. Sand and gravel resources of the Lethbridge area. Earth Sciences Report 81-4, Alberta Research Council. Edmonton, Alberta. 41pp and maps.

Smoliak, S., Johnston, A., Wroe, R.A., and Turnbull, M.G. 1975. Range pastures in Alberta. Publication No. 134/14. Alberta Dept. of Agriculture and Lands and Forests. 29pp.

Smoliak, S., Johnston, A., Wroe, R.A., and Turnbull, M.G. 1976. Guide to range condition and stocking rates for Alberta. Alberta Energy and Natural Resources. 26pp.

Smoliak, S., Johnston, A., Wroe, R.A., and Yule, D.A. 1981. Range its nature and use. Alberta Energy and Natural Resources, Public Lands Division. 34pp.

Stalker, A. Mac S. 1963. Quaternary stratigraphy in southern Alberta, Canada Geol. Survey Paper No. 62-34. 52pp.

Strong, W.L. and Leggat, K.R. 1981. Ecoregions of Alberta. Alberta Energy and Natural Resources, Edmonton, Alberta. Report No. T/4. 64pp and 1 map.

U.S.D.A. (United States Department of Agriculture) 1951. The soil survey manual. U.S. Dept. of Agric. Handbook No. 18. 503pp.

U.S.D.A. (United States Department of Agriculture, Soil Conservation Service) 1975. Soil taxonomy. A base system of soil classification for making and interpreting soil surveys. Agriculture Handbook No. 436. 754pp.

U.S.D.A. (United States Department of Agriculture, Soil Conservation Service) 1980. Soil survey of Glacier County area and part of Pondera County, Montana. 161pp and maps.

Washburn, A.L. 1973. Periglacial processes and environments. Edward Arnold (pub.) Ltd. 320pp.

Wyatt, F.A., Bowser, W.E., and Odynsky, W. 1939. Soil survey of Lethbridge and Pincher Creek sheets. Bull. No.32. University of Alberta, Edmonton, Alberta. 98pp. and map.

APPENDIX A

SOIL FORMATION AND CLASSIFICATION.

This appendix provides readers of this report with a short description of soil forming factors, characteristics used for describing soils and the Canadian System of Soil Classification.

A.1. Soil Formation.

Soil is the naturally occurring, unconsolidated mineral or organic material at the earth surface, which is capable of supporting plant growth. "Soil consists of a large number of soil individuals that mantle the surface of the earth as a continuum except where interrupted by water, shifting sand, salt deposits, perpetual ice and snow, and steep rocky areas" (p.12 Green and Lord 1979). Each soil individual is a natural body of mineral and organic matter that changes or has changed due to soil genesis.

A.1.1 Soil Forming Factors.

Soil genesis or formation is a complex process involving the five principal factors:

- Parent material, the raw, unaltered material, (building block), which is modified by the remaining soil forming factors.

- Climate, principally temperature and precipitation, controls the rate and type of chemical and physical weathering processes.

- Biota, including vegetation, soil organisms, as well as man, determines the proportion and distribution of organic matter and nutrients in the soil system.

- Topography or relief, influences the climate at the micro and macro scale of the soil environment, which also affects the rate of soil formation or degradation.

- The last factor, is the length of time that soil genesis has acted upon the original parent material.

Soil genesis is a dynamic process. These soil forming factors are interdependent. As a result the product of soil formation varies as one or more of the factors is changed to some degree. Therefore, the distribution of soil types varies greatly across a landscape.

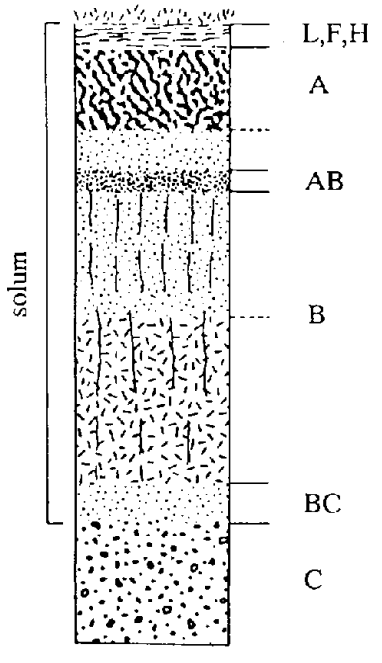


Figure 53. A schematic drawing of a soil profile

Most soils in southern Alberta have developed since the retreat of the Wisconsin-aged glaciers, during the last 10 - 15 thousand years. Within the M.D., as one proceeds from east to west, climatic changes are dramatic; precipitation increases while the frost-free period decreases. The shift in vegetation from mixed grass prairie to coniferous forest, reflect this change in climate. Similarly, the shift in soil characteristics across the M.D. reflect variability of the other interdependent soil forming factors.

The products of soil genesis are observed in vertical exposures, called soil profiles. Soil horizons or layers are the features within the soil profile which are characterized, and ultimately determine the soil classification of the profile. A schematic representation of a soil profile is displayed in Figure 53.

Each soil series has a unique profile that varies in the type and number of horizons. The horizons may differ from each other in one or more of the following characteristics: color, structure, texture, consistence, or chemical composition. The main or master soil horizons and some of their subdivisions are described below. For a more detailed description and explanation of these master horizons and the use of the lower-case suffixes and numerals, refer to the Canadian System of Soil Classification (E.C.S.S., 1987).

L,F, and H - These are organic surface layers. The organic matter is raw in L, partly decomposed in F, and well decomposed in H.

A - This is a mineral horizon at or near the surface. It may be dark colored because of an accumulation of humus (Ah) or light colored when clay, iron and humus have been leached out (Ae).

AB and BA - These are transition horizons.

B - This is a mineral horizon which may be a zone of enrichment or alteration. When clay or iron has accumulated, the horizon is designated Bt or Bf, respectively. When significant amounts of exchangeable sodium has accumulated and the horizon has a characteristic columnar structure, it is called a Bn or Bnt. If the layer is altered to give a change in color or structure, the designation is Bm. Usually lime and salts have been leached out of this horizon.

BC - This is a transition horizon.

C - This is a mineral horizon that is comparatively unaffected by the soil-forming processes operating in the A and B horizons, with the exception of gleying (Cg), the accumulation of calcium or magnesium carbonates (Cca) and soluble salts (Cs).

R - Consolidated rock, which may be close to the surface or many meters below it.

A.1.2 Soil Forming Processes.

Horizons are the product of certain physical, chemical and biological processes. The major processes that occur in the soils of the M.D. of Cardston these processes may be broadly grouped as follows:

Accumulation of organic matter - A dark coloured, organic matter rich, surface horizon is characteristic of soils developed in a prairie environment. Annually, grass roots die and decompose leaving organic matter incorporated within the surface mineral layer. This layer is called an Ah horizon. Under forest vegetation, most organic matter is deposited and accumulates upon the mineral surface (leaves, etc.). These surface organic accumulations are named for increasing degrees of decomposition (L,F, and H, horizons).

In some environments organic matter accumulation exceeds the rate of decomposition and over time, surface organic deposits (greater than 40 cm. thick) occasionally develop. Within the M.D. of Cardston, soils developed on these deposits only occur in the Foothills region.

Leaching of calcium carbonate and bases - Leaching, involves the dissolution from the A and B horizons and subsequent reprecipitation of calcium carbonate, and bases within lower soil horizons. This process occurs in most soils within southern Alberta. The extent of the process is controlled by precipitation variability or the accumulation of surface water. For example, the depth to the Cca horizon is greater in the Foothills portion of the M.D. (precipitation nearly 600 mm) than in the drier eastern portion. Also, the depth to the calcium carbonate is greater in lower slope positions, where surface water accumulates, than on the crests of knolls, within the landscape.

Translocation of clay minerals - Materials weathered and leached from the A horizon are deposited in the underlying horizons. If a significant amount of clay has been translocated from the A to the B horizon, then the receiving horizon is designated a Bt horizon. The presence of clay films on ped faces or pores in the B horizon is often used as an indication of clay movement.

Usually, iron and organic matter are translocated from the A horizon in association with the clay minerals. This results in a bleached or whitish coloured Ae horizon within some soil profiles. Distinct Ae and Bt horizons are characteristic features of Luvisolic soils such as Westcastle and Spruce Ridge, present along the western edge of this survey area.

Reduction of iron - In environments of poor aeration and restricted oxidation, iron is present in the chemically reduced state. This condition is called gleying. When iron is in this form the soil appears dull and grayish in colour. The term "gleyed" is used to describe this condition. Gleying is usually most pronounced in poorly drained soils generally associated with depressional areas. Joanto and Pothole soils are examples.

Under periodic oxidation and reduction conditions, yellowish or reddish brown mottles occur in some horizons. These mottles indicate the segregation of iron into different chemical forms. Generally, this process is controlled by the presence of a seasonal, fluctuating water table.

Solifluction - This is a physical process which alters the appearance of soil profiles. It is a composite process consisting of soil creep and soil flow. Soil creep is the downslope movement of individual soil particles under the

influence of gravity. Soil flow is the plastic movement of a soil material above a saturated layer. This process may occur on gentle slopes.

Soils developed on steep slopes often have disrupted and dislocated horizons due to soil creep, mechanical sorting and the incorporation of materials from other horizons. Soils within the (Spruce Ridge) SP:F/7-8 map unit are examples of this process.

A.2. Soil Classification

A soil classification system organizes soils into an orderly arrangement based on their characteristics. This conceptual reference framework provides a means for communicating, testing and applying pedological information of similar soil entities (Mitchell 1973).

In the M.D. of Cardston soil survey, the soils are classified according to the guidelines established by the Canadian System of Soil Classification (E.C.S.S., 1987). This system is hierarchical in structure, with Order being the highest and broadest level, and Series being the lowest, most specific one. The series is the building block of soil map units which are described in the legend, accompanying the M.D. of Cardston soil map. Series are defined in terms of horizon characteristics and configuration as well as parent material type and texture.

In the M.D. of Cardston, seven soil orders are recognized. A brief description listing the more important characteristics of each order and their occurrence within the M.D. are described below.

Brunisolic soils:

- have B horizons which do not meet Bt or Bf horizon criteria, therefore have Bm horizons.
- Ah horizons, if present, are less than 10 cm thick.
- develop under mixed vegetation, primarily in the transitional grassland areas on well drained positions of the landscape.
- generally confined to the Foothills physiographic region.

Chernozemic soils:

- have an organic rich surface horizon, organic Carbon 1-17%, and at least 10 cm thick.
- have a C:N ratio of less than 17 in the A horizon.
- base saturation is greater than 80%, with Ca being the dominant cation.
- do not have Bnt, Bf or Bg horizons.
- developed under grassland and transitional aspen - grassland vegetative cover.
- mean annual temperature is greater than 0° C

Gleysolic soils:

- have dull soil colours indicative of reducing conditions or gleying.
- usually associated with wet depressional positions in the landscape.
- developed under hydrophytic vegetation (wet conditions).

Luvisolic soils:

- have well developed Bt horizons, containing clay skins, generally beneath an Ae horizon.
- in the survey area thick, earthworm altered, Ah horizons are often present; however the clay translocation process is assumed dominant.
- generally found under pine - spruce vegetation.

Organic soils:

- organic layer must be greater than 40 cm in thickness.
- organic layer must contain more than 17% organic C (30% organic matter).
- organic matter decomposition of the material below 40 cm determines the classification (in Cardston - dominantly mesic decomposition).
- occur in groundwater discharge areas in association with Gleysolic soils.
- vegetative cover consists of sedges and rushes.

Regosolic soils:

- have weak to no profile development - no B horizon present.
- are found on recent deposits or in extensively eroded map units (ie. RB4).
- vegetative cover is variable.

Solonetzic soils:

- have a hard and impermeable B horizon.
- strong columnar or prismatic structure is present in the B horizon.
- have a Ca:Na (Calcium:Sodium) ratio of 10 or less in the B horizon.
- are associated with saline parent materials high in Na.

APPENDIX B

ANALYTICAL METHODS.

The chemical and physical analytical methods which were performed on the soil samples in order to make classification and mapping decisions are outlined. The purpose of each analysis and the procedural methods followed are briefly documented. The majority of the procedures are the same as outlined in McKeague (1978), except where noted.

Reaction or pH - A measure of the acidity or alkalinity of the soil.

Use 0.01 M $CaCl_2$ solution in a 2:1 ratio with soil sample. A pH meter was used. Some field pH's were determined with the Cornell field kits.

Calcium carbonate equivalent - A measure of the calcium carbonate or lime content of a sample.

Dissolution of $CaCO_3$ present in the sample with HCl. The volume of CO_2 evolved is measured using a manometer system. (Bascomb 1961).

Particle size distribution - Determination of the relative amounts of sand, silt and clay in the sample.

The hydrometer method as described by Gee and Bauder (1979) was used. Carbonates and organic matter were not removed.

Organic matter - By multiplying the organic C percentage value by 1.724, organic matter content of the sample is able to be determined.

Total Carbon was determined using the Leco CR 12.1 carbon determinator. Organic carbon is equal to the difference of total carbon minus inorganic C (ie. $CaCO_3$, when present).

Electrical Conductivity - Used as an indicator of the amount of water soluble salts present in the soil. Soils with values of greater than 4mS/cm are saline and plant growth is severely retarded due to the excess salt content.

The electrical conductivity of the solution extracted from a soil saturated paste was obtained. A salinity meter was used. (Richards 1954).

Cation exchange capacity and exchangeable cations - CEC is the measure of the capacity of the colloidal complex for exchangeable cations. Of the exchangeable cations, calcium and sodium are important. The ratio of Ca and Na is an important criterion in the classification of Solonetzic soils.

Exchangeable cations and CEC were determined by ammonium acetate extraction and sodium chloride replacements of the ammonium ion. Ammonium ion concentration was determined by an ion selective electrode. Exchangeable cations were determined by inductively coupled plasma - atomic emission spectroscopy. (ICP-AES).

Nitrogen - This is an important plant nutrient which is usually concentrated in the A horizon of soils in the form of organic matter. The ratio of C and N is an important feature of Chernozemic soils.

Kjeldahl - N was determined by soil digestion and the ammonium ions were measured with a ion selective electrode.

Available moisture - This is the water that is held in the soil that is able to be absorbed by plant roots. It refers to water that is held between 1/3 bar and 15 bar tensions.

The pressure plate extraction method was used.

APPENDIX C

SOIL MAP UNIT AREA IN HECTARES AND PERCENTAGE OF TOTAL AREA.

Map Unit Symbol	Area in ha.	% of Total Area	Map Unit Symbol	Area in ha.	% of Total Area
AV1	5328	1.59	BZR1/5-6D	8953	2.66
AV6	5816	1.73	BZR1/6	568	.17
BDCC1/4-5	454	.14	BZR2/4	14510	4.32
BDNF1/6-7	700	.21	BZR2/5	6019	1.79
BDY1/3-4	278	.08	BZR4/4	3681	1.10
BFRN1/3	3539	1.05	BZR4/5	2752	.82
BFT1/3	1233	.37	BZR4/6D	853	.25
BVA6/4-6	777	.23	BZR6/4	873	.26
BVLT1/3-4	729	.22	BZR6/5	1249	.37
BVNF1/5-6	594	.18	BZR6/5-6D	630	.19
BZCT1/3	15974	4.75	BZR8/4	6237	1.86
BZCT2/3	3352	1.00	BZSO1/3-4	1280	.38
BZCT3/3	3081	.92	BZSO2/2-3	2866	.85
BZCT4/4	2487	.74	BZSO3/3	564	.17
BZOK1/5-6	5096	1.52	CCBD1/5-6	607	.18
BZOK4/4	188	.06	CCNF1/5-6	804	.24
BZOK4/6D	5437	1.62	CFNE1/3-4	764	.23
BZR1/3	11725	3.49	CFT4/2-3	1752	.52
BZR1/4	17002	5.06	CLLE1/2	914	.27
BZR1/4D	2443	.73	CRD1/3	3278	.98
BZR1/5	4923	1.47	CRD1/4	897	.27

Map Unit Symbol	Area in ha.	% of Total Area	Map Unit Symbol	Area in ha.	% of Total Area
CRD2/4	318	.09	DVG1/4D	1100	.33
CRD3/3	96	.03	DVG1/5	1212	.36
CRD4/3	1487	.44	DVG1/6	656	.20
CRD4/4	784	.23	DVG2/3-4	5926	1.76
CRLN1/4	786	.23	DVG2/4-5	5161	1.54
CRLN1/5-6	149	.04	DVG6/4-5	2034	.61
CRMG1/3	4594	1.37	DVG6/5-6	2538	.76
CRMG4/3	3066	.91	DVG7/3-4	1377	.41
CRMG4/4	1394	.41	DVOK1/4-5	716	.21
CRMG4/5	310	.09	DVOK1/5-6	1859	.55
CRVA1/3	905	.27	DVOK1/5-7	4857	1.45
CRVA4/4	1527	.45	FSH7/3	75	.02
CRW1/4	649	.19	G	794	.24
CT:L4/4	125	.04	HEG1/3	2227	.66
CTN1/2-3	11881	3.54	HEG2/3-4	1191	.35
CTN3/3	111	.03	HEG7/3D	981	.29
CTPG1/2-3	653	.19	HLM1/3	1382	.41
DLB1/2	5454	1.62	HLM1/4	1964	.58
DLHL1/3	1015	.30	HLM6/4D	941	.28
DVBV1/4-5	1491	.44	HRNE1/3-4	689	.21
DVFS1/3	200	.06	HRNE1/5	692	.21
DVG1/3	2257	.67	JAT1/2-3	692	.21
DVG1/4	7046	2.10	JAT3/2-3	347	.10

Map Unit Symbol	Area in ha.	% of Total Area	Map Unit Symbol	Area in ha.	% of Total Area
KGT1/2	28	.01	MKR5/3	531	.16
KNRN1/4	1860	.55	NED1/3	329	.10
KNT1/4	439	.13	OKPP1/6-8	764	.23
KNT4/3	236	.07	ORG	135	.04
KNT4/5	137	.04	OTP1/3-4	264	.08
KSHR1/3-4	678	.20	OWHL4/4	1433	.43
KSNE1/3	177	.05	OWHL4/5D	1238	.37
KSR4/3	413	.12	PNSO2/2-3	3590	1.07
LEOA1/2-3	725	.22	POT1/2-3	481	.14
LET1/3	87	.03	PUBZ1/4	2530	.75
LNB1/3	548	.16	PUBZ1/5	546	.16
LNB1/4	475	.14	PUBZ2/5	2511	.75
LNB2/3	215	.06	PUBZ4/4	1316	.39
LTC2/4-5	363	.11	PUHE1/3	577	.17
LUP1/3	174	.05	PUHE2/4	885	.26
LUP2/3	195	.06	PULU7/3D	443	.13
LVY7/3	442	.13	PUR1/3	835	.25
MC:S/2-3	888	.26	PUR1/4	2072	.62
MFT2/2-3	4097	1.22	PUR1/4D	332	.10
MGCL1/2-3	2347	.70	PUR1/5	930	.28
MGCL3/2-3	843	.25	PUR2/4	4457	1.33
MGLE4/2-3	9857	2.93	PUR2/5	3125	.93
MKR1/3	1555	.46	PUR4/4	3733	1.11

Map Unit Symbol	Area in ha.	% of Total Area
PUR4/5	2218	.66
PUR4/6D	848	.25
PUR6/4	496	.15
PUR6/5	446	.13
PUR7/3	159	.05
RB1	11895	3.54
RB2	941	.28
RB4	7065	2.10
RFD1/3-4	277	.08
RND1/3	318	.09
RND1/4	430	.13
S	226	.07
SAKN1/3	957	.28
SASO1/3	275	.08
SASO4/3	1041	.31
SND2/3	616	.18
SND4/3	722	.21
SNHL1/4D	436	.13
SOF1/3	1494	.44
SOF2/3	343	.10
SP:F/7-8	151	.04
SPR1/4-5	213	.06
SXT3/2-3	57	.02
TUC1/5-6	1525	.45
TUSP1/6-7	2242	.67
VAC4/5	273	.08
WCT1/3-4	212	.06
TOTAL	**336029**	**100**

APPENDIX D

GLOSSARY OF TERMS

The majority of the following definitions are extracted from the Glossary of Terms in Soil Science (Agriculture Canada 1976). Other references are indicated where applicable.

acid soil - A soil having a pH of less than 7.0.

alkaline soils - Any soil that has pH greater than 7.0.

alluvial deposit (alluvium) - Material such as clay, silt, sand and gravel deposited by modern streams and rivers.

apron - An extensive, continuous, outspread, blanket-like deposit of alluvial, glacial, eolian or other unconsolidated material derived from an identifiable source and deposited at the base of a headland. (Gary et al. 1972)

asymmetric valleys - Valleys that have one side steeper than the other, usually associated with periglacial environments. (p.212 Washburn 1973)

Atterberg limits - The moisture contents of a soil mass at which it changes from one major physical state to another. The Atterberg limits most useful for engineering purposes are liquid limit and plastic limit. The liquid limit is the moisture at which a soil passes from a plastic to liquid state. The plastic limit is the moisture content at which a soil changes from a semi-solid to a plastic state.

bedrock - The solid rock underlying soils and the regolith or exposed at the surface.

blanket - A relatively uniform cover of unconsolidated material which is thick enough to mask irregularities in the underlying unit, or exceeds 1 m in thickness.

boulders - Coarse fragments greater than 60 cm. in diameter.

bulk density, soil - The mass of dry soil per unit bulk volume.

calcareous class - The amount of carbonates present in the soil are expressed as $CaCO_3$ equivalent. Five classes are recognized in terms of $CaCO_3$ equivalent percentage values: Weak 5%; Moderate 5-15%; Strongly 15-25%; Very strongly 25-40% and Extreme 40%. (E.C.C.S. 1982)

calcareous soil - Soil containing sufficient calcium carbonate (often with magnesium carbonate) to effervesce visibly when treated with cold 0.1N hydrochloric acid.

capability class (soil) - The class indicates the general suitability of the soils for agricultural use. It is a grouping of subclasses that have the same relative degree of limitation of hazard. The limitation or hazard becomes progressively greater from Class 1 to Class 7.

capability subclass (soil) - This is a grouping of soils with similar kinds of limitations and hazards. It provides information on the kind of conservation problem or limitation. The class and subclass together provide the map user with information about the degree and kind of limitation for broad land use planning and for the assessment of conservation needs.

carbon-nitrogen ratio - The ratio of the weight of organic carbon to the weight of total nitrogen in a soil or in organic material. It is obtained by dividing the percentage of organic carbon (C) by the percentage of total nitrogen (N).

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

cation exchange capacity (C.E.C.) - A measure of the total amount of exchangeable cations that can be held by the soil; it is expressed in terms of milliequivalents per 100 g of soil.

chroma, color - The relative purity, strength, or saturation of a color; directly related to the dominance of the determining wavelength of the light and inversely related to grayness; one of the three variables of color.

clay - As a particle-size term: a size fraction mm equivalent diameter.

clod - A compact, coherent mass of soil produced by digging or plowing.

coarse fragments - Rock or mineral particles 2.0 mm in diameter.

coarse textured - The texture exhibited by sands, loamy sands, and sandy loams except very fine sandy loam. A soil containing large quantities of these textural classes.

cobbles - Coarse fragments 7.5 to 25 cm. in diameter.

consistency - (i) The resistance of a material to deformation or rupture. (ii) The degree of cohesion or adhesion of the soil mass.

control section - The vertical section upon which soil classification is based. The control section extends to a depth of 120 cm or to the lithic contact for mineral soils, and to 160 cm for organic soils.

creep - Slow mass movement of soil material down steep slopes primarily under the influence of gravity, but aided by saturation with water and alternate freezing and thawing.

cryoturbation - Refers to the stirring, churning or mixing modification of the soil material as a result of intensive frost action, which may be associated with periglacial environments. (Gary et al. 1972)

deposit - Material left in a new position by a natural transportation agent such as water, wind, ice or gravity, or by the activity of man.

dissected - Product of erosion where a relatively even topographic surface which has been sculptured or destroyed by the formation of gullies, ravines or canyons or other kinds of valleys by erosions. (Gary et al. 1972)

dominant soil - Specific soil type which occupies between 40-100% of the soil unit.

droughty soil - Sandy or very rapidly drained soil.

dryland farming - The practice of crop production in low-rainfall areas without irrigation.

dunes - Wind built ridges and hills of sand formed in the same manner as snowdrifts. They are started by some obstruction such as a bush, boulder, fence, or other obstacle which causes an eddy, or otherwise thwarts the sand-laden wind. Once begun, the dunes themselves offer further resistance and they grow to form various shapes.

eluviation - The removal of soil material in suspension or in solution from a layer or layers of soils.

end moraine - A ridgelike accumulation of drift built along any part of the margin of an active glacier.

engineering tests - Laboratory tests made to determine the physical properties of soils that affect their uses for various types of engineering construction.

eolian deposit - Material deposited by wind, including both loess and dune sand.

erosion - The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep.

esker - A winding ridge of irregularly stratified sand, gravel and cobbles laid down under the ice by a rapidly flowing glacial stream.

evapotranspiration - The loss of water from a given area during a specified time by evaporation from the soil surface and by transpiration from the plants.

fan - Material deposited by a stream when it emerges from hills unto a lowland where there is a marked decrease in gradient.

fertility, soil - The status of a soil with respect to the amount and availability to plants of elements necessary for plant growth.

fine textured - Consisting of or containing large quantities of the fine fractions, particularly of silt and clay.

floodplain - The land bordering a stream, built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

fluvial deposit - All sediments, past and present, deposited by flowing water, including glaciofluvial deposits.

friable - A consistency term pertaining to the ease of crumbling of soils.

frost-free period - Season of the year between the last frost of spring and first frost of fall.

glacial drift - Embraces all rock material transported by glacier ice, glacial meltwater, and rafted by icebergs. This term includes till, stratified drift and scattered rock fragments.

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

glaciolacustrine deposits - Deposits composed of suspended material brought by meltwater streams flowing into lakes bordering the glaciers. (Gary et al. 1972)

gravel - Coarse fragments 2 mm. to 7.5 cm. in diameter.

gravelly - Modifier for material containing appreciable or significant amounts (20%) of gravel.

ground moraine - An unsorted mixture of rocks, boulders, sand, silt and clay deposited by glacial ice. The predominant material is till, though stratified drift is present in places. The till is thought to have accumulated largely by lodgement beneath the ice but partly also by being let down from the upper surface of the ice through the ablation process. Ground moraine is most commonly in the form of undulating plains with gently sloping swells, sags and enclosed depressions.

groundwater - That portion of the total precipitation which at any particular time is either passing through or standing in the soil and the underlying strata and is free to move under the influence of gravity.

horizon - A layer of soil or soil material approximately parallel to the land surface; it differs from adjacent genetically related layers in properties such as color, structure, texture, consistence and chemical, biological and mineralogical composition.

hue, color - The aspect of color that is determined by the wavelengths of light, and changes with the wavelength. Munsell hue notations indicate the visual relationship of a color to red, yellow, green, blue or purple or an intermediate of these hues.

hummocky - A very complex sequence of slopes extending from somewhat rounded depressions or kettles of various sizes to irregular to conical knolls or knobs. There is a general lack of concordance between knolls or depressions. (E.C.S.S. 1987)

ice-contact material - Stratified drift deposited in contact with melting glacier ice, such as an esker, kame, kame terrace, or a feature marked by numerous kettles. (Gary et al. 1972)

illuviation - The process of depositing soil material removed from one horizon to another in the soil; usually from an upper to a lower horizon in the soil profile. Illuviated substances include silicate clay, iron and aluminum hydrous oxides and/or organic matter.

immature soil - A soil with indistinct or only slightly developed horizons.

impeded drainage - A condition which hinders the movement of water through soils under the influence of gravity.

impervious - Resistant to penetration by fluids or by roots.

inclusion soil - This specific soil type occupies less than 20% of the map unit. The presence of this soil does not alter the interpretative ratings of the unit.

indicator plants - Plants characteristic of specific soil or site conditions.

infiltration - The downward entry of water into the soil.

intergrade - A soil that possesses moderately well-developed distinguishing characteristics of two or more genetically related taxa.

irrigation - The artificial application of water to the soil for the benefit of growing crops.

kame - A long, low, steep-ridged, hummock or short irregular ridge composed chiefly of poorly sorted and stratified sand and gravel deposited by subglacial stream as an alluvial fan, or delta against or upon the terminal margin of a melting glacier. (Gary et al. 1972)

lacustrine deposit - Material deposited in lake water and later exposed either by lowering the water level or by uplift of the land. These sediments range in texture from sands to clays.

lacustro-till - Deposits considered to consist of till that has been partially sorted or deposited in glacial lakes (p.23 Reeder & Odynsky 1969). Waterlain till, a crudely stratified variety of till deposited in water, is now the more widely accepted term for these materials (lacustro-till) (Dreimanis 1979). Within this study area, this drift is siltier and finer textured than the more extensive, normal till. Varves may be visible in exposures. Lacustro-till is described as being synonymous with glaciolacustrine.

landscape - All the natural features such as fields, hills, forests, water, etc., which distinguish one part of the earth's surface from another part. Usually it is the portion of land or territory which the eye can comprehend in a single view, including all its natural characteristics.

leaching - The removal of soil materials in suspension or solution from a soil or soil horizon.

lime concretion - An aggregate of precipitated calcium carbonate, or of other material cemented by precipitated calcium carbonate.

liquid limit - (upper plastic limit) - (i) The water content corresponding to an arbitrary limit between the liquid and plastic states of consistency of a soil. (ii) The water content at which a part of soil, cut by a groove of standard dimensions, will flow together for a distance of 12 mm under the impact of 25 blows in a standard liquid limit apparatus.

lithic - A general term referring to soils with consolidated (hard) bedrock within 1 m.

loess - A widespread, homogeneous commonly non-stratified porous, friable unconsolidated but slightly coherent usually calcareous material deposited by wind. This wind blown dust is believed to be generally of Pleistocene age, carried from source areas such as alluvial valleys, outwash plains and unconsolidated glacial material, prior to the establishment of vegetation cover. (Gary et al. 1972)

loose - A soil consistence term.

mature soil- A soil with well-developed soil horizons produced by the natural processes of soil formation.

medium textured - Intermediate between fine-textured and coarse-textured (soils). (It includes the following textural classes: very fine sandy loam, loam, silt loam, silt, clay loam, sandy clay loam and silty clay loam).

microrelief - Small-scale, local difference in topography, including mounds, swales, or pits that are only a few feet in diameter and with elevation differences of up to 6 feet.

mottles - Spots or blotches of different color or shades of color interspersed with the dominant color.

Munsell color system - A color designation system that specifies the relative degree of the three simple variables of color: hue, value, and chroma. See chroma, hue, and value.

neutral soil - A soil in which the surface layer, at least to normal plow depth, is neither acid nor alkaline in reaction.

nunatak - An isolated hill or knob of bedrock that projects prominently above the surface of a glacier and is completely surrounded by glacier ice. (Gary et al. 1972)

organic matter - The decomposition residues of plant material derived from: (a) plant materials deposited on the surface of the soils; and (b) roots that decay beneath the surface of the soil.

outwash - Sediments washed out by flowing water beyond the glacier and laid down as stratified drift in thin foreset beds. Particle size may vary from boulders to silt.

paralithic - (lithic-like) - Refers to weathered bedrock which is permeable and penetratable by plant roots. The material is "diggable" and has a hardness on the Moh's hardness scale. Coarse fragment content of this boundary layer between soil and solid bedrock increases with depth until consolidated rock is encountered. (U.S.D.A. 1975)

parent material - The unconsolidated and more or less chemically weathered mineral or organic matter from which the solum of a soil is developed by pedogenic processes.

particle size - The effective diameter of a particle measured by sedimentation, sieving, or micrometric methods.

particle size analysis - The determination of the various amounts of the different seperates in a soil sample usually by sedimentation and sieving.

ped - A unit of soil structure such as a prism, block, or granule, formed by natural processes (in contrast with a clod, which is formed artificially).

pedology - Those aspects of soil science involving the constitution, distribution, genesis and classification of soils.

percolation, soil water - The downward movement of water through soil. Especially, the downward flow of water in saturated or nearly saturated soil at hydraulic gradients of the order of 1.0 or less.

pH, soil - The negative logarithm of the hydrogen-ion activity of a soil. The degree of acidity (or alkalinity) of a soil as determined by means of glass, quinhydrone, or other suitable electrode or indicator at a specified moisture content of soil-water ratio, and expressed in terms of the pH scale.

phase, soil - A subdivision of a soil type or other unit of classification having characteristics that affect the use and management of the soil, but which do not vary sufficiently to differentiate it as a separate type. A variation in a property or characteristic such as degree of slope, degree of erosion, content of stones, etc.

plastic limit - (i) The water content corresponding to an arbitrary limit between the plastic and the semisolid states of consistency of a soil. (ii) Water content at which a soil will just begin to crumble when rolled into a thread approximately 3 mm in diameter.

plasticity index - The numerical difference between the liquid and the plastic limit or, synonymously, between the lower plastic limit and upper plastic limit.

platy - Consisting of soil aggregates that are developed predominately along the horizontal axes, laminated; flaky.

profile, soil - A vertical section of the soil through all its horizon and extending into the parent material.

reaction, soils - The degree of acidity or alkalinity of soil, usually expressed as a pH value.

residual material - Unconsolidated and partly weathered mineral materials accumulated by disintegration of consolidated rock in place.

riser - The vertical or steeply sloping surface of one of a series of natural step-like landforms, as those of successive stream terraces. (Gary et al. 1972)

saline soil - A nonalkali soil containing soluble salts in such quantities that they interfere with the growth of most crop plants. The conductivity of the saturation extract is greater than 4 mmhos/cm, the exchangeable-sodium percentage is less than 15, and the pH is usually less than 8.5.

salinization - The process of accumulation of salts in soils.

salt-affected soils - Soil that has been adversely modified for the growth of most crop plants by the presence of certain types of exchangeable ions or of soluble salts or an excess of exchangeable sodium or both.

sand - A soil particle between 0.05 and 2.0 mm in diameter.

series, soil - The second category in the Canadian Classification system. This is the basic unit of soil classification consisting of soils which are essentially alike in all major profile characteristics except the texture of the surface.

significant soil - Specific soil type occupies between 20-50% of the soil unit.

silt - A soil separate consisting of particles between 0.05 to 0.002 mm in equivalent diameter.

slope - The degree of deviation of a surface from horizontal, measured in a numerical ratio, percent and degree.

soil - The unconsolidated mineral material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.

soil classification - The systematic arrangement of soils into categories and classes on the basis of their characteristics. Broad groupings are made on the basis of general characteristics and subdivisions on the basis of more detailed differences in specific properties.

soil complex - A mapping unit used in detailed and reconnaissance soil surveys where two or more defined soil units are so intimately intermixed geographically that it is impractical, because of the scale used, to separate them.

soil moisture - Water contained in the soil.

soil structure - The combination or arrangement of primary soil particles into secondary particles, unit or peds. These secondary units may be, but usually are not, arranged in the profile in such a manner as to give a distinctive characteristics pattern. The secondary units are characterized and classified on the basis of size, shape, and degree of distinctness into classes, types, and grades, respectively.

soil survey - "Includes the researches necessary (i) to determine the important characteristics of soils, (ii) to classify soils in to defined types and other classificational units, (iii) to establish and to plot on maps the boundaries among kinds of soil, and (iv) to correlate and to predict the adaptability of soils to various crops, grasses and trees, their behaviour and productivity under different management systems, and the yields of adapted crops under defined sets of management practices." (p.23, U.S.D.A. 1951)

soil variant - A soil whose properties are believed to be sufficiently different from other known soils to justify a new series name but comprising such a limited geographic area that creation of a new series is not justified.

solum (plural sola) - The upper horizons of a soil in which the parent material has been modified and within which most plant roots are confined. It consists usually of A and B horizons.

stones - Coarse fragments 25 to 60 cm. in diameter.

terrace - A nearly level, usually narrow, plain bordering a river, lake, or sea. Rivers sometimes are bordered by a number of terraces at different levels.

till - Unstratified glacial drift deposited directly by the ice and consisting of clay, sand, gravel, and boulders intermingled in any proportion.

topography - The relative positions and elevations of the natural or man made features of an area that describe the configuration of it's surface.

toposequence - A sequence of related soils that differ, one from the other, primarily because of topography as a soil-formation factor.

tread - The flat or gently sloping surface of one of a series of natural step-like landforms, as those of successive stream terraces.(Gary et al. 1972)

value, color - The relative lightness of intensity of color and approximately a function of the square root of the total amount of light. One of the three variables of color.

veneer - Unconsolidated materials too thin to mask the minor surface irregularities of the underlying unit. A veneer will range between 100 centimeters and 1 meter in thickness and will possess no form typical of the materials genesis.

weathering - The physical and chemical disintegration, alteration and decomposition of rocks and minerals at or near the earth's surface by atmospheric agents.

LIST OF SOIL SERIES BY PARENT MATERIAL, TAXONOMY AND AGROCLIMATE

CLASSIFICATION			Till			Lacustro till	Lacustrine		Lacustrine or Fluvial		Glaciofluvial								Eolian	Residual
			blanket		veneer rock	blanket	blanket	veneer till	blanket		blanket					veneer gravel	fan		blanket	blanket
			med	stony med	med	fine	fine	med	med	med coarse	med	coarse	med-coarse	gravelly med	gravelly coarse	med	fine	med	med	med
	O.DB	2A	CRD		VAC	MGT	CLD		LET	OAS		KSR HRK			NED					
	O.DB	2A(H)	PUR			HEG		LUP				KSR HRK			NED	CFT				
	O.BL	2A(H)	BZR		OKY		PNR		SOF	SAK		KNT		RFD	RND	BFT	SND	HLM	DLB	OWD
	O.BL	2H	BZR		OKY	CTN	PNR		SOF	SAK	LVY	KNT		RFD	RND	BFT	SND			
	O.BL	3H	DVG			FSH						CRW		OTP	LNB					
	R.DB	2A	VEB																	
	R.DB	2A(H)	WID																	
	R.BL	2A(H)	PSO																	
	R.BL	2H	PSO																	
	R.BL	3H	PSO																	
	O.DG	3H	BVA		BDY															
	O.EB	3H-5H			NFK															
	D.GL	5H	LTC		CCR															
	O.GL	5H	SPR	WCT																
		2A(H)							JAT											
	Gleysols	2H							JAT											
		3H					POT													
	Sz	2A(H)					KGT													
		2H					PGN													
	Regosols	2A(H)											SXT		MKR					

Soil boundary

Zonal boundary

International boundary

County boundary

Reserve, park boundary

Township & Range line

Township & Range intersection

Main highway

Stream, lake

Dyke

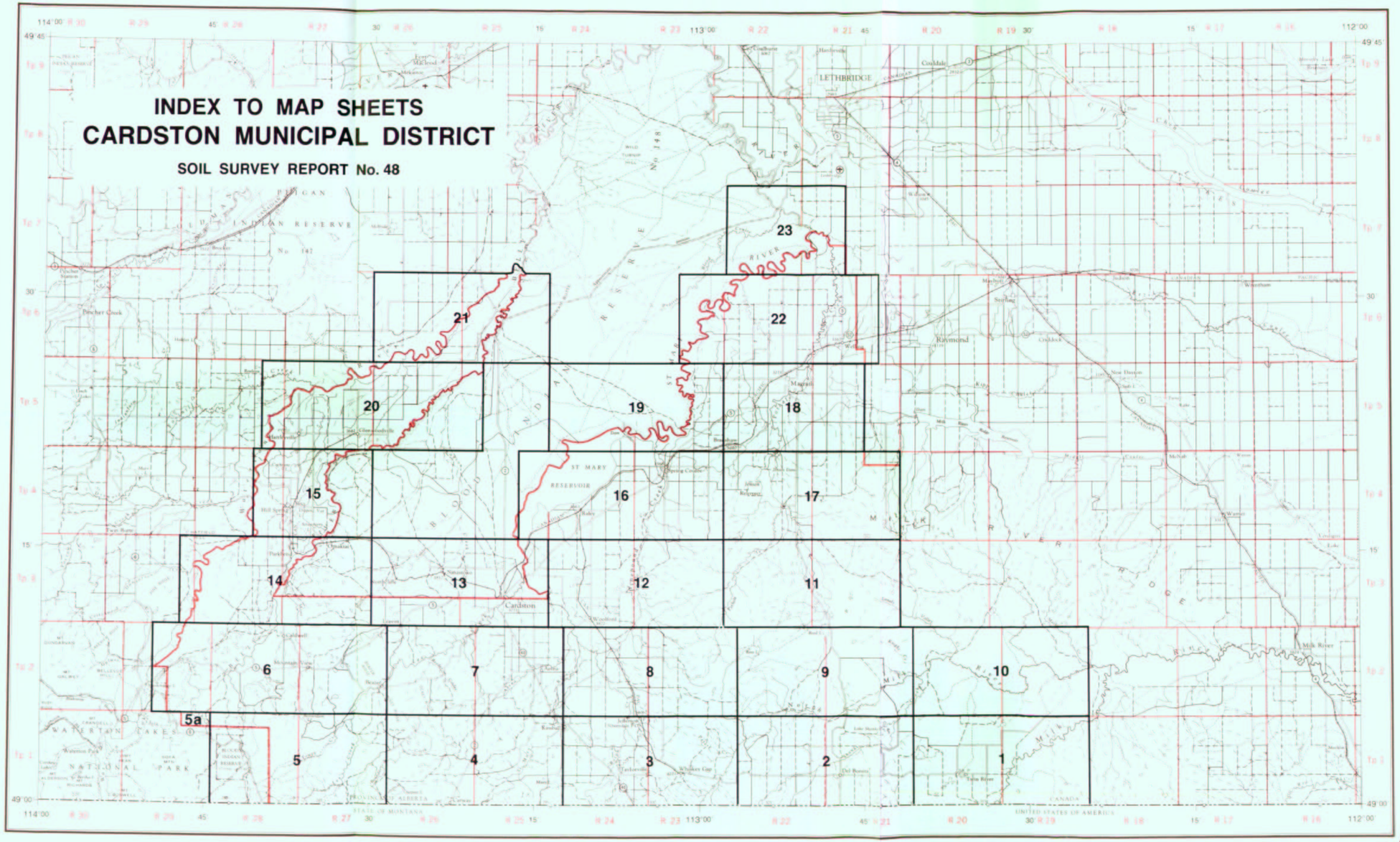
1:50,000

Kilometres 1 0 1 2 3 Kilometres

Miles 1 ½ 0 1 2 Miles

INDEX TO MAP SHEETS
CARDSTON MUNICIPAL DISTRICT

SOIL SURVEY REPORT No. 48



MAP UNIT SYMBOL	MAP UNIT NAME	PARENT MATERIAL(S)	SURFACE EXPRESSION AND SLOPE	MAJOR SOIL COMPONENT(S)
MGCL1/2-3	Magrath-Coaldale	Fine textured lacustro-till and fine textured lacustrine.	Level to undulating. 0-5%	O.DB MGT 40-60% O.DB CLD 40-60%
MGCL3/2-3	Magrath-Coaldale	Fine textured lacustro-till and fine textured lacustrine.	Level to undulating. 0-5%	O.DB MGT 30-50% O.DB CLD 30-50% Saline soils 20-40%
MGLE4/2-3	Magrath-Lethbridge	Fine textured lacustro-till and medium textured lacustrine.	Level to undulating. 0-5%	O.DB MGT 30-50% O.DB LET 30-50% R.DB WLG,DIM 20-40%
MKR1/3	Milk River	Coarse textured fluvial blanket-veneer over gravel.	Terraced and undulating. 2-5%	CU.HR MKR 40-60%
MKR5/3	Milk River	Coarse and medium textured fluvial blanket-veneer over gravel.	Terraced and undulating. 2-5%	CU.R MKR 30-50% O.DB soils 30-50%
NED1/3	New Dayton	Gravelly coarse textured glacio-fluvial.	Terraced and undulating. 2-5%	O.DB NED 60-80%
OKPP1/6-8	Ockey-Porcupine	Medium textured till veneer and medium textured colluvium over residual material, paralithic. Bed-rock outcrops.	Ridged. 15-70%	O.BL OKY 30-50% O.BL PPE 20-30% O.BL DVG 20-30%
ORG	Organic	Mesic organic material over fine textured lacustrine.	Level to undulating. <3%	Terric Mesisols 60-90%
OTP1/3-4	Outpost	Gravelly medium textured glacialfluvial.	Undulating to hummocky. 3-9%	O.BL OTP 60-80%
OWHL4/4	Owendale-Hillmer	Medium textured residual material and medium textured slopewash material.	Hummocky and inclined. 5-9%	O.BL OWD 30-50% O.BL HLM 30-50% R.BL soils and O.R 20-40%
OWHL4/5D	Owendale-Hillmer	Medium textured residual material and medium textured slopewash material.	Inclined and dissected. 9-15%	O.BL OWD 30-50% O.BL HLM 30-50% R.BL soils and O.R 20-40%
PNSO2/2-3	Pincher-Standoff	Fine and medium textured lacustrine.	Level to undulating. 0-5%	O.BL PNR 30-50% O.BL SOF 30-50% Gleyed soils, Gleysolics and Water 15-30%
POT1/2-3	Pothole	Fine textured lacustrine.	Level 0-3%	O.HG POT 60-80%
PUBZ1/4	Purescape-Beazer	Medium textured till.	Hummocky. 5-9%	O.DB PUR 50-80% O.BL BZR 20-50%
PUBZ1/5	Purescape-Beazer	Medium textured till.	Hummocky. 5-9%	O.DB PUR 50-80% O.BL BZR 20-50%
PUBZ2/5	Purescape-Beazer	Medium textured till.	Hummocky. 9-15%	O.DB PUR 40-60% O.BL BZR 20-40% Gleyed soils, Gleysolics and Water 15-30%
PUBZ4/4	Purescape-Beazer	Medium textured till.	Hummocky and inclined. 5-9%	O.DB PUR 50-70% O.BL BZR 20-30% R.DB WID 20-40%
PUHE1/3	Purescape-Hegson	Medium textured till and fine textured lacustro-till.	Undulating. 2-5%	O.DB PUR 40-60% O.DB HEG 30-50%
PUHE2/4	Purescape-Hegson	Medium textured till and fine textured lacustro-till.	Hummocky. 5-9%	O.DB PUR 40-60% O.DB HEG 20-40% Gleyed soils, Gleysolics and Water 15-30%
PULU7/3D	Purescape-Lupen	Medium textured till and medium textured lacustrine veneer over till.	Inclined and dissected. 2-5%	O.DB PUR 40-60% O.DB LUP 20-40% SZ. soils 20-40%
PUR1/3	Purescape	Medium textured till.	Undulating. 2-5%	O.DB PUR 60-90%
PUR1/4	Purescape	Medium textured till.	Hummocky. 5-9%	O.DB PUR 60-90%
PUR1/4D	Purescape	Medium textured till.	Inclined and dissected. 5-9%	O.DB PUR 60-90%
PUR1/5	Purescape	Medium textured till.	Hummocky. 9-15%	O.DB PUR 60-90%
PUR2/4	Purescape	Medium textured till.	Hummocky. 5-9%	O.DB PUR 50-70% Gleyed soils, Gleysolics and Water 15-30%
PUR2/5	Purescape	Medium textured till.	Hummocky. 9-15%	O.DB PUR 50-70% Gleyed soils, Gleysolics and Water 15-30%
PUR4/4	Purescape	Medium textured till.	Hummocky. 5-9%	O.DB PUR 40-60% R.DB WID 20-50%
PUR4/5	Purescape	Medium textured till.	Hummocky. 9-15%	O.DB PUR 40-60% R.DB WID 20-50%
PUR4/6D	Purescape	Medium textured till.	Inclined and dissected. 15-30%	O.DB PUR 40-60% R.DB WID 20-50%
PUR6/4	Purescape	Medium textured till and gravelly medium to coarse textured glaciofluvial.	Hummocky. 5-9%	O.DB PUR 60-80% O.DB gravelly phases of PUR 20-40%
PUR6/5	Purescape	Medium textured till and gravelly medium textured glaciofluvial.	Hummocky. 9-15%	O.DB PUR 60-80% O.DB gravelly phases of PUR 20-40%
PUR7/3	Purescape	Medium textured till.	Undulating. 2-5%	O.DB PUR 50-70% SZ. soils 20-30%
RB1	Rough Broken	Undifferentiated rough broken land.	Coulee sides and river banks. >10%	O.DB and O.BL soils 40-60% R.DB, R.BL soils and O.R 40-60%
RB2	Rough Broken	Undifferentiated rough broken land, with significant bedrock outcrops.	Coulee sides and river banks. >10%	R.DB, R.BL soils and O.R 50-70% O.DB and O.BL soils 30-50%
RB4	Rough Broken	Undifferentiated rough broken land. Erosional channels.	Coulees and gullies. >5%	O.DB and O.BL soils 40-60% R.DB, R.BL soils and O.R 40-60%
RFD1/3-4	Rockford	Gravelly medium textured glaciofluvial.	Undulating to hummocky. 2-9%	O.BL RFD 60-80%
RND1/3	Rinard	Gravelly coarse textured glacio-fluvial.	Terraced and undulating. 2-5%	O.BL RND 60-80%
RND1-4	Rinard	Gravelly coarse textured glacio-fluvial.	Terraced and hummocky or ridged. 5-9%	O.BL RND 60-80%
S	Saline areas	Glaciofluvial, lacustrine or till.	Level. <5%	Saline soils 60-80%
SAKN1/3	Sakalo-Knight	Discontinuous medium textured lacustrine veneer over coarse textured glaciofluvial.	Undulating. 2-5%	O.BL SAK 40-60% O.BL KNT 20-40%
SASO1/3	Sakalo-Standoff	Medium textured lacustrine veneer and blanket over coarse textured glaciofluvial.	Undulating. 2-5%	O.BL SAK 40-60% O.BL SOF 30-50%
SASO4/3	Sakalo-Standoff	Medium textured lacustrine veneer and blanket over coarse textured glaciofluvial.	Undulating. 2-5%	O.BL SAK 30-50% O.BL SOF 30-50% R.BL soils and O.R 20-40%
SND2/3	Shandor	Fine textured slopewash material derived from fine textured residual material.	Undulating. 2-5%	O.BL SND 50-70% Gleyed soils, Gleysolics and Water 15-30%
SND4/3	Shandor	Fine textured slopewash material derived from fine textured residual material.	Undulating. 2-5%	O.BL SND 50-70% R.BL soils and O.R 20-40%
SNHL1/4D	Shandor-Hillmer	Fine textured slopewash material derived from fine textured residual and medium textured slopewash material.	Inclined and dissected. 5-9%	O.BL SND 30-50% O.BL HLM 30-50%
SOF1/3	Standoff	Medium textured lacustrine.	Undulating. 2-5%	O.BL SOF 70-90%
SOF2/3	Standoff	Medium textured lacustrine.	Undulating. 2-5%	O.BL SOF 60-80% Gleyed soils, Gleysolics and Water 15-30%
SP-F7-8	Spruce Ridge (failing)	Medium textured till.	Inclined. 30-70%	O.GL SPR 40-60% O.R 20-40%
SPR1/4-5	Spruce Ridge	Medium textured till.	Rolling and inclined. 5-15%	O.GL SPR 50-70% D.GL 15-30%
SXT3/2-3	Sexton	Medium to coarse textured fluvial.	Undulating to level. 0-5%	O.HR SXT 30-50% CU.HR 30-50% Saline soils 20-40%
TUC1/5-6	Tough Creek	Medium textured till veneer over residual material, paralithic.	Rolling and inclined. 9-30%	O.GL TUC 50-70%
TUSP1/6-7	Tough Creek-Spruce Ridge	Medium textured till veneer and blanket over residual material, paralithic.	Ridged and inclined. 15-45%	O.GL TUC 20-40% O.GL SPR 20-40%
VAC4/5	Van Cleeve	Medium textured till veneer over residual material, paralithic.	Inclined. 9-15%	O.DB VAC 40-60% R.DB soils and O.R 20-40%
WCT1/3-4	Westcastle	Stony medium textured till.	Undulating. 2-9%	O.GL WCT 70-90%

MAP UNIT SYMBOL EXPLANATION

Soil Unit: **BZR1** — Map Unit Number; **3** — Slope Class

Complex Soil Unit: **BZOK1** — Map Unit Number; **5-6D** — Slope Modifier

Three letter symbol denotes a unit with one dominant soil eg. **BZR** Beazer.

Four letter symbol is used when a complex of 2 soils are present in a map unit. Symbol combines the first two letters of each of the two soils forming the soil unit eg. **BZOK** from **BZR** (Beazer) and **OKY** (Ockey).

GLOSSARY OF TERMS USED IN LEGEND

blanket	- material depth greater than 1 meter.
glaciofluvial	- includes fluvial and ice-contact material.
gravelly	- refers to coarse fragments of variable sizes and the content is between 20-80%.
gravel	- refers to coarse fragments of variable sizes and the content is >50%.
lacustro-till	- includes glaciolacustrine and till, usually fine textured.
lithic	- material depth over bedrock is less than 1 meter.
paralithic	- refers to residual materials, where weathered bedrock fragment percentage increases with depth, and solid bedrock is usually present.
rolling	- long convex slopes up to 1 km in cycle distance.
stony	- refers to coarse fragments greater than 25 cm in diameter and the content is between 20-50%.
veneer	- material depth less than 1 meter.

SOIL CLASSIFICATION ABBREVIATIONS

BL.SS	- Black Solodized Solonetz
BL.SZ	- Black Solonetz
CU.HR	- Cumulic Humic Regosol
CU.R	- Cumulic Regosol
D.GL	- Dark Gray Luvisol
O.BL	- Orthic Black Chernozemic
O.DB	- Orthic Dark Brown Chernozemic
O.DG	- Orthic Dark Gray Chernozemic
O.EB	- Orthic Eutric Brunisol
O.GL	- Orthic Gray Luvisol
O.HG	- Orthic Humic Gleysol
O.HR	- Orthic Humic Regosol
O.R	- Orthic Regosol
R.BL	- Rego Black Chernozemic
R.DB	- Rego Dark Brown Chernozemic
R.HG	- Rego Humic Gleysol
SZ.	- Solonetzic soils

MAP UNIT NUMBER EXPLANATION*

1. Relatively pure unit.
2. Significant Gleyed soils, Gleysolics and Water.
3. Significant saline soils.
4. Significant Rego and Calcareous Chernozemics.
5. Significant finer textured soils.
6. Significant coarser textured soils.
7. Significant Solonetzic soils.
8. Significant Gleyed soils, Gleysolics and Water, and Rego Chernozemics.

* These numbers don't apply to **AV** or **RB** units.

MISCELLANEOUS SYMBOLS

S - saline spot symbols, for areas <4 ha in size.

<><> - eskers.

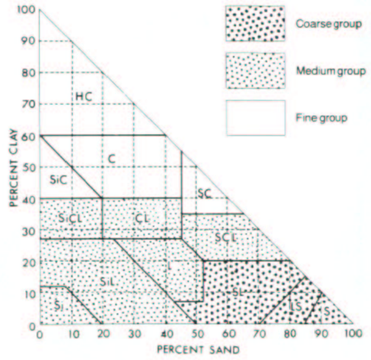
SLOPE CLASS

2	0-2%
3	2-5%
4	5-9%
5	9-15%
6	15-30%
7	30-45%
8	45-70%

SLOPE MODIFIER

D - Dissected

TEXTURAL GROUPING



Cartography by the Information Systems and Cartography Unit, Land Resource Research Centre, Research Branch, Agriculture Canada, Ottawa, 1990.
Production: B. Edwards (Manager).
Drafting: H.D. Kinney (Supr.); J.H.R. Guilbault, L.B. Medynski, E.C. Hill.
Map editing: D.N. Perkins (Supr.).
Photomechanical: R. St. John (Supr.); R.W. Davies, B.E. Wollenschlager.
Typography: L. Routhier.

Printing supplied by the Map Reproduction Centre, Reproduction and Distribution Division, Department of Energy, Mines and Resources, Ottawa.

MAP UNIT SYMBOL	MAP UNIT NAME	PARENT MATERIAL(S)	SURFACE EXPRESSION AND SLOPE	MAJOR SOIL COMPONENT(S)
AV1	Alluvium	Medium textured fluvial.	Level terraces between steep sided banks. Variable slopes.	CU.HR 60-80% O.BL and O.DB soils 20-40%
AV6	Alluvium	Gravelly coarse textured fluvial.	Level floodplain and terraces. Steep sided banks sometimes included. Variable slopes.	O.R 60-90% CU.HR 10-20%
BDCC1:4-5	Birdseye-Crooked Creek	Medium textured till veneer over residual material, paralithic.	Rolling and inclined. 5-15%	O.DG.BDY 30-50% D.GL.CCR 20-30%
BDNF1:6-7	Birdseye-North Fork	Medium textured till veneer over residual material, paralithic.	Ridged, rolling and inclined. 15-45%	O.DG.BDY 30-50% O.EB.NFK 20-40%
BDY1:3-4	Birdseye	Medium textured till veneer over residual material, paralithic.	Rolling and undulating. 2-9%	O.DG.BDY 50-70%
BFRN1:3	Blackfoot-Rinard	Discontinuous medium textured glaciofluvial veneer over gravel.	Terraced and undulating. 2-5%	O.BL.BFT 30-50% O.BL.RND 30-50%
BFT1:3	Blackfoot	Medium textured glaciofluvial veneer over gravel.	Terraced and undulating. 2-5%	O.BL.BFT 60-90%
BVA6:4-6	Beauvais	Medium textured till and gravelly medium to coarse textured glaciofluvial.	Hummocky and ridged. 5-30%	O.DG.BVA 40-60% O.DG gravelly phases of BVA 20-40%
BVLT1:3-4	Beauvais-Leighton Centre	Medium textured till.	Undulating to rolling. 2-9%	O.DG.BVA 40-60% D.GL.LTC 20-50%
BVNF1:5-6	Beauvais-North Fork	Medium textured till blanket-veneer over residual material, paralithic.	Hummocky, ridged and inclined. 9-30%	O.DG.BVA 40-60% O.EB.NFK 20-40%
BZCT1:3	Beazer-Cardston	Medium textured till and fine textured lacustro-till.	Undulating. 2-5%	O.BL.BZR 40-60% O.BL.CTN 30-50%
BZCT2:3	Beazer-Cardston	Medium textured till and fine textured lacustro-till.	Undulating. 2-5%	O.BL.BZR 30-50% O.BL.CTN 20-40% Gleyed soils, Gleysolics and Water 15-30%
BZCT3:3	Beazer-Cardston	Medium textured till and fine textured lacustro-till.	Undulating. 2-5%	O.BL.BZR 30-50% O.BL.CTN 20-40% **Saline soils 15-30%**
BZCT4:4	Beazer-Cardston	Medium textured till and fine textured lacustro-till.	Hummocky and inclined. 5-9%	**O.BL.BZR 30-50%** **O.BL.CTN 20-40%** **R.BL PSO,CWY 20-40%**
BZOK1:5-6	Beazer-Ockey	Medium textured till blanket-veneer over residual material, paralithic. Bedrock outcrops.	Ridged and rolling. 9-30%	O.BL.BZR 40-60% O.BL.OKY 15-30%
BZOK4:4	Beazer-Ockey	Medium textured till blanket-veneer over residual material, paralithic.	Rolling and inclined. 5-9%	O.BL.BZR 30-50% O.BL.OKY 15-30% R.BL soils and O.R 20-40%
BZOK4:6D	Beazer-Ockey	Medium textured till blanket-veneer over residual material, paralithic. Bedrock outcrops.	Inclined and dissected. 15-30%	O.BL.BZR 30-50% O.BL.OKY 15-30% R.BL soils and O.R 20-40%
BZR1:3	Beazer	Medium textured till.	Undulating and inclined. 2-5%	O.BL.BZR 60-90%
BZR1:4	Beazer	Medium textured till.	Hummocky and inclined. 5-9%	O.BL.BZR 60-90%
BZR1:4D	Beazer	Medium textured till.	Hummocky, inclined and dissected. 5-9%	O.BL.BZR 60-90%
BZR1:5	Beazer	Medium textured till.	Hummocky. 9-15%	O.BL.BZR 60-90%
BZR1:5-6D	Beazer	Medium textured till.	Hummocky, inclined and dissected. 9-30%	O.BL.BZR 60-80%
BZR1:6	Beazer	Medium textured till.	Hummocky. 15-30%	O.BL.BZR 60-80%
BZR2:4	Beazer	Medium textured till.	Hummocky. 5-9%	O.BL.BZR 60-80% Gleyed soils, Gleysolics and Water 15-30%
BZR2:5	Beazer	Medium textured till.	Hummocky. 9-15%	O.BL.BZR 60-80% Gleyed soils, Gleysolics and Water 15-30%

MAP UNIT SYMBOL	MAP UNIT NAME	PARENT MATERIAL(S)	SURFACE EXPRESSION AND SLOPE	MAJOR SOIL COMPONENT(S)
BZR4:4	Beazer	Medium textured till.	Hummocky. 5-9%	O.BL.BZR 50-70% R.BL.PSO 20-40%
BZR4:5	Beazer	Medium textured till.	Hummocky. 9-15%	O.BL.BZR 50-70% R.BL.PSO 20-40%
BZR4:6D	Beazer	Medium textured till.	Inclined and dissected. 15-30%	O.BL.BZR 50-70% R.BL.PSO 20-40%
BZR6:4	Beazer	Medium textured till and gravelly medium to coarse textured glaciofluvial.	Hummocky. 5-9%	O.BL.BZR 50-80% O.BL gravelly phases of BZR 20-40%
BZR6:5	Beazer	Medium textured till and gravelly medium to coarse textured glaciofluvial.	Hummocky. 9-15%	O.BL.BZR 50-80% O.BL gravelly phases of BZR 20-40%
BZR6:5-6D	Beazer	Medium textured till and gravelly medium to coarse textured glaciofluvial.	Hummocky, inclined and dissected. 9-30%	O.BL.BZR 40-60% O.BL gravelly phases of BZR 20-40%
BZR8:4	Beazer	Medium textured till.	Hummocky. 5-9%	O.BL.BZR 40-60% R.BL.PSO 20-40% Gleyed soils, Gleysolics and Water 15-30%
BZSO1:3-4	Beazer-Standoff	Medium textured till and medium textured lacustrine blanket-veneer over till.	Undulating to hummocky. 2-9%	O.BL.BZR 40-60% O.BL.SCF 30-50%
BZSO2:2-3	Beazer-Standoff	Medium textured till and medium textured lacustrine blanket-veneer over till.	Level to undulating. 0-5%	O.BL.BZR 30-50% O.BL.SCF 20-40% Gleyed soils, Gleysolics and Water 15-30%
BZSO3:3	Beazer-Standoff	Medium textured till and medium textured lacustrine blanket-veneer over till.	Undulating. 2-5%	O.BL.BZR 40-60% O.BL.SCF 20-40% Saline soils 15-30%
CCBD1:5-6	Crooked Creek-Birdseye	Medium textured till veneer over residual material, paralithic.	Rolling, ridged and inclined. 9-30%	D.GL.CCR 30-50% O.DG.BDY 20-40%
CCNF1:5-6	Crooked Creek-North Fork	Medium textured till veneer over residual material, paralithic.	Rolling, ridged and inclined. 9-30%	D.GL.CCR 30-50% O.EB.NFK 30-50%
CFNE1:3-4	Crowfoot-New Dayton	Discontinuous medium textured glaciofluvial veneer over gravel.	Undulating and terraced. 2-9%	O.DB.CFT 40-60% O.DB.NED 30-50%
CFT4:2-3	Crowfoot	Medium textured glaciofluvial veneer over gravel.	Level and undulating. 0-5%	O.DB.CFT 50-70% R.DB soils and O.R 20-30%
CLLE1:2	Coaldale-Lethbridge	Fine and medium textured lacustrine.	Level. 0-2%	O.DB.CLD 40-60% O.DB.LET 30-50%
CRD1:3	Cradduck	Medium textured till.	Undulating. 2-5%	O.DB.CRD 60-90%
CRD1:4	Cradduck	Medium textured till.	Hummocky. 5-9%	O.DB.CRD 60-90%
CRD2:4	Cradduck	Medium textured till.	Hummocky. 5-9%	O.DB.CRD 60-80% Gleyed soils, Gleysolics and Water 15-30%
CRD3:3	Cradduck	Medium textured till.	Undulating. 2-5%	O.DB.CRD 60-80% Saline soils 15-30%
CRD4:3	Cradduck	Medium textured till.	Undulating. 2-5%	O.DB.CRD 60-80% R.DB.VEB 20-40%
CRD4:4	Cradduck	Medium textured till.	Hummocky. 5-9%	O.DB.CRD 60-80% R.DB.VEB 20-40%
CRLN1:4	Carway-Lundbreck	Coarse and gravelly coarse textured glaciofluvial.	Hummocky. 5-9%	O.BL.CRW 40-60% O.BL.LNB 30-50%
CRLN1:5-6	Carway-Lundbreck	Coarse and gravelly coarse textured glaciofluvial.	Hummocky. 9-30%	O.BL.CRW 40-60% O.BL.LNB 30-50%
CRMG1:3	Cradduck-Magrath	Medium textured till and fine textured lacustro-till.	Undulating. 2-5%	O.DB.CRD 40-60% O.DB.MGT 30-50%
CRMG4:3	Cradduck-Magrath	Medium textured till and fine textured lacustro-till.	Undulating. 2-5%	O.DB.CRD 40-50% O.DB.MGT 20-40% R.DB.VEB,WLG 20-40%
CRMG4:4	Cradduck-Magrath	Medium textured till and fine textured lacustro-till.	Hummocky. 5-9%	O.DB.CRD 30-50% O.DB.MGT 20-40% R.DB.VEB,WLG 20-40%
CRMG4:5	Cradduck-Magrath	Medium textured till and fine textured lacustro-till.	Hummocky. 9-15%	O.DB.CRD 30-50% O.DB.MGT 20-40% R.DB.VEB,WLG 20-40%

MAP UNIT SYMBOL	MAP UNIT NAME	PARENT MATERIAL(S)	SURFACE EXPRESSION AND SLOPE	MAJOR SOIL COMPONENT(S)
CRVA1:3	Cradduck-Van Cleeve	Medium textured till blanket-veneer over residual material, paralithic.	Inclined. 2-5%	O.DB.CRD 40-60% O.DB.VAC 30-50%
CRVA4:4	Cradduck-Van Cleeve	Medium textured till blanket-veneer over residual material, paralithic.	Inclined. 5-9%	O.DB.CRD 30-50% O.DB.VAC 20-40% R.DB soils and O.R 20-40%
CRW1:4	Carway	Coarse textured glaciofluvial.	Hummocky. 5-9%	O.BL.CRW 60-80%
CT:L4:4	Cardston (lithic)	Fine textured lacustro-till veneer over residual material, paralithic.	Rolling. 5-9%	O.BL.CTN 60-80% R.BL.CWY 20-40%
CTN1:2-3	Cardston	Fine textured lacustro-till.	Level to undulating. 0-5%	O.BL.CTN 60-90%
CTN3:3	Cardston	Fine textured lacustro-till.	Undulating. 2-5%	O.BL.CTN 60-80% Saline soils 20-30%
CTPG1:2-3	Cardston-Peigan	Fine textured lacustro-till.	Level to undulating. 0-5%	O.BL.CTN 60-80% BL.SS PGN 20-40%
DLB1:2	Del Bonita	Medium textured glaciofluvial or eolian.	Level. 0-2%	O.BL.DLB 80-100%
DLHL1:3	Del Bonita-Hillmer	Medium textured glaciofluvial or eolian and medium textured slopewash material.	Inclined and undulating. 2-5%	O.BL.DLB 50-70% O.BL.HLM 20-40%
DVBV1:4-5	Dunvargan-Beauvais	Medium textured till.	Hummocky. 5-15%	O.BL.DVG 40-60% O.DG.BVA 30-50%
DVFS1:3	Dunvargan-Fish Creek	Medium textured till and fine textured lacustro-till.	Undulating. 2-5%	O.BL.DVG 40-60% O.BL.FSH 30-50%
DVG1:3	Dunvargan	Medium textured till.	Undulating. 2-5%	O.BL.DVG 60-90%
DVG1:4	Dunvargan	Medium textured till.	Hummocky and inclined. 5-9%	O.BL.DVG 60-90%
DVG1:4D	Dunvargan	Medium textured till.	Inclined and dissected. 5-9%	O.BL.DVG 60-90%
DVG1:5	Dunvargan	Medium textured till.	Hummocky. 9-15%	**O.BL.DVG 60-90%**
DVG1:6	Dunvargan	Medium textured till.	Hummocky. 15-30%	**O.BL.DVG 60-80%**
DVG2:3-4	Dunvargan	Medium textured till.	Undulating to hummocky. 2-9%	O.BL.DVG 60-80% Gleyed soils, Gleysolics and Water 15-30%
DVG2:4-5	Dunvargan	Medium textured till.	Hummocky. 5-15%	O.BL.DVG 60-80% Gleyed soils, Gleysolics and Water 15-30%
DVG6:4-5	Dunvargan	Medium textured till and gravelly medium to coarse textured glaciofluvial.	Hummocky. 5-15%	O.BL.DVG 60-80% O.BL gravelly phases of DVG 20-40%
DVG6:5-6	Dunvargan	Medium textured till and gravelly medium to coarse textured glaciofluvial.	Hummocky. 9-30%	O.BL.DVG 60-80% O.BL gravelly phases of DVG 20-40%
DVG7:3-4	Dunvargan	Medium textured till.	Rolling and inclined. 2-8%	O.BL.DVG 60-80% SZ. soils 20-30%
DVOK1:4-5	Dunvargan-Ockey	Medium textured till blanket-veneer over residual material, paralithic.	Hummocky. 5-15%	O.BL.DVG 50-70% O.BL.OKY 20-40%
DVOK1:5-6	Dunvargan-Ockey	Medium textured till blanket-veneer over residual material, paralithic. Bedrock outcrops.	Ridged and rolling. 9-30%	O.BL.DVG 50-70% O.BL.OKY 20-40%
DVOK1:5-7	Dunvargan-Ockey	Medium textured till blanket-veneer over residual material, paralithic. Bedrock outcrops.	Ridged and hummocky. 9-45%	O.BL.DVG 50-70% O.BL.OKY 20-40%
FSH7:3	Fish Creek	Fine textured lacustro-till.	Undulating to level. 2-5%	O.BL.FSH 50-80% SZ. soils 20-30%
G	Gleysolics	Glaciofluvial, lacustrine or till of variable textures.	Level to depressional. <3%	O.HG 60-80%
HEG1:3	Hegson	Fine textured lacustro-till.	Undulating and inclined. 2-5%	O.DB.HEG 70-90%

MAP UNIT SYMBOL	MAP UNIT NAME	PARENT MATERIAL(S)	SURFACE EXPRESSION AND SLOPE	MAJOR SOIL COMPONENT(S)
HEG2:3-4	Hegson	Fine textured lacustro-till.	Undulating to hummocky. 2-9%	O.DB.HEG 70-80% Gleyed soils, Gleysolics and Water 15-30%
HEG7:3D	Hegson	Fine textured lacustro-till.	Inclined and dissected. 2-5%	O.DB.HEG 60-80% SZ. soils 20-30%
HLM1:3	Hillmer	Medium textured slopewash material.	Undulating and inclined. 2-5%	O.BL.HLM 70-90%
HLM1:4	Hillmer	Medium textured slopewash material.	Inclined. 5-9%	O.BL.HLM 70-90%
HLM6:4D	Hillmer	Medium textured and gravelly medium to coarse textured slopewash material.	Inclined and dissected. 5-9%	O.BL.HLM 40-60% O.BL gravelly phases of HLM 30-50%
HRNE1:3-4	Heartbreak-New Dayton	Coarse textured and gravelly coarse textured glaciofluvial.	Undulating and ridged. 2-9%	O.DB.HRK 40-60% O.DB.NED 30-50%
HRNE1:5	Heartbreak-New Dayton	Coarse textured and gravelly coarse textured glaciofluvial.	Hummocky. 9-15%	O.DB.HRK 40-60% O.DB.NED 30-50%
JAT1:2-3	Joanto	Medium to fine textured lacustrine.	Level. 0-5%	R.HG.JAT 60-80% O.HG 20-40%
JAT3:2-3	Joanto	Medium to fine textured lacustrine.	Level. 0-5%	R.HG.JAT 40-60% Saline soils 15-30%
KGT1:2	Klemengurt	Fine textured lacustrine.	Level. 0-2%	BL.SZ.KGT 60-80%
KNRN1:4	Knight-Rinard	Coarse textured and gravelly coarse textured glaciofluvial.	Hummocky. 5-9%	O.BL.KNT 40-60% O.BL.RND 30-50%
KNT1:4	Knight	Coarse textured glaciofluvial.	Hummocky. 5-9%	O.BL.KNT 60-80%
KNT4:3	Knight	Coarse textured glaciofluvial.	Undulating. 2-5%	O.BL.KNT 50-70% R.BL soils and O.R 20-40%
KNT4:5	Knight	Coarse textured glaciofluvial.	Hummocky. 9-15%	O.BL.KNT 50-70% R.DB soils and O.R 20-50%
KSHR1:3-4	Kessler-Heartbreak	Coarse textured glaciofluvial.	Undulating to hummocky. 2-9%	O.DB.KSR 40-60% O.DB.HRK 30-50%
KSNE1:3	Kessler-New Dayton	Coarse textured and gravelly coarse textured glaciofluvial.	Undulating. 2-5%	O.DB.KSR 40-60% O.DB.NED 30-50%
KSR4:3	Kessler	Coarse textured glaciofluvial.	Undulating. 2-5%	O.DB.KSR 60-80% R.DB soils and O.R 20-40%
LEOA1:2-3	Lethbridge-Oasis	Medium textured lacustrine blanket-veneer over coarse textured glaciofluvial.	Level to undulating. 0-5%	O.DB.LET 50-70% O.DB.OAS 20-40%
LET1:3	Lethbridge	Medium textured lacustrine.	Undulating. 2-5%	O.DB.LET 60-80%
LNB1:3	Lundbreck	Gravelly coarse textured glaciofluvial.	Undulating. 2-5%	O.BL.LNB 50-70%
LNB1:4	Lundbreck	Gravelly coarse textured glaciofluvial.	Hummocky. 5-9%	O.BL.LNB 50-70%
LNB2:3	Lundbreck	Gravelly coarse textured glaciofluvial.	Undulating. 2-5%	O.BL.LNB 40-60% Gleyed soils, Gleysolics and Water 15-30%
LTC2:4-5	Leighton Centre	Medium textured till.	Hummocky and inclined. 5-15%	D.GL.LTC 40-60% Gleyed soils, Gleysolics and Water 15-30%
LUP1:3	Lupen	Medium textured lacustrine veneer over till.	Undulating. 2-5%	O.DB.LUP 60-80%
LUP2:3	Lupen	Medium textured lacustrine veneer over till.	Undulating. 2-5%	O.DB.LUP 50-70% Gleyed soils, Gleysolics and Water 15-30%
LVY7:3	Lonely Valley	Medium textured fluvial and fine textured lacustrine.	Undulating. 2-5%	O.BL.LVY 40-60% BL.SZ.KGT 30-50%
MC:S2:3	Magrath-Coaldale (saline)	Fine textured lacustro-till and fine textured lacustrine.	Level to undulating. 0-5%	Saline soils 40-70% O.DB.MGT 15-30% O.DB.CLD 15-30%
MFT2:2-3	Maycroft	Medium textured lacustrine.	Level to undulating. 0-5%	O.BL.MFT 60-80% Gleyed soils, Gleysolics and Water 15-30%

ADJOINS PAGE 10

ADJOINS PAGE 2

BLACK SOIL ZONE

DARK BROWN SOIL ZONE

WARNER COUNTY
CARDSTON MUNICIPAL DISTRICT

ALBERTA
MONTANA

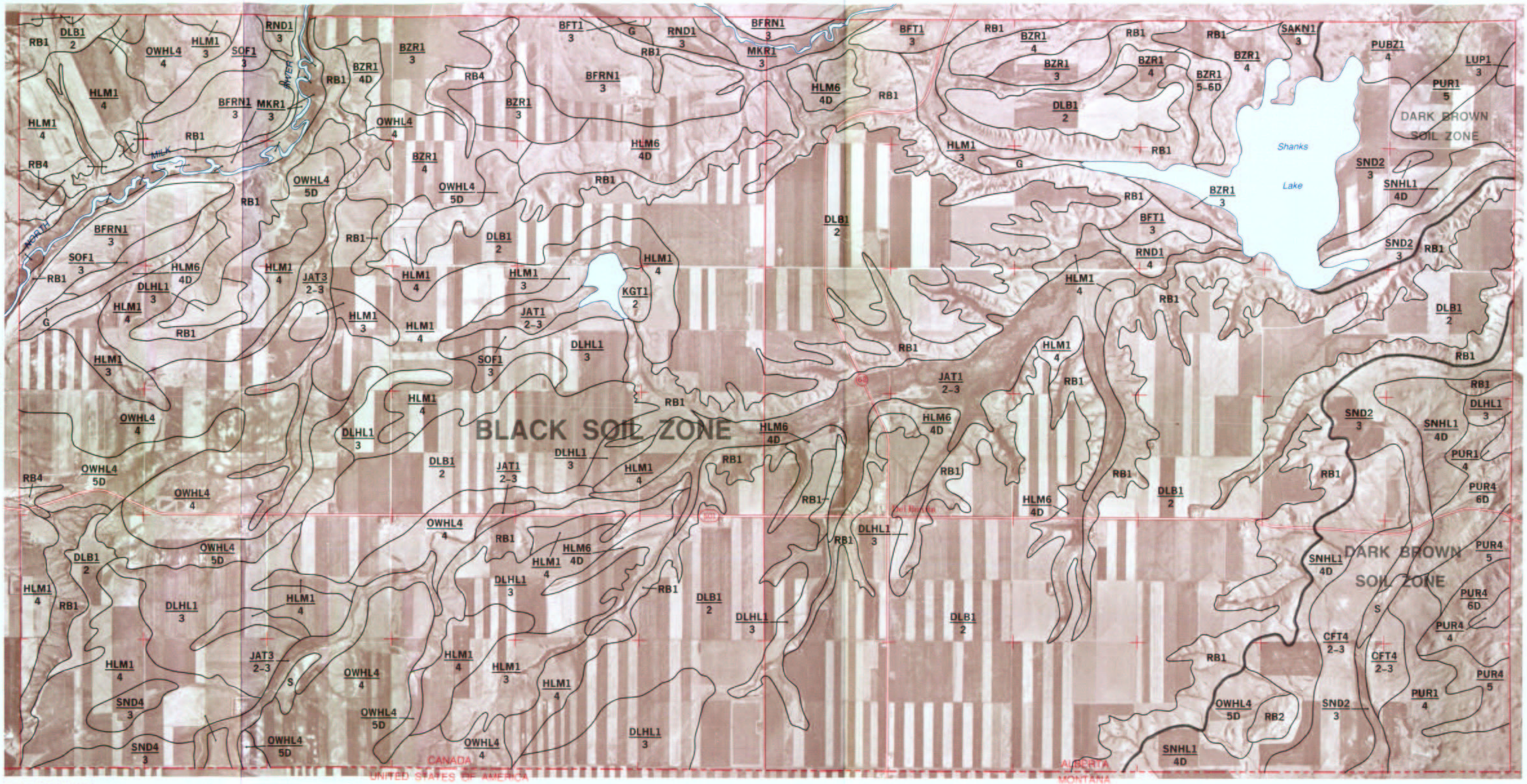
CANADA
UNITED STATES OF AMERICA

TP 1 R 19 & 20

ADJOINS PAGE 9

ADJOINS PAGE 3

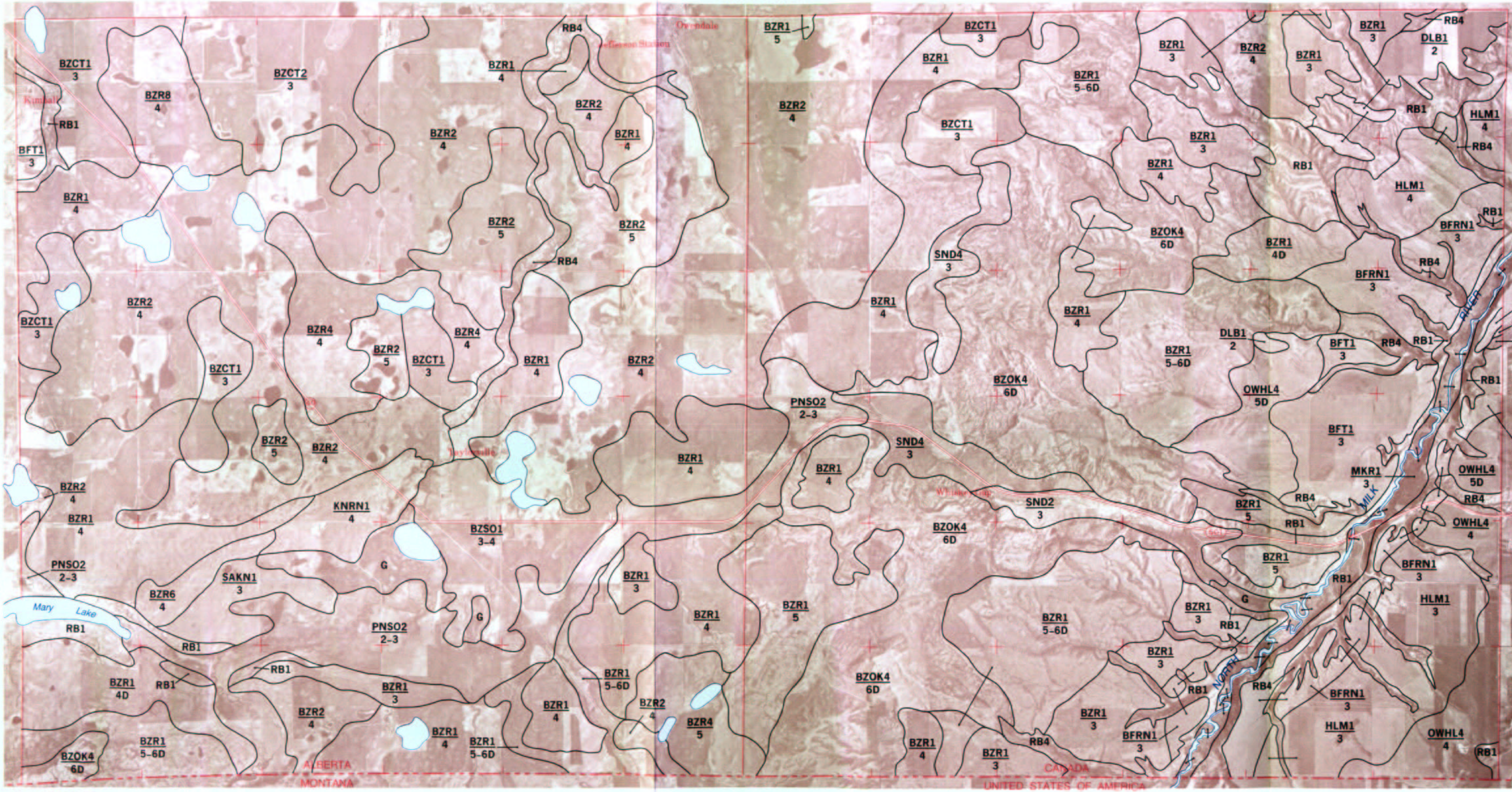
ADJOINS PAGE 1



TP 1 R 21 & 22

ADJOINS PAGE 8

ADJOINS PAGE 4



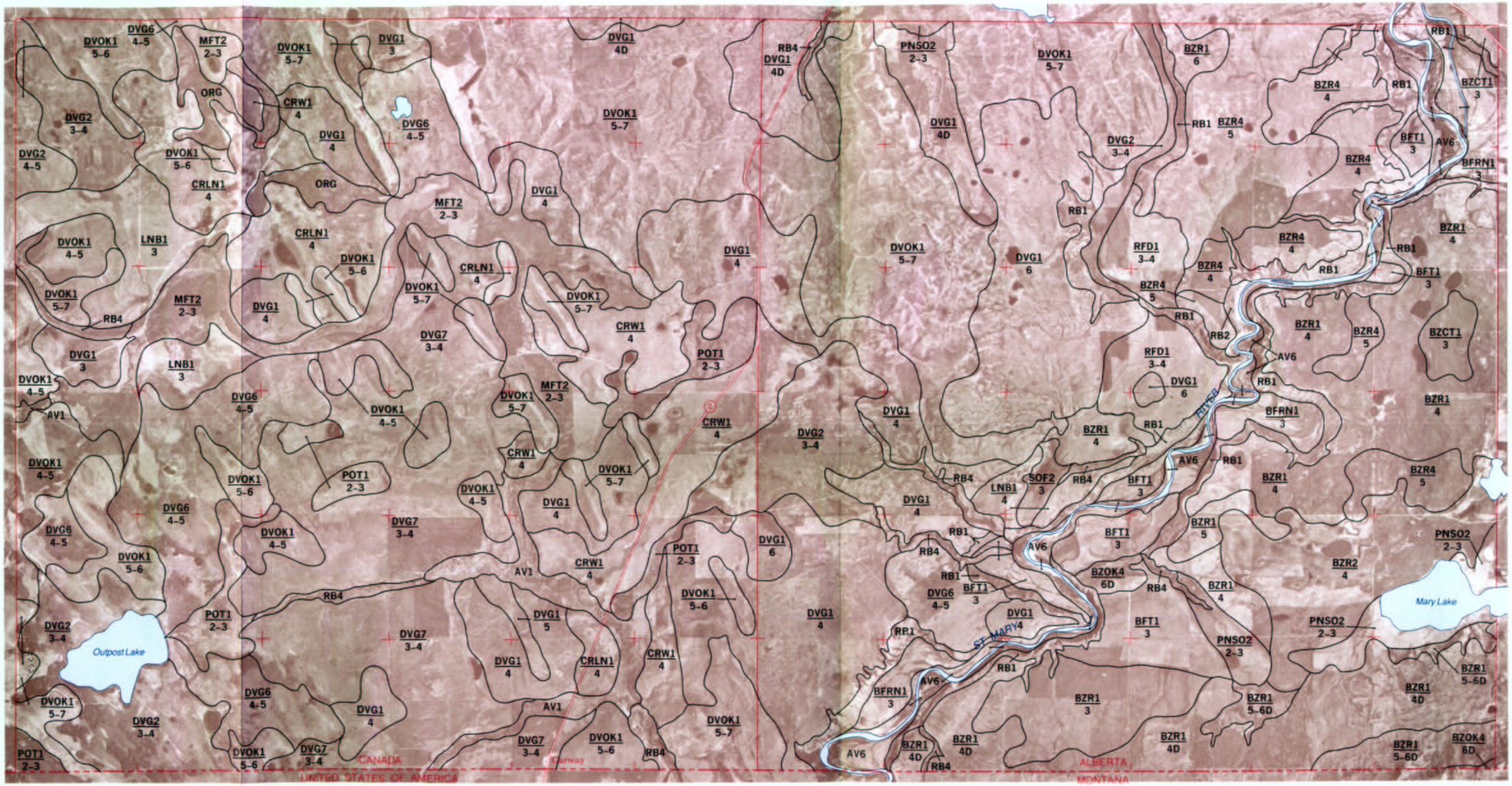
ADJOINS PAGE 2

TP 1 R 23 & 24

ADJOINS PAGE 7

ADJOINS PAGE 5

ADJOINS PAGE 3



TP 1 R 25 & 26

ADJOINS PAGE 6

ADJOINS PAGE 5a

DVG1 4 | AV6 | LNB1 3 | DVG1 4 | BVNF1 5-6 | LTC2 4-5 | BDNF1 6-7 | AV6

BELLY RIVER

WATERTON LAKES NATIONAL PARK

BLOOD INDIAN RESERVE

DVG1 4 | BDNF1 6-7 | BVA6 4-6 | TUSP1 6-7 | FSH7 3 | OTP1 3-4 | SP:F1 7-8 | WCT1 3-4 | BDCC1 4-5 | BDNF1 6-7 | BDCC1 4-5

Beaverdam Lake

DVG2 4-5 | DVOK1 5-6 | FSH7 3 | DVBV1 4-5 | RB1 | G | DVOK1 5-6 | DVG6 5-6 | AV1 | AV6 | DVG6 4-5 | DVOK1 5-6 | LNB1 4 | LNB1 4 | LNB1 3 | MFT2 2-3 | DVG2 4-5 | LNB1 3 | RB1 | G

BVLT1 3-4 | AV1 | DVOK1 5-6 | BVLT1 3-4 | RB4 | Creek | BDCC1 4-5 | DVBV1 4-5 | DVOK1 4-5 | CCBD1 5-6 | AV6 | Creek | DVG1 3 | DVG6 5-6 | G | OTP1 3-4 | DVG1 3 | BDY1 3-4 | DVG6 4-5 | DVBV1 4-5 | DVOK1 4-5 | Boundary Creek | AV1 | DVOK1 5-7 | DVBV1 4-5 | G | DVG6 5-6

Tough Lee

TUC1 5-6 | CCBD1 5-6 | AV6 | TUSP1 6-7 | RB4 | BDCC1 4-5 | RB4 | SPR1 4-5 | TUC1 5-6

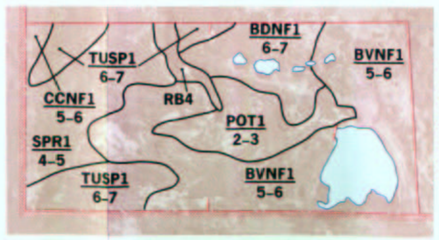
ALBERTA | MONTANA | CANADA | UNITED STATES OF AMERICA

ADJOINS PAGE 4

TP 1 R 27 & 28

5a

ADJOINS PAGE 6



ADJOINS PAGE 5

TP 1 R 29

ADJOINS PAGE 13 & 14

ADJOINS PAGE 7

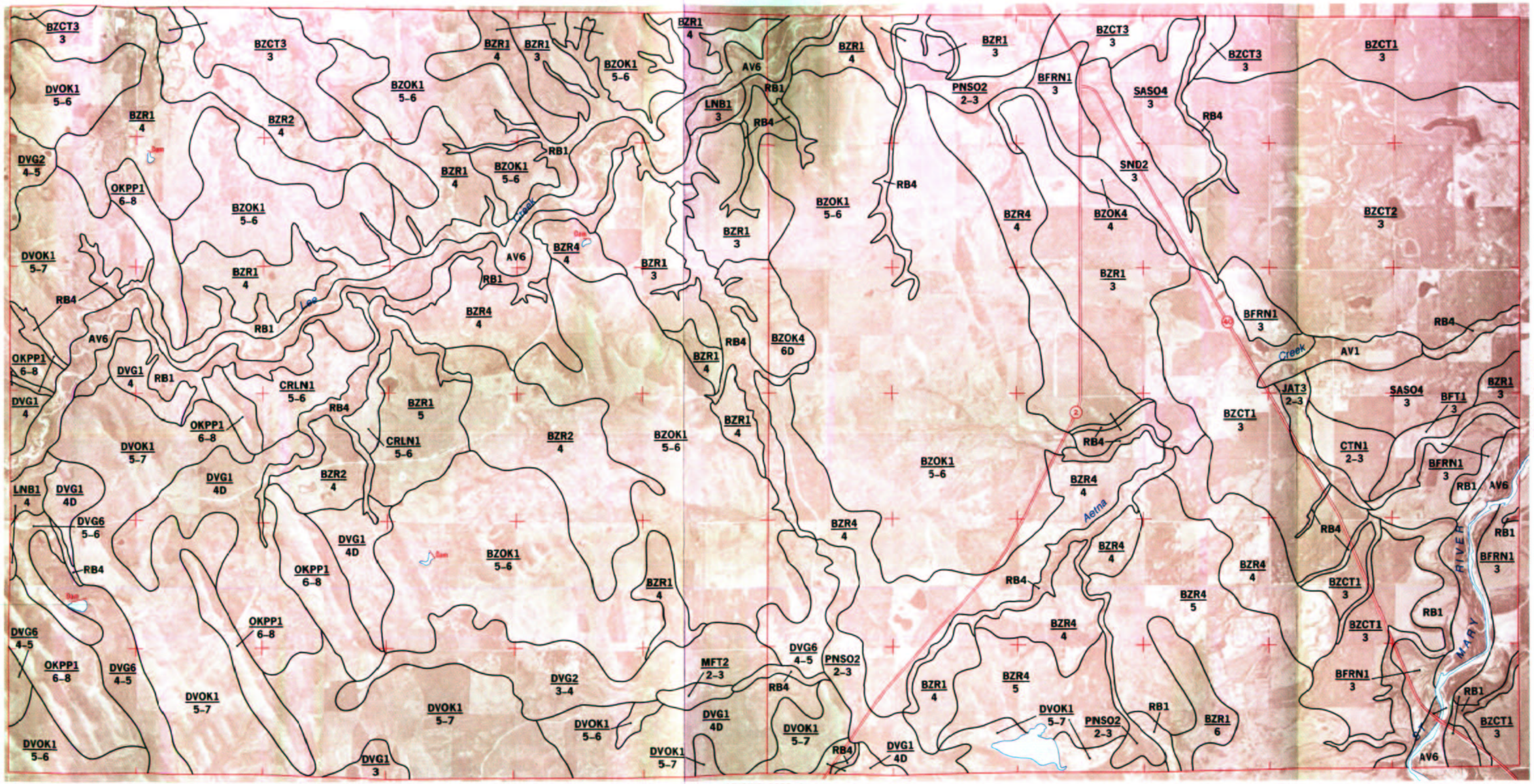
TP 2 R 27, 28 & 29

ADJOINS PAGE 5 & 5a

ADJOINS PAGE 13

ADJOINS PAGE 6

ADJOINS PAGE 8



TP 2 R 25 & 26

ADJOINS PAGE 4

ADJOINS PAGE 11 & 12

ADJOINS PAGE 7

ADJOINS PAGE 9

TP 2 R 23 & 24

ADJOINS PAGE 3

ADJOINS PAGE 11

ADJOINS PAGE 8

ADJOINS PAGE 10

TP 2 R 21 & 22

ADJOINS PAGE 2

WARNER COUNTY
CARDSTON MUN. DISTRICT

BLACK SOIL ZONE

DARK BROWN SOIL ZONE

RIVER

NORTH

MILK

BZR6 4 · RB4 · BZR1 4 · RB1 · BZR2 4 · PUR6 5 · PUBZ2 5 · PUBZ1 4 · PUR2 5 · PUR1 5 · PUR4 6D · PULU7 3D

BZR1 3 · BZR1 5–6D · BZR6 5 · LVY7 3 · CFNE1 3–4 · PUR2 4 · PUR1 4 · PUR1 3 · PUR1 3 · RB4 · HRNE1 3–4

SAKN1 3 · BZR6 4 · PUR2 5 · RB4 · KSHR1 3–4

KNT1 4 · MKR1 3 · G · KSHR1 3–4 · PUR4 4 · PUR6 4 · MKR1 3 · HRNE1 5

KNRN1 4 · CFNE1 3–4 · KSNE1 3 · HRNE1 5 · HRNE1 3–4

RND1 3 · SAKN1 3 · PUBZ1 4 · PUBZ1 4 · RB2 · PUR1 3 · HRNE1 5 · RB1 · RB4 · KSNE1 3 · MKR1 3 · HRNE1 3–4

LUP1 3 · RB4 · PUR4 4 · CFNE1 3–4 · MKR1 3 · RB1 · LUP1 3 · RB4 · G · KSR4 3

BZR1 3 · PUBZ2 5 · PUR1 5 · CFNE1 3–4 · KSNE1 3 · RB2 · PUR1 5 · PUR1 4 · PUHE1 3 · PUR1 4

PUR2 4 · PUR6 5 · PUR4 4 · RB1 · HEG1 3

PUBZ1 4 · PUR6 5 · PUBZ1 4 · PUR4 6D · PUR1 3 · PUR4 4 · PUR4 5 · PUR1 4D · PUR1 4 · G · PUR4 5 · PUHE2 4 · PUR4 5 · HEG1 3 · PUHE1 3

PUR1 5 · PUR6 4 · PUR4 6D · PUR2 5 · PUR2 4 · LUP2 3

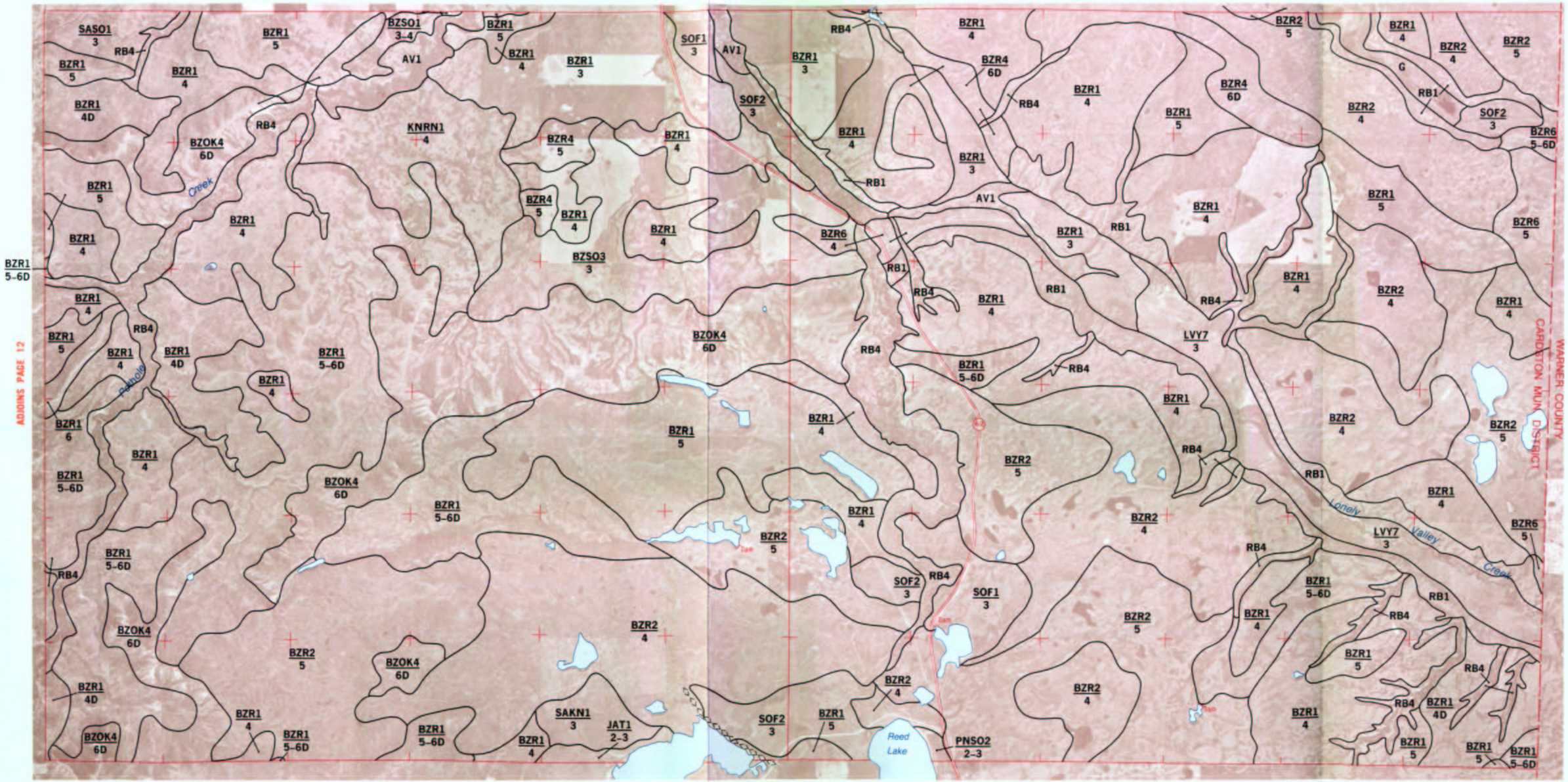
ADJOINS PAGE 9

ADJOINS PAGE 1

WARNER COUNTY
CARDSTON MUN. DISTRICT

TP 2 R 19 & 20

ADJOINS PAGE 17



TP 3 R 21 & 22

ADJOINS PAGE 9

ADJOINS PAGE 16

ADJOINS PAGE 13

ADJOINS PAGE 11

RB4
BZR1 3
CTN1 2-3
BZR8 4
AV1
BZR4 4
BZR1 4
BZR6 5
BZR4 5
BZR4 4
BZR1 4
RB4
BZR4 5
BZR1 4D
BZOK4 6D
SASO1 3
BZR1 5
BZR1 4D
BZSO1 3-4
BZR1 4D
BZR1 5-6D
BZR1 5
BZR1 5-6D
BZOK4 6D
BZR6 5
BZR1 4
BZR1 6
PNSO2 2-3
BZR1 4
BZR1 5
BZR1 4D
CTN1 2-3
CTPG1 2-3
RB4
BZR1 4D
RB4
BZR1 4
BZR1 3
AV1
BZR1 4
BZR1 5
BZR2 5
RB2
BZR1 3
BZR8 4
BZR2 4
BZR1 5
BZR1 5-6D
BZR1 6
BZR1 4
BZR1 5-6D
BZOK4 6D
RB2
ST MARY
RIVER
G
BZR1 3
BZR4 5
AV1
RB4
BZR1 4D
BZSO1 3-4
SND4 3
AV6
RB1
SAKN1 3
SND4 3
RB2
BZR4 4
SOF1 3
BZR1 4
BZR2 4
BZR1 5-6D
BZR1 5-6D
BZOK4 6D
BZCT1 3
AV6
RB1
WOODFORD PROVINCIAL PARK
SND4 3
CTN1 2-3
BZR1 5
AV1
BZCT1 3
BZR2 4
BZR1 5
BZR2 4
RB4
BZR1 4
BZR1 4
BZOK4 6D
RB4
BZR1 4D

TP 3 R 23 & 24

ADJOINS PAGE 7 & 8

ADJOINS PAGE 16

BLOOD INDIAN RESERVE 148

Nizaatoko

ST MARY RESERVOIR

SASO1 3

CTN1 2-3

RB4

AV6

RB1

ST MARY RIVER

CTN1 2-3

AV6

RB4

BFT1 3

CT:L4 4

CTN1 2-3

BZR1 3

AV6

RB1

RB2

AV6

AV6

RB1

BZCT1 3

BZCT3 3

RB4

BZR1 4

BZCT3 3

BZOK1 5-6

S

BZR1 4

BZR1 4

BZCT3 3

BZOK1 5-6

S

BZCT3 3

BZR1 4

BZOK1 5-6

BZR1 4

BZR1 4

BZOK1 5-6

BZR1 4

BZR1 4

BZR1 4

BZOK1 5-6

BZR1 4

BZR1 4

BZCT3 3

RB4

BZR1 4

BZCT3 3

BZR1 4

BZR2 4

BZR1 3

PNSO2 2-3

SAKN1 3

KNRN1 4

SAKN1 3

Cimarron

BZR1 3

AV6

RB1

RB4

BZR1 4

AV6

BZR1 3

SAKN1 3

RB4

SAKN1 3

BZCT3 3

CTPG1 2-3

BZCT1 3

RB4

BZCT3 3

DVG2 4-5

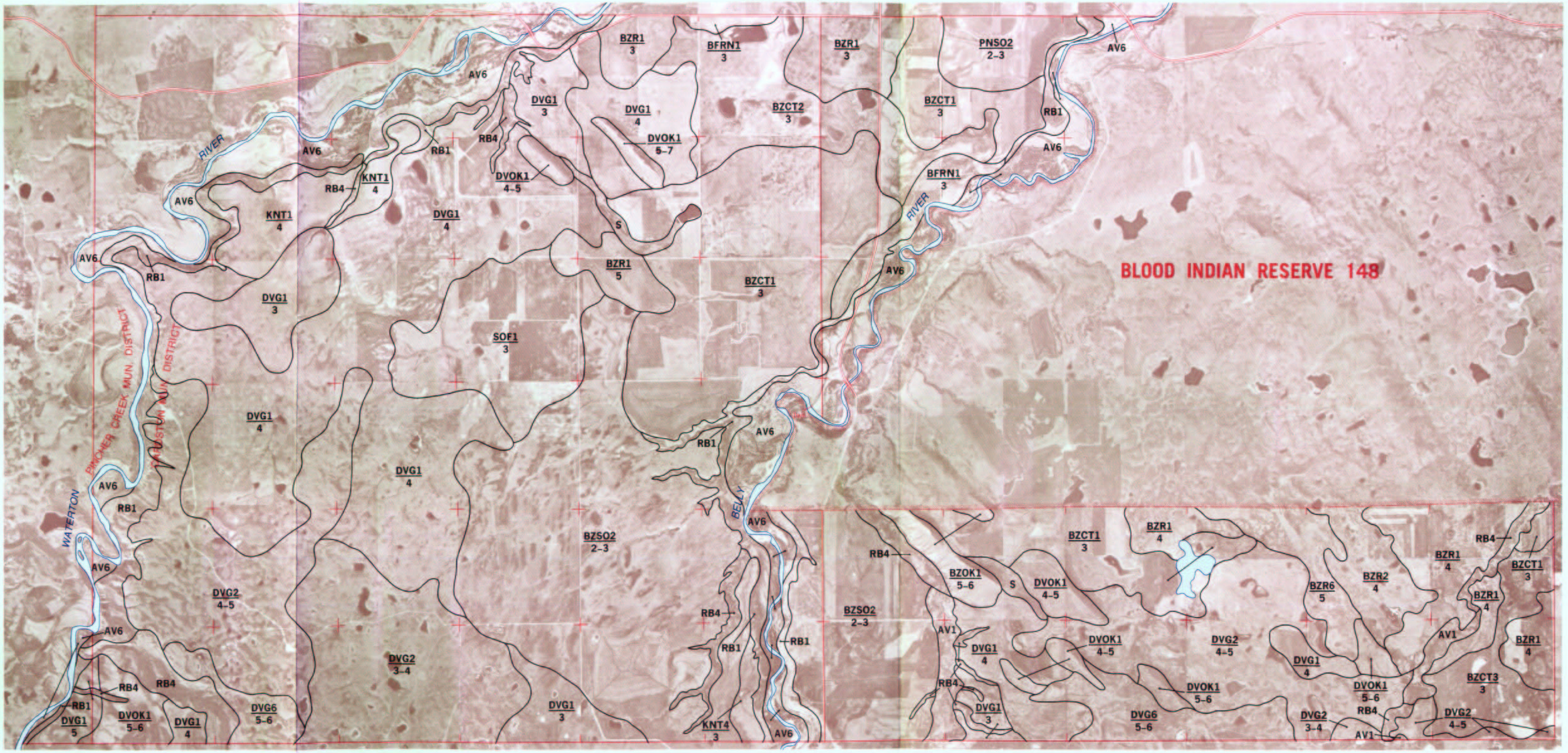
ADJOINS PAGE 14

ADJOINS PAGE 12

TP 3 R 25 & 26

ADJOINS PAGE 6 & 7

ADJOINS PAGE 15

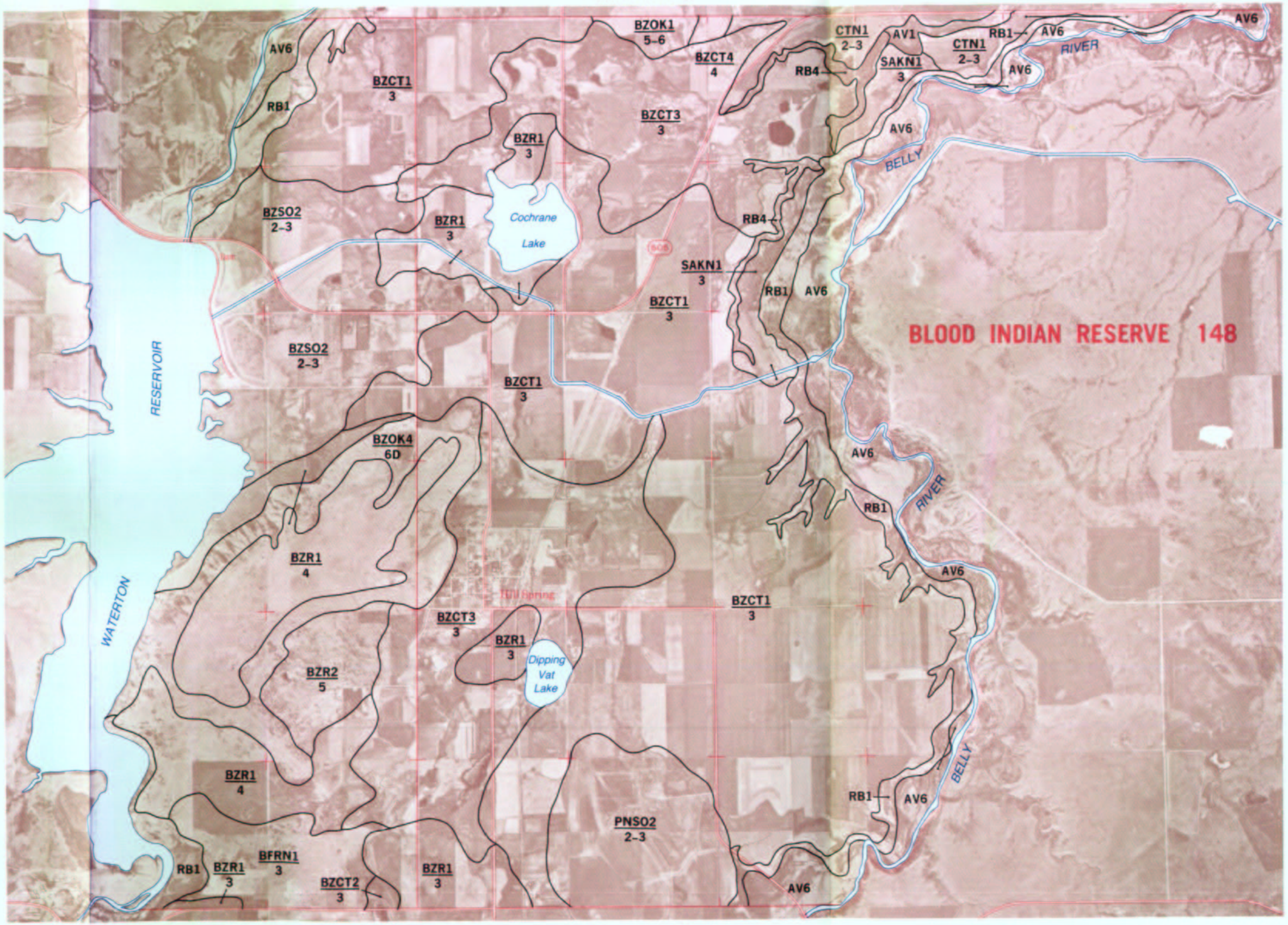


ADJOINS PAGE 13

TP 3 R 27 & 28

ADJOINS PAGE 6

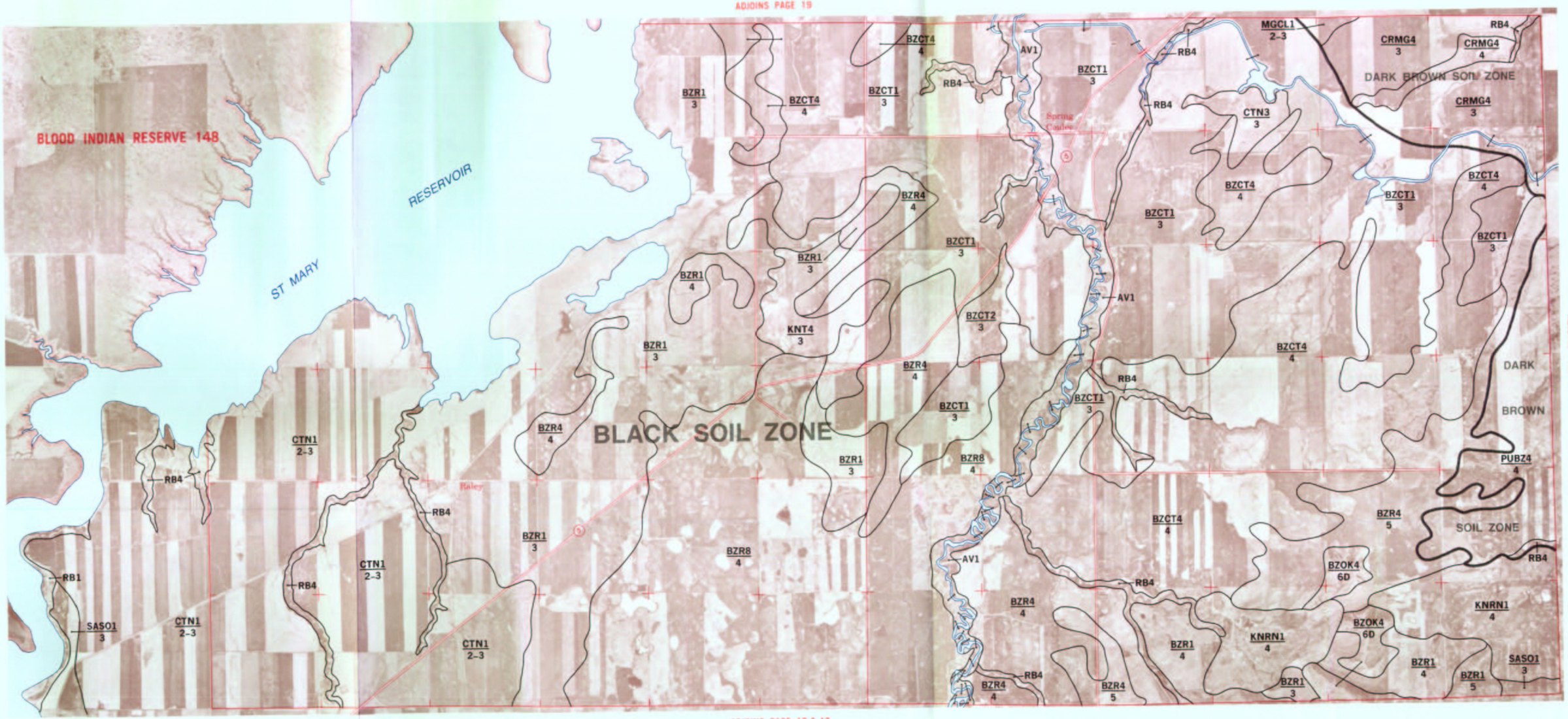
ADJOINS PAGE 20



TP 4 R 27 & 28

ADJOINS PAGE 14

ADJOINS PAGE 19



ADJOINS PAGE 17

ADJOINS PAGE 12 & 13

TP 4 R 23 & 24

ADJOINS PAGE 18

ADJOINS PAGE 16

DARK BROWN SOIL ZONE

BLACK SOIL ZONE

Jensen Reservoir

Pattee Creek

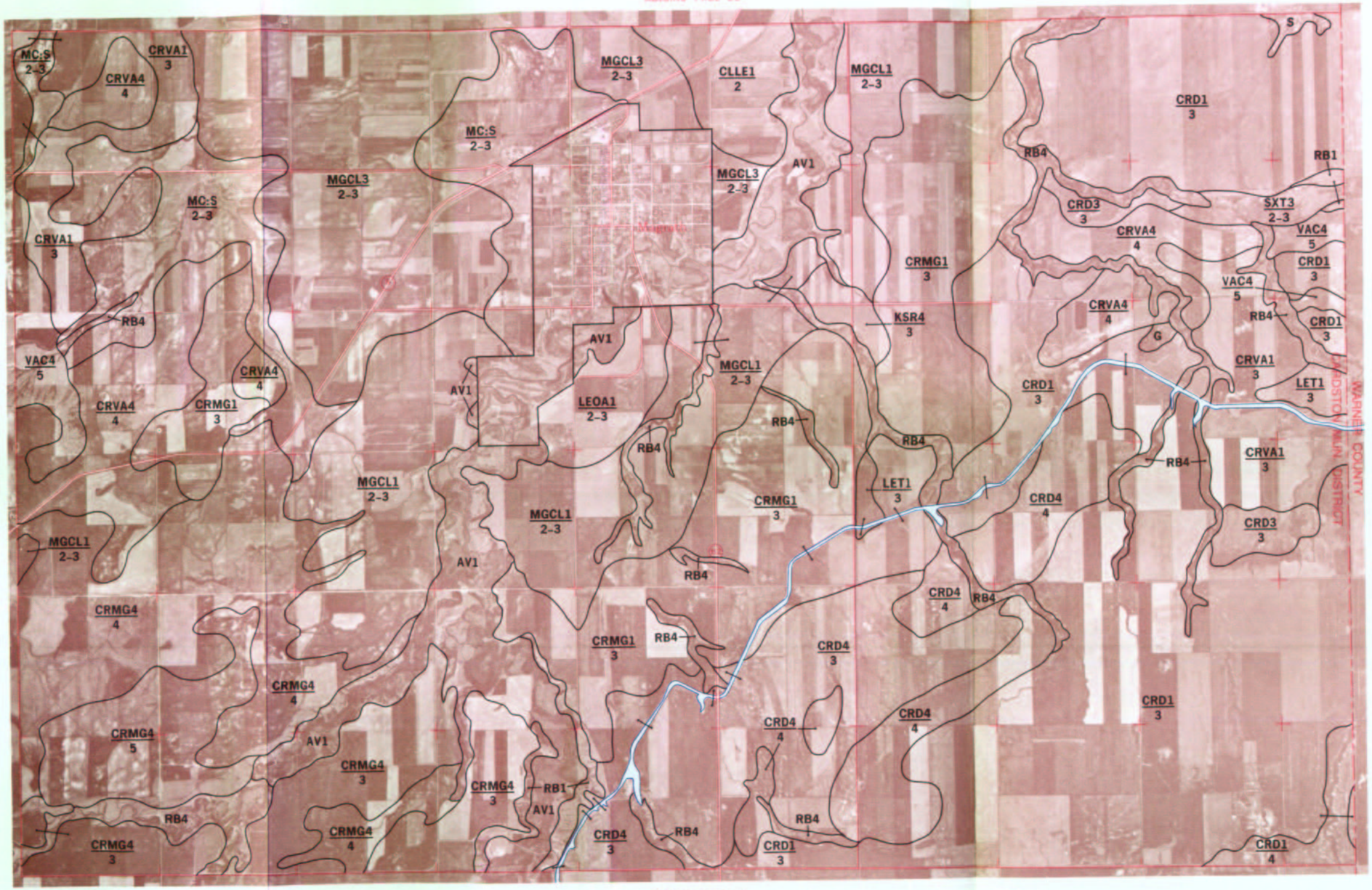
CRMG4 4 · RB4 · CRMG4 3 · AV1 · RB1 · RB4 · CRD4 3 · CRMG1 3 · CRD4 3 · RB4 · CRD1 3 · CRD4 4 · CRD1 4 · PUR1 4 · PUR2 4 · RB4 · CRD1 3 · CRD1 4 · CRD2 4 · CRD1 4 · CRD4 4 · CRD1 4 · RB4 · CRD4 3 · CRMG4 3 · RB1 · CRMG1 3 · PUBZ1 5 · PUBZ1 4 · PUR6 5 · PUR1 4 · PUR2 5 · RB4 · PUBZ2 5 · PUBZ4 4 · RB4 · PUR1 3 · PUBZ1 4 · PUBZ1 5 · PUBZ1 5 · RB4 · PUR6 4 · BZR1 5 · BZR1 5-6D · BZR4 6D · RB4 · CRMG1 3 · RB1 · AV1 · LEOA1 2-3 · CRMG1 3 · RB4 · BZR1 6 · BZR2 5 · BZR2 5 · BZR1 4 · SOF1 3 · RB4 · LEOA1 2-3 · RB4 · BZR6 4 · BZR4 6D · BZR2 4 · BZR6 5 · KGT1 2 · BZR6 5-6D · BZR2 5 · RB1 · BZR1 4 · BZR2 4 · RB4 · BZR1 3 · BZR1 4 · AV1 · SOF1 3 · BFRN1 3 · BZR1 3 · BZSO3 3 · S · BZR1 3 · S · BZSO3 3 · KNRN1 4 · JAT3 2-3 · BZSO3 3 · RB4 · BZR1 4 · BZR1 5 · SASO1 3 · BZR1 5 · AV1 · BZR1 4 · CRMG1 3 · S · CRMG4 3 · RB1 · CRMG1 3 · PUBZ4 4 · RB4 · PUBZ1 5 · RB4 · SOF1 3

TP 4 R 21 & 22

ADJOINS PAGE 11

WARNER COUNTY CARDSTON MAP SHEET

ADJOINS PAGE 22



ADJOINS PAGE 19

ADJOINS PAGE 17

TP 5 R 21 & 22

ADJOINS PAGE 22

BLOOD INDIAN RESERVE 148

AV1
MGLE4 2-3
G
CRVA1 3
RB1
LEOA1 2-3
ST MARY
RB4
MGLE4 2-3
CRVA4 4
CRMG4 3
VAC4 5
RIVER
DARK BROWN SOIL ZONE
RB1
CRMG4 3
LEOA1 2-3
G
MGCL1 2-3
CRMG4 4
MGCL1 2-3
RB4
CRMG4 3
MGCL1 2-3

ST MARY RESERVOIR

ST MARY RESERVOIR

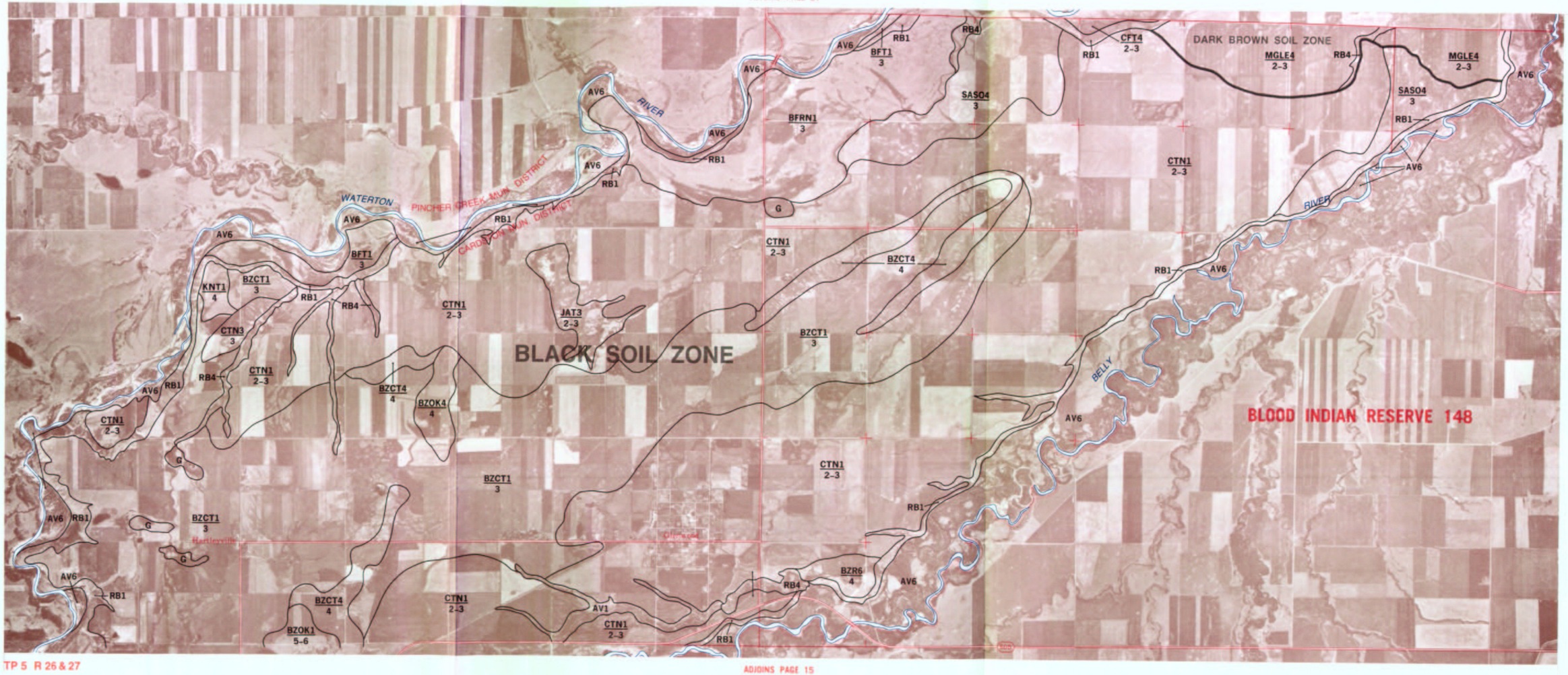
AV1
ST MARY RIVER
BZOK4 4
RB1
BZR1 3
BZCT1 3
BZCT4 4
RB1
AV1
BZCT1 3
AV1
RIVER
AV1
RB1
AV1
AV1
BZCT1 3
BLACK SOIL ZONE

ADJOINS PAGE 18

TP 5 R 23 & 24

ADJOINS PAGE 16

ADJOINS PAGE 21



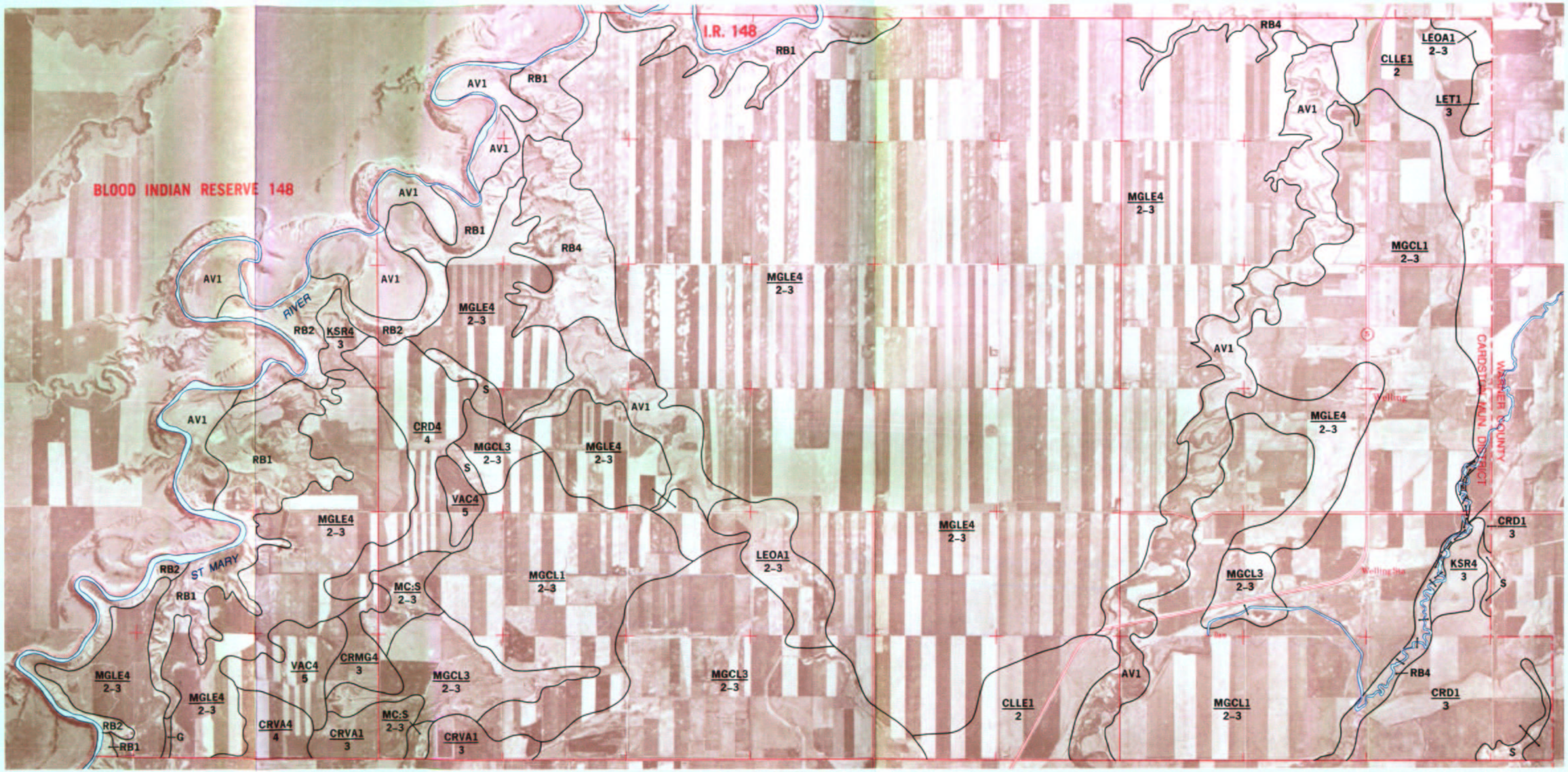
TP 5 R 26 & 27

ADJOINS PAGE 15

TP 6 R 25 & 26

ADJOINS PAGE 20

ADJOINS PAGE 23



TP 6 R 21, 22 & 23

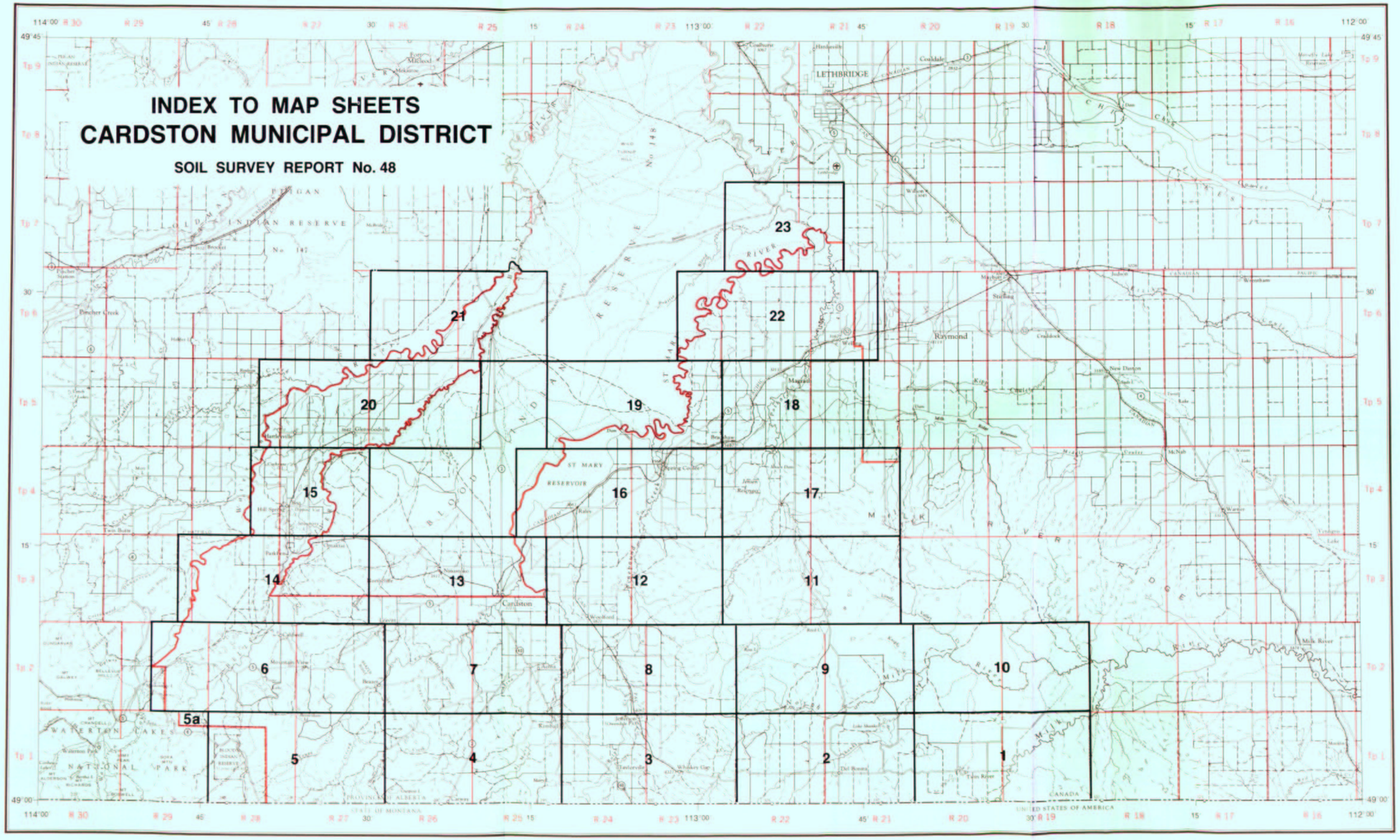
ADJOINS PAGE 18 & 19

TP 7 R 21 & 22

ADJOINS PAGE 22

INDEX TO MAP SHEETS
CARDSTON MUNICIPAL DISTRICT

SOIL SURVEY REPORT No. 48



Soil boundary
Zonal boundary
International boundary
County boundary
Reserve, park boundary
Township & Range line
Township & Range intersection
Main highway
Stream, lake
Dyke

1:50,000

Kilometres 1 0 1 2 3 Kilometres

Miles 1 ½ 0 1 2 Miles

MAP UNIT SYMBOL	MAP UNIT NAME	PARENT MATERIAL(S)	SURFACE EXPRESSION AND SLOPE	MAJOR SOIL COMPONENT(S)
AV1	Alluvium	Medium textured fluvial.	Level terraces between steep sided banks. Variable slopes.	CU.HR 60-80% O.BL and O.DB soils 20-40%
AV6	Alluvium	Gravelly coarse textured fluvial.	Level floodplain and terraces. Steep sided banks sometimes included. Variable slopes.	O.R 60-90% CU.HR 10-20%
BDCC1:4-5	Birdseye-Crooked Creek	Medium textured till veneer over residual material, paralithic.	Rolling and inclined. 5-15%	O.DG BDY 30-50% D.GL CCR 20-30%
BDNF1:6-7	Birdseye-North Fork	Medium textured till veneer over residual material, paralithic.	Ridged, rolling and inclined. 15-45%	O.DG BDY 30-50% O.EB NFK 20-40%
BDY1:3-4	Birdseye	Medium textured till veneer over residual material, paralithic.	Rolling and undulating. 2-9%	O.DG BDY 50-70%
BFRN1:3	Blackfoot-Rinard	Discontinuous medium textured glaciofluvial veneer over gravel.	Terraced and undulating. 2-5%	O.BL BFT 30-50% O.BL RND 30-50%
BFT1:3	Blackfoot	Medium textured glaciofluvial veneer over gravel.	Terraced and undulating. 2-5%	O.BL BFT 60-90%
BVA6:4-6	Beauvais	Medium textured till and gravelly medium to coarse textured glaciofluvial.	Hummocky and ridged. 5-30%	O.DG BVA 40-60% O.DG gravelly phases of BVA 20-40%
BVLT1:3-4	Beauvais-Leighton Centre	Medium textured till.	Undulating to rolling. 2-9%	O.DG BVA 40-60% D.GL LTC 20-50%
BVNF1:5-6	Beauvais-North Fork	Medium textured till blanket-veneer over residual material, paralithic.	Hummocky, ridged and inclined. 9-30%	O.DG BVA 40-60% O.EB NFK 20-40%
BZCT1:3	Beazer-Cardston	Medium textured till and fine textured lacustro-till.	Undulating. 2-5%	O.BL BZR 40-60% O.BL CTN 30-50%
BZCT2:3	Beazer-Cardston	Medium textured till and fine textured lacustro-till.	Undulating. 2-5%	O.BL BZR 30-50% O.BL CTN 20-40% Gleyed soils, Gleysolics and Water 15-30%
BZCT3:3	Beazer-Cardston	Medium textured till and fine textured lacustro-till.	Undulating. 2-5%	O.BL BZR 30-50% O.BL CTN 20-40% Saline soils 15-30%
BZCT4:4	Beazer-Cardston	Medium textured till and fine textured lacustro-till.	Hummocky and inclined. 5-9%	O.BL BZR 30-50% O.BL CTN 20-40% R.BL PSO,CWY 20-40%
BZOK1:5-6	Beazer-Ockey	Medium textured till blanket-veneer over residual material, paralithic. Bedrock outcrops.	Ridged and rolling. 9-30%	O.BL BZR 40-60% O.BL OKY 15-30%
BZOK4:4	Beazer-Ockey	Medium textured till blanket-veneer over residual material, paralithic.	Rolling and inclined. 5-9%	O.BL BZR 30-50% O.BL OKY 15-30% R.BL soils and O.R 20-40%
BZOK4:6D	Beazer-Ockey	Medium textured till blanket-veneer over residual material, paralithic. Bedrock outcrops.	Inclined and dissected. 15-30%	O.BL BZR 30-50% O.BL OKY 15-30% R.BL soils and O.R 20-40%
BZR1:3	Beazer	Medium textured till.	Undulating and inclined. 2-5%	O.BL BZR 60-90%
BZR1:4	Beazer	Medium textured till.	Hummocky and inclined. 5-9%	O.BL BZR 60-90%
BZR1:4D	Beazer	Medium textured till.	Hummocky, inclined and dissected. 5-9%	O.BL BZR 60-90%
BZR1:5	Beazer	Medium textured till.	Hummocky. 9-15%	O.BL BZR 60-90%
BZR1:5-6D	Beazer	Medium textured till.	Hummocky, inclined and dissected. 9-30%	O.BL BZR 60-80%
BZR1:6	Beazer	Medium textured till.	Hummocky. 15-30%	O.BL BZR 60-80%
BZR2:4	Beazer	Medium textured till.	Hummocky. 5-9%	O.BL BZR 60-80% Gleyed soils, Gleysolics and Water 15-30%
BZR2:5	Beazer	Medium textured till.	Hummocky. 9-15%	O.BL BZR 60-80% Gleyed soils, Gleysolics and Water 15-30%

MAP UNIT SYMBOL	MAP UNIT NAME	PARENT MATERIAL(S)	SURFACE EXPRESSION AND SLOPE	MAJOR SOIL COMPONENT(S)
BZR4:4	Beazer	Medium textured till.	Hummocky. 5-9%	O.BL BZR 50-70% R.BL PSO 20-40%
BZR4:5	Beazer	Medium textured till.	Hummocky. 9-15%	O.BL BZR 50-70% R.BL PSO 20-40%
BZR4:6D	Beazer	Medium textured till.	Inclined and dissected. 15-30%	O.BL BZR 50-70% R.BL PSO 20-40%
BZR6:4	Beazer	Medium textured till and gravelly medium to coarse textured glaciofluvial.	Hummocky. 5-9%	O.BL BZR 50-80% O.BL gravelly phases of BZR 20-40%
BZR6:5	Beazer	Medium textured till and gravelly medium to coarse textured glaciofluvial.	Hummocky. 9-15%	O.BL BZR 50-80% O.BL gravelly phases of BZR 20-40%
BZR6:5-6D	Beazer	Medium textured till and gravelly medium to coarse textured glaciofluvial.	Hummocky, inclined and dissected. 9-30%	O.BL BZR 40-60% O.BL gravelly phases of BZR 20-40%
BZR8:4	Beazer	Medium textured till.	Hummocky. 5-9%	O.BL BZR 40-60% R.BL PSO 20-40% Gleyed soils, Gleysolics and Water 15-30%
BZSO1:3-4	Beazer-Standoff	Medium textured till and medium textured lacustrine blanket-veneer over till.	Undulating to hummocky. 2-9%	O.BL BZR 40-60% O.BL SOF 30-50%
BZSO2:2-3	Beazer-Standoff	Medium textured till and medium textured lacustrine blanket-veneer over till.	Level to undulating. 0-5%	O.BL BZR 30-50% O.BL SOF 20-40% Gleyed soils, Gleysolics and Water 15-30%
BZSO3:3	Beazer-Standoff	Medium textured till and medium textured lacustrine blanket-veneer over till.	Undulating. 2-5%	O.BL BZR 40-60% O.BL SOF 20-40% Saline soils 15-30%
CCBD1:5-6	Crooked Creek-Birdseye	Medium textured till veneer over residual material, paralithic.	Rolling, ridged and inclined. 9-30%	D.GL CCR 30-50% O.DG BDY 20-40%
CCNF1:5-6	Crooked Creek-North Fork	Medium textured till veneer over residual material, paralithic.	Rolling, ridged and inclined. 9-30%	D.GL CCR 30-50% O.EB NFK 30-50%
CFNE1:3-4	Crowfoot-New Dayton	Discontinuous medium textured glaciofluvial veneer over gravel.	Undulating and terraced. 2-9%	O.DB CFT 40-60% O.DB NED 30-50%
CFT4:2-3	Crowfoot	Medium textured glaciofluvial veneer over gravel.	Level and undulating. 0-5%	O.DB CFT 50-70% R.DB soils and O.R 20-30%
CLLE1:2	Coaldale-Lethbridge	Fine and medium textured lacustrine.	Level. 0-2%	O.DB CLD 40-60% O.DB LET 30-50%
CRD1:3	Cradduck	Medium textured till.	Undulating. 2-5%	O.DB CRD 60-90%
CRD1:4	Cradduck	Medium textured till.	Hummocky. 5-9%	O.DB CRD 60-90%
CRD2:4	Cradduck	Medium textured till.	Hummocky. 5-9%	O.DB CRD 60-80% Gleyed soils, Gleysolics and Water 15-30%
CRD3:3	Cradduck	Medium textured till.	Undulating. 2-5%	O.DB CRD 60-80% Saline soils 15-30%
CRD4:3	Cradduck	Medium textured till.	Undulating. 2-5%	O.DB CRD 60-80% R.DB VEB 20-40%
CRD4:4	Cradduck	Medium textured till.	Hummocky. 5-9%	O.DB CRD 60-80% R.DB VEB 20-40%
CRLN1:4	Carway-Lundbreck	Coarse and gravelly coarse textured glaciofluvial.	Hummocky. 5-9%	O.BL CRW 40-60% O.BL LNB 30-50%
CRLN1:5-6	Carway-Lundbreck	Coarse and gravelly coarse textured glaciofluvial.	Hummocky. 9-30%	O.BL CRW 40-60% O.BL LNB 30-50%
CRMG1:3	Cradduck-Magrath	Medium textured till and fine textured lacustro-till.	Undulating. 2-5%	O.DB CRD 40-60% O.DB MGT 30-50%
CRMG4:3	Cradduck-Magrath	Medium textured till and fine textured lacustro-till.	Undulating. 2-5%	O.DB CRD 40-50% O.DB MGT 20-40% R.DB VEB,WLG 20-40%
CRMG4:4	Cradduck-Magrath	Medium textured till and fine textured lacustro-till.	Hummocky. 5-9%	O.DB CRD 30-50% O.DB MGT 20-40% R.DB VEB,WLG 20-40%
CRMG4:5	Cradduck-Magrath	Medium textured till and fine textured lacustro-till.	Hummocky. 9-15%	O.DB CRD 30-50% O.DB MGT 20-40% R.DB VEB,WLG 20-40%

MAP UNIT SYMBOL	MAP UNIT NAME	PARENT MATERIAL(S)	SURFACE EXPRESSION AND SLOPE	MAJOR SOIL COMPONENT(S)
CRVA1:3	Cradduck-Van Cleeve	Medium textured till blanket-veneer over residual material, paralithic.	Inclined. 2-5%	O.DB CRD 40-60% O.DB VAC 30-50%
CRVA4:4	Cradduck-Van Cleeve	Medium textured till blanket-veneer over residual material, paralithic.	Inclined. 5-9%	O.DB CRD 30-50% O.DB VAC 20-40% R.DB soils and O.R 20-40%
CRW1:4	Carway	Coarse textured glaciofluvial.	Hummocky. 5-9%	O.BL CRW 60-80%
CT:L4:4	Cardston (lithic)	Fine textured lacustro-till veneer over residual material, paralithic.	Rolling. 5-9%	O.BL CTN 60-80% R.BL CWY 20-40%
CTN1:2-3	Cardston	Fine textured lacustro-till.	Level to undulating. 0-5%	O.BL CTN 60-90%
CTN3:3	Cardston	Fine textured lacustro-till.	Undulating. 2-5%	O.BL CTN 60-80% Saline soils 20-30%
CTPG1:2-3	Cardston-Peigan	Fine textured lacustro-till.	Level to undulating. 0-5%	O.BL CTN 60-80% BL.SS PGN 20-40%
DLB1:2	Del Bonita	Medium textured glaciofluvial or eolian.	Level. 0-2%	O.BL DLB 80-100%
DLHL1:3	Del Bonita-Hillmer	Medium textured glaciofluvial or eolian and medium textured slopewash material.	Inclined and undulating. 2-5%	O.BL DLB 50-70% O.BL HLM 20-40%
DVBV1:4-5	Dunvargan-Beauvais	Medium textured till.	Hummocky. 5-15%	O.BL DVG 40-60% O.DG BVA 30-50%
DVFS1:3	Dunvargan-Fish Creek	Medium textured till and fine textured lacustro-till.	Undulating. 2-5%	O.BL DVG 40-60% O.BL FSH 30-50%
DVG1:3	Dunvargan	Medium textured till.	Undulating. 2-5%	O.BL DVG 60-90%
DVG1:4	Dunvargan	Medium textured till.	Hummocky and inclined. 5-9%	O.BL DVG 60-90%
DVG1:4D	Dunvargan	Medium textured till.	Inclined and dissected. 5-9%	O.BL DVG 60-90%
DVG1:5	Dunvargan	Medium textured till.	Hummocky. 9-15%	O.BL DVG 60-90%
DVG1:6	Dunvargan	Medium textured till.	Hummocky. 15-30%	O.BL DVG 60-80%
DVG2:3-4	Dunvargan	Medium textured till.	Undulating to hummocky. 2-9%	O.BL DVG 60-80% Gleyed soils, Gleysolics and Water 15-30%
DVG2:4-5	Dunvargan	Medium textured till.	Hummocky. 5-15%	O.BL DVG 60-80% Gleyed soils, Gleysolics and Water 15-30%
DVG6:4-5	Dunvargan	Medium textured till and gravelly medium to coarse textured glaciofluvial.	Hummocky. 5-15%	O.BL DVG 60-80% O.BL gravelly phases of DVG 20-40%
DVG6:5-6	Dunvargan	Medium textured till and gravelly medium to coarse textured glaciofluvial.	Hummocky. 9-30%	O.BL DVG 60-80% O.BL gravelly phases of DVG 20-40%
DVG7:3-4	Dunvargan	Medium textured till.	Rolling and inclined. 2-8%	O.BL DVG 60-80% SZ. soils 20-30%
DVOK1:4-5	Dunvargan-Ockey	Medium textured till blanket-veneer over residual material, paralithic.	Hummocky. 5-15%	O.BL DVG 50-70% O.BL OKY 20-40%
DVOK1:5-6	Dunvargan-Ockey	Medium textured till blanket-veneer over residual material, paralithic. Bedrock outcrops.	Ridged and rolling. 9-30%	O.BL DVG 50-70% O.BL OKY 20-40%
DVOK1:5-7	Dunvargan-Ockey	Medium textured till blanket-veneer over residual material, paralithic. Bedrock outcrops.	Ridged and hummocky. 9-45%	O.BL DVG 50-70% O.BL OKY 20-40%
FSH7:3	Fish Creek	Fine textured lacustro-till.	Undulating to level. 2-5%	O.BL FSH 50-80% SZ. soils 20-30%
G	Gleysolics	Glaciofluvial, lacustrine or till of variable textures.	Level to depressional. <3%	O.HG 60-80%
HEG1:3	Hegson	Fine textured lacustro-till.	Undulating and inclined. 2-5%	O.DB HEG 70-90%

MAP UNIT SYMBOL	MAP UNIT NAME	PARENT MATERIAL(S)	SURFACE EXPRESSION AND SLOPE	MAJOR SOIL COMPONENT(S)
HEG2:3-4	Hegson	Fine textured lacustro-till.	Undulating to hummocky. 2-9%	O.DB HEG 70-80% Gleyed soils, Gleysolics and Water 15-30%
HEG7:3D	Hegson	Fine textured lacustro-till.	Inclined and dissected. 2-5%	O.DB HEG 60-80% SZ. soils 20-30%
HLM1:3	Hillmer	Medium textured slopewash material.	Undulating and inclined. 2-5%	O.BL HLM 70-90%
HLM1:4	Hillmer	Medium textured slopewash material.	Inclined. 5-9%	O.BL HLM 70-90%
HLM6:4D	Hillmer	Medium textured and gravelly medium to coarse textured slopewash material.	Inclined and dissected. 5-9%	O.BL HLM 40-60% O.BL gravelly phases of HLM 30-50%
HRNE1:3-4	Heartbreak-New Dayton	Coarse textured and gravelly coarse textured glaciofluvial.	Undulating and ridged. 2-9%	O.DB HRK 40-60% O.DB NED 30-50%
HRNE1:5	Heartbreak-New Dayton	Coarse textured and gravelly coarse textured glaciofluvial.	Hummocky. 9-15%	O.DB HRK 40-60% O.DB NED 30-50%
JAT1:2-3	Joanto	Medium to fine textured lacustrine.	Level. 0-5%	R.HG JAT 60-80% O.HG 20-40%
JAT3:2-3	Joanto	Medium to fine textured lacustrine.	Level. 0-5%	R.HG JAT 40-60% Saline soils 15-30%
KGT1:2	Klemengurt	Fine textured lacustrine.	Level. 0-2%	BL.SZ KGT 60-80%
KNRN1:4	Knight-Rinard	Coarse textured and gravelly coarse textured glaciofluvial.	Hummocky. 5-9%	O.BL KNT 40-60% O.BL RND 30-50%
KNT1:4	Knight	Coarse textured glaciofluvial.	Hummocky. 5-9%	O.BL KNT 60-80%
KNT4:3	Knight	Coarse textured glaciofluvial.	Undulating. 2-5%	O.BL KNT 50-70% R.BL soils and O.R 20-40%
KNT4:5	Knight	Coarse textured glaciofluvial.	Hummocky. 9-15%	O.BL KNT 50-70% R.DB soils and O.R 20-50%
KSHR1:3-4	Kessler-Heartbreak	Coarse textured glaciofluvial.	Undulating to hummocky. 2-9%	O.DB KSR 40-60% O.DB HRK 30-50%
KSNE1:3	Kessler-New Dayton	Coarse textured and gravelly coarse textured glaciofluvial.	Undulating. 2-5%	O.DB KSR 40-60% O.DB NED 30-50%
KSR4:3	Kessler	Coarse textured glaciofluvial.	Undulating. 2-5%	O.DB KSR 60-80% R.DB soils and O.R 20-40%
LEOA1:2-3	Lethbridge-Oasis	Medium textured lacustrine blanket-veneer over coarse textured glaciofluvial.	Level to undulating. 0-5%	O.DB LET 50-70% O.DB OAS 20-40%
LET1:3	Lethbridge	Medium textured lacustrine.	Undulating. 2-5%	O.DB LET 60-80%
LNB1:3	Lundbreck	Gravelly coarse textured glaciofluvial.	Undulating. 2-5%	O.BL LNB 50-70%
LNB1:4	Lundbreck	Gravelly coarse textured glaciofluvial.	Hummocky. 5-9%	O.BL LNB 50-70%
LNB2:3	Lundbreck	Gravelly coarse textured glaciofluvial.	Undulating. 2-5%	O.BL LNB 40-60% Gleyed soils, Gleysolics and Water 15-30%
LTC2:4-5	Leighton Centre	Medium textured till.	Hummocky and inclined. 5-15%	D.GL LTC 40-60% Gleyed soils, Gleysolics and Water 15-30%
LUP1:3	Lupen	Medium textured lacustrine veneer over till.	Undulating. 2-5%	O.DB LUP 60-80%
LUP2:3	Lupen	Medium textured lacustrine veneer over till.	Undulating. 2-5%	O.DB LUP 50-70% Gleyed soils, Gleysolics and Water 15-30%
LVY7:3	Lonely Valley	Medium textured fluvial and fine textured lacustrine.	Undulating. 2-5%	O.BL LVY 40-60% BL.SZ KGT 30-50%
MC:S2:3	Magrath-Coaldale (saline)	Fine textured lacustro-till and fine textured lacustrine.	Level to undulating. 0-5%	Saline soils 40-70% O.DB MGT 15-30% O.DB CLD 15-30%
MFT2:2-3	Maycroft	Medium textured lacustrine.	Level to undulating. 0-5%	O.BL MFT 60-80% Gleyed soils, Gleysolics and Water 15-30%

MAP UNIT SYMBOL	MAP UNIT NAME	PARENT MATERIAL(S)	SURFACE EXPRESSION AND SLOPE	MAJOR SOIL COMPONENT(S)
MGCL1/2-3	Magrath-Coaldale	Fine textured lacustro-till and fine textured lacustrine.	Level to undulating. 0-5%	O.DB MGT 40-60% O.DB CLD 40-60%
MGCL3/2-3	Magrath-Coaldale	Fine textured lacustro-till and fine textured lacustrine.	Level to undulating. 0-5%	O.DB MGT 30-50% O.DB CLD 30-50% Saline soils 20-40%
MGLE4/2-3	Magrath-Lethbridge	Fine textured lacustro-till and medium textured lacustrine.	Level to undulating. 0-5%	O.DB MGT 30-50% O.DB LET 30-50% R.DB WLG,DIM 20-40%
MKR1/3	Milk River	Coarse textured fluvial blanket-veneer over gravel.	Terraced and undulating. 2-5%	CU.HR MKR 40-60%
MKRS/3	Milk River	Coarse and medium textured fluvial blanket-veneer over gravel.	Terraced and undulating. 2-5%	CU.R MKR 30-50% O.DB soils 30-50%
NED1/3	New Dayton	Gravelly coarse textured glacio-fluvial.	Terraced and undulating. 2-5%	O.DB NED 60-80%
OKPP1/6-8	Ockey-Porcupine	Medium textured till veneer and medium textured colluvium over residual material, paralithic. Bed-rock outcrops.	Ridged. 15-70%	O.BL OKY 30-50% O.BL PPE 20-30% O.BL DVG 20-30%
ORG	Organic	Mesic organic material over fine textured lacustrine.	Level to undulating. <3%	Terric Mesisols 60-90%
OTP1/3-4	Outpost	Gravelly medium textured glaciafluvial.	Undulating to hummocky. 3-9%	O.BL OTP 60-80%
OWHL4/4	Owendale-Hillmer	Medium textured residual material and medium textured slopewash material.	Hummocky and inclined. 5-9%	O.BL OWD 30-50% O.BL HLM 30-50% R.BL soils and O.R 20-40%
OWHL4/5D	Owendale-Hillmer	Medium textured residual material and medium textured slopewash material.	Inclined and dissected. 9-15%	O.BL OWD 30-50% O.BL HLM 30-50% R.BL soils and O.R 20-40%
PNSO2/2-3	Pincher-Standoff	Fine and medium textured lacus-trine.	Level to undulating. 0-5%	O.BL PNR 30-50% O.BL SOF 30-50% Gleyed soils, Gleysolics and Water 15-30%
POT1/2-3	Pothole	Fine textured lacustrine.	Level 0-3%	O.HG POT 60-80%
PUBZ1/4	Purescape-Beazer	Medium textured till.	Hummocky. 5-9%	O.DB PUR 50-80% O.BL BZR 20-50%
PUBZ1/5	Purescape-Beazer	Medium textured till.	Hummocky. 5-9%	O.DB PUR 50-80% O.BL BZR 20-50%
PUBZ2/5	Purescape-Beazer	Medium textured till.	Hummocky. 9-15%	O.DB PUR 40-60% O.BL BZR 20-40% Gleyed soils, Gleysolics and Water 15-30%
PUBZ4/4	Purescape-Beazer	Medium textured till.	Hummocky and inclined. 5-9%	O.DB PUR 50-70% O.BL BZR 20-30% R.DB WID 20-40%
PUHE1/3	Purescape-Hegson	Medium textured till and fine tex-tured lacustro-till.	Undulating. 2-5%	O.DB PUR 40-60% O.DB HEG 30-50%
PUHE2/4	Purescape-Hegson	Medium textured till and fine tex-tured lacustro-till.	Hummocky. 5-9%	O.DB PUR 40-60% O.DB HEG 20-40% Gleyed soils, Gleysolics and Water 15-30%
PULU7/3D	Purescape-Lupen	Medium textured till and medium textured lacustrine veneer over till.	Inclined and dissected. 2-5%	O.DB PUR 40-60% O.DB LUP 20-40% SZ. soils 20-40%
PUR1/3	Purescape	Medium textured till.	Undulating. 2-5%	O.DB PUR 60-90%
PUR1/4	Purescape	Medium textured till.	Hummocky. 5-9%	O.DB PUR 60-90%
PUR1/4D	Purescape	Medium textured till.	Inclined and dissected. 5-9%	O.DB PUR 60-90%
PUR1/5	Purescape	Medium textured till.	Hummocky. 9-15%	O.DB PUR 60-90%
PUR2/4	Purescape	Medium textured till.	Hummocky. 5-9%	O.DB PUR 50-70% Gleyed soils, Gleysolics and Water 15-30%

MAP UNIT SYMBOL	MAP UNIT NAME	PARENT MATERIAL(S)	SURFACE EXPRESSION AND SLOPE	MAJOR SOIL COMPONENT(S)
PUR2/5	Purescape	Medium textured till.	Hummocky. 9-15%	O.DB PUR 50-70% Gleyed soils, Gleysolics and Water 15-30%
PUR4/4	Purescape	Medium textured till.	Hummocky. 5-9%	O.DB PUR 40-60% R.DB WID 20-50%
PUR4/5	Purescape	Medium textured till.	Hummocky. 9-15%	O.DB PUR 40-60% R.DB WID 20-50%
PUR4/6D	Purescape	Medium textured till.	Inclined and dissected. 15-30%	O.DB PUR 40-60% R.DB WID 20-50%
PUR6/4	Purescape	Medium textured till and gravelly medium to coarse textured glaciofluvial.	Hummocky. 5-9%	O.DB PUR 60-80% O.DB gravelly phases of PUR 20-40%
PUR6/5	Purescape	Medium textured till and gravelly medium textured glaciofluvial.	Hummocky. 9-15%	O.DB PUR 60-80% O.DB gravelly phases of PUR 20-40%
PUR7/3	Purescape	Medium textured till.	Undulating. 2-5%	O.DB PUR 50-70% SZ. soils 20-30%
RB1	Rough Broken	Undifferentiated rough broken land.	Coulee sides and river banks. >10%	O.DB and O.BL soils 40-60% R.DB, R.BL soils and O.R 40-60%
RB2	Rough Broken	Undifferentiated rough broken land, with significant bedrock out-crops.	Coulee sides and river banks. >10%	R.DB, R.BL soils and O.R 50-70% O.DB and O.BL soils 30-50%
RB4	Rough Broken	Undifferentiated rough broken land. Erosional channels.	Coulees and gullies. >5%	O.DB and O.BL soils 40-60% R.DB, R.BL soils and O.R 40-60%
RFD1/3-4	Rockford	Gravelly medium textured glaciofluvial.	Undulating to hummocky. 2-9%	O.BL RFD 60-80%
RND1/3	Rinard	Gravelly coarse textured glacio-fluvial.	Terraced and undulating. 2-5%	O.BL RND 50-80%
RND1-4	Rinard	Gravelly coarse textured glacio-fluvial.	Terraced and hummocky or ridged. 5-9%	O.BL RND 60-80%
S	Saline areas	Glaciofluvial, lacustrine or till.	Level. <5%	Saline soils 60-80%
SAKN1/3	Sakalo-Knight	Discontinuous medium textured lacustrine veneer over coarse textured glaciofluvial.	Undulating. 2-5%	O.BL SAK 40-60% O.BL KNT 20-40%
SASO1/3	Sakalo-Standoff	Medium textured lacustrine ven-eer and blanket over coarse tex-tured glaciofluvial.	Undulating. 2-5%	O.BL SAK 40-60% O.BL SOF 30-50%
SASO4/3	Sakalo-Standoff	Medium textured lacustrine ven-eer and blanket over coarse tex-tured glaciofluvial.	Undulating. 2-5%	O.BL SAK 30-50% O.BL SOF 30-50% R.BL soils and O.R 20-40%
SND2/3	Shandor	Fine textured slopewash material derived from fine textured residual material.	Undulating. 2-5%	O.BL SND 50-70% Gleyed soils, Gleysolics and Water 15-30%
SND4/3	Shandor	Fine textured slopewash material derived from fine textured residual material.	Undulating. 2-5%	O.BL SND 50-70% R.BL soils and O.R 20-40%
SNHL1/4D	Shandor-Hillmer	Fine textured slopewash material derived from fine textured residual and medium textured slopewash material.	Inclined and dissected. 5-9%	O.BL SND 30-50% O.BL HLM 30-50%
SOF1/3	Standoff	Medium textured lacustrine.	Undulating. 2-5%	O.BL SOF 70-90%
SOF2/3	Standoff	Medium textured lacustrine.	Undulating. 2-5%	O.BL SOF 60-80% Gleyed soils, Gleysolics and Water 15-30%
SP:F7-8	Spruce Ridge (tailing)	Medium textured till.	Inclined. 30-70%	C.GL SPR 40-60% O.R 20-40%
SPR1/4-5	Spruce Ridge	Medium textured till.	Rolling and inclined. 5-15%	C.GL SPR 50-70% D.GL 15-30%
SXT3/2-3	Sexton	Medium to coarse textured flu-vial.	Undulating to level. 0-5%	C.HR SXT 30-50% CU.HR 30-50% Saline soils 20-40%

MAP UNIT SYMBOL	MAP UNIT NAME	PARENT MATERIAL(S)	SURFACE EXPRESSION AND SLOPE	MAJOR SOIL COMPONENT(S)
TUC1/5-6	Tough Creek	Medium textured till veneer over residual material, paralithic.	Rolling and inclined. 9-30%	O.GL TUC 50-70%
TUSP1/6-7	Tough Creek-Spruce Ridge	Medium textured till veneer and blanket over residual material, paralithic.	Ridged and inclined. 15-45%	O.GL TUC 20-40% O.GL SPR 20-40%
VAC4/5	Van Cleeve	Medium textured till veneer over residual material, paralithic.	Inclined. 9-15%	O.DB VAC 40-60% R.DB soils and O.R 20-40%
WCT1/3-4	Westcastle	Stony medium textured till.	Undulating. 2-9%	O.GL WCT 70-90%

MAP UNIT SYMBOL EXPLANATION

Soil Unit: **BZR1** — 1 = Map Unit Number; 3 = Slope Class

Complex Soil Unit: **BZOK1** — 1 = Map Unit Number; 5-6D = Slope Modifier

Three letter symbol denotes a unit with one dominant soil eg. **BZR** Beazer.

Four letter symbol is used when a complex of 2 soils are present in a map unit. Symbol combines the first two letters of each of the two soils forming the soil unit eg. **BZOK** from **BZR** (Beazer) and **OKY** (Ockey).

GLOSSARY OF TERMS USED IN LEGEND

- blanket - material depth greater than 1 meter.
- glaciofluvial - includes fluvial and ice-contact material.
- gravelly - refers to coarse fragments of variable sizes and the content is between 20-80%.
- gravel - refers to coarse fragments of variable sizes and the content is >50%.
- lacustro-til - includes glaciolacustrine and till, usually fine textured.
- lithic - material depth over bedrock is less than 1 meter.
- parilithic - refers to residual materials, where weathered bedrock fragment percentage increases with depth, and solid bedrock is usually present.
- rolling - long convex slopes up to 1 km in cycle distance.
- stony - refers to coarse fragments greater than 25 cm in diameter and the content is between 20-50%.
- veneer - material depth less than 1 meter.

SOIL CLASSIFICATION ABBREVIATIONS

- BL.SS - Black Solodized Solonetz
- BL.SZ - Black Solonetz
- CU.HR - Cumulicc Humic Regosol
- CU.R - Cumulic Regosol
- D.GL - Dark Gray Luvisol
- O.BL - Orthic Black Chernozemic
- O.DB - Orthic Dark Brown Chernozemic
- O.DG - Orthic Dark Gray Chernozemic
- O.EB - Orthic Eutric Brunisol
- O.GL - Orthic Gray Luvisol
- O.HG - Orthic Humic Gleysol
- O.HR - Orthic Humic Regosol
- O.R - Orthic Regosol
- R.BL - Rego Black Chernozemic
- R.DB - Rego Dark Brown Chernozemic
- R.HG - Rego Humic Gleysol
- SZ. - Solonetzic soils

MAP UNIT NUMBER EXPLANATION*

1. Relatively pure unit.
2. Significant Gleyed soils, Gleysolics and Water.
3. Significant saline soils.
4. Significant Rego and Calcareous Chernozemics.
5. Significant finer textured soils.
6. Significant coarser textured soils.
7. Significant Solonetzic soils.
8. Significant Gleyed soils, Gleysolics and Water, and Rego Chernozemics.

* These numbers don't apply to **AV** or **RB** units.

MISCELLANEOUS SYMBOLS

S - saline spot symbols, for areas < 4 ha in size.

<><> - eskers.

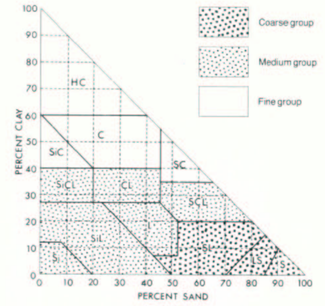
SLOPE CLASS

2. ..... 0-2%
3. ..... 2-5%
4. ..... 5-9%
5. ..... 9-15%
6. ..... 15-30%
7. ..... 30-45%
8. ..... 45-70%

SLOPE MODIFIER

D - Dissected

TEXTURAL GROUPING



Cartography by the Information Systems and Cartography Unit, Land Resource Research Centre, Research Branch, Agriculture Canada, Ottawa, 1990.
Production: B. Edwards (Manager).
Drafting: H.D. Kinney (Supr.); J.H.R. Guilbault, L.B. Medynski, E.C. Hill.
Map editing: D.N. Perkins (Supr.).
Photomechanical: R. St. John (Supr.); R.W. Davies, B.E. Wollenschlager.
Typography: L. Routhier.

Printing supplied by the Map Reproduction Centre, Reproduction and Distribution Division, Department of Energy, Mines and Resources, Ottawa.