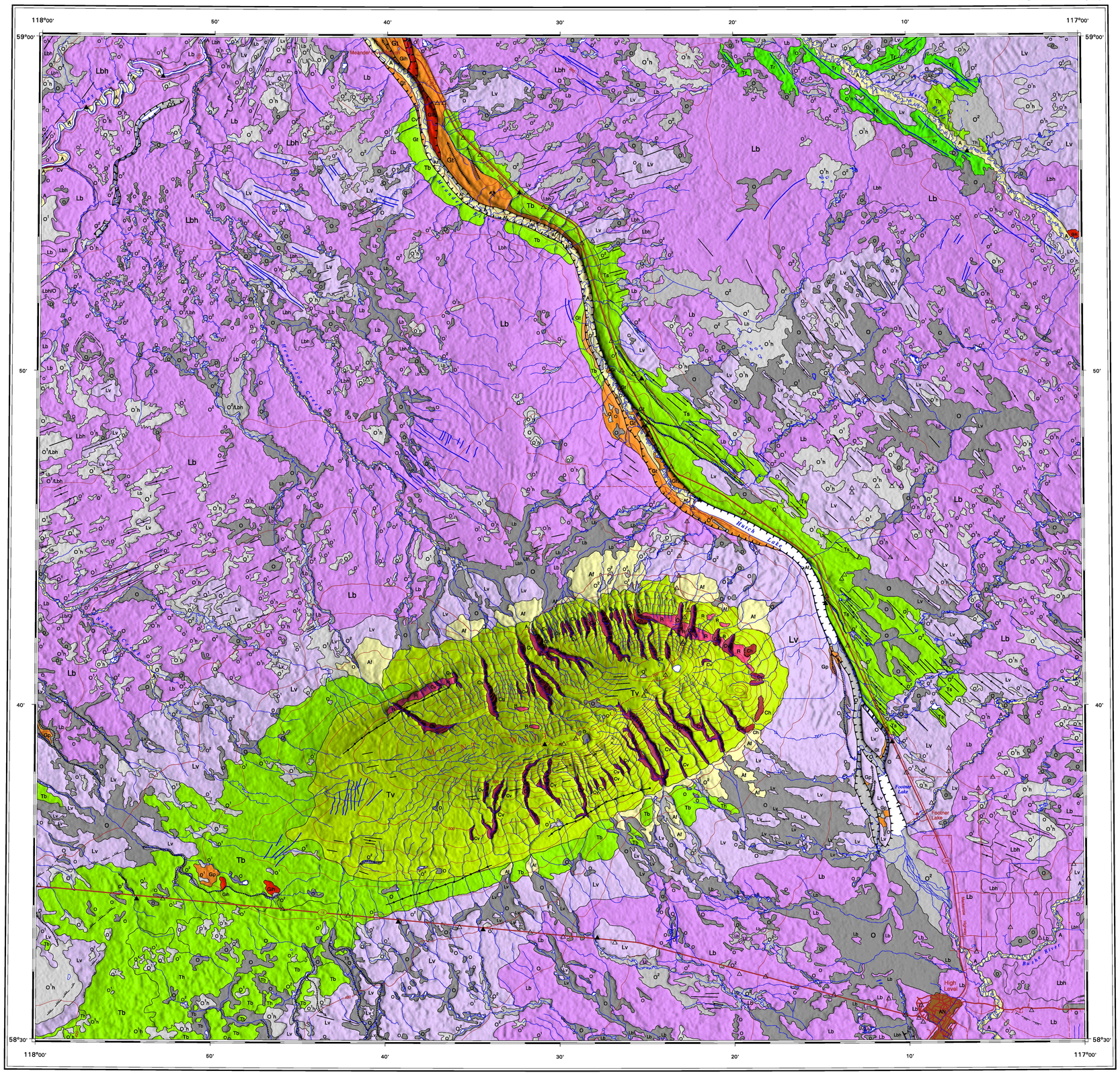
Natural Resources Canada | Ressources naturelles Canada

GEOLOGICAL SURVEY OF CANADA | COMMISSION GÉOLOGIQUE DU CANADA

EUB Alberta Energy and Utilities Board | AGS Alberta Geological Survey



LEGEND

This legend is common to maps OF5460 and OF5461. Coloured legend blocks indicate map units that appear on this map. Not all map symbols shown in the legend appear on this map.

Note: In areas where the surficial cover forms a complex pattern, the area is coloured according to the dominant unit and labelled in descending order of cover (e.g. O-Tv). Where buried aggregate deposits (sand and gravel–commonly associated with Gt surficial units) are known, or suspected, areas are coloured according to the overlying unit and labelled in the following manner: Lv/Gt.

QUATERNARY
SURFICIAL DEPOSITS
POST LAST GLACIATION
NONGLACIAL ENVIRONMENTS

AN — ***ANTHROPOGENIC DEPOSITS:*** *culturally-made or modified geological materials such that their original physical properties (e.g. structure, cohesion, compaction) have been drastically altered; >2 m thick.*

ORGANIC DEPOSITS: *peat and muck; 1 to 3 m thick on average; formed by the accumulation of plant material in various stages of decomposition; generally occurs as flat, wet terrain (swamps and bogs) over poorly drained substrates.*

O¹ — ***Bog peat:*** *sphagnum or forest peat formed in an ombrotrophic environment; wet terrain; may be treed or treeless; O¹h, hummocky, mounds and plateaus; area may be underlain by ground ice or shallow permafrost conditions.*

O² — ***Fen peat:*** *peat derived from sedges and partially decayed shrubs in a eutrophic environment; forms relatively open peatlands with a mineral-rich water table that persists seasonally near the surface; generally covered with low shrubs and an occasional sparse cover of trees.*

O — *Undifferentiated bog and fen deposits.*

COLLUVIAL DEPOSITS: *mass wasting debris; poorly sorted, massive to stratified debris deposited by direct, gravity-induced movement; composition dependant on source material.*

Ch — ***Landslide and slump debris:*** *active and inactive landslides; hummocky topography; diamicton, generally 1 to 10 m thick, but may exceed 10 m near the toe of large landslides.*

Cv — ***Colluvial veneer:*** *thin and discontinuous cover of slumped and/or soliflucted material <1 m thick; overlies bedrock or till.*

ALLUVIAL DEPOSITS: *sorted gravel, sand, minor silt, and organic detritus deposited by streams; commonly stratified.*

Ap — ***Floodplain deposits:*** *sorted gravel, sand, silt, and organic detritus >1 m thick; forming active floodplains close to river level with meander channels and scroll marks.*

At — ***Fluvial terrace deposits:*** *inactive terraces above modern floodplain; >2 m thick; represents a potential aggregate source.*

Af — ***Alluvial fan deposits:*** *poorly sorted gravel, sand, and organic detritus >1 m thick.*

A — *Undifferentiated fluvial deposits.*

L¹ — ***LACUSTRINE DEPOSITS:*** *sand, silt, and minor clay deposited in a former lake; >1 m thick; generally overlain by organic deposits; exposed by recent fluctuations in lake levels.*

NONGLACIAL AND PROGLACIAL ENVIRONMENTS

EOLIAN DEPOSITS: *wind-deposited medium to fine sand; derived from deltaic or glaciolacustrine deposits; in some areas eolian sediments are thin or absent between dunes.*

Er — ***Ridged eolian deposits:*** *forming dunes; generally >2 m thick.*

POSTGLACIAL OR LATE WISCONSINAN
PROGLACIAL AND GLACIAL ENVIRONMENTS

GLACIOLACUSTRINE DEPOSITS: *fine sand, silt, and clay, with minor debris-flow diamicton, deposited in glacier-dammed lakes in valleys and along the margin of the retreating Laurentide Ice Sheet; usually overlain by organic deposits in lowlands.*

Lb — ***Glaciolacustrine blanket:*** *>1 m thick;* Lbh, *hummocky glaciolacustrine sediments, >1 m thick; forming circular hummocks and hills surrounded by depressions with a relief usually >2 m; interspersed with minor fens.*

Lv — ***Glaciolacustrine veneer:*** *thin and discontinuous; <1 m thick.*

GLACIOFLUVIAL DEPOSITS: *well to poorly stratified sand and gravel; minor diamicton; deposited behind, at, or in front of the ice margin by glacial meltwater; represents a potential aggregate source.*

G — ***Proglacial outwash:*** *cross-stratified gravel and sand deposited in front of the ice margin; Gp, outwash plain deposits, generally 1 to 5 m thick, generally mantle valley floors and surfaces adjacent to glacial meltwater channel margins; Gt, outwash terrace deposits, generally associated with meltwater channels and canyons; 1 to 10 m thick.*

Gi — ***Ice-contact stratified drift:*** *poorly-sorted sand and gravel with minor diamictons; deposited in contact with the retreating glacier; 1 to >20 m thick;* Gih, *hummocky topography relating to melting of underlying ice;* Gir, *esker ridges.*

TILL: *diamicton deposited directly by the Laurentide Ice Sheet; sandy to clayey matrix with striated clasts of various lithologies, including many Canadian Shield, carbonate, and sandstone erratics; clast content is typically low (<10 %).*

Tb — ***Till blanket:*** *>1 m thick, continuous till cover forming undulating topography that locally obscures underlying units.*

Ts — ***Streamlined and fluted till:*** *>1 m thick, till surface marked by streamlined landforms including flutes and drumlins.*

Th — ***Hummocky till:*** *>1 m thick; hummocky till surface.*

Tr — ***Ridged till deposits:*** *>1 m thick, moraines or crevasse fillings forming a ridged topography.*

Tv — ***Till veneer:*** *<1 m thick, discontinuous till cover, underlying bedrock topography is discernible.*

PRE-QUATERNARY
BEDROCK

R — ***Sedimentary bedrock:*** *Cretaceous Fort St. John Group shales (including the Shaftesbury Formation) and Dunvegan Formation sandstone exposed in highlands and along meltwater channel and canyon walls.*

Geological boundary (defined)
Major landslide
Minor landslide
Paleoshorelines
Meltwater channel or underfit channel, small (paleoflow direction known)
Meltwater channel or underfit channel, small (paleoflow direction unknown)
Meltwater channel, large (paleoflow direction known)
Dunes
Abandoned fluvial channel
Major moraine
Minor moraine and crevasse filling
Esker
Drumlinoid ridge parallel to ice flow (direction unknown)
Fluting
Unknown circular feature
Outcrop
Gravel pit
Field observation site (with, without sample)

DESCRIPTIVE NOTES

The Meander River map area is located in northwestern Alberta within the Fort Nelson Lowlands (Bostock, 1967) which is a region of flat relief with an elevation varying from 300 to 500 m above sea level (asl). Mount Watt, a bedrock erosional remnant, stands out above the lowland reaching an elevation of 760 m asl. Rivers and streams drains northwesterly towards the Hay River except south and southeast of Mount Watt where they drain southeasterly towards the Peace River. The main economic activities in the map area include gas exploitation and forestry and, to a lesser extent, granular aggregate mining and agriculture.

The surficial geology of the map area was interpreted from 1:60 000 scale black and white air photographs dating to 1994 and produced by Alberta Sustainable Resource Development. In addition and to a lesser extent, the surficial geology was interpreted from the shuttle radar topography mission (SRTM) imagery (3-arc second; 90 meter resolution). Field work was conducted during a 3 week period in the summer of 2005 and included the collection of field observations necessary for the mapping of the surficial geology, the logging of stratigraphy exposed in borrow pits and river bank exposures, and the collection of bulk glacial sediment samples (approx. 30 kg per sample). Access to the region was by truck, all terrain vehicle, foot traverses, and helicopter. A hand auger was utilized to identify the sediment type within the upper one meter from surface due to the paucity of natural and man-made sediment exposures. The surficial geology was interpreted on air photographs and was subsequently digitized by a consultant using a digital visual plotter (DVP) system.

Bedrock in the map area consists of horizontally bedded, poorly indurated shale of the Shaftesbury Formation underlain by grey shale of the Loon River Formation and overlain by sandstone of the Dunvegan Formation on Mount Watt (Green et al., 1970; Okulitch, 2006). Ironstone beds and concretions are present in the Shaftesbury Formation. The Shaftesbury Formation is exposed on the flanks and in the gullies of Mount Watt. Well sorted and glaciodectorized sand on top of shale was observed at one station on top of Mount Watt and could represent the base of the Dunvegan Formation.

Till in the Meander River map area consists of a clayey diamicton (10 to 40% clay) with a clast content varying from 5 to 20%. Clast lithologies in till consist of locally derived shale and ironstone intermixed with Canadian Shield and Proterozoic to Paleozoic sedimentary bedrock transported from the northeast.

Glaciofluvial sand and gravel deposits are present along the Meander River spillway channel. Deposits along the length of this spillway channel have been mined for granular aggregate for decades and this feature continues to supply the region with high quality aggregate today.

Glacial lake sediments are the most serially abundant surficial material in the Meander River map area. They consist of massive and rarely bedded, well-sorted fine sand, silt, and clay. Two glacial lakes developed in the region as a result of the damming of the northward and eastward drainage by ice. Glacial lake Hay occupied the region north of Mount Watt where the drainage is to the north and glacial lake Peace flooded the southeastern region where the drainage is to the east (Mathews, 1980; Lemmen et al., 1994). South of Mount Watt, the maximum elevation reached by glacial lake sediments is estimated at 410 m asl based on observations made at a number of stations located along Highway 58. North of Mount Watt, control points are fewer but glacial lake sediments were observed at one station at an elevation of 380 m asl, accessed by helicopter. Shorelines in both of these glacial lakes are rare, short, and discontinuous.

Alluvial deposits are restricted to the major streams of the area and occur in the form of alluvial fans in the periphery of Mount Watt. Colluvial deposits are restricted to the gullies of Mount Watt. They are composed of unconsolidated sediments and bedrock reworked by gravity-induced movement. Organic deposits in the form of bogs and fens are omnipresent throughout the map area. Permafrost is dominantly present in the hummocky bogs (unit O¹h).

Glacial landforms such as flutings, moraines, and paleoshorelines are present in the region. over most of the map area, flutings are draped with glacial lake sediments or organic deposits but are still visible on air photographs. Flutings are a key indicator of ice-flow directions in this region where bedrock striations are absent because of the poorly indurated nature of the bedrock. Moraine orientations provide an indication of the ice front configuration during ice retreat. As indicated on the map, an unknown circular landform was observed in the northwest sector of the map area. The origin of this landform, glacial or periglacial, is still unclear. Similar features are found a few kilometres to the west and to the south (Plouffe and Paulen, 2007).

During the Late Wisconsinan glaciation, glaciers derived from the Keewatin Sector of the Laurentide Ice Sheet advanced westerly to southwesterly over the Meander River map area. Retreat of ice from the area occurred between 11 500 and 11 000 radiocarbon years BP (13 450 to 13 000 calendar years BP) along an ice front which was marked by ice lobes and ice-front readvance. Northwest-southeast oriented flutings to the east of the Meander River spillway channel are thought to result from a late-phase readjustment of the ice-flow pattern in the ice lobe located east of the map area. The northeastward retreat of the ice lobe in the Hay River valley, to the north of the map area, allowed the ice lobe derived from the east to flow northwesterly in the deglaciated area. During deglaciation, a large sector of the map area was inundated by glacial lakes because of the damming of the northward (Hay River) and the eastward drainages (Peace River). For a period of time, glacial lake Peace occupied a level of approximately 330 m asl with an outlet through the Meander River spillway. This channel is in part eroded in glacial lake Hay sediments indicating that glacial lake Peace persisted longer than glacial lake Hay. Some time after deglaciation, vegetation invaded the region and organic material accumulated. Conditions became cool enough at about 3700 radiocarbon years BP to allow for the development of permafrost over much of the area (Zoltai, 1993) which is still present dominantly in hummocky bogs (unit O¹h). Because of the generally flat topography of the region and the continuous damming of small streams by beavers, the energy of secondary streams is low and little fluvial incision has occurred.

Granular aggregate resources have been extracted from the glaciofluvial deposits of the Meander River spillway channel but the remaining reserves, although not quantified, are substantial (Edwards et al., 2004). Small glaciofluvial deposits mapped from airphoto interpretation alone located southwest of Mount Watt remain to be evaluated on the ground. Other fluvial deposits in the area are unlikely to represent potential aggregate resources as they are composed generally of sand and silt, are limited in extent, and are located near modern river level where the water table is high. Minor and major bedrock and sediment landslides have occurred on the flanks of Mount Watt and represent natural hazards in this region.

This map represents a product of the project Shallow Gas and Diamond Opportunities in Northern Alberta and British Columbia of the Northern Resources Development Program of the Geological Survey of Canada. The project is conducted in collaboration with the Alberta Geological Survey and the British Columbia Ministry of Energy, Mines and Petroleum Resources. Surficial geology maps adjacent to the Meander River sheet include to the west (Paulen et al., 2005), to the northwest (Paulen et al., 2006), to the east, (Paulen and Plouffe, in press a), to the southeast (Paulen and Plouffe, in press b), and to the south (Plouffe and Paulen, 2007). Capable field assistance was provided by Thomas Ahkimnachie, Erwin Fournier, Thomas Talley, and Nicky-Lee Wasp Colin.

REFERENCES

Bostock, H.S.
1967: Physiographic regions of Canada; Geological Survey of Canada, Map 1254A, scale 1:5 000 000.

Dyke, A.S.
2004: An outline of North American deglaciation with emphasis on central and northern Canada; in Quaternary glaciations - extent and chronology, part II, (eds.) J. Ehlers and P.L. Gibbard; Elsevier, Amsterdam, p. 373–424.

Edwards, D., Budney, H., Berezniuk, T., and Butkovic, L.
2004: Sand and gravel deposits with aggregate potential, Mount Watt, Alberta (NTS 84K); Alberta Energy and Utilities Board, EUB/AGS, Map 306, scale 1:250 000.

Green, R., Mellon, G.B., and Carrigy, M.A.
1970: Bedrock geology of northern Alberta; Reserch Council of Alberta, scale 1:500 000.

Lemmen, D.S., Duk-Rodkin, A., and Bednarski, J.M.
1994: Late glacial drainage systems along the northwestern margin of the Laurentide Ice Sheet; Quaternary Science Reviews, v. 13, p. 805–828.

Mathews, W.H.
1980: Retreat of the last ice sheets in northeastern British Columbia and adjacent Alberta; Geological Survey of Canada, Bulletin 331, 22 p.

Okulitch, A.
2006: Bedrock geology, Peace River, Alberta; Geological Survey of Canada, Open File 5282, scale 1:1 000 000.

Paulen, R.C. and Plouffe, A.
in press a: Surficial geology of the Bushe River-Ponton River area (NTS 84K/NE); Alberta Energy and Utilities Board, EUB/AGS Map 413 and Geological Survey of Canada, Open File 5525, scale 1:100 000.
in press b: Surficial geology of the La Crête area (NTS 84K/SE); Alberta Energy and Utilities Board, EUB/AGS Map 412 and Geological Survey of Canada, Open File 5226, scale 1:100 000.

Paulen, R.C., Fenton, M.M., Weiss, J.A., Pawlowicz, J.G., Plouffe, A., and Smith, I.R.
2005: Surficial geology of the Hay Lake Area, Alberta (NTS 84L/NE); Alberta Energy and Utilities Board, EUB/AGS Map 316, scale 1:100 000.

Paulen, R.C., Kowalchuk, C.J., Plouffe, A., Ward, B.C., and Smith, I.R.
2006: Surficial geology of the Zama City Area (NTS 84M/SE); Alberta Energy and Utilities Board, EUB/AGS Map 361 and Geological Survey of Canada, Open File 5184, scale 1:100 000.

Plouffe, A. and Paulen, R.C.
2007: Surficial geology, Caribou Creek, Alberta (NTS 84K/SW); Geological Survey of Canada, Open File 5460, Alberta Energy and Utilities Board, Alberta Geological Survey, Map 415, scale 1:100 000.

Zoltai, S.C.
1993: Cyclic development of permafrost in the peatlands of northwestern Alberta, Canada; Arctic and Alpine Research, v. 25, p. 240–246.

Canada

Authors: A. Plouffe, C.J. Kowalchuk, and R.C. Paulen

Geology by A. Plouffe, 2005–2006

Airphoto interpretation by A. Plouffe, 2005–2006

Digitizing and digital cartography by Géotech, Geomatic services

Digital map compilation by L. Robertson, Northern Canada Division, 2006

Digital cartography by J.D. Narraway, Data Dissemination Division (DDD)

GSC OPEN FILE 5461
EUB/AGS MAP 414

SURFICIAL GEOLOGY

MEANDER RIVER

ALBERTA

Scale 1:100 000/Échelle 1/100 000

kilometres 2 0 2 4 6 8 kilometres

Universal Transverse Mercator Projection
North American Datum 1983

Projection transverse universelle de Mercator
Système de référence géodésique nord-américain, 1983

This map was produced from processes that conform to the Scientific and Technical Publishing Services Subdivision (DDD) Quality Management System, registered to the ISO 9001: 2000 standard

Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada

Digital base map from data compiled by Alberta Sustainable Resource Development, modified by DDD

Mean magnetic declination 2007, 20°19'E, decreasing 22.5' annually. Readings vary from 20°40'W in the NW corner to 19°57'W in the SE corner of the map

Elevations in metres above sea level

OF5070	84 M OF5183		84 N	84-O
OF5237	OF5184			
	84 L	OF5461	84 K OF5525	84 J
OF4754	OF4637	OF5460	OF5526	
	84 E		84 F	84 G

NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND INDEX TO ADJOINING GEOLOGICAL SURVEY OF CANADA MAPS

OPEN FILE
DOSSIER PUBLIC
5461
GEOLOGICAL SURVEY OF CANADA
COMMISSION GÉOLOGIQUE DU CANADA
2007

Open files are products that have not gone through the GSC formal publication process.

Les dossiers publics sont des produits qui n'ont pas été soumis au processus officiel de publication de la CGC.

Recommended citation:
Plouffe, A., Kowalchuk, C.J., and Paulen, R.C.
2007: Surficial geology, Meander River, Alberta; Geological Survey of Canada, Open File 5461; Alberta Energy and Utilities Board, Alberta Geological Survey, Map 414, scale 1:100 000.