Nova Scotia Department of Natural Resources
Mineral Resources Branch

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Geological Map for Part of NTS 11E/08, Lochaber Area, Nova Scotia

J. B. Murphy and R. J. Rice

Scale 1:50 000

1 0 1 2 3 km

Halifax, Nova Scotia

Descriptive Text

The St. Marys Basin, central mainland Nova Scotia, is dominated by a Late Devonian(?) - Early Carboniferous intracontinental alluvial fan-fluviatile-lacustrine basin-fill sequence that occupies the current boundary between the Meguma and Avalon terranes of the Canadian Appalachians. The Basin rocks belong to the Horton Group which is divided into six, partially laterally equivalent, formations. The stratigraphically lowest rocks are predominantly exposed in the central part of the Basin in a series of en echelon anticlinal closures (11E/06-08). These clastic rocks were deposited in a longitudinal drainage system represented by a lacustrine (Little Stewiacke River Formation) and an overlying braided fluvial (Barrens Hills, Lochiel and Graham Hill formations) environment, which are in turn overlain by the Cross Brook and West River St. Marys formations. These rocks unconformably overly the Meguma Group, reflecting a decrease in accommodation space and implying that the St. Marys Basin is underlain, at least in part, by Meguma basement.

The northwestern part of this map area is underlain by the *Little Stewiacke River Formation*, which consists of interstratified, thinly bedded, bioturbated mudstone, fissile, light to dark grey and black shale and slate, and light to dark grey sandstone, and frequently contains abundant comminuted plant debris. Coarsening- and thickening-upward cycles, 2-25 m thick, occur with individual beds ranging in thickness from 2 mm to 15 cm. In some localities the sandstones display soft sediment deformation. In many sections, the finer grained lithologies display a slaty cleavage. Siltstone/shale-sandstone contacts are either sharp or transitional, or, less commonly, erosional. Sandstones are typically grey or dark grey weathering, very fine- to fine-grained and micaceous, and in some locations, moderately feldspathic. Primary and penecontemporaneous sedimentary features include normal grading, parallel lamination, ripple crosslamination, loading features and bioturbation. Sandstone strata generally vary from millimetres to decimetres in thickness. As the contact with the overlying Barrens Hills Formation is approached, the upper member lithologies are coarser, erosionally amalgamated with channel scours and possible swaley cross-stratification, and display large scale (10-20 cm) trough cross-stratification. Fine, organic debris is often abundant in these sandstones and their weathering colour darkens accordingly.

The *Barrens Hills Formation* is characterized by resistant intervals of light grey to grey-white weathering, fine- to very coarse-grained sandstone, monomict or polymict granulestone and conglomerate interstratified with recessive intervals of micaceous, grey to dark grey weathering shale and/or siltstone. Interbeds of minor red siltstone and sandstone also occur. The sandstones are dominated by quartz and feldspar, although grey sedimentary lithic clasts are common near the base of the formation. Feldspars are generally intensely weathered to clay minerals. Locally, the sandstones may be slightly micaceous, moderately feldspathic, and contain varying, but significant amounts of dark grey sedimentary lithic clasts of schist and sandstone, some with a fabric, that are probably derived from the Meguma Terrane south of the St. Marys Basin. The Barrens Hills Formation underlies large areas of both the central and eastern Basin where it outcrops along a broad, regional, northeastward-trending anticlinal axis. To the west of the Stewiacke River region (11E/06, 07) the Formation thins dramatically and passes into the laterally equivalent Graham Hill Formation. To the east, in the eastern portion of this map sheet, it passes into the laterally equivalent Lochiel Formation.

The basal contact is positioned where sand- to granule-sized quartz-rich clastic sediment starts to predominate over the darker and more thinly bedded lithologies of the Little Stewiacke River Formation. This contact is exposed in the Stewiacke River region (11E/07) where it is transitional over 1 m. It is recognized by the abrupt occurrence of thin (10-20 cm) lenses of small pebble conglomerate at the base of the Barrens Hills Formation. However, contact relationships between these two formations are still being mapped out, so they are presented as an undivided unit on this map.

The upper contact occurs in the eastern portion of the Basin where the Barrens Hills Formation is conformably overlain by the Cross Brook Formation. The contact between these formations is gradational over 100 m and is defined where the green feldspathic sandstones, siltstones and shales of the Cross Brook Formation predominate. To the north, near Eden Lake, the Barrens Hills Formation is truncated by the Chedabucto Fault.

The *Lochiel Formation* typically consists of sandstones which are grey or green, fine- to very coarse-grained, micaceous and feldspathic, interbedded with minor granulestone and dark grey siltstone. Sandstone beds range from 5 cm up to 2 m in thickness and abundant fining-upward cycles have bases defined by granulestone beds. Sandstone beds occur in measured intervals up to 17 m in thickness. Parallel lamination, ripple crosslamination and large-scale crossbedding are common in the sandstones. The crossbeds are both trough (dominant) and planar with set thicknesses varying from 0.1 to 0.6 m. Cosets of trough cross-stratification can be up to several metres thick. Grey weathering siltstone, similar to that in the Barrens Hills Formation, is sparse and occurs in recessive, highly fractured intervals 1-2 m thick. Parallel lamination and ripple crosslamination are present in the siltstone, but may be partially masked by fracturing.

The *Cross Brook Formation* consists of grey-green weathering sandstone interstratified with less abundant grey-green weathering siltstone, shale, conglomerate and rare limestone. The Formation can be distinguished from the Lochiel Formation by the abundance of igneous and metamorphic clasts that are clearly derived from the Meguma Terrane to the south. The sandstones are typically fine- to coarse-grained, micaceous, variably feldspathic, and locally contain varying amounts of granule-sized quartz and sedimentary/metasedimentary lithic fragments. They generally are thinly bedded and commonly display ripple crosslamination, and trough cross-stratification in sets up to 1 m thick. Pebble conglomerates are polymict, poorly sorted, and framework supported. Dominant clast types in the sandstones and conglomerates include psammite, pelite, micaceous granite, vein quartz and muscovite. Less abundant, sedimentary clasts include laminated carbonaceous mudstone (possibly of algal origin), siltstone, sandstone, carbonate and organic debris, all of which are interpreted as intrabasinal detritus. Most clasts are subangular to subrounded. Siltstone and shale beds are grey weathering, micaceous and display parallel lamination and ripple crosslamination.

The *West River St. Marys Formation* consists of reddish-brown to grey-brown weathering conglomerate interstratified with grey-brown weathering sandstone. The Formation outcrops along the southern flank of the central and eastern portions of the Basin. The red-brown to grey-brown weathering conglomerate contains clasts ranging from pebbles to boulders. The rock is dominantly framework- to locally matrix-supported with a roughly 80:20 framework to matrix ratio. It is very poorly to poorly sorted, may contain imbricated pockets, or display crude inverse- to normal-grading. The conglomerate contains numerous, major scour surfaces and fines upward to large pebble-size in the top of the measured section. Basal contacts with sandstone lenses are erosional. Clast shape and size vary with composition. Sedimentary clasts are largest (sandstone to 90 cm, shale/siltstone to 6 cm) and are subrounded to subangular. Metasedimentary clasts are similar in shape, but generally smaller in size. Granite and quartz clasts are rounded to well rounded, the quartz clasts reaching 30 cm in diameter. Sandstone clasts are dominantly grey-green weathering, fine- to medium-grained, micaceous and feldspathic. In some instances they exhibit postdepositional en echelon tension fractures. Clast counts also indicate that metasedimentary clasts are marginally more dominant in the west and sedimentary clasts are more dominant in the east. Metasedimentary clasts are dominantly dark-grey weathering pelite commonly with an inherited tectonic fabric. The matrix is grey-brown weathering, medium- to very coarse-grained, feldspathic, lithic sandstone. Conglomerates further upsection are finer grained and better organized displaying imbrication and trough cross-stratification. In the eastern portion of the Basin, these conglomerates contain a significant amount of plant debris including fragments up to 30 cm long. Sandstone occurs as trough-shaped lenses up to approximately 2 m thick, characteristically 30-80 cm thick, with a minimum lateral extent of 15 m. The lenses are grey-green weathering, medium- to very coarse-grained, feldspathic and micaceous. Occasional interstratified pebbly or granulestone horizons occur. Scours, trough cross-stratification (sets to 30 cm), ripple cross-stratification and normal grading all occur in the sandstone. The number of sandstone lenses increases upsection.

The deposition of coarse conglomerates occurs along the southern flank of the Basin suggesting a strong tectonic influence on sedimentation where subsidence along this Basin margin occurs along northerly dipping listric normal faults. In contrast, the character of the sediments does not vary with proximity to the northern margin (Chedabucto Fault) suggesting that the Fault does not constitute the original Basin margin, and that an unknown portion of the Basin and its Meguma basement have been tectonically removed and may be found north of the Fault.

The St. Marys Basin is an example of basin development and evolution adjacent to an intracontinental fault zone associated with oblique convergence during orogenesis. Its evolution provides constraints on the potential relationship between the termination of the mid-Paleozoic Acadian Orogeny, subsequent basin development and the ongoing interactions between the Avalon and Meguma terranes, and between Laurentia and Gondwana during the assembly of Pangea. More generally, because the relationship between fabric development and motion along intracontinental strike-slip faults in continental zones is difficult to interpret, the sedimentology and structural geology in basins developed along these fault zones may preserve a less ambiguous record of the main tectonic events.

The evolution of the St. Marys Basin preserves evidence of protracted dextral shear along an intracontinental fault zone during collisional orogenesis and the assembly of Pangea. The origin and evolution of the Basin are attributed to either discrete or progressive dextral strike-slip tectonics along the Minas Fault Zone (MFZ) between the Late Devonian and Late Carboniferous. Evidence for the Late Devonian origin of the Basin is recorded along its southern flank by the fabrics of the deformed ca. 370 Ma granites, the overall sedimentary facies distribution and some syndepositional features within the clastic rocks. The most intense deformation within the Basin is concentrated in a narrow east-northeastward-trending zone, in which predominantly fine grained clastic rocks are deformed into periclinal folds and related reverse faults. The orientation of this zone, relative to the MFZ, is consistent with dextral shear. At least some of this deformation occurred after the deposition of the overlying Viséan Windsor Group (11E/06). The style of deformation along the present northern margin of the Basin (the Chedabucto Fault) is also consistent with regional dextral shear.

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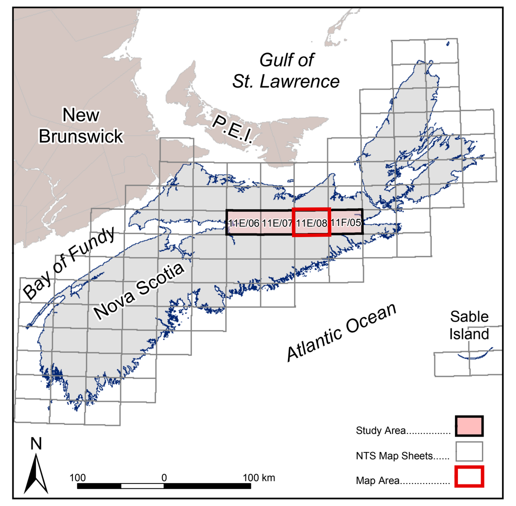
Regional Key Map



Map Notes

Universal Transverse Mercator Projection (UTM), Zone 20, Central Meridian 63°00' West.

North American Datum (NAD) 1927.

Base and digital data derived from the Nova Scotia Topographic Database (NSTDB). The NSTDB is available from Service Nova Scotia and Municipal Relations (SNSMR), Land Information Services Division (LIS), Nova Scotia Geomatics Centre (NSGC), Amherst, Nova Scotia.

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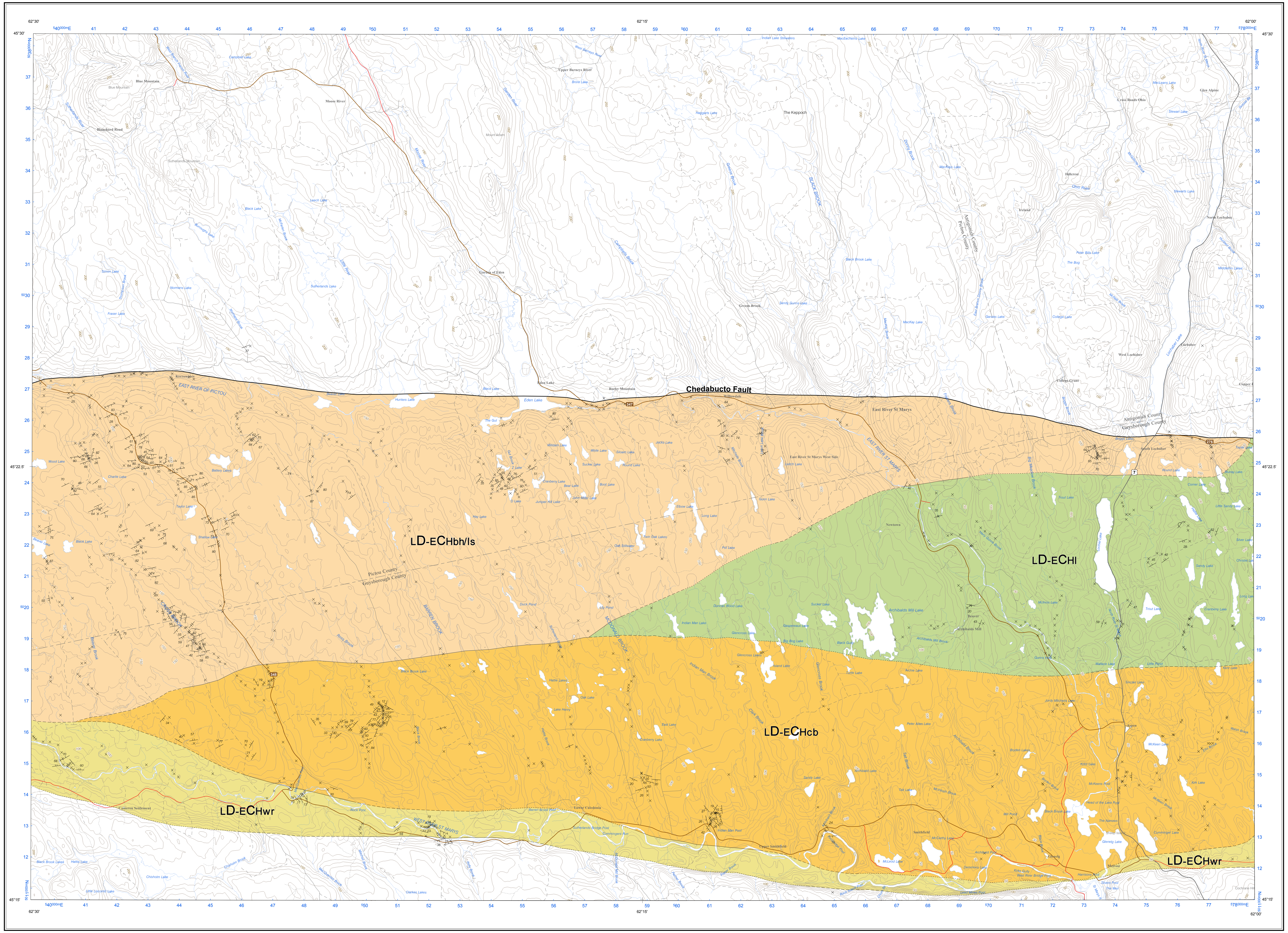

LEGEND

CARBONIFEROUS

WINDSOR GROUP*

ECw — undivided

LATE DEVONIAN - EARLY CARBONIFEROUS

HORTON GROUP

LD-ECHwr — *WEST RIVER ST. MARYS FORMATION*
reddish-brown to grey-brown weathering, pebble to boulder conglomerate interstratified with grey-brown weathering sandstone. Abundant clasts derived from the Meguma Terrane.

LD-ECHcb — *CROSS BROOK FORMATION*
grey-green weathering sandstone, interbedded grey-green weathering siltstone, shale, conglomerate and rare limestone. Abundant clasts derived from the Meguma Terrane.

LD-ECHgh | LD-ECHl | LD-ECHbh/ls — *GRAHAM HILL*, LOCHIEL, BARRENS HILLS and LITTLE STEWIACKE RIVER FORMATIONS*

*GRAHAM HILL FORMATION** (LD-ECHgh): red and maroon weathering, finer grained litharenite to feldspathic litharenite and siltstone with thick intervals of grey weathering, interstratified, coarser grained sandstone, pebbly sandstone and granule to pebble conglomerate. Clasts include quartz, mica, intraformational siltstone (0.5-1 cm), and flow-banded rhyolite.

LOCHIEL FORMATION (LD-ECHl): grey or green, fine- to very coarse-grained, micaceous and feldspathic sandstones, interbedded minor granulestone, dark grey siltstone.

BARRENS HILLS AND LITTLE STEWIACKE RIVER FORMATIONS (LD-ECHbh/ls): undivided

BARRENS HILLS FORMATION: resistant grey to grey-white weathering, fine- to very coarse-grained sandstone, monomict or polymict granulestone and conglomerate interstratified with recessive micaceous, grey to dark grey weathering shale and/or siltstone, minor red siltstone and sandstone.

LITTLE STEWIACKE RIVER FORMATION: interstratified, thinly bedded, bioturbated mudstone, fissile, light to dark grey and black shale and slate, and light to dark grey sandstone containing comminuted plant debris.

*Bedrock units are not mapped in this map area

Outcrop data from Benson (1974), although not illustrated, were used locally to help support map interpretation. Map users should refer to Benson (1974) for additional outcrop locations and structural measurements.

Geological Symbols

Outcrop
Bedding, tops known (inclined, overturned, vertical, horizontal)
Bedding, tops unknown (inclined, vertical, horizontal)
Intersection lineation, 1st generation
Cleavage or foliation, 1st generation (inclined, vertical)
Minor fold axis
Anticline and syncline (approximate)
Minor fault
Major fault (defined)
Geological boundary (defined, approximate, assumed)
Interfingering contact, approximate (units of approximately similar age, units of differing age)

Legend

Contour
Index Contour
Depression Contour
Index Depression Contour
Coastline
Lakes, Single-line Rivers, Streams
100 Series Highway
Trans-Canada Highway
Trunk Highway
Collector Highway
Hard Surface Road
Road Under Construction
Loose Surface/Resource Access Road
VehicleTrack
Trail/Footpath
Railway
Railway Inactive
County Boundary

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