

Geological Map for Part of NTS 11E/07, Hopewell Area, Nova Scotia

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Scale 1:50 000

Halifax, Nova Scotia

NOVA SCOTIA
Natural Resources

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Descriptive Text

The St. Marys Basin, central mainland Nova Scotia, is dominated by a Late Devonian(?) - Early Carboniferous intracratonic aluvial fan-fluvial-lacustrine basin-fill sequence that occupies the central 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 arenaceous in the central part of the Basin in a series of an echelon anticlinal closures (11E/06/08). These clastic rocks were deposited in a longitudinal drainage system represented by a lacustrine (Little Stevacke River Formation) and an overlying braided fluvial (Barrens Hills, Lochiel and Graham Hill formations) in turn overlain by the Cross Brook and West River St. Marys formations. These rocks unconformably overlie 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.

This map is predominantly underlain by the Little Stevacke River and Barrens Hills formations. The contact between these formations is exposed on this map on the Stevacke River about 100 m south of its intersection with highway 289. Faulting directions in the vicinity of this contact clearly show that the Barrens Hills Formation overlies the Little Stevacke River Formation. However, contact relationships between these formations are still being mapped out, so they are presented as an undivided unit on this map. The Little Stevacke River Formation, which consists of interstratified, finely bedded, bioturbated mudstone, siltstone, light to dark grey and black shale and slate, and light to dark grey sandstone, frequently contains abundant compressed 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 fine grained lithologies display a silty cleavage. Siltstone/shale-sandstone contacts are either sharp or transitional, or, less commonly, erosional. Sandstones are typically grey to dark grey weathering, very fine to fine-grained and micaceous, and in some localities, moderately feldspathic. Primary and periconglomerate sedimentary features include normal grading, parallel lamination, ripple crossamination, 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, coarsely amalgamated with channel scours and possibly wavy 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 sandstones, micaceous to polygenic granitoides and conglomerate interstratified with recessive intervals of micaceous, grey to dark grey weathering shale and 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, northward-trending anticlinal axis. To the west the Stevacke River Formation thins dramatically and passes into the laterally equivalent Graham Hill Formation. To the east of this map sheet, it passes into the laterally equivalent Lochiel Formation.

The basal contact of the Barrens Hills Formation 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 Stevacke River Formation. This contact is exposed in the Stevacke River region (11E/07) where it is transitional over 1 m. It is recognized by the abrupt occurrence of small pebble conglomerate at the base of the Barrens Hills Formation.

In the western portion of the map, the Graham Hill Formation consists of 1220 m of 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, metamorphic siltstone (0.5-1 cm), and flow-banded rhyolite. Regional relationships indicate that the Graham Hill Formation is also a lateral facies equivalent of the Barrens Hills Formation. In separate stratigraphic sections, both formations conformably overlie the Little Stevacke River Formation. In the eastern portion of 11E/06, the Graham Hill Formation is completely interstratified with both the Barrens Hills and Little Stevacke River formations. This indicates that the three formations are, at least in part, time equivalents. This style of interfingering is thought to characterize the stratigraphic relationships between formations throughout the Basin.

The Cross Brook Formation consists of grey-green weathering sandstone interstratified with less abundant grey-green weathering siltstone, shale and conglomerate and rare limestone. The Cross Brook Formation is not exposed in this map area, but further east it occurs along the southern flank of the Basin. 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 finely bedded and commonly display ripple crossamination, and trough cross-stratification in sets up to 1 m thick. Pebble conglomerates are polygenic, poorly sorted and framework supported. Dominant clast types in the sandstones and conglomerates include psammite, siltite, 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 crossamination.

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 60:20 framework to matrix ratio. It is very poorly to poorly sorted, may contain interbedded pebbles, or display crude levels 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 finer in size. Granite and quartz clasts are rounded to well-rounded, the latter 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 an 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 pebbles, 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 20 cm long. Sandstone occurs as trough-banded 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 granulation horizons occur. Scours, trough cross-stratification (pebbles 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 intracratonic fault zone associated with oblique convergence during orogenesis. Its evolution provides constraints on the potential relationships 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 intracratonic 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 major tectonic events.

The evolution of the St. Marys Basin preserves evidence of protected dextral shear along an intracratonic 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 recovered 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-northeast-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 Visitan 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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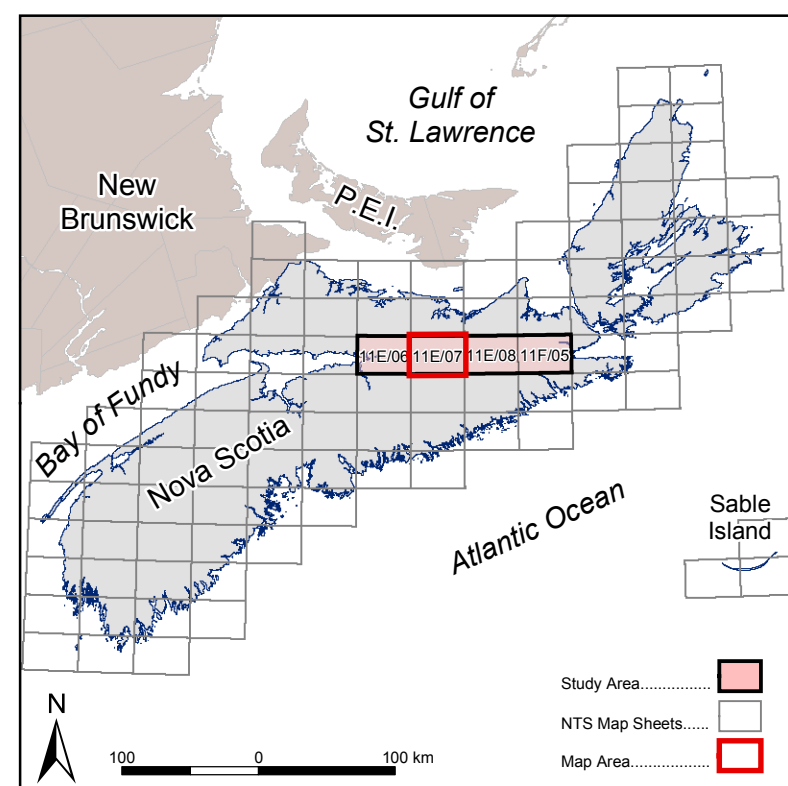
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Regional Key Map



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 (SNMRL), Land Information Services Division (LIS), Nova Scotia Geomatics Centre (NSGC), Amherst, Nova Scotia.

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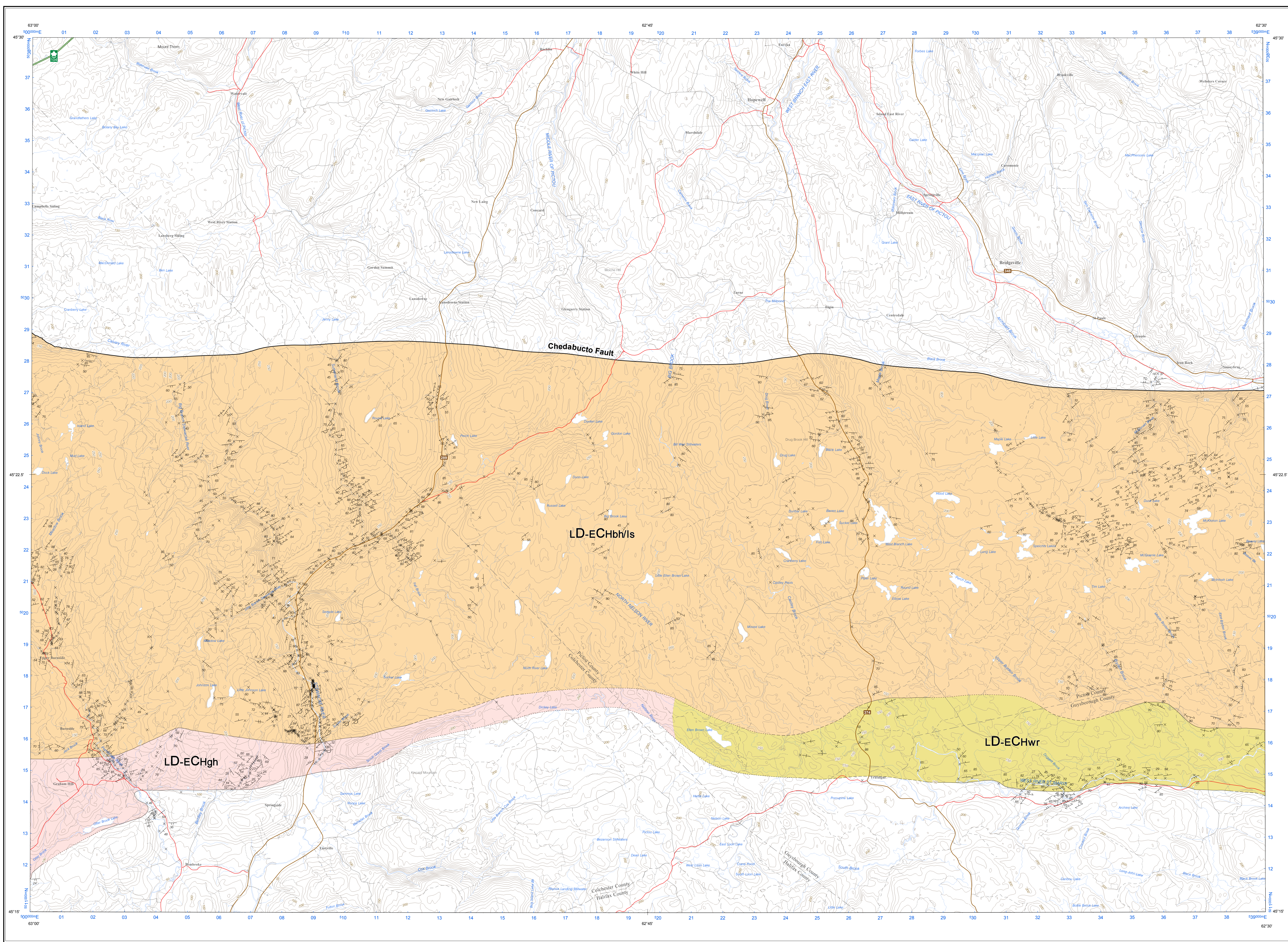
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LEGEND

CARBONIFEROUS

WINDSOR GROUP*

LD-EChw undivided

LATE DEVONIAN - EARLY CARBONIFEROUS

HORTON GROUP

LD-EChhb 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-EChwr LITTLE STEVACKE RIVER FORMATION*

grey-green weathering sandstone, interbedded light-green weathering siltstone, shale, conglomerate and rare limestone. Abundant clasts derived from the Meguma Terrane.

LD-EChgh GRAHAM HILL, LOCHIEL, BARRENS HILLS and LITTLE STEVACKE RIVER FORMATIONS

reddish-brown to grey-brown weathering, pebble to boulder conglomerate interstratified with grey weathering sandstone, micaceous and rare limestone. Abundant clasts derived from the Meguma Terrane.

LD-EChhb/ls BARRENS HILLS AND LITTLE STEVACKE RIVER FORMATION (LD-EChhb/ls) undivided

reddish-brown to grey-brown weathering, pebble to boulder conglomerate interstratified with grey weathering sandstone, micaceous and rare limestone. Abundant clasts derived from the Meguma Terrane.

LD-EChwr LITTLE STEVACKE RIVER FORMATION (LD-EChwr) undivided

grey-green weathering sandstone, interbedded light-green weathering siltstone, shale, conglomerate and rare limestone. Abundant clasts derived from the Meguma Terrane.

Geological Symbols

- Outcrop: Outcrop, top known (inclined, overturned, vertical, horizontal); Outcrop, top 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

- Index Contour; Depression Contour; Inland 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; Vehicle/Track; Trail/Footpath; Railway; Railway Inactive; County Boundary