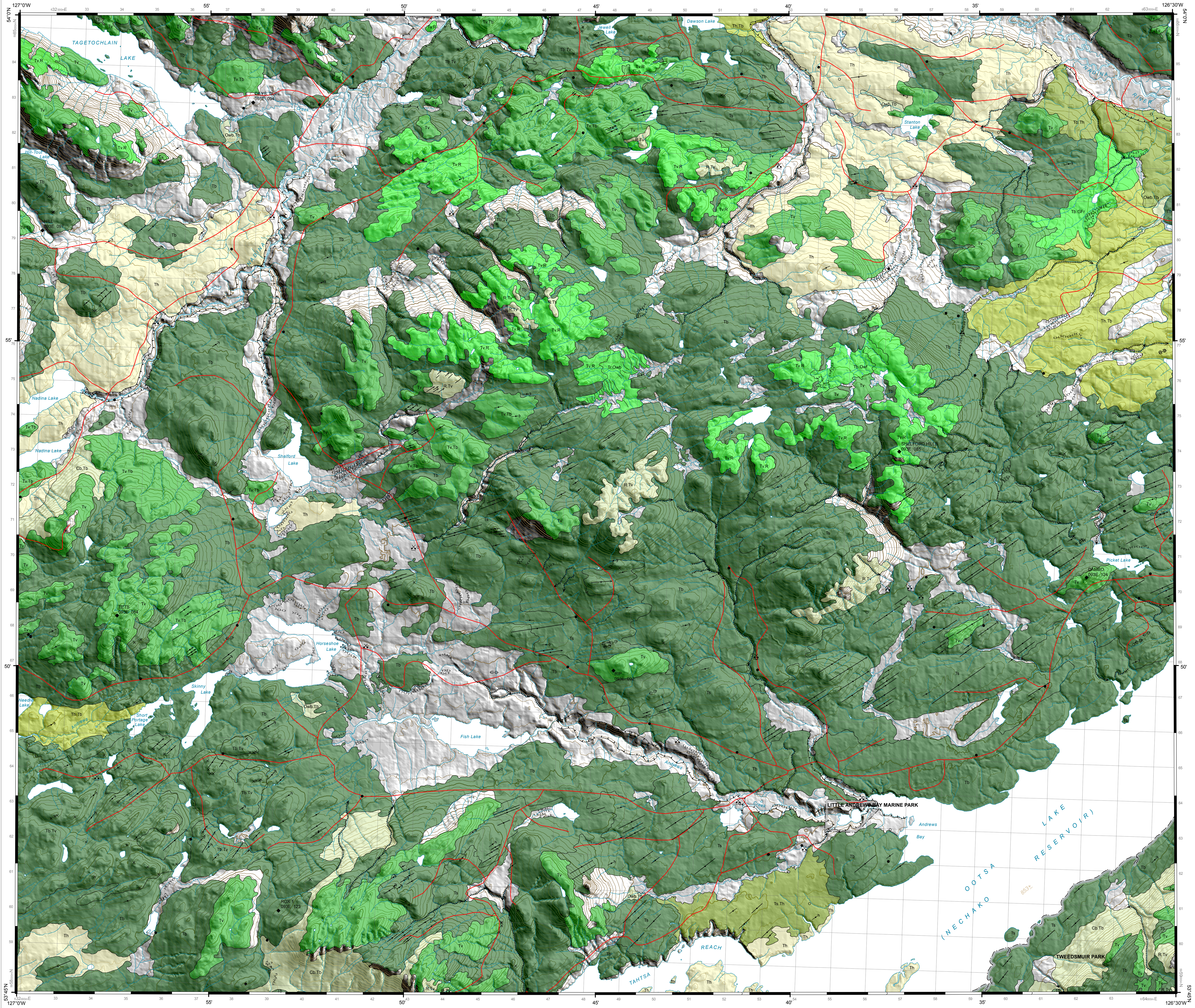

British Columbia Ministry of Energy and Mines

British Columbia Geological Survey Open File 2014-02

Basal till potential of the Nadina River map area (NTS 093E/15), British Columbia

T. Ferbey

0 1 2 4 6 8 10

Kilometres

Scale 1:50,000

Cartography by H. Arnold

Note: Where map units are composed of multiple surficial materials, a compound map unit designator is used, separating more extensive materials from less extensive (e.g., for Tb.Th, Tb is more extensive than Th).

QUATERNARY SURFICIAL DEPOSITS

HOLOCENE
NONGLACIAL ENVIRONMENTS
Organic deposits. *Formed by the accumulation of organic matter in topographic depressions or level areas that are poorly drained.*

Owb - *Bog deposits:* *fibric to humic organic matter; may be treeless or have sparse trees; elevated above water table.*

Owf - *Fen deposits:* *fibric to humic organic matter; mineral-rich water table persists seasonally at or near surface; generally covered with low shrubs; local sparse trees.*

Colluvial and mass-wasting deposits. *Poorly sorted angular gravels and sandy diamictons; commonly clast supported and can be massive to stratified; product of downslope transport of weathered bedrock and pre-existing Quaternary sediments by gravity; texture dependent on parent material.*

Cb - *Colluvial blanket:* *diamictons >2 m of roughly equal thickness; mainly occurs below bedrock highs but can also form on steep, till-covered slopes.*

LATE WISCONSINAN
PROGLACIAL AND GLACIAL ENVIRONMENTS
Glaciofluvial deposits. *Sands and gravels deposited by glacial meltwater; can be massive to stratified, sorted to poorly sorted; typically above pre-existing Quaternary sediments, but can also overlie bedrock; can be an aggregate source.*

GFr – *Ridged glaciofluvial:* *sands and gravels occurring as long sinuous ridges (eskers) >2 m in height; massive to stratified; may include silts; deposited by glacial meltwater in contact with glacial ice.*

Till deposits. *Unsorted to poorly sorted diamictons deposited by a glacier; matrix and clast texture dependent on parent material and mechanism of transported and deposition; stratification and degree of consolidation also dependent on transport and depositional processes.*

Tv - *Till veneer:* *silt- and clay-rich diamicton <2 m of variable thickness; overconsolidated, typically massive and matrix supported; subglacially eroded, transported and deposited by active glaciers; often forms a transitional zone between thicker tills in valleys and on valley sides and bedrock above; can include discontinuous areas of colluvial veneer and bedrock; ideal sample medium for till geochemistry and mineralogical surveys.*

Tb - *Till blanket:* *silt- and clay-rich diamicton >2 m of roughly equal thickness; overconsolidated, typically massive and matrix supported; subglacially eroded, transported and deposited by active glaciers; bedrock exposures are rare in areas of thick till; ideal sample medium for till geochemistry and mineralogical surveys.*

Th - *Hummocky till:* *sand-rich diamicton, typically several metres thick, occurring as steep sided hills and hollows with varied slope aspect forming irregular topography with local relief >1 m; composed of ablation (englacial and supraglacial) tills deposited passively by melt out of stagnant ice during deglaciation; less consolidated than basal tills and have a higher percentage of gravel-sized material; may interfinger with glaciofluvial sands and gravels; overlies older glacial sediments and windows through it can expose underlying basal till; not generally sampled in till geochemical or mineralogical surveys.*

Tr - *Ridged till:* *silt-rich diamictons deposited in elongate ridges one to several metres high, oriented perpendicular to ice-flow direction; intervening lows commonly filled with organic deposits; formed by ice thrusting during full glacial conditions; ideal sample medium for till geochemistry and mineralogical surveys.*

Ts - *Streamlined till:* *silt-rich diamictons that have been subglacially streamlined forming drumlins and flutes; streamlined landforms are typically <700 m long but can exceed 1.75 km; ideal sample medium for till geochemistry and mineralogical surveys.*

PRE-QUATERNARY
Bedrock. *Exposed in high ground of Shelford and Mosquito hills are Kasalka Group andesites (Cretaceous) and Endako Group basalts (Eocence to Lower Miocene), respectively; Bulkley Suite felsic to intermediate intrusives (Late Cretaceous) host porphyry mineralization in the region and can be exposed in areally small and isolated topographic highs; additional bedrock exposures can be found in road and stream cuts and in areas mapped as till veneer.*

R – *Bedrock:* *bedrock outcrop; may include discontinuous areas of till or colluvial veneer.*

Minor meltwater channel (paleocurrent known, unknown)
Major meltwater channel
Moraine ridge
Esker ridge (flow direction unknown)
Drumlin, Drumlinoid or fluting
Crag-and-tail
Fluted bedrock (flow direction known, unknown)
Striation (flow direction known, unknown)
Small bedrock outcrop
Pit (inactive or unspecified)
Station (Ground observation)
Sample

Road
Provincial park and protected area; National park

BASAL TILL POTENTIAL

High

1: Only thick basal till (Tb or Ts); may contain lesser amounts of thin basal till (e.g., Tb.Tv).

2: Only thin basal till (Tv); may contain lesser amounts of thick basal till (e.g., Tv.Tb).

3: Basal till with lesser amounts of another surficial material, excluding ablation till (e.g., Tb.GFr; Tv.R).

Moderate

4: Basal till with lesser amounts of ablation till (Tb.Th).

5: Ablation till with lesser amounts of basal till (Th.Tb).

Low

6: Another surficial material with lesser amounts of basal till (e.g., Cb.Tb).

Poor

7: Only ablation till at surface (Th).

None

Surficial material other than till.

MINERAL OCCURRENCES

Provincial MINFILE database (Labeled with name and MINFILE number)

Showing

MINFILE NUMBER	NAME	STATUS	COMMODITY	DEPOSIT TYPE*
093E 084	TETS	Showing	Copper, Zinc, Lead, Silver	I05:Polymetallic veins Ag-Pb-Zn+/-Au, L01:Subvolcanic Cu-Ag-Au (As-Sb)
093E 085	SHELFORD HILLS	Showing	Zinc, Lead, Gold	H04:Epithermal Au-Ag-Cu: high sulphidation
093E 092	RIP	Showing	Copper, Molybdenum	L04:Porphyry Cu +/- Mo +/- Au, L05:Porphyry Mo (Low F- type)
093E 094	DILYS, DUAL	Showing	Copper	
093E 097	HILL	Showing	Copper, Gold, Zinc	L03:Alkalic porphyry Cu-Au
093E 123	ROX 1	Showing	Gold, Silver	
093E 124	DAMBO	Showing	Gold, Silver	

*See Lefebure and Ray (1995) and Lefebure and Höy (1996) for mineral deposit profile codes and definitions.

North American Datum 1983
Universal Transverse Mercator Zone 9 North
Shuttle Radar Topography (SRTM) DEM, 3 arcsecond (90 m) resolution
Contour interval 20 metres

DESCRIPTIVE NOTES

The Nadina River map area is in the Nechako Plateau, a subdivision of the Interior Plateau with flat to gently rolling topography (Holland, 1976). Areas of continuous bedrock outcrop are relatively uncommon, and the area is covered by a succession of glacial sediments (Ferbey, 2014a).

This map complements surficial geology and till geochemistry reports by Ferbey (2010a, b). Previous work in the area includes soils and terrain mapping by Young (1976) and Singh (1998). To the north and northwest (NTS 093L, M and 103I, P), Clague (1984), Tipper (1994), and Levson (2002) studied Quaternary geologic and geomorphologic features. To the northeast (west half of NTS 093K), Plouffe (1996a, b) mapped surficial deposits, and Ferbey (2011a, b, 2014b) integrated the Quaternary geology with till geochemistry (Colleymount area, NTS 093L/01). Mate and Levson (2000, 2001) investigated the Quaternary geology to the southeast (NTS 093F/12) and, to the southwest, Ferbey and Levson (2001a, b, 2003, 2007) studied the Quaternary geology and till geochemistry of the Huckleberry mine region.

Surficial sediment geochemical and mineralogical anomalies can be used to locate buried bedrock mineralization. Sediments with a relatively simple transport and depositional history, such as basal tills, are better suited for mineral exploration. Basal till is ideal for assessing mineral potential because: 1) it is a common sediment in glaciated terrain; 2) it can be considered a first derivative of bedrock (Shilts, 1993) and therefore has a similar geochemical signature to its bedrock source; 3) its transport history can be determined by local ice-flow reconstructions; and 4) it produces a geochemical signature that is areally more extensive than the bedrock source (Levson, 2001). Glacial transport and deposition of basal till produces a dispersal train, elongated down ice from its parent rock (Figure 1).

The purpose of this basal till potential map series is to assist in the design of exploration projects, and to guide surficial sediment geochemistry and mineralogy sampling programs, by identifying areas where basal till is most likely to occur. The maps identify areas where basal till samples can likely be collected and areas where sampling will be difficult or require different geochemical sampling protocols. Ice flow indicators compiled by Ferbey et al. (2013) are included in the maps to illustrate the general transport directions of basal till.

This mapping builds on earlier drift exploration potential maps developed by Proudfoot et al. (1995). Map unit definitions are based on conventions outlined by Deblonde et al. (2012). Map unit colours depict the potential occurrence of basal till; map unit labels include surficial materials and their topographic expression.

Existing surficial geology, terrain, or soils and landform mapping data were reviewed and updated using digital air photo stereo-pairs in DAT/EM Summit Evolution photogrammetry software running in tandem with Esri ArcMap. New mapping emphasized the till facies best suited for geochemical and mineralogical analysis. The focus is on distinguishing basal till (Figure 2) from ablation till (Figure 3) which, because of a more complex transport and depositional history, is ill-suited for mineral exploration. This differentiation was based largely on interpretations of air photo stereo-pairs supplemented by sparse field data.

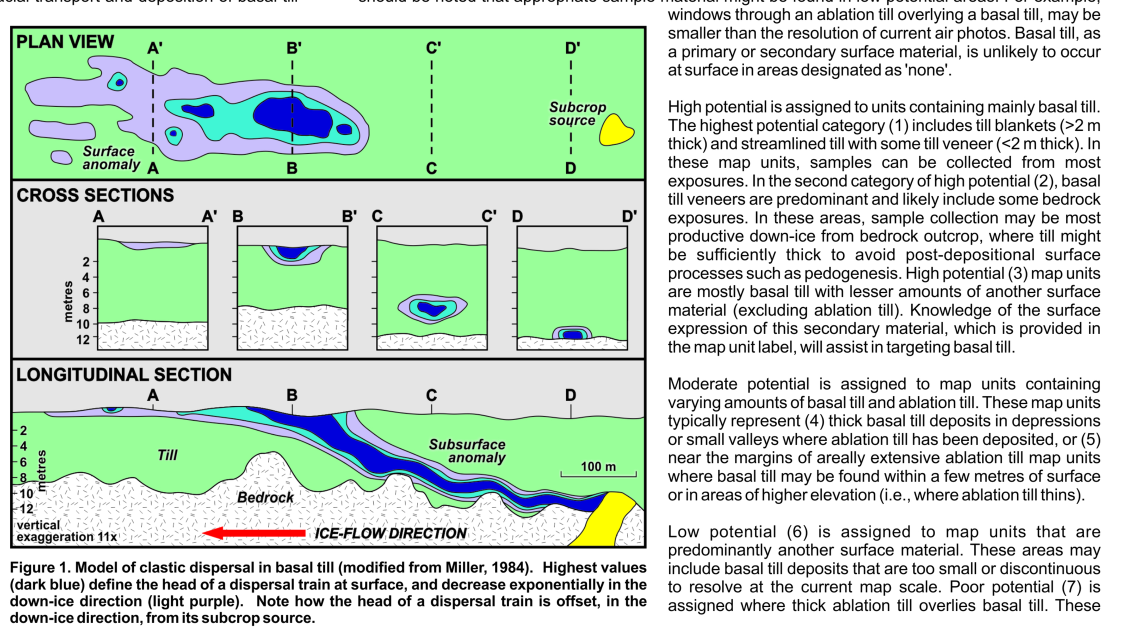

Figure 1. Model of clastic dispersal in basal till (modified from Miller, 1984). Highest values (dark blue) define the head of a dispersal train at surface, and decrease exponentially in the down-ice direction (light purple). Note how the head of a dispersal train is offset, in the down-ice direction, from its subcrop source.

Basal till is eroded, transported, and deposited at the base of an active glacier. It typically has a subdued surface expression that either follows underlying topography (as a blanket or veneer) or is streamlined in the direction of ice flow. It is a dense, unsorted, massive, matrix-supported diamicton, with a matrix consisting mainly of silt and clay with lesser amounts of sand (Figure 3). Vertical joint and subhorizontal fissility intersections can give basal till a blocky appearance. Clasts are mostly gravel-sized and subangular to subrounded, and are commonly striated. The transport path of basal till is relatively simple and short and can be established by measuring the azimuth of ice-flow indicators, also produced in the subglacial environment. Multiple ice-flow events can, however, create a more complex transport path, highlighting the importance of ice-flow history reconstructions (cf. Ferbey and Levson, 2007). Compared to basal till, the transport distance of ablation till is longer and the depositional history more complex. Ablation till consists of material transported in the englacial and supraglacial environments and deposited by passive melt out processes. Deposition of ablation till adjacent to remnant ice-blocks produces an irregular, undulating to hummocky topography. Ablation till is less consolidated, has a higher percentage of gravel-sized material and a sandier matrix (Figure 3). It can be massive to crudely stratified and may contain lenses of sorted sand and gravel. Formed by ice downwasting during deglaciation, ablation tills are typically exposed at the surface and can overlie basal tills.

Each mapped till unit is assigned a basal till potential rating. This is assignment is based on the spatial and genetic association of basal till with other surficial materials and their depositional environments. It should be noted that appropriate sample material might be found in low potential areas. For example, windows through an ablation till overlying a basal till, may be smaller than the resolution of current air photos. Basal till, as a primary or secondary surface material, is unlikely to occur at surface in areas designated as 'none'.

High potential is assigned to units containing mainly basal till. The highest potential category (1) includes till blankets (>2 m thick) and streamlined till with some till veneer (<2 m thick). In these map units, samples can be collected from most exposures. In the second category of high potential (2), basal till veneers are predominant and likely include some bedrock exposures. In these areas, sample collection may be most productive down-ice from bedrock outcrop, where till might be sufficiently thick to avoid post-depositional surface processes such as pedogenesis. High potential (3) map units are mostly basal till with lesser amounts of another surface material (excluding ablation till). Knowledge of the surface expression of this secondary material, which is provided in the map unit label, will assist in targeting basal till.

Moderate potential is assigned to map units containing varying amounts of basal till and ablation till. These map units typically represent (4) thick basal till deposits in depressions or small valleys where ablation till has been deposited, or (5) near the margins of areally extensive ablation till map units where basal till may be found within a few metres of surface or in areas of higher elevation (i.e., where ablation till thins).

Low potential (6) is assigned to map units that are predominantly another surface material. These areas may include basal till deposits that are too small or discontinuous to resolve at the current map scale. Poor potential (7) is assigned where thick ablation till overlies basal till. These areas typically consist of hummocky ablation till and may include lesser amounts of another surficial material (e.g., ice-contact glaciofluvial deposits). These areas are still mapped as having basal till potential because exposures of sufficient depth could expose underlying basal till deposits.

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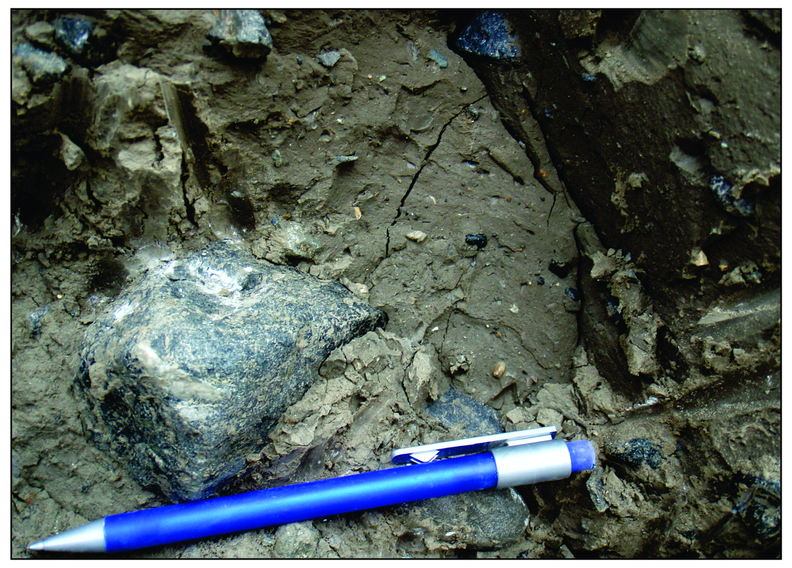

Figure 2. Basal till in vertical exposure. Note blocky appearance. Granule and coarser-sized clasts float in a clay-silt matrix.

Figure 3. Ablation till exposed in road cut with higher percentage of sand and gravel, and lower density, compared to typical basal tills (see Figure 2). Pick for scale (65 cm).

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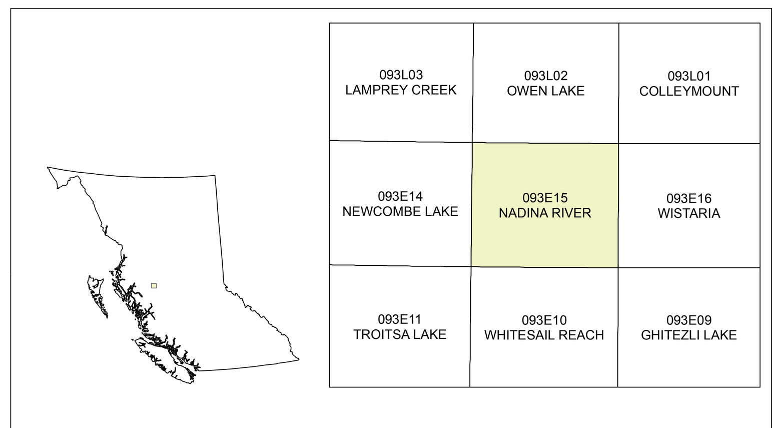

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