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GRANULAR-AGGREGATE MAPPING ALONG THE TRANS-LABRADOR HIGHWAY FROM CARTWRIGHT JUNCTION TO THE CHURCHILL RIVER

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ABSTRACT

In 2010, aggregate mapping took place along the Trans-Labrador Highway between Cartwright Junction and the Churchill River. This is the final year of a three-year project to complete granular-aggregate mapping along this recently constructed road. The first phase of mapping in 2003 included the southern part of the road from Red Bay (NTS map area 12P/9) to the northwest end of NTS map area 13A/15, including the branch roads to St. Lewis and Charlottetown. In 2004, mapping was conducted from the southeast end of NTS map area 13A/14 to north end of the road, at Cartwright.

Sand and gravel deposits were identified at several locations along this recently mapped segment of the road. These deposits are regularly spaced, providing good access to material along most parts of the road. Most of these deposits have a coarse gravel and boulder–cobble texture. However, sandy gravel and gravelly sand deposits were also sampled. Deposits vary in quantity from 12 000 m^3 to over 40 000 000 m^3. Most deposits are within 1 km of a road and have potential for use in future road upgrading and for winter ice control.

INTRODUCTION

The objectives of the aggregate mapping program are to locate, map and sample sand, gravel, and till, in support of road upgrading and construction activities in adjacent communities, and to reserve deposits for future development. The mapping of aggregate deposits and the provision of data, on quantity and quality of granular aggregate, will assist road builders, contractors and consultants to determine the sources and quality of material in a given area, and evaluate the distance required to transport these materials to a specific job site, a factor that can greatly affect construction costs.

Definition of aggregate depends on the producer, location, and use of the material (Smith and Collis, 1993). Aggregate, as used in the context of this report, is defined as any hard, inert material such as gravel, sand, crushed stone, or other mineral material that is used in the construction industry (Carter, 1983; Rutka, 1976). The demand for aggregate is closely associated with construction, and road-construction activity, particularly maintenance, which is, by far, the most important use of mineral aggregates. Water and sewer systems, driveways, building foundations, backfill and landscaping are also important consumers of aggregate.

Aggregates are characterized by their high bulk and low unit value, so that the economic value of a deposit is a function of its proximity to a market area, as well as its quality and size (Vanderveer, 1983). Comprehensive planning and resource-management strategies are required to make the best use of available resources, especially in areas experiencing rapid development. Such strategies must be based on a sound knowledge of the total mineral aggregate resource base at both local and regional levels. Aggregate materials can be:

i) processed and used as Class A gravel (aggregate with a diameter of less than 19 mm having a specified proportion of finer grain sizes and 3 to 6% silt–clay; Department of Transportation, 2008) or Class B gravel (aggregate with a diameter less than 102 mm, having a specified proportion of finer grain sizes and 3 to 6% silt–clay (Department of Transportation, 2008);
ii) processed to mix with a cementing agent to form concrete, asphalt and mortar; or
iii) used as unprocessed, out of pit material.

The suitability of quarry material for aggregate use depends on their composition. The silt–clay quantity is important. High silt–clay volumes can cause instability, such as flowage. Too much silt–clay in concrete (>2%) can interfere with the bonding process between the aggregate and the cementing agent. High silt–clay aggregate (greater than 15%) can be used for earth-filled dams, fill and sub-grade road material. Low silt–clay volumes can result in loss of compaction. The presence of deleterious substances (such as silt–clay coatings or iron-oxide staining on the surface of the aggregate), or of blade-shaped fragments, can cause bonding problems with the cementing agent, or the breakdown of aggregate with time.

Knowledge of the nature and distribution of the surficial aggregate deposits (sand, gravel and low silt–clay materials) can assist in estimating the construction cost of projects requiring aggregate. When it is necessary to identify new aggregate sources for production of large quantities of construction materials, the surficial geology of the area and the bedrock geology are important considerations. In a large-scale operation, it may be more economical to truck granular products longer distances rather than use inferior material close at hand; processing cost could be lower and the quality of the product higher, therefore, offsetting the high cost of transportation.

The suitability of aggregate depends on physical properties and the capability of the rock to withstand stresses placed upon it when it is used as a construction material. The lithology of the pebble fraction (16 to 32 mm) was evaluated to define the petrographic characteristics (Canadian Standards Association, 1973; Ontario Ministry of Transportation 1994; Bragg, 1995). The petrographic number (PN) can range from 100 to 1000, and is derived by taking the sum of the percentage of each rock type present in the pebble fraction (in a sample of approximately 100 pebbles) multiplied by a petrographic factor (based on soundness and durability) assigned to that rock type (Ricketts and Vatcher, 1996). The petrographic factor is determined by type and grain size of the rock in a given sample, and by weathering (fresh, slightly, moderately, highly, or intensely weathered) and fracturing; the lower the PN, the better the quality of aggregate material. For example, clean, hard, fresh granite would normally have a PN of 100, whereas friable shale would have a PN of 1000. Most deposits contain a combination of different rock types having different petrographic factors. The proportion of each of these components determines the PN. For most purposes, aggregate material used in concrete requires a PN of 135 or less, whereas in road asphalt and Class A and B gravels, a PN up to 150 is acceptable (Department of Transportation, 2008).

The presence of silt–clay coatings (clean, thin, medium, or thick), staining, rounding of pebbles, and the number of fracture faces and their sphericity are important considerations in using an aggregate for concrete. These factors affect the bonding capabilities of concrete, and the amount of water necessary to make a concrete, both of which have a direct impact on the strength of a concrete.

STUDY AREA AND PHYSIOGRAPHY

The recently constructed part of the Trans-Labrador Highway (TLH) extends from Cartwright Junction to the Churchill River, near Goose Bay (Figure 1). The TLH crosses eleven 1:50 000-scale NTS map areas between 52°30' and 53°15'N, and 57°30' and 61°00'W. These map areas are 13A/13, 13B/9, 10, 11, 12, 13, 16, 13C/16, 13F/1, 2 and 13H/04. The study area was within a 6-km-wide corridor along the road.

The geography of the region was discussed by Hare (1959), who completed a photo-reconnaissance survey of Labrador–Ungava, primarily to determine vegetation type; drift-cover and physiographic type were noted as a secondary objective. The area has moderate to low relief and shows the rounded geomorphology typical of glaciated terrain.

Reconnaissance surficial geological mapping at 1:50 000 scale (Fulton *et al*., 1975), based largely on aerial photographic interpretation, is completed for the field area. This work was part of a much larger program, covering over 95 000 km^2 of southern and eastern Labrador. Compilation of these maps at 1:250 000 scale (Fulton *et al*., 1979) and 1:500 000 scale (Fulton, 1986) shows glacial flow features with a dominant southeast to east orientation.

Aggregate resource reconnaissance mapping (Kirby *et al*., 1983) provided site data along some of the eskers in the map area. Aggregate resource fieldwork (Ricketts, 2004, 2005) provided maps and sample data along the road between Red Bay and Cartwright. Bedrock geology maps from Gower (2010), and Douglas and Hsu (1967a, b) were used to assist in the identifying of pebble types and in determining petrographic numbers.

MAPPING AND ANALYTICAL METHODS

Assessing the potential use and value of granular aggregates can be complex, especially when a variety of different material types occur within any given aggregate deposit. Interpretation of aerial photographs (1:50 000-scale black-and-white, and 1:12 500-scale colour photographs) is the first stage in locating potential deposits. Airphoto interpretation is used to produce preliminary landform classification maps that show the distribution and nature of the various deposits found within an area. These maps commonly show a variety of tills, sand, and gravel deposits. Till is a sediment deposited by glaciers, commonly with a wide variety of grain sizes. Sand and gravel is commonly formed by fluvial action, either by glacial meltwater or streams.

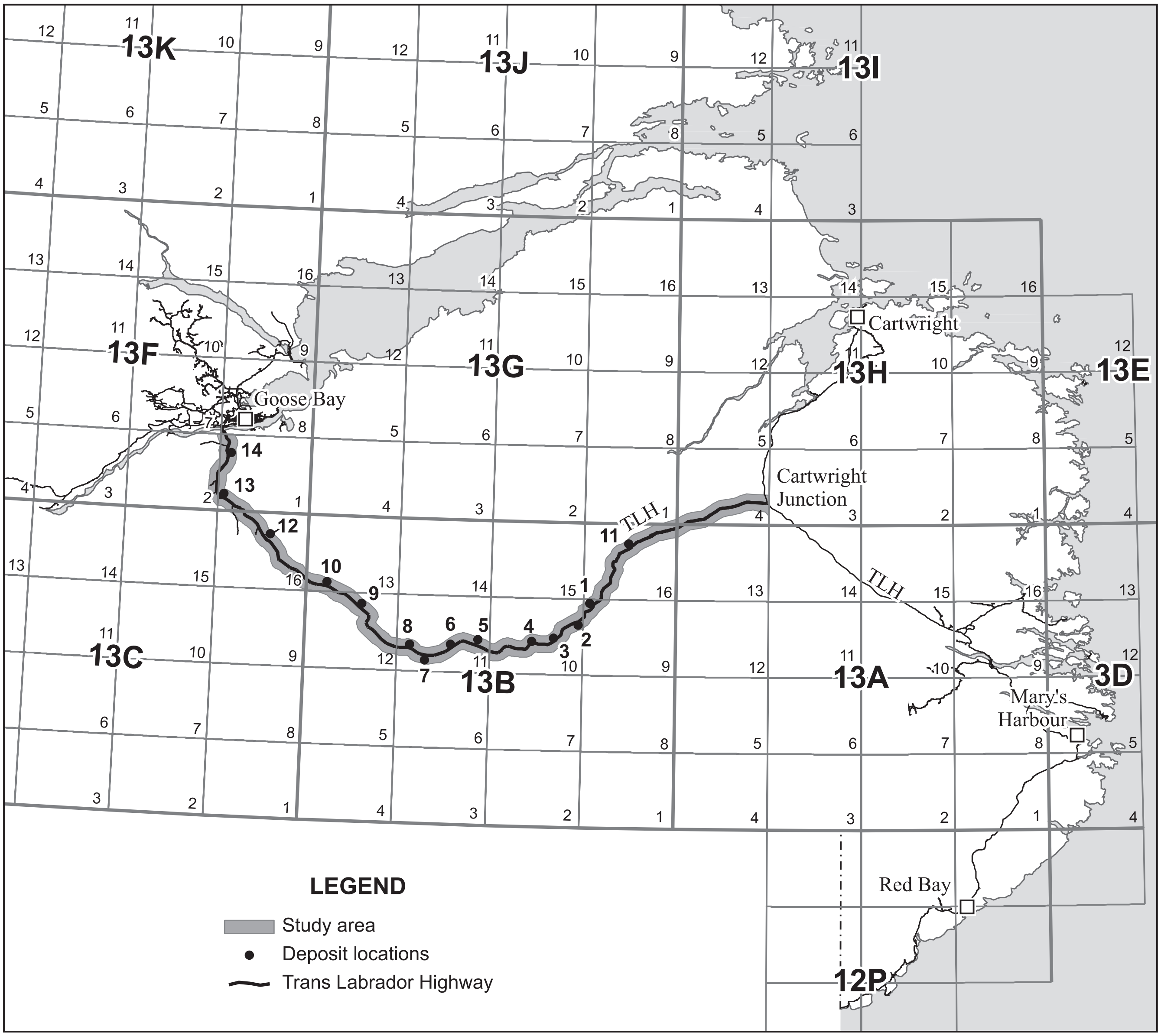


Figure 1. *Granular-aggregate resource deposit locations along the Trans-Labrador Highway between the Cartwright Junction in the east and the Churchill River in the west.*

Granular-aggregate maps are a derivative of landform classification maps supplemented by ground proofing and sampling. They subdivide potential aggregate deposits into high, moderate, or low potential for aggregate production. The size of the deposit can be determined if its aerial extent and average thickness are known or can be estimated. Thickness values are approximations, based on the face heights of pits developed in the deposit, roadside exposure, or features of the general landscape such as the height of ridges or terraces above the surrounding terrain. From all data, individual deposits may be assigned one of four zones, with Zone 1 being the area of highest potential (Kirby *et al*., 1983).

In addition to the data collected from airphotos, the composition of various sediment types (Table 1) was described using parameters defined by Carter (1983). Data were obtained in the field by examining natural exposures (*e.g.*, stream cuts, shorelines, and gullies) or man-made exposures (*e.g.,* roadcuts, and pit and quarry excavations). Where exposures were not available, samples were collected from 1-m-deep hand-dug pits. In some places, hand-dug pits were not practical because of boulders or a thick, cemented B-horizon, making it difficult to see the undisturbed parent material. Lack of exposures meant that deposit thickness was difficult to assess. The scarcity of vertical sections, combined with the presence of a concealing surface

Table 1. Composite soil description (Carter, 1983)

Description	Composition
Slightly sandy gravel	>95% gravel
Sandy gravel	5 to 20% sand
Very sandy gravel	>20% sand
Sand/gravel	About equal
Very gravelly sand	> 20 % gravel
Gravelly sand	5 to 20 % gravel

mat of organic material in many places, made positive interpretation of the nature and extent of the glacial sediments heavily dependent upon evaluation of the geomorphology. Thus, in most instances, surface form was an important aspect in recognition of the unit mapped. Obvious landform boundaries were the basis of many delineations. Other features recorded in the field were sediment thickness, stoniness, presence of compact layers, and the presence of vegetation.

Approximately 15 kg of material was collected for field sieving at each site. Field sieving and petrographic analysis were performed on most samples containing >8 mm size material. A split (70 to 140 g) of the sand–silt–clay fraction (<8 mm) was retained for laboratory sieve analysis, which involved drying and splitting the sample to a manageable size (70 to 140 g) and wet and/or dry sieving of each sample following the procedures outlined by Ricketts (1987). This data was used to outline zones of aggregate potential on aggregate resource maps.

AGGREGATE POTENTIAL

Surficial sediments in the map area consist of till, glaciofluvial sand and gravel, glaciomarine sand–silt–clay, and organic deposits. Till is widespread over most of the area, varying in composition, commonly in relation to underlying bedrock. Generally, tills have a higher silt–clay content than sands and gravels, which renders most of these deposits unsuitable for most construction purposes, unless washed to remove the silt. Potential quarry sites for low silt–clay tills will be outlined on 1:50 000-scale maps to be open-file released in 2011. Sand and gravel have the greatest economic potential. These types of deposits were sampled at 14 locations within the 6-km-wide corridor (Figure 1). Textures ranged from fine sand and silt to cobble and boulder gravels. Data are summarized in Table 2. Deposits size ranges from 12 000 m^3 to 40 000 000 m^3.

Some gravel and sand deposits are outlined in figures, but not discussed in the text. These may be thin deposits not suitable for quarry potential, deposits mostly depleted during road construction, or deposits where there is insufficient data available to determine their potential.

Petrographic analyses were completed on 187 pebble samples, and show a range of petrographic numbers from

Table 2. Summary results of sand and gravel deposits sampled in a 6-km-wide corridor along the Trans-Labrador Highway from the Cartwright Junction to Goose Bay

Deposits	m^3	No. of Samples Analyzed	Gravel	Sand	Sl-Cl	Petrographic Numbers
1	150 000	3	58.2	40.9	0.9	111, 154, 161
2	1 000 000	10	37.8	61.1	1.1	134, 162, 176, 179, 187, 195, 197
3	4 000 000	13	39.2	59.5	1.3	129, 138, 150, 151, 155, 158, 168, 241, 262
4	50 000	2	61.9	37.5	0.6	129, 156
5	2 000 000	8	58.6	39.2	2.2	123, 151, 159, 202, 206, 213, 235
6	1 000 000	7	48.5	50.2	1.3	111, 118, 120, 136, 154, 180
7	150 000	3	60.2	37.8	2	196, 199, 219
8	12 000	2	57.9	41.7	0.4	249, 262
9	2 000 000	3	44.1	54.9	1	176, 191
10	1 500 000	2	18.4	81.3	0.3	218
11	13 000 000	16	48.1	50.3	1.6	118, 124, 129, 134, 148, 151, 151, 165, 173, 173, 185, 186
12	200 000	3	58.4	41.2	0.4	115, 183, 271
13	3 000 000	4	51.2	46.3	2.5	132, 205, 210
14	40 000 000	2	67.1	32.7	0.2	180, 208

Note: Estimated quantities in table are based on air photo interpretation and observations at field sample locations. Grain-size percentages are based on a compilation of sample data for each deposit. Petrographic analyses were conducted on samples that contained grain-size material greater than 16 mm.

111 to 271. Although reserves are large in many areas, the presence of varying amounts of weathered pebbles, mostly micaceous gneiss, decrease the petrographic quality. Petrographic classification and petrographic quality were determined by using a list of petrographic factors for rock types in Newfoundland and Labrador (Table 3).

Table 3. Petrographic classification (Bragg, 1995)

Classification	
Good (PN 100-135)	-Excellent for major asphalt/ concrete construction
Fair (PN 136-300)	-May be used in minor construction (gravel roads, house foundations, minor retaining walls, low traffic asphalt roads) if it passes other required specifications
Poor (PN 301-600)	-Should only be used as fill material
Deleterious (PN 601-1000)	-Unsuitable for aggregate use

Below are brief descriptions of deposits with potential quarry materials. These are listed in order of NTS map area.

DEPOSIT 1

Deposit 1 is a segmented esker located on the northeast side of the TLH in NTS map area 13B/09. The esker is orientated in an east-west direction located between 1.2 km and 2.8 km from the road, and extending beyond the boundary of NTS map area13B/9 to the edge of the 6-km-wide corridor study area (Figures 1 and 2). The surrounding area consists of hummocky till, till ridges and bog. Minor rock outcrops are also present.

The deposit is estimated to contain 150 000 m^3 of gravel and sand. Dense spruce vegetation covers most of the ridge. Site observations indicate this deposit contains approximately 20% boulder–cobble content, overlain by 0.2 m of oxidized sand. Grain-size analyses of three samples collected from 0.7- to 1-m-deep hand-dug pits along the ridge show an average 58.2% gravel, 40.9% sand, and 0.9% silt–clay (Table 2). Pebbles consist of fresh to highly weathered gneiss (43%), fresh to slightly weathered granite (30%), fresh quartz pebbles (8%), fresh to slightly weathered gabbro (7%), fresh to slightly weathered anorthosite (5%), fresh to moderately weathered syenite (5%) and fresh quartzite (2%). Petrographic numbers of three samples are 111, 154, and 161, indicating the aggregate has good to fair quality.

DEPOSIT 2

Deposit 2 is an esker-hummocky gravel deposit that crosses the border between NTS map areas 13B/09 and 13B/10 (Figures 1 and 3). The TLH cuts through a 2 km section of this deposit. The esker is mostly continuous for over 3 km to the east and southeast of the road, where it continues beyond the study area boundary. West of the TLH, the esker has 100- to 500-m-long segments, with gaps up to 700 m long. The surrounding area consists of numerous till moraines, and thin till cover and organic deposits. Spruce growth is the dominant vegetation covering the deposit.

Deposit 2 contains approximately 1 000 000 m^3 of gravel and sand. Grain-size analyses of 10 samples, collected from 1.5- to 7-m-high roadcut and quarry exposures (Plate 1) and from 1.1-m-deep hand-dug pits, indicate it contains 37.8% gravel, 61.1% sand and 1.1% silt–clay (Table 2). Pebbles consist of fresh to highly weathered gneiss (38%), fresh to moderately weathered granite (31%), fresh gabbro (11%), fresh quartz pebbles (6%), fresh syenite (5%), fresh anorthosite (4%), fresh amphibolite (4%), and fresh monzonite (1%). Petrographic numbers of seven samples range from 134 to 197 with an average of 176, indicating the aggregate has fair quality.

DEPOSIT 3

Deposit 3 is a large esker complex in an outwash system, orientated perpendicular to the road, located in NTS map area 13B/10 (Figures 1 and 4). It is up to 1100 m wide and greater than 6 km long. The deposit is kettled in places, and is covered by spruce forest and minor bog.

Deposit 3 contains an estimated 4 000 000 m^3 of aggregate. Grain-size data based on analyses of 13 samples collected from 2- to 4-m-high roadcuts (Plate 2), and 8 samples collected from 0.9- to 1.5-m-deep hand-dug pits show an average of 39.2% gravel 59.5% sand and 1.3% silt–clay (Table 2). Pebbles consist of fresh to moderately weathered granite (52%), fresh to intensely weathered gneiss (28%), fresh gabbro (8%), fresh to slightly weathered syenite (5%), fresh anorthosite, monzonite and amphibolite, (4%), and fresh quartz pebbles (3%). Petrographic numbers of nine samples range from 129 to 262, with an average 172, indicating the aggregate has good to fair quality.

DEPOSIT 4

Deposit 4 is a 1.5-km-long esker, located 150- to 450-m north of the TLH in NTS map area 13B/10 (Figures 1 and

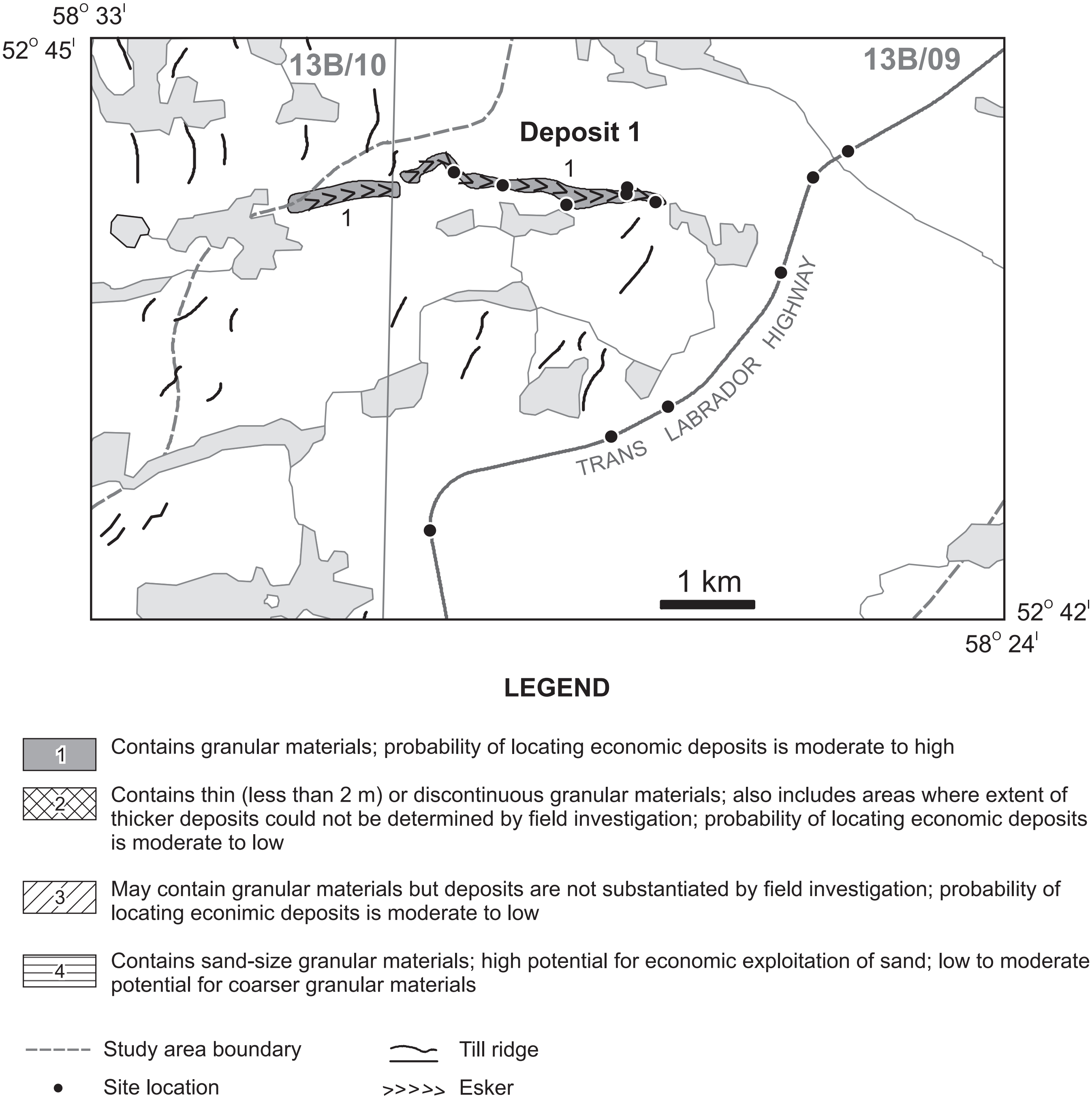


Figure 2. *Location of Deposit 1 along the Trans-Labrador Highway.*

4). There are several till ridges, hummocky till and bog surrounding this deposit. Bedrock was noted in or nearby a roadcut underlying 6 m of till.

Deposit 4 contains an estimated quantity of 50 000 m^3 of gravel and sand. Observations at 2 hand-dug pits (0.8 to 1 m deep) indicate there maybe up to 30% boulder content. Grain-size analyses of 2 samples show an average of 61.9% gravel, 37.5% sand, and 0.6% silt–clay (Table 2). Pebbles consist of fresh granite (68%), fresh to intensely weathered gneiss (21%), fresh gabbro (6%), fresh syenite (4%), and fresh amphibolite (1%). Petrographic numbers of 2 samples are 129 and 156, indicating the aggregate has good to fair quality.

DEPOSIT 5

Deposit 5 is located along the TLH in the east part of

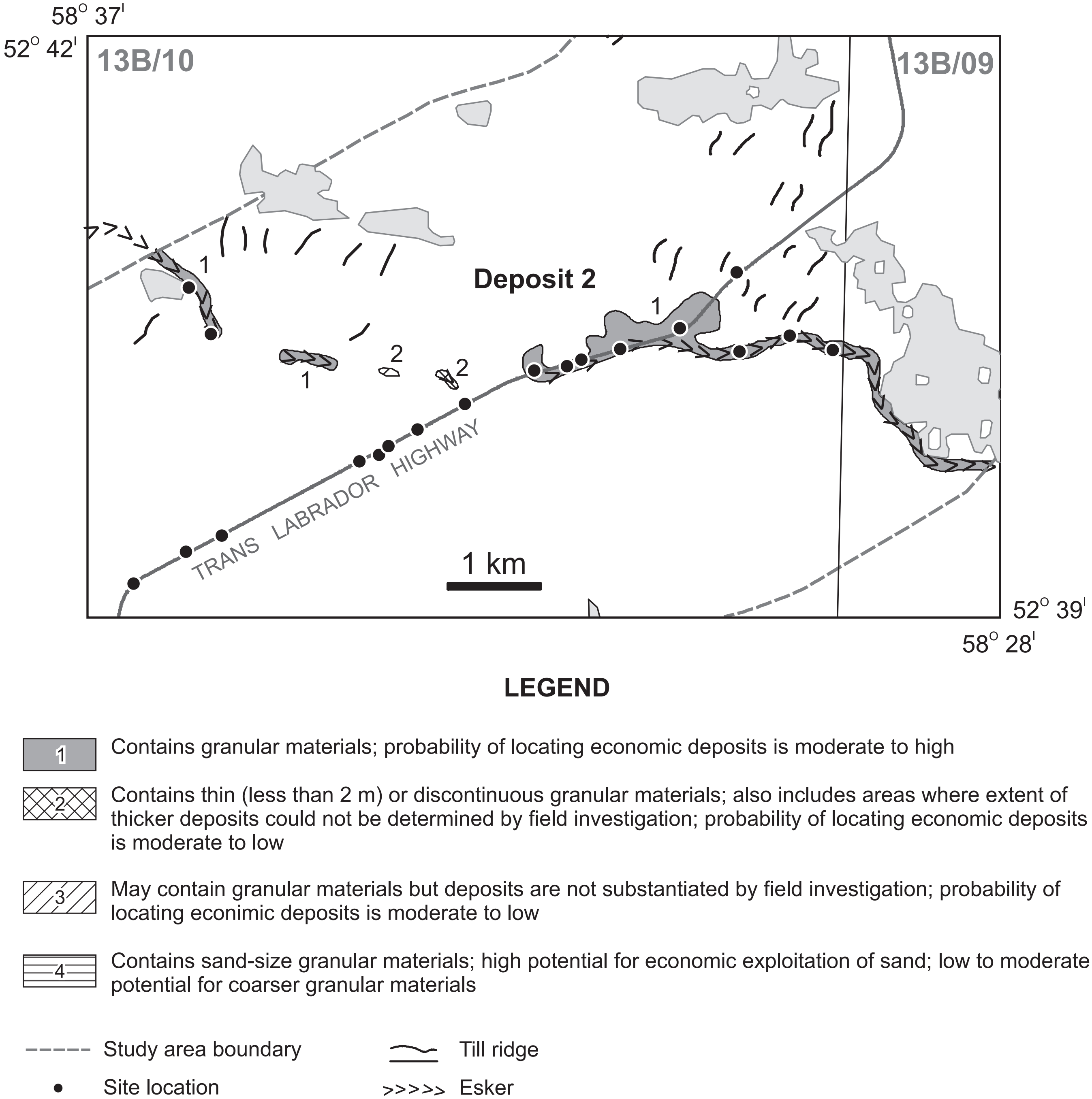


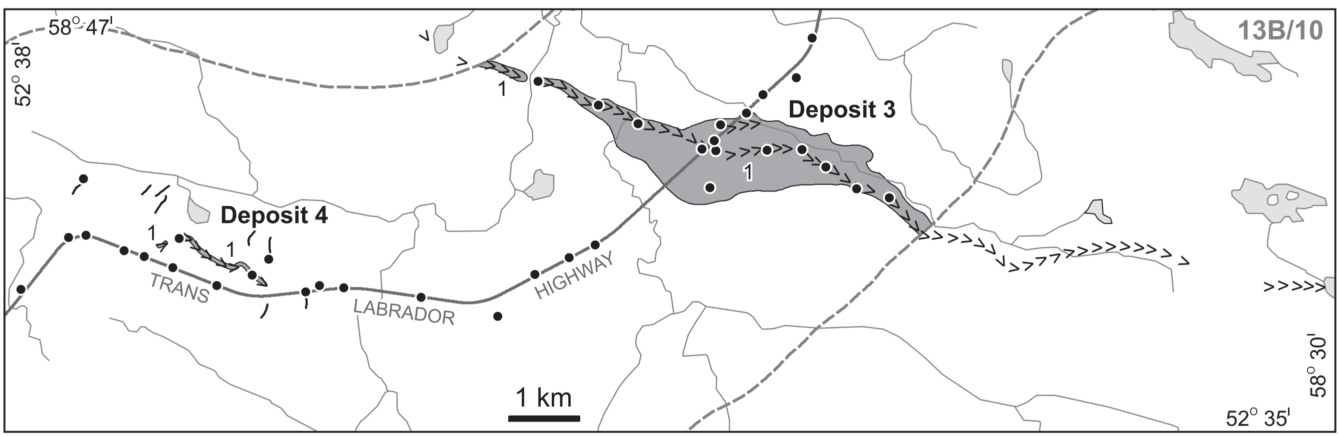
Figure 3. *Location of Deposit 2 along the Trans-Labrador Highway.*

NTS map area 13B/11 (Figures 1 and 5). It consists of eroded gravels, hummocky gravel and esker deposits. It contains approximately 2 000 000 m^3 of gravel and sand. Two areas identified from airphotos but not verified in the field (Zone 3) may also be sand and gravel. If confirmed, this may substantially increase the volume of quarry material in the area. An extensive zone of till ridges is located to the west and southwest of Deposit 5 (Figure 5). In other areas around the deposit, hummocky till, eroded till and bog are more common.

Deposit 5 contains an estimated 2 000 000 m^3 of sand and gravel. Grain-size analyses of 8 samples collected from 1.4-m-deep hand-dug pits and from five samples collected from 2- to 7-m-high roadside and quarry exposures (Plate 3) show 58.6% gravel, 39.2% sand and 2.2% silt–clay (Table 2). Pebbles consist of fresh to moderately weathered granite (37%), fresh to intensely weathered gneiss (29%), fresh gabbro (18%), fresh syenite (8%), fresh quartz pebbles (3%), fresh amphibolite, mylonite and quartzite (3%), and fresh anorthosite (2%). Petrographic numbers of seven samples

Plate 1. *Alternate units of gravel and sand along a 7-m-high roadcut along side of esker, located in NTS map area 13B/10.*

Plate 2. *Sandy boulder gravel along a 3-m-high roadcut through esker, located in NTS map area 13B/10.*



LEGEND

1 — Contains granular materials; probability of locating economic deposits is moderate to high

2 — Contains thin (less than 2 m) or discontinuous granular materials; also includes areas where extent of thicker deposits could not be determined by field investigation; probability of locating economic deposits is moderate to low

3 — May contain granular materials but deposits are not substantiated by field investigation; probability of locating econimic deposits is moderate to low

4 — Contains sand-size granular materials; high potential for economic exploitation of sand; low to moderate potential for coarser granular materials

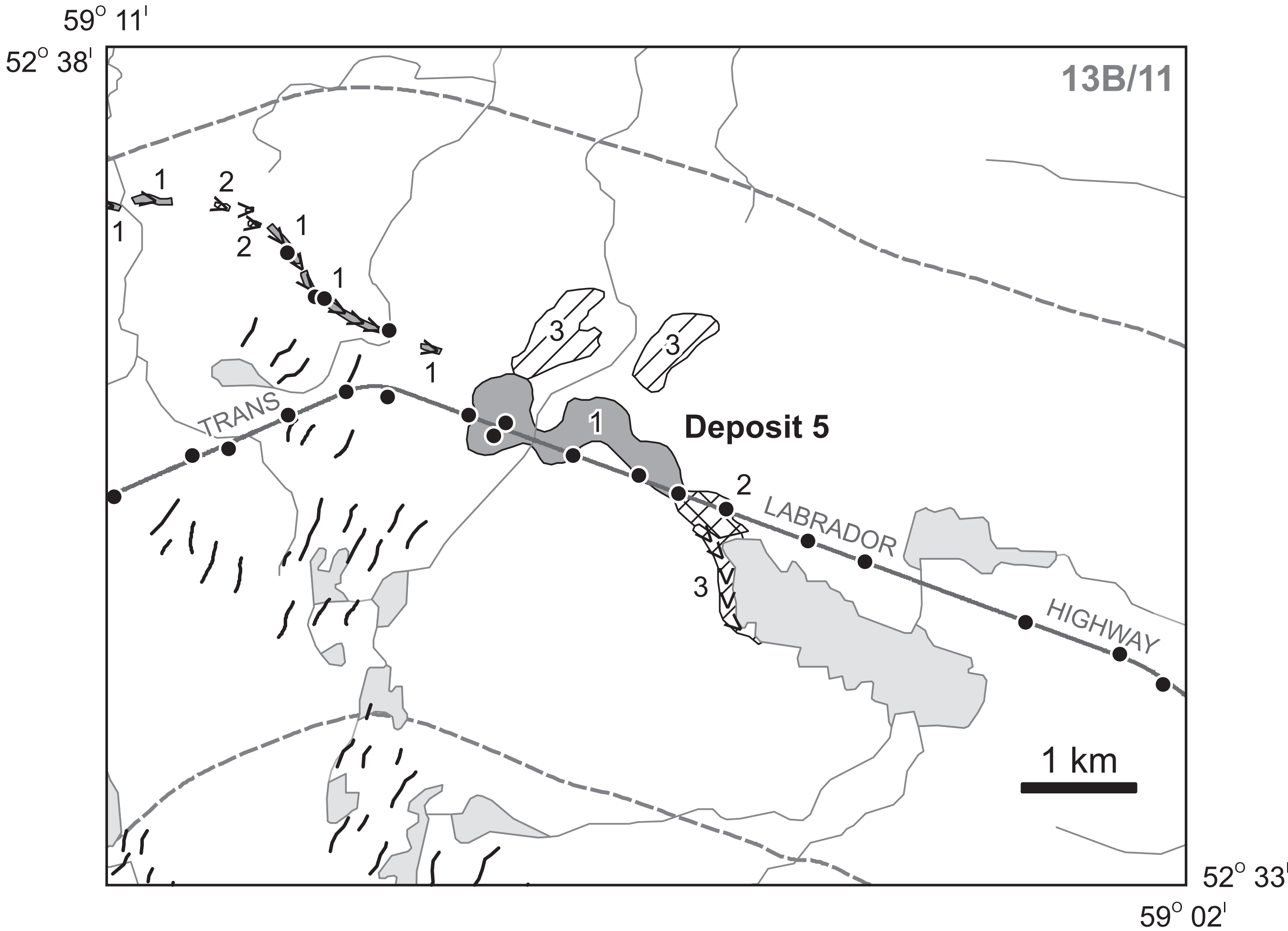
----- Study area boundary

• Site location

Till ridge

>>>>> Esker

Figure 4. *Location of Deposits 3 and 4 along the Trans-Labrador Highway.*



LEGEND

1 — Contains granular materials; probability of locating economic deposits is moderate to high

2 — Contains thin (less than 2 m) or discontinuous granular materials; also includes areas where extent of thicker deposits could not be determined by field investigation; probability of locating economic deposits is moderate to low

3 — May contain granular materials but deposits are not substantiated by field investigation; probability of locating econimic deposits is moderate to low

4 — Contains sand-size granular materials; high potential for economic exploitation of sand; low to moderate potential for coarser granular materials

----- Study area boundary

Till ridge

• Site location

>>>>> Esker

Figure 5. *Location of Deposit 5 along the Trans-Labrador Highway.*

Plate 3. *Boulder gravel along a 5-m-high quarry exposure in Deposit 5, located in NTS map area 13B/11.*

Plate 4. *Gravel over sand in a 10-m-high quarry exposure in esker, in Deposit 6, located in NTS map area 13B/11.*

range from 123 to 235 with an average of 184, indicating the aggregate has good to fair quality.

DEPOSIT 6

Deposit 6 is an esker system located in NTS map area 13B/11 (Figures 1 and 6). On the south side of the TLH, the esker is over 3 km long with 4 breaks ranging from 50 m to 150 long. A 1.3-km-long segment of the same esker system is located on the north side of the road. Till ridges are located near the esker on the north side of the road, and east of the esker near the south boundary of the study area. Two- to four-m-high roadcuts in till ridges indicate they have low boulder–cobble content and high silt–clay. Till veneers, concealed bedrock, and organics were also noted in areas around the esker.

Deposit 6 contains an estimated 1 000 000 m^3 of sand and gravel. Grain-size analyses of 7 samples collected from 1- to 1.5-m-deep hand-dug pits, and from two, 10-m-high quarry exposures (Plate 4) show 48.5% gravel, 50.2% sand and 1.3% silt–clay (Table 2). Pebbles consist of fresh to moderately weathered granite (54%), fresh to intensely weathered gneiss (19%), fresh gabbro (18%), fresh syenite (5%), fresh quartz pebbles, anorthosite, amphibolite and monzonite (4%). Petrographic numbers of six samples range from 111 to 180 with an average of 136, indicating the aggregate has good to fair quality.

DEPOSIT 7

Deposit 7 is located 350 m to 650 m south of the road, along the St. Agustin River in NTS map area 13B/11 (Figures 1 and 6). The deposit consists of two esker segments, 120 and 800 m long, respectively. Outwash material on the north side of the esker is up to 3 m thick. Thin layers of gravel, sometimes overlain by organic deposits, are common in the valley where the esker system is located. Over 2 km east of this deposit, remnants of this esker system are traced east and southeastward, and extending into a large esker complex that continues several kilometres beyond the study area. Most of the surrounding area consists of till veneers, till blanket, organics, and concealed bedrock. Till samples show a variation of material from boulder-rich till with sand lenses, to tills with a silt–clay matrix.

Deposit 7 contains approximately 150 000 m^3 of sand and gravel. Analyses of 3 samples collected from 1- to 1.5-m-deep hand-dug pits show an average of 60.2% gravel, 37.8% sand and 2% silt–clay (Table 2). Pebbles consist of fresh granite (29%), fresh to intensely weathered gabbro (26%), fresh to intensely weathered gneiss (24%), fresh syenite (5%), fresh quartz pebbles (5%), fresh amphibolite (4%), fresh anorthosite (3%), fresh quartzite (2%) and fresh mylonite (2%). Petrographic numbers of three samples are 196, 199 and 219, indicating the aggregate has fair quality.

DEPOSIT 8

Deposit 8 is located between 100 m and 2000 m north of the road near the west end of NTS map area 13B/11 (Figures 1 and 6). It consists of numerous 1- to 2-m-high ridges, probably the remnants of an eroded glaciofluvial terrace. The surrounding area consists of organics, till veneer and blanket tills. The textures of the till deposits, observed from roadcut exposures, varied from boulder–cobble having a low silt–clay content, to dominantly silt–clay with a low boulder–cobble content.

Deposit 8 contains an estimated 12 000 m^3 of sand and gravel. Analyses of 2 samples indicate this deposit contains 57.9% gravel, 41.7% sand, and 0.4% silt–clay (Table 2).

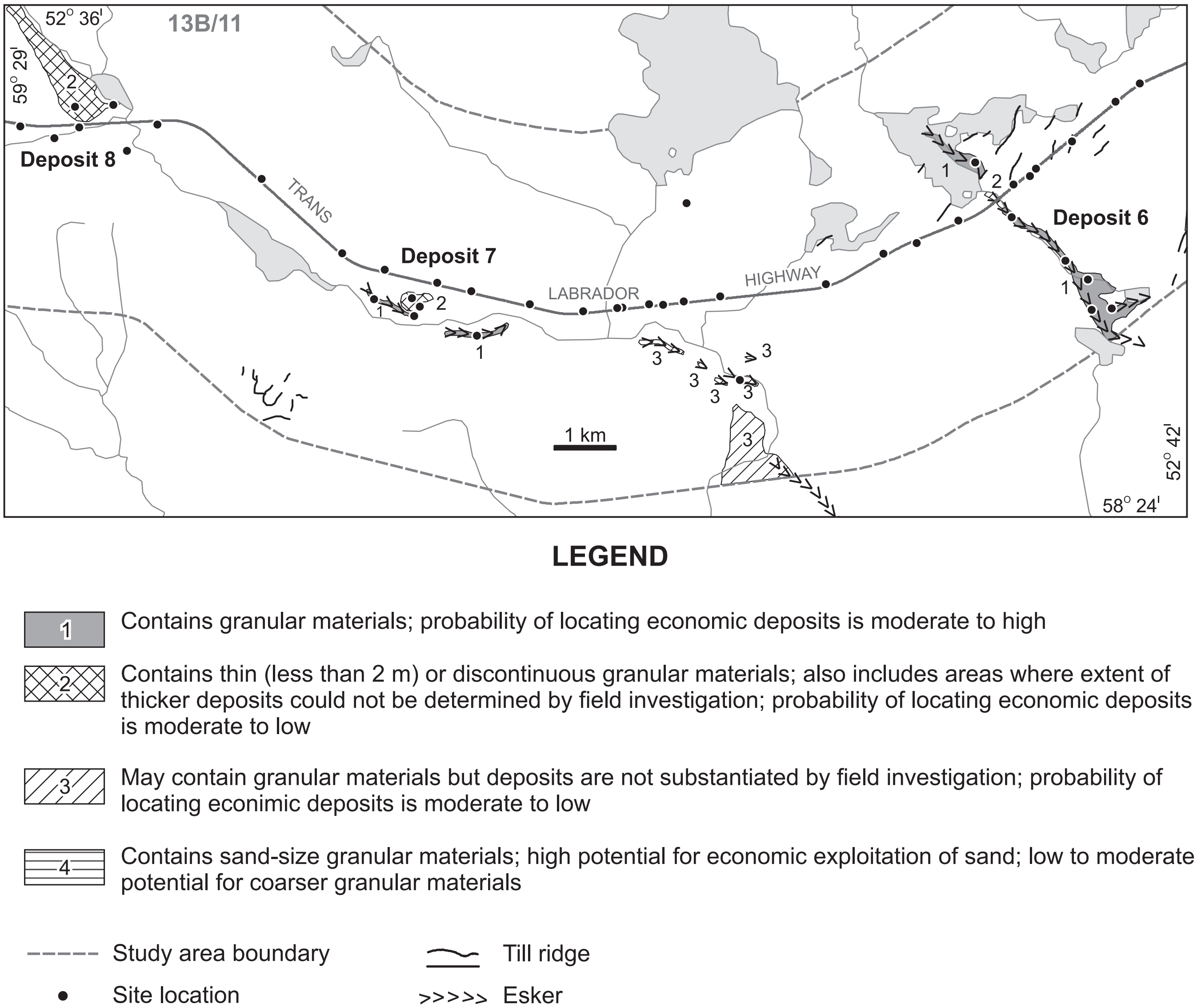


Figure 6. *Location of Deposits 6, 7 and 8 along the Trans-Labrador Highway.*

Pebbles consist of fresh to intensely weathered gneiss (29%), fresh to moderately weathered syenite (23%), fresh granite (19%), fresh to intensely weathered gabbro (19%), fresh quartz pebbles (6%), fresh amphibolite (2%), fresh anorthosite (1%), and fresh mylonite (1%). Petrographic numbers of two samples are 249 and 262, indicating the aggregate has fair quality.

DEPOSIT 9

Deposit 9 is located between 0.7 and 3 km east of the TLH in NTS map area 13B/12 (Figures 1 and 7). It covers a 1 200 000 m^2 area and extends beyond the study area, and consists of an esker and hummocky gravel complex, up to 16 m thick. There is a separate deposit of washed materials located northwest of Deposit 9, consisting of silty gravel, sand and pebble sand. However, this deposit is only 1 to 3 m thick and is covered by numerous small bogs. Till ridges are located near the east end of Deposit 9, and eskers several kilometres long are located east of the study area. Eroded till, till veneer and till hummocks are located in other areas around the deposit.

This deposit is estimated to contain 2 000 000 m^3 of sand and gravel. Analyses of 3 samples show an average of 44.1% gravel, 54.9% sand and 1% silt–clay (Table 2). Pebbles consist of fresh monzonite (26%), fresh to moderately weathered gabbro (25%), fresh gneiss (21%), fresh syenite (19%), fresh quartz pebbles (3%), fresh amphibolite (2%), fresh anorthosite (2%), and fresh mylonite (2%). Petrographic numbers of two samples are 176, and 191, indicating the aggregate has fair quality.

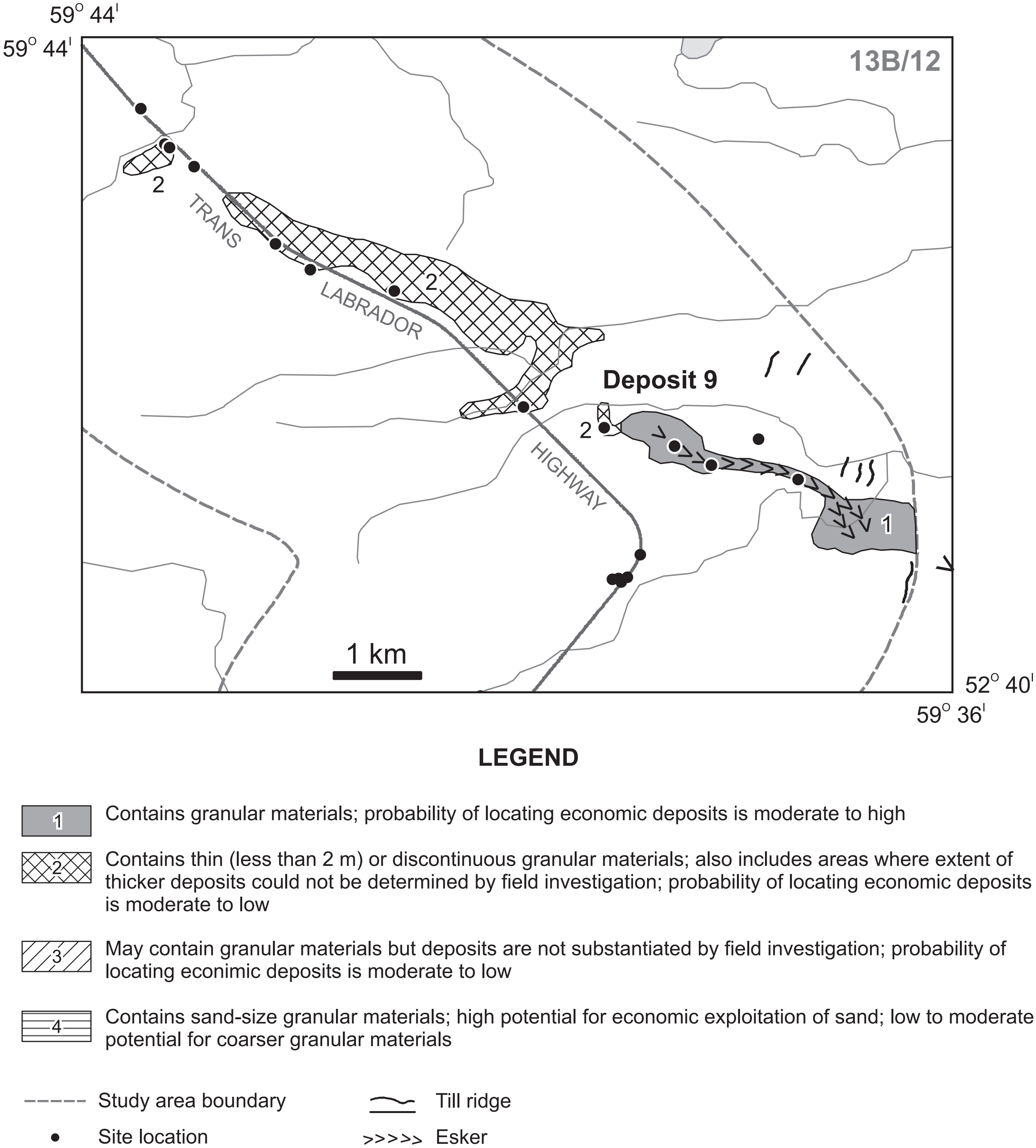


Figure 7. *Location of Deposit 9 along the Trans-Labrador Highway.*

DEPOSIT 10

Deposit 10 is a sand and gravel terrace, located between 250 m and 1000 m north of the TLH in NTS map area 13B/13 (Figures 1 and 8). This deposit covers a 300 000 m^2 area and is up to 9 m thick. A thin gravel unit sampled near the road, east of the Deposit 10 (Zone 2, Figure 8), is less than 2 m thick and has rock knobs protruding through the gravel. This deposit was nearly depleted during road construction.

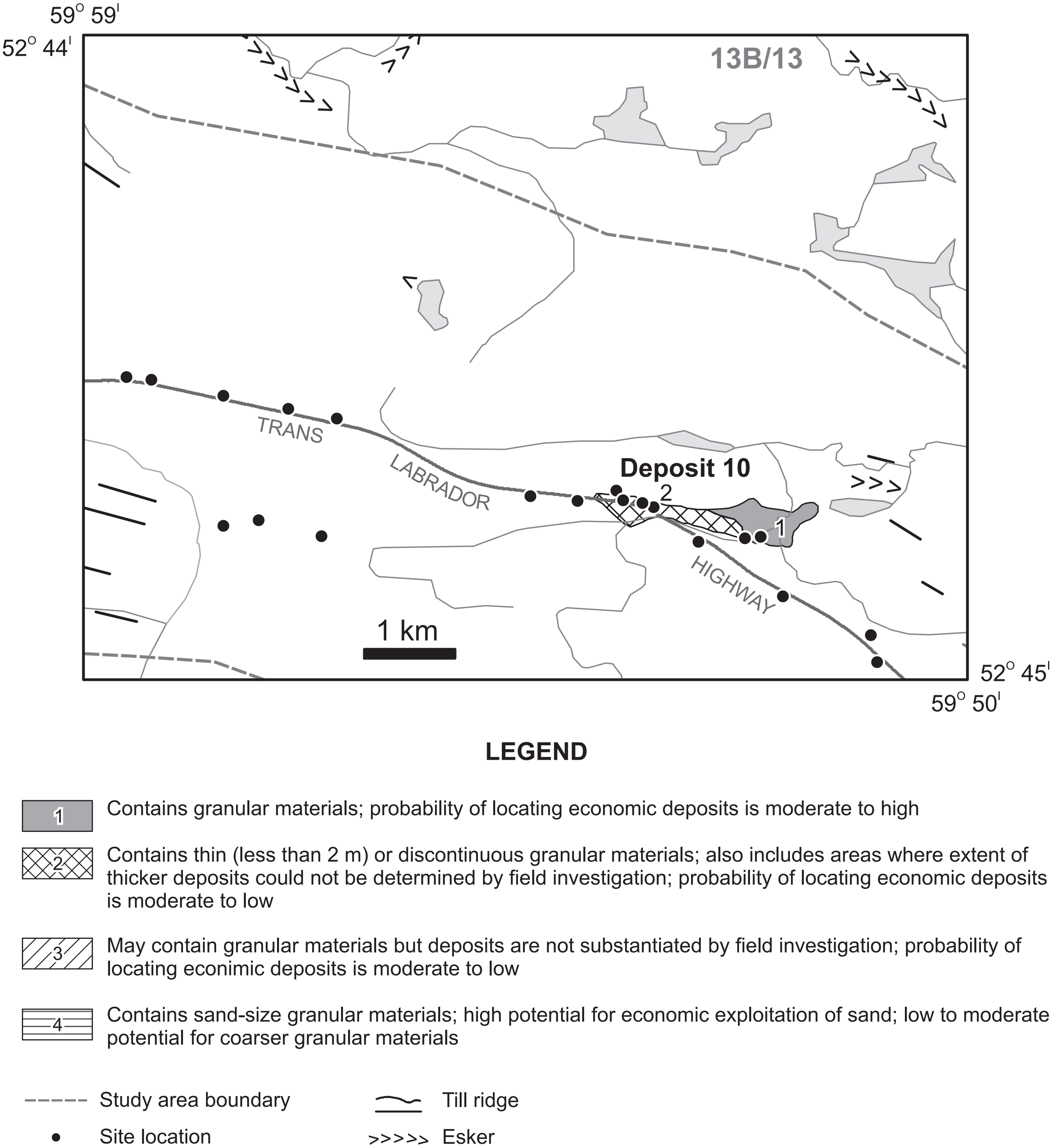


Figure 8. *Location of Deposit 10 along the Trans-Labrador Highway.*

In the area around Deposit 10, till veneers and concealed bedrock are the dominant surficial types. Lineated till ridges were identified east and west of the deposit. Many rock cuts overlain by a till veneer were noted along the road. Densely to moderately spaced spruce growth is the dominant vegetation in the area.

Deposit 10 contains approximately 1 500 000 m^3 of sand and gravel. Analyses of 2 samples collected from hand-dug pits, 1 m and 1.2 m deep, show 18.4% gravel, 81.3% sand and 0.3% silt–clay (Table 2). Pebbles consist of fresh to slightly weathered gneiss (36%), fresh gabbro (20%), fresh syenite (17%), fresh monzonite (9%), fresh diorite

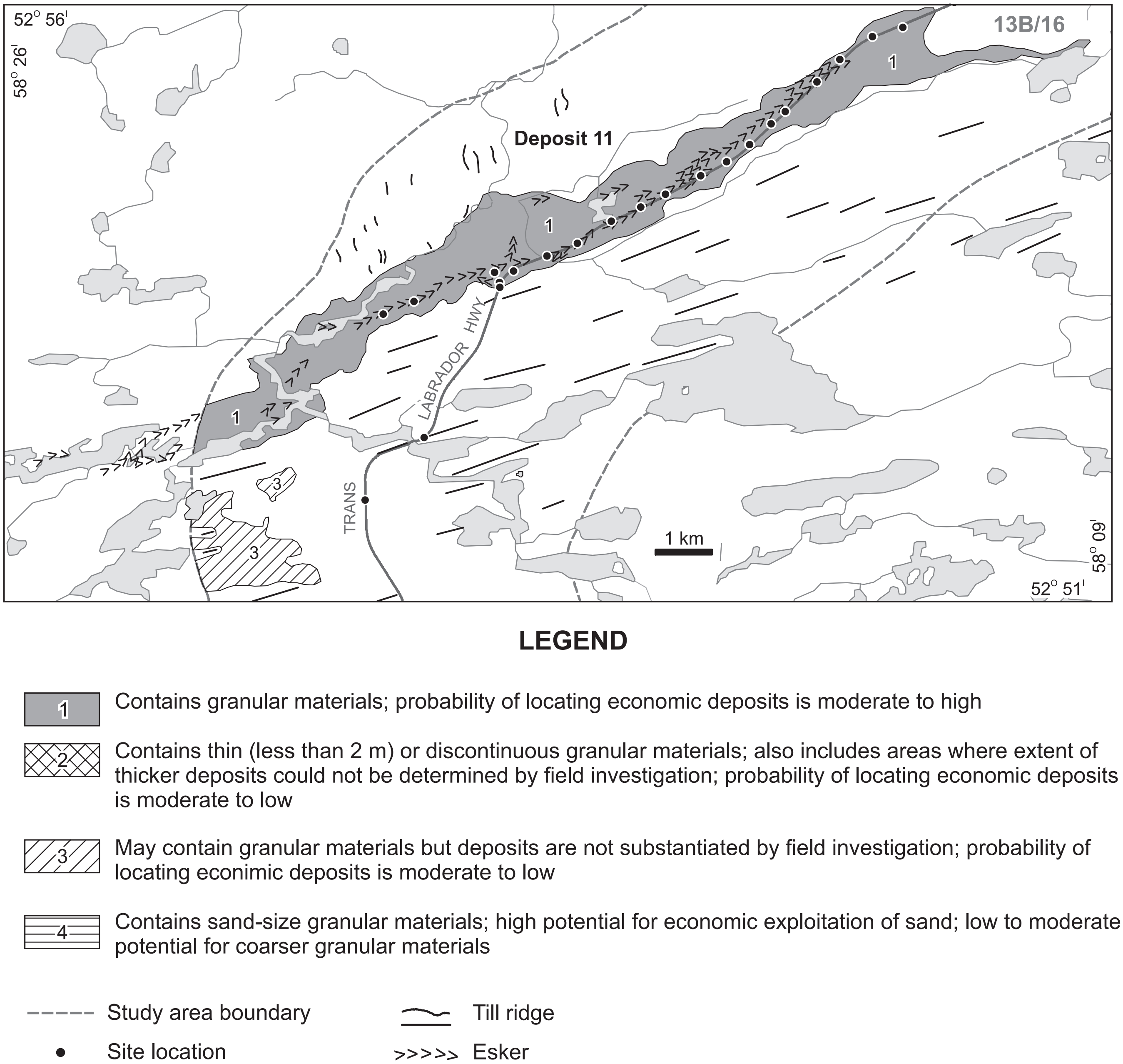


Figure 9. *Location of Deposit 11 along the Trans-Labrador Highway.*

(9%), fresh granite (6%), and fresh amphibolite (3%). A petrographic number of 218 was determined for one sample, indicating the aggregate has fair quality.

DEPOSIT 11

Deposit 11 is a large esker complex located along the TLH near the central part of NTS map area 13B/16 (Figures 1 and 9). This deposit is over 17 km long and covers a 14 000 000 m^2 area. Textures range from fine- to medium-grained sand to boulder–cobble gravel (Plate 5). Lineated till ridges are located to the south and cross-valley moraines to the north. Till and rock exposures were noted along the road to the northeast and southwest of the deposit.

Deposit 11 contains an estimated 13 000 000 m^3 of sand and gravel. Grain-size analyses of 16 samples collected from 2- to 10-m-high roadcut exposures, and from one, 1-m-deep hand-dug pit, show 48.1% gravel, 50.3% sand and 1.6% silt–clay (Table 2). Pebbles consist of fresh to intensely weathered gabbro, (24%), fresh to intensely weathered gneiss (20%), fresh to slightly weathered anorthosite (19%),

Plate 5. *Boulder gravel along a 10-m-high roadcut through esker, in Deposit 11, located in NTS map area 13B/16.*

Plate 6. *Gravel along a 4- to 8-m-high quarry exposure at top of 20-m-high riverbank, in Deposit 14 located in NTS map area 13F/1.*

fresh to moderately weathered granite (17%), fresh to slightly weathered syenite (13%), fresh quartzite, amphibolite, monzonite, and mylonite (4%), and fresh quartz pebbles (3%). Petrographic numbers range from 118 to 186, with an average of 153, indicating the aggregate has good to fair quality.

DEPOSIT 12

Deposit 12 is a gravel terrace located along a riverbank east of the TLH in NTS map area 13C/16 (Figures 1 and 10). The terrace is 50 to 70 m wide, 1 to 3 m high and covers a 180 000 m^2 area. Till was sampled below 3 m of gravel at one location along the riverbank. Silty wet till, noted along roadcut and quarry exposures, is the major surfical sediments in this area.

The deposit contains an estimated 200 000 m^3 of sand and gravel. Analyses of 3 samples show 58.4% gravel, 41.2% sand and 0.4% silt–clay (Table 2). Pebbles consist of, fresh monzonite (33%), fresh syenite (19%), fresh to slightly weathered granite (12%), fresh to slightly weathered gneiss (10%), fresh conglomerate (9%), fresh sandstone (6%), fresh quartz pebbles (6%) and fresh anorthosite (3%) and fresh gabbro (2%). Petrographic numbers of three samples are 115, 183, and 271, indicating the aggregate has good to fair quality.

DEPOSIT 13

Deposit 13 is located less than 100 m east of the road on the north side of the Traverspine River (Figures 1 and 11). The deposit was used extensively during construction of the TLH. This deposit covers almost a 700 000 m^2 area. A thin deposit of boulder gravel, covering a 500 000 m^2 area, is located south of Deposit 13, and another thin deposit, covering a 1 000 000 m^2 area, was sampled west of Deposit 13. Samples consisting of pebble sand and medium to fine sand were collected from roadcuts and backhoe pits in this area.

Deposit 13 contains an estimated 3 000 000 m^3 of sand and gravel. Analyses of 4 samples collected from 2- to 8-m quarry exposures, and one, 1-m river exposure, show 51.2% gravel, 46.3% sand and 2.5% silt–clay (Table 2). One of these samples was sand with 9.1% silt–clay. Pebbles consist of fresh to moderately weathered gabbro (53%), fresh monzonite (17%), fresh to moderately weathered gneiss (15%), fresh syenite (5%), fresh granite (5%), fresh quartz pebbles (3%) and fresh siltstone (2%). Petrographic numbers of three samples are 132, 205, and 210, indicating the aggregate has good to fair quality.

DEPOSIT 14

Deposit 14 is located between 100 m and 3000 m east of the TLH in NTS map area 13F/1 (Figures 1 and 12). It is the largest deposit of sand and gravel in the map area, covering an area of approximately 3 000 000 m^2. There is an extensive gravel deposit (Zone 2), covering almost 8 000 000 m^2 area, north of the main deposit (Zone 1). This zone consists of pebble gravels, oxidized, compacted gravel, pebble sand, boulder gravel, silty sand, sand, and sandy gravel, in 0.5- to 3-m-thick beds. Till and bedrock were also noted in this area. To the north and northeast of the main deposit there is an extensive area of aggregate resource (Zone 3), covering a 33 000 000 m^2 area. This area was identified from airphoto interpretation, but was not sampled in the field. It is at the same elevation as Zone 4, located at the north end of NTS map area 13F/01 and consists of stratified medium to fine sands overlying clay. It may be part of the Churchill River terrace system, where sand, silt and clay samples were

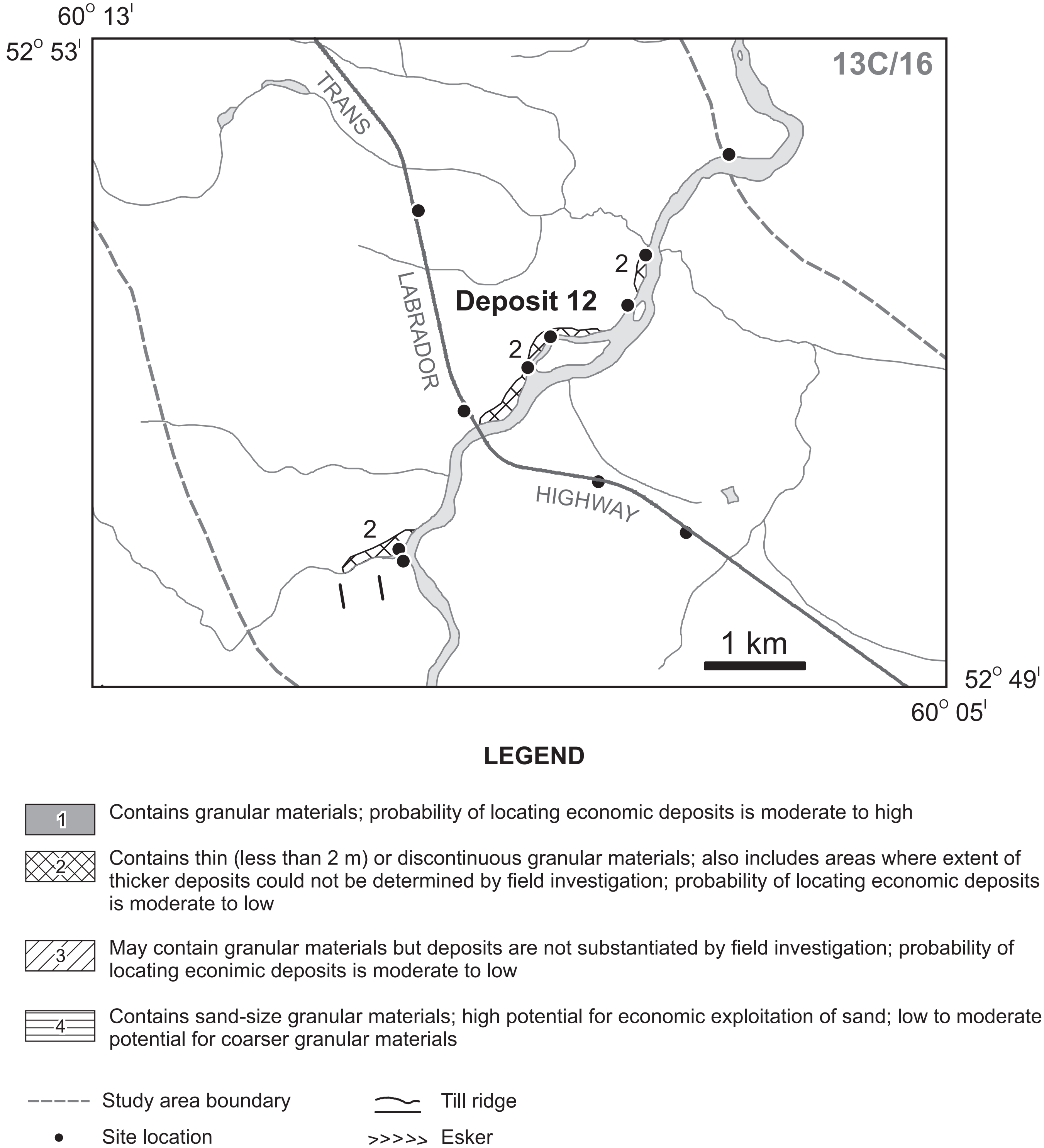
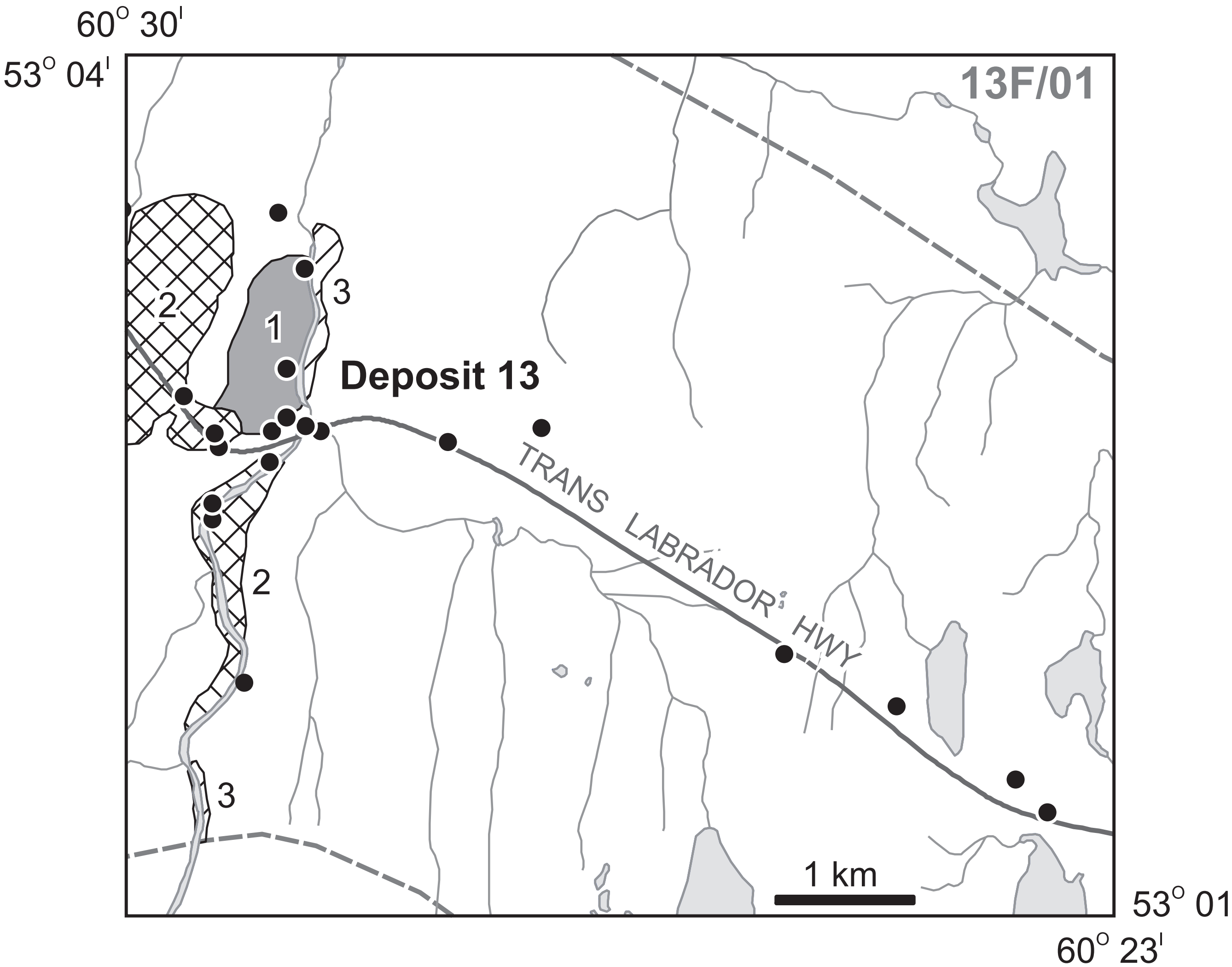


Figure 10. *Location of Deposit 12 along the Trans-Labrador Highway.*

collected during an earlier sampling program (Kirby *et al.*, 1983)

Zone 1 in Deposit 14 contains approximately 40 000 000 m^3 of sand and gravel. Two samples were collected from this deposit. One sample was taken from a 1-m-deep hand-dug pit at the top of a 15-m-high riverbank, and another sample was taken from an 8 m exposure (*see* Plate 6) at the top of a 20-m-high riverbank. Analyses of these samples show an average of 67.1% gravel, 32.7% sand and 0.2%



LEGEND

1 — Contains granular materials; probability of locating economic deposits is moderate to high

2 — Contains thin (less than 2 m) or discontinuous granular materials; also includes areas where extent of thicker deposits could not be determined by field investigation; probability of locating economic deposits is moderate to low

3 — May contain granular materials but deposits are not substantiated by field investigation; probability of locating econimic deposits is moderate to low

4 — Contains sand-size granular materials; high potential for economic exploitation of sand; low to moderate potential for coarser granular materials

----- Study area boundary

● Site location

Till ridge

>>>>> Esker

Figure 11. *Location of Deposit 13 along the Trans-Labrador Highway.*

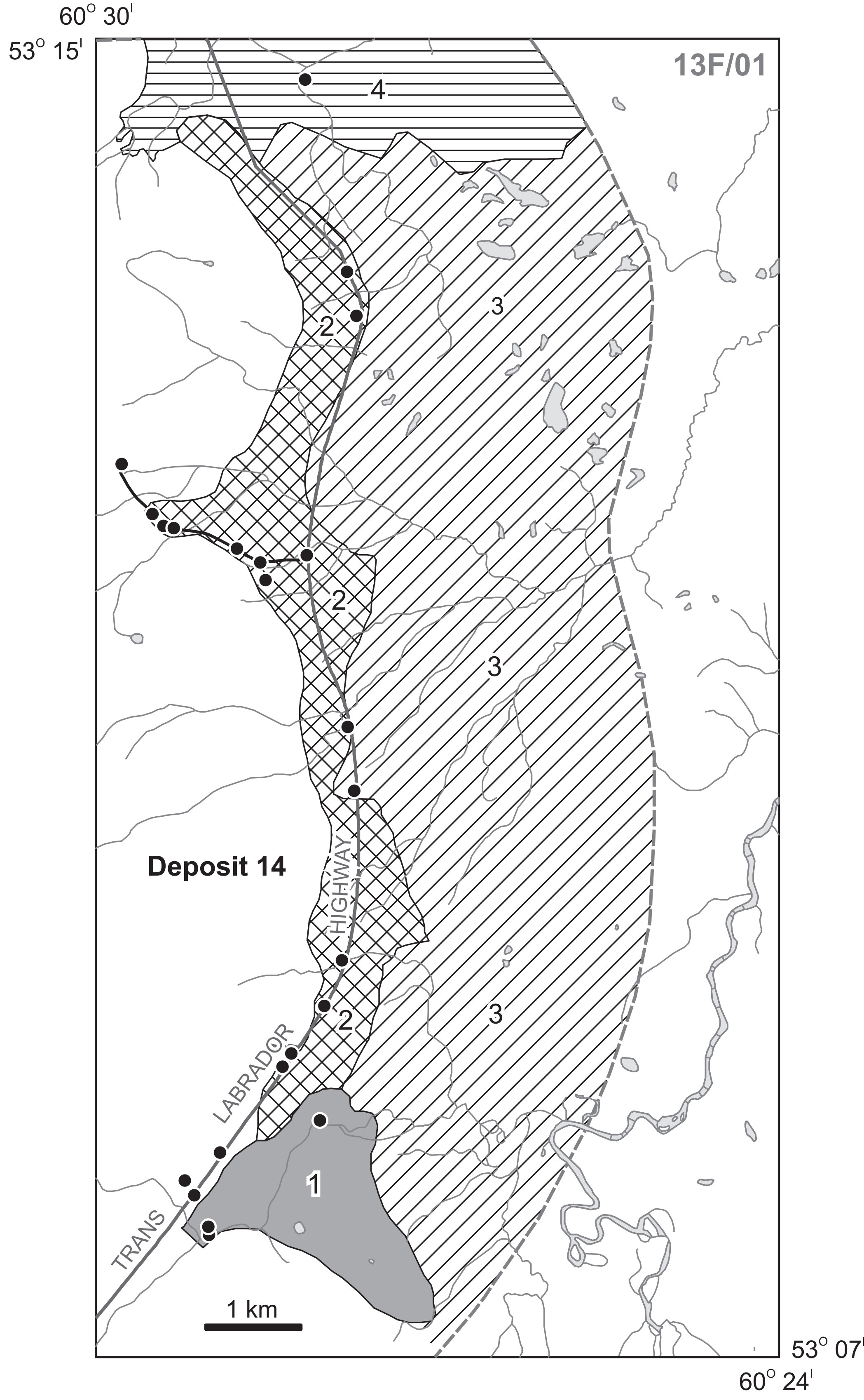


Figure 12. *Location of Deposit 14 along the Trans-Labrador Highway.* [Legend opposite page]

LEGEND FOR FIGURE 12

1 Contains granular materials; probability of locating economic deposits is moderate to high

2 Contains thin (less than 2 m) or discontinuous granular materials; also includes areas where extent of thicker deposits could not be determined by field investigation; probability of locating economic deposits is moderate to low

3 May contain granular materials but deposits are not substantiated by field investigation; probability of locating econimic deposits is moderate to low

4 Contains sand-size granular materials; high potential for economic exploitation of sand; low to moderate potential for coarser granular materials

----- Study area boundary

Till ridge

• Site location

>>>>> Esker

silt–clay (Table 2). Pebbles consist of fresh to highly weathered gabbro (27%), fresh granite (22%), fresh gneiss (12%), fresh syenite (11%), fresh quartz pebbles (6%), moderate to highly weathered undefined pebbles (8%), fresh amphibolite (2%), fresh anorthosite (4%), fresh monzonite (4%) and fresh sandstone (4%). Petrographic numbers of two samples are 180 and 208, indicating the aggregate has fair quality.

SUMMARY

Deposits sampled during the 2010 field season range in quantity from 12 000 m^3 to 40 000 000 m^3. Sediment samples collected and site observations indicate these deposits varied from boulder gravel to gravel, sandy gravel, sand and clay. Deposits may be suitable for quarry development depending on quality of material, and the type of material needed, whether for use in road construction, asphalt, cement, or for winter ice control. High boulder content in some deposits may require screening or crushing to get the right grain-size fractions required in some construction projects. Petrographic quality is variable, and although suitable for some road construction, the deposit will require further testing if used in concrete. Gravel ridges in Deposit 8, may be too small, and scattered, to make a suitable site for quarry material, and quarry activity in Deposit 12 may be restricted due to its proximity to the river. Most deposits are close to the road and easily accessible.

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