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GRANULAR AGGREGATE-RESOURCE MAPPING OF THE WEST AND NORTHERN TIP OF THE GREAT NORTHERN PENINSULA, NEWFOUNDLAND

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ABSTRACT

This report gives preliminary results of 1:50 000-scale aggregate mapping along the western and northern parts of the Great Northern Peninsula, Newfoundland. The aim of the project is to conduct a regional aggregate study to locate suitable deposits for future use by the construction industry when development occurs in these areas.

Finding deposits in non-coastal areas is considered to be of major importance. In the past, aggregate shortages have resulted in coastal exploitation, turning large segments of the shoreline and nearby roadsides into wide areas of barren landscape, leaving behind stockpiles of waste material, boulders and water-filled pits, which may have a significant and negative affect on the tourism industry in this area. The largest known potential deposits are located along Five Mile Road, near Portland Creek Pond, Eastern Blue Pond, Western Blue Pond, along Zinc Mine Road, near Bellburns, along Bowaters Road, the Microwave Tower road, near the River of Ponds, Spirity Cove, Little Brook Pond, Castors River and Squid Cove.

INTRODUCTION

The 1992 field season marked the beginning of a regional granular aggregate-resource mapping program for the Great Northern Peninsula, Newfoundland. The project was initiated as a result of aggregate demand and a general lack of good-quality granular materials.

Mineral aggregates, as used in the context of this report, are defined as any hard, inert material such as gravel, sand, crushed stone or other mineral material used in the construction industry (Carter, 1981). Aggregates are used extensively in all types of construction activities related to domestic, industrial or other developments. Provincially, road construction is a major use of aggregate material. Municipally, water and sewer systems, driveway construction and building foundations all require aggregate. Backfill is another major use, as is topsoil for landscaping.

The guidelines from the Newfoundland Department of Works, Services and Transportation (1987) state that aggregate materials can be, (1) aggregates less than 19 mm in diameter with a specified proportion of finer grain sizes and 3 to 6 percent silt–clay and used as Class A gravel: aggregates between 19 mm and 102 mm in diameter with a specified proportion of finer grain sizes and 3 to 6 percent silt–clay and used as Class B gravel; (2) processed to mix with a cementing agent to form concrete, asphalt and mortar; and (3) unprocessed, out of pit material.

Not all quarry materials are suitable as aggregate. Vanderveer (1983) defined the quality of mineral aggregate by its composition. Aggregates containing too much or too little silt and clay when used in road construction can cause instability, such as flowage in the case of too much fine material, or the loss of compaction properties in the case of too little fine material. Too much fine material in concrete (> 2 percent) can interfere with the bonding process between the aggregate and the cementing agent. The presence of deleterious substances such as silt–clay coating or iron-oxide staining on the surface of the aggregate, and the presence of blade-shape fragments, often cause bonding problems with the cementing agent, or the breakdown of aggregate with time.

Aggregates are a high-volume, low-cost material. The cost of transport represents, on average, 30 percent of the delivered price (Vanderveer, 1982). Thus, the location of resources relatively close to the users is important. In the case of insular Newfoundland, the situation of users throughout the entire 112 000 km² island makes a regional mapping project of resources vital.

Some areas of the Great Northern Peninsula are severely lacking in sand and gravel deposits and contractors have resorted to removing fractured and weathered limestone as an aggregate source. This removal has occurred without blasting and has resulted in the disturbance of large segments of roadside and coastal areas. In many areas, deposits of granular material are both thin and discontinuous. This partly accounts for the large number of shallow borrow pits in the area, some covering significant acreage. Rock quarries, and rock rubble where it can be mined without blasting, have also been utilized to secure sufficient supplies of aggregate and fill.

In many areas, there is concern about roadside quarries being used as dumping grounds for household garbage, car

wrecks (Plate 1) and other discarded items, as well as waste material associated with quarrying operations and the impact it may have on tourism along the Great Northern Peninsula. By finding alternative aggregate sources, away from road sides, and regulating quarry activity it may be possible to minimize these problems in the future.

Plate 1. *Abandoned quarry in Brig Bay used as dumping ground for car wrecks and other discarded items.*

The objectives of the program are to locate, map and sample sand, gravel and till materials. Field sampling concentrated on raised marine deposits consisting of deltas and beaches, which are the major sources of sand and gravel in this area. Test pits were dug in some bog-land areas to locate gravel sources, and till sampling was done to locate low silt content tills. Till is generally regarded as poor-quality aggregate due to its large silt–clay fraction and therefore, was given less attention during field investigations.

Results will help road builders, contractors and consultants determine sources and quality of material available in a given area, and evaluate distance to transport these materials to a specific job site.

LOCATION AND ACCESS

The field area included the western and northern tip of the Great Northern Peninsula, Newfoundland, consisting of NTS map areas 2M/5, 6, 11, 12, 12I/4, 5, 6, 11, 14, 15, 12P/2, 7, 8 and 9 (Figures 1 and 2).

Most of the southern part of the field area is easily accessible by major roads throughout the study area, numerous logging roads (in use and abandoned), which are usable by all-terrain vehicles, and water-ways accessible by canoe. The northern part of the field area, in areas away from the major roads, is less accessible by motorized vehicle and foot traversing was often required in this area.

PREVIOUS WORK

Surficial geological mapping at 1:50 000 scale (based mainly on reconnaissance airphoto interpretation) has been completed for most of the field area (Grant, 1992, 1986, 1974, 1972; Kirby *et al.*, 1989). Detailed surficial mapping is completed for NTS map areas 12I/4, 5, 6 and 11 (Proudfoot and St. Croix, 1991a, b, c). Previous surficial mapping indicated that most of the study area was once below sea level, and Grant (1992) estimated that sea level was once 150 m above present day level. This has resulted in numerous raised beaches, some located several kilometres inland from the present day shoreline. If volumes are large enough, these beaches could be a good aggregate source.

Work by Pollett (1968) on peat resources of Newfoundland was used as a guide to determine peat thickness in areas of potential sand and gravel deposits. Nolan, White and Associates Limited (1975) conducted an aggregate-resource study in the Strait of Belle Isle area. Work on the Newfoundland section, between Plum Point and Eddies Cove, noted the existence of extensive raised beach deposits between Forresters Point and Eddies Cove. Generally these deposits are little more than a thin veneer but thicknesses of 1 to 4 m are present in places. Calcareous sand and gravel make up most of these deposits. An aggregate-resource study was conducted by the Department of Mines and Energy from 1978 to 1982 (Environmental Geology Section, 1983a, b; Kirby *et al.* 1983), which covers a 6-km-wide corridor along all major roads and a wider radius around towns and cities in Newfoundland and Labrador. Kirby (1991) conducted detailed sampling around the community of Raleigh in the NTS map area 2M/12. Deposits of good-quality granular material are scarce in this area. Material that was available is now depleted or is sterilized by residential development. In addition to these data, geotechnical bedrock maps of Newfoundland were compiled at a scale of 1:250 000 (Bragg, 1986). Bedrock aggregate mapping at a scale of 1:50 000 was conducted on the Great Northern Peninsula (Bragg, 1992) to locate suitable bedrock deposits where granular aggregates are scarce and/or poor in quality.

MAPPING AND ANALYTICAL METHODS

Field work was undertaken in a similar manner to that outlined by Kirby *et al.* (1983). Interpretation of 1:50 000-scale black-and-white airphotos was used to locate potential deposits of sand and gravel. Following this, interpretation of coloured airphotos at 1:12 500 scale was conducted in selected areas based on deposit type (e.g., marine, glaciofluvial, till) to delineate deposit boundaries. In these selected deposits where exposures were present, field sampling was carried out at 0.5 to 1.0 km intervals in outwash deposits and at 1.5 to 2 km intervals in till. Additional samples were taken in each deposit wherever sediment type changes were observed, where quality differences were apparent, or wherever sediments of variable quality or texture could potentially be quarried separately.

Where possible, samples were taken from natural exposures such as stream cuts, shorelines, and gullies or from

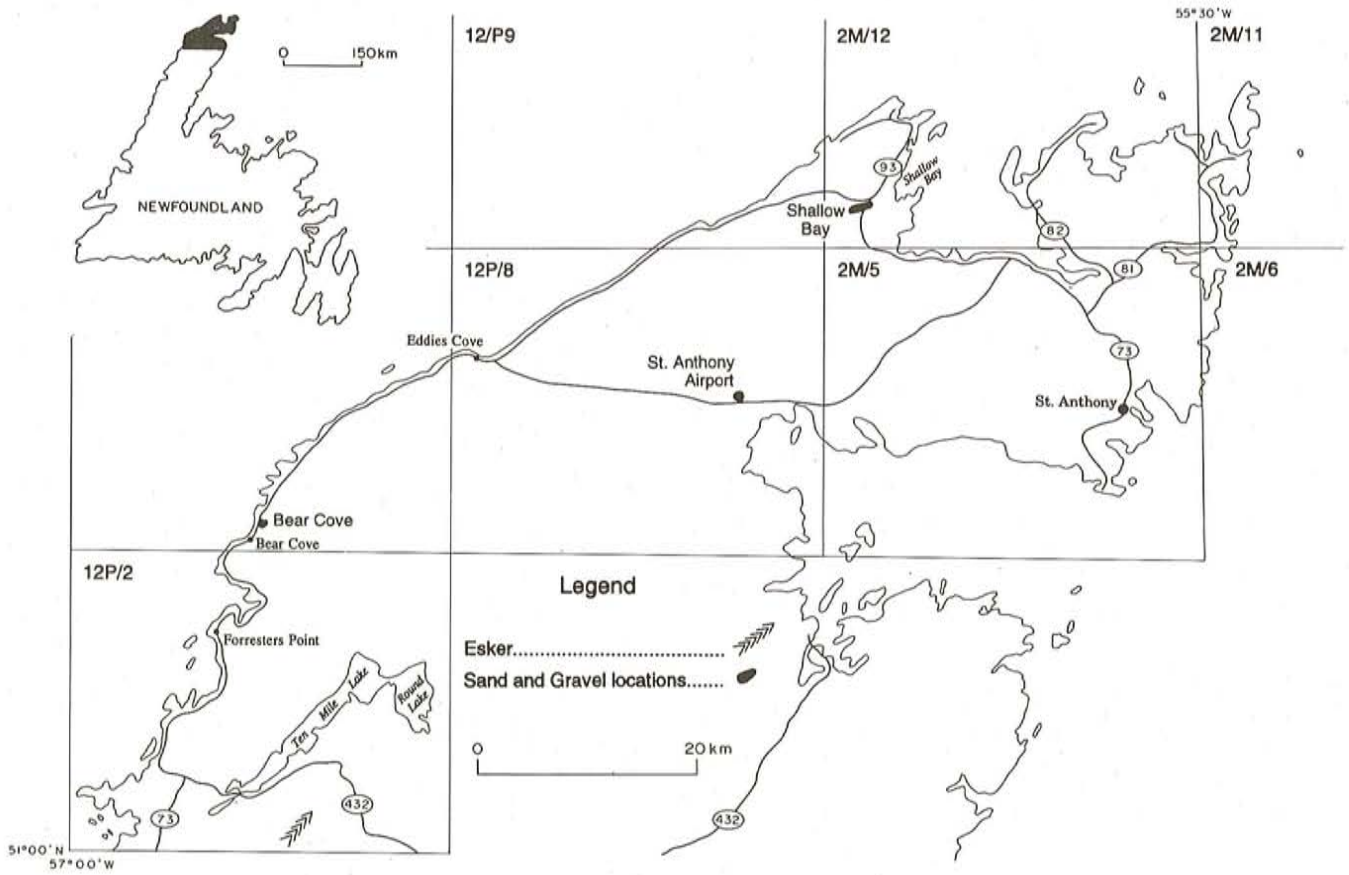

Figure 1. *Sand and gravel locations in the NTS map areas 12M and 12P.*

man-made exposures such as road cuts, and pit and quarry excavations. Where these types of exposures were not available, samples were collected from hand-dug pits, 1 m in depth.

Sampling provided material for petrographic and grain-size analyses, and Los Angeles Abrasion (ASTM Standards C88-83, 1990) and Soundness Tests (ASTM Standard C 131-89, 1990). Approximately 15 kg of material were collected for field sieving. Field sieving and petrographic analysis were performed on all samples containing >8 mm-size material. A split (70 to 140 g) of the sand–silt–clay fraction (<8mm) was retained for laboratory sieve analysis, which involved drying and splitting the sample to a manageable size and wet and/or dry sieving of each sample following the procedures outlined in Ricketts (1987). The results from the Los Angeles Abrasion and Soundness Tests are currently unavailable.

CLAST-TYPE ANALYSIS

Aggregate samples were examined to determine the petrographic characteristics of the pebble fraction (16 to 32 mm) as a preliminary means of determining aggregate quality for construction purposes. A petrographic number was calculated similar to procedures outlined in CSA standard A23.2.30 (Canadian Standards Association, 1973). Petrographic numbers may be regarded as a subjective analyses in defining aggregate quality, but this information does determine whether the aggregate is good or poor and whether there is a need to conduct different analytical procedures to determine quality more quantitatively. The petrographic number, which can range from 100 to 1000, is derived by taking the sum of the percentage of each rock type present in the pebble fraction (in a sample of approximately 50 pebbles) multiplied by a petrographic factor (based on soundness and durability) assigned to that rock type (Bragg, 1990). The petrographic factor is determined mostly by type and grain size of the rock in a given sample, and also by the presence of silt–clay coatings, weathering, staining, degree of sphericity, rounding and fractures. The lower the petrographic number, the better the quality of aggregate material. For example, a clean, hard, fresh granite would normally have a petrographic number of 100, whereas a friable, soft shale would be 1000. Most deposits contain a combination of different rock types with different petrographic factors. The proportion of each of these components determines the petrographic number (Table 1). For most purposes, aggregate material used in concrete requires a petrographic number of 135 or less, whereas in road asphalt and Class A and B gravels, a petrographic number of 150 or less is acceptable (Department of Transportation, 1987).

RESULTS

In 1992, 144 sites were examined and 123 samples collected in the study area. The samples consisted of 53 gravel and sandy gravel, 53 till, 32 sand, gravel–sand and silty sand

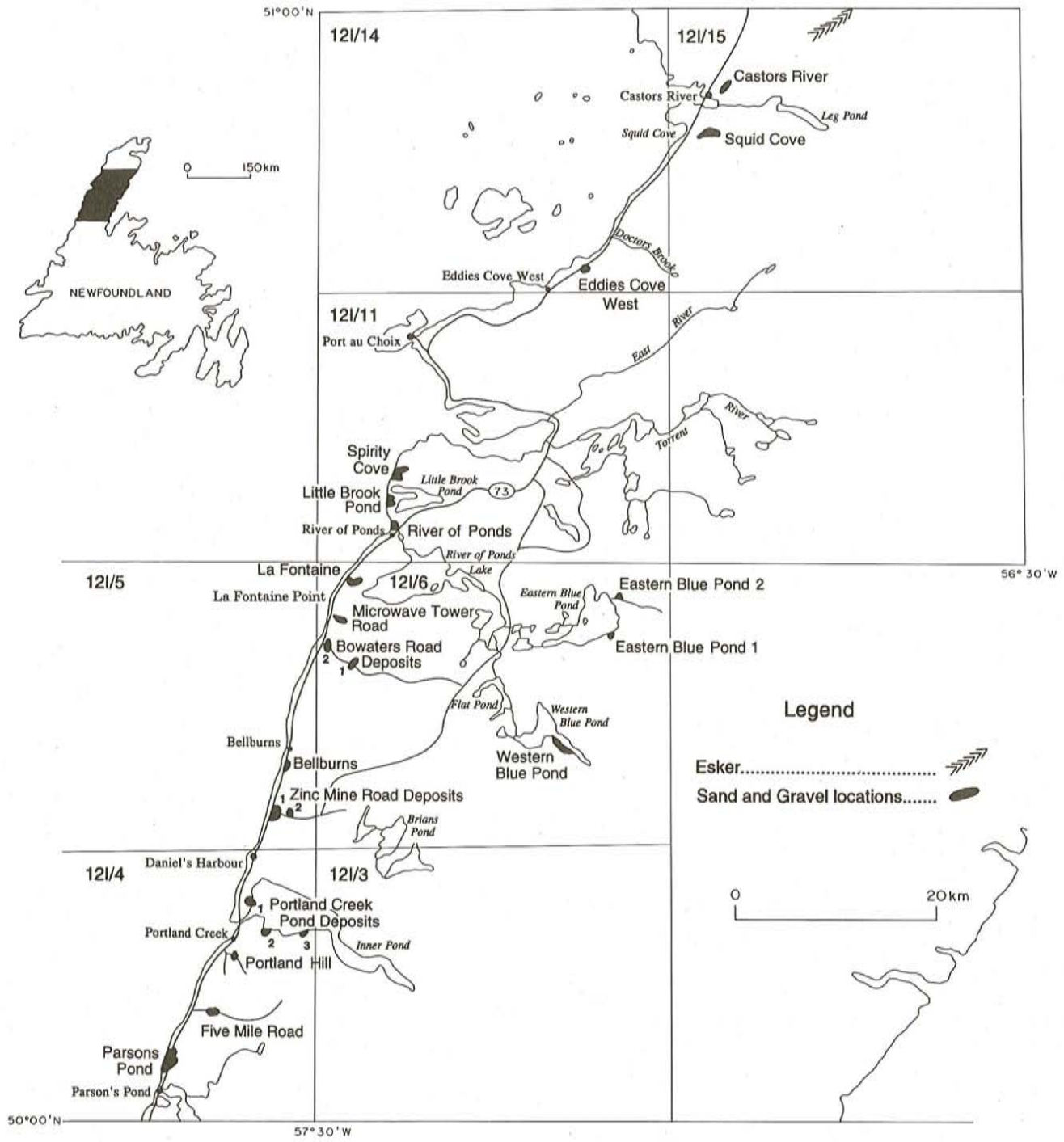

Figure 2. *Sand and gravel locations in the NTS map area 12I.*

and 6 silt–clay samples. A computer graph program (available at the Department of Mines and Energy) is used to plot results as cumulative curves (Kirby *et al.*, 1983) to calculate percentages of gravel, sand, and silt–clay or individual sieve percentages for each sample. Grain-size analysis of till samples showed all contain >6 percent silt and clay and are thus of little interest for aggregate uses. They will not be discussed further and have little economic importance in most industrial projects. Data, including aggregate-resource maps and grain-size analyses, will become available through open-file release.

POTENTIAL DEPOSITS

The following are brief descriptions of some of the major granular deposits in the study area (Figures 1 and 2; Table 2). The descriptions include deposit location, dimensions, exposure types where samples were collected and

Table 1. Example for calculating a petrographic number for a granular aggregate sample containing more than one rock type

Rock type	# of pebbles	%		Petrographic factor	
Shale	12	22	x	10	= 220
Granite	27	50	x	1	= 50
Sandstone	10	19	x	3	= 57
Schist	5	9	x	6	= 54
				Total	= 381
				Petrographic number	= 381

petrographic results for each deposit. Results of grain size and petrographic analyses are based on a compilation of sample data collected during the 1992 field season and previous sampling programs by the Department of Mines and Energy since 1977.

Map Area NTS 2M

The NTS 2M map area is covered principally by barrens, bog and forest. Sand and gravel deposits suitable for quarry sites are few with the exception of a small deposit near Shallow Bay. Numerous deposits of thin marine gravels and raised marine beaches are present in many areas. These deposits are generally small, sporadic and inaccessible. In this area, raised marine ridges are usually composed of cobbles and boulders, making them unsuitable for small aggregate operations. Deposits outlined in earlier surveys are depleted or unusable due to conflicting land use. Bedrock sources should be investigated in these areas.

Shallow Bay

The Shallow Bay deposit is a thin marine gravel located 3 km southwest of Shallow Bay at the intersection of Routes 73 and 93 in the NTS map area 2M/12 (Figure 1). The deposit was originally sampled by Kirby *et al.* (1983) and detailed sampling from backhoe-dug pits took place in 1990 (Kirby, 1991).

The deposit is 1700 m long and up to 400 m wide, but is mostly thin (<1 m) making it unsuitable for quarrying. A large part of the thicker sand and gravel units (2 to 3 m) have been quarried in the past (Plate 2). Analyses of 5 samples (Table 2; Figure 3) taken from quarry exposures and backhoe pits indicate this to be a moderately sorted pebble gravel having the greatest amount (70 percent) of material in the 2 to 32 mm range. In some areas of the deposit, pebble content is near 40 percent. Good petrographic quality was determined from sampled material consisting of 100 percent fresh hard limestone, which resulted in low petrographic numbers.

Grain size and petrographic quality of this deposit are good. Past removal, and the small size of the deposit will restrict more than one or two operators from using this site.

Map Area NTS 12P

The NTS map area 12P is lacking in large deposits of sand and gravel. Many raised marine beaches were observed in the study area but these usually consist of cobble–boulder material unsuitable as a quarry site. Several deposits outlined in a 6-km-wide road corridor survey (Kirby *et al.*, 1983) are depleted or are to small too sustain a quarry operation.

Bear Cove

The Bear Cove deposit is situated on the east side of Route 73 near Bear Cove in the south part of the NTS map area 12P/7 (Figure 1). The deposit is approximately 400 m long, 25 m wide and 1 to 2 m thick. Analyses of three samples indicate this deposit is composed of a pebble–cobble gravel having 92 percent of material >1 mm. Petrographic quality of all samples was poor (Table 2), resulting from 90 percent slightly to highly weathered siltstone and sandstone. The poor quality aggregate of the Bear Cove deposit is considered useful only for fill purposes.

St. Anthony Airport

This deposit, situated near the St. Anthony airport in NTS map area 12P/8 (Figure 1), is 100 m long, 50 m wide and 2 to 3 m thick. It has a pebble–cobble texture with 84 percent of material between 1 mm and 63 mm diameter, based on analyses of two samples collected from 2.5- (Plate 3) and 3-m-high quarry exposures. The deposit has good petrographic quality, resulting from fresh hard limestone, which made up 94 percent of sampled material.

The St. Anthony airport deposit is an excellent source of high-quality aggregate but its small size means a short life span with only room for one operator. Its distance from community areas will also mean increased trucking cost for users of this material.

Map Area NTS 12I

Work conducted along the west side of the NTS map area 12I has determined a number of locations for potential quarry sites. Most of these are situated in the Parson's Pond–River of Ponds area (NTS map areas 12I/4 and 12I/5). Backhoe pits reaching depths of 3 m were dug in bog land near Portland Creek and at Hawke's Bay but these did not encounter sand or gravel deposits. These bogs were either underlain by silty tills, or were too wet to penetrate more than 1 or 2 m without infilling, or were too thick to reach underlying material. There is evidence of pebble gravel around recently placed poles along a transmission line in the east end of a bog near Portland Hill, but a backhoe machine could not get to this area and the ground was too wet to dig with a pick and shovel. An esker deposit noted by Knight (1991), while conducting bedrock geology mapping in the NTS map areas 12I/15 and 12P/2 map area, consists of boulder gravel, unsuitable for most aggregate purposes. Efforts will be made in 1993 to look at other outwash deposits in this area and at Doctors Brook in the NTS map area 12I/14.

Table 2. Summary of sand and gravel deposits on the west and northern tip of Great Northern Peninsula, Newfoundland

		Grain-size Analyses				Petrographic Analyses			
Deposit	Estimated m3 x 6	# of samples analyzed	% Grv. (+5mm)	% Sd. +78um to 5mm	% Slt-Cly -78um	# of samples analyzed	Range	Average	Comments
Shallow Bay	< 0.1	6	54.0	45.6	0.4	2	100-114	107	Pebble gravel
Bear Cove	< 0.1	3	66.5	32.4	1.0	2	279-582	430	Pebble cobble gravel
St. Anthony Airport	< 0.1	2	67.5	31.8	0.7	2	104-106	105	Pebble cobble gravel
Parson's Pond	1–5	5	58.1	41.0	0.8	4	130-400	283	Pebble cobble gravel
Five Mile Road	< 1	5	40.9	57.7	1.5	2	162-186	174	Sandy gravel
Portland Hill	< 1	6	60.2	39.3	0.5	5	126-562	237	Pebble gravel
Portland Creek Pond #1	< 1	5	33.3	66.5	0.2	2	250-279	264	Medium to fine sand and minor gravel
Portland Creek Pond #2	1–5	1	0.0	75.4	24.6	0	-	-	Well-sorted fine sand
Portland Creek Pond #3	0.1–0.5	2	41.3	57.9	0.7	1	106	106	Medium sand and cobble pebble gravel
Western Blue Pond	< 1	3	62.6	36.9	0.5	3	167-436	330	Sandy gravel
Eastern Blue Pond #1	1–5								
Unit 1		2	50.5	45.1	1.4	2	112-156	134	Cobble pebble sandy gravel
Unit 2		2	9.2	81.8	8.9	0	-	-	Medium sand
Eastern Blue Pond #2	0.1–0.5	4	29.9	65.0	5.1	2	266-540	493	Sandy gravel, gravel and compacted sand
Bowaters Road #1	0.5–1	3	49.7	49.7	0.6	2	122-204	163	Sandy pebble gravel
Bowaters Road #2	< 0.1	3	55.3	43.8	0.8	3	100-152	118	Cobble boulder pebble gravel
La Fontaine Point	1–5	4	27.7	69.6	2.8	2	116-150	133	Moderate to well-sorted sand and gravel
Zinc Mine Road #1	1–5	9	56.0	42.8	1.2	5	100-178	144	Variable gravel textures containing minor sand
Zinc Mine Road #2	< 0.1	2	81.4	18.4	0.2	2	100-132	116	Moderately sorted pebble gravel
Bellburns	0.1–0.5	4	81.3	18.4	0.3	2	104-110	107	Pebble cobble boulder gravel
Microwave Tower Road	0.5–1	4	41.7	56.7	1.7	2	152-206	179	Poorly sorted pebble sandy cobble gravel
Spirity Cove	0.5–1	1	82.1	17.3	0.7	1	151	151	Pebble cobble boulder gravel
Little Brook Pond	0.5–1	1	78.6	21.1	0.4	1	139	139	Pebble cobble boulder gravel
River Of Ponds	1–5	2	79.9	19.3	0.9	2	110-139	124	Pebble cobble boulder gravel
Eddies Cove West	0.1–0.5	2	0	98.9	1.1	0	-	-	Well sorted fine sand
Castors River	1–5	6	77.9	21.0	1.1	6	256-442	317	Cobble boulder pebble gravel
Squid Cove	5–10	6	1.4	87.7	10.9	0	-	-	Well sorted fine sand and silty sand

Note: Estimated quantities in table are based on airphoto analysis and field investigation of road cuts, shallow hand-dug pits and natural exposures. Detailed sampling methods such as drilling were not conducted. Grain-size percentages are based on a compilation of samples for each deposit and do not take into account extent and thickness of units at any one location.

Plate 2. *Pebble-gravel quarry near Shallow Bay.*

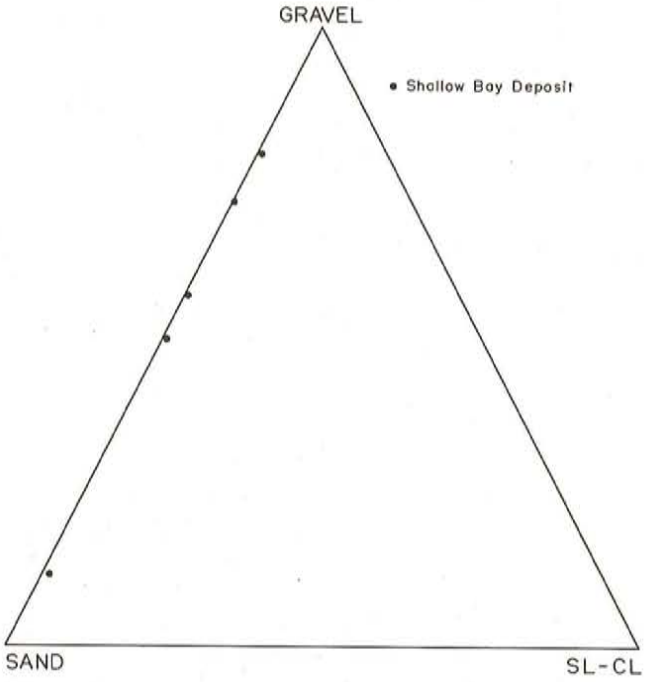

Figure 3. *Ternary diagram showing gravel, sand and silt-clay content of samples collected in the Shallow Bay deposit.*

Parson's Pond

The Parson's Pond deposit is a marine delta situated along Route 73 on the north side of Parson's Pond in the NTS map area 12I/4 (Figure 2). The deposit is approximately 2500 m long and 300 m wide. It is estimated to be 15 m thick along shoreline exposures (Plate 4) and 3 to 6 m thick in quarried areas on the east side of Route 73. Analyses of 5 samples (Table 2; Figure 4) collected from shoreline and quarry locations indicate that the deposit is composed of a pebble–cobble gravel with 91 percent of sampled material occurring between 0.25 and 63 mm. Poor petrographic quality is due to 20 percent pebble content of moderately to highly weathered sandstone that resulted in generally high petrographic numbers.

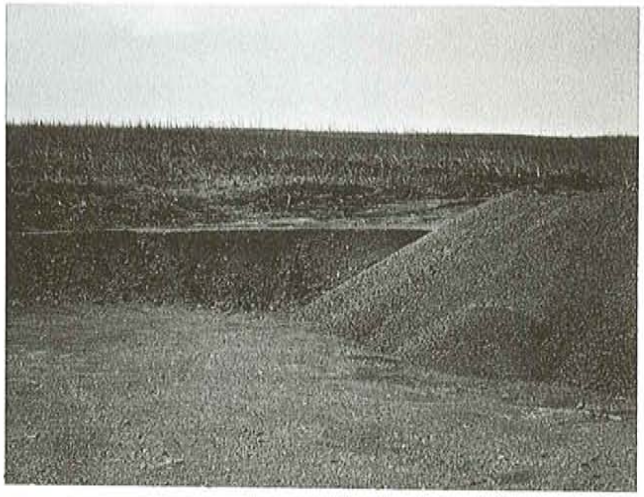

Plate 3. *One-and-a-half-metre high gravel exposure in quarry near the St. Anthony airport.*

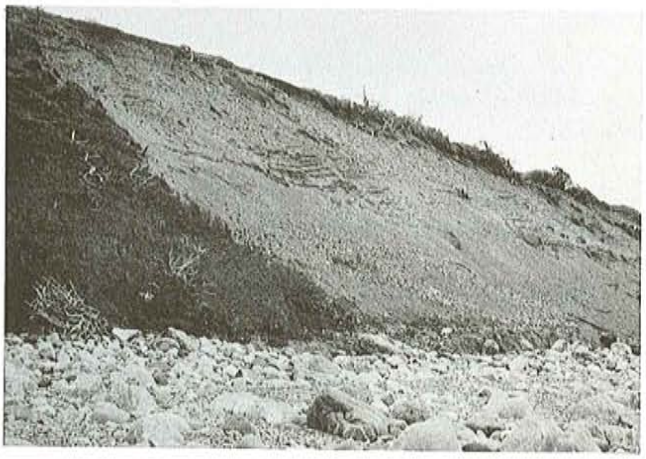

Plate 4. *Pebble–cobble gravel along 15-m-high shoreline exposure near Parsons Pond.*

Although grain-size analyses appears favourable, poor petrographic results should be considered before using this aggregate in concrete or road construction projects. Most of this deposit is also under private land ownership.

Five Mile Road

The Five Mile Road deposit is marine gravel situated along a gravel road branching off Route 73, seven kilometres north of Parson's Pond in NTS map area 12I/4 (Figure 2). The deposit is approximately 1500 m long and 150 m wide. Thickness was difficult to determine due to the gently sloping nature of the landscape. Two backhoe pits reached depths of 3 m containing sections of sandy gravel. The deposit contains moderately sorted sandy gravel having the greatest amount of material (82 percent) in the 0.25 mm to 16 mm range. Texture varies considerably throughout the deposit based on analyses of five samples (Table 2; Figure 4). Poor petrographic quality is due to the presence of 20 percent

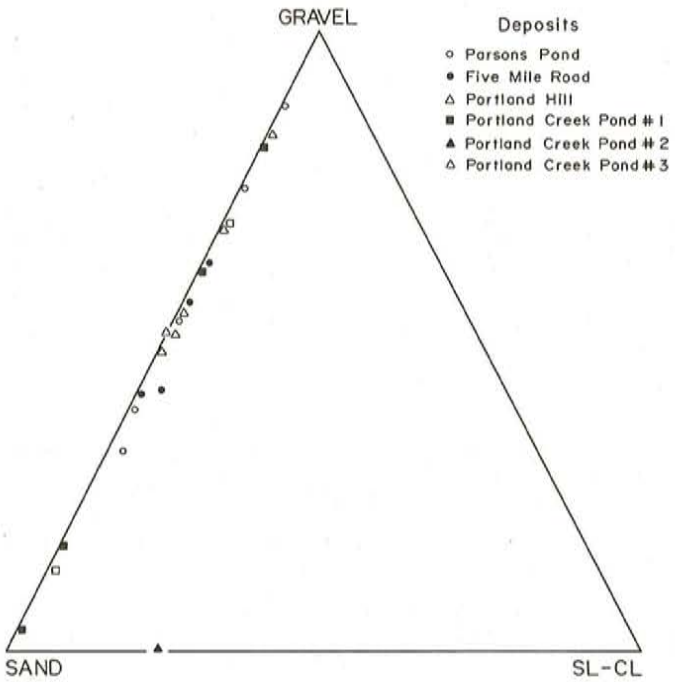

Figure 4. *Ternary diagram showing gravel, sand and silt-clay content of samples collected from deposits in NTS map area 12I/4.*

highly weathered calcareous siltstone and ten percent moderately weathered conglomerate.

Petrographic numbers determined from two samples occur in a range that make it difficult to accurately determine the aggregate quality. More field work and sampling maybe required in this area to obtain a broader range of analyses for aggregate testing.

Portland Hill

The Portland Hill deposit is a marine delta situated near the south end of Portland Creek on the east side of Route 73 in the NTS map area 12I/4 (Figure 2). The deposit is approximately 400 m long, 200 m wide and over 8 m thick. Analyses of six samples (Table 2; Figure 4) collected from backhoe pits and a quarry exposure (Plate 5) indicate this is a moderately sorted pebble gravel with 93 percent of material ranging between the 0.25 and the 63 mm diameter.

Petrographic numbers indicate a wide range in quality based on analyses of five samples. Poor quality principally results from the 20 to 30 percent content of highly weathered sandstone and siltstone in three of the samples collected.

The Portland Hill deposit will require further testing to determine suitability for high-quality aggregate use. There is one operator presently working from this site and there is potential room for one more.

Plate 5. *Four-metre-thick sandy, pebble gravel quarry exposure in marine delta.*

Portland Creek Pond #1

The Portland Creek Pond #1 deposit is situated near the west end of Portland Creek Pond in NTS map area 12I/4 (Table 2). The deposit is approximately 1400 m long and 700 m wide. Thickness generally ranges from 4 to 8 m. It has a medium to fine sandy texture and contains minor pebble–cobble gravel at the one exposure observed (Plate 6). Approximately 96 percent of grain sizes occurs between the 0.25 to 63 mm diameter. Petrographic analysis could not be conducted due to the fine texture of material.

Plate 6. *Nine-metre-thick sand and pebble sand in deposit 1 near Portland Creek Pond.*

The Portland Creek #1 deposit is within the boundaries of a privately owned park and quarry materials will not likely be accessible to the general public. It is surrounded by thin coarser aggregate, which has been quarried in the past, but what remains is too thin for continued quarrying.

Portland Creek Pond #2

This deposit is situated in the southwest corner of Portland Creek Pond in the NTS map area 12I/4 (Figure 2). It is approximately 1000 m long, 600 m wide and 6 m thick. An extensive bog and organic layer covers most of this deposit. One sample, collected from a 6-m stream-cut exposure, indicates that this deposit has a well sorted fine sandy texture with 85 percent of material between 0.062 and 0.25 mm diameter.

Petrographic analyses were not conducted on this deposit due to fine texture. The deposit is not accessible by road and its fine texture makes it unsuitable for use in most construction projects.

Portland Creek Pond #3

The Portland Creek Pond #3 deposit is situated near the southwest corner of Portland Creek Pond in NTS map area 12I/4 (Figure 2). It is approximately 400 m long, 200 m wide and 2 to 3 m thick. Two units of material were sampled in this deposit along a 2.5-m-high stream bank. The top unit consist of 1 m of medium sand. The lower unit is a 1.5-m-thick, cobble, pebble gravel with 76 percent material between 2 and 63 mm diameter.

Petrographic results determined from analysis of one sample indicate the deposit has a very good petrographic quality (Table 2) due to 98 percent of the pebbles are of hard, fresh granite, dolomite and limestone. The remaining 2 percent consist of weathered alkali-feldspar granite. The deposit is suitable for high-quality aggregate but its small size and distance from any roads make immediate use unlikely.

Western Blue Pond

The Western Blue Pond deposit is located near the east side of Western Blue Pond in the NTS map area 12I/5 and 6 (Figure 2). Information on the deposit was compiled from data collected by Kirby *et al.* (1983). The deposit is approximately 3000 m long and 100 m wide. Thickness was estimated to range from 1 to 5 m. It is composed of a sandy gravel, in which 92 percent of material ranges between 0.25 mm and 32 mm, based on analyses of three samples.

The petrographic quality of the Western Blue Pond deposit is poor (Table 2), with the three samples examined generally containing slightly to moderately weathered granite and minor gneiss.

Eastern Blue Pond #1

Deposit 1 near the Eastern Blue Pond deposit is a glaciofluvial terrace situated near the southeast corner of Eastern Blue Pond in NTS map area 12I/5 and 6 (Figure 2). The deposit is approximately 1000 m long, 200 m wide and has variable thickness up to 9 m. Site investigations along two stream exposures (Plate 7) identified two units. The top unit is a 4-m-thick, moderately sorted gravel, varying in grain size from sand to cobbles, and the lower unit is a 5-m-thick, fine to medium sand. Petrographic analyses of two samples (Table 2) taken from the gravel unit indicate a good aggregate source containing 88 percent fresh, hard alkali-feldspar granites.

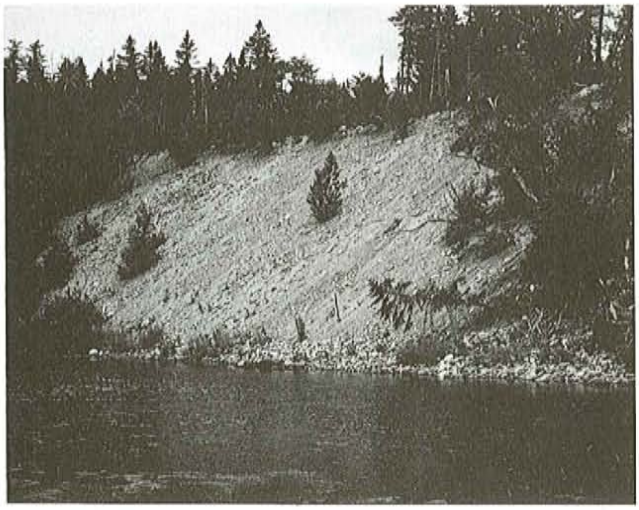

Plate 7. *Gravel–sand exposure along 9-m-high river bank through a glaciofluvial terrace in deposit 1 near Eastern Blue Pond #1.*

Grain size and petrographic information indicate the Eastern Blue Pond #1 deposit is suitable for use as a high-quality aggregate but its distance from major centres and roads make it uneconomical for use at this time.

Eastern Blue Pond #2

The Eastern Blue Pond #2 deposit is located near the northeast end of Eastern Blue Pond in NTS map area 12I/5 and 6 (Figure 2). It is approximately 800 m long, 400 m wide and up to 4 m thick but generally less than 2 m. The deposit contains sandy gravel, gravel (Table 2; Figure 5) and compacted sand. The sands are well sorted and medium to fine grained. The gravels tend to be poorly sorted with material more evenly dispersed in the 0.25 mm to 32 mm range giving it a sandy pebble texture. Petrographic results determined from analyses of two samples (Table 2) indicate a poor-quality material consisting of 38 percent weathered granite and sandstone, and 12 percent pelitic schist and shale.

The high sand content in this deposit makes it most suitable as a concrete aggregate, although it has been used in the past for construction and upgrading of a forest access road. For most construction projects its poor petrographic quality should be considered when using this material. Long trucking distance precludes its use in urban construction projects.

Bowaters Road #1

Deposit #1 is a marine delta situated along Bowaters road, 4 km east of its intersection with Route 73 in NTS map area

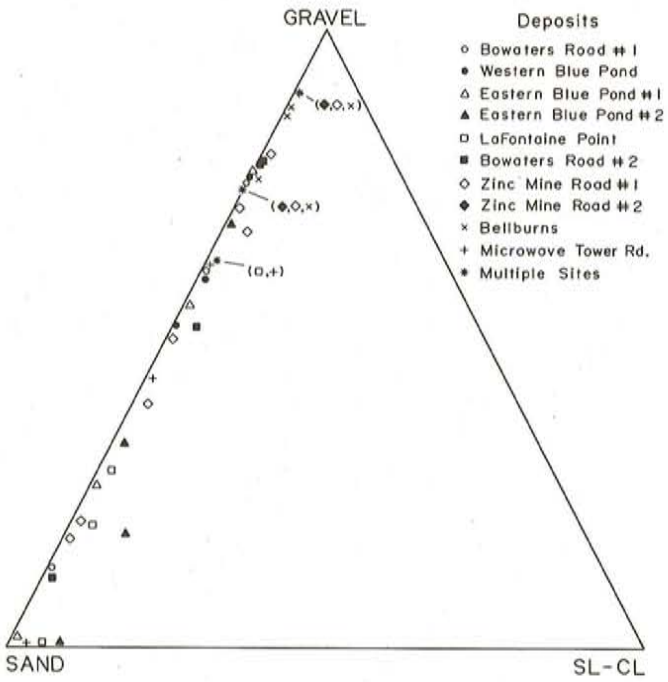

Figure 5. *Ternary diagram showing gravel, sand and silt-clay content of samples collected from deposits in NTS map areas 12I/5 and 6.*

12I/5 and 6. It is approximately 400 m long, 200 m wide and up to 8 m thick. The deposit consists of pebble gravel with moderate amounts of sand and cobble. Ninety percent of material is in the 0.25 mm to 63 mm size range, and is based on analyses of three samples collected from quarry exposures (Plate 8) and backhoe pits.

Plate 8. *Four-metre-thick sandy, pebble gravel exposure in marine delta in Deposit #1 along Bowaters Road.*

The results of petrographic analyses of two samples are contradictory, one being of good and the other of poor quality as aggregate. The poor-quality sample is the result of a few slightly weathered limestone, dolostone, sandstone and granite pebbles.

The deposit has potential for use as a high-quality aggregate although more petrographic data is needed. Soundness and abrasion tests should be conducted if petrographic results continue to be variable.

Bowaters Road #2

Deposit #2 is situated along the Bowaters Road near its intersection with Route 73 in NTS map area 12I/5 and 6 (Figure 2). It is 400 m long, 100 m wide and approximately 2 m thick. It consist of cobble, boulder gravel with the dominant grain size (23 percent) falling in the +63 mm mesh sieve based on results of 2 samples collected from a backhoe pit and a quarry exposure.

Low petrographic numbers of three samples (Table 2) were determined from fresh, hard limestone, dolostone, granite and sandstone which make up approximately 90 percent of the pebble fraction resulting in good quality.

Grain-size analyses indicate that the gravel in the deposit is not suitable for most construction purposes without crushing or screening the coarser fraction out. Screening may be not be considered practical due to the small size of the deposit and the large amount of waste material that would accumulate.

La Fontaine Point

The La Fontaine Point deposit is located between Route 73 and the River of Ponds in the north end of NTS map area 12I/5 and 6 (Figure 2). The deposit is 1500 m long 500 m wide and 2 to 3 m thick. Data compiled from 3 of the 4 samples for this deposit were collected by Kirby *et al.* (1983). The La Fontaine Point deposit consists of moderate- to well-sorted sand and gravel with dominant grain sizes (90 percent) between 0.25 mm and 4 mm diameter. Forty-three percent of this material is between 0.5 mm and 2 mm.

Results of petrographic analyses of two samples show the deposit to be good-quality aggregate (Table 2), due to a combination of hard, fresh dolomite, granite, quartzite, gneiss, gabbro, limestone and arkose. Pelitic schist and minor, weathered sandstone in some areas may be a negative factor but these are not abundant and should not be of great concern.

Grain-size results and petrographic information indicate this is a suitable deposit for use as a high-quality aggregate. If quarrying is planned for this area, there may be problems with a high water table (at 1.5 m in a backhoe pit dug in 1992) and a forestry silvicultural area covering part of the deposit.

Zinc Mine Road #1

The Zinc Mine Road #1 deposit is situated at the intersection of Zinc Mine Road and Route 73 in the southwest corner of NTS map area 12I/5 and 6 (Figure 2). The deposit is approximately 1800 m long, 600 m wide and from 2 to 4 m thick. Approximately 25 percent of this deposit has been

quarried and about 50 percent of remaining material is likely composed of boulder gravel. Well-sorted sand was sampled in the north part of this deposit and good-quality pebble gravel was sampled near the intersection of Zinc Mine Road and Route 73, where quarrying is presently occurring (Plate 9).

Plate 9. *Pebble gravel along 4-m-high quarry exposure in marine delta in deposit 1 along Zinc Mine Road.*

Petrographic results from 4 samples are variable (Table 2). This is the result of variable amounts of unidentified, moderate to highly weathered pebbles and a few weathered granites and limestones that show up in some samples. The deposit contains material suitable for most construction projects and despite variable petrographic results this material has been used in the past for road construction and in concrete.

Zinc Mine Road #2

The Zinc Mine Road #2 deposit is located 2 km east of Route 73 along Zinc Mine Road in NTS map area 12I/5 and 6 (Figure 2). The deposit is 400 m long, 200 m wide and 1 to 2 m thick. This deposit is underlain by bedrock as determined from one backhoe pit. It consists of moderately sorted pebble gravel, with 56 percent of material between 8 and 32 mm diameter, based on analyses of two samples.

Results of petrographic analyses of two samples collected are good (Table 2) as determined from hard, fresh limestone that make up ninety-two percent of sampled material. Grain-size and petrographic analyses indicate it is a small deposit suitable for use as a high-quality aggregate.

Bellburns

The Bellburns deposit is situated on the east side of Route 73, south of Bellburns in NTS map area 12I/5 and 6 (Figure 2). The deposit is 1500 m long, 150 m wide and 3 to 4 m thick. It contains boulder gravel with moderate amounts of pebble- and cobble-size material. Ninety-two percent of material is greater than 2 mm diameter, based on analyses of 4 samples collected from two backhoe pits and two road exposures.

Petrographic analyses of two samples had excellent results (Table 2), principally due to the 80 percent fresh dolostone and limestone and 20 percent fresh to slightly weathered granite, sandstone and gneiss.

The Bellburns deposit is a coarse gravel deposit and may require crushing or screening for this material to be used in most construction projects. Petrographic results indicate this material is suitable for any high-quality aggregate use.

Microwave Tower Road

The Microwave Tower Road deposit is situated along the Microwave Tower Road east of Route 73 in the north part of NTS map area 12I/5 and 6 (Figure 2). It is 1200 m long, 200 m wide and 2 to 4 m thick. The deposit consists of moderately to poorly sorted cobble gravel with moderate amounts of pebble- and sand-size material. Ninety-five percent of grain sizes are greater than 1 mm, based on results of four samples.

The petrographic analyses of three samples show moderate to poor quality (Table 2). Poor results are due to 11 percent highly weathered granite and 13 percent moderate to highly weathered sandstone.

Although grain size is appropriate for high-quality aggregate use, petrographic characteristics are generally poor. Care should be taken before using the material in concrete, asphalt or other construction projects where high-quality aggregate is required. A transmission line may interfere with quarrying along the west end of this deposit.

Spirity Cove

The Spirity Cove deposit is situated 2 km south of Spirity Cove in the NTS map area 12I/11 (Figure 2). It is 2000 m long, 250 m wide and 2 to 5 m thick. The deposit consists of boulder gravel (Plate 10) with moderate amounts of pebble- and cobble-size material, having 84 percent of material greater than 8 mm, as determined from analyses of one sample taken from a backhoe pit. Petrographic analysis shows 84 percent fresh, hard quartzite, dolostone and 16 percent highly to slightly weathered sandstone (moderate quality).

Coarse grain size and moderate petrographic quality indicate this deposit should not be used as a high-quality aggregate.

Little Brook Pond

The Little Brook Pond deposit is situated near Little Brook Pond in the southeast section of NTS map area 12I/11 (Figure 2). It is 1000 m long, 250 m, wide 3 to 5 m thick. The deposit contains boulder gravel with moderate amounts of cobble- and pebble-size aggregate similar to the Spirity Cove deposit. Seventy-three percent of material in this deposit

Plate 10. *Boulder gravel similar to that in the Spirity Cove deposit.*

is greater than 8 mm, based on analyses of sampled material taken from one backhoe pit. The Little Brook deposit has moderate to good petrographic quality (Table 2) determined from 90 percent fresh, hard dolostone and sandstone, and 10 percent slightly weathered to highly weathered sandstone and dolostone.

Coarse grain sizes may be detrimental in using the Little Brook Pond deposit as an aggregate source. If it is considered for a quarry site, additional samples should be collected to determine the petrographic quality more accurately.

River of Ponds

The River of Ponds deposit is a marine delta situated north of the River of Ponds community, west of Route 73 in NTS map area 12I/11 (Figure 2). It is 1000 m long, 500 m wide and 6 m thick. It consists of boulder gravel with moderate amounts of pebble- and cobble-size aggregate. The dominant grain size (41 percent) is between 8 and 32 mm diameter, based on analyses of two samples collected from a 6-m-high river-bank exposure. Petrographic analyses of two samples indicate (Table 2) a good-quality aggregate as pebbles consists mostly of fresh, hard dolostone, limestones and granite.

The grain size and petrographic results indicate the River Of Ponds deposit can be used in concrete, road construction or other high-quality aggregate uses.

Eddies Cove West

The Eddies Cove deposit is situated on the southeast side of Route 73 in the south part of NTS map area 12I/14 (Figure 2). The deposit is 800 m long, 150 m wide and 2 m thick. It consist of well-sorted fine sand with 87 percent of material occurring in a narrow range between 0.25 to 0.5 mm diameter, based on analyses of two samples (Table 2; Figure 6) collected

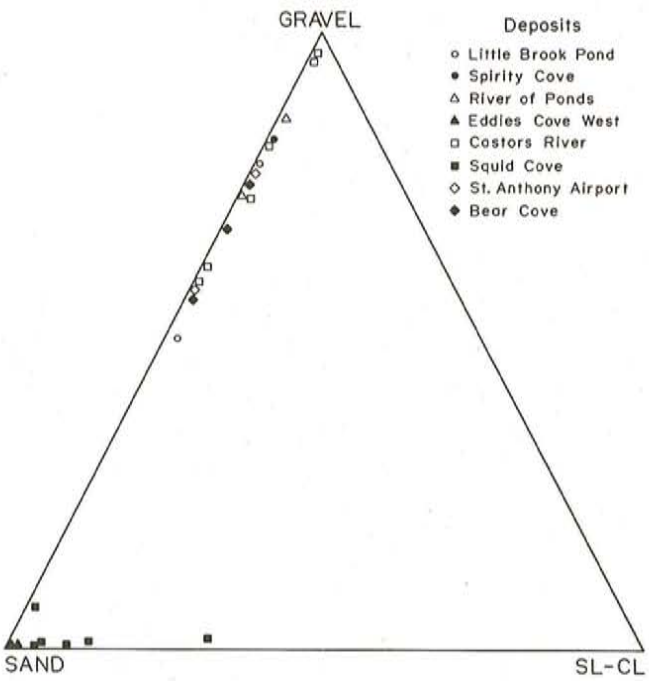

Figure 6. *Ternary diagram showing gravel, sand and silt-clay content of samples collected from deposits in NTS map areas 12I/11, 14, 15 and 12P/7 and 8.*

from quarry and road-cut exposures. The material is too fine for use in most construction projects. No petrographic analyses were conducted for this deposit due to the fine texture of the material.

Castors River

The Castors River deposit is situated 600 m north of Castors River and 1300 m east of Route 73 in NTS map area 12I/15 (Figure 2). The deposit is 1800 m long, 300 m wide and up to 6 m thick. It is composed of a pebble gravel with nearly equal amounts of cobble- and boulder-size aggregate. Seventy-one percent of the material is coarser than 8 mm, based on analyses of six samples. Petrographic analyses of sampled material indicate it is of poor quality (Table 2), as it contains 30 percent moderate to highly weathered sandstone, siltstone and granite.

Removal of material from the Castors River deposit will require the construction of a 1.5 km road through a dense forested area. Removal of material will be restricted in some areas where a transmission line runs in a north–south direction through the centre of the deposit. Coarse grain size and poor petrographic quality will reduce the economic potential of the deposit as an aggregate source.

Squid Cove

The Squid Cove deposit is situated adjacent to Squid Cove on the east side of Route 73 in NTS map area 12I/15 (Figure 2). The deposit is estimated to be 3500 m long, 700 m wide

and 4 m thick. It consists of well-sorted fine sand (Table 2; Figure 6) with dominant grain sizes (50 percent) in the 0.125 to 0.5 mm range.

Petrographic analyses were not conducted on this deposit due to the fine texture of material. High silt–clay content and generally fine sandy texture makes the deposit unsuitable for most construction purposes.

SUMMARY

Granular deposits were sampled at many locations within the study area to determine their potential for use in the aggregate industry. Preliminary data reveals differences between these deposits and provides information for potential quarry development and for various construction purposes. This data is based on grain-size analyses, and petrographic examination of the pebble fraction (+16 to -32 mm) from samples collected in each deposit.

Several deposits are thin (between 2 and 3 m) and would require extensive overburden clearing to quarry small amounts of material, thereby increasing excavating costs. Deposits of this type are located at Shallow Bay, Five Mile Road, Portland Creek Pond #3, La Fontaine Point, Bowaters Road deposit #2, Zinc Mine Road, Bellburns, Eddies Cove West, Bear Cove and St. Anthony airport.

Many of the deposits sampled have sufficient quantities of aggregate for local demand. These too, may support quarrying operations over a considerable length of time (exceeding a 10-year production period), although some are inaccessible or poor in quality. These include deposits at Parson's Pond, Portland Hill, Portland Creek Pond #1 and #2, Western Blue Pond, Eastern Blue Pond #1, Bowaters Road #1, Castors River and Squid Cove.

Low silt–clay content is necessary for aggregates used in concrete and asphalt. Some deposits have a fine sand–silt–clay texture not suitable for higher quality aggregate uses. Deposits of this type are located at Portland Creek Pond #2 and Squid Cove. Most deposits sampled have a silt–clay content less than 1 percent. Other deposits may have zones of sand–silt or silt–clay, which can be avoided during quarrying. This reduces the need for washing the material, thereby reducing overall cost. In some areas, screening or crushing may be necessary to remove the coarse aggregate fraction.

Results of petrographic analyses indicate variable petrographic quality throughout the study area. Samples from six deposits show petrographic numbers low enough to indicate suitable aggregate material for use in asphalt and/or concrete type projects. These are located at Shallow Bay, Portland Creek Pond #3, Zinc Mine Road #2, River Of Ponds, La Fontaine Point, Spirity Cove and near St. Anthony airport. Other deposits show variable quality and may require other analytical procedures to determine their suitability for use in concrete such as outlined by the CSA Standards for concrete materials. Deposits of this type are located at Portland Hill, Eastern Blue Pond #1, Zinc Mine Road and Bowaters Road #1.

CONCLUSIONS

Field work in 1992 has shown that there are adequate aggregate reserves in the Parson's Pond to River of Ponds area, although quality and quantity may vary throughout the region. Further field work is necessary in the Castors River and Eddies Cove West area to sample deposits along Doctors Brook and north of Castors River. Local sources of granular aggregate need to be found in the Port Aux Choix area and north of Castors River (including all of the NTS 2M and 12P map areas) to meet future demand. Transporting aggregate into the area, from outside sources, by truck or boat would be expensive. Therefore, the most likely option would be to find good-quality bedrock sources as a long-term solution to aggregate shortages in these areas.

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