

## DETAILED AGGREGATE RESOURCE ASSESSMENTS—INSULAR NEWFOUNDLAND

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### ABSTRACT

*This report summarizes results of the 1987 detailed assessment of the aggregate potential of: (1) the Robert's Arm municipal planning area, (2) the Roddickton, Bide Arm and Englee municipal planning areas and (3) the St. John's Peninsula and Conception Bay North region.*

*The study has verified that the Robert's Arm, Roddickton, Bide Arm and Englee study areas lack any substantial reserves of high quality surficial-aggregate materials.*

*In the St. John's Peninsula and Conception Bay North areas, field work involved the sampling of bedrock to assess its potential as an aggregate source along with a hammer seismic survey at preselected sites throughout the St. John's Urban Region. The objective of the latter study is to evaluate the potential of the hammer seismic instrument in determining overburden thickness, so that aggregate reserves can be estimated in areas of high aggregate potential. The results of this survey are not yet available.*

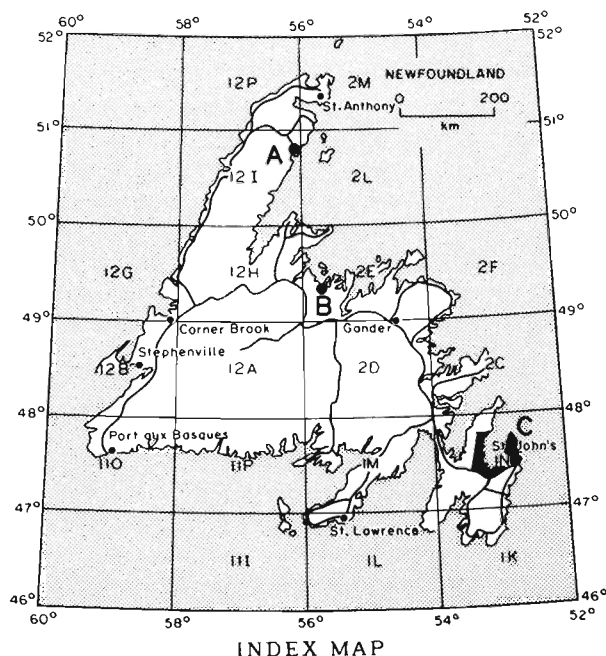
### INTRODUCTION

A program of aggregate-resource assessment was initiated in 1982 to evaluate in detail the aggregate-resource potential of selected areas of the province. The focus of the program has been on areas where municipal planning is ongoing. The existing regional aggregate-resource data (Kirby *et al.*, 1983) is of invaluable assistance in defining conflict areas, but was not adequate in providing detailed information on the aggregate resources necessary to resolve these conflicts. To date, detailed aggregate surveys have been completed in 44 municipal planning areas and the results forwarded to the Department of Municipal Affairs for inclusion in appropriate municipal plans. In most cases, the recommendations have been adopted or modified. For unresolved issues, discussions are underway.

In 1987, the author conducted field work in the Robert's Arm, Roddickton, Bide Arm and Englee municipal planning areas, and in the St. John's Peninsula and Conception Bay North region (Figure 1).

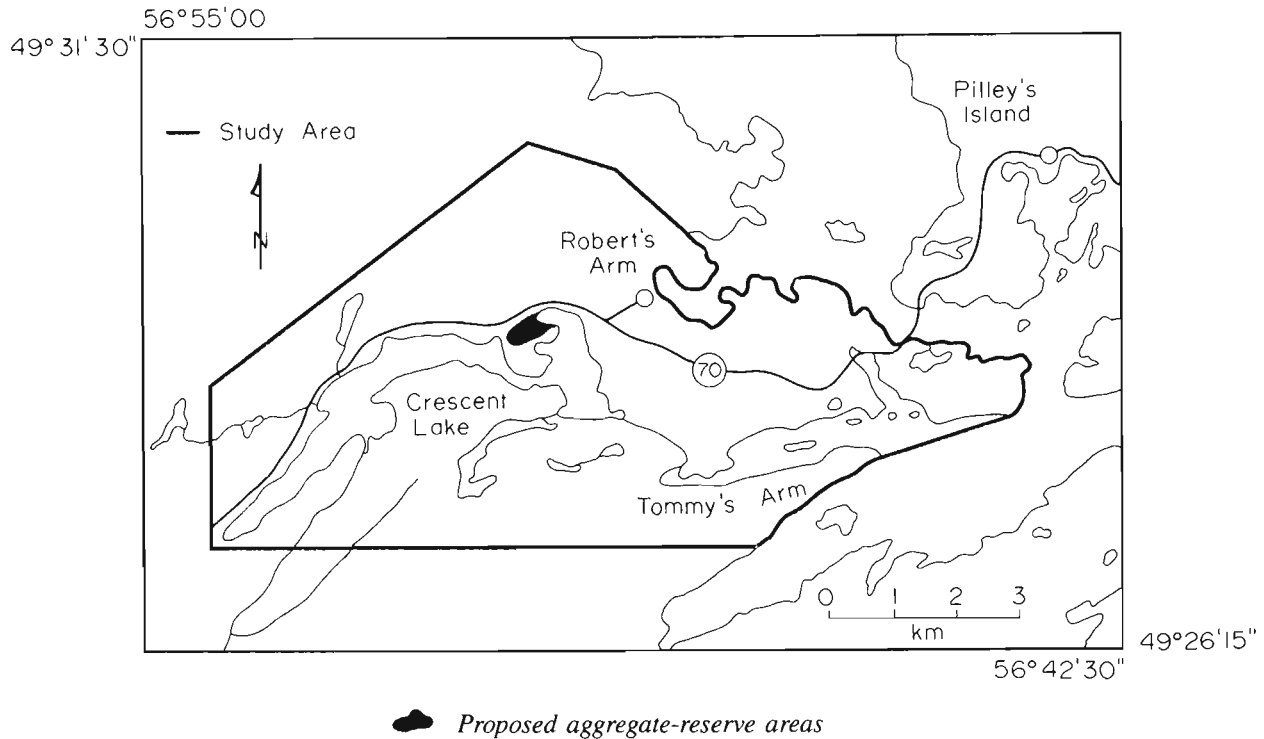
#### Field Program

Areas were preselected for detailed aggregate analysis following a review of all available aggregate resource and surficial data. The first phase of field work involved vehicular traverses along all passable roads to update data on previously sampled and unsampled surficial deposits (Kirby *et al.*, 1983). Foot traverses were conducted in the preselected target areas and other areas of potential quarry development within the identified planning area.



**Figure 1.** Location of study areas: (A) Roddickton—Englee—Bide Arm area; (B) Robert's Arm area; (C) St. John's Peninsula—Conception Bay North.

In the St. John's Peninsula area, hammer seismic work using a Hunttec FS-3, Portable Facsimile seismograph was conducted to determine the thickness of overburden in



**Figure 2.** Aggregate-reserve areas within the Robert's Arm Municipal Planning Area.

aggregate-resource areas previously identified by the Detailed Aggregate Resources Assessment Program in 1983 (Newfoundland Department of Municipal Affairs (1986).

### Data Analysis and Computer Storage

Seventy-eight aggregate samples were collected during the 1987 field program. Samples of unconsolidated aggregates containing plus 8 mm size material were field sieved, and a split of the minus 8 mm fraction was retained for laboratory sieve analysis (Kirby *et al.*, 1983). A split (about 100 pebbles) of the 16 to 31.6 mm pebble fraction was retained for field lithological and petrographic analyses.

Prior to 1986, all aggregate-resource data were incorporated into the Scientific Information Retrieval (S.I.R.) computer system. In 1986, the Mineral Development Division acquired its own minicomputer (HP9000/560), which will enable the in-house storage and computing of all aggregate resource data.

## STUDY RESULTS

### Robert's Arm (2E/5 and 2E/12)

The surficial geology of the Robert's Arm Municipal Planning area is characterized by rock outcrop and a thin veneer of till and/or frost-shattered rock overlying bedrock. The only sand and gravel deposit in the area is confined to a small glaciofluvial terrace at Crescent Lake (Figure 2). This deposit is composed of 3 to 5 m exposures of stratified sandy gravel and sand. Being the only local source of gravel, the

deposit has been heavily exploited. Approximately 70 percent of the previously existing resource has been extracted. Up to 50 percent of the remaining deposit is located within a municipal camping park, which is not presently in use. Partical size and petrographic analyses of samples collected from this deposit give an average grain size distribution of 30 percent gravel, 69 percent sand and 1 percent silt-clay and a petrographic number (Bragg, 1986) ranging between 271 and 353.

The relatively high petrographic number is the result of weathering of the pebble content of the gravels, which makes this deposit unsuitable for asphaltic pavement or concrete. However, local residents have utilized the material for concrete in house foundations and walkways. The sand content of the gravels is suitable for blending-sand for asphaltic pavement and concrete, and is also used for road ice control during the winter months.

Till deposits in the area are thin (usually less than 1 m) and are confined to shallow veneers over bedrock. These deposits are small and of insufficient quality for high grade aggregate use. Silt-clay contents range from 6 to greater than 15 percent.

The bedrock geology (Dean, 1977) of the Robert's Arm planning area mainly consists of basalts interbedded with cherty sediments. Where fresh or slightly weathered, this rock type is excellent for most high grade aggregate uses. However, the suitability decreases with an increase in the degree of weathering and the presence of deleterious substances such

as clay minerals (Bragg, 1986). Generally, the cherty sediments are suitable as a source of high grade aggregate, but if used in cement, alkali reactivity with the cement paste may occur.

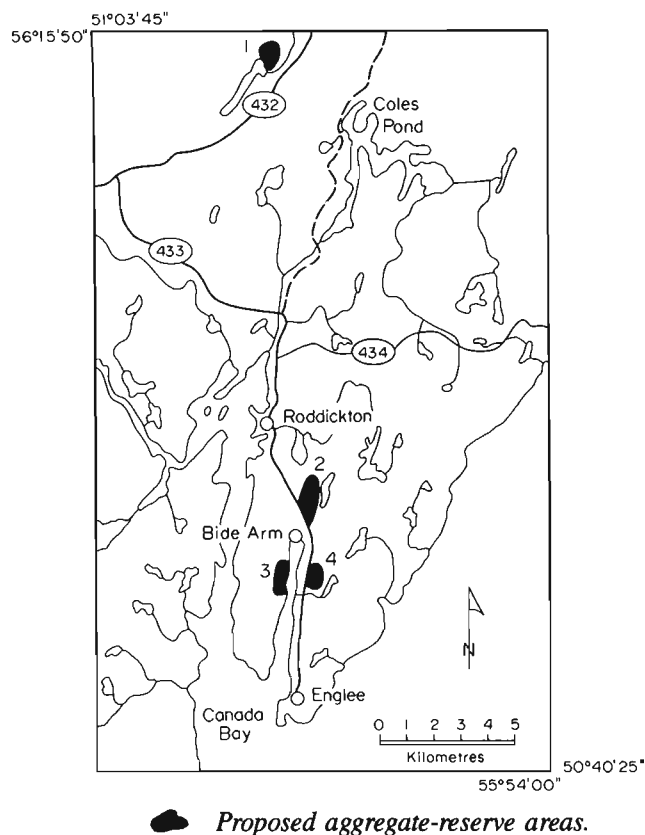
### Roddickton–Englee–Bide Arm (12I/9, 12I/16, 12P/1)

The surficial geology of these areas is characterized by thin veneers (less than 2 m) of marine sediments over bedrock. Generally, these deposits are unsorted, but along river valleys (below 75 m above sea level), some of these deposits have undergone varying degrees of washing and sorting. Three glaciomarine deposits with aggregate potential were identified during the survey (Figure 3). The highest potential aggregate source is a terrace deposit located at the northeast end of Scammels Pond (Deposit 1, Figure 3). This deposit is composed of 1 to 5 m of stratified, shelly sand and sandy gravel over bedrock. The deposit is the major source of sand and gravel for concrete and winter sand for ice control for the whole region and therefore has been heavily exploited. The average grain-size distribution for samples collected from this deposit is 59 percent gravel, 39 percent sand and 1 percent silt–clay. The petrographic number ranges from 352 to 372. The high petrographic number of the pebble content of the gravel is the result of the presence of moderately weathered sandstone and badly weathered undefinable lithologies. This high petrographic number precludes the use of these gravels as a source of coarse aggregate in asphaltic pavement or concrete, but the sand content is suitable for blending purposes. The other two deposits identified (Deposits 2 and 3) are located near Bide Arm, and are more massive deposits with a higher silt–clay content (Table 1). The average grain size distribution for samples collected from these deposits is 70 percent gravel, 27 percent sand and 3 percent silt–clay. The petrographic number ranges from 207 to 276. The relatively high petrographic numbers of the pebble content of the gravel is mainly the result of the presence of small percentages of highly weathered undefinable lithologies in the deposit.

Tills in the area are located at elevation generally above 75 m a.s.l. The deposits are usually thin veneers over bedrock or confined to isolated hummocks and ridges. Deposits are usually silty and contain large angular boulders. The average grain-size distribution of till samples collected in this area was 46 percent gravel, 33 percent sand and 21 percent silt–clay. The high silt content and poor petrographic characteristics (petrographic numbers range between 212 and 446) of the samples would make these deposits only suitable as a source of fill.

The writer observed stratified silty sand and gravel with silt lenses at the base of Deposit 2. The high silt content makes this deposit unsuitable for high grade aggregate uses.

The bedrock geology of the study area consists mainly of carbonate rocks of the Table Cove, March Point, Petit Jardin, Catoche, Boat Harbour and Watts Bight formations (Knight, 1987). Where fresh, these rocks are excellent as a source of high quality crushed aggregate. However, the quality



**Figure 3.** Aggregate-reserve areas in the Roddickton–Englee–Bide Arm region.

of the rock is dependent upon the hardness, degree of weathering and the presence of deleterious substances such as cherty or argillaceous beds. Poor quality (Deposit 4, Figure 3) shale is exposed in the area and is only used as a source of fill.

Rocks of the Maiden Point Formation are also exposed in the study area and mainly consist of greywacke, slate and conglomerate. Generally, the greywacke is excellent as a source of crushed aggregate, whereas the slate is poor and could only be used as a source of fill. The conglomerates have a quality range of good to poor, depending on its hardness, durability, degree of weathering and deleterious substances present.

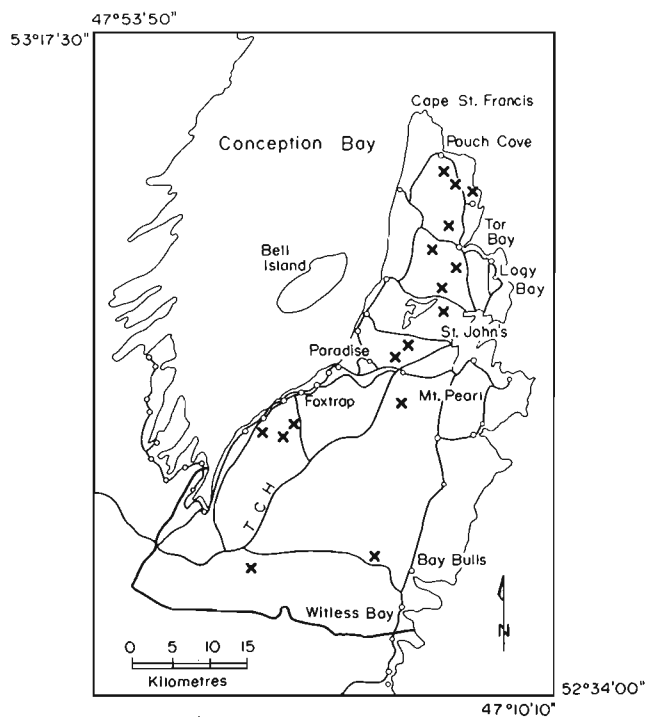
### St. John's Peninsula–Conception Bay North (1N/6/7/10/11/14/15)

Field work in this area was divided into two segments; these were, hammer seismic profiling and bedrock evaluation for aggregate purposes.

Hammer seismic work was conducted in a number of areas within the St. John's Urban Region (Figure 4). Many of the areas tested are identified as aggregate-resource areas on the St. John's Urban Region Plan and most have already been testpitted by backhoe and sampled (Newfoundland

**Table 1.** Summary of sieve analysis by area

Deposit	Number of Samples	Average Petrographic Number	% Gravel	% Sand	% Silt-Clay	Comments
Robert's Arm	7	312	30	69	1	Predominantly sandy stratified gravel with numerous sand exposures. Average exposure height from quarry faces was 3 m.
Roddickton-Bide Arm-Englee						
1	3	362	59	40	1	1 to 5 m exposures of stratified sandy gravel and sand in a large gravel quarry. The deposit contains numerous shell fragments.
2	3	249	74	23	3	Site is on the side of a rock covered ridge. 1-2 m of unsorted marine sediment overlying 1-2 m of stratified sand and gravel with silt lenses. There is a high percentage of shell fragments in the deposit.
3	2	207	65	32	3	4-6 m of gravelly marine sediment with shell fragments. The deposit does show some stratification.



x Hammer seismic locations

**Figure 4.** Hammer seismic locations within the St. John's Urban Region.

Department of Municipal Affairs, 1986). The main aim of this project was to evaluate the usefulness of a hammer seismic instrument to determine overburden depth in various terrain and overburden types. The instrument used in this survey was a Huntec FS-3, Portable Facsimile Seismograph (Hammer Seismic). It is hoped that by employing this geophysical method, combined with backhoe testpitting and sampling, a better estimate can be made of the aggregate-resource potential of a given region. A total of seventy hammer seismic profiles were done over a two week period. Analyses of the hammer seismic data have not been completed.

The bedrock-aggregate survey was conducted throughout the region and involved the collection of representative bedrock samples to evaluate their potential as a source of crushed aggregate. This is discussed in Bragg (*this volume*).

**SUMMARY**

A total of 78 aggregate and rock samples were collected and seventy hammer seismic profiles were conducted during the 1987 field season. Laboratory analyses on all aggregate samples have been completed; the hammer seismic data are presently being analyzed.

The work conducted in the Robert's Arm and Roddickton-Bide Arm-Englee areas has shown that these areas lack adequate reserves of high quality surficial-aggregate materials within their municipal boundaries. Bedrock reserves in these areas are generally of high quality and are suitable

as a source of crushed aggregate material, but the degree of weathering and presence of deleterious substances would greatly affect the quality of these deposits. The results of these surveys have been forwarded to the Department of Municipal Affairs for inclusion in municipal or other plans for these areas so that the resources identified can be protected from conflicting land uses.

A hammer seismic program was conducted mainly within existing aggregate-resource areas that are identified in the St. John's Urban Region Plan. The main aim of this project was to evaluate the use of this instrument in determining overburden depths in potential aggregate-resource areas. In the Conception Bay-St. John's Peninsula areas, a bedrock sampling program was conducted to determine the potential of each representative rock type as a source of crushed aggregate.

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