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URBAN GEOLOGY OF THE NORTHEAST AVALON

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ABSTRACT

The objective of the urban geology project is to develop a centralized digital database of geological, geotechnical and related data for the northeast Avalon. During the past twenty years, many of Canada's larger centres have conducted some form of urban–environmental geological studies, usually in response to a specific engineering project, e.g., subway systems, deep sewer construction or a geological hazard, i.e., slope stability or earthquakes. As development and expansion of the urban areas on the northeast Avalon continues, there will be increasing demand on the natural resources and services such as groundwater and surface-water supply, aggregate and construction material supply, landfill siting considerations, contamination problems, geological hazards and land-use planning based on the natural capabilities and limitations of the area.

The centralizing of the available data, and conducting of field work to improve our knowledge of areas with little or no available data, will aid federal, provincial and municipal governments, along with planners, developers and consultants in dealing with these demands in the future.

INTRODUCTION

> 'Geology is applicable to many aspects of the urban development because in any physical environment, the overall interdependent natural systems are built on a geologic framework. The need for effective land use planning to ensure the orderly development of urban centres has created a much greater demand for geologic information' (Kathol and McPherson, 1975, page 3).

The process of compiling and interpreting geological and geotechnical information for an urban area has been coined 'urban geology'. Urban geology can be defined as the study of the earth's materials and groundwater resources as they relate to the development, re-development and expansion of urban areas (Howard and Young, 1992).

The northeast Avalon urban geology project (Figure 1) was initiated to meet the demand for geological information. The study area includes that part of the Avalon Peninsula north of the Witless Bay Line and east of the Holyrood Access Road. Geological and geotechnical information is being compiled from existing maps and reports. Field surveys initiated in the summer of 1992 concentrated on the area from St. John's north to Torbay, south to Motion Bay, and west to Donovan's Industrial Park. The 1993 field season focussed on the remaining areas of Conception Bay South, St. Phillips–Portugal Cove, Pouch Cove, and the Goulds south to Bay Bulls (Figure 2).

DATABASE

The project will use Geographical Information System (GIS) technology to handle the variety and volume of data

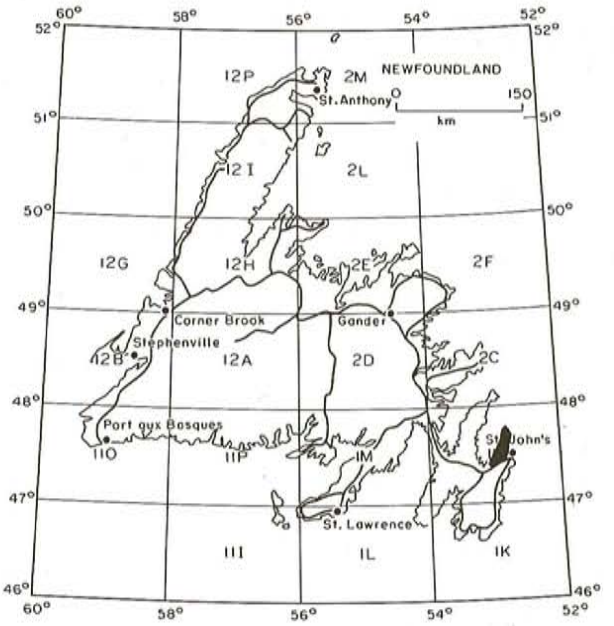

Figure 1. *Location of study area.*

required to accomplish the broad scope of an urban geology project. A series of layers or coverages representing different types of information on the northeast Avalon will be developed (Table 1). The GIS technology makes it possible to overlay these coverages (Figure 3) and perform spatial analysis to create new relationships that can determine the suitability of various sites for development, evaluate environmental impacts and help to solve the broad range of questions people have on the development of the northeast Avalon.

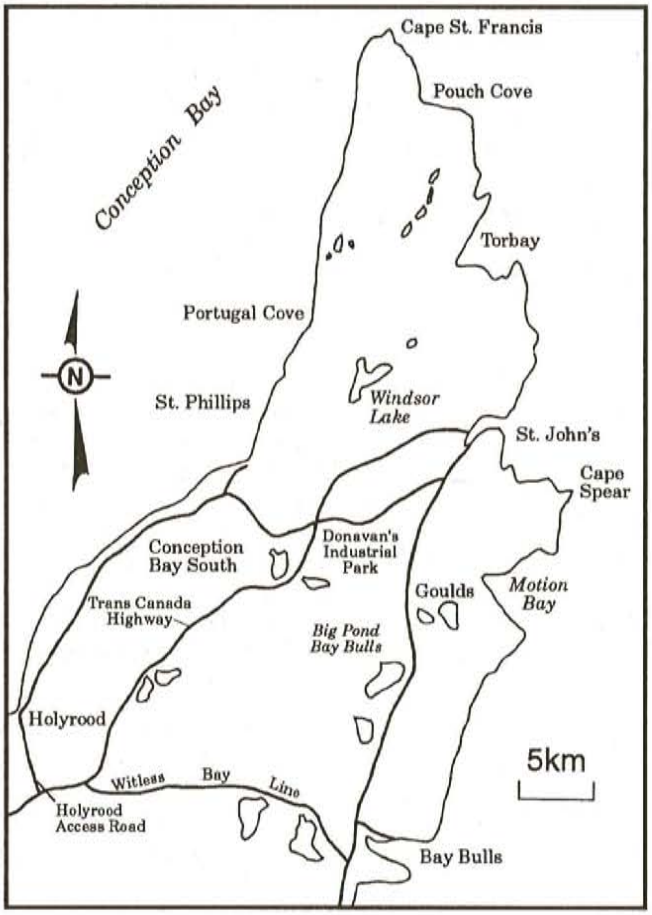

Figure 2. *Northeast Avalon Peninsula.*

The coverages listed in Table 1 were compiled from reports and maps produced over the past 20 years. Some coverages, such as topography and geophysical surveys, require only minimal attention to include in the urban database. Other coverages, like bedrock geology and hydrogeology, require digitizing of the maps and entering of point data into the database, whereas other coverages require substantial compilation, field work and database development, before they are included in the database.

FIELDWORK

The field work is designed to accomplish several goals. The primary goal is to produce surficial maps at a scale of 1:25 000. These maps will reflect parameters including the surficial geology, sediment types, degree of compaction, grain-size distribution and overburden thickness. The secondary goal is to supplement existing datasets where there is little or no data, or where control data for verification is required. The geological field investigations consisted of examining the material below the soil horizons. Samples and detailed descriptions were collected from exposures in roadcuts, drainage ditches, coastal sections, stream and river banks, gravel and sand pits, and building excavations.

The field area can be subdivided into four geomorphic zones (Figure 4). The surficial terrain of Zone 1 is dominated by bedrock. Quaternary sediment cover is generally thin and discontinuous. The sediment has a slightly to moderately compact, silty to fine sand matrix, and contains a high percentage of clasts that generally reflect the underlying bedrock. The area northwest of the Trans-Canada Highway

Table 1. Themes of coverage which will be used to develop a centralized digital database of geological, geotechnical and related data for the northeast Avalon

Theme of Coverage	Components of Coverage	Source of Coverage
Topography	Coastline, surface water, contours, roads	1:50 000 digital NTS maps
Geology (bedrock)	Geological units, structural features, site locations	King (1988, 1990), Hsu (1975)
Geology (surficial)	Geological units, geomorphic landforms, site locations	Henderson (1972), and Vanderveer (1975)
Overburden	Site locations	Batterson (1984), Rhodenizer (1972) and compilation
Soils	Soils classification, soil capabilities	Heringa (1981)
Peat	Peat resource inventory	Northland Associates Limited (1980)
Aggregate Resources	Grain-size analysis, site locations	Ricketts (1993)
Bedrock Geotechnical	Petrographic units, petrographic #, site locations	Bragg (1986)
Land Use	Land-use zoning, protected areas, municipal boundaries	Department of Municipal and Provincial Affairs (1976)
Hydrogeology	Bedrock hydrostratigraphic units, well locations	Gale *et al.*, (1984) and Department of Environment and Lands (1990)
Geophysical Surveys	Aeromagnetic survey (200 m grid cell)	Kilfoil and Bruce (1990)
Geotechnical Reports	Site evaluations	Nolan *et al.*, (1972) and compilation

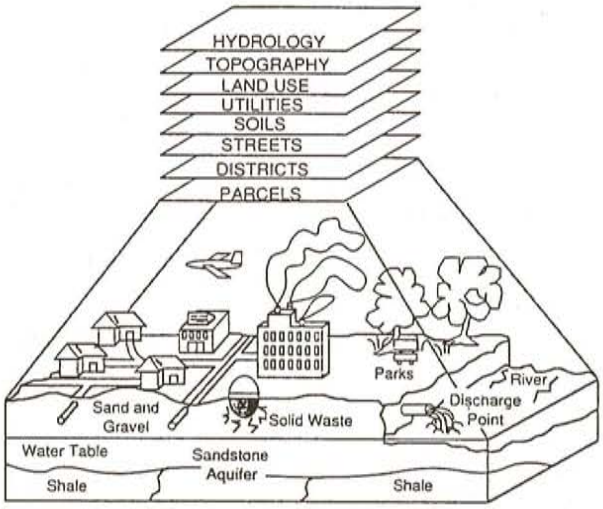

Figure 3. *The 'real world' consists of many geographies which can be represented as a number of related data layers (after Environmental Systems Research Institute, 1992).*

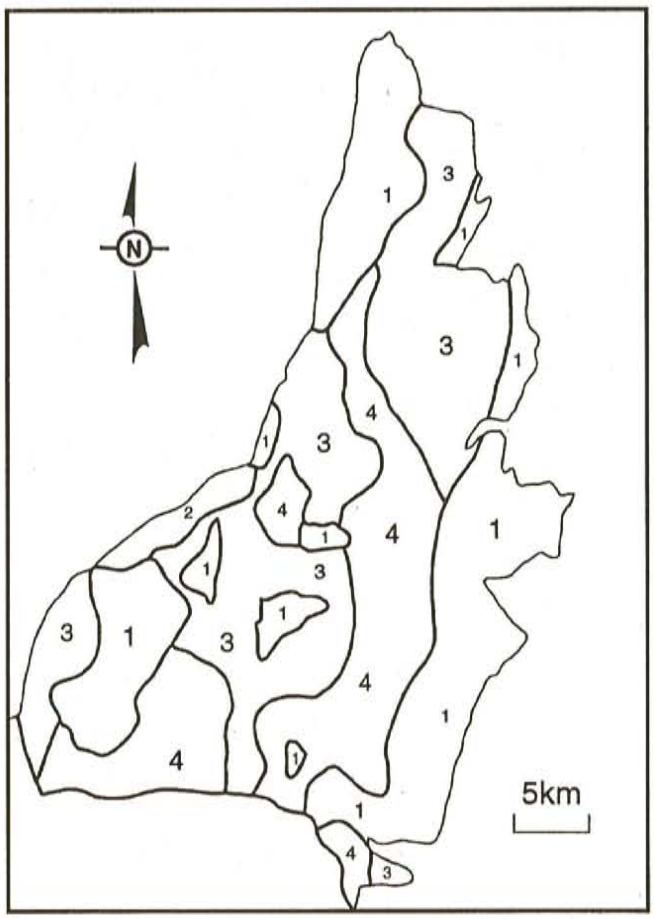

Figure 4. *Generalized zones of the surficial geology of northeast Avalon.*

including Holyrood to Conception Bay South (Zone 2) is characterized by numerous valley systems entering Conception Bay. The highlands are generally exposed bedrock or have a thin veneer of Quaternary sediments. The valleys contain moderate to thick Quaternary deposits. The head of the valleys is typically dominated by glacial diamicton of probable basal origin. It has a moderately to highly compact, silty to sandy matrix. The sediment contains irregularly shaped lenses of silt and sand, which are deformed under, and draped over clasts. The lower valley is dominated by moderate to well-developed glaciofluvial deposits. The sediments are sandy gravels with subrounded to well-rounded clasts. The area contained in Zone 3 is dominated by a veneer of glacial diamicton generally 1 to 3 m in thickness. Bedrock outcrops are common and the underlying geological features are usually evident. The sediment has a slightly to moderately compact, poorly sorted sandy matrix and contains angular to subangular clasts, which are locally derived. Zone 4 consists of glacial terrain characterized as hummocky, drumlinoid and till plains. These areas have deposits generally 3 m or more in thickness and usually reveal little evidence of the underlying geological characteristics. Sediment textures vary with the mode of deposition but can be generally described as massive, poorly sorted diamictons with a sandy–silty matrix, and have a high percentage of locally derived clasts.

CONCLUSION

The 1993 field season marks the completion of the second and final scheduled field season and a turning point for the urban geology project. Now, the focus will shift from data collection to database development and digital-map compilation. The project will use GIS technology to handle the volume and variety of data. The greatest justification for using GIS technology is the capabilities it offers for customizing the data to meet user requirements. The user group for this information is expected to be geotechnical consultants, civil engineers, regional planners, drillers and contractors.

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