

Granular Resource Requirements for Proposed Mackenzie Valley Pipelines:

Technical Papers and Workshop Proceedings

**Sponsored by:
Northern Oil and Gas Action Program (NOGAP) Project A4:
Granular Resources Inventory and Management**

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SECTION 3.

TECHNICAL PANEL "A"

**SOURCES OF INFORMATION ON
GRANULAR RESOURCES**

DIAND NORTHERN GRANULAR RESOURCES INVENTORY PROGRAM

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ABSTRACT

DIAND first attempted to establish a comprehensive inventory of Mackenzie Valley granular resources in the early 1970s. These efforts were in anticipation of an increase in demands due to hydrocarbon exploration activity in the Mackenzie Delta, completion of the Mackenzie Highway, and competing proposals for large diameter gas transmission facilities. Most of the initial work was completed by consulting firms contracted by DIAND. Supplemental to this were regional assessments based on surficial geology maps of the Mackenzie Corridor that were completed for DIAND by the GSC, and site specific investigations by government and industry.

With the expansion of hydrocarbon exploration into the Beaufort Sea in the 1980s and the growth of industrial support facilities in Tuktoyaktuk, a second period of granular resource inventory work was completed. This was largely concentrated in the Beaufort Sea-Mackenzie Delta-Tuk Peninsula area. Since 1984, significant funding has been available through NOGAP to assist in developing government preparedness for northern hydrocarbon development. More recently, the pressures on public supplies of granular resources have arisen from community land use concerns and from aboriginal land claims. Continued cooperation between key stakeholder groups is required to complete further granular resources inventory work.

The Department of Indian Affairs and Northern Development (DIAND) undertakes a northern granular resources inventory program in support of its responsibilities regarding management of granular resources in the Northwest Territories (NWT), the Yukon Territory and in the adjacent offshore areas. In recent years, the program has received limited "core" departmental funding and varying levels of support from special allocations as part of the Northern Oil and Gas Action Program (NOGAP) and the Inuvialuit Final Agreement Implementation Program. Over the past five years, considerable effort has been expended towards compiling existing information on northern granular resources into a series of computerized databases. These will provide improved accessibility to the extensive body of information that has been collected in numerous consultants reports. Once complete, this will be one of the most extensive computerized granular resource data collections in existence.

DIAND is responsible for the management of granular resources on most Crown lands in the NWT, the

Yukon and in the adjacent offshore areas. Previously, this involved most of the known deposits in the Canadian North since Crown lands represented all but a few percent of the total area. This paper outlines DIAND's efforts to develop an inventory of the granular deposits in the Mackenzie Valley. It does not include, but does acknowledge, the significant body of information produced by various departments of the Government of the Northwest Territories (GNWT) and by other federal departments in support of their requirements as consumers of granular resources.

Background

The first attempts, commencing in the early 1970's, to establish a comprehensive inventory of Mackenzie Valley granular resources responded to an anticipated increase in demands due to hydrocarbon exploration activity in the Mackenzie Delta, plans for completion of the Mackenzie Highway and competing proposals for large diameter gas transmission facilities. Most of the initial work was completed in three stages by several consulting firms contracted by DIAND

(Pemcan Services, 1972; Ripley, Klohn and Leonoff, 1973; and, EBA Engineering and F.F. Slaney, 1974). Supplementing those reports were regional assessments of granular resource potential based on preliminary surficial geology maps of the Mackenzie Corridor that were completed for DIAND by the Geological Survey of Canada (Minning, *et al*, 1975; Lawrence, *et al*, 1975), and site specific field investigations, mostly by Public Works Canada and the petroleum industry. Bibliographic citations for all available granular studies will be included in the database and bibliography described in another paper in these proceedings (by Ross Goodwin).

Collectively, these studies formed a major part of the granular borrow materials extraction plans prepared by the pipeline proponents, and for much of the corridor, they have provided adequate information for all types of construction activities, continuing to the present. This work has been consolidated and summarized as part of regional studies that will be described in three following papers (by Rita Olthof, Jim Oswell, and Jack Fujino). In a few communities, growth has led to depletion of the initially-identified deposits; but there has generally been little need for additional field work in much of the corridor.

With the expansion of hydrocarbon exploration into the Beaufort Sea in the early 1980s and the tremendous associated growth of industrial support facilities in Tuktoyaktuk, a second period of granular resource inventory work was needed. This was largely concentrated in the Beaufort Sea and in the Mackenzie Delta and Tuktoyaktuk Peninsula. These efforts have been intermittent and continue to the present.

More recently, the pressures on public supplies of granular resources have arisen primarily from community land use concerns and from land claims. Ownership of, and responsibility for management of granular resources has changed considerably in recent years as a result of land claims settlements. Granular resources are considered part of the surface title, and therefore are included with ownership of lands. As a result, a major proportion of the known granular deposits are now privately-owned, and generally more costly. This creates a greater demand for the remaining sources of supply on Crown lands, and an increased need for more effective management of the public resources. As a result, a significant effort is now needed in many areas to update and expand the existing information base before hydrocarbon

development or other enhanced economic activity proceeds in the Mackenzie Vally region.

In support of this, DIAND's Land Management Division, Natural Resources and Environment Branch, has initiated a northern granular resources inventory program. The main objective of this program is to ensure that adequate scientific and technical information is available to support the department's responsibilities regarding management of northern granular resources.

Program Focus

DIAND's role in the preparation of a granular resource inventory is as a resource manager, not as a resource user. Therefore, it attempts to classify granular materials according to their natural condition (without processing) and their broadest range of potential uses, by all potential users. In contrast, a more specialized (e.g. highways) user-oriented inventory might classify materials according to their adherence to precise material specifications (e.g. surfacing material, or concrete aggregate). While the DIAND inventory gives highest priority to higher quality resources, it does not exclude lower quality materials since they also must be managed.

The main goal of the program is to develop a coordinated, systematic approach to granular resources inventory. Emphasis has been placed on avoiding duplication of effort and on utilization of existing information. The program also tries to make the inventory information more accessible to current and potential users.

Within the department, the responsibility for inventory activities is informally divided among headquarters, regional and district offices. *DIAND Headquarters* provides geotechnical support and research, and overall direction of the inventory program. Technical advice on granular resource issues is provided by headquarters personnel to various parts of the department, from senior managers, to regional land administrators, to resource management officers in the district offices. Granular resource inventory work related to major projects (e.g. pipelines) or transboundary issues would normally be undertaken by headquarters.

DIAND Regional offices have main responsibility for planning and administration. This would normally include initiation of regional granular resource

management plans and issuing quarry permits. Studies to identify, delineate or plan the development of specific public or community granular material sources are usually initiated by the regional offices.

DIAND District offices are responsible for operations. This includes inspection of proposed granular extraction sites and of existing pits and quarries and the monitoring of ongoing operations. They also represent the primary contact between DIAND and granular resource users.

It is important that all areas provide input to, and feedback on, the inventory activities of each of the others. For example, geotechnical interpretations may be required from headquarters, regional offices may identify new areas requiring more detailed inventory, and the districts may provide confirmation of predicted subsurface conditions based on site inspections.

Program Funding

Funding for most of the previous northern granular resource inventory work has involved special allocations. The original three-stage inventory work was completed with one-time funding allocated to the Mackenzie Highway Granular Working Group. Core funding for granular resources inventory and management in the past has been sporadic, variable and susceptible to postponement or cancellation. More recently, as local shortages of granular materials became apparent, funding for granular resources inventory work has been more plentiful and more certain.

Since 1984, significant funding for salaries and contracted studies has been made available through the Northern Oil and Gas Action Program (NOGAP), as Project A4 - Northern Granular Resources Inventory and Management. NOGAP was established to assist in developing government preparedness for future northern hydrocarbon development. The overall objectives of Project A4 are to provide information on the location, type, quantities and qualities of major borrow sources in the Mackenzie Valley and Beaufort Sea Regions, to support conservation and effective utilization strategies and policies, and to recommend appropriate management strategies and a more modern regulatory regime.

The NOGAP granular project initially focused on development of a preliminary inventory for the Beaufort Sea, but included several regional onshore

studies, and evaluations of special materials that might be required for hydrocarbon development. The regional studies included field investigations on Richards Island (Subproject A4-07) and in the South Slave Region (Subproject A4-18; see also paper in these proceedings by Nick Hernadi), and a compilation of existing information for the Lower Mackenzie Corridor (Subproject A4-08; see also paper by Jim Oswell). Special studies of potential sources of concrete aggregates (Subproject A4-09) and of quarry rock (Subproject A4-12) for use in offshore hydrocarbon structures, and of the feasibility of dredging granular materials from the bed of the Mackenzie River (Subproject A4-10; see also paper by Neil MacLeod) were completed.

In 1990, Project A4 was revised to place greater emphasis on granular resource issues related to pipeline transportation of hydrocarbons in the Mackenzie Valley. These activities are the main focus of this paper and the workshop proceedings. The workshop is sponsored entirely by NOGAP, as Subproject A4-26A. NOGAP ends at the completion of the 1993-94 fiscal year.

The second major source of funding for granular resources inventory studies in the Mackenzie Delta area is a special allocation made as part of the Inuvialuit Final Agreement Implementation Program (IFAIP). IFAIP Task 7 - Sand and Gravel Inventories, received varying levels of funding for each of the first ten years of the program. The main objective of this task is to update and complete inventories of granular resources in the Inuvialuit Settlement Region. More specifically, the task attempts to transfer to the Inuvialuit Land Administration (ILA) existing data needed for granular resources management, to assist in determining and updating long-term demand forecasts, and to assist in establishing reserves for public use. Studies completed under Task 7 and covering parts of the Mackenzie Valley corridor include a series of reports on granular inventory and demand forecasts (Task 7.1) and development plans (Task 7.4) for Aklavik, Inuvik and Tuktoyaktuk, and geotechnical field investigations of new sources near each of these NWT communities (Tasks 7.2 and 7.5), and compilation of the existing information in computerized granular resource databases (Tasks 7.1 and 7.3).

The limited core funding available for granular resources management has generally been spent on an as-needed basis to address critical shortages in

communities throughout both territories. In 1991, a consistent level of core funding was established for granular inventory and management programs. This covers most salary and support costs, all travel costs, student assistants, and several small contracted studies each year. These studies generally relate to inter-regional granular issues (e.g. Dempster Highway), methods and tools for inventory and management (e.g. databases, training aids) and other geotechnical issues requested by DIAND Regional offices.

Beginning in 1993-94, limited "seed" funding will be available for granular resources research related to energy, through the Panel on Energy Research and Development (PERD). Two new PERD projects have been established. One PERD project will deal with environmental issues related to pipeline borrow development, and a second project is to support continued research on offshore granular resources development.

Granular Resources Databases

Over the past five years, considerable progress has been made towards compiling existing information on northern granular resources into a series of computerized databases. These will provide improved accessibility to the extensive body of information that has been collected in numerous consultants reports. They will also make it feasible to make this data available to existing and potential users, thereby making effective management an attainable goal. As a matter of policy, new information is now being collected in the standardized formats of the existing databases.

The northern granular resources inventory consists of four separate databases that are linked by two unique key fields. The databases include a reports catalogue, a deposits database, a borehole database and a geographic database. Each report or study in the report catalogue is identified by a unique study number. Each deposit or borrow source in the source database is identified by a unique source number. The remaining databases include both the study number and the source number. Each of the databases is described briefly in the following paragraphs.

The Report Catalogue contains a listing of all available reports containing granular resource data for the area under study; included are geotechnical, surficial geology, airphoto interpretation and geophysical reports. This information extends beyond

a bibliographic database by including a preliminary evaluation of the extent and usefulness of the data in the reports. A summary of the main subject areas in the database and the number of data fields (in parentheses) in each area is shown in Figure 1.

The Deposits Database contains data for individual deposits (gravel/sand pits and/or deposits) that was obtained from the reports listed in the Report Catalogue. A comprehensive description of a Deposit and its materials is obtained if all fields are filled out. This database also summarizes the information contained in the Borehole Database. A summary of the main subject areas in the database and the number of data fields (in parentheses) in each area is shown in Figure 2.

The Borehole Database contains geotechnical borehole data from the reports listed in the Report Catalogue and for the individual sources listed in the Deposit Database. These include a description of the borehole, stratigraphic data and laboratory test results. A complete borehole log, and other graphical or tabular output can also be generated with the borehole database software. A summary of the main subject areas in the database and the number of data fields (in parentheses) in each area is shown in Figure 3.

The Geographic Database contains information needed to display the locations of the studies, sources or boreholes on a map using the *QUIKMap/inFOcus* desktop mapping system. It includes plotting instructions for symbols and labels, including size, colour, orientation and fill pattern.

The databases and their linkages are indicated in Figure 4, together with proposed additions to the granular inventory. Information on granular resource usage should be included in a separate database, that would be linked to the source database by source number. This would permit instantaneous determination of the remaining quantity of material in any source through a simple database report that would access both databases. Similarly, compilation of laboratory test data obtained during source development could be maintained in a material properties database that could be linked to both the source database and the borehole database to provide verification of the exploration data.

A brief summary of the current extent of granular resource databases in the Mackenzie Valley and the Inuvialuit Settlement Region is given in Table 1.

Figure 1. DIAND Granular Resources Database: REPORT CATALOGUE

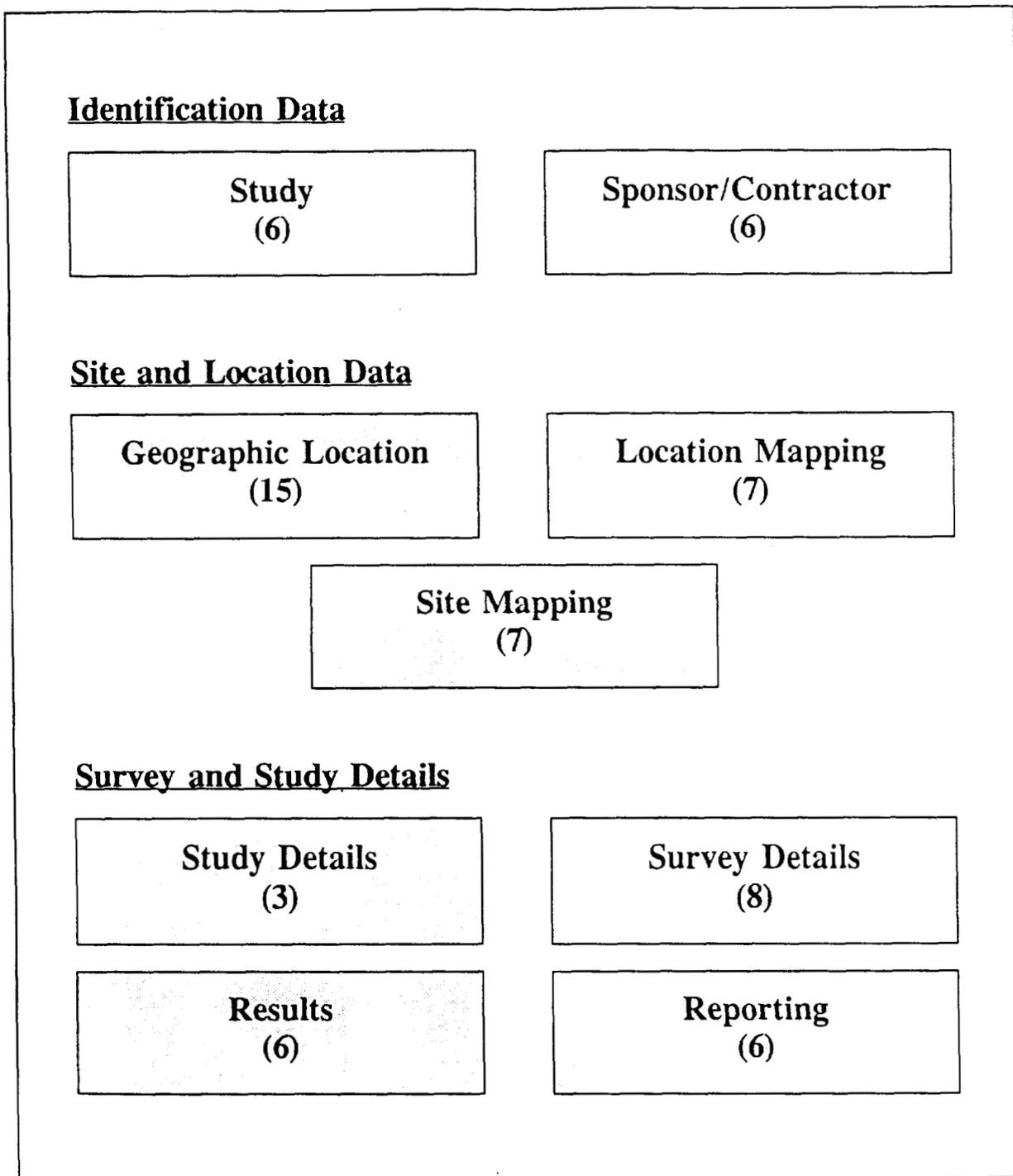


Figure 2. DIAND Granular Resources Database: SOURCE CATALOGUE

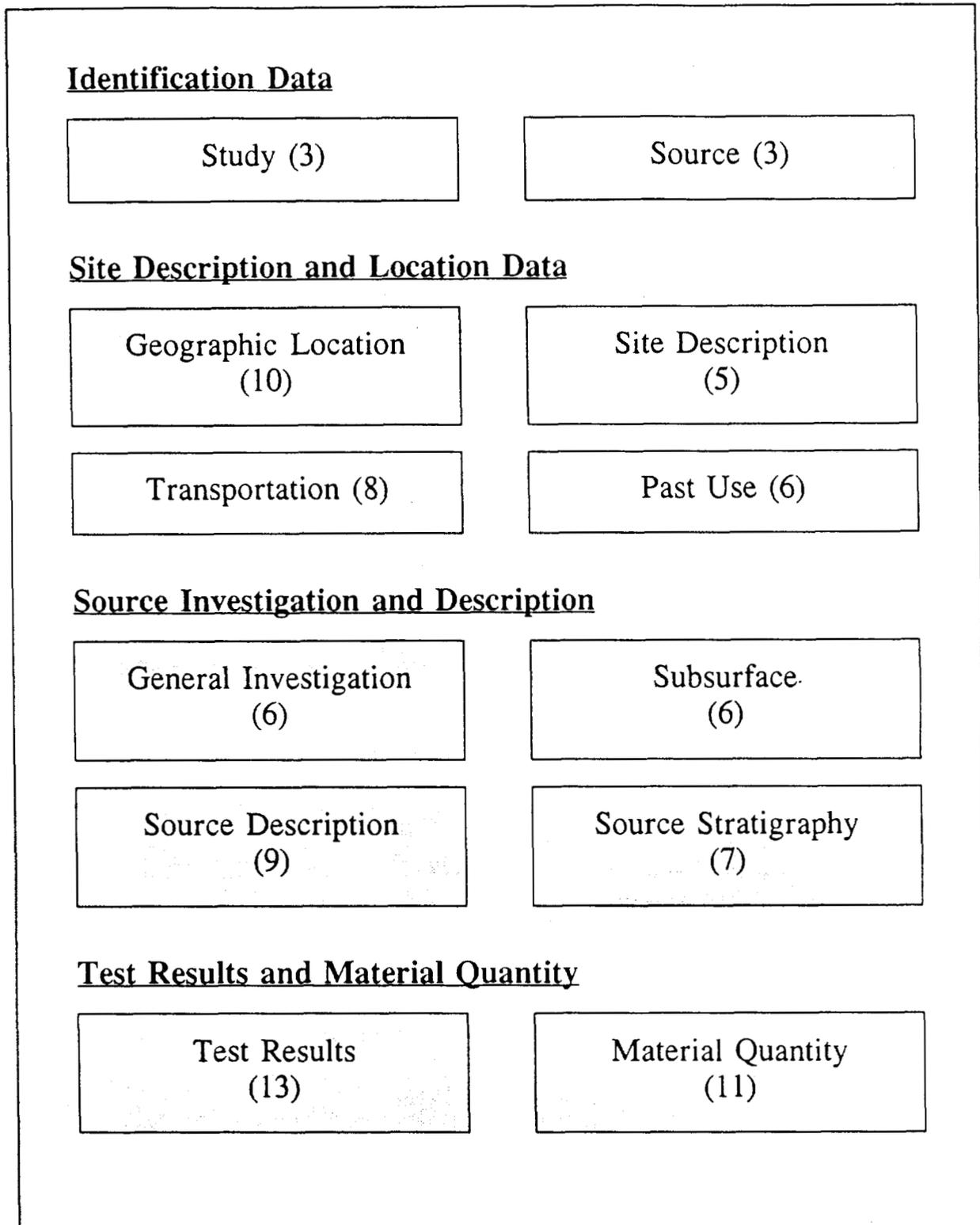


Figure 3. DIAND Granular Resources Database: BOREHOLE DATABASE

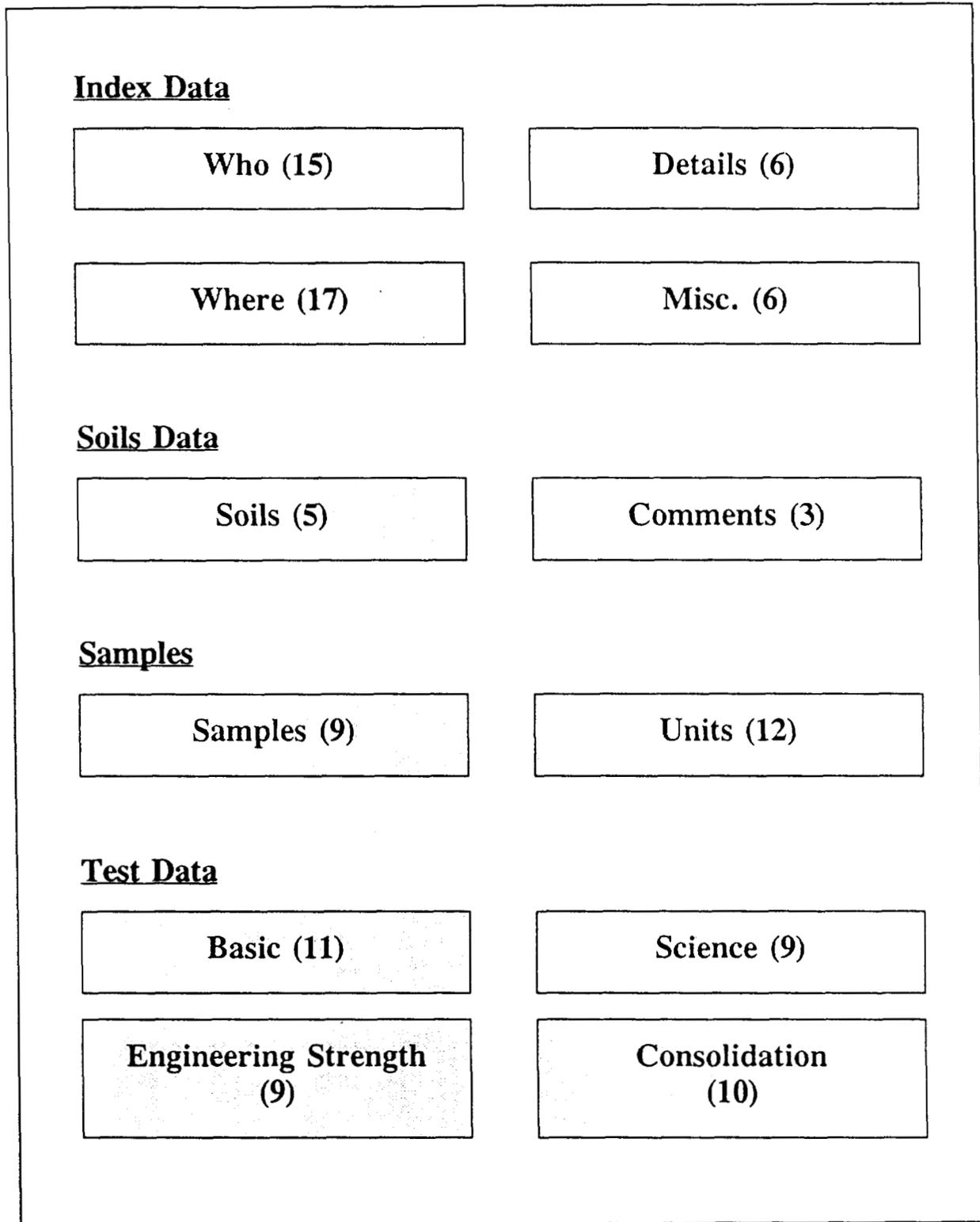


Figure 4. DIAND Granular Resources Database: GRANULAR DATABASES

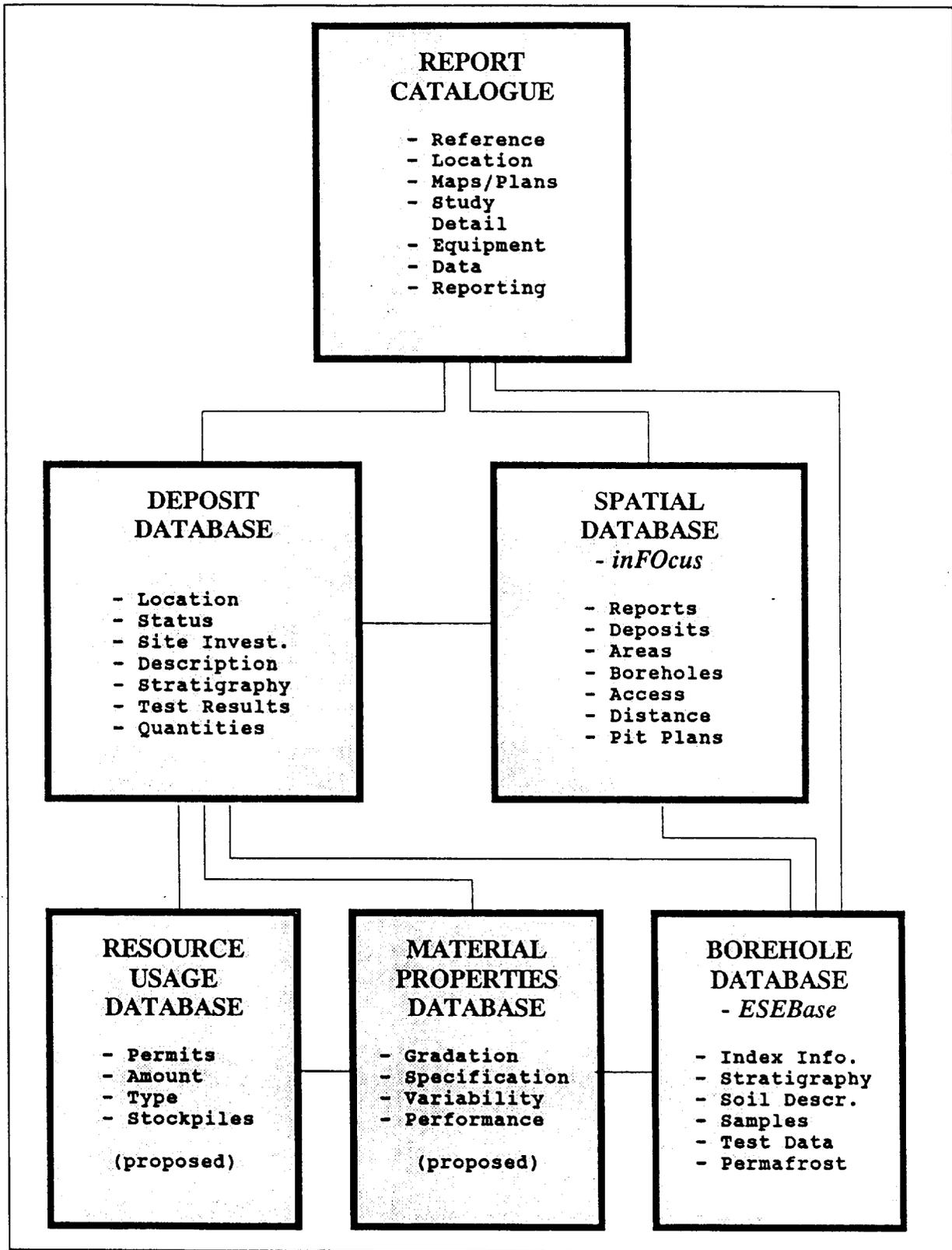


Table 1. NWT Granular Resource Databases

Region	Year Created	Contents	Records
Mackenzie Valley	1990	Borehole Database	12,695
	1992	Report Catalogue	130
	1992	Bibliography	188
North Mackenzie Valley	1992	Source Catalogue	558
South Mackenzie Valley	1992	Source Catalogue	762
Paulatuk	1991	Report Catalogue	7
	1991	Source Catalogue	4
	1991	Borehole Database	80
Inuvialuit Settlement Area	1987	Borehole Database	819
	1988	Source Catalogue	226
	1988	Report Catalogue	42
South Slave	1987	Source Catalogue	42

Ongoing studies are currently extending these databases and linking them with the geographic database. Once complete, a user-friendly interface will be developed to make this information accessible to users lacking database management experience.

It should be noted that the information compiled to date is often old data, and in most cases we have not identified the extent to which these sources have been utilized. To overcome this deficiency, it is planned to review each data record with local resource management officers and highway foreman, and update the source databases. Information held by the territorial government and other users would be a most welcome addition to the granular resource inventory.

Conclusions

Potential users of the northern granular resources

inventory include government departments, native organizations, consultants and contractors. The interest expressed by several user groups has been encouraging and these efforts will continue for the next few years. Once complete, this will represent one of the most extensive computerized granular resource data collections in existence.

One of the main reasons for success achieved to-date is the co-operation of industry, various federal and territorial government departments and the Inuvialuit Land Administration through their participation in program planning and reviews, sharing of available information, and joint-funding and management of projects. Considering the current economic climate and the intense competition for limited claims implementation funds, continued co-operation will be needed to complete the needed granular resources inventory work.