

Granular Resource Requirements for Proposed Mackenzie Valley Pipelines:

Technical Papers and Workshop Proceedings

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

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SECTION 4.

TECHNICAL PANEL "B"

**REGIONAL BORROW DEPOSITS
INVENTORIES**

**REGIONAL BORROW DEPOSITS INVENTORY:
UPPER MACKENZIE VALLEY**

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ABSTRACT

In 1988, EBA produced a computerized summary of existing granular resource data for the Upper Mackenzie Valley. The summary included over 50 granular resource studies that were conducted in the Upper (South) Mackenzie Valley prior to 1988 and covered an area of about 100,000 km² from Fort Providence to Norman Wells. Both sides of the Mackenzie River and adjacent regions outside the narrow pipeline and highway corridor were included. Geographic, geologic and engineering characteristics for 762 sites were summarized and an assessment of the potential value of each site was provided in the database. Five new Borrow Management Areas were proposed by EBA to be continuous with the seven areas developed in 1986 for the Lower (North) Mackenzie Valley by HBT AGRA.

In 1992, additional work was done to convert the granular resource databases compiled in 1988 for the Upper and Lower Mackenzie Valley to a consistent format. A computerized summary of the reports providing granular resource information was begun by EBA in 1991, and updated in 1992. An ESEBase borehole database containing about 12,500 boreholes for the Mackenzie Valley was converted from a GSC database by EBA in 1991. The database is currently being updated by EBA for the GSC.

Introduction

This presentation discusses the data compiled under NOGAP and related contracts for Indian and Northern Affairs Canada (INAC) in 1986, 1988, 1991, and 1992, by EBA Engineering Consultants Ltd. (EBA) and others. It also presents some information about related contracts for the Geological Survey of Canada (GSC) in 1992-93. These contracts relate to granular resource inventory databases and geotechnical borehole log databases.

In 1988, EBA and its subconsultant GVM Geological Consultants Ltd. (GVM) compiled a summary of over 50 granular resource studies that were conducted in the Upper Mackenzie Valley prior to 1988. The summary covered an area of about 100,000 km² south of Norman Wells, including both sides of the Mackenzie River and adjacent regions outside the narrow pipeline and highway corridor. EBA's study area is shown on Figure 1. The study developed as a by-product of EBA's study of the feasibility of developing granular borrow resources from the Mackenzie River bed,

which Neil MacLeod of EBA discusses in a later presentation in this workshop.

As part of their 1986 work for INAC on the Lower Mackenzie Valley, HBT AGRA Ltd. (HBT) summarized data from 292 potential granular sources. HBT's study area is shown in Figure 2. A computerized summary for the Lower Mackenzie Valley was done by Mr. L. Bennett for INAC in 1988, including granular sources at 558 sites, covering much of the same area as HBT's study, as shown in Figure 3. EBA's database for the Upper Mackenzie Valley adopted a similar but not identical format to Bennett's database. Like EBA's work, both the HBT and Bennett studies were based on published and readily available data, and were intended to provide a framework for a regional granular inventory.

A computerized summary of the reports providing granular resource information was begun by EBA in 1991, and updated in 1992. This report catalogue database has 131 entries for the Mackenzie Valley. A less-detailed bibliographic summary database produced

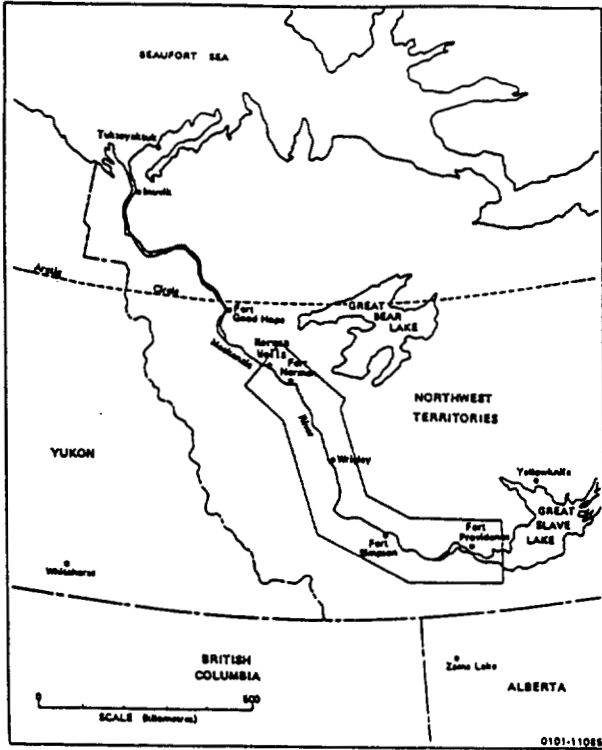


Figure 1. Upper (Southern) Mackenzie Study Area
(EBA, 1988, 0306-34395)

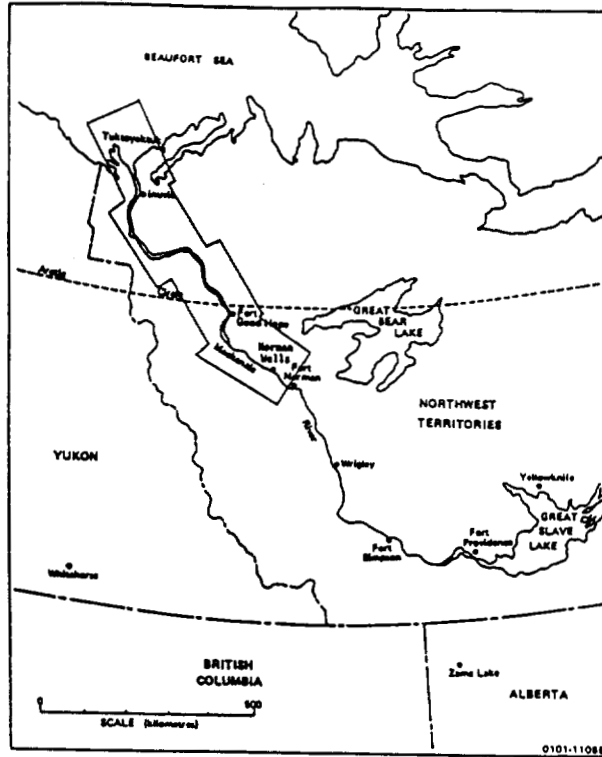


Figure 2. Lower (Northern) Mackenzie Study Area
(Hardy BBT, 1986)

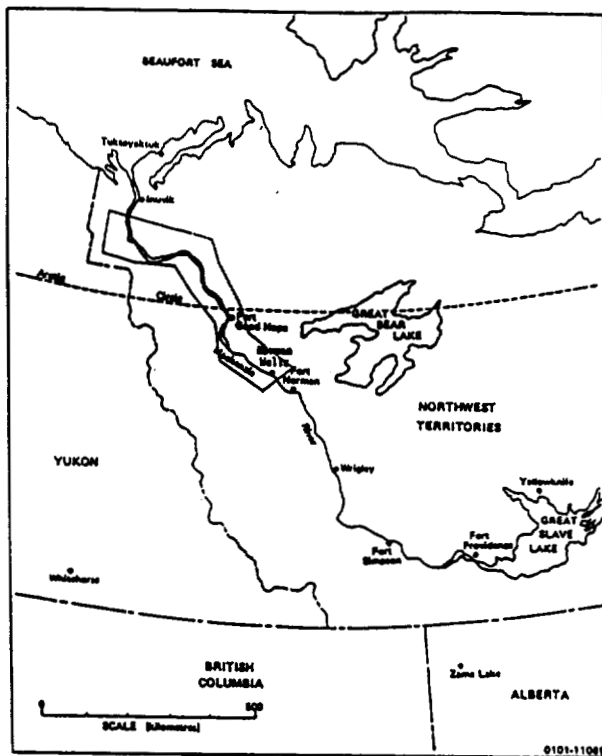


Figure 3. Lower (Northern) Mackenzie Study Area
(Bennett, 1988)

by EBA includes reports, fieldwork, maps and other information and has 188 entries including the report catalogue entries. The standardized source databases can now be conveniently linked to the report catalogue database. The Arctic Institute of North America (AINA) at the University of Calgary is conducting further work in 1993 on a bibliographic database for the Mackenzie Valley.

In 1992, programming work was done by EBA to convert the granular source databases compiled in 1988 for the Upper and Lower Mackenzie Valley to a consistent format. These efforts were intended to facilitate linking of the databases. The new standardized databases are in a format consistent with the existing Yukon and Paulatuk databases which were previously compiled by EBA for INAC.

There is also a related database containing about 12,500 boreholes for the Mackenzie Valley, which EBA prepared in 1991. These logs were converted from a GSC database to an ESEBase format. This database is being updated to ESEBase Version 4.0 by EBA for the GSC in 1992-1993. Final linking of this database to the granular source databases and the report catalogue has not been addressed yet.

Report Catalogue Database

Information in the Report Catalogue Database

The objective of EBA's 1991 work, which was further extended in 1992, was to compile a report catalogue to identify sources of granular resource related information including reports, maps, field work and other data. This information was acquired from various government departments, major petroleum and pipeline companies, and geotechnical engineering consultants.

The report catalogue database summarizes general data for each report containing geophysical or geotechnical data in the Mackenzie Valley. The database now contains information from 131 reports. The report catalogue summarizes such items as the report title, the year and month of the field work, the sponsor and contractor of the work, contact names, the location coordinates and area name of the site, study type and size, a list of the granular sources names discussed in the report, the quality of the data obtained, numbers of samples obtained, where the reports and raw data are archived, and so on.

The database entries are in dBase III+ format, standardized according to the terms defined in the Data Dictionary. Figure 4 shows a sample page of the report catalogue data dictionary, which defines each of the fields contained in the database. Figure 5 shows the report catalogue database structure. A sample entry of the report catalogue is shown in Figure 6.

A brief description of the two main fields used for linking the report catalogue to other databases is as follows:

Study Number

The study number is a 12 character field which identifies the report from which borehole information is obtained, and is used as a link to other databases. The first four characters of the study number identified the contractor, the following two characters identified the year of the study, and (up to) the remaining six characters were allowed to identify the geographic area or local name. For example:

PEM 73 FG

Contractor = PEM (Pemcan)

Year of Study = 73 (1973)

Area Name = FG (Fort Good Hope)

Table 1 lists the abbreviations used for the contractor names. Table 2 lists the abbreviations used for the geographic/area names.

Source Number

The source number identifies the original source deposit number where information has been obtained and is also a link to other databases. The source number field is also twelve characters long. For most reports specific to source deposits, the original source numbers appear in the report catalogue entry. The granular source databases (discussed further below) include the original source numbers in the field "source_no".

Use of the Report Catalogue Database

The report catalogue can be used in conjunction with the existing source and borehole databases to evaluate granular resources for construction materials. The links to these other databases comprise the study number and source number fields. These fields are discussed further above.

Figure 4. Sample Page of Report Catalogue Data Dictionary: Granular Resources

| PART A: <u>STUDY REFERENCE AND LOCATION</u> | |
|---|---|
| AA - | STUDY NUMBER: A unique study identifier number which serves as a link to other databases (e.g. Source Database, ESEBase Borehole Database). |
| AB - | YEAR: The calendar year in which the majority of the field work on the study was complete (e.g. 1983). |
| ABI - | MONTH: The month in which the majority of the field work was completed (e.g. 07). |
| AC - | SPONSOR: The name of the company, department, agency or organization sponsoring the study. (e.g. Indian and Northern Affairs Canada, Yukon Transportation Engineering, Public Works Canada) |
| AC1 - | SPONSOR JOB/FILE NUMBER: The sponsor's job number. |
| AD - | SPONSOR CONTACT NAME: The name of the person within the sponsoring organization who might be contacted to obtain additional information on the study and/or authorization for its use. |
| AE - | CONTRACTOR: The name of the prime contractor, consultants or group contracted by the sponsor to undertake the study (e.g. EBA Engineering Consultants Ltd., Northern Engineering Services Company Ltd.) |

Figure 5. Report Catalogue Structure

| Field | Field Name | Type | Width | Dec | | | |
|---|------------|-----------|-------|-----|-------------|------------|---------------|
| Structure for database: C:\MACK92RC.dbf | | | | | | | |
| Number of data records: 130 | | | | | | | |
| Date of last update : 12/10/92 | | | | | | | |
| 1 | STUDY_NO | Character | 12 | | 34 | SIT_PLN_SC | Character 45 |
| 2 | YEAR | Numeric | 4 | | 35 | SIT_PLN_DN | Character 20 |
| 3 | MONTH | Numeric | 2 | | 36 | SIT_PLN_AR | Character 120 |
| 4 | SPONSOR | Character | 50 | | 37 | SOURCE_NOS | Character 180 |
| 5 | SP_JOB_NO | Character | 15 | | 38 | NEW_SRC_NO | Character 180 |
| 6 | SP_CONTACT | Character | 20 | | 39 | LINE_NO | Character 180 |
| 7 | CONTRACTOR | Character | 65 | | 40 | STUDY_TYPE | Character 120 |
| 8 | CO_JOB_NO | Character | 16 | | 41 | STUDY_SCOP | Character 60 |
| 9 | CO_CONTACT | Character | 24 | | 42 | SURV_LEVEL | Character 180 |
| 10 | MN_ZONE | Numeric | 2 | | 43 | STUDY_SIZE | Character 40 |
| 11 | MN_EAST | Numeric | 6 | | 44 | SURV_PATT | Character 40 |
| 12 | MN_NORTH | Numeric | 7 | | 45 | SURV_SPAC | Character 50 |
| 13 | MN_LAT_DEG | Numeric | 8 | 5 | 46 | PGM_LEN | Character 30 |
| 14 | MN_LON_DEG | Numeric | 9 | 5 | 47 | SEASON | Character 25 |
| 15 | CN_LAT_DEG | Numeric | 8 | 5 | 48 | EQUIP_TYPE | Character 120 |
| 16 | CN_LON_DEG | Numeric | 9 | 5 | 49 | PENETRATN | Character 120 |
| 17 | CN_ZONE | Numeric | 2 | | 50 | RESOLUTION | Character 15 |
| 18 | CN_EAST | Numeric | 6 | | 51 | SAMPL_RATE | Character 60 |
| 19 | CN_NORTH | Numeric | 7 | | 52 | SAMPL_QUAL | Character 80 |
| 20 | MX_ZONE | Numeric | 2 | | 53 | SAMPL_TYPE | Character 100 |
| 21 | MX_EAST | Numeric | 6 | | 54 | SAMPL_SIZE | Character 60 |
| 22 | MX_NORTH | Numeric | 7 | | 55 | INTRP_LEVL | Character 120 |
| 23 | MX_LAT_DEG | Numeric | 8 | 5 | 56 | RPT_LEVL | Character 100 |
| 24 | MX_LON_DEG | Numeric | 9 | 5 | 57 | RPT_ARCHIV | Character 100 |
| 25 | LOC_MAP_NO | Character | 40 | | 58 | RPT_DIST | Character 120 |
| 26 | LOC_MAP_FM | Character | 40 | | 59 | DAT_ARCHIV | Character 120 |
| 27 | LOC_MAP_SC | Numeric | 10 | | 60 | OTHER | Character 100 |
| 28 | LOC_MAP_DN | Character | 10 | | 61 | COMPILER | Character 120 |
| 29 | LOC_MAP_AR | Character | 60 | | 62 | COMP_DATE | Character 8 |
| 30 | AREA_NAME | Character | 40 | | 63 | DC_PROJ_NO | Character 15 |
| 31 | SITE_NAME | Character | 40 | | 64 | UPDATE_BY | Character 120 |
| 32 | SIT_PLN_NO | Character | 80 | | 65 | UPDT_DATE | Character 8 |
| 33 | SIT_PLN_FM | Character | 120 | | 66 | DU_PROJ_NO | Character 15 |
| | | | | | 67 | RPT_TITLE | Character 180 |
| | | | | | 68 | PROPRI | Character 80 |
| | | | | | 69 | RPT_OR_BIB | Character 10 |
| | | | | | ** Total ** | | 3786 |

Figure 6. Report Catalogue Sample Entry

MACKENZIE VALLEY TRANSPORTATION CORRIDOR
INDIAN AND NORTHERN AFFAIRS CANADA
CATALOGUE OF GRANULAR RESOURCE-RELATED INFORMATION

=====

STUDY NUMBER: EBA74FGAR MONTH: 0 YEAR: 1973

SPONSOR : DIAND
JOB NO : OSR3-0053 CONTACT: BOB GOWAN
CONTRACTOR : EBA ENGINEERING CONSULTANTS LTD
JOB NO : E-666 CONTACT: NEIL MACLEOD
REPORT TITLE: GRANULAR MATERIALS INVENTORY, STAGE III V.1, GENERAL REPORT, 1975 APRIL (SPECIFIC SITE
EVALUATION AND DATA IN VOLUMES II, III, IV)

COORDINATES :

| UTM: ZONE: | MINIMUM | CENTRE | MAXIMUM |
|---------------|-----------------------|-----------------------|-----------------------|
| EASTING: | 8 | 9 | 9 |
| NORTHING: | 0 | 0 | 0 |
| OR: LATITUDE: | 0 | 0 | 0 |
| LONGITUDE: | 66.31666 127.16666 | 67.30000 130.50000 | 68.26666 133.66666 |

LOCATION:

| NAME : | GENERAL LOCATION | SITE PLAN |
|-------------------|------------------------------------|---------------------------------------|
| NUMBER: | FORT GOOD HOPE TO ARCTIC RED RIVER | FT GOOD HOPE-LITTLE CHICAGO-RED RIVER |
| SCALE : | 1:1707000 | SOUTH HALF, NORTH HALF |
| FORMAT: | PAPER COPY | 1:250000 |
| ARCHIV: | IN REPORT | PAPER COPY |
| DIG NO: | N/A | IN REPORT |
| SOURCE NUMBER(S): | 1001-1156 | N/A |

SURVEY LINES / LOCATION DETAILS:

DESCRIPTION OF STUDY AND SURVEY DETAILS:

TYPE : GEOTECHNICAL
SCOPE: REGIONAL-150 SITES
LEVEL: EXPLORATION, BORROW INVESTIGATION (GRANULAR AND BEDROCK), REVIEW OF EXISTING DATA

SIZE : 104 BHS, 245 TPS, 17400 KM
SURVEY PATTERN: UP TO 5 BHS PER SITE, IRREGULAR
SURVEY SPACING: IRREGULAR
SEASON: PROGRAM LENGTH: 41 DAYS, SEPT-OCT 1974

EQUIPMENT : MOBILE ARCTIC AUGER-CONTINUOUS FLIGHT WITH SEISMIC TYPE AIR CIRCULATING OPTION, HELI-DRILL WITH BECKER DOUBLE WALL PIPE
PENETRATION: 0.9M-5.0M-9.1M FOR BHS, 0.9M FOR TPS
RESOLUTION : GOOD

INFORMATION ON SAMPLES OR SURVEY RECORDS:

RATE : 0.6M-1.5M
QUALITY: GOOD
TYPE : DISTURBED
SIZE : N/A

LEVEL OF DETAIL: INTERPRETATION/ANALYSIS/REPORTING:
INTERP : CLASSIFICATION OF BORROW, RECOMMENDATIONS FOR DEVELOPMENT AND RESTORATION
REPORT : FORMAL GEOTECHNICAL, MAPS, ASSESSMENTS, SITE DESCRIPTIONS
DISTRIB: SPONSOR/CONTRACTOR
OTHER : PWC74FGDH, MVPL72NH, RMH73FSIN, CASSL, CN-CP ARCTIC RAILWAY STUDY GROUP

ARCHIVING OF INFORMATION:
REPORT : SPONSOR/CONTRACTOR
DATA : SPONSOR/CONTRACTOR, FOOTHILLS PIPELINES

DATA COMPILATION AND UPDATING:
COMPILED BY: EBA ENGINEERING CONSULTANTS LTD.
DATE : 91/03/13 COMPILATION PROJECT NO.: 0306-34693
UPDATED BY : EBA
DATE : 92/12/10 UPDATE PROJECT NO.: 0101-11085

**Table 1. (part of)
Contractor Names and Abbreviations**

| CONTRACTOR NAME | ABBREVIATION |
|--|--------------|
| Acres Consulting Services Ltd. | ACR |
| BBT Geotechnical Consultants and GVM Geological Consultants Ltd. | BBT |
| J.M. Blackwell | BLK |
| J.M. Blackwell and G.H. Watson | BW |
| Canada North Engineering Ltd. | CNE |
| Canadian Arctic Gas Pipeline Ltd. | CAG |
| EBA Engineering Consultants Ltd. | EBA |
| Elmer W. Brooker & Associates Ltd. | EWB |
| Gas Arctic/Northwest Project Study Group | GSNP |
| Gas Arctic Systems Study Group Ltd. | GAS |
| Gentile, D.J., and Zaturechy, J.W. | GENT |
| Golder Associates (Western Canada) Ltd. | GAL |
| Hardy Associates (1978) Ltd. | HAL |
| Hardy BBT Ltd. | HBT |
| Neabitt, T.H.D., and Howell, J.D. | NH |
| Inuvialuit Development Corporation | IDC |
| Klohn Leonoff Consultants Ltd. | KLC |
| Klohn Leonoff Ltd. | KLL |
| Lombard Group North | LNG |
| Mackenzie Highway Granular Materials Working Group | MHG |
| Mackenzie Valley Pipe Line Research Ltd. | MVPL |
| MacLaren PlanSearch | MLP |
| J.D. Mollard and Associates Ltd. | MOL |
| not available | NA |

**Table 2. (part of)
Geographic Region or Local Names and Abbreviations**

| GEOGRAPHIC NAME | ABBREVIATION |
|--------------------------------------|--------------|
| Aklavik | AK |
| Arctic Red River | AR |
| Axe Point | AX |
| Big Smith Creek | BS |
| Bosworth Creek | BC |
| Blackwater River | BR |
| Campbell Creek | CC |
| Campbell River | CR |
| Camsell Bend | CB |
| Canot Lake | CL |
| Canyon Creek | CY |
| Caribou Hills | CH |
| Central Mackenzie Valley | CM |
| Cristine Creek | CR |
| Dempster Highway | DH |
| Enterprise | EN |
| Fort Good Hope | FG |
| Fort McPherson | FM |
| Fort Norman | FN |
| Fort Simpson | FS |
| Francis Creek | FC |
| Great Bear (River) | GB |
| Great Bear River Alternate Crossings | GBA |
| Hanna River | HR |

The report catalogue is useful for determining what has been done in a specified area. For example, a researcher can use the report catalogue to search for all the reports discussing a specified area or region (for example, Fort Good Hope) of the Mackenzie Valley. Or, a listing of all reports with a specified UTM zone, minimum and maximum northings and eastings can be made. As another example, the researcher could search for all the reports done for a specified sponsor (for instance, Esso Resources) between the years 1982 and 1988, with the data quality listed as "good". Selected report catalogue summary sheets (database entries) can be printed using the program Relational Report Writer.

Using the list of granular source numbers given in the report catalog entry, the researcher could refer to the source database for the summarized data on a particular granular source. The researcher can also use either the study number of each report found by the search, or the source numbers listed to find the related boreholes in the ESEBase borehole database. Numerous operations can be done in ESEBase to provide an evaluation of the specified area of interest. Finally, the researcher could obtain the original reports to obtain the detailed background information.

Granular Resources Databases

Information in the Granular Resources Databases

Geographic, geologic and engineering characteristics for granular resources at 762 sites in the Upper (South) Mackenzie Valley were summarized and an assessment of the potential value of each site was provided in EBA's 1988 database. HBT and Bennett provided similar information for 292 sites and 558 sites in the Lower (North) Mackenzie Valley, respectively, though HBT's information was not stored in a database.

Data was available in a variety of studies compiled by pipeline firms, government, and highway agencies. Granular deposits, potential quarry sites and existing pits described in these studies were located and presented on a series of 1:250,000 maps.

Quantitative information was interpreted by EBA for the Upper (South) Mackenzie Valley from site investigation data or original estimates, if available. Quantities removed by Public Works Canada for the Mackenzie Highway and by Interprovincial Pipe Line for the Norman Wells to Zama Crude Oil Pipeline

were included, if applicable, and where they were available.

Five new Borrow Management Areas were proposed by EBA to be contiguous with the seven areas developed in 1986 for the Lower (North) Mackenzie Valley by HBT AGRA. These areas generally encompass similar geologic materials and resource availability. Regional requirements and shortages of granular materials were broadly addressed by considering future community, highway, pipeline and airstrip demands relative to the distribution of the previously identified deposits. Recommendations were presented to address concerns raised in the Fort Providence, Fort Simpson and Fort Norman areas, and south of River-Between-Two-Mountains.

The following information is presented in the granular source databases:

- Summaries of granular sources based on published and unpublished reports relating to surficial geology and granular materials of the Upper Mackenzie Valley.
- Data from various reports related to a single granular deposit, condensed into a single entry for the South Mackenzie database. (It is not certain how much or how little condensing of data was done for the North Mackenzie database).
- A unique identification number (South Mackenzie database only).
- Summary of the previously documented characteristics of each deposit including quantity of granular material, where possible.
- Summary of the previously documented development history and/or development constraints (environmental) that have been identified for each deposit.
- Provision of additional geologic and geomorphic data which can be readily interpreted from the reports and maps.
- Assessment of the level of reliability for the existing data.
- Assignment of a priority for further study to each deposit.

Figure 7 shows a sample page of the source database data dictionary, which defines each of the fields contained in the database. Figure 8 shows the source database structure. A sample entry of the source database is shown in Figure 9.

There are still a few minor differences between the North and South Mackenzie databases. For instance, the North Mackenzie source database entries had only one "primary" study number assigned. However, in the South Mackenzie source database, the entries in the source database were intended to be a compilation of information from all the references listed for each source, therefore, a "primary" study (report) reference was not used. In some cases, sources which were listed as separate sources in the original reports have been combined. Thus, choosing one report as taking priority over another in the South Mackenzie database may be misleading.

Also, because they are part of the same geologic feature, numerous sources described in the South Mackenzie source database cross geographic boundaries such as creeks or rivers. One report may be more applicable for one side of the creek, whereas another may be more applicable to the other side of the creek. Presumably a researcher with a more than cursory interest in a specific source would obtain all of the original references to any particular granular source.

With these considerations in mind, a single unique study number was also assigned to each source in the South Mackenzie database, for the purpose of creating a convenient link to the report catalogue. Table 3 shows a list of EBA's 1988 reference numbers correlated to the new 1992 study numbers. Table 4 lists Bennett's 1988 reference numbers correlated to the new 1992 study numbers. Where more than one report applies to a particular granular source, these additional reports are listed in the study reference field.

For the South Mackenzie Valley, there are unique EBA-assigned source numbers. For the North Mackenzie Valley, only the original source numbers appear in the source database. EBA has not assigned source numbers to the North Mackenzie database. This is a task which could be done at some later date, perhaps by use of UTM grid coordinates, correlating HBT's and Bennett's work.

Use of the Granular Source Databases

In total, 1320 sources have been described in the source databases compiled by EBA (1988) and Bennett (1988). These databases thus far have been kept separate; however, they could be merged if desired. The study number and source number fields are used as links to other databases. Entries can be printed using Relational Report Writer.

From the source database, a printout (as shown on Figure 9) can be made of a specified source or sources. Details on soils in an area can be obtained, including numbers of boreholes, type and thickness of overburden, details on proportions of gravel/sand/fines in the granular resource, and test result summaries can be obtained. Or, the relevant study numbers can be used to refer to the report catalogue, perhaps to acquire information on other related sources. Or, all the sources with an overburden layer of less than 0.5 m thick could be printed. Or, one could print all the sources which are described as fluvial deposits, or all those sources with a "high" development potential.

Various parameters can be calculated using dBase commands, including historical demand for granular material, as shown in Table 5. For the Upper Mackenzie Valley, more demand data is available, because the volumes of granular material used for the Mackenzie Highway and the pipeline were recorded if found in the original source reports. The Lower Mackenzie database does not have this information.

The study and source numbers, or the UTM northings and eastings, can also be used to link to the ESEBase borehole database, to obtain very detailed information on a specific site.

ESEBase Borehole Database

Information in the ESEBase Borehole Database

As a separate project in 1991, an ESEBase borehole database containing about 12,500 boreholes for the Mackenzie Valley was converted from a GSC database by EBA. It is about 24.5 MB in size and covers the entire Mackenzie Valley. The main objective for EBA's 1992-1993 work on this database was to update it to ESEBase Version 4.0. Final linking of this database to the granular source databases and the report catalogue has not been addressed.

Figure 7. Sample Page of Source Database Data Dictionary: Granular Resources

| PART A: <u>DEPOSIT LOCATION AND STATUS</u> | |
|--|---|
| AA1 - | OLD STUDY NUMBER: The sources listed in Bennett's 1988 source database have an old study number which was the original study number assigned to the report reference for the source by Bennett. |
| AA2 - | STUDY NUMBER: Each source has been assigned a unique study identifier number, to serve as a link to other databases (e.g. the report catalogue, and ESEBase borehole database). This number identifies the study in which the source was first described in detail and provides a link to INAC's granular resource study catalogue database. The number consists of an alphabet prefix representing the sponsor of the report (4 characters), the year of the study (2 digits, and the geographic location or area (up to 6 characters), (e.g. INAC87PL). |
| AA3 - | ASSIGNED SOURCE NUMBER: The sources listed in EBA's 1988 source database have a unique source number which correlate to mapped source locations. These source numbers refer to granular deposits which may comprise one or several of the original source numbers. This number is a numeric sequence with the Land Management Area as a prefix, and an arbitrarily assigned source number as a suffix (e.g. 7.043). |
| AA4 - | SOURCE NUMBER: Each source has been assigned a unique source identifier number, normally the number of the source in the original study which located the source, which will serve as a link to other databases (e.g. ESEBase borehole database). This number consists of an alphanumeric sequence of up to twelve digits (e.g. 87-P-12). |

Figure 8. Database Structures for North and South Mackenzie Valley: Granular Sources

| Structure for database: C:SRCE92NM.dbf | | | | Structure for database: C:SRCE92SM.dbf | | | | | | | | |
|--|------------|-----------|-------|--|----|------------|-----------|-----|-------------|-------------|-----------|------|
| Number of data records: 558 | | | | Number of data records: 762 | | | | | | | | |
| Date of last update : 12/07/92 | | | | Date of last update : 12/08/92 | | | | | | | | |
| Field | Field Name | Type | Width | Dec | 30 | PAST_USE | Character | 75 | 61 | USC_NO. | Numeric | 3 |
| 1 | O_STUDY_NO | Character | 12 | | 31 | EXC_VOL_MH | Numeric | 9 | 62 | USC_CLASS | Character | 30 |
| 2 | STUDY_NO | Character | 12 | | 32 | EXC_VOL_PL | Numeric | 9 | 63 | MC_NO | Numeric | 3 |
| 3 | ASN_SRC_NO | Character | 6 | | 33 | PERF_RATIN | Character | 50 | 64 | MC_RESULTS | Character | 14 |
| 4 | SOURC_NO | Character | 12 | | 34 | INVEST_LEV | Character | 25 | 65 | SI_ZANAL_NO | Numeric | 3 |
| 5 | STUDY_REF | Character | 132 | | 35 | LAST_DATE | Character | 4 | 66 | OVERSIZE | Character | 8 |
| 6 | SOURCE_REF | Character | 125 | | 36 | GEPHYS_DAT | Character | 60 | 67 | GRAVEL | Character | 8 |
| 7 | NTS_REF | Character | 15 | | 37 | THDENSITY | Character | 10 | 68 | SAND | Character | 8 |
| 8 | LOCAL_NAME | Character | 25 | | 38 | BHOLE_NO | Numeric | 4 | 69 | FINES | Character | 8 |
| 9 | MAP_DIG_NO | Character | 5 | | 39 | BHOLE_DEPT | Character | 14 | 70 | D_50 | Character | 17 |
| 10 | LOC_MAP_SC | Character | 8 | | 40 | TESTP_NO | Numeric | 3 | 71 | PETRO_NO | Numeric | 3 |
| 11 | LOCATION | Character | 100 | | 41 | TESTP_DEPT | Character | 14 | 72 | PETRO_RESU | Character | 11 |
| 12 | CN_LAT_DEG | Numeric | 8 | 5 | 42 | EXPOS_NO | Numeric | 3 | 73 | OTHERTESTS | Character | 152 |
| 13 | CN_LON_DEG | Numeric | 9 | 5 | 43 | EXPOS_DEPT | Character | 14 | 74 | CLASS_1 | Character | 32 |
| 14 | CN_ZONE | Numeric | 2 | | 44 | DATAQUALIT | Character | 40 | 75 | CLASS_2 | Character | 32 |
| 15 | CN_EAST | Numeric | 6 | | 45 | GENERIC_OR | Character | 25 | 76 | CLASS_3 | Character | 32 |
| 16 | CN_NORTH | Numeric | 7 | | 46 | LANDFORM | Character | 50 | 77 | CLASS_4 | Character | 32 |
| 17 | COR_NO_NAM | Character | 50 | | 47 | TOPOGRAPHY | Character | 20 | 78 | CLASS_5 | Character | 32 |
| 18 | KILO_POST | Numeric | 6 | 1 | 48 | SLOPE | Character | 25 | 79 | TOTAL_VOLU | Numeric | 9 |
| 19 | OFST_DS_DR | Character | 37 | | 49 | DRAINAGE | Character | 40 | 80 | PROV_VOL | Numeric | 9 |
| 20 | DISTANCE | Character | 10 | | 50 | VEGETATION | Character | 75 | 81 | PROB_VOL | Numeric | 9 |
| 21 | ACCESS | Character | 150 | | 51 | PERMF_FEAT | Character | 60 | 82 | PROS_VOL | Numeric | 9 |
| 22 | CONDITION | Character | 40 | | 52 | ACTV_LAYER | Character | 11 | 83 | TOTAL_RECO | Numeric | 9 |
| 23 | AREA | Numeric | 4 | | 53 | ACTV_DATE | Date | 8 | 84 | ANNUAL_REC | Numeric | 8 |
| 24 | SIT_PLN_SC | Character | 8 | | 54 | GRANULR_TP | Character | 150 | 85 | STDY_PRIOR | Character | 15 |
| 25 | PLN_DIG_NO | Character | 5 | | 55 | GRANULR_TH | Character | 14 | 86 | COMPILER | Character | 120 |
| 26 | LND_TENURE | Character | 30 | | 56 | OVRBURD_TP | Character | 30 | 87 | COMP_DATE | Date | 8 |
| 27 | STATUS | Character | 22 | | 57 | OVRBURD_TH | Character | 14 | 88 | CO_PROJ_NO | Character | 15 |
| 28 | STOCK_TYPE | Character | 30 | | 58 | UNDRBUR_TP | Character | 30 | 89 | UPDATE_BY | Character | 120 |
| 29 | STOCK_QUAN | Character | 15 | | 59 | DEV_CONSTR | Character | 180 | 90 | UPDT_DATE | Date | 8 |
| | | | | | 60 | DEV_POTENT | Character | 20 | 91 | UP_PROJ_NO | Character | 15 |
| | | | | | | | | | ** Total ** | | | 2760 |

Figure 9. Source Database Sample Entry

MACKENZIE VALLEY TRANSPORTATION CORRIDOR (MVT)
 GRANULAR RESOURCES DATABASE
 SOURCE DATABASE DATA SHEET

===== PART A: LOCATION AND STATUS =====
 SOURCE NUMBER : 100 STUDY NO. : EWB73MH1 ASSIGNED SOURCE NUMBER: 7.043
 NTS MAP REFERENCE : 96-E(6) DIGITIZ NO: NR MAP SCALE : 1:NR
 UTM ZONE-EASTING : 9 - 584500 LOCATION : W of Billy Creek N of Mac
 UTM NORTHING : 7249900
 LOCAL NAME(S) : NOT RECORDED
 CORRIDOR NO./NAME : 03 - MACKENZIE VALLEY
 KILOMETRE POST : OFFSET(m) : SEE AC
 CROSS REFERENCES : HAL86NH,EWB73MH1,EWB73MH2

SOURCE ACCESS : Mackenzie Hwy
 ACCESS DISTANCE (m): SEE ACCESS CONDITION : SEE ACCESS
 AREA (ha) : 1 SITE SCALE: 1:NR DIGITIZ NO: NR
 LAND TENURE : NOT RECORDED STATUS : NOT RECORDED
 PAST USE - SOURCE : SEE EXC_VOL_MH (HIGHWAY) AND STOCKPILE - TYPE : NOT RECORDED
 EXC_VOL_PL (PIPELINE) IN M^3 - QUANTITY : NOT RECORDED
 PERFORMANCE RATING : NOT RECORDED

===== PART B: SOURCE INVESTIGATION AND DESCRIPTIVE INFORMATION =====
 INVESTIGATION LEVEL: NOT RECORDED LAST INVEST DATE : NR
 GEOPHYSICAL DATA : NOT RECORDED TEST MOLE DENSITY (#/ha): 5.
 BOREHOLES - NUMBER : 8 TEST PITS - NO. : 0 EXPOSURES - NO. : 0
 - DEPTH (m) : 5.50 (MAX) - DEPTH (m): 0.00 (MAX) - DEPTH (m) : NOT RECORDED
 DATA QUALITY : fair
 SOURCE TOPOGRAPHY : NOT RECORDED SLOPE: NOT RECORDED
 AREA DRAINAGE : -
 SOURCE VEGETATION : NOT RECORDED
 PERMAFROST FEATURES: ICE CONTENT - high
 ACTIVE LAYER (m) : NOT REC'D DESCRIPTION DATE :
 GENERIC ORIGIN : aeolian LANDFORM(S) : sand dunes
 GRANULAR - TYPE : SAND OVERBURDEN-TYPE : peat & silt
 - THICKNESS (m) : 3.50 - THICKNESS (m) : 0-0.8
 UNDERBURDEN : NOT RECORDED
 DEVELOP. CONSTRAINT: -
 DEVELOP. POTENTIAL : poor to unsuitable

===== PART C: TEST RESULTS AND MATERIAL QUANTITY =====
 USC - NUMBER : MOISTURE CONTENT-NUMBER : 32
 CLASS : NOT RECORDED SAND (%): NOT RECO -RESULTS: NOT RECORDED
 SIZE ANALYSIS-NO. : 2 GRAVEL (%): NOT RECO FINES (%): NOT RECO
 - OVERSIZE (%): NOT RECO D-50 (um) : NOT RECORDED

PETROGRAPHIC ANALYSIS-NO. OF TESTS: 0 RESULTS: NOT RECORD
 OTHER TESTS (see the DATA DICTIONARY) : 0
 MATERIAL QUANTITY (All in cubic metres) CLASS 1:
 CLASS 2:
 TOTAL RECOVERABLE : 50000 CLASS 3:
 ANNUAL RECOVERABLE : CLASS 4: 0/ 50000/ 0
 TOTAL VOLUME : 50000 CLASS 5:
 PROVEN : 0 PROBABLE : 50000 PROSPECTIVE : 0

===== UPDATE INFORMATION =====
 RECORD UPDATED BY : EBA ENGINEERING CONSULTANTS LTD.
 LAST UPDATE : 12/07/92
 UPDATE PROJECT NO. : 0101-11085

Table 3. (part of)
EBA 1988 Reference Numbers and EBA 1992 Study Numbers

| EBA 1988 REFERENCE NUMBER | EBA 1992 STUDY NUMBER |
|---------------------------|-----------------------|
| 1 | NES75FGAB |
| 2 | PEM73FSWR |
| 3 | NES74MV |
| 4 | PEM73WRFN |
| 5 | PEM73FS |
| 6 | NES75MDFS |
| 7 | PEM73FNNW |
| 8 | PEM73FN |
| 9 | PEM73WR |
| 10 | PEM73NW |
| 11 | PEM73FS |
| 11A-19 | GSC73SM5 - GSC73SM13 |
| 20 | ESP73SM |
| 21 | EBA80MV |
| 22 | PAAG74MV |
| 23 | IPL80NW |
| 24 | PWC75MH1 |
| 25 | PWC73MH |
| 26 | PWC76FSRM |
| 27 | PWC81MH |
| 28 | PWC86MH |
| 29-36 | GSC73SM14 - GSC73SM21 |
| 37 | IPL80NW |
| 38 | EWB73MH1 |

Table 4. Bennett 1988 Study Numbers and EBA 1992 Study Numbers

| BENNETT 1988 STUDY NUMBERS | EBA 1992 STUDY NUMBERS |
|----------------------------|---------------------------------|
| A-0101-1 | EBA74FGAR |
| A-0102-1 | PEM73FG PEM73NWFG PEM73NW |
| A-0103-1 | RKL73AR RKL73MV |
| A-0104-1 | NES76NM * |
| A-0105-1 A-105-01 | TEC76MV |

*Report not seen by EBA at time of writing, preliminary entry done in report catalogue dated 1975, 1976; designated NES76NM.

Table 5. Summary of Numerical Data from SOURCE Databases

| PARAMETER CALCULATED | UPPER MACKENZIE | LOWER MACKENZIE |
|---|-----------------|-----------------|
| Sum of source areas (ha) | 177,097 | 73,801 |
| Average area of source (ha) | 232 | 132 |
| Sum of boreholes drilled | 1491 | 357 |
| Sum of testpits excavated | 363 | 313 |
| Average number of boreholes/site | 2 | < 1 |
| Average number of testpits/site | < 1 | < 1 |
| Sum of proven volumes (m ³) | 290,535,000 | 1,314,722,000 |
| Sum of probable volumes (m ³) | 372,038,000 | 1,911,871,500 |
| Sum of prospective volumes (m ³) | 15,367,671,000 | 3,668,946,500 |
| Sum of volumes for highway (m ³) | 3,196,000 | not recorded |
| Sum of volumes for pipeline (m ³) | 999,000 | not recorded |

The ESEBase borehole logs contain information such as location of the borehole, soil classification data and description, ground ice description, and so on. A sample borehole log as printed from ESEBase is shown in Figure 10. Figure 11 shows a scatterplot of borehole locations in the Mackenzie Valley.

Use of the ESEBase Borehole Database

The researcher can use the borehole database to call up, for example, boreholes from a specified region, or boreholes with a specified gravel content. The researcher can then produce area plots showing the boreholes, stratigraphic cross-sections, plots of laboratory data versus depth, individual borehole plots,

and so on. Improved mapping features will be available with the new *Infocus/FoxPro* implementation of ESEBase.

Summary

This presentation has summarized the information available in each of the report catalogue database, the granular source databases, and the ESEBase borehole database for the Mackenzie Valley. The most probable uses of each of the databases has been discussed, and some sample outputs have been presented. These databases should be a useful tool for future granular resource research in the Mackenzie Valley.

Figure 10. Sample ESEBase Borehole Log

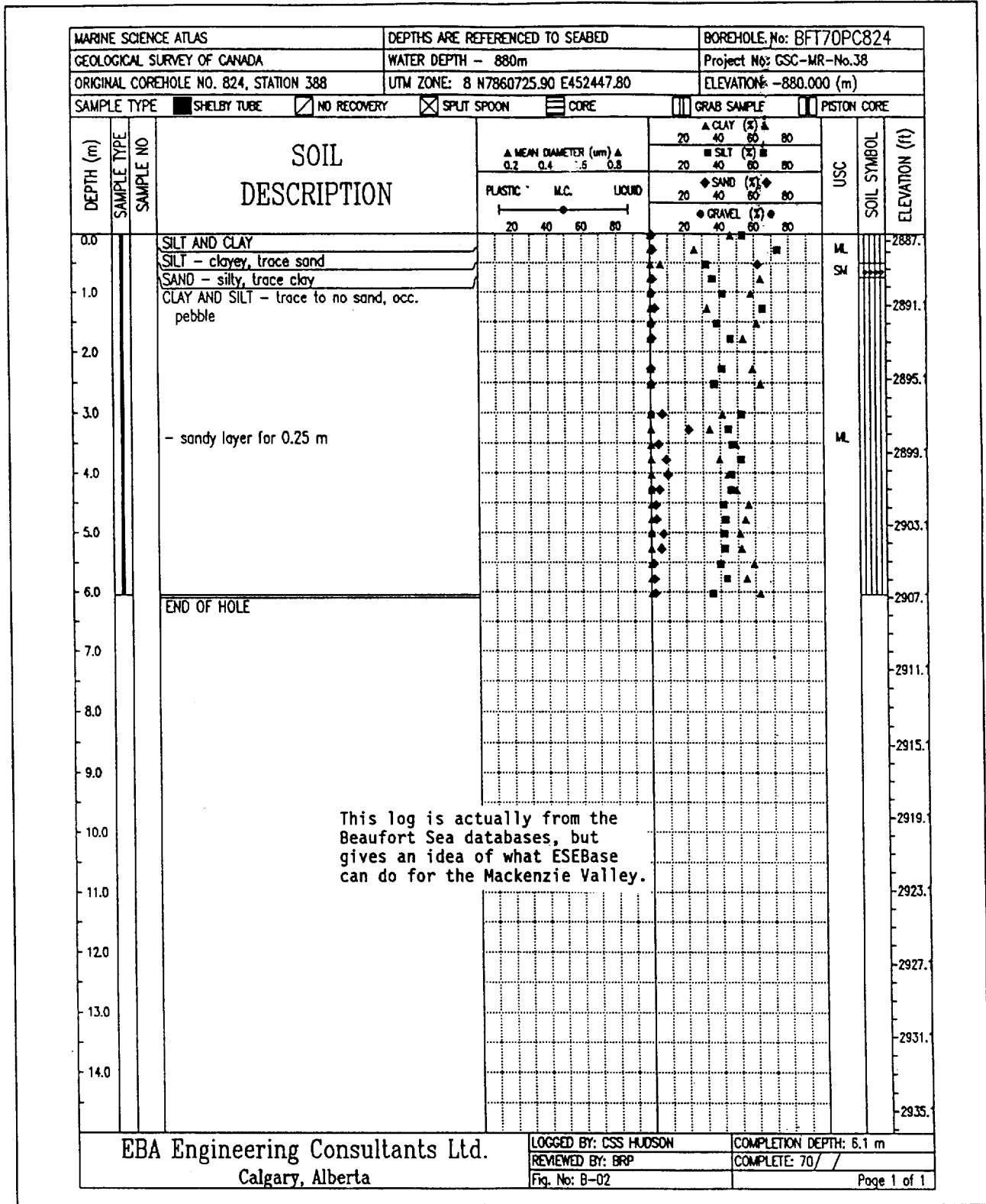
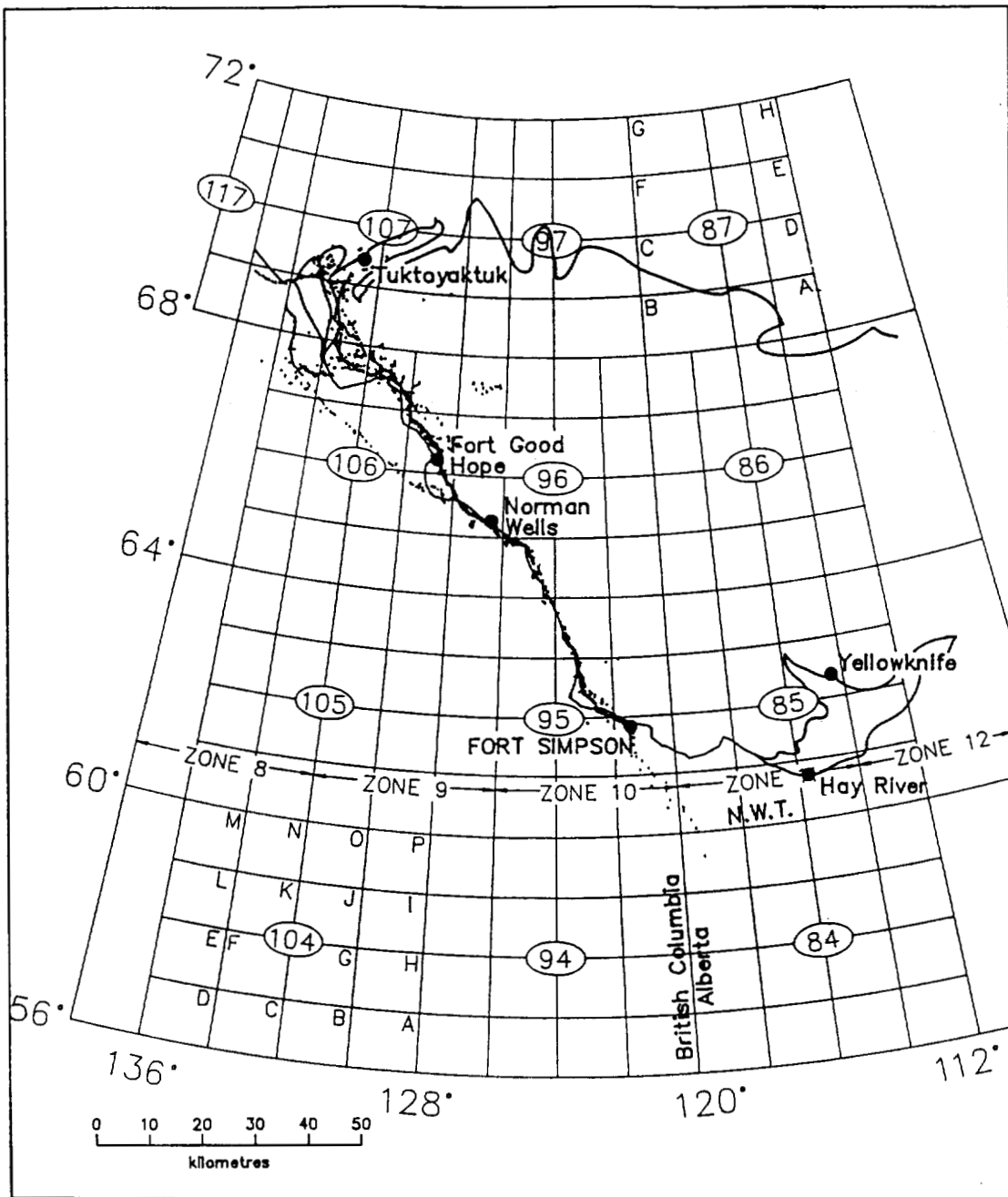


Figure 11. Scatterplot of Borehole Locations in the Mackenzie Valley



| | | | | | |
|--|------------|------|-----|---|-----|
| EBA Engineering Consultants Ltd. | | | | PROJECT MACKENZIE VALLEY DATABASE | |
| CLIENT INDIAN AND NORTHERN AFFAIRS CANADA | | | | TITLE SCATTERPLOT OF BOREHOLE LOCATIONS IN THE MACKENZIE VALLEY | |
| DATE | 89-09-29 | DWN. | CGE | CHKD. | DWH |
| FILE NO. | 0101-11085 | | | FIGURE 11 | |