EBA Engineering Consultants Ltd.

Civil, Geotechnical and Materials Engineers

INUVIALUIT SETTLEMENT SAND AND GRAVEL INVENTORY AND RECOMMENDATIONS FOR DEVELOPMENT

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PREPARED FOR

INDIAN AND NORTHERN AFFAIRS CANADA

APRIL 1987

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INUVIALUIT SETTLEMENT SAND AND GRAVEL INVENTORY AND RECOMMENDATIONS FOR DEVELOPMENT

HOLMAN

REPORT SUBMITTED TO

INDIAN AND NORTHERN AFFAIRS CANADA

SUBMITTED BY

EBA ENGINEERING CONSULTANTS LTD.

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EXECUTIVE SUMMARY

This report presents the results of a study, conducted under the terms of the Inuvialuit Final Agreement, to determine the supply of granular materials and the 20-year demand for granular materials in the community of Holman. Development scenarios and recommendations designed to optimize the utilization of resources for the anticipated demand are presented.

In summary, the 20-year demand for granular materials in the community is approximately 126,000 cubic metres. Seventy-eight percent of the demand is for maintenance of community facilities, the remainder is for local capital projects (28,300 cubic metres).

Granular materials sufficient to meet the forecast demand are available in the Holman area. Rock, rock products, high quality fill and general fill are readily available on a year-round basis by all-weather roads. High quality (Class 1) aggregate is in relatively short supply, with only one small deposit located through the study. While the community does not have a large demand for this type of granular material, it is important that the deposit be reserved for projects where Class 1 material is required. Substantial granular resource deposits are located several kilometres from the community. Development of these sources is not recommended at present; however, if any large projects are undertaken in the community, the deposits should be considered for use.

Holman is a community that has been meeting its granular resource requirements adequately for many years. It is recommended that the community continue to obtain and manage its granular resources in the manner it has established.

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1.0 INTRODUCTION

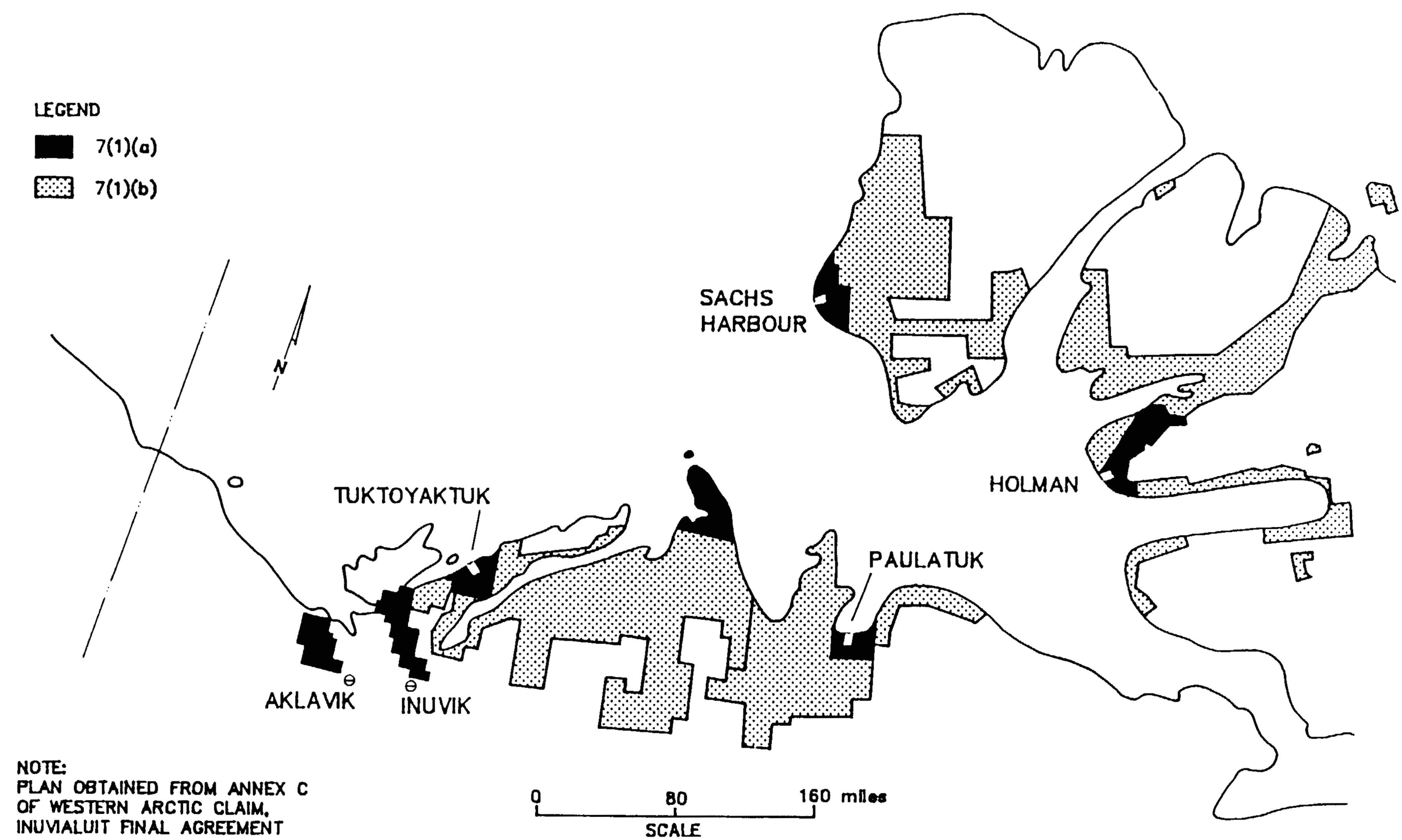
1.1 Background

The Inuvialuit Final Agreement provided that Canada grant to the Inuvialuit, fee simple title to a land quantum of 90,650 square kilometres (35,000 square miles) in the Western Arctic Region. The Agreement further specified that the land be sub-divided into two categories, that with mineral rights and that without. For purposes of classification, the two categories have become known as 7(1)(a) and 7(1)(b) lands, respectively. The former includes 12,950 square kilometres (5,000 square miles) of lands; the latter 77,700 square kilometres (30,000 square miles). The 7(1)(a) lands are generally located adjacent to each of the six communities (Aklavik, Holman, Inuvik, Paulatuk, Sachs Harbour and Tuktoyaktuk, Figure 1) considered in the Final Agreement. The 7(1)(b) lands generally surround the 7(1)(a) lands and extend outward from the communities.

The Agreement recognized that most of the proven granular resources of acceptable quality within reasonable distance of the communities were located on Inuvialuit 7(1)(a) lands. In order to ensure that adequate reserves of granular material were maintained at a regulated cost, the Agreement granted control of the 7(1)(a) granular resources to the Inuvialuit, subject to certain provisions.

For purposes of the project described in this report, the provisions concern the supply of, and the demand for, granular resources. Under the terms of the provisions, the Inuvialuit agreed to maintain granular material reserves of appropriate quality sufficient to meet the projected 20-year demand as determined by the Inuvialuit Land Administration [ILA] and appropriate levels of government . The demand for granular materials was to be formed on the basis of estimates of requirements in each community.

In order to ensure that adequate supplies of sand and gravel of appropriate quality remained available within reasonable distance of the communities, the provisions stipulated that the supply of granular materials should be priorized according to end use as determined by the 20-year demand. The first priority was established as the need of the community, the second priority is the need of the Inuvialuit and the third priority is the need of others.



EBA Engineering Consultants Ltd.		PROJECT: GRANULAR RESOURCES INVENTORY AND MANAGEMENT PLAN	
CLIENT: INDIAN AND NORTHERN AFFAIRS CANADA		TITLE: INUVIALUIT LANDS LOCATION PLAN WESTERN ARCTIC AGREEMENT	
DATE 87/02/24	DWN EBR	CHKD BAB	JOB NO. 0101–4575	4575–001

Indian and Northern Affairs Canada [INAC], on behalf of the ILA, has undertaken to develop a granular resources inventory and management plan to fulfill these initial obligations. This report presents the resource inventory as it is currently known together with certain development recommendations for the community of Holman.

1.2 Project Authorization

This study was authorized by Supply and Services Canada [SSC] through Contract No. 25ST.A7134-6-0014, awarded to EBA Engineering Consultants Ltd. [EBA]. The Scientific Advisor for the project was Mr. R. J. Gowan, Geotechnical Advisor for the Northern Renewable Resources Directorate of INAC.

1.3 Project Scope

The project scope, as defined by SSC and INAC in the contract, included the following:

a)Development of granular resource supply models for each of the six communities by examination of all existing reports describing granular material deposits.

b)Development of a granular resource demand model for each community through consultation with private and public sector users.

c)Development of a recommended resource development scenario for each community to ensure reserves are established according to the priorities outlined in the Inuvialuit Final Agreement.

d)Preparation of appropriate development recommendations for those sources with the best development prospects.

The following task was subsequently added to the project through a contract amendment:

e)Development of a geotechnical data base consisting of historic borehole information from the study area.

2.0 EVALUATION OF GRANULAR RESOURCES

2.1 Classification

2.1.1 General

A standard for the classification of granular borrow material does not exist within the study area. The first granular resource inventories in the region, carried out in the early 1970's, classified potential borrow material encountered during exploration according to the Unified Classification System [USC]. However, this general classification proved inadequate because there was no direct reference to the end use of the material.

Several years ago, the Government of the Northwest Territories [GNWT] initiated a classification system whereby potential granular borrow was graded according to its most suitable application. The territorial government's system provided the following five material groups:

- Concrete Aggregate [CA],
- Surfacing Material [SM],
- Base [B],
- Subbase [SB],
- Embankment [E] and
- Rip-Rap.

In 1983, INAC adopted a classification system similar to that presented in the draft Territorial Pits and Quarries Regulations that considered both the USC classification of the material as well as the most suitable end use. This system, modified by INAC, is the basis for all borrow material classification carried out under the current contract.

Materials at prospective borrow sources have been graded into one of the five following classes:

Class 1	Excellent Quality Material,
Class 2	Good Quality Material,
Class 3	Fair Quality Material,
Class 4	Poor Quality Material and
Class 5	Bedrock, Felsenmeer and Talus.

These abbreviated descriptions are elaborated upon in the following subsections of this report.

2.1.2 Class 1

Excellent quality material consisting of clean, well-graded, structurally-sound sands and gravels suitable for use as high quality surfacing materials, or as high quality asphalt or concrete aggregate, with a minimum of processing.

2.1.3 Class 2

Good quality material generally consisting of well-graded sands and gravels with limited quantities of silt. This material will provide good quality base and surface course aggregates or structure-supporting fill. Production of concrete aggregate may be possible with extensive processing, except where deleterious materials are present.

2.1.4 Class 3

Fair quality material consisting generally of poorly-graded sands and gravels with or without substantial silt content. This material will provide fair quality general fill for roads, foundation pads or lay-down yards.

2.1.5 Class 4

Poor quality material generally consisting of silty, poorly-graded, fine-grained sand with minor gravel. These deposits may also contain weak particles and deleterious materials. These materials are considered suitable for marginal general (non-structural) fill.

2.1.6 Class 5

Bedrock of fair to good quality, felsenmeer or talus. Potentially excellent sources of construction material, ranging from general fill to concrete aggregate or building stone if quarried and processed. Also includes erosion control materials such as rip-rap or armour stone.

2.1.7 Summary

The five material classes presented above are summarized in Table 1. For reference purposes, the GNWT's classification system has been correlated in the table with the adopted INAC system.

TABLE 1 GRANULAR MATERIAL TYPES

MATERIAL DESCRIPTION	CLASS	POTENTIAL APPLICATIONS
Excellent quality material consisting of clean, well-graded, structurally-sound sands and gravel suitable for use as high-quality (e.g., runway or roof) surfacing materials, or as asphalt or concrete aggregate, with a minimum of processing.	1	Concrete Aggregate (CA), Surfacing Material (SM)
Good quality material generally consisting of well-graded sands and gravels with limited quantities of silt. This material will provide good quality base and surface course aggregates or structure-supporting fill. Production of concrete aggregates may be possible with extensive processing, except where deleterious materials are present.	2	Concrete Aggregate (CA), Surfacing Material (SM)
Fair quality material consisting generally of poorly-graded sands and gravels with or without substantial silt content. This material will provide fair quality general fill for roads, flexible foundation pads, or lay-down yards.	3	Base (B), Subbase (SB), Embankment (E)
Poor quality material generally consisting of silty, poorly-graded, fine-grained sand, with minor gravel. May also contain weak particles and deleterious materials and are considered suitable only for marginal, general (non-structural) fills.	4	Subbase (SB), Embankment (E)
Bedrock of fair to good quality, felsenmeer, or talus. Potentially excellent sources of construction material, ranging from general fill to concrete aggregate or building stone if quarried and processed. Also includes erosion control materials such as rip-rap or armour stone.	5	Rip-rap, or if processed properly, equivalent to Class 1 or any other class of material.

2.2 Inventory

The calculated volumes of the various types of granular materials available at the examined sources have been divided into various certainty levels, as detailed below. These definitions are consistent with those used by INAC.

2.2.1 Proven

A 'proven' volume is one whose occurrence, distribution, thickness and quality is supported by ground truth information such as geotechnical drilling, test pitting and/or exposed stratigraphic sections. Usually the thickness of material encountered in a borehole is extrapolated to a radius not exceeding 50 metres around the hole.

2.2.2 Probable

A 'probable' volume is one whose existence and extent is inferred on the basis of direct and indirect evidence, including topography, landform characteristics, airphoto interpretation, extrapolation of stratigraphy, geophysical data and/or limited sampling.

2.2.3 Prospective

A 'prospective' volume is one whose existence is suspected on the basis of limited direct evidence, such as airphoto interpretation and/or general geological considerations.

In the context of this project, the uncertainty associated with prospective volumes of granular material varies with the terrain conditions specific to the various communities. For instance, substantial amounts of bedrock are located northwest of the community of Aklavik. Since the bedrock has not been explored in detail, the volume of rock is considered to be prospective. Any exploration would likely result in the prospective volume becoming 'probable' or 'proven'. The situation is very different in the vicinity of Tuktoyaktuk, where granular materials are scarce and landforms are poorly defined. Features that contain 'prospective' volumes of material are often found during detailed investigation to contain little or no useable granular material.

3.0 SUPPLY OF GRANULAR RESOURCES

3.1 General

The amount of information available on the borrow sources in the vicinity of each community varies greatly. This is due in part to the historic level of activity in and around each community, but predominately to the relative supply of acceptable quality borrow within reasonable distance of the community.

Communities whose growth has not been significantly affected by northern petroleum exploration (ie. Holman, Paulatuk and Sachs Harbour) have little formal information regarding the location, size and quality of appropriate borrow sources. As the granular materials demand in general is modest and wholly generated by the community, there is little incentive to undertake borrow material studies provided adequate quantities for current needs exist adjacent to the community. The quality of the borrow materials may not meet desirable standards but this is usually offset by the convenient location. If the borrow performs poorly once in place, it is a simple matter to obtain more material and improve the deteriorating areas.

Communities whose recent growth can be partially attributed to northern petroleum exploration (Inuvik and Tuktoyaktuk) have greater requirements for granular resources. These requirements usually impact both the quality and quantity of borrow materials . Industrial developments usually require large volumes of higher quality material.

The extent of identification and investigation of granular material sources has depended upon local demand. Minimal information is available pertaining to borrow reserves in the vicinity of Holman, Paulatuk and Sachs Harbour. Transport Canada has conducted airphoto studies for the area adjacent to each community, but the results have not been confirmed by field evaluations. Information pertaining to borrow resources for Inuvik and Aklavik is available , however, extensive exploration work has not been undertaken because developed sources have been sufficient to meet the demands.

Tuktoyaktuk is a unique situation with respect to supply of granular materials Although Tuktoyaktuk has grown substantially over the past 10 years and petroleum resource activities have put unusual demands on granular material resources, semi-continuous granular resource exploration activities have generally failed to prove large deposits of quality material within a reasonable distance of the community.

The supply of granular resources for the six western Arctic communities was determined summarizing existing data from site investigations, airphoto interpretation and field reconnaissance of prospective sources. These estimates were made by combining the areal extent of the sources (aerial photography and field measurements) with the stratigraphy determined from test pits and boreholes within the source.

The accuracy of the estimates may not accurately reflect the true situation as detail is lacking for certain sources. Some sources have no ground truthing or very few boreholes and test pits and the depth to which the investigations were completed was often insufficient to reasonably represent the extent of the individual materials within a source. Testing of samples for moisture content or grain size analysis was not necessarily carried out consistently and so designation of a certain class of material to a particular source may be based only upon visual soil description.

Source-by-source descriptions and estimated material volumes are located in the Supply appendix. The following sections describes the supply of granular resources situated on or near 7(1)(a) and 7(1)(b) lands adjacent to the community of Holman.

3.2 Holman

3.2.1 General

The community of Holman is located on the west coast of Victoria Island. The terrain in the vicinity of the community is of variable relief and consists of moderately sloping sedimentary rock towards the northwest and very rugged flat-lying intrusive diabase/gabbroic sills to the east and southeast.

There are two principal types of sand/gravel deposits in the Holman area. Raised beaches, comprised of flat clasts of gravel and broken rock, are located along the coast, while inland there are several small kame-like and glaciofluvial deposits. The latter sources are located too far from the community to be of practical use while the former serves as Holman's main source of granular material.

A complete description of the granular resources located within the community's region is presented in the following sub-sections. All of the sources discussed have been identified through airphoto interpretation and limited visual source inspection.

3.2.2 Class 1

One source of Class 1 material exists and is located within the community limits. Source 87-H-8 has a proven, probable and prospective volume of 3000 cubic metres of Class 1 material (Figure 3 and Table 4). This source is presently being developed but may be depleted in a short period if the demand for Class 1 material were to increase.

3.2.3 Class 2

Four sources are presently identified as having significant volumes of Class 2 material in the Holman region. Figure 3 shows a prospective volume of material of 1,210,000 cubic metres. The probable volume from these sources is however, only 60,000 cubic metres. Table 5 shows that there are four sources that are within the community limits and are currently being developed. Of these four sources, only 87-H-5 has any Class 2 material. The Northwest Territories Department of Public Works and Highways has sampled the existing pits and tested the gradation. It appears that with some processing, acceptable concrete aggregate (Class 1) could be produced from several of the Class 2 sources. Careful quality control will be necessary to produce an acceptable product.

3.2.4 Class 3

Seven of the eleven viable sources within the Holman region have prospective volumes of Class 3 material (Table 6). The total prospective volume has been estimated at 1,675,000 cubic metres. Probable volumes have been determined to be 575,000 cubic metres at three of the seven sources. No proven resources of Class 3 material were identified. Source 87-H-12 with 750,000 cubic metres has been identified as the largest single source but it is located 15 km away and is only accessible by barge. Source 87-H-8 is located within the town limits, has 300,000 cubic metres and is presently being developed.

3.2.5 Class 4

No Class 4 material was identified in any of the sources in the Holman region.

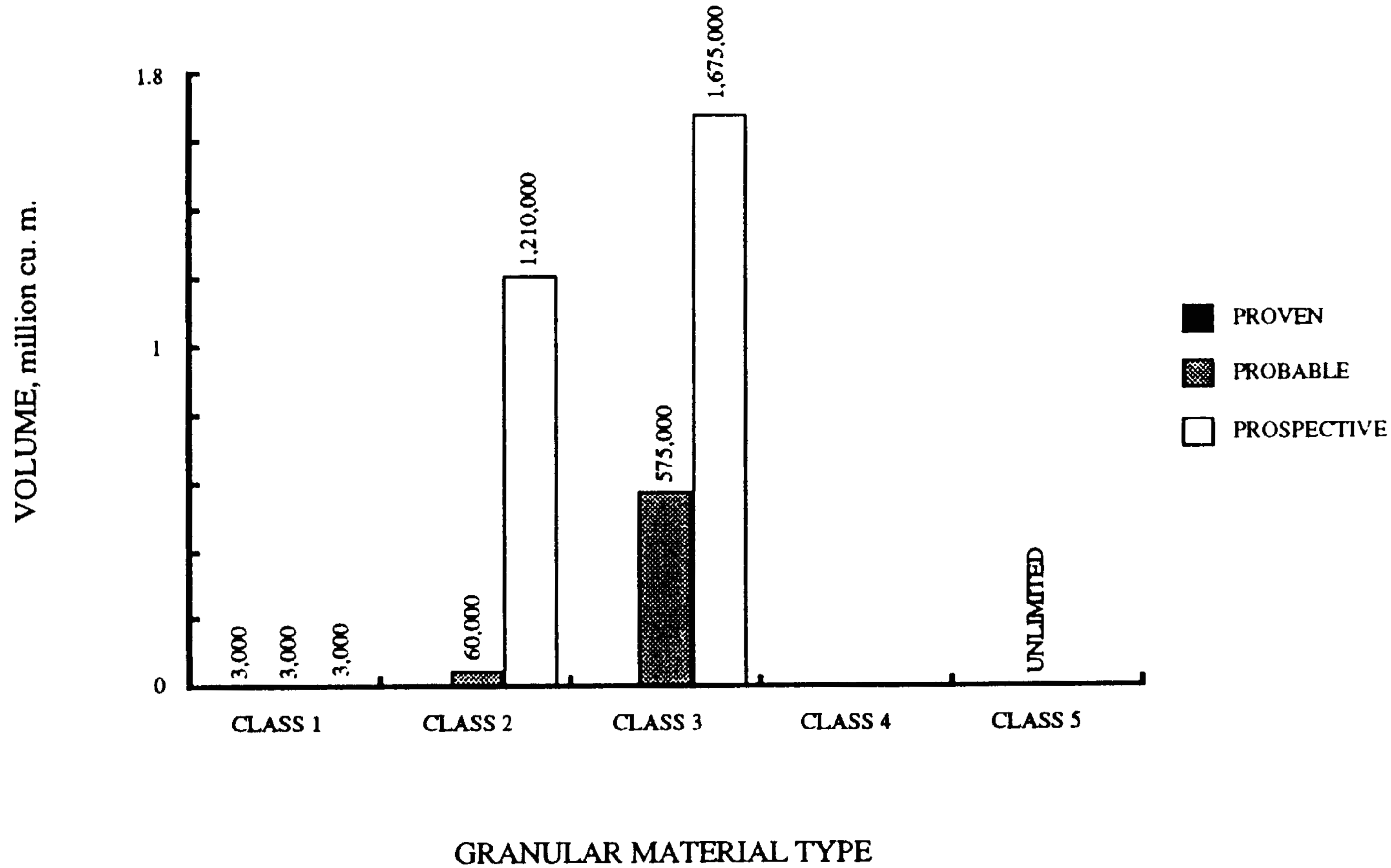


FIGURE 3 SUPPLY OF GRANULAR RESOURCES-HOLMAN

TABLE 4 DISTANCE TO CLASS 1 GRANULAR RESOURCES-HOLMAN

SOURCE	DISTANCE (km)	PROVEN (cu. m.)	PROBABLE (cu. m.)	PROSPECTIVE (cu. m.)	CONSIDERATIONS
87-H-8	0	3,000	3,000	3,000	Current townsite

TABLE 5 DISTANCE TO CLASS 2 GRANULAR RESOURCES-HOLMAN

SOURCE	DISTANCE (km)	PROVEN (cu. m.)	PROBABLE (cu. m.)	PROSPECTIVE (cu. m.)	CONSIDERATIONS
87-H-5	0		60,000	60,000	Currently developed
87-H-4	5.5			150,000	Feasible for development
87-H-13	12.5			700,000	
87-H-1	14			300,000	Quality indeterminate

TABLE 6 DISTANCE TO CLASS 3 GRANULAR RESOURCES-HOLMAN

SOURCE	DISTANCE (km)	PROVEN (cu. m.)	PROBABLE (cu. m.)	PROSPECTIVE (cu. m.)	CONSIDERATIONS
87-H-6	0		200,000	200,000	Currently developed
87-H-7	0		75,000	75,000	Partially developed and inaccessible
87-H-8	0		300,000	300,000	Current town site
87-H-10	5			75,000	Small and out of the way
87-H-2	11			75,000	Coastal, probably oversized material
87-H-11	11			200,000	Variable, some boulders
87-H-12	15			750,000	Extensive, barge accessible

3.2.6 Class 5

Holman has unlimited supplies of Class 5 borrow. Bedrock outcrops occur adjacent to the community as both massive and intrusive features. Fragmented rock is also available as felsenmeer in talus slopes located at the base of the outcrops.

4.0 DEMAND FOR GRANULAR RESOURCES

4.1 General

The purpose of the demand model was to determine the requirements for granular materials within the study area for a period encompassing the next 20 years. The needs of the model required that a substantial amount of specific information be obtained. This information consisted of descriptions of proposed types of projects and end users of the granular material, as well as material type and volume requirements.

The first step in compilation of the demand model was the identification of individuals and groups likely to have granular material demands or, alternatively, be concerned with the use of granular materials in general. A list of potential respondents was prepared by identifying the various departments in all levels of government involved with civil-oriented community projects and by forming a list of contractors residing or prominent in each community. A questionnaire was then assembled and distributed.

The questionnaire was designed to determine the need for various quantities of selected types of granular materials and to indicate the end use of the material. The questionnaire recipient was also asked to indicate, if possible, the likely or preferred source of the granular materials for each project or material type. In an attempt to quantify the rate of granular material demand, information was requested to be submitted in four data blocks, each five years in length.

Shortly after submission of the questionnaires, two EBA representatives, Messrs. D. Hayley, P. Eng., and J. Carss, P. Eng., visited each project community, as well as Yellowknife and Cambridge Bay, to meet with recipients of the questionnaires and other representatives of the local community to discuss their specific requirements for granular materials. This not only provided direct contact with most of the users and regulators of granular materials but also permitted the EBA representatives to become familiar with local conditions regarding granular resources.

Recipients of the questionnaire who were not visited were contacted by telephone, where possible, to ensure that all possible input was obtained and to clarify any questions or ambiguities that developed regarding the information sought by the questionnaire. The data collected was then assembled into a computerized data base to facilitate data handling and interpretation.

A large number of the respondents defined material quality in terms other than those in the INAC classification system that was outlined in the questionnaire. Table 1 presents the current interpretation of these various classes of required materials in light of the INAC classification system.

The process of data assimilation indicated that a project requiring granular materials could best be described as belonging to one of three categories: planned capital projects, speculative projects and maintenance. While the demand generated by all three project categories may be somewhat speculative, the 'speculative' projects category specifically refers to large scale projects that may or may not occur within the next 20 years. These projects usually involve a political decision and require a substantial committment of both funding and granular materials and typically involve projects such as airstrips, lengthy highways and construction of infrastructure for the production of oil and gas.

The total demand for granular materials in all of the Western Arctic communities is graphically presented in Figure 8. The total demand for granular materials for the years 1987 to 2007 has been estimated at 17.4 million cubic metres. Ninety-two percent of the demand (16 million cubic metres) is for projects that have been described as speculative, five percent of the demand (0.8 million cubic metres) has been indicated for planned capital projects and three percent of the demand (0.6 million cubic metres) has been designated for maintenance. Most of the demand is created by the various levels of government, with expansion of private industry requiring only three percent of the non-speculative capital project demand.

Despite the attempt of the questionnaire to determine the 20-year demand in 5-year blocks, most data received did not contain any specific 5-year information for non-speculative capital projects beyond 1991. The reasons for this occurrence appear to be two-fold: first, the Territorial Government uses an annually up-dated 5-year plan for budgeting capital expenditures; and second, most of the communities will acquire their basic facilities (ie. schools, nursing stations, government offices, etc.) within the next five years.

Projects designated as speculative appear to require 38 percent of the designated 16 million cubic metres within the next five years and 62 percent thereafter. This break-down is likely as speculative as the projects themselves, since it predominately reflects the desire for the project to occur in the near future. In contrast to the public/private split

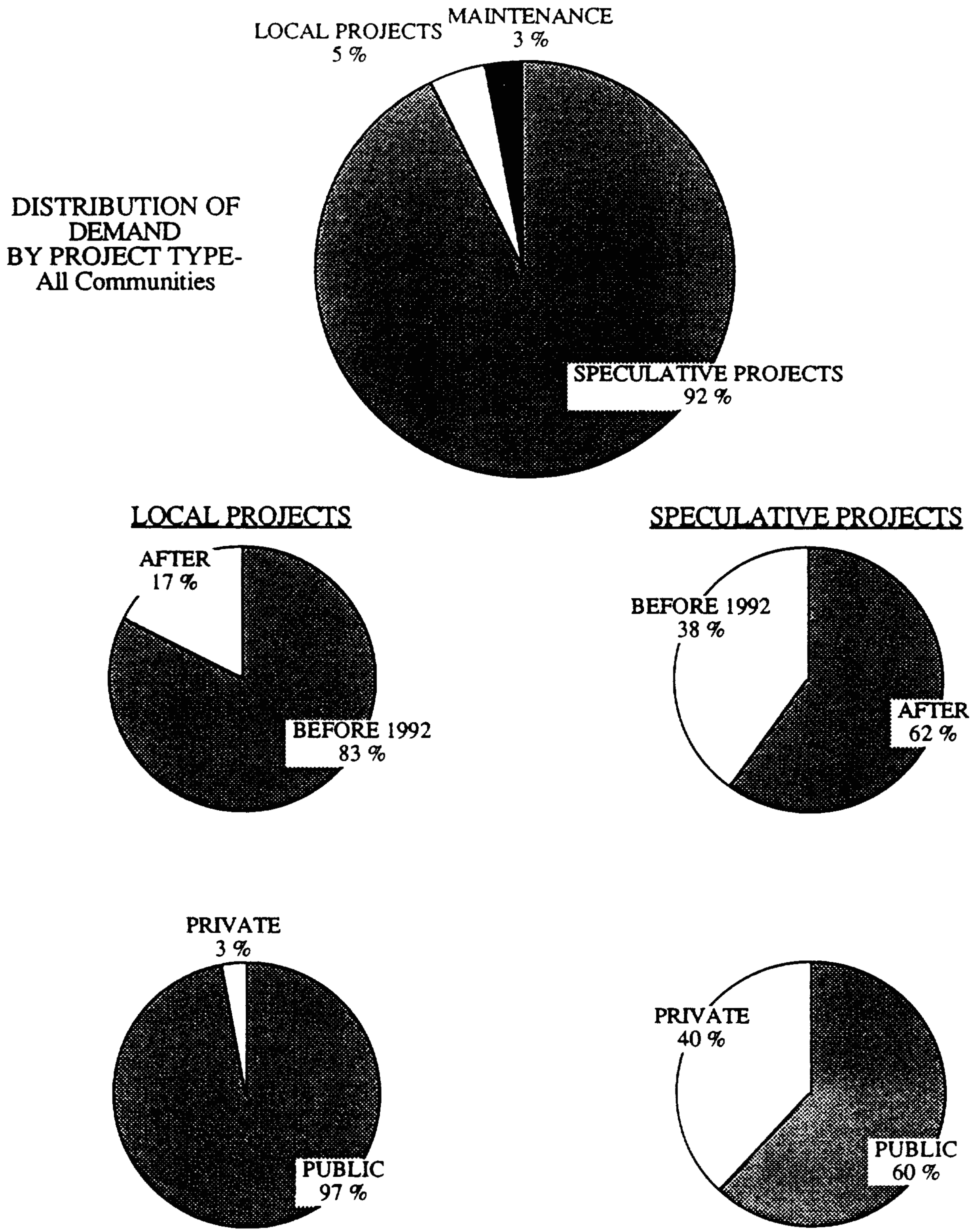


FIGURE 8 GRANULAR RESOURCES DEMAND SUMMARY-
ALL COMMUNITIES

on local capital projects, private industry envisages requiring 40 percent (6.9 million cubic metres) of the total speculative demand.

The following subsections present and discuss the demand data collected. Granular material requirements for the projects identified within the area of the community are presented and summarized in the Demand appendix. Figures presenting the required volume of each class of material for Holman are contained in the following text.

4.2 Holman

4.2.1 General

Holman is a small hamlet for which expansion of community facilities is planned. The total 20-year demand for local capital projects is 28,300 cubic metres and the maintenance requirement for the same time period is 98,000 cubic metres. All of the capital demand is public, with a small proportion of the granular material requirements being directed towards improvement of private housing lots. The entire quantity of capital project granular material is required within the next five years. A major sewage and solid waste disposal project planned for this community constitutes 71 percent (20,000 cubic metres) of the local capital projects granular resource demand.

A summary of required granular material volumes for each 5-year group is presented in Figure 11; the cumulative volume required of each material class is presented in Figure 12.

4.2.2 Class 1

The community of Holman requires 150 cubic metres of Class 1 granular material. All of the demand is generated between 1987 and 1991, with no apparent requirements for any Class 1 material beyond 1991.

4.2.3 Class 2

The Class 2 granular material requirement is for 10,550 cubic metres in the years 1987 through 1991 and 5,000 cubic metres of granular material in each of the subsequent 5-year blocks.

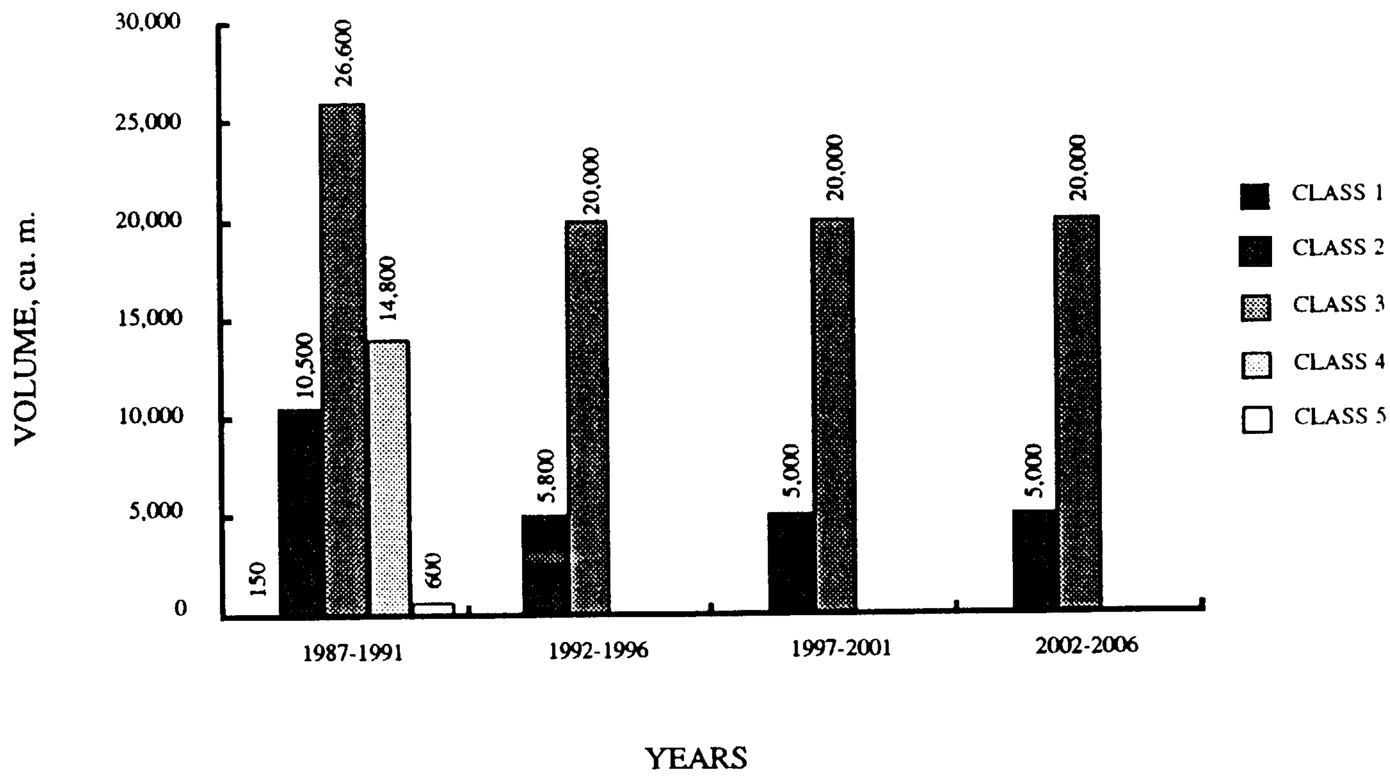


FIGURE 11 DEMAND FOR GRANULAR RESOURCES-HOLMAN

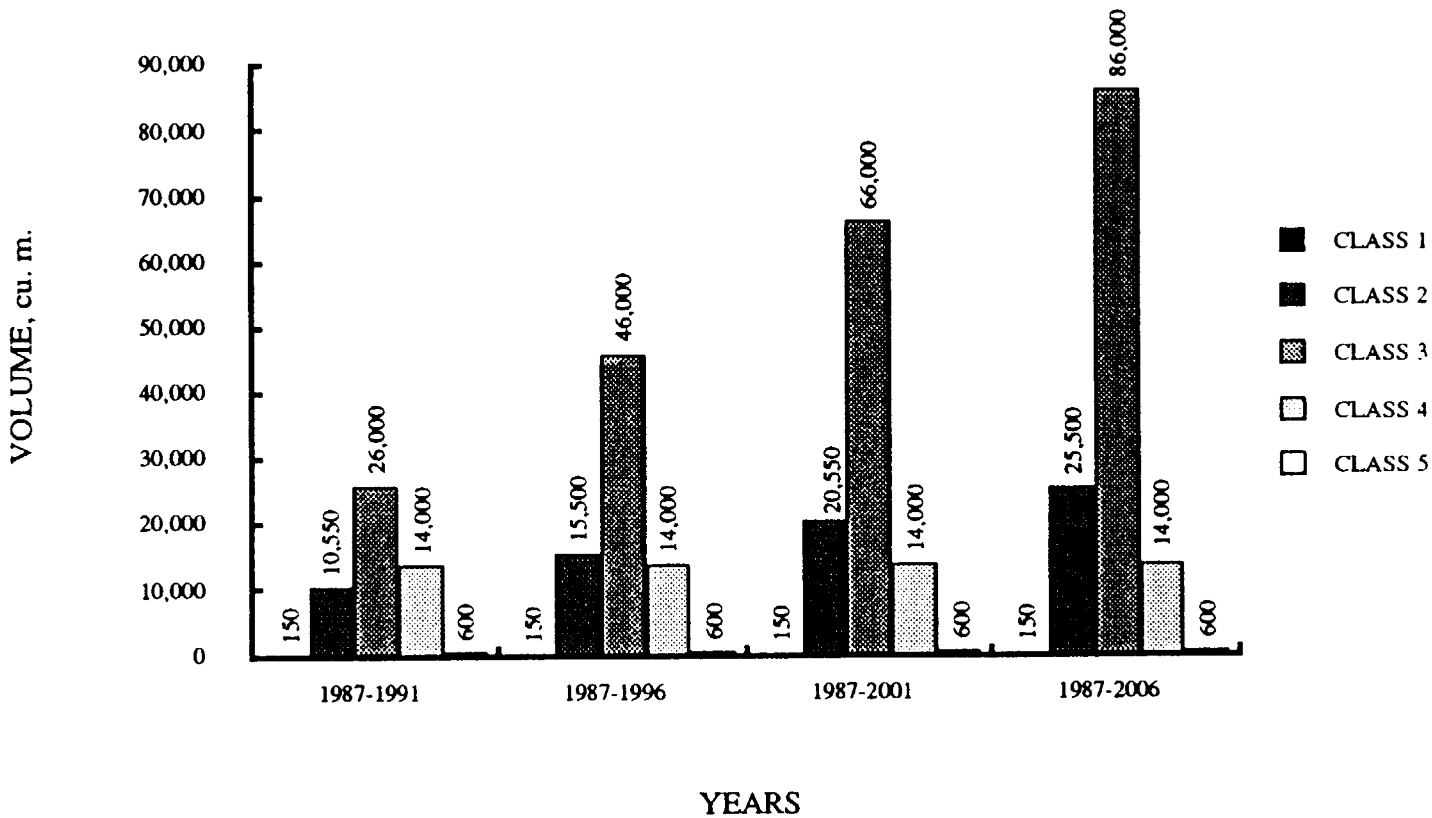


FIGURE 12 CUMULATIVE DEMAND FOR GRANULAR RESOURCES-HOLMAN

4.2.4 Class 3

Requirements for Class 3 material are 26,000 cubic metres for 1987 through 1991, with each of the subsequent 5-year blocks requiring 20,000 cubic metres. This material class constitutes the bulk of Holman's demand and is generally for material to be used for road maintenance and other general public projects.

4.2.5 Class 4

Holman has indicated a requirement for 14,000 cubic metres of Class 4 granular material between 1987 and 1991. This material is required for development of a sewage and solid waste site. There is no apparent requirement for Class 4 materials after 1991.

4.2.6 Class 5

Requirements for Class 5 materials are nominal, with only 600 cubic metres being required for 1987 through 1991. There is no indicated need for this type of material beyond 1991.

5.0 DEVELOPMENT SCENARIO

5.1 General

Holman currently obtains the majority of the required granular material from raised beaches in the immediate vicinity of the community. Airstrip requirements are met with material from a pit located at the west end of the strip.

The granular material obtained from the raised beaches consists of flat, coarse gravel-sized particles. Weathering processes to have reduced the parent intrusive bedrock to a material which is clean and fairly uniform in gradation. Some of the borrow areas currently under development contain granular material which has better gradation and these sources are used when higher quality aggregate is required. Blending and screening material from selected sources to obtain higher quality borrow will become attractive as the quantity of natural higher quality granular material declines.

The flat, platey gravel available from most of the sources is not ideal for general surfacing requirements because it has no natural binder and is unstable when placed.

The proposed granular materials development scenario for Holman is summarized on Table 23 and is discussed in the following subsections.

5.2 Class 1

Holman's small Class 1 granular material requirement (150 cubic metres) should be obtained from Source 87-H-8, the material surrounding the community site. Most of this potential borrow material is considered to be Class 3; however, 3,000 cubic metres of higher quality material exist in the pit located on the east side of the road near R.C.A.F. Lake.

5.3 Class 2

Holman's Class 2 granular requirements for the airstrip should be supplied from Source 87-H-5 (the Transport Canada pit). Material required for small projects located in the community should be obtained either from Source 87-H-5 or selected portions of 87-H-8. This will result in the use of some lower grade material , but this is difficult to avoid given the relative lack of Class 2 material in the immediate area of the community.

TABLE 23 GRANULAR RESOURCE UTILIZATION-
HOLMAN

MATERIAL		1987-1991	1992-1996	1997-2001	2002-2006
CLASS 1	Demand, cu. m.	150			
	Source(s)	87-H-8			
CLASS 2	Demand, cu. m.	10,550	5,000	5,000	5,000
	Source(s)	87-H-5/8	87-H-5/8	87-H-5/8	87-H-5/8
CLASS 3	Demand, cu. m.	26,000	20,000	20,000	20,000
	Source(s)	87-H-8	87-H-8	87-H-8	87-H-8
CLASS 4	Demand, cu. m.	14,000			
	Source(s)	87-H-8			
CLASS 5	Demand, cu. m.	600			
	Source(s)	Most Convenient			

NOTES:

1. Source 87-H-8 constitutes the granular material in the sources immediately surrounding the community. For the most part, the material is of Class 3 quality, except for the portion of the source located on the east side of the road near R.C.A.F. Lake.
2. Source 87-H-5 (the Transport Canada pit) is the only source of Class 2 material located near the community. It is recommended that the airstrip continue to draw its granular requirements from this pit and that the community use better sections of 87-H-8 as Class 2 material. Any large projects carried out should obtain Class 2 granular material from Sources 87-H-1, 4 and 13, located several kilometers from the community.
3. Holman is surrounded by Class 5 material. The Class 5 material requirement should be obtained from the most convenient location on an as-needed basis.

Substantial volumes of Class 2 borrow are located at some distance from the community (Sources 87-H-1,4 and 13); however, recovery of these materials would likely only be feasible for projects larger than currently anticipated for Holman.

5.4 Class 3

Class 3 borrow requirements should continue to be filled with granular material obtained from Source 87-H-8, which comprises the current sources located at the fringe of the community. The available supply of material from this source will adequately meet the projected needs of the community. The portion of the source located on the east side of the road near R.C.A.F. Lake should be reserved for projects requiring Class 1 borrow.

5.5 Class 4

Only 14,000 cubic metres of Class 4 borrow are required within the community over the next 20 years. It is recommended that this need be filled with Class 3 borrow obtained from Source 87-H-8, the normal town source, since there are no prospective sources of Class 4 borrow in the vicinity.

5.6 Class 5

Holman is surrounded by massive bedrock outcrops. The small requirement for Class 5 material (600 cubic metres) can easily be supplied from any convenient talus slope.

6.0 BORROW SOURCE DEVELOPMENT RECOMMENDATIONS

6.1 General

The following sections present guidelines and recommendations for developing a management plan.

These recommendations have taken into consideration information presented in the Environmental Guidelines: Pits and Quarries Handbook (Indian and Northern Affairs Canada, 1983), and the draft Territorial Lands and Public Lands Pits and Quarries Regulations. The ILA currently do not have regulations governing pits and quarries, but generally follow the guidelines suggested in the above documents.

6.2 Objectives

Site-specific management plans must consider the requirements and constraints of regional borrow demand and availability. Each plan should ensure that economical recovery of quality granular materials is achieved at each pit while minimizing the adverse environmental impact. The environmental impact on the region can be minimized by restricting granular recovery operations to a select number of pits, realizing that maximum extraction from a pit will likely cause a slight rise in material cost. This cost increase must be weighed against the environmental costs associated with high grading the better drained surface materials. This local practice frequently results in numerous smaller pits being worked simultaneously or sequentially. Pit management plans should be developed primarily to maximize the utilization of limited resources and to minimize environmental disturbance.

6.3 Pit Access

Access to sources of granular material should be by the most economical, least environmentally damaging manner. Areas with granular resources located nearby (Inuvik, Holman, Paulatuk and Sachs Harbour) can access certain resources with all weather roads. Areas with distant resources (Aklavik and Tuktoyaktuk) can usually only obtain borrow in the winter by tundra/ice roads or in the summer by barge, if the sources are located adjacent to a waterway.

Summer operations would require construction of temporary access roads from the sources and docking facilities for barges. The construction of these facilities would probably require large quantities of granular materials, and would significantly reduce the recoverable volumes.

6.4 Pit Development

6.4.1 Site Preparation Work

Site preparation should be conducted in advance of excavation to prevent contamination of granular materials. This preparation also should preferably be carried out in winter to minimize disturbance to the surrounding terrain. Snow should be cleared from both the area to be excavated and yard areas and placed so as to minimize subsequent pit infilling by drifting snow. Topsoil consisting of peat and organic soils, while typically scarce, should be stripped where possible and stockpiled or windrowed at the edges of the pit area. Windrows should be placed parallel to slope direction to prevent ponding of surface water during spring, or contamination of granular materials. Inorganic overburden materials should be stripped and placed in separate stockpiles or windrows, with similar consideration of drainage considerations. The stripped materials are to be reserved for reclamation purposes. Disturbed areas must be kept to a practical minimum.

6.4.2 Extraction Methods

Winter recovery operations will normally consist of the ripping of friable frozen granular material and pushing it into temporary windrows or stockpiles for loading. This type of extraction can be conducted with conventional equipment including bulldozers with rippers, loaders, and trucks. Poorly-bonded or friable granular material will usually be located near the surface of deposits that exhibit positive relief. If an insufficient volume of material cannot be obtained through ripping, blasting will be necessary.

Summer operations will typically consist of stripping and windrowing or stockpiling thawed layers of granular material with bulldozers, commencing when thaw has progressed about 0.5 m into the deposit. The cycle of operation is largely dependent on the rate of thawing, and the drainage considerations. This method allows potentially greater annual recovery by progressively increasing the amount of thawed material, and it may enhance drainage of the material in stockpiles or windrows.

Experience has shown that winter excavation of frozen stockpiles windrowed the previous summer, may be just as difficult as winter excavation directly from the borrow source unless the stock pile process results in a significant reduction in natural moisture content. Moisture reduction from 10 percent in situ to 5 percent in a stockpile has been achieved by use of conveyors during favourable summer conditions (Hayley and MacLeod, 1977). Frozen gravel stockpiles with a moisture content less than 5 percent are usually sufficiently friable for direct loading without ripping.

Drilling and blasting of frozen ground in the winter has proven cost effective for larger operations. The techniques developed and used extensively at Prudhoe Bay, Alaska, is to remove gravel in lifts 5.5 m thick, by drilling shot holes 6 m deep on a 3 m pattern. Load factors are typically 0.9 kg of ANFO explosive per cubic metre of gravel to create manageable size chunks. Typical specifications for Alaska winter construction restrict the size of frozen gravel chunks to 200 mm.

6.4.3 Treatment of Massive Ice

Logistical constraints caused by massive ice during summer development of YaYa Lake pit are described by Hayley and MacLeod (1977). Where practical, the extent of massive ice in a prospective deposit should be defined prior to pit development. The development plans should include methodology for coping with ice bodies as they are encountered.

Where practical, large bodies of massive ice should be avoided. Thin, or less extensive massive ice within the granular material at higher elevations should be excavated and wasted, or exposed to permit thawing during the summer months. Drainage must be considered with either method of disposal.

Relatively thin layers of massive ice at depth may be permitted to thaw provided all overlying recoverable granular materials are removed during one extraction season. Formation of thaw ponds as ice melts during the summer is inevitable in this situation. Appropriate measures must be taken to control drainage and to protect, and ensure access to, adjacent recoverable granular materials.

It may be desirable to identify and preserve thicker ice bodies at depth. If this material thaws it is likely to prevent recovery of adjacent materials, or result in major disturbance of the surrounding areas. A minimum cover of 1.5 m of granular material should be left as insulation over massive ice to prevent excessive thawing. Criteria for establishing the minimum thickness of massive ice beds which should be preserved is influenced by topographic relief, thickness and extent of granular materials, and the effect of thaw ponds on surrounding terrain. Operators involved with large extraction operations may simply wish to excavate and waste the ice.

6.4.4 Drainage Considerations

Adequate drainage of pit areas must be maintained to ensure availability of recoverable granular material and to attain required annual extraction rates. Higher moisture contents inhibit thawing, increase excavation costs and reduce material quality. Small amounts of meltwater runoff from ice bonded and thinly ice-lensed granular materials could be allowed to seep into the surrounding terrain. Larger amounts of runoff, from thawing of large massive ice bodies, should be directed to retention ponds or sumps excavated in the pit floor. Where gravity drainage is possible, natural ponds or drainage ditches may be effective at removing water from the site. However, excavated ditches are generally ineffective in areas of high ice content.

It is essential that pit drainage facilities be maintained and updated frequently to ensure that moisture drains away from the working face, and that ponded runoff does not accumulate on recoverable granular material. Where thaw ponds are allowed to form by exposing buried massive ice, or where collection ponds are created, care should be taken to preserve and maintain access to adjacent recoverable granular materials. A development plan to adequately account for pit drainage is particularly important where summer extraction operations are employed.

6.4.5 Waste Material

All lenses of fine-grained material (silts and clays) found within the granular deposit, should be stripped and wasted. Waste material should be stockpiled near the stockpiled overburden for use in pit reclamation. Fine-grained waste material at depth will undoubtedly have high excess ice contents, hence it may be advisable to construct a dyke of drier overburden around waste piles to prevent flow of thawed waste onto surrounding terrain or into pit areas.

6.5 Restoration

Restoration measures are required whether the pit is being abandoned temporarily or permanently. All worked areas should be cleaned of all debris, and graded to remove all topographic irregularities. Where abandonment is temporary, positive drainage away from existing faces and access routes must be provided by grading or by ditching to ensure the future recovery of remaining materials. Berms should be constructed at the top of pit faces, if necessary, to prevent surface runoff from entering the pit area.

Prior to permanent abandonment, the edges of worked areas or pit walls should be recontoured to blend into the surrounding terrain. All obstructions to natural drainage should be removed and any slopes graded to prevent runoff from channelling and downcutting. If thaw ponds and lakes and massive ground ice are common in the area, flooding of pits is an acceptable, and frequently inevitable, method of restoration. Areas which are not likely to become flooded should be smoothly graded and covered with stockpiled overburden and organics.

Revegetation may be feasible in certain areas by redistributing stockpiled organic topsoil and peat over the graded slopes of areas unlikely to be flooded, and by seeding or allowing reinvasion of natural vegetation, depending on the nature of the site and the quality of the topsoil. Fine-grained overburden soils are generally adequate for surface reclamation, however, the amount of naturally-occurring topsoil is very limited at some sites. The fertility of these soils may require enrichment for revegetation.

6.6 Site Specific Development Recommendations

6.6.1 General

The site specfic development plans presented in the following report subsections pertain to selected sources that are prominent in the development scenario proposed for the community of Holman. The level of detail presented for each source reflects the amount of information available for a particular deposit.

6.6.2 Source 87-H-5

Access

The source constitutes the Transport Canada pit, located on the seaward end of the airstrip located north of the community of Holman, and is accessible on a year-round basis by an all-weather road..

Site Preparation

The site is currently partially developed. Any addition site preparation work should be conducted in accordance with the recommendations presented in Section 6.4.1 of this report.

Extraction Methods

Extraction of granular material from the source should be accomplished on an as-needed basis by excavating material that has thawed and drained during the summer. If large volumes of granular material are required, ripping of frozen ground and temporary stockpiling will likely be necessary.

Drainage Considerations

The pit floor should be graded where possible, to ensure gravity drainage of surface and melt water. Water should be collected and discharged in an environmently acceptable manner. Good drainage enhances seasonal thaw and limits the ingress of water.

Restoration

When the pit becomes partially exhausted, restoration can be undertaken concurrent with further borrow recovery. Restoration should be conducted in accordance with the recommendations presented in Section 6.5 of this report and should primarily consist of roughening the surface and contouring the abandoned areas of the pit to ensure adequate drainage occurs and that large volumes of water are not trapped within the pit area. Revegetation can be considered as pit abandonment proceeds.

6.6.3 Source 87-H 8

Access

The source consists of several deposits located along the margin of the community of Holman and is accessible on a year-round basis by all-weather roads.

Site Preparation

The site is currently partially developed. Any addition site preparation work should be conducted in accordance with the recommendations presented in Section 6.4.1 of this report. The section of the source located adjacent to R.C.A.F. Lake should be reserved for production of high quality aggregate (ie. Class 1).

Extraction Methods

Extraction of granular material from the source should be accomplished on an as-needed basis by excavating material that has thawed and drained during the summer. If large volumes of granular material are required, ripping of frozen ground and temporary stockpiling will likely be necessary.

Drainage Considerations

The pit floor should be graded where possible, to ensure gravity drainage of surface and melt water. Water should be collected and discharged in an environmently acceptable manner. Good drainage enhances seasonal thaw and limits the ingress of water.

Restoration

When the pit becomes partially exhausted, restoration can be undertaken concurrent with further borrow recovery. Restoration should be conducted in accordance with the recommendations presented in Section 6.5 of this report and should primarily consist of roughening the surface and contouring the abandoned areas of the pit to ensure adequate drainage occurs and that large volumes of water are not trapped within the pit area. Revegetation can be considered as pit abandonment proceeds.

7.0 RECOMMENDATIONS

7.1 General

The recommendations contained in the following subsection pertain to additional work required to confirm the quantity and quality of granular resources contained in sources that are prominent in the development scenario proposed for the community of Holman and are presented with regard to all information collected and reviewed during the study.

In summary, the recommendations concern the effort necessary to confirm the volume and quality of material available from local granular sources.

7.2 Sources 87-H-5 and 87-H-8

Sources 87-H-5 and 87-H-8 constitute unexplored, yet well-developed sources of granular construction material. Due to the mature state of the pits, little benefit would be gained by conducting geotechnical/geological investigations of the sites.

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159	HARDY 1977	TUK HARBOUR, AIRSTRIP	EBA 1973
160/161	HARDY 1977	TUK HARBOUR, AIRSTRIP	EBA 1973
162	HARDY 1977		
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171	HARDY 1977	25	DPW 1976
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PARSONS LK. 10	KLCL 1974		
PARSONS LK. 11	KLCL 1974		
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YAYA	EBA 1975		

SUPPLY SUMMARY

HOLMAN

GRANULAR RESOURCES SUPPLY SUMMARY
Holman

SOURCE: 87-H-1

ILA 7(1)(a)

LOCATION: 14 km NW of Holman

REFERENCE(S): None

SETTING
Upland

LANDFORM
Raised beach

AREA
100,000 sq m

RELIEF
5 m

CONTINUITY
3 deposits

DEVELOPMENT CONSTRAINTS
None discernible

WINTER ACCESS
Tundra/ice road

SUMMER ACCESS
None

BOREHOLES (#)
Unknown

MOIST. CON. (#)
Unknown

TEST PITS (#)
Unknown

GRAINSIZE (#)
Unknown

	OVERBURDEN	GROUND ICE
TYPE:	Unknown	Unknown
EXTENT:	-	-
THICK.:	-	-

POTENTIAL VOLUME, cu. m.: 300,000

RECOVERABLE, cu.m: 300,000

MATERIAL	PROVEN, cu.m. Annual	PROVEN, cu.m. Total	PROBABLE, cu.m. Annual	PROBABLE, cu.m. Total	PROSPECTIVE, cu.m. Annual	PROSPECTIVE, cu.m. Total
CLASS 1						
CLASS 2					150,000	300,000
CLASS 3						
CLASS 4						
CLASS 5						

GRANULAR RESOURCES SUPPLY SUMMARY
Holman

SOURCE: 87-H-2

ILA 7(1)(a)

LOCATION: 11 km NW of Holman

REFERENCE(S): None

SETTING
Coastal bluffs

RELIEF
20 to 30 m

WINTER ACCESS
Tundra/ice road

LANDFORM
Raised beaches

CONTINUITY
4 deposits

SUMMER ACCESS
Barge

AREA
72,000 sq m

DEVELOPMENT CONSTRAINTS
None discernible

BOREHOLES (#)
Unknown

TEST PITS (#)
Unknown

MOIST. CON. (#)
Unknown

GRAINSIZE (#)
Unknown

	OVERBURDEN	GROUND ICE
TYPE:	Unknown	Unknown
EXTENT:	-	-
THICK.:	-	-

POTENTIAL VOLUME, cu. m.: 75,000 **RECOVERABLE, cu.m:** 75,000

MATERIAL	PROVEN, cu.m. Annual	PROVEN, cu.m. Total	PROBABLE, cu.m. Annual	PROBABLE, cu.m. Total	PROSPECTIVE, cu.m. Annual	PROSPECTIVE, cu.m. Total
CLASS 1						
CLASS 2						
CLASS 3					75,000	75,000
CLASS 4						
CLASS 5						

GRANULAR RESOURCES SUPPLY SUMMARY
Holman

SOURCE: 87-H-4

ILA 7(1)(a)

LOCATION: 5.5 km NW of Holman

REFERENCE(S): None

SETTING
Coastal bluffs

LANDFORM
Raised beaches

AREA
90,000 sq m

RELIEF
20 m

CONTINUITY
Semicontinuous

DEVELOPMENT CONSTRAINTS
None discernible

WINTER ACCESS
Tundra/ice road

SUMMER ACCESS
Barge

BOREHOLES (#)
Unknown

MOIST. CON. (#)
Unknown

TEST PITS (#)
Unknown

GRAINSIZE (#)
Unknown

	OVERBURDEN	GROUND ICE
TYPE:	Unknown	Unknown
EXTENT:	-	-
THICK.:	-	-

POTENTIAL VOLUME, cu. m.: 150,000

RECOVERABLE, cu.m: 150,000

MATERIAL	PROVEN, cu.m. Annual	PROVEN, cu.m. Total	PROBABLE, cu.m. Annual	PROBABLE, cu.m. Total	PROSPECTIVE, cu.m. Annual	PROSPECTIVE, cu.m. Total
CLASS 1						
CLASS 2					150,000	150,000
CLASS 3						
CLASS 4						
CLASS 5						

GRANULAR RESOURCES SUPPLY SUMMARY
Holman

SOURCE: 87-H-5

ILA 7(1)(a)

LOCATION: At SW end of Airstrip

REFERENCE(S): Transport Canada 1986

SETTING
Coastal slope

LANDFORM
Raised beach

AREA
45,000 sq m

RELIEF
4 to 6 m

CONTINUITY
2 deposits

DEVELOPMENT CONSTRAINTS
Substantially depleted

WINTER ACCESS
Road

SUMMER ACCESS
Road

BOREHOLES (#)
Unknown

MOIST. CON. (#)
Unknown

TEST PITS (#)
Yes

GRAINSIZE (#)
Unknown

	OVERBURDEN	GROUND ICE
TYPE:	Unknown	Unknown
EXTENT:	-	-
THICK.:	-	-

POTENTIAL VOLUME, cu. m.: 60,000   RECOVERABLE, cu.m: 60,000

MATERIAL	PROVEN, cu.m. Annual	PROVEN, cu.m. Total	PROBABLE, cu.m. Annual	PROBABLE, cu.m. Total	PROSPECTIVE, cu.m. Annual	PROSPECTIVE, cu.m. Total
CLASS 1						
CLASS 2			60,000	60,000	60,000	60,000
CLASS 3						
CLASS 4						
CLASS 5						

GRANULAR RESOURCES SUPPLY SUMMARY
Holman

SOURCE: 87-H-6

ILA 7(1)(a)

LOCATION: At Ukpillik River crossing

REFERENCE(S): Transport Canada 1986

SETTING
Coastal plain

LANDFORM
Reworked delta

AREA
100,000 sq m

RELIEF
4 to 5 m

CONTINUITY
Continuous

DEVELOPMENT CONSTRAINTS
None discernible

WINTER ACCESS
Road

SUMMER ACCESS
Road

BOREHOLES (#)
Unknown

MOIST. CON. (#)
Unknown

TEST PITS (#)
Unknown

GRAINSIZE (#)
Unknown

	OVERBURDEN	GROUND ICE
TYPE:	Unknown	Unknown
EXTENT:	-	-
THICK.:	-	-

POTENTIAL VOLUME, cu. m.: 200,000

RECOVERABLE, cu.m: 200,000

MATERIAL	PROVEN, cu.m. Annual	PROVEN, cu.m. Total	PROBABLE, cu.m. Annual	PROBABLE, cu.m. Total	PROSPECTIVE, cu.m. Annual	PROSPECTIVE, cu.m. Total
CLASS 1						
CLASS 2						
CLASS 3			200,000	200,000	200,000	200,000
CLASS 4						
CLASS 5						

GRANULAR RESOURCES SUPPLY SUMMARY
Holman

SOURCE: 87-H-7

ILA 7(1)(a)

LOCATION: Nose of Limestone Hill

REFERENCE(S): None

SETTING
Bedrock ridge

RELIEF
30 m

WINTER ACCESS
Road

LANDFORM
Raised beach

CONTINUITY
Continuous

SUMMER ACCESS
Road

AREA
75,000 sq m

DEVELOPMENT CONSTRAINTS
Some development, difficult access

BOREHOLES (#)
Unknown

TEST PITS (#)
Yes

MOIST. CON. (#)
Unknown

GRAINSIZE (#)
Unknown

	OVERBURDEN	GROUND ICE
TYPE:	Unknown	Unknown
EXTENT:	-	-
THICK.:	-	-

POTENTIAL VOLUME, cu. m.: 75,000

RECOVERABLE, cu.m: 75,000

MATERIAL	PROVEN, cu.m. Annual	PROVEN, cu.m. Total	PROBABLE, cu.m. Annual	PROBABLE, cu.m. Total	PROSPECTIVE, cu.m. Annual	PROSPECTIVE, cu.m. Total
CLASS 1						
CLASS 2			75,000	75,000	75,000	75,000
CLASS 3						
CLASS 4						
CLASS 5						

GRANULAR RESOURCES SUPPLY SUMMARY
Holman

SOURCE: 87-H-8

ILA 7(1)(a)

LOCATION: Under Town

REFERENCE(S): None

SETTING
Head, Kings Bay

LANDFORM
Raised beaches

AREA
150,000 sq m

RELIEF
20 m

CONTINUITY
Continuous

DEVELOPMENT CONSTRAINTS
Located under town

WINTER ACCESS
Road

SUMMER ACCESS
Road

BOREHOLES (#)
Unknown

MOIST. CON. (#)
Unknown

TEST PITS (#)
Unknown

GRAINSIZE (#)
Unknown

	OVERBURDEN	GROUND ICE
TYPE:	Unknown	Unknown
EXTENT:	-	-
THICK.:	-	-

POTENTIAL VOLUME, cu. m.: 300,000

RECOVERABLE, cu.m: 300,000

MATERIAL	PROVEN, cu.m. Annual	PROVEN, cu.m. Total	PROBABLE, cu.m. Annual	PROBABLE, cu.m. Total	PROSPECTIVE, cu.m. Annual	PROSPECTIVE, cu.m. Total
CLASS 1	3,000	3,000	3,000	3,000	3,000	3,000
CLASS 2						
CLASS 3			300,000	300,000	300,000	300,000
CLASS 4						
CLASS 5						

GRANULAR RESOURCES SUPPLY SUMMARY
Holman

SOURCE: 87-H-10

ILA 7(1)(a)

LOCATION: 5 km SE of Holman

REFERENCE(S): None

SETTING
Coastal slope

LANDFORM
Raised beach

AREA
55,000 sq m

RELIEF
50 m

CONTINUITY
Continuous

DEVELOPMENT CONSTRAINTS
None discernible

WINTER ACCESS
Tundra/ice road

SUMMER ACCESS
Barge

BOREHOLES (#)
Unknown

MOIST. CON. (#)
Unknown

TEST PITS (#)
Unknown

GRAINSIZE (#)
Unknown

	OVERBURDEN	GROUND ICE
TYPE:	Unknown	Unknown
EXTENT:	-	-
THICK.:	-	-

POTENTIAL VOLUME, cu. m.: 75,000

RECOVERABLE, cu.m: 75,000

MATERIAL	PROVEN, cu.m. Annual	PROVEN, cu.m. Total	PROBABLE, cu.m. Annual	PROBABLE, cu.m. Total	PROSPECTIVE, cu.m. Annual	PROSPECTIVE, cu.m. Total
CLASS 1						
CLASS 2						
CLASS 3					75,000	75,000
CLASS 4						
CLASS 5						

GRANULAR RESOURCES SUPPLY SUMMARY
Holman

SOURCE: 87-H-11

ILA 7(1)(a)

LOCATION: 11 km SE of Holman

REFERENCE(S): None

SETTING
Coastal slope

LANDFORM
Beach on talus

AREA
>100,000 sq m

RELIEF
30 to 50 m

CONTINUITY
3 deposits

DEVELOPMENT CONSTRAINTS
Possibly bouldery

WINTER ACCESS
Tundra/ice road

SUMMER ACCESS
Barge

BOREHOLES (#)
Unknown

MOIST. CON. (#)
Unknown

TEST PITS (#)
Unknown

GRAINSIZE (#)
Unknown

	OVERBURDEN	GROUND ICE
TYPE:	Unknown	Unknown
EXTENT:	-	-
THICK.:	-	-

POTENTIAL VOLUME, cu. m.: 200,000

RECOVERABLE, cu.m: 200,000

MATERIAL	PROVEN, cu.m. Annual	Total	PROBABLE, cu.m. Annual	Total	PROSPECTIVE, cu.m. Annual	Total
CLASS 1						
CLASS 2						
CLASS 3					200,000	200,000
CLASS 4						
CLASS 5						

GRANULAR RESOURCES SUPPLY SUMMARY
Holman

SOURCE: 87-H-12

ILA 7(1)(a)

LOCATION: 15 km SE of Holman

REFERENCE(S): None

SETTING Coastal bluffs	RELIEF 20 m	WINTER ACCESS Ice road
LANDFORM Raised beaches	CONTINUITY Semicontinuous	SUMMER ACCESS Barge
AREA 650,000 sq m	DEVELOPMENT CONSTRAINTS None discernible	

BOREHOLES (#) Unknown	TEST PITS (#) Unknown
MOIST. CON. (#) Unknown	GRAINSIZE (#) Unknown

	OVERBURDEN	GROUND ICE
TYPE:	Unknown	Unknown
EXTENT:	-	-
THICK.:	-	-

POTENTIAL VOLUME, cu. m.: 1,500,000 RECOVERABLE, cu.m: 1,500,000

MATERIAL	PROVEN, cu.m. Annual	PROVEN, cu.m. Total	PROBABLE, cu.m. Annual	PROBABLE, cu.m. Total	PROSPECTIVE, cu.m. Annual	PROSPECTIVE, cu.m. Total
CLASS 1						
CLASS 2						
CLASS 3					750,000	750,000
CLASS 4						
CLASS 5						

GRANULAR RESOURCES SUPPLY SUMMARY
Holman

SOURCE: 87-H-13

ILA 7(1)(a)

LOCATION: 12.5 km NW of Holman

REFERENCE(S): None

SETTING
Upland

RELIEF
5 to 8 m

WINTER ACCESS
Tundra/ice road

LANDFORM
Glaciofluv. delta

CONTINUITY
Semicontinuous

SUMMER ACCESS
None

AREA
115,000

DEVELOPMENT CONSTRAINTS
None discernible

BOREHOLES (#)
Unknown

TEST PITS (#)
Unknown

MOIST. CON. (#)
Unknown

GRAINSIZE (#)
Unknown

	OVERBURDEN	GROUND ICE
TYPE:	Unknown	Unknown
EXTENT:	-	-
THICK.:	-	-

POTENTIAL VOLUME, cu. m.: 700,000

RECOVERABLE, cu.m: 700,000

MATERIAL	PROVEN, cu.m. Annual	PROVEN, cu.m. Total	PROBABLE, cu.m. Annual	PROBABLE, cu.m. Total	PROSPECTIVE, cu.m. Annual	PROSPECTIVE, cu.m. Total
CLASS 1						
CLASS 2					230,000	700,000
CLASS 3						
CLASS 4						
CLASS 5						

DEMAND SUMMARY

HOLMAN

GRANULAR RESOURCES DEMAND SUMMARY
Holman

YEAR GROUP	PROJECT (¥ Denotes Speculative Project)	CATEGORY		VOLUME, cu.m.
1987-1991	AIRFIELD MAINTENANCE	PUBLIC		
			Class 1:	
			Class 2:	3,000
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	3,000
1987-1991	ARENA AND CURLING RINK	PUBLIC		
			Class 1:	100
			Class 2:	275
			Class 3:	1,000
			Class 4:	
			Class 5:	
			TOTAL	1,375
1987-1991	BEACH EROSION	PUBLIC		
			Class 1:	
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	200
			TOTAL	200
1987-1991	CONCRETE FLOORS	PUBLIC		
			Class 1:	
			Class 2:	100
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	100
1987-1991	CONCRETE FOUNDATIONS	PUBLIC		
			Class 1:	
			Class 2:	400
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	400
1987-1991	HOUSE PADS	PUBLIC		
			Class 1:	
			Class 2:	
			Class 3:	1,000
			Class 4:	
			Class 5:	
			TOTAL	1,000

GRANULAR RESOURCES DEMAND SUMMARY
Holman

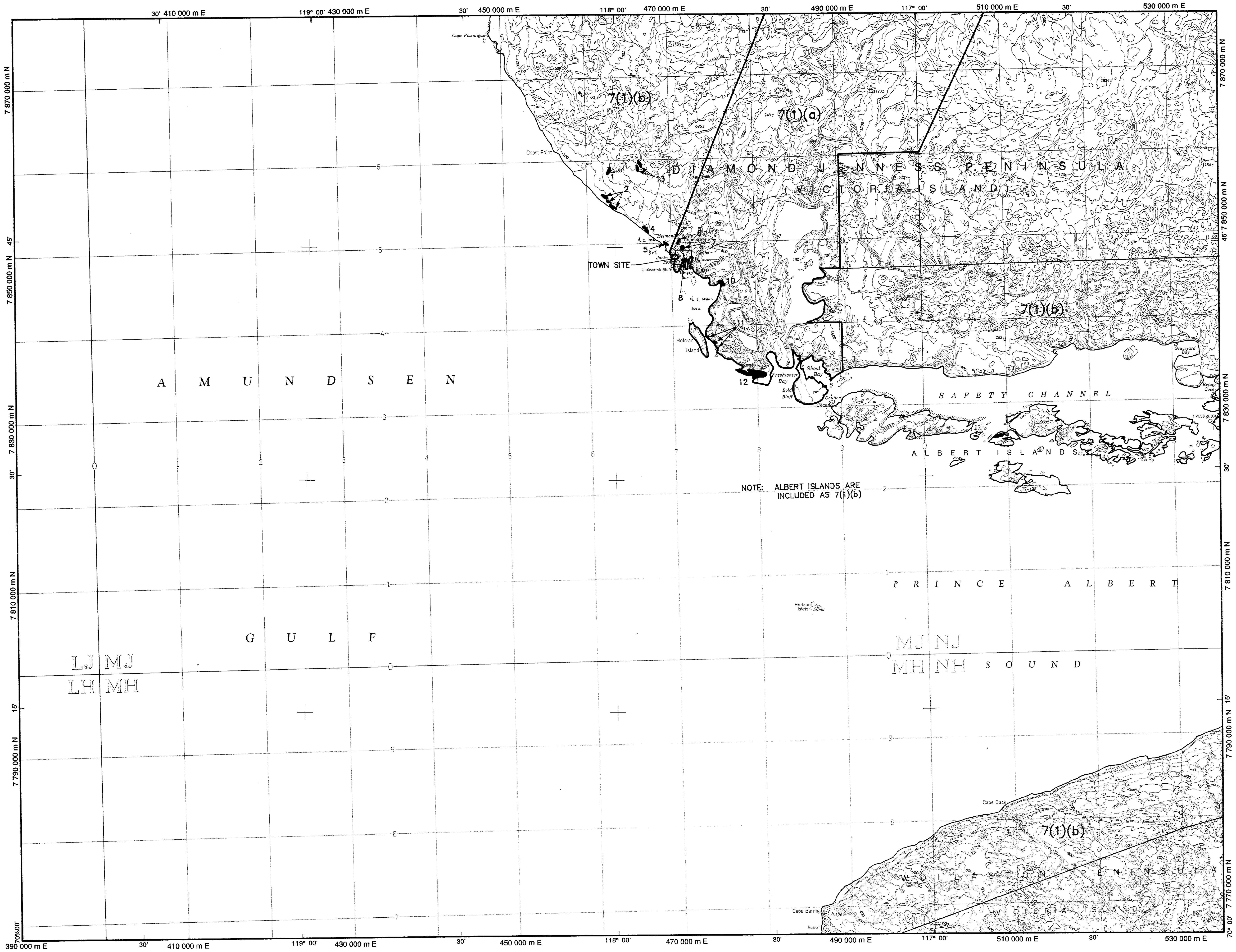
YEAR GROUP	PROJECT (¥ Denotes Speculative Project)	CATEGORY		VOLUME, cu.m.
1987-1991	OFFICE/WAREHOUSE COMPLEX	PUBLIC		
			Class 1:	
			Class 2:	500
			Class 3:	900
			Class 4:	
			Class 5:	
			TOTAL	1,400
1987-1991	RIP RAP	PUBLIC		
			Class 1:	
			Class 2:	
			Class 3:	
			Class 4:	
			Class 5:	200
			TOTAL	200
1987-1991	ROADS (10KM)	PUBLIC		
			Class 1:	
			Class 2:	
			Class 3:	2,000
			Class 4:	
			Class 5:	
			TOTAL	2,000
1987-1991	ROAD/GENERAL MAINTENANCE	PUBLIC		
			Class 1:	
			Class 2:	
			Class 3:	20,000
			Class 4:	
			Class 5:	
			TOTAL	20,000
1987-1991	SEWAGE AND SOLID WASTE SITES	PUBLIC		
			Class 1:	
			Class 2:	5,800
			Class 3:	
			Class 4:	14,000
			Class 5:	200
			TOTAL	20,000
1987-1991	STAFF HOUSING	PUBLIC		
			Class 1:	50
			Class 2:	475
			Class 3:	1,100
			Class 4:	
			Class 5:	
			TOTAL	1,625

GRANULAR RESOURCES DEMAND SUMMARY
Holman

YEAR GROUP	PROJECT (¥ Denotes Speculative Project)	CATEGORY	VOLUME, cu.m.	
1992-1996	AIRFIELD MAINTENANCE	PUBLIC		
			Class 1:	
			Class 2:	5,000
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	5,000
1992-1996	ROAD/GENERAL MAINTENANCE	PUBLIC		
			Class 1:	
			Class 2:	
			Class 3:	20,000
			Class 4:	
			Class 5:	
			TOTAL	20,000
1997-2001	AIRFIELD MAINTENANCE	PUBLIC		
			Class 1:	
			Class 2:	5,000
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	5,000
1997-2001	ROAD/GENERAL MAINTENANCE	PUBLIC		
			Class 1:	
			Class 2:	
			Class 3:	20,000
			Class 4:	
			Class 5:	
			TOTAL	20,000
2002-2006	AIRFIELD MAINTENANCE	PUBLIC		
			Class 1:	
			Class 2:	5,000
			Class 3:	
			Class 4:	
			Class 5:	
			TOTAL	5,000
2002-2006	ROAD/GENERAL MAINTENANCE	PUBLIC		
			Class 1:	
			Class 2:	
			Class 3:	20,000
			Class 4:	
			Class 5:	
			TOTAL	20,000

GRANULAR RESOURCES DEMAND SUMMARY
Holman

YEAR GROUP	PROJECT (¥ Denotes Speculative Project)	CATEGORY		VOLUME, cu.m.
1987-2006	SUMMARY OF DEMAND VOLUMES			
	Holman		Class 1:	150
			Class 2:	25,550
			Class 3:	86,000
			Class 4:	14,000
			Class 5:	600
			TOTAL	



Scale 1:250 000 Échelle

Miles 5 0 5 10 15

Kilometres 5 0 5 10 15 20 25

7(1)(a) Lands Boundary

7(1)(b) Lands Boundary

Approximate Boundary of Granular Source

87–H–23 Granular Source Number

Proposed International Biological Program Area

EBA Engineering Consultants Ltd.	PROJECT INUVIALUIT SETTLEMENT SAND AND GRAVEL INVENTORY AND MANAGEMENT PLAN
CLIENT INDIAN AND NORTHERN AFFAIRS CANADA	TITLE GRANULAR DEPOSIT LOCATIONS HOLMAN DISTRICT OF FRANKLIN, N.W.T.
DATE 87/02/20 · DWN. EBR · CHKD BAB	DWG. NO. 0101-4575-002