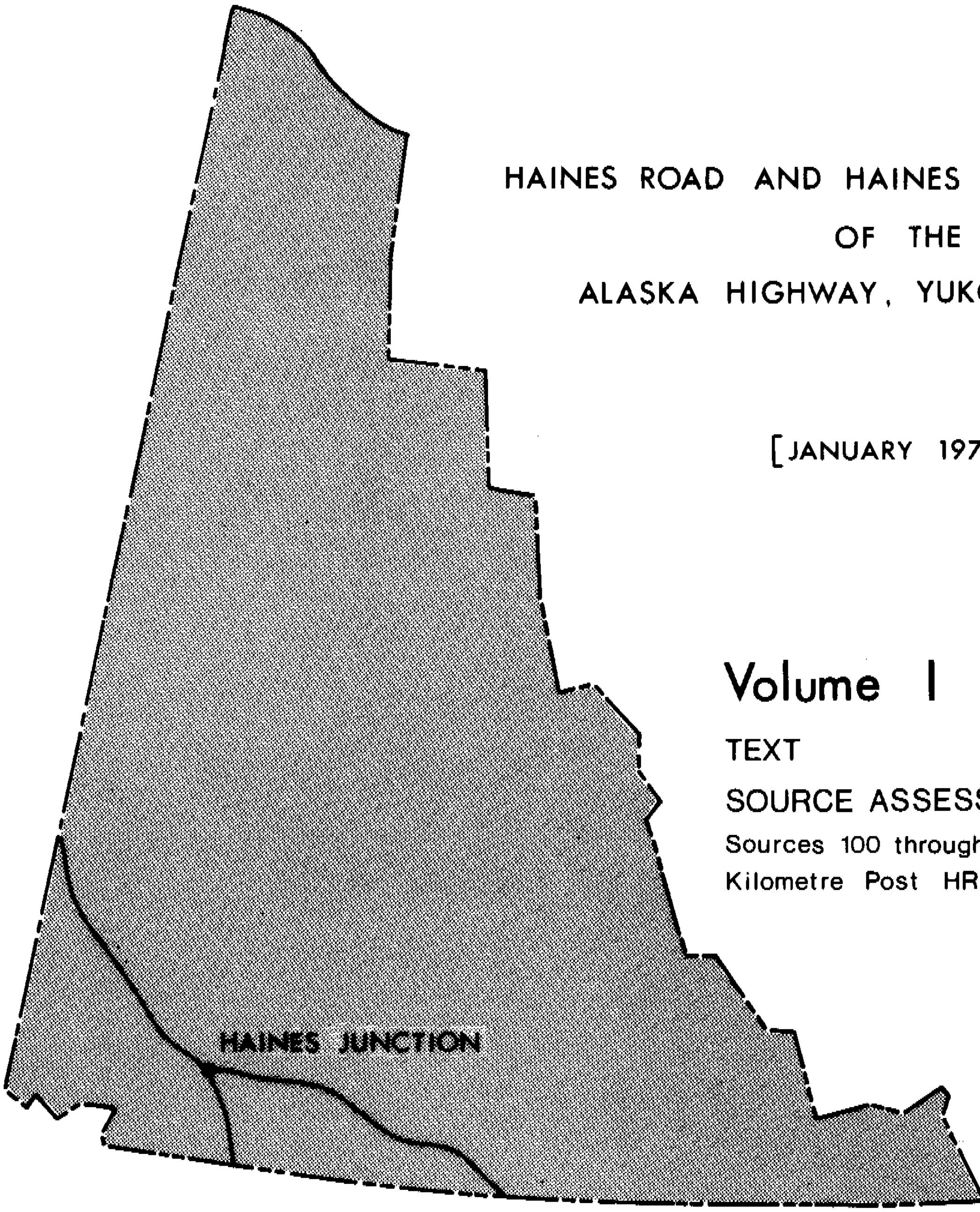
GRANULAR MATERIALS INVENTORY



HAINES ROAD AND HAINES KLUANE SECTION OF THE ALASKA HIGHWAY, YUKON TERRITORY

[JANUARY 1978]

Volume I

TEXT

SOURCE ASSESSMENT SUMMARIES

Sources 100 through 320

Kilometre Post HR 151 to HR 178

EBA Engineering Consultants Ltd.

F.F. SLANEY & COMPANY (ALBERTA) LIMITED

GRANULAR MATERIALS INVENTORY

HAINES ROAD AND HAINES KLUANE SECTION
OF THE ALASKA HIGHWAY
YUKON TERRITORY

Submitted to:

GOVERNMENT OF CANADA
DEPARTMENT OF INDIAN AND NORTHERN AFFAIRS

Prepared by:

EBA ENGINEERING CONSULTANTS LTD.
in association with
F.F. SLANEY AND COMPANY (ALBERTA) LIMITED

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APRIL 1978

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SUMMARY

An inventory of granular material sources has been conducted along a corridor extending one (1) mile on each side of the Haines Road (Y.T. Highway #4) from the Yukon/British Columbia Border (M.P. 95) to the intersection of Haines Road with the Alaska Highway (Y.T. Highway #1) to Mile Post 1040.

Results of the inventory are presented in this two volume report. Volume 1 contains the text and source information summaries from the Yukon/British Columbia border north to Kilometre Post HR 178. Information for sources north of HR 178 are contained in Volume II. Source information includes an airphotograph showing the site location and details of the geomorphic, environmental and laboratory assessment.

The text of the report contains a regional overview of the study area, a description of the inventory and a proposed management plan for the granular resources.

Substantial quantities of granular resources were found to exist within the study area. Although many potential sources do not appear to exhibit overwhelming concerns of an environmental/social nature, aggregates suitable for high quality applications are not readily available everywhere. The largest quantities were found to be concentrated near the south end of the study area where user requirements are expected to be lower.

Potential source areas were classified into three groups: principal, secondary and general fill. Principal sources are those that contain good quality material and which can be developed without undue environmental/social impact. Secondary sources are those that are of marginal quality or which contain good quality aggregate but where development is restricted by apparent environmental/social concerns. General fill sources are areas where material can be acquired with little regard for quality. Criteria are suggested for application to resource management.

I. INTRODUCTION

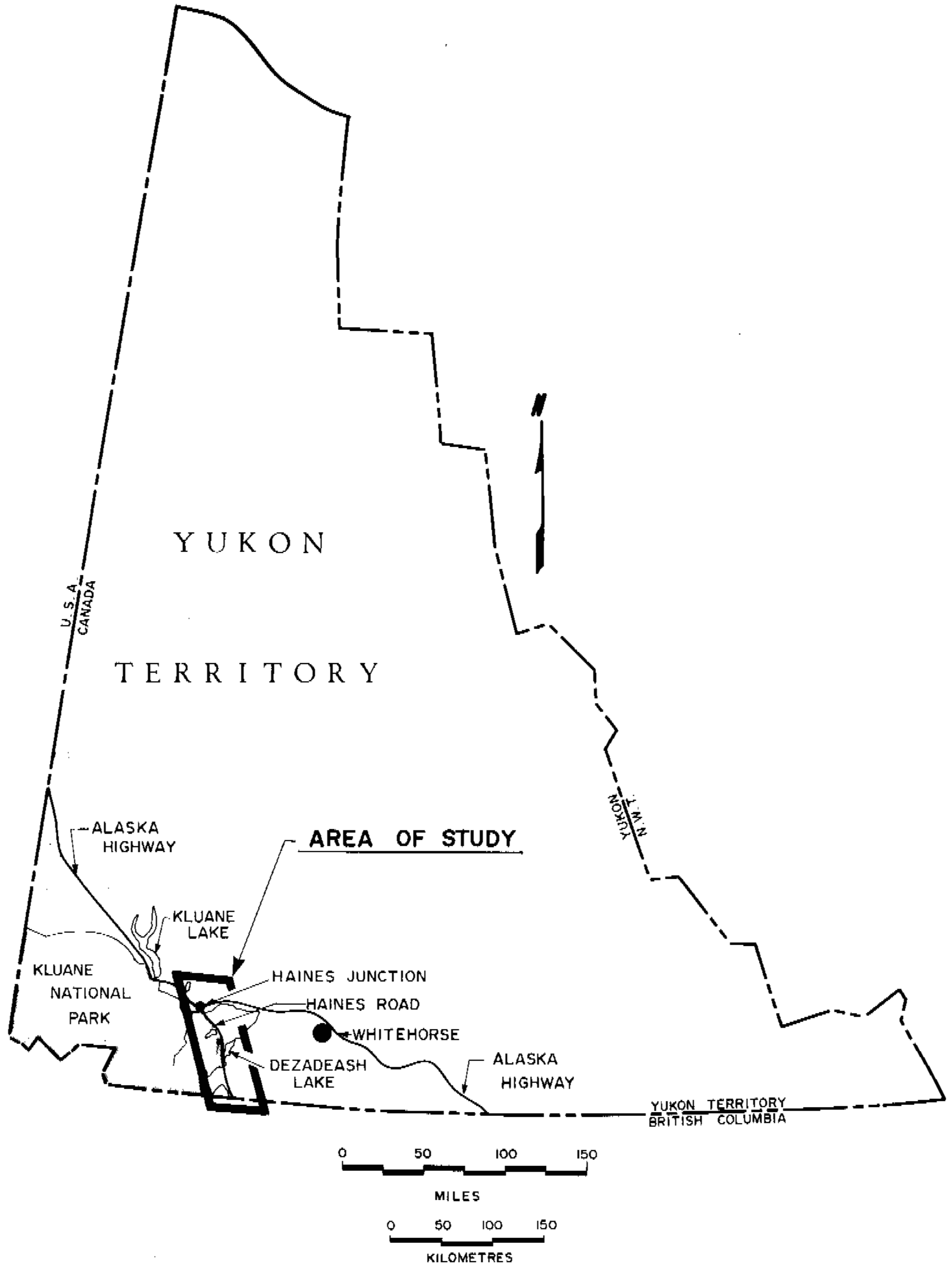
1.1 General

This report presents the results of a Granular Materials Inventory conducted by EBA Engineering Consultants Limited in association with F. F. Slaney & Company (Alberta) Limited along specified sections of the Haines Road and Alaska Highway in the southern Yukon Territory (Drawing No. 1.1).

The investigation was undertaken at the request of the Department of Supply and Services (DSS) acting on behalf of the Department of Indian Affairs and Northern Development (DIAND) Canada, DSS File No. 04 SUC7111-7-0171.

The principal objective of the study was to "conduct an Inventory of Granular Material sources along a corridor extending one (1) mile on each side of the Haines Road (Y.T. Highway #4) from the Yukon/British Columbia Border (M.P. 95) to the intersection of Haines Road with the Alaska Highway at Haines Junction and thence west along the Alaska Highway (Y.T. Highway #1) to Mile Post 1040".

Secondary objectives were to provide; (a) recommendations on the best location for highway borrow pits, and specific procedures to be followed in developing them, in order to reduce the frequency to a more reasonable yet practical number; (b) recommendations concerning restraints for minimizing environmental disturbances during development and operation of these borrow pits identified in (a); (c) recommendations for subsequent methods of restoration; and (d) general recommendations for management of the granular resources identified.



HAINES ROAD - ALASKA HIGHWAY
GRANULAR RESOURCES INVENTORY

LOCATION OF STUDY AREA

EBA Engineering Consultants Ltd.	
JOB No: 36 - 0260	DATE: 77·01·11
DRAWN BY: BJH	DRAWING No:
REVIEWED BY:	1.1

1.2 Project Organization

The project involved three components:

I. Assessment of Granular Material Sources
This included an evaluation of location, quantity and quality of borrow material available in the study corridor.

II. Assessment of Environmental Concern
This included an evaluation of environmental concerns associated with material sources identified in I, recommendations for development restraints and restoration procedures.

III. Preparation of a Management Plan for Resource Development - conducted jointly by EBA and Slaney. This included recommendations for pit location and spacing in view of likely future development as well as procedures to be followed during development and subsequent reclamation.

1.3 Report Organization

Assembly of the report is in two volumes, the first comprising the text of the report and source assessment information from the Yukon/ British Columbia Border north to kilometre post 178. Assessment information for the remaining sources is contained in Volume II.

The text portion describes the methodology adopted in conducting the study and presents a regional overview of the existing geomorphological, biological and human use conditions in the study area. Inventory results are summarized in section III of the text, followed by a proposed management plan for granular resources.

Source information is presented in a north to south sequence and includes a detailed assessment sheet, airphoto showing source outline and test pit locations, laboratory test results, test pit logs and environmental assessment sheet.

1.4 Methods of Investigation

1.4.1 Preliminary Office Studies

Initial work involved the collection and evaluation of existing surficial and bedrock geological data, in order to provide an overview of the landforms within the study area and their possible petrological characteristics.

GSC Map 1019A, Geology of Dezadeash, Y.T., prepared by E. D. Kindle, served as the starting point. This was subsequently updated using information presented by Rampton (1976) and personal communication with Geological Survey personnel currently mapping areas west of 138° longitude along the Alaska Highway.

Airphoto interpretation was performed to identify landforms containing potential granular materials. High level photos were used to obtain a regional overview of the study corridor. A 1974 survey of Kluane National Park, flown at an approximate altitude of 5,340 m ASL, provided excellent coverage of the central portion of the study area. At the extreme north and south ends, however, only 1947 coverage was available. Not only were these photos taken at a higher altitude (6,100 m ASL), but the quality is poor, and hence identification of subtle landforms near the northern limits of the study area was somewhat hampered.

Excellent low level photographs were also obtained along the entire highway corridor. This survey, conducted in 1976, was flown at an average elevation of approximately 2000 m ASL. The resulting 1:8000 scale is too large to accommodate the width of the entire study corridor on a single photograph.

Available information relating to biological resources and land-use the region was also collected and reviewed.

1.4.2 Field Reconnaissance and Sampling

A field reconnaissance program was conducted to check on potential sources identified on the airphotos during preliminary office studies. Field studies were conducted during the last week of September, 1977.

Shallow test pits were excavated at a number of sites along the route, and samples for laboratory analysis were aquired. The large number of existing borrow pits, both active and inactive, as well as road cuts, especially within the southern part of the study area, provided exposures of the subsurface material, and permitted an assessment of soil conditions.

Access to many of the potential sources was facilitated by the existence of a telephone line and abandoned pipeline, both of which parallel the highway on separate right-of-ways. A pocket level and Topofil Chain were used to survey surface elevations and distances. A Geonics EM31 inductive electromagnetic device was used in some areas to measure shallow resistivity, and evaluate the nature of the subsurface material indirectly.

1.4.3 Evaluation of Environmental Concerns

During the field program, each site was evaluated (scored) in terms of potential concern for eight environmental factors utilizing a scale from zero to five. Factors evaluated were related to geoterrain, vegetation, terrestrial fauna, acquatic fauna, surface water, land use and special interest. Details of evaluation within each category are given in the source assessment. Each catagory (factor) was separately evaluated and a value assigned. Values included:

0 - indicating no apparent concern for the factor considered in view of potential extraction of granular material.

1-4 - indicating increasing concern for the factor considered with possible mitigation of the concern taken into account. A score of one would indicate an existing concern which in the evaluators view could be quite easily avoided using appropriate removal procedures. A score of four would indicate a concern which could not be easily avoided.

5 - indicating a very high concern which appeared unlikely to be amenable to mitigative efforts. Development is not recommended due to environmental concerns.

These scores simply indicate the degree of apparent difficulty in overcoming environmental concerns at each site. A score of 5 means that development is not currently recommended. Demonstration that effective mitigation procedures could (and would) be used during development could result in a reduction of the score to less than 5.

Following the field reconnaissance program an environmental assessment of sites was completed. This work involved the examination of approximately 40 sources of granular materials previously identified. A description and analysis of each area was prepared summarizing available data on terrain, vegetation, fauna habitat value, surface water, land use, heritage resources and special interests. Site descriptions and evaluations are included in the source assessment data.

Field studies were followed by discussions with regional resource managers in Whitehorse and Public Works Canada officials in Vancouver. These discussions provided some background data on present resource management operations and future needs along the highway, and were used together with field observations, airphoto interpretation and a review of reference publications to provide the final site assessment. Persons contacted are listed following the bibliography.

1.4.4 Laboratory Analysis

Sixty-five (65) granular samples collected during the field program were subjected to laboratory testing. The purpose of these tests was:

(a) to verify and extend the field descriptions;

(b) to obtain textural data (grain size distribution) for assessing engineering properties;

(c) to indicate the uniformity of granular material within a single deposit; and

(d) to provide general petrographic information for assessing deleterious components and potential aggregate performance in construction materials.

Sieve and petrographic analyses were performed on each of the 65 samples. Sulphate soundness tests were also undertaken on three samples with different petrological characteristics, in order to assess the significance of potentially deleterious components.

1.4.5 Borrow Volume Calculations and Assumptions in Interpretation

Data acquired during the laboratory analyses were integrated with field reconnaissance information and then utilized to update the original airphoto interpretation.

Borrow volume estimates were usually calculated by planimetering the total area of the deposit as marked on the aerial photographs, and then estimating the average potential thickness of borrow material available. Sufficient field data were available to calculate the dimensions of certain eskers and beach deposits with some accuracy. In other cases (kame complexes, for instance) the total area of the deposit shown on the airphoto was reduced by a factor which accounted for the low-lying areas within the source which appeared to have little granular resource potential. More specific information concerning the assumptions used at each site are presented in the detailed source assessment sheets.

Probably the most significant assumption in the present analysis concerns the uniformity of the deposit. Inherent in the calculation of borrow volume is the assumption that the samples obtained from that deposit are entirely representative of the granular resource, both in grain size and petrology. While some deposits are known to be rather uniform (active flood plains, for instance), others are characteristically non-uniform (eskers and kames). The present study must be viewed as a reconnaissance inventory, and further field and laboratory programs are required to verify the quality and quantity of granular resources.

II. REGIONAL OVERVIEW

2.1 Geology

The study corridor lies within the Dezadeash map area, the geology of which was reported by E. D. Kindle in 1953. Recent publications (1975) from the Geological Survey of Canada's Operation Saint Elias, Yukon Territory have revised and updated some of Kindle's work. The following geological overview is a synopsis of available reports in the study area.

The bedrock geology of the southwestern Yukon is complex. Folded and faulted igneous, sedimentary and metamorphic rocks ranging in age from Mid-Paleozoic to Tertiary are present. Three separate physiographic regions dominate the southwestern Yukon: the St. Elias Mountains, the Coast Mountains and the Kluane Plateau. The broad Shakwak Valley separates the St. Elias Mountains in the southwest from the Kluane Plateau in the northeast along a linear trend extending from the Yukon/ Alaska border to Dezadeash Lake. Southeast of Dezadeash Lake the Shakwak Valley divides the Coast Mountains from the Kluane Plateau. South of Dezadeash Lake the Klukshu and Tatshenshini River valleys separate the St. Elias Mountains on the west from the Coast Mountains on the east. The study corridor occupies the Shakwak Valley from kilometre post 1674 on the Alaska Highway south to Dezadeash Lake, and the Klukshu and Tatshenshini River valleys from Dezadeash Lake to the Yukon/British Columbia border.

The Kluane Ranges form the eastern margin of the St. Elias Mountains. Bedrock exposed along the western slopes of the Kluane Ranges belongs to the Upper Jurassic-Lower Cretaceous Dezadeash Group. The Dezadeash Group consists entirely of marine flysch, ie. sandstones, greywackes, siltstones and shales, deposited mainly by turbidity currents along the distal portion of the subsea fan (Eisbacher, 1975). Low-grade contact metamorphism has altered these sediments into meta-sandstones, meta-greywackes and meta-siltstones, which for the purposes of this report have been classified as quartzites. Slates present in the stratigraphic section are metamorphosed shales.

The Coast Mountains on the east side of the southern portion of the study corridor are represented by the Boundary Ranges. Both the Boundary Ranges and the Kluane Plateau are composed of rocks known as the Coast Crystalline Complex. Intrusive granodiorite is the main rock type of the Boundary Ranges. The Kluane Plateau consists mainly of quartz-biotite schists which are believed to be the metamorphosed facies of the outer subsea fan of the Dezadeash Group (Eisbacher, 1975).

Eisbacher (1975) reported a zone of high angle reverse faulting following the Shakwak and Klukshu - Tatshenshini River valleys. The study corridor lies within structurally controlled valleys with Coast Crystalline Complex rock thrust over Dezadeash Group materials. Pleistocene and recent sediments have infilled the valleys and obscured the fault line.

2.2 Geomorphology

In Pleistocene time most of the study area was covered by valley glaciers to an elevation of approximately 1800 m (GSC Map 1019A). Ablation processes have produced a variety of glacial, glaciolacustrine, and glaciofluvial landforms, and these have been modified in recent times by fluvial processes.

Much of the highway corridor is covered by a blanket of gravelly silty sand or sandy silt. While this deposit is commonly nonstratified, sorting and stratification were evident in some areas.

Large areas in the northern part of the study area have been designated as undifferentiated drift. Destinctive landforms are largely absent except for a few glacial flutings and bedrock controlled ridges. Materials present include loessal sediments overlying gravelly silty and sandy silt.

Melting of the valley glaciers produced a large proglacial lake (Glacial Lake Champagne). Thick deposits of stratified silts mark the bottom of this lake, while beach deposits of sand and gravel now mark the former lake perimeter. Beach ridges which appear throughout the study area, are generally exposed between elevations of 700 and 850 m.

Sand and gravel accumulated in watercourses within, upon, and in front of stagnating ice, forming the large esker-kame complexes which occur along the southern sector of the highway. The crests of the eskers are generally accordant, and somewhat lower in elevation than crests within the associated kame complexes. Although sand and gravel are the chief constituents of most of the eskers examined, silt and boulders are also present in places. Kame deltas associated with these esker complexes are typically fine grained and poorly sorted. Moulin kames examined near Kloo Lake also exhibited a wide range of grain sizes although individual beds tended to be well sorted.

Stratified drift accumulated between the margin of stagnating glaciers and the adjacent valley walls south of Klukshu Lake, leaving behind a large kame terrace. While much of the ice-contact form of the terrace face has been subsequently destroyed by post-glacial processes, typical ice-contact features have been exposed by present borrow removal operations.

In recent time major advances of the Lowell Glacier have dammed the Alsek River, causing the river waters to back up and flood much of the study area northwest of Haines Junction. The old shorelines of Lake Alsek, as it was called, are marked by well developed beaches, composed principally of sand and gravel in high-energy environments such as spits, and much siltier material in the low-energy bays.

Recent glacial activity is also evidenced by the rock glaciers which occur on the gentle slopes west of Dezadeash Lake. These are characteristically lobate, with abruptly steepened termini composed of angular boulder rubble derived from the bedrock cliffs above. Concentric lobes, which are clearly evident on the airphotos, suggest that these are ice-cored.

Recent processes have also produced two of the most prominant types of landforms encountered along the study corridor: alluvial fans and alluvial cones. The largest fans originate along the west side of the highway north of Haines Junction. These vast deposits of sand and gravel also commonly contain active meander plains, as well as active and inactive flood plains.

Alluvial cones occur along the east side of the Haines Road south of Klukshu Lake. The material in these deposits is very poorly sorted and may include boulders up to 1 m in diameter.

2.3 Climate

Climate in the area is characterized by dry, cold continental conditions, caused in part by the area's location in the rainshadow of the St. Elias peaks.

Climatic data from the Haines Junction meteorological station are thought to be fairly representative of valley conditions in the study area. Average annual rainfall and snowfall is low (approximately 152 mm rainfall and 1270 mm snowfall). The frost-free period is short (21 days average) and growing degree days total only an average 828. Plant growth in the area is restricted by both lack of moisture and the short growing season. Surface run-off is generally low at most sites, reflecting low total precipitation.

2.4 Vegetation

The study area is entirely within the Kluane Forest Section of the Boreal Forest Region (Rowe, 1972). Forests in this section reflect the dry cold regional climate described in the foregoing. Forest stands are generally open and park-like, even along river valleys. From a commercial point of view, the best forest stands are valley associations of white spruce, trembling aspen and balsam poplar. On benchlands along the valley sides, vegetation is composed of white spruce, trembling aspen and Alaska birch. Lodgepole pine does not occur in this forest section.

Forest stands are interspersed with open, grassy meadows, particularly in the Haines Junction area. Previously disturbed sites, such as roadsides, abandoned trails and the abandoned pipeline rights-of-way are frequently covered with native grasses, predominantly wheat grass, (*Calamagrostis sp.*) and rough fescue (*Festuca scabrella*).

On upland slopes the open forest is composed of white spruce with an undergrowth of low-growing willows and birches, giving way to shrubby or grassy barrens at about 1400 m elevation.

The existing vegetative cover of each potential borrow area is included in the site descriptions. An assessment of the commercial and/or aesthetic value of vegetation is a component of an environmental sensitivity index, shown in the source assessment.

2.5 Terrestrial Fauna

Areas immediately adjacent to the highway corridor involved in this study may support as many as 150 different bird species and perhaps as many as 40 mammal species. Because the characteristic forest habitats in the area are relatively unproductive, most birds an mammals occur in moderate to low numbers. Exceptions do, however, occur and certain big game animals (grizzly bear, moose, Dall sheep) are thought to occur in high numbers relative to other Yukon areas. Partly as a reflection of this the Kluane Game Sanctuary was set aside in 1942 to protect wildlife values in the region.

Of the various bird and mammal species occurring in the region, few can be judged as being highly susceptible to activities which may arise during the removal of gravel from the study area. Most birds occurring in the area are those of the boreal forest. They characteristically remain dispersed throughout any area they inhabit, thus minimizing the severity of any disturbance which might occur. Gregarious forms such as waterfowl occur only in small numbers and in very restricted lake and marsh habitats. These are relatively easy to avoid in time or space. Mammal species which might be susceptible to significant disturbance include the grizzly bear, Dall sheep and perhaps moose.

The grizzly bear (*Ursus arctos*) is widely distributed throughout the vegetated portion of the Kluane area, with an estimated density of 1 per 25 km^2 (Parks Canada, 1977). Sockeye salmon runs in the Tatshenshini River and its tributaries are a favoured source of food for grizzlies. Grizzlies are reported to range over a very wide area, up to 125 km^2, with dens generally in the subalpine zone around 1000 to 1400 m. Borrow operations within the highway corridor and associated noise of construction activities could result in stress to the grizzly bear populations and an increase in man/bear encounters. The corridor south of Klukshu is considered the most critical grizzly bear range in terms of numbers present.

Dall sheep (*Ovis dalli*) occupy higher mountain slopes in the general area and may be sensitive to borrow operations in some fan deposits high on valley sides. These sheep can range from the valley bottom to 2100 m or more depending on time of year and availability of forage.

Moose (Alces alces) are present in the Kluane area but because of generally non-gregarious habits are judged unlikely to occur in numbers sufficient to represent a significant disturbance to the population near potential borrow sources.

The type of wildlife habitat available at each potential borrow site has been assessed and a value assigned in the environmental sensitivity index.

2.6 Aquatic Fauna

The study area is entirely within the Alsek-Tatshenshini River system which drains into Dry Bay in coastal Alaska. All five species of Pacific salmon are indigenous to this drainage, except where barriers prevent the migration of fish.

Rainbow trout, Dolly Varden, arctic char and arctic grayling are also present throughout most of the drainage and some lakes support lake trout, whitefish and northern pike. The Kathleen Lakes and Kathleen River contain a unique population of landlocked kokanee salmon, as well as the only native rainbow trout populations in the Territory.

Commercial use of the fisheries resource is substantial. In the 1950's, commercial fisherman in the Dry Bay area harvested an annual average of 27,825 sockeye, 102 pink, 10,042 chum, 12,894 coho and 1,347 chinook salmon from the Alsek River (Aro and Shepard, 1967). In addition, native subsistence fisheries on the Klukshu River take an annual average of approximately 2,000 sockeye and 100 each of chinook and coho salmon (Aro and Shepard, 1967).

Sport fishing occurs throughout the Alsek-Tatshenshini drainage system, particularly in the Klukshu River and the Kathleen Lakes and River.

The potential for involvement of aquatic systems at each site has been evaluated for the environmental sensitivity index.

2.7 Regional Land Status and Use

Most lands adjacent to the highway are unoccupied crown lands, except for the village of Haines Junction. A few small parcels of titled land used for residences or lodges are located at Dezadeash Lake, Kathleen Lakes and Bear Creek. The Haines Junction Local Improvement District occupies a 75 km^2 area on the north side of the Dezadeash River at the junction of the Alaska and Haines Highway. The village of Haines Junction has a population of 268 (1976 census).

Other land uses encountered within the corridor include: agricultural (grazing), industrial (abandoned pipeline and pumping stations), communication (telephone lines), Native Indian hunting, trapping and recreational use, the latter including both commercial and individual pursuits.

Horses and cattle range throughout much of the highway corridor. A petroleum products pipeline, no longer in use, adjoins the highway, crossing it at several points. Two abandoned pumping stations and a petroleum products storage site are also within the study area. The pipeline right-of-way and access trails from the highway to the pipeline corridor with upgrading, could serve as haul roads from borrow sources. A telephone line is present in the highway corridor.

Areas formerly reserved for Native peoples are located at Dalton Post, Klukshu village, Haines Junction, and Kloo Lake, but the extent of future Indian lands is presently under negotiation.

Registered outfitter/guiding areas and registered trapping areas are designated for all the lands east of the Haines Road and the Alaska Highway.

Recreational camping and picnic sites have been established by the territorial government at several points along the corridor. The Kathleen Lake campsite is operated by Parks Canada.

Kluane National Park is the predominant landholding in the region. The 2200 km^2 area was set aside as a National Park in 1976 out of the larger Kluane Game Sanctuary established earlier as a wildlife preserve. All of the study area west of Haines Road and the Alaska Highway is within the Kluane Game Sanctuary. National Park lands border the highway from Klukshu to approximately 10 km north of Haines Junction. A 300 m buffer strip presently exists between the existing highway alignment and the legal park boundary to allow for possible highway realignment within the corridor. It is expected that the park boundaries will be adjusted to abut the highway when paving and realignment are complete (pers. comm. J. Masyk, Park Superintendent).

It is a stated policy that granular materials for off-park use shall not be removed from Park lands. Potential borrow sites identified within park boundaries are therefore inaccessible for highway or pipeline use unless park policies change. In the environmental sensitivity index, shown in the Source information, sites within the Park have been given a maximum rating of 5.

Regulations concerning the Kluane Game Sancturary provide protection for wildlife but do not preclude other land uses. Borrow operations within the sanctuary would be subject to particular scrutiny by wildlife managers to avoid undue stress to wildlife populations and habitat. Sites within the sanctuary have been given a sensitivity rating of 3.

The Canadian Committee for the International Biological Program (IBP) has designated two areas as potential reserves for the purpose of scientific study. Both IBP reserves encountered in the study corridor are within the Kluane Game Sancturary (IBP Sites 16 and 16b), thus the involvement of these has been given a similar sensitivity rating to the game sanctuary.

All other land uses have been assigned sensitivity ratings dependent on the relative importance within the area.

2.8 Heritage Resources

Archaeological investigations in the Kluane region have not been extensive, but work at some sites indicates that the region has been occupied for over 7000 years. It is probable that the known sites do not represent the total prehistoric record. The likelihood of further discoveries long the highway corridor is high because the route follows existing drainage channels and known historic travel routes. Known sites have been recorded near Dalton Post, Klukshu village and east of Dezadeash Lake. Areas of historic interest are recorded for Dalton Post, Bear Creek and Kloo Lake.

The potential for archaeological and historic discoveries is high at many of the designated borrow areas, since prominent land forms such as beach terraces are favoured sites used by prehistoric peoples. Each proposed excavation area and access road should be field checked by a qualified archaeologist before development is undertaken.

For purposes of the environmental sensitivity index, deposits were rated in relation to known archaeological and historic sites only. No field searches were undertaken.

2.9 Special Interest Sites

Eleven sites were judged to have special attributes because of particular landscape features or recreation potential.

Ratings were assigned on the basis of the field survey, published maps of recreational capability and discussions with regional resource managers.

III. INVENTORY OF GRANULAR RESOURCES

3.1 Landforms Along the Study Corridor

Drawing No. 3.1 shows those portions of the Haines Road and Alaska Highway which have been included in the present study. The landforms within this area are primarily glacial, glaciofluvial or glaciolacustrine in origin, with some modification by recent fluvial processes.

North of the British Columbia/Yukon Territory border (Drawing No. 3.2), the Haines Road traverses a terrace which abuts against bedrock on the east side and is dissected by the active meander plain of the Blanchard River on the west. Alluvial cones originate at the base of each bedrock gulch, spreading out over the terrace in a fan-like pattern. Eskers in this region commonly appear in large complexes, and are usually associated with adjacent kame or kame-and-kettle complexes.

North of the Takhanne River the highway traverses a number of bedrock controlled drift ridges (Drawing No. 3.3). Near the Klukshu River the thin drift which covers the bedrock merges with a narrow kame terrace containing ice contact features. In some places this terrace has been dissected, either by large alluvial cones originating in the bedrock above (as occurs at Vand Creek) or by local gullying within the terrace itself.

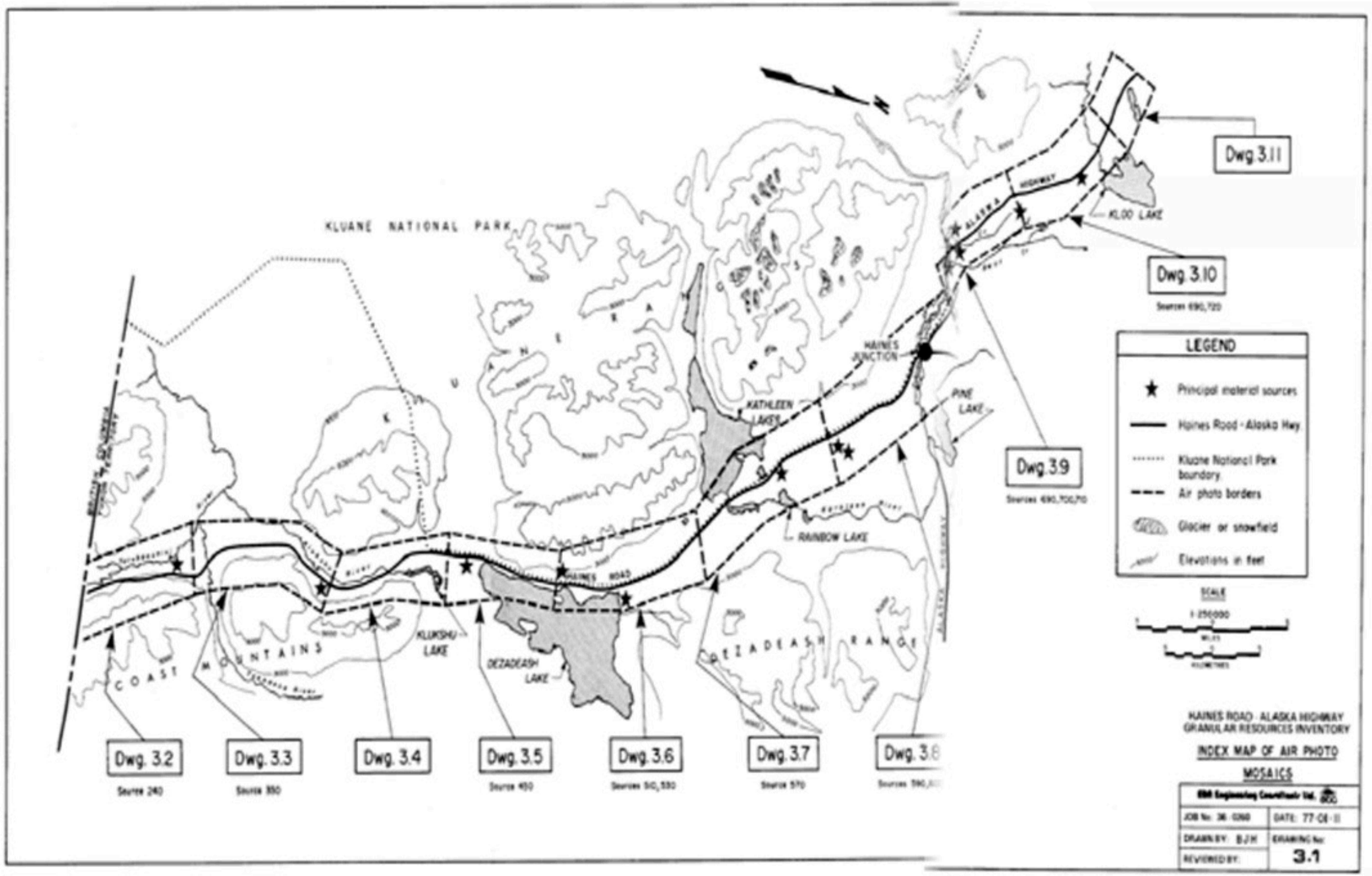
At Klukshu Lake (Drawing No. 3.4) the highway swings west over a broad flat alluvial fan containing the active flood plain of Gribbles Gulch, and then north through an esker-kame complex near Dezadeash Lake (Drawing No. 3.5).

Narrow rock glaciers occupy the lower reaches of the mountain gulches along the west shore of the lake, spreading out over the thin drift and bedrock surface to within 500 m of the highway. At the north end of the lake a series of gentle beach ridges mark the limits of one arm of Glacial Lake Champagne (Drawing No. 3.6). The Haines Road then traverses approximately 13 km of undifferentiated glacial drift. Except for a few ridges and glacial flutings northeast of the road, few distinct landforms can be differentiated in this area.

A series of well developed beach terraces occur at Kathleen Lakes (Drawing No. 3.7). Where examined, these were found to consist primarily of silt. Sand and gravel are abundant both within and between the esker-kame complexes situated in the same vicinity.

As Drawing No. 3.8 shows, the present day torrential watercourse of Quill Creek occupied a much broader flood plain in the past, overlying the coarser glacial deposits to the south and dissecting the undifferentiated drift to the north.

The study corridor crosses the braided flood plain deposits of the Dezadeash River south of Haines Junction, and then follows the Alaska Highway to the northwest. Along the southwest side of the route lie a series of coalescing alluvial fans and active meander plains. To the northeast lie a series of Lake Alsek beach terraces (Drawing No. 3.9). Beyond Summit Creek the northeast side of the route consists of undifferentiated drift, except for a singular beach ridge which crosses the highway near Kloo Lake (Drawing No. 3.10). Low, circular mounds are apparent on the airphotographs between Kloo Lake and Sulphur Lake (Drawing No. 3.11). Their origin is unconfirmed at the present time, but field inspection suggests that these may be buried moulin kames.



KLUANE NATIONAL PARK
BRITISH COLUMBIA
YUKON TERRITORY
KLUANE RANGES
KATHLEEN LAKES
HAINES JUNCTION
PINE LAKE
RAINBOW LAKE
KLOO LAKE
ALASKA HIGHWAY
HAINES ROAD
COAST MOUNTAINS
KLUKSHU LAKE
DEZADEASH LAKE
DEZADEASH RANGE
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Kluane National Park boundary
Air photo borders
Glacier or snowfield
Elevations in feet
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MOSAICS
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JOB No: 36-0260
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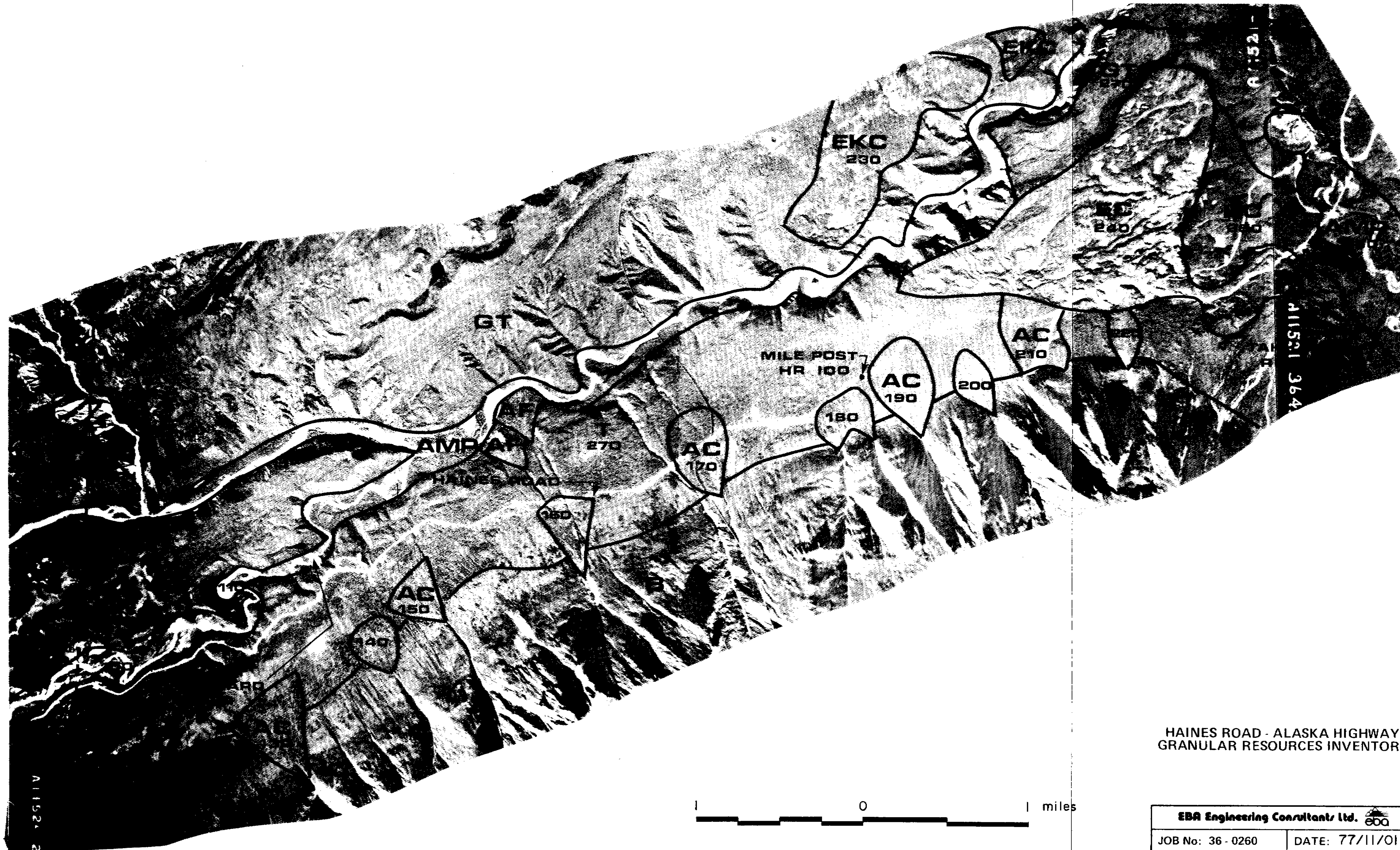

1 0 1 miles

1 0 1 kilometres

HAINES ROAD - ALASKA HIGHWAY
GRANULAR RESOURCES INVENTORY

EBA Engineering Consultants Ltd.	
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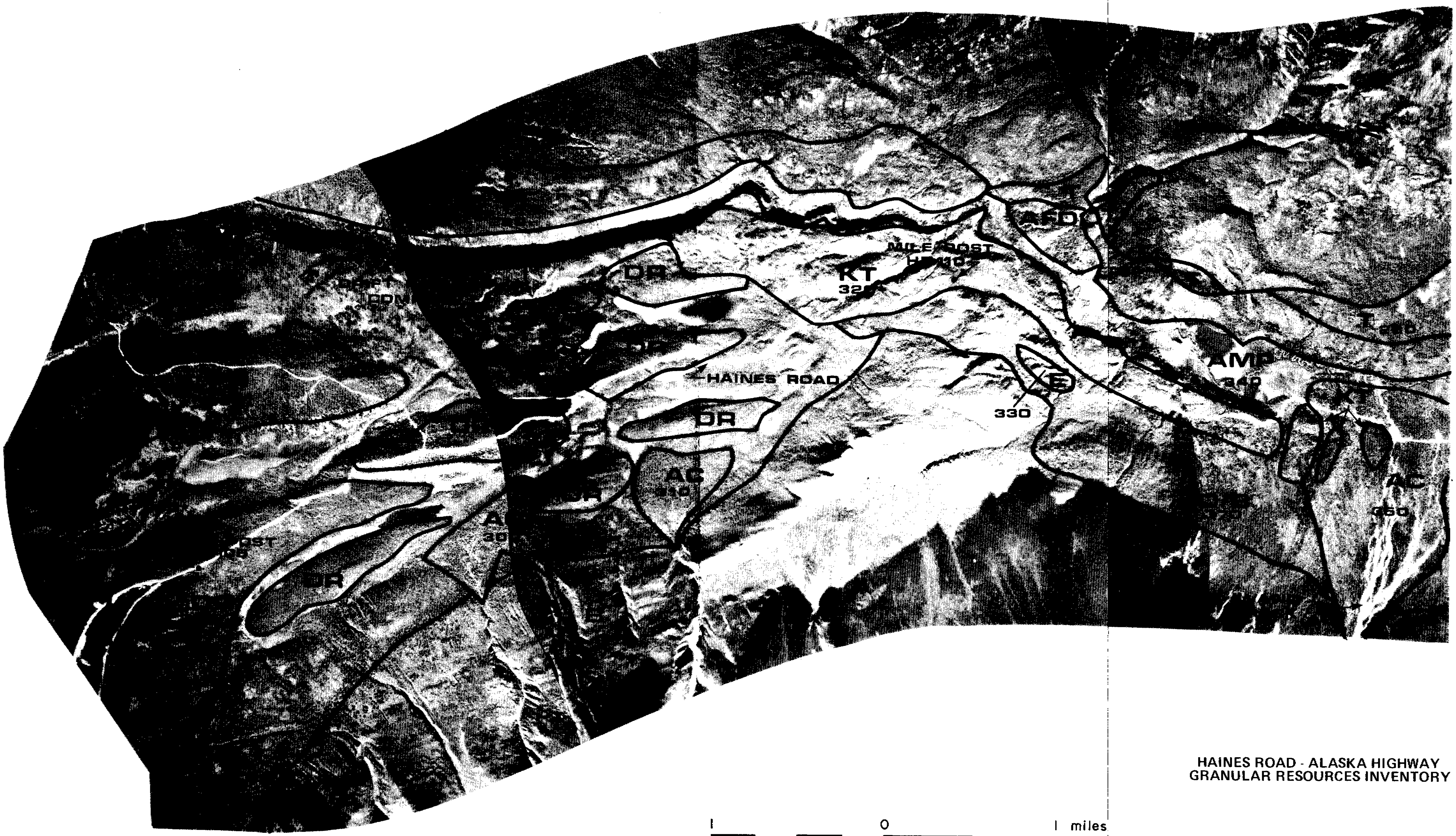

HAINES ROAD - ALASKA HIGHWAY
GRANULAR RESOURCES INVENTORY

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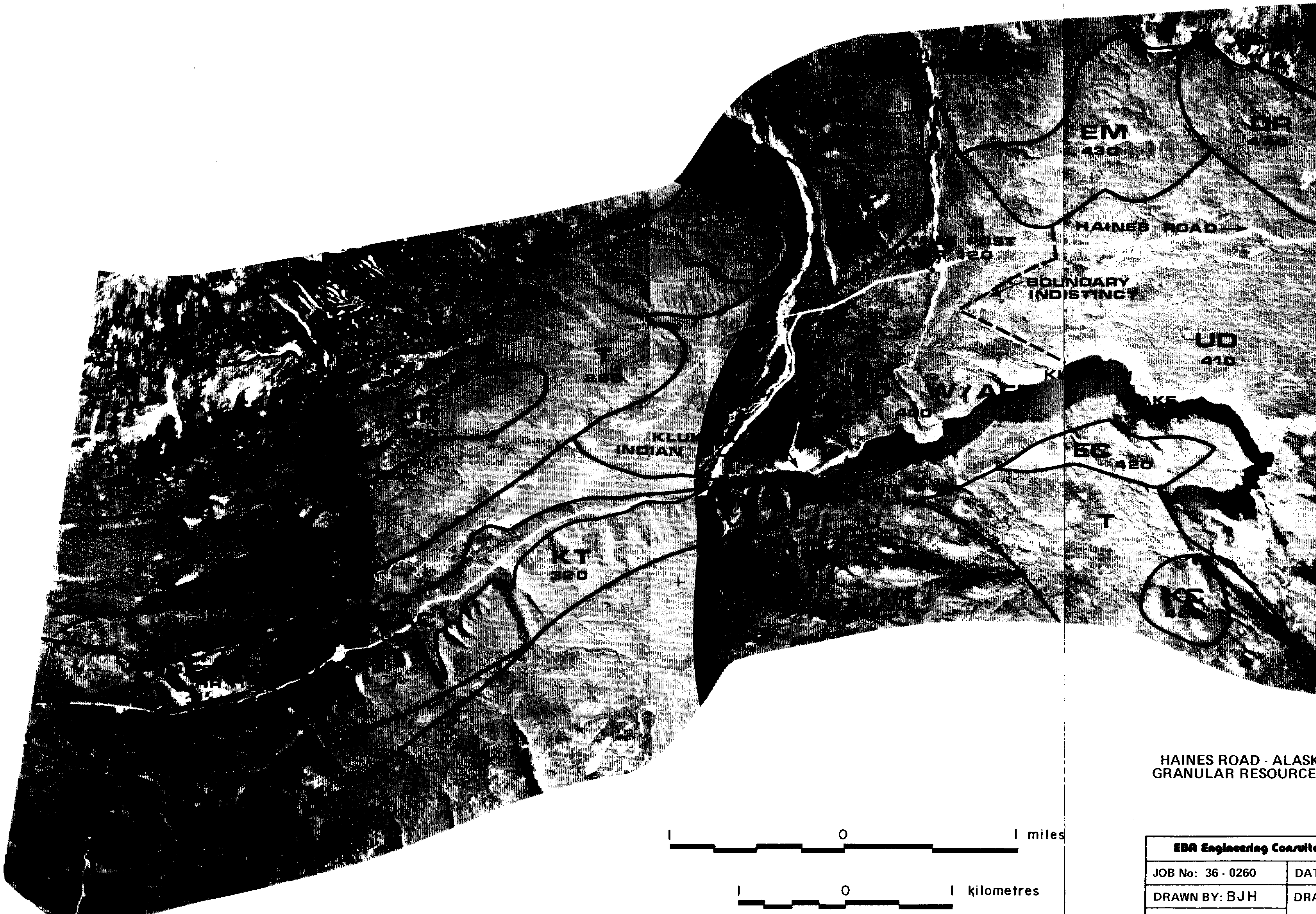

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HAINES ROAD - ALASKA HIGHWAY
GRANULAR RESOURCES INVENTORY

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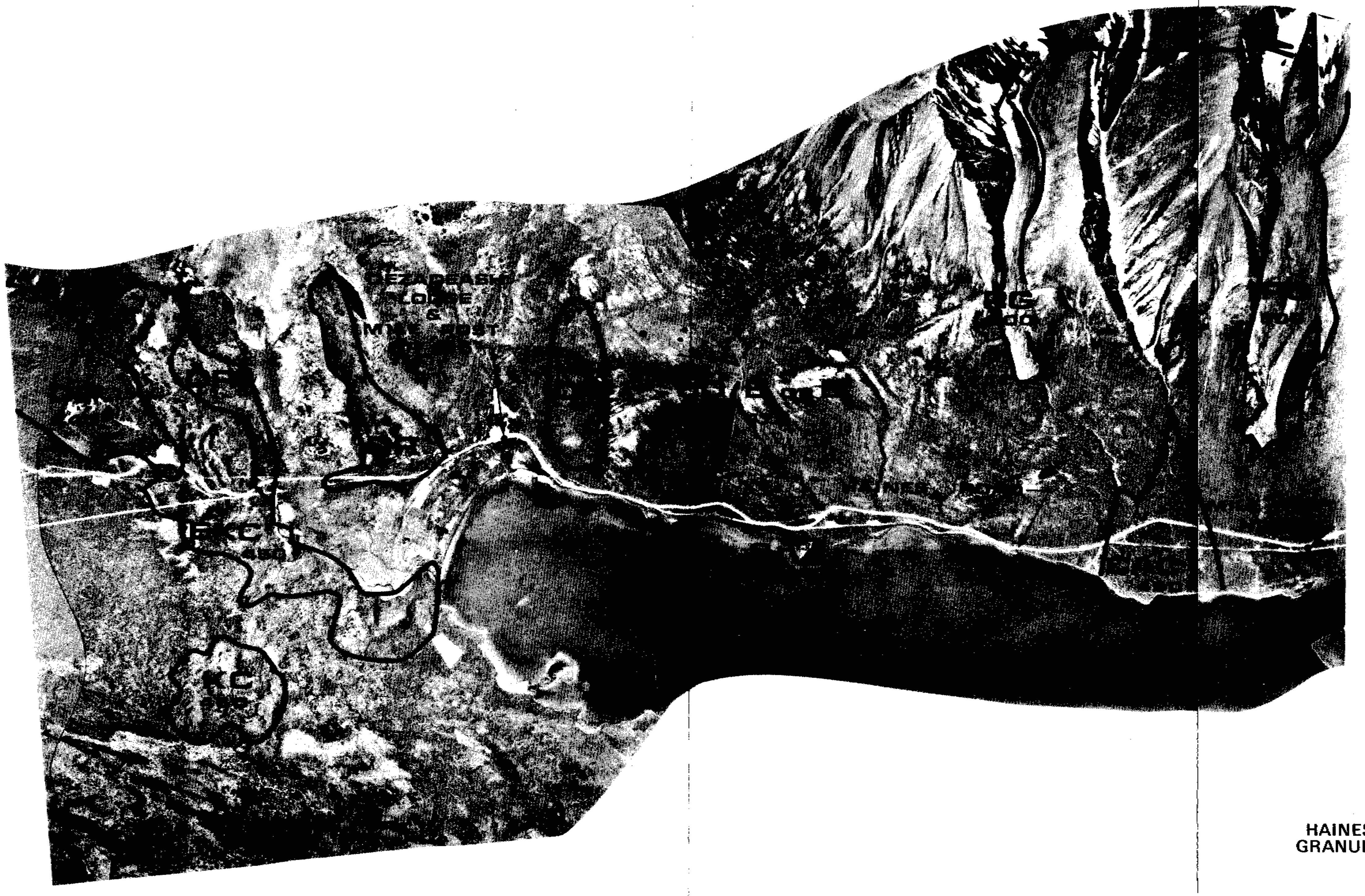

HAINES ROAD - ALASKA HIGHWAY
GRANULAR RESOURCES INVENTORY

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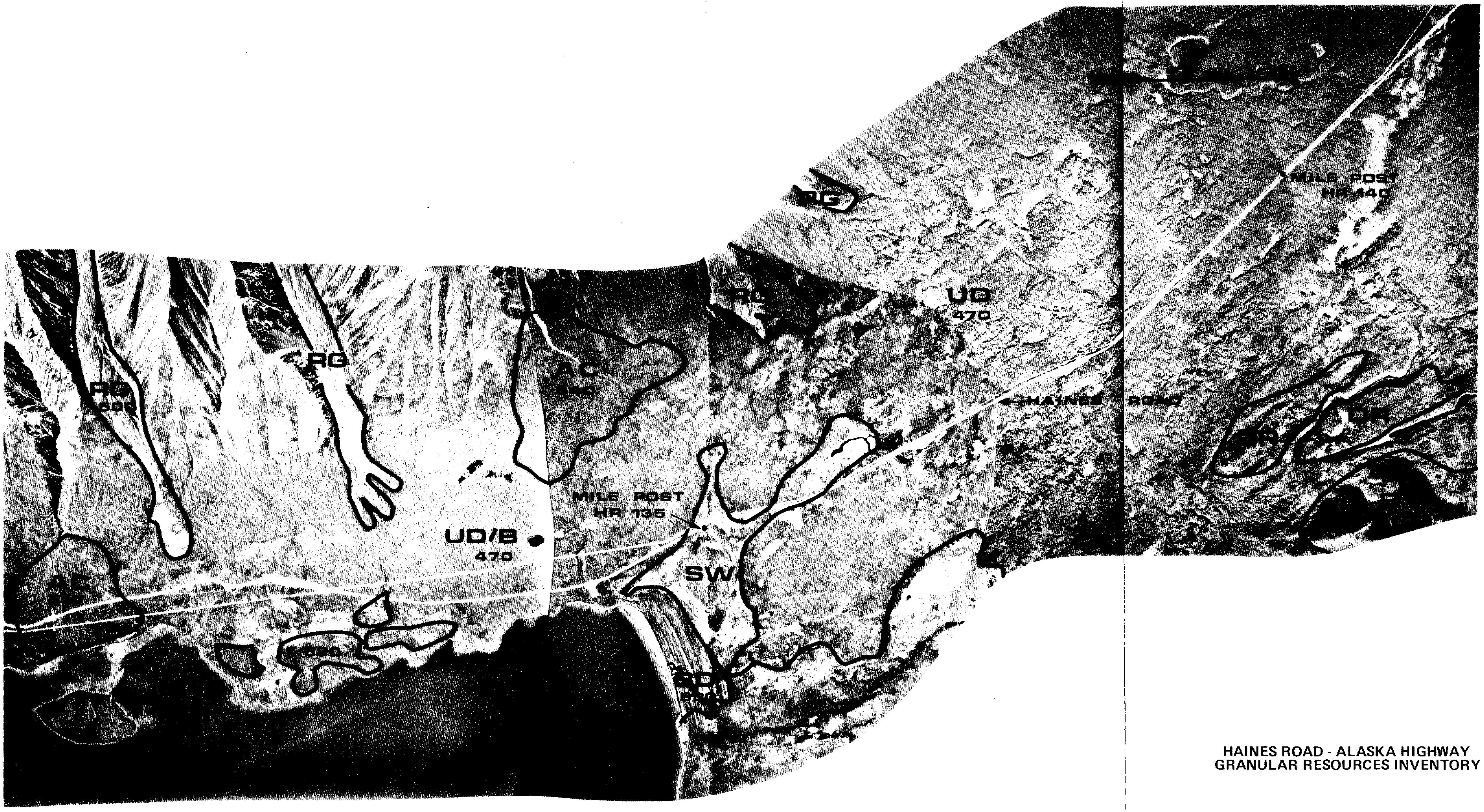

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HAINES ROAD - ALASKA HIGHWAY
GRANULAR RESOURCES INVENTORY

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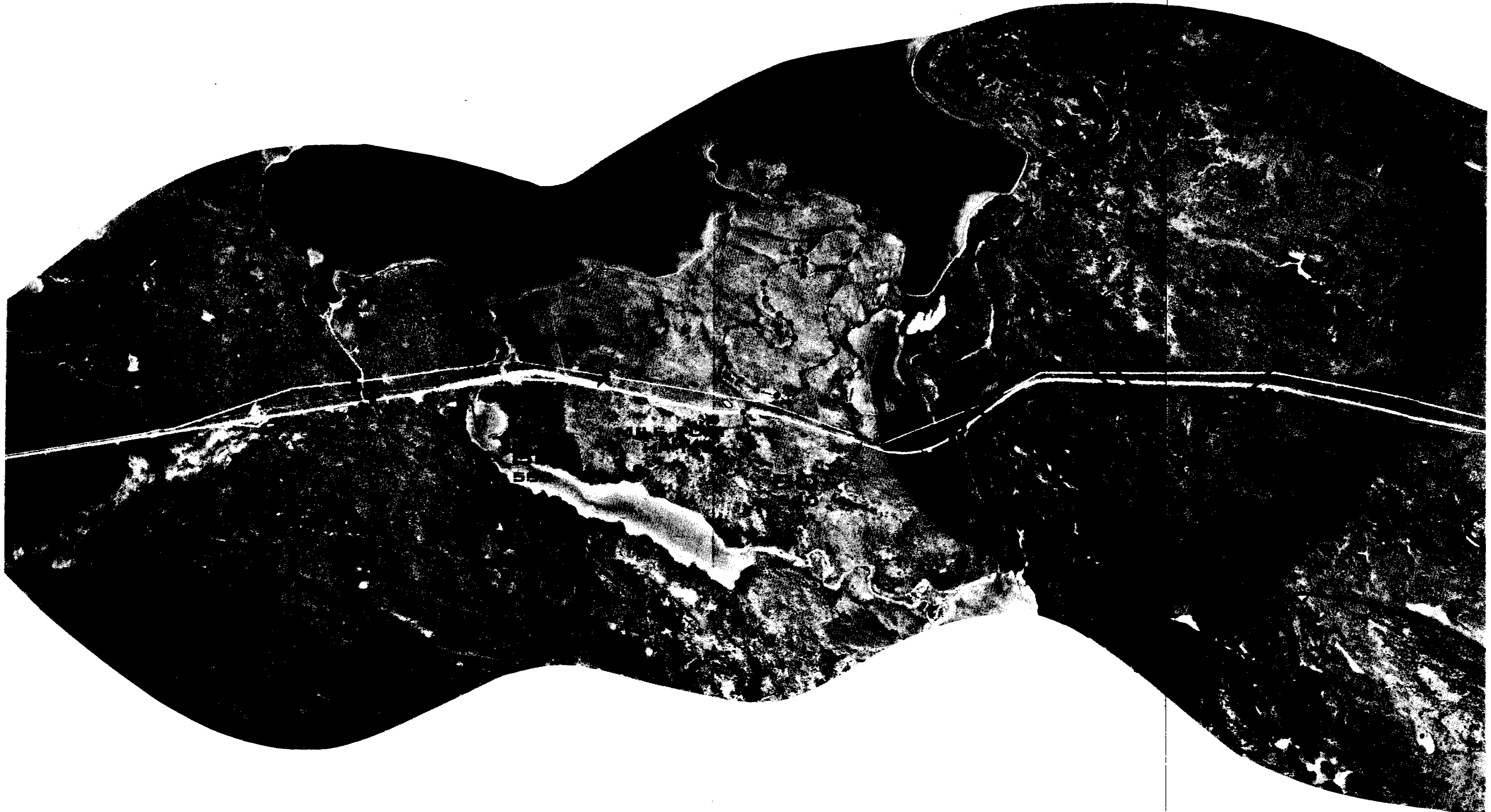

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HAINES ROAD - ALASKA HIGHWAY
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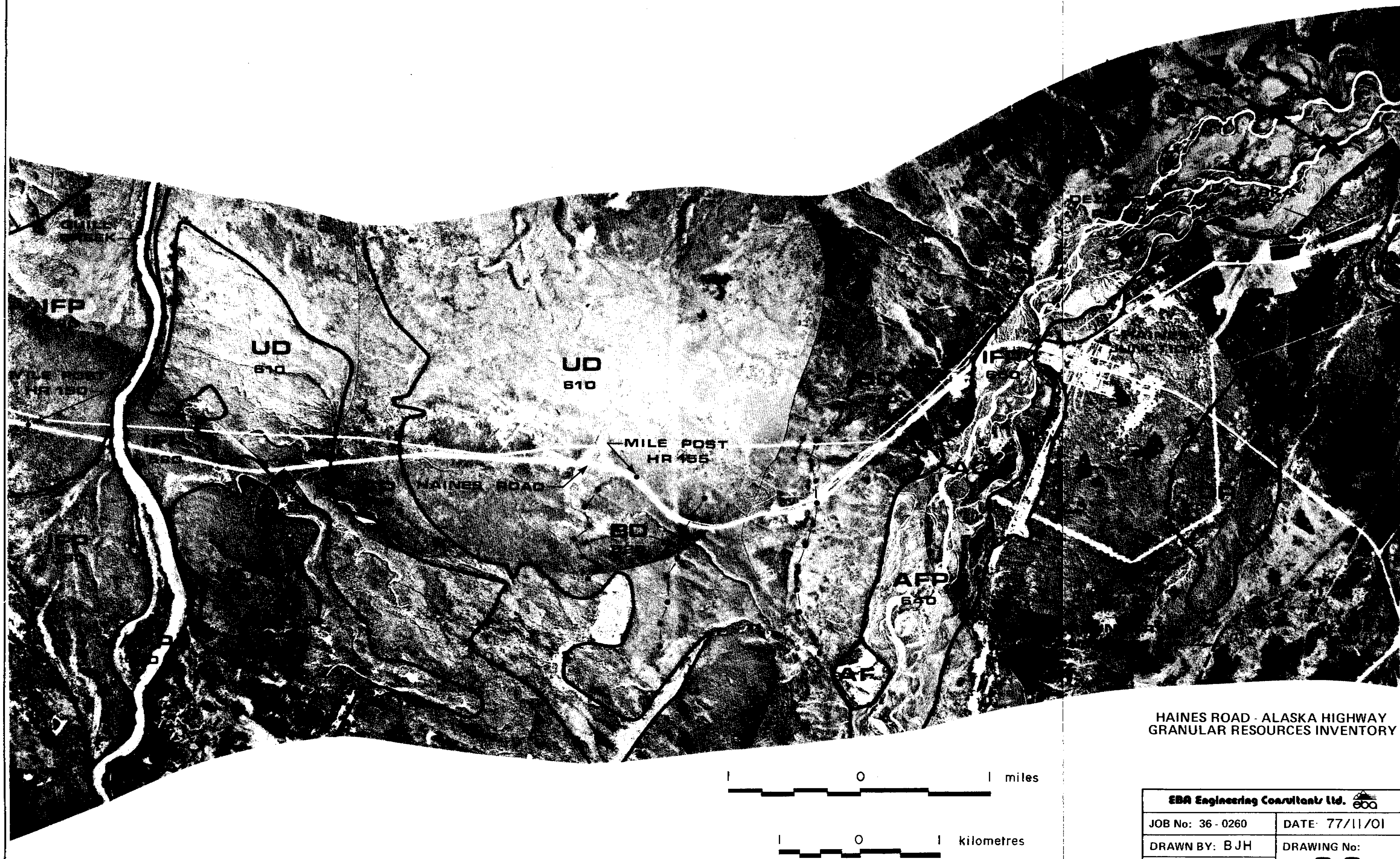

HAINES ROAD - ALASKA HIGHWAY
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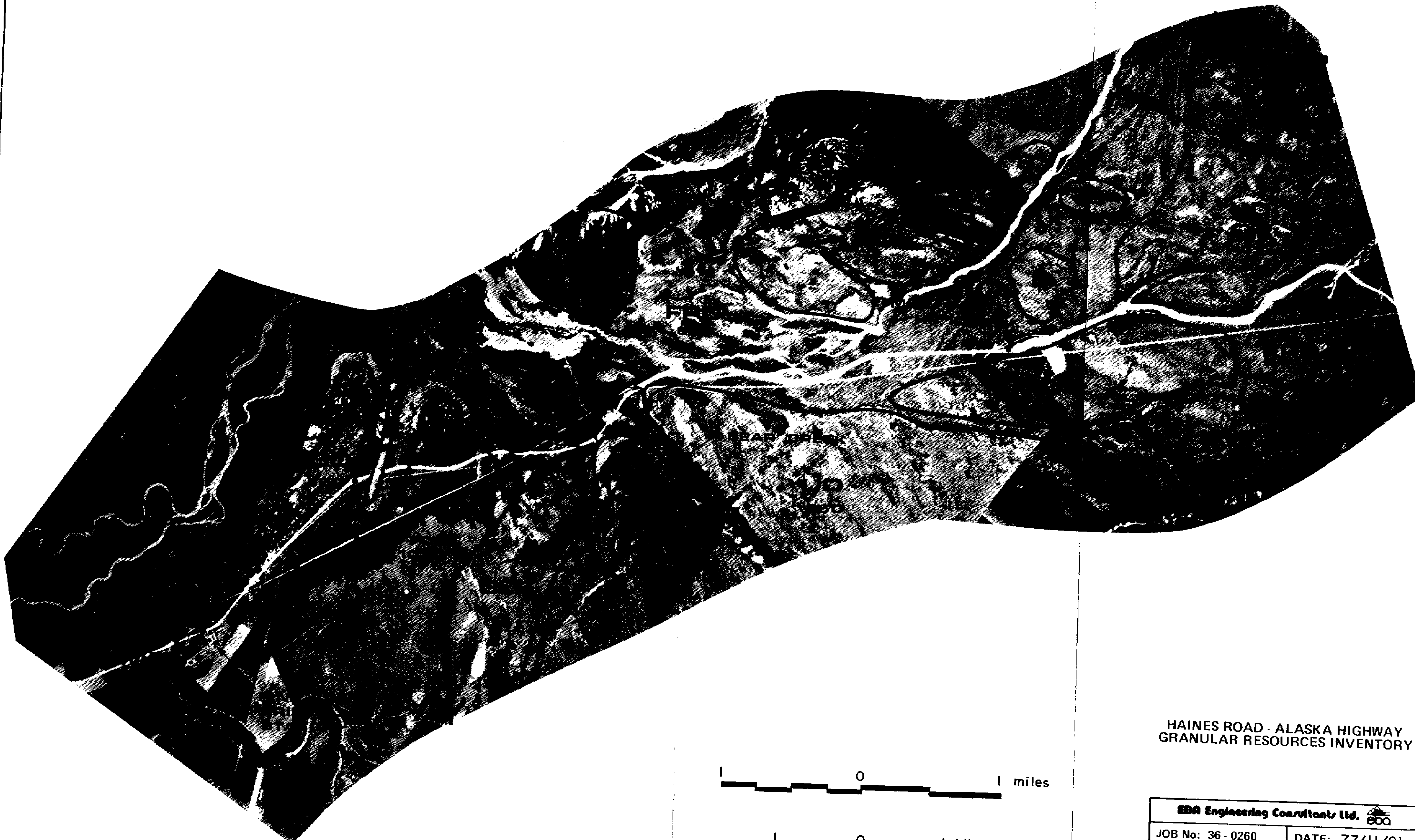

HAINES ROAD - ALASKA HIGHWAY
GRANULAR RESOURCES INVENTORY

1 0 1 miles

1 0 1 kilometres

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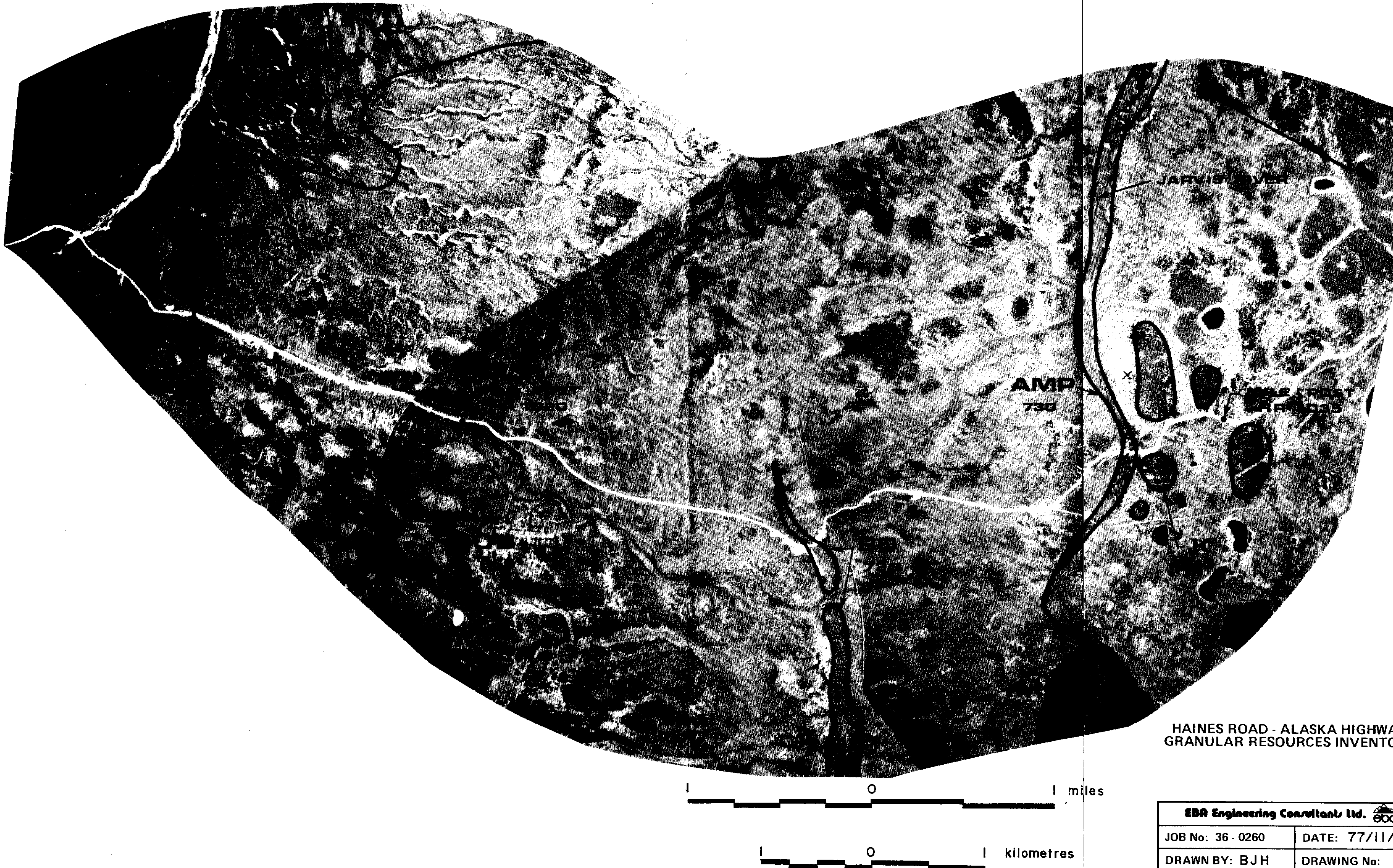

HAINES ROAD - ALASKA HIGHWAY
GRANULAR RESOURCES INVENTORY

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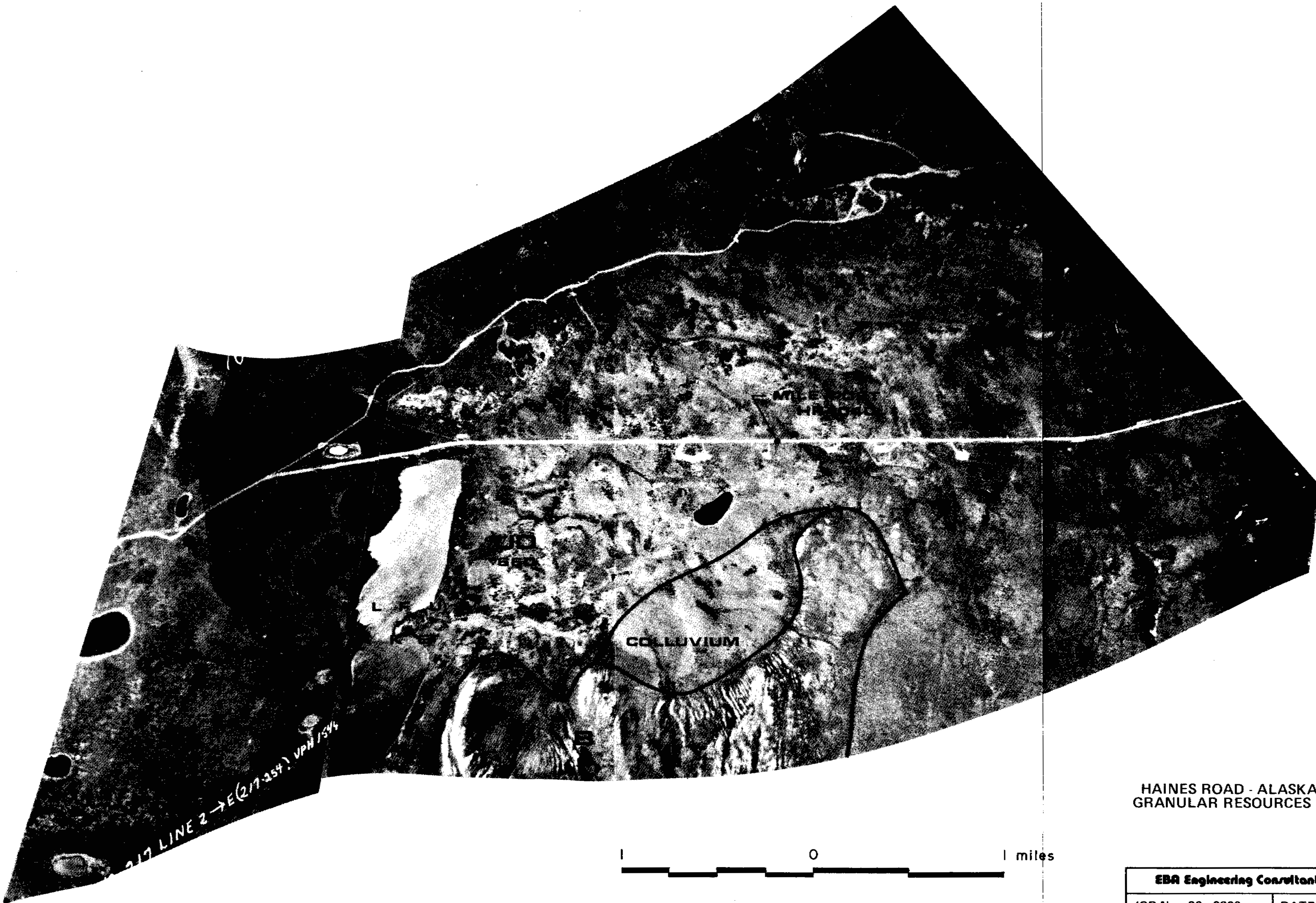

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HAINES ROAD - ALASKA HIGHWAY
GRANULAR RESOURCES INVENTORY

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3.2 Sources of Granular Material

3.2.1 Nomenclature of this Study

As noted in the previous subsection, each potential source has been given a three digit number. Each test pit within a source also commences with the same number. Two symbols have been used to designate test pit locations:

- designates a location where a sample was recovered for laboratory analyses;

- designates a location where the material was observed but no sample was obtained.

The former generally occur where suitable, or marginally suitable material was excavated from the test pit. The latter occur frequently in areas of silty undifferentiated drift, or in deposits of better grade material where representative samples had already been obtained.

3.2.2 Landform Characteristics

Each landform has particular characteristics which affect not only the type of granular material which can be expected within a deposit, but also its distribution, homogeneity, and uniformity. A knowledge of these characteristics is fundamental to the optimization of pit development procedures.

Eskers examined during this study generally occur in reticulated or braided systems which connect downstream with fans or kame deltas built at the glacier terminus. Sand and gravel appear to be the chief constituents, but sub-rounded boulders and thin beds of silt were also encountered in some exposures. In most places the sediments are crossbedded, but the crossbedding is much less regular than in outwash; lenses and pockets of till or slightly washed drift may also be present. Granular material in both eskers and kames is unsorted, except within individual sedimentary strata. The mean grain size of the esker decreases consistently in the downstream direction. Kame deltas, which are formed at the esker terminis, may contain large amounts of silt sized particles. This natural variability makes it difficult to reliably assess the distribution or quality of granular resources within esker-kame complexes using a limited sampling and testing program such as the one employed here. While esker-kame complexes are believed to contain large quantities of material suitable for production of engineering aggregates, large scale development procedures for these sources must remain flexible, so that processing techniques can be adjusted to suit the site-specific requirements.

Flood plain deposits, which include active flood plains, inactive flood plains and active meander plains, constitute another major source of granular materials in the study corridor. For the purposes of this report the broad alluvial fan deposits of the northern sector have also been included under the same terminology.

Flood plain deposits often exhibit a complex vertical and horizontal structure. Braided flood plains in the study area are usually composed of coarse grained material which can be suitably processed to provide base course, sub-base course or concrete aggregate. Meander plains are generally medium grained (silty sand and fine sand). Both types of landforms may contain associated components such as backswamps, channel fillings, oxbow lakes, point bars and natural levees. These may be subsequently buried during vertical accretion and hence be difficult to delineate on aerial photographs. Detailed subsoil exploration in such deposits is imperative for planning efficient pit development.

Terraces or ridges representing former beach levels may contain a wide range of grain sizes depending upon the depositional or erosional environment and the location of the source material. Most of the deposits south of Haines Junction contain primarily sands and silts. Some very coarse sand and gravel is available in selected areas of terraces near Bear Creek. While the smaller, singular ridges are difficult to develop, large terraces can provide excellent granular material. Unfortunately, the larger terraces in the particular area also tend to be prominant landforms, and this makes it difficult to screen borrow operations from sight lines of travellers along the highway.

Alluvial cones are accumulations of detrital material deposited by both water and gravity on relatively gentle slopes at the mouth of bedrock gulches. Most of the material in the cones consists of poorly sorted, angular to sub-angular, silty sands and gravels, reflecting the proximity of the parent material and lack of any reworking by fluvial processes. Where intermittent torrential watercourses occur on the surface of the cone, the streambed material is commonly well sorted. In some very high-energy streams only rounded cobble and boulder sizes remain.

Many of the alluvial cones contain too much silt to be considered excellent sources of aggregate material. Detailed sampling programs are required in all potential cone deposits in order to identify site specific development procedures.

3.2.3 General Petrology and Grain Size Characteristics

Petrographic examination of sample specimens collected during this study shows that the principal component of most deposits is an argillaceous meta-sandstone or meta-siltstone. The most common variety occurs as grey-black, subangular blades, the larger particles tending to break along bedding planes. This material is highly siliceous and has been called a quartzite in this study. A second common component is a brown-grey, poorly sorted, fine to medium grained sandstone which has also been recrystallized during metamorphism. This material is most appropriately termed a meta-greywacke, however, because of its siliceous nature and engineering behaviour it has also been classified as a quartzite.

Sulphate soundness tests indicate that the quartzite is quite durable, in spite of its argillaceous nature. The blade shaped particles suggest that larger rock specimens may exhibit a slatey cleavage. When particles having this shape are used in the production of Portland cement concrete aggregate, significantly higher cement contents may be required to attain the same workability. Similarly, their use in asphalt aggregate may make it more difficult to obtain high mix densities, and asphalt contents may have to be increased to achieve durability.

Granodiorite is the major rock type found in the alluvial cones near the British Columbia/Yukon Territory border. Although many of the samples examined looked fresh, some highly weathered cobbles were encountered in road-cut exposures. Rhyolite, basalt and greenstone (amphibolites) were also identified in very small amounts.

Significant amounts of deleterious materials were present in many of the landforms along the highway corridor. Slates and phyllites were the most common varieties, as were amounts of a soft, highly weathered, crumbly sandstone. The latter could often be broken apart in the fingers. Metamorphics showing muscovite/biotite mica were encountered only infrequently in deposits. For classification purposes, deleterious substances have all been put into the schist category. Crushing of materials containing substantial amounts of slate, phyllite, or schist may significantly increase the proportion of fines in the processed aggregate.

Calcareous coatings were apparent on aggregates in some of the granular deposits. Significant amounts of $CaCO^3$ coatings reduce bonding of aggregate and cement, and could affect utilization of the resource for the manufacture of high quality cemented mixtures. For the purpose of this study the amount of calcite present has been classified as:

abundant - for samples having 50% or more of the fine gravel particles coated with a calcareous dust;

some - when 20% - 49% of the particles appear coated;

minor - when 0 - 19% are coated.

The geological origin of many of the parent rock types is such that some constituents in each sample are difficult to classify petrologically. There is only a very fine line in engineering behaviour between a siliceous argillite or slate (normally considered deleterious), and an argillaceous quartzite (normally considered suitable for engineering aggregates). This line is extremely difficult to define in hand specimens. Granular material in each of the principal sources should therefore be thoroughly tested prior to full scale development. This would ensure that the aggregate performance specifications can be met by that particular material.

3.3 Recommended Sources for Development

An evaluation of the landforms along the highway corridor is presented in the source evaluation sections. Included in the evaluation are specific concerns relating to development of each deposit as a borrow source. Although most of the landforms examined are potential borrow sources (the number of existing borrow pits adjacent to the highway bears proof of this fact), only certain of these are recommended for development here. Potential sources have been divided into three groups:

Principal Sources: deposits which contain substantial material which is believed to be suitable for the production of base course, sub-base course, asphalt concrete or Portland cement concrete aggregate, and which were not found to exhibit extreme concerns of an environmental/social nature.

Secondary Sources:	deposits which contain material which is only marginally acceptable for engineering purposes, deposits which contain acceptable material in undefined quantities, and deposits where the material is acceptable but development is prohibited by apparent environmental/social restrictions.
General Fill Sources:	deposits which contain material which is primarily useful as general fill.

A brief description of each of these sources is presented in Tables 3.1 to 3.3. More detailed site specific recommendations are outlined in the source evaluation sections.

TABLE 3.1

SUMMARY OF RECONNAISSANCE INFORMATION FOR PRINCIPAL SOURCES

SOURCE NO.	LOCATION	GEOMORPHOLOGY	GRAIN SIZE DISTRIBUTION	SHAPE	PETROLOGY	$CaCO_3$ COATINGS	ESTIMATED QUANTITY cubic metres	COMMENTS
240	Kilometre Post 163 Takhanne & Tatshenshini Rivers	esker-kame complex	cobbles, gravel, sand some areas silty	subangular to subrounded blades & rollers	primarily quartzite & granodiorite, some slate & soft sandstone	none to abundant depending on location	7 500 000	good access; should be tested in detail for use as a source of construction aggregate; pit operations must allow for flexibility to achieve blending, etc.
350	Kilometre Post 181 Vand Creek	alluvial cone	boulders, cobbles, sand & gravel; low silt	angular spheroids	primarily granodiorite, quartzite, some sandstone	none	3 000 000	current information suggests excellent potential as source of construction aggregates; heavy crush requirement
450	South End of Dezadeash Lake	esker-kame complex	gravel & sand, trace of silt	subangular blades, spheroids	primarily quartzite; soft sandstones & slate	some	8 000 000 to 1 600 000	area partially within park; area outside park could be developed as source of construction aggregates
510	Kilometre Post HR210	alluvial cone	cobbles, gravel, sand, trace of silt	subangular blades	primarily quartzite, with soft sandstone & slate	some	3 000 000	partially within park; cannot be worked in early season due to runoff
530	North End of Dezadeash Lake	beach deposit	sandy gravel, trace of silt	subangular to subrounded	primarily quartzite, with soft sandstone, slate	none	200 000	source of sub-base or perhaps blend with coarse material from 510
570	Kathleen Lake	esker-kame complex	gravel & sand, trace of silt	subangular blades & spheroids	primarily quartzite; slate, soft sandstone, schist	abundant	1 000 000 to 2 000 000	good potential for sub-base - base course potential for asphalt concrete, partially within park
590	South of Quill Creek	inactive flood plain	sandy gravel with cobbles & boulders	not determined, probably same as Source No. 600	not determined, probably same as Source No. 600	not determined, probably same as Source No. 600	250 000 to 750 000	good potential for construction materials
600	Quill Creek	active flood plain	gravel & sand, some boulders, trace of silt	subangular blades	primarily quartzite, traces of siltstone	abundant	120 000 to 300 000	good potential for construction materials, partially within park

Table 3.1

Page 2

SOURCE NO.	LOCATION	GEOMORPHOLOGY	GRAIN SIZE DISTRIBUTION	SHAPE	PETROLOGY	$CaCO_3$ COATINGS	ESTIMATED QUANTITY cubic metres	COMMENTS
690	AH 1644 - AH 1655	flood plain deposit	gravel & sand trace of silt	subrounded to subangu-lar blades	primarily quartzite with slate	none to minor depending on location	5 000 000	good potential for construction materials
700	Bear Creek	beach deposit	gravel & sand	subangular blades & spheroids	primarily quartzite with minor diorite, granite, slate & schist	abundant	1 000 000 to 1 500 000	good potential for construction materials
710	Bear Creek	beach deposit	sand & gravel	not deter-mined, prob-ably same as Source 700	not determined, probably same as Source No. 700	not deter-mined, prob-ably same as Source 700	300 000 to 1 200 000	good potential for construction materials
720	AH 1661	beach deposit	gravelly sand, trace of silt	subrounded blades & rollers	primarily quartzite, minor granite, diorite, syenite, slate and schist	minor	560 000	potential use as sub-base material

TABLE 3.2

SUMMARY OF RECONNAISSANCE INFORMATION
FOR SECONDARY SOURCES

SOURCE NO.	LOCATION	GEOMORPHOLOGY	GRAIN SIZE DISTRIBUTION	SHAPE	PETROLOGY	$CaCO_3$ COATINGS	ESTIMATED QUANTITY cubic metres	COMMENTS
470	Kilometre Post HR201 to Quill Creek	undifferentiated drift & drift over bedrock	sand & gravel some silt, trace of cobbles	angular to subangular blades & spheroids	primarily quartzite with minor granodiorite, sandstone, diorite & slate traces of schist, gneiss & granite	none to abundant depending on location	not estimated	existing pit at 470-10 could be expanded as a source of base and sub-base material
490	West Side of Dezadeash Lake Near Kilometre Post HR208	coalescing alluvial cones	sandy gravel trace of silt	subangular blades	primarily quartzite, some slate, trace of granite	none	2 000 000	some potential as a source of base and sub-base material
580	North of and Adjacent to Quill Creek	inactive flood plain	gravel & sand, some silt	subangular to subrounded blades	primarily quartzite, trace of granite	none	not estimated	some potential for construction materials in certain areas, partially within park
610	Kilometre Post HR243 to Dezadeash River	undifferentiated drift	gravel & sand, trace of silt	angular to subrounded blades	primarily quartzite, some slate and sandstone, minor diorite schist, calcite & rhyolite	none	not estimated	some potential for base and sub-base materials in abandoned pits 610-1 and 610-8 and possibly other areas
660	Pine Creek to Kilometre Post AH1674	undifferentiated drift	gravel & sand, some silt, very silty in some areas	subangular blades	primarily quartzite & diorite, minor syenite, slate & schist	minor	not estimated	pit 660-3 and possibly other areas have good potential for construction materials
680	Northeast of Pine Creek Near Kilometre Post AH1641	beach deposit	gravel & sand silt & sand depending on location	subangular blades	primarily quartzite minor sandstone, slate, diorite, granite & schist	abundant	1 000 000 to 1 500 000	certain areas of the beach deposit have material suitable for all engineering purposes but deleterious materials appear to be present in significant amounts, area is within National Park

TABLE 3.3

SUMMARY OF RECONNAISSANCE INFORMATION
FOR SOURCES OF GENERAL FILL

SOURCE NO.	LOCATION	GEOMORPHOLOGY	GRAIN SIZE DISTRIBUTION	GRAIN SIZE SHAPE	PETROLOGY	$CaCO_3$ COATINGS	ESTIMATED QUANTITY cubic metres	COMMENTS
270	Kilometre Post HR151 to HR163	terrace deposit	highly variable includes gravel sand & silt	angular blades & spheroids	primarily granodiorite & quartzite, minor schist, slate, diorite sandstone & greenstone	none	not estimated	some potential in certain areas as general fill
320	Kilometre Post HR174 to HR190	kame terrace	highly variable uniform silt to sandy gravel	subangular blades & spheroids	primarily quartzite, minor granodiorite, diorite and sandstone, traces of schist, greenstone & slate	minor to abundant depending on location	not estimated	good potential in certain areas as general fill
410	Kilometre Post HR194 to HR199	undifferentiated drift	sand & gravel, some silt	angular blades	primarily quartzite, traces of slate, sandstone, granodiorite, diorite & gneiss	none to some depending on location	not estimated	good potential as general fill
470	Kilometre Post HR201 to Quill Creek	undifferentiated drift & drift over bedrock	sand & gravel, some silt, trace of cobbles	angular to subangular blades & spheroids	primarily quartzite with minor granodiorite, sandstone, diorite & slate, traces of schist, gneiss & granite	none to abundant depending on location	not estimated	good potential as general fill Pit at 470-10 should be preserved as a secondary source of engineering aggregate
580	North of and Adjacent to Quill Creek	inactive flood plain	gravel & sand some silt	subangular to subrounded blades	primarily quartzite, trace of granite	none	not estimated	good potential as general fill certain areas should be reserved for base and sub-base materials, partially in park
610	Kilometre Post HR243 to Dezadeash River	undifferentiated drift	gravel & sand, trace of silt	angular to subangular blades	primarily quartzite, some slate & sandstone, minor diorite, schist calcite & rhyolite	none	not estimated	good potential as general fill except pits 610-1 and 610-8 which should be reserved for base and sub-base materials
660	Pine Creek to Kilometre Post AH1674	undifferentiated drift	gravel & sand, some silt, very silty in some areas	subangular blades	primarily quartzite & diorite, minor syenite, slate & schist	minor	not estimated	some potential as general fill except pit 660-3 and possibly other areas which have potential for construction materials

IV. MANAGEMENT PLAN

4.1 Objectives of Plan

The granular resource management plan is herein defined as: a program for the development of a nonrenewable resource having as objectives:

(a) distribution of the resource in some equitable fashion to meet the needs of varied users;

(b) conservation of the resource;

(c) reduction of the environmental and aesthetic impact of development.

If the plan is to achieve these objectives, the following must exist:

(a) a suitable data base of resource quality, quantity and location;

(b) a suitable data base of environmental features;

(c) guidelines for resource development aimed at aesthetic features and environmental impact;

(d) a suitable definition of user needs and of procedures to be followed in resource allocation and utilization.

The following subsections outline the present status of information within the study area and suggest additional steps to be taken to provide adequate information for plan implementation.

4.2 Granular Resource Data Base

Within the study area, substantial quantities of granular material have been identified. There are, however, three significant factors which have an important impact on the overall availability of aggregates for construction. These factors are:

(a) much smaller quantities of the resource are judged to be suitable for high quality uses such as road bases, asphalt concrete and Portland Cement (P.C.) concrete;

(b) the greatest quantities of high quality aggregates are located near the south end of the study area where needs are least;

(c) some good quality aggregate sources are located within zones where development is restricted by environmental features or land use restrictions (e.g. within Park).

The largest deposits of granular materials suitable for engineering purposes are concentrated near the south end of the study area, within the esker complexes and alluvial cones south of Klukshu Lake. North of Klukshu and south of Kathleen River, these same landforms, where present, are generally smaller and more difficult to develop. North of the Kathleen River through to Summit Creek some deposits of suitable material are available at regular intervals along the highway, but these decrease in number and size near the north end of the project corridor.

In this study, sources have been classified as:

(a) principal, designating those areas that contain good quality aggregate suitable for road bases and concretes, and which can be developed without undue environmental impact;

(b) secondary, designating those areas that contain good quality aggregate but which are subject to development restrictions (as within the National Park) or those areas that contain granular resources of marginal quality or limited quantity.

(c) general fill, designating those areas in which the quality is less than that required for principal sources.

Resource conservation requires that those sources designated as principal or secondary be used only for the supply of road bases and concrete aggregates. Within source areas designated as principal, there are a limited number of areas which appear to offer the greatest potential for the manufacture of aggregates for concretes. Table 4.1 shows a more detailed classification of the principal sources.

If principal sources are to be developed in a knowledgeable fashion, it is essential that the present reconnaissance level information be substantially extended. Detailed data must be acquired at each of these sources to refine quality definitions, to refine quantity estimates and to obtain required data on overburden characteristics and topographic features. An outline of additional exploration is given in Table 4.1.

Quality definition for principal sources should include laboratory testing to define:

- grain size distribution
- detailed petrographic classification
- specific gravity
- sand equivalent (fine material classification)
- sulphate soundness
- Los Angeles Abrasion (limited program)

TABLE 4.1

PRINCIPAL SOURCES OF GRANULAR MATERIAL

PRINCIPAL SOURCE	RECOMMENDED USE: GENERAL FILL	SUB-BASE COURSE	BASE COURSE	ASPHALT	CONCRETE	ADDITIONAL INVESTIGATION
240	NO	YES	YES	YES	YES	excavate approximately 40 test pits in areas to delineate 1 000 000 m^3 of usable material
350	NO	YES	YES	YES	NO	excavate approximately 30 test pits in area to delineate 1 000 000 m^3 of usable material
450	NO	YES	YES	YES	NO	excavate approximately 20 test pits in area to delineate usable material
510	NO	YES	YES	YES	YES	excavate approximately 20 test pits in area to delineate usable material
530	NO	NO	NO	YES	NO	excavate approximately 10 test pits in area to delineate usable material
570	NO	YES	YES	NO	NO	excavate approximately 40 test pits in area to delineate 1 000 000 m^3 of usable material

TABLE 4.1

PRINCIPAL SOURCES OF GRANULAR MATERIAL

PRINCIPAL SOURCE	RECOMMENDED USE: GENERAL FILL	SUB-BASE COURSE	BASE COURSE	ASPHALT	CONCRETE	ADDITIONAL INVESTIGATION
590	NO	YES	YES	YES	YES	excavate approximately 20 test pits in area to delineate usable material
600	NO	YES	YES	YES	YES	excavate approximately 10 test pits in area to delineate 1 000 000 m^3 of usable material
690	NO	YES	YES	NO	NO	excavate approximately 40 test pits in area to delineate 1 000 000 m^3 of usable material
700	NO	YES	YES	YES	YES	excavate approximately 10 test pits in area to delineate 1 000 000 m^3 of usable material
710	NO	YES	YES	YES	YES	excavate approximately 10 test pits in area to delineate usable material
720	NO	NO	NO	YES	NO	excavate approximately 10 test pits in area to delineate usable material

Secondary sources have not been considered as part of any initial development program. These sources may be considered for development at some future date. For the present and near future, no further investigation should be undertaken in these areas. Secondary sources include source numbers:

- 470 at test location 470-10
- 490
- 580 at test location 580-3 and 580-4
- 610 at test location 610-1 and 610-8
- 660 at test location 660-3
- 680

General fill material can be obtained in virtually unlimited quantities from most deposits in the study area. The seven deposits shown in Table 4.2 are particularly recommended, partly because of their location

TABLE 4.2

SUGGESTED SOURCES OF GENERAL FILL

SOURCE NO.
270
320
410
470
580
610
660

along the highway, and partly because of the absence of major environmental concerns in each area. The quality of each deposit is usually variable, and may include material suitable for sub-base.

Current information regarding general fill should be supplemented by a more refined reconnaissance study which would serve to identify all terrain types along the entire length of highway, and not only those with particular coarse granular potential. This information would permit improved judgement of borrow requirements and of borrow pit locations.

4.3 Environmental Data Base

For the present study, a prototype sensitivity index has been developed that recognizes eight environmental categories and identifies environmental concern within each category. A sensitivity rating of 1 through 5 has been used for each area examined. Ratings are included on the source assessment sheets.

The quantitative sensitivity rating for each site has been based on reconnaissance level data. Prior to the final selection of source areas for development, an environmental impact assessment should be completed for each site. This assessment should include an archaeological field survey.

An environmental protection plan should be prepared for each of the source areas eventually chosen for development. This plan should include restrictions on removal and disposal of overburden, restrictions on design of the pit and factors associated with reclamation and restoration of the pit area. Access roads must also be dealt with in the protection plan.

4.4 Guidelines for Resource Development

The following outline some general guidelines for environmental protection planning for design of pits and access roads. Guidelines must be carefully interpreted for application to specific sites.

4.4.1 Vegetative Screen

In the Haines Road-Alaska Highway corridor, borrow sites should generally be screened from the highway by vegetation and/or heights of land. Existing borrow areas adjacent to the highway should be reclaimed, shaped to blend with natural landforms, and seeded with a suitable grass mixture.

Where borrow areas are to be screened, sources should be located at least 200 m back from the cleared highway right-of-way, and at a greater distance where vegetation is thin or where borrow operations may be within the sight-lines of highway travellers.

At specific sites, it may be feasible to landscape areas adjacent to the highway to provide for open sites, exposing a panorama and providing for more distant visual contact.

4.4.2 Design of Pits

The initial design of borrow excavations should include plans for restoration as an integral part of the development program. The configuration of the pit clearing should conform to the general terrain pattern. Clearing should be designed in accordance with natural landforms rather than as a rectangular intrusion where possible.

In rolling terrain where a number of knolls are excavated for borrow, several interconnected clearings in an irregular pattern will blend with the landscape. Leaving undisturbed "islands" of vegetation between pits will break up the large cleared area, provide some cover for wildlife and serve as a seed source for natural revegetation. Similarly, a large deposit could be excavated in a number of locations served by a single haul road system, leaving undisturbed bands of vegetation between the pits. Borrow sites along a single haul road should be excavated in sequence.

Small volume pits should be an elongated shape for ease of borrow removal. If the long axis of the excavation is oriented in a north-south direction, only a short section of cut slope will be exposed to the more severe freeze-thaw conditions of a southern exposure. Freeze-thaw conditions are detrimental to young plant growth. South and west slopes with relatively greater amounts of solar radiation are favoured animal habitats. Where possible, borrow excavations should be carried out on north facing slopes of terraces and eskers.

Development plans for each site should be submitted prior to issuance of a permit. The plans should include the maximum size of clearing, location of access road(s), timing and method of clearing and specific plans for reclamation. As a further precaution, the setting and design of borrow pits should be field-checked by specialists during the initial layout and staking phase to ensure that recommended designs are being followed by field personnel.

4.4.3 Pit Size

The suggested management policy for the study area is based on the concept that a few major borrow sites should be developed in preference to many small pits. Environmental disturbance is then confined to a minimal number of locations, the total length of access routes is reduced, and comprehensive reclamation plans are more readily justifiable. Large deposits may be excavated in a number of locations within one area, as described in the foregoing.

4.4.4 Access Roads

Access roads to borrow sources should be dog-legged to screen the pit from view. It is frequently desirable to develop two haul roads for safety, one for access and one for egress. This procedure increases road length and the area of disturbance. Wherever possible, existing trails and cleared rights-of-way should be utilized rather than developing new routes.

High volume traffic on haul roads will require cut and fill construction similar to highway standards, and similar construction and stabilizing safeguards are essential. Winter roads should be located to avoid sensitive terrain. Routes along ridge areas are preferred to those traversing valleys or wetlands.

Where watercourses must be crossed, care should be taken in constructing suitable crossings which will avoid siltation or blockage of streams. Temporary structures should be removed before spring breakup to avoid washouts. All-season roads will require culverts which meet highway standards and allow for fish passage.

Ditching, culverts and ditch blocks should ensure that water flows along the road surface are channelled into undisturbed vegetation, particularly near streams.

One hectare per kilometre is disturbed by clearing a 10 m right-of-way, thus the accumulated area of disturbance from roads may be more significant than the actual pit development.

4.4.5 Clearing, Stripping and Stockpiling of Overburden

Clearing and stripping should be coordinated with the expected rate of borrow removal so that stripping of overburden takes place just prior to excavation.

Woody material can be disposed of by burying, burning or chipping. There is generally little use for timber cleared from remote sites.

Reducing woody material to a mulch by means of chippers is an ideal means of waste disposal. Chippers work most effectively during the summer when wood is not frozen. Chipping is environmentally sound, but is expensive since it requires specialized equipment. However, on large projects such as Shakwak and the Foothills pipeline, the use of such equipment may be warranted for many aspects of the work. Mulch prepared from chipping of waste could be distributed over the reclaimed pit and access road to aid in conserving moisture and promoting plant growth.

Burying debris in the bottom of the excavation and covering it with overburden can provide natural-looking mounds or terraces which do not detract from the restoration of the pit.

Burning of debris must conform to territorial fire regulations and be strictly controlled.

Stockpiling of overburden should be a requirement for all sites. When excavation has ceased in all or part of the pit the overburden can then be respread over the area. Surface soils contain organic matter, nutrients and seeds which will assist with reestablishing vegetation.

Waste boulders may be used to retain the toe of a slope or line a drainage channel. Piles of waste material unsuitable for borrow may be shaped to form "islands" or "peninsulas" in the pit.

Waste material remaining after excavation is completed may be buried in the pit floor. Debris from construction activities may also be disposed of in abandoned borrow pits provided that all waste is well covered by overburden and no waste material drains into watercourses.

4.4.6 Recommended Restoration Procedures

Generally, the pit walls should be sloped to the desired grade during the excavation operations. Upon completion of the excavating, slopes should be at a maximum of 3 horizontal to 1 vertical to facilitate revegetation. Once the slope is established, overburden can be pushed down over the slope from above or built up from below.

Creating a series of benches or terraces in the pit slope during the excavation will aid in revegetation and erosion control. The width of a terrace will depend on the amount of space required for manoeuvering equipment. Terraces should be well drained to avoid slope instability.

Following removal of borrow material, a grooming operation should be scheduled as a final clean-up and shaping of a pit before equipment is moved out of the site. A pit floor contoured with depressions, hummocks and ridges will be more natural and will revegetate more readily than a flat floor. Overburden stripped from the site and "fines" remaining after processing should be spread over the pit area to aid in revegetation procedures. Compact areas should be scarified, and any available organic material should be added to the surface soils and worked in.

Seeding of agronomic grasses is not recommended for borrow sites well-screened from the road. In the arid climate near Haines Junction, the success of seeding operations may be very low, and thus may not warrant the cost. Native grasses appear to successfully colonize disturbed areas such as the existing pipeline. If borrow sites can be shaped and prepared to promote plant growth, natural revegetation should proceed without the necessity of seeding, and the final result will blend with the natural landscape. Seeds of the native wheat grasses, fescue and calamagnostis species are not readily available in the quantities required. If a means of collecting native seeds is devised, or if seed in sufficient quantities is grown to supply the needs of the project, then a seeding program for borrow sites could be considered.

For existing borrow areas open to the roadway, a comprehensive reclamation and seeding program should be devised. Hydroseeding techniques may be necessary to produce an effective cover, particularly on steep slopes.

4.5 User Needs and Allocation

Public Works Canada will require approximately 1 300 000 m^3 of sub-base, base course and asphalt aggregate as well as minor amounts of concrete aggregate from sources within the study area during the reconstruction and paving of the Haines Road and Alaska Highway west of Haines Junction. This reconstruction and paving, which has been termed the Shakwak Project, will make Public Works Canada the largest user of granular materials in the study area in the next few years.

The community of Haines Junction will also require granular resources for use as concrete aggregate and general fill during residential development and improvement. If community expansion occurs with pipeline development, future needs may also include some paving materials, including sub-base, base course and asphalt aggregate. It is estimated that the direct future needs of the community for all uses, even if rapid expansion does occur, would not exceed 150 000 m^3 of base and sub-base course material and 100 000 m^3 of asphalt and/or concrete aggregate.

Foothills Pipeline Company is also expected to require granular material during construction of the gas pipeline along the Alcan route. Both the quantity and quality of material required will depend, to a large extent, on the design approaches taken to control frost heave, as well as the work pad requirements and the final route alignment. No estimate of pipeline requirements within the study area is currently available, however, it is not unreasonable to expect that needs could be 1 000 000 to 2 000 000 m^3. Estimates for the line in Alaska or for the Arctic Gas proposal are of little value, since neither of these are along existing transportation routes.

There are a number of small, individual developments throughout the study area, including both residences and fishing and hunting facilities. These individual developments, while requiring only small quantities, must also be considered, particularly if random excavation of material exposed in highway cuts is to be avoided.

The principal users, then, are: (1) Public Works Canada, which will have an immediate need for substantial amounts of engineering material along the entire study corridor; (2) the community of Haines Junction which will need relatively small amounts of material within a short distance of the community, but over a much longer time period; and (3) Foothills Pipeline Company, which will require undefined quantities along the Alaska Highway northwest of Haines Junction within the next five years.

Large users can probably be best accommodated on a permit basis. These users, such as Public Works and Foothills, will not require access on a continuing basis. Permit applications should define the quality of gravel needed and quality requirements. Applicants should also be required to designate the pit area to be worked, reclamation and restoration procedures to be followed, and means of disposal or stockpiling of material rejected from the processing operation.

Smaller users such as local contractors In the Haines Junction area may be accommodated by providing a stockpile of unprocessed aggregate, sufficiently larger to meet local needs for a 3 to 5 year period. This would allow pit operations to be carried out on a larger scale and therefore ensure control of reclamation operations. The Government of Canada could contract for pit excavation and restoration, with resale of the aggregates to local users.

Convenience pits must be provided not only near Haines Junction, but also at intervals along the road where private development occurs. Gravel removal from these pits should become more convenient than removal from ditch cuts.

Borrow pit spacing should not be specified. Requirements for borrow are a function of the design of a section of roadway. Borrow selection must include considerations of economic and a host of other factors. Pit spacing should be permitted to be quite close in circumstances where limited amounts of fill are available from road cuts and other factors are suitable. Pits may not be required in other sections where the terrain is rolling and ditch cuts are substantial.

4.6 Summary

A management plan for resource development can be an effective tool in conservation of granular resources and environmental protection. Such a plan must be implemented from a sound data base of resource and environmental information. It must be an application of guidelines, rather than regulations, in order that it can respond to the needs of a variety of users. Some of the data base has been provided during the current study, but more information is necessary to establish detailed site-specific recommendations for some areas.

V. LIMITATIONS OF THE PRESENT STUDY

Airphoto interpretation has been used in conjunction with limited ground checks to perform a reconnaissance survey of the granular resources within the study corridor. The survey has several limitations:

1. High altitude airphotographs near the north end of the study are poor in quality, unsuitable for detailed mapping of subtle geomorphic features. Since landforms in this region are generally low relief, the determination of regional geomorphology proved to be difficult, and may require re-evaluation when more information is available.

2. The number of potential landforms to be ground checked was very large, hence, the number of sites which could be visited on each deposit was limited.

3. Since the field program consisted of hand dug test pits, evaluation of overburden thickness was limited to the sites where natural or man-made exposures (road cuts, gullies, borrow pits) were available.

4. The assessment of the performance of each aggregate as an engineering material is generally based on two parameters, the grain size curve and the petrology analysis. Since it was sometimes difficult to distinguish between a siliceous argillite (slates, for the present purposes) and an argillaceous quartzite, the petrological classification may not be totally indicative of the field performance of the material.

4. No borrow pit was recommended for the exclusive use of the Haines Junction community. If one is required, then an additional study should be initiated to investigate the potential for granular material in a small area along the highways north and east of the community. This would permit recommendations to be made for borrow development at a location which is most suitable to the community.

5. Evaluation of environmental concerns at potential borrow sites was based on a general review of knowledge pertaining to the area and upon brief visits to the sites. Evaluations presented are potentially suspect until more detailed efforts are undertaken.

VI. GLOSSARY

SYMBOL	DESCRIPTION
AC	Alluvial Cone - a steeply sloped cone-shaped granular deposit accumulated under the twin agencies of running water and gravity.
AFD	Alluvial Fan Deposit - a fan-shaped deposit with its apex pointing upstream and with a convex slope, formed by a stream where it suddenly leaves a narrow ravine and enters a larger valley.
AFP	Active Flood Plain - relatively flat portion of a stream valley built up of sediments deposited during the present regimen of the stream, subject to inundation by the annual flood.
AMP	Active Menader Plain - includes the active and inactive flood plains of meandering streams, characterized by point-bar deposits, oxbows and meander scars.
B	Bedrock - outcrop, solid rock exposed at the surface.
BD	Beach Deposits - an essentially continuous ridge or terrace of beach material formed by the wave action of ancient or existing lakes.
CAC	Coalescing Alluvial Cones - a series of overlapping alluvial cones.
D/B	Drift Over Bedrock - thin undifferentiated drift deposits overlying bedrock.

SYMBOL	DESCRIPTION
DR	Drift Ridge - elongated ridge, usually trending parallel to the valley in which it exists. Composed of undifferentiated drift, may be bedrock controlled.
EC	Esker Complex - a network of long and narrow, commonly sinuous, ridges composed of ice-contact stratified drift.
EKC	Esker-Kame Complex - eskers and kames occurring within the same complex.
EM	End Moraine - ridge-like accumulations of drift constructed at the margin of former valley glaciers.
FPD	Flood Plain Deposits - large undifferentiated area consisting of active meander plain, alluvial fan, active flood plain and inactive flood plain deposits.
GLB	Glacial Lake Basin - flat to rolling glaciolacustrine sediments.
GT	Glaciofluvial Terrace - a granular deposit formed by pro-glacial streams which subsequently assumes an elevated position as a result of recent erosion along its margins.
IFP	Inactive Flood Plain - includes the flat portion of a river valley adjacent to a relatively high energy stream which is infrequently inundated.

SYMBOL	DESCRIPTION
K	Kame - an irregular ridge, hill or mound of melt-water-laid stratified drift.
KT	Kame Terrace - an irregular terrace-like body of poorly stratified materials located on the sides of valleys formerly occupied by glaciers.
KC	Kame Complex - a series of interconnecting kame mounds and coalescing elongate kame ridges.
RG	Rock Glacier - a lobate steep-fronted mass of coarse angular rock debris extending from the front of cliffs in a mountainous area.
S	Spit - elongated deposits projecting from the shore into a body of water.
SW	Swamp - a low lying area characterized by organic terrain and a water table coincident with the surface.
T	Terrace - a relatively flat elongate deposit of uncertain origin which may be bedrock controlled.
UD	Undifferentiated Drift - includes undifferentiated material existing as nondescript landforms deposited by glaciers and by the action of meltwater streams and lakes associated with them.

VII. DEFINITION OF ENVIRONMENTAL COMPONENTS AND RATING OF CONCERNS

Each site was examined in the field and rated for eight components on a scale of 0 to 5.

Components included:

1. Geoterrain

This component was rated with regard to particle size only. Sites with fine grained deposits which could be easily moved by wind or water action were rated high while coarse deposits which would be resistant to erosion were rated low. While the rating was aimed at preventing siltation in aquatic habitats, rating was based solely on particle size and ignored the presence or absence of waterbodies that might, in fact, be affected.

2. Vegetation

Vegetation was rated dependant upon the commercial value of the stands involved, or, in a general category, related to the extend to which it contributed to the local setting. The aesthetic point of view was not attached to specifics of habitat or recreational use. These latter values were rated separately.

3. Fauna - Terrestrial

Sites were rated in terms of the likely presence of animals generally regarded as representing a resource, and which were likely to be affected be development of borrow pits. In most areas animals considered were:

a) sheep which congregate on and rely upon specific ranges during certain seasons where they might be expected to be disturbed by gravel mining activity;

b) grizzly bears, which because of confrontations with persons working at gravel sites, might be shot to protect workers; and

c) waterfowl which might concentrate in large numbers in restricted areas during moulting migration or brood rearing, and be adversely disturbed by gravel extraction activity.

Other species which are not known to concentrate in large numbers in restricted areas, or which do not become involved in interactions with humans (which would cause them to be shot systematically for protection) were not included. As an example, even in restricted winter habitat moose often range widely, and therefore would be little affected by activities involving several hectares in close proximity to the road.

4. Aquatic Fauna

Areas were rated in terms of the presence of recognized resource fish populations which might be affected by gravel pit development. The presence or absence of fishing at the site was rated separately under the heading of Land-Use.

5. Water

Areas were rated in terms of the possibility of water movement across the site which could result in the transport of fines to aquatic habitats of commercial and sport fishes. Lack of potential movement or lack of a receiving body caused low scoring.

6. Land-Use

Areas were rated as to other present and potential land-uses, with scoring reflecting the extent to which gravel operations might affect those uses.

7. Land Status

Areas were rated in terms of existing land status, reflecting legal and/or cultural claims. Areas reserved for national parks for example, are legally sanctioned, and as part of that legal sanction a very limited number of land-uses are allowed. In the cultural area some lands have historically been used by native people for certain land-uses. Such use carries with it a quasi-legal claim which will shortly be formalized in the Yukon Territory through native claims settlement.

8. Special Interest Areas

Areas were rated in terms of special interest they may hold for a wide range of user groups. For example, the Blanchard River site lies upon the British Columbia/Yukon border and is a point of interest to travellers. Similarly, the esker complex south of the Takhanne River is a clearly identifiable esker deposit which is of value as a point of geological interest to travellers and, in addition, supports a type of vegetation virtually unique in the region. This not only accentuates the geological interest but creates interest in itself.

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PERSONS CONTACTED - GRANULAR MATERIALS STUDY

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DETAILED SOURCE ASSESSMENT SHEET

SOURCE NO. 100

SAMPLE NOS. 100-6, 100-7, 100-8

LANDFORM AND LOCATION AMP and IFP along Blanchard River at B.C./Y.T. border.

MATERIAL sand and gravel, trace of silt, cobbles and boulders

ESTIMATED VOLUME 900 000 m^3 depending on depth to bedrock beneath IFP terraces. At least 225 000 m^3 readily accessible without disturbing pumping station.

AIRPHOTO NOS. HIGH LEVEL A11524-287

LOW LEVEL A24177-123

DETAILED ASSESSMENT

ENVIRONMENT

Physical

The source is composed of active flood plains and inactive flood plains on both sides of the Blanchard River. Two levels of deposition are evident with the active flood plains including channel and bar deposits, occupying the lower level, 1 to 5 m above the river and the inactive flood plains occupying the relatively flat upper terrace 18 m above the river. Drainage of the source on both levels is excellent. An abandoned petroleum product pipeline and pumping station and two small cabins exist within the potential source on the east side of the river. The Blanchard River is 9 to 17 m wide through a shallow riffle 0.5 m deep over cobbles and boulders.

Biotic

Vegetation is composed of scattered white spruce and balsam poplar with a thick understory of willow and some open grass and sedge areas. Prominent flood channels through the vegetation indicate torrential spring flows. Filamentous green algae lightly cover the stream bottom sediments. The river, a portion of the Tatshenshini - Alsek River system, supports populations of Chinook salmon, possibly other salmon species, trout and char. The entire area is utilized by moose and grizzly bear.

Recreation

The source is entirely within the Kluane Game Sanctuary. Sport fishing is active in the area with many access trails evident from the highway to the river. The area has tourist interest because of its location at the B.C./Yukon boundary.

GRANULAR RESOURCES

Granular materials in the source area are generally composed of gravelly sand or sandy gravel with a trace of silt. In some areas close to the river cobbles and boulders make up a large percentage of the deposit. The main rock type is a quartzite (63-70%). Accessory rock types include slate, granite, rhyolite, schist, gneiss, sandstone, diorite, basalt, granodiorite, gabbro and andesite. The slates, schists and sandstones are the only rock types that show evidence of weathering. In general the granular particles are relatively hard, angular to subangular blades with a dull rough surface texture. The volume of granular material was calculated on the assumption that an average depth of 3 m could be recovered above bedrock from the IFP east of the river, 6 m from the IFP west of the river, and 2 m above the waterline in the AFP areas. Approximately 40% of the granular materials are located on the west side of the Blanchard River. Overburden is absent close to the river and on some terrace levels. Maximum overburden cover is approximately 0.2 m. Road access to the deposits on the east side of the river is excellent. The Haines Road passes through the source area. Granular materials on the west side of the river could be exploited if a bridge were constructed. Winter access could be achieved by means of an ice bridge.

DEVELOPMENT

The source is not recommended for large scale development because of unavoidable disturbance to fish populations and the special interest of the British Columbia/Yukon boundary to tourists. Some material could be removed from the inactive flood plain areas located away from the river. Full utilization of the inactive flood plain deposits on the east side of the river would necessitate the dismantling of the abandoned pump station.

Material suitable for both asphalt aggregate, bases and sub-bases is available within the source. Some crushing would be required for asphalt aggregate. Local deposits with high sand content could be used for blending. Weathered rock types make up a small percentage of total material. The relatively high slate content precludes the use of these materials for concrete aggregate.

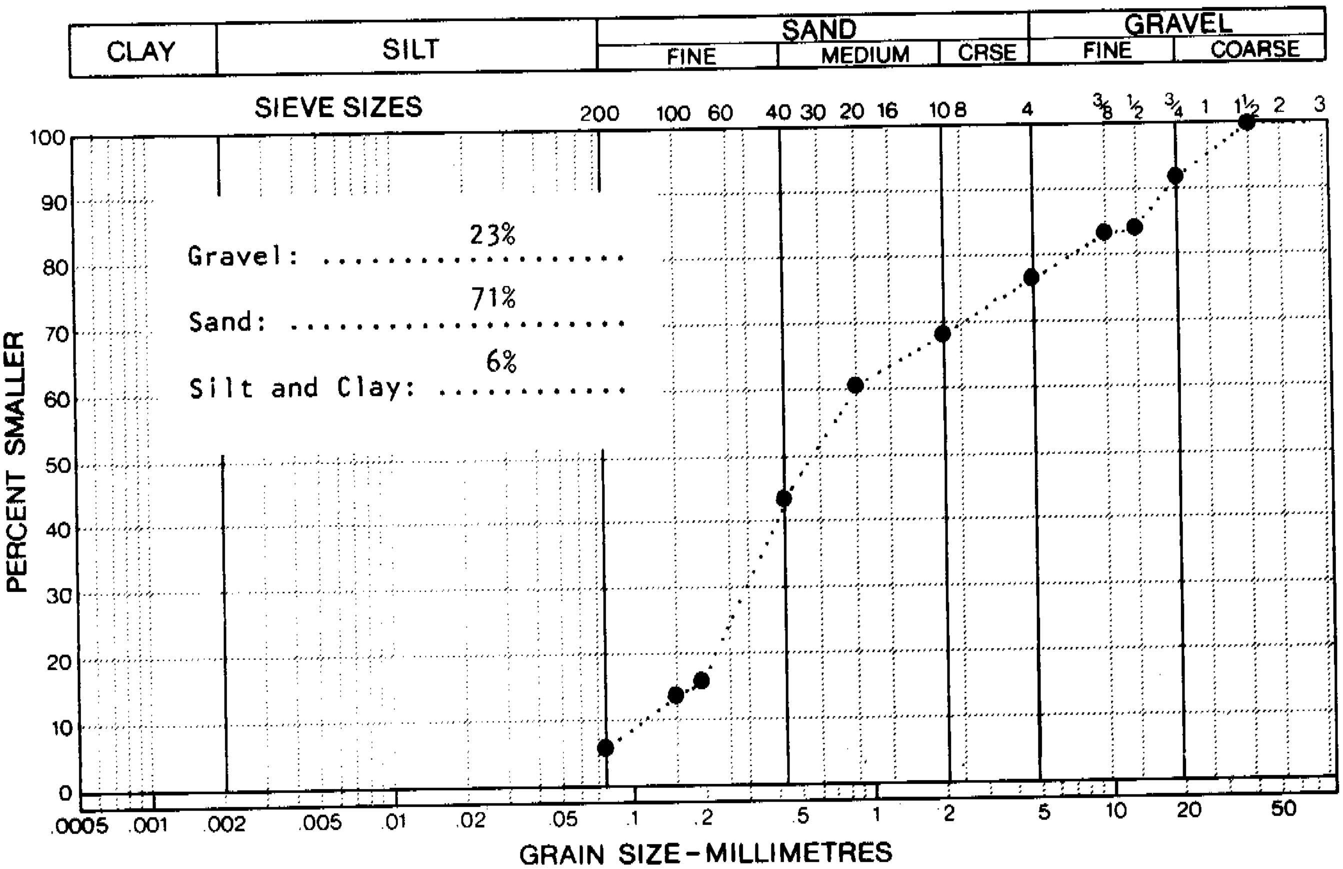
Source No. 100 Airphoto No. A24177-122

LABORATORY ANALYSIS

SOURCE NO. 100

PIT NO. 100-6

EXPOSURE: test pit on AFP terrace



MATERIAL TYPE: gravelly sand, trace of silt

GENISIS (LANDFORM): active flood plain

PETROGRAPHIC ANALYSIS:

quartzite 63%
slate 14%
granodiorite 7%
gneiss 5%
sandstone 4%
schist 4%
diorite 3%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: blades, angular

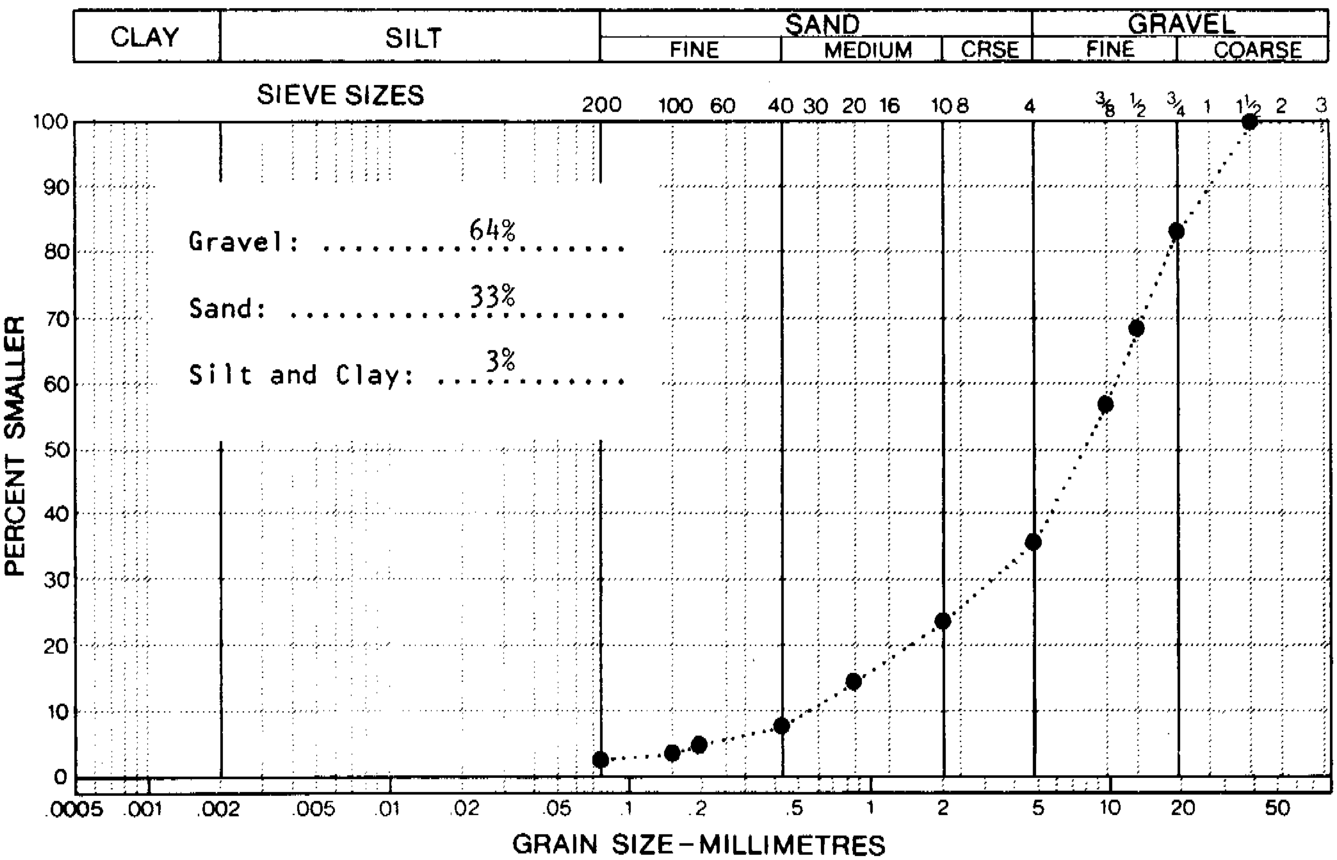
REMARKS:

LABORATORY ANALYSIS

SOURCE NO. 100

PIT NO. 100-7

EXPOSURE: hand excavated test pit



MATERIAL TYPE: sand and gravel, trace of silt

GENISIS (LANDFORM): active flood plain

PETROGRAPHIC ANALYSIS:

quartzite 69%	schist 4%
slate 12%	sandstone 4%
granite 6%	rhyolite 1%
diorite 4%	

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: blades, subangular

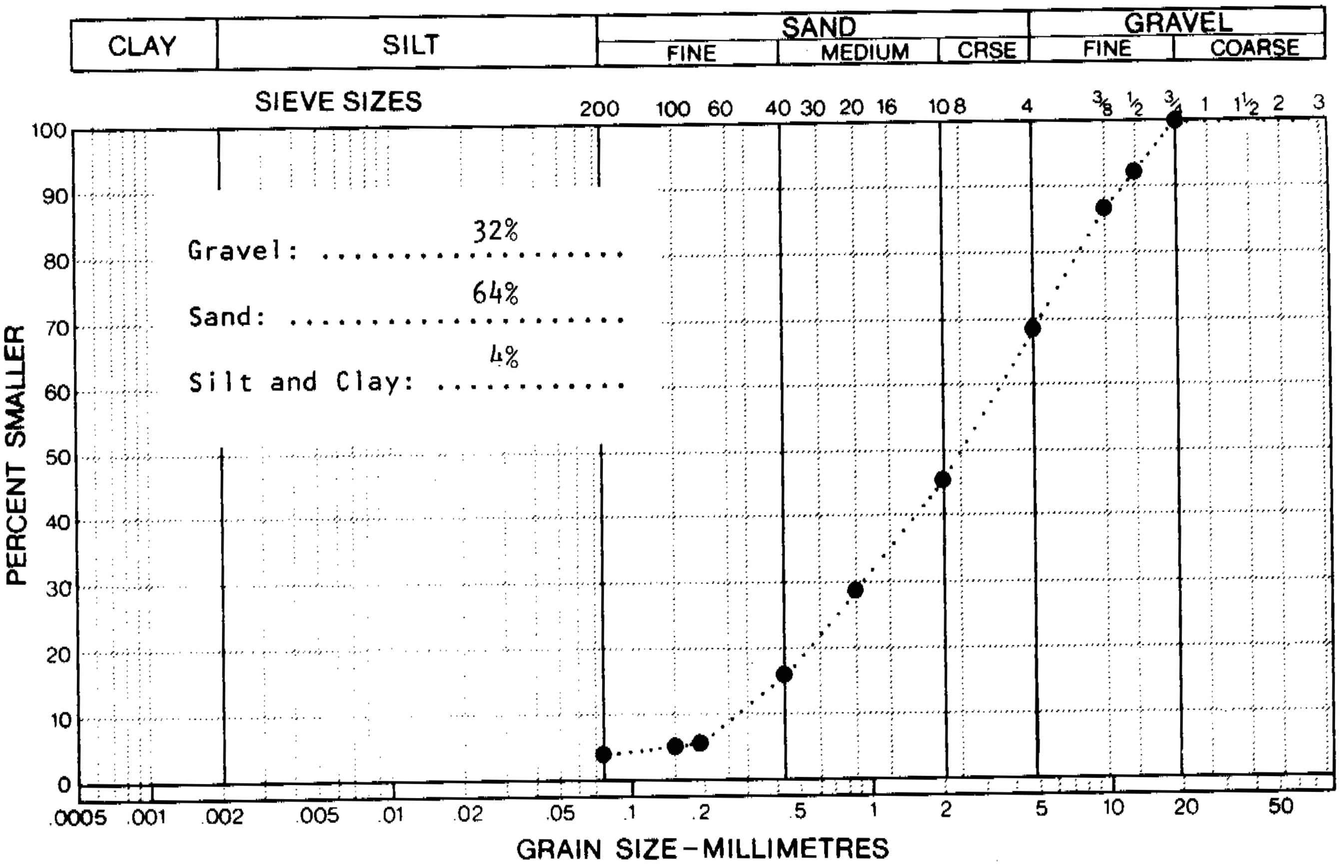
REMARKS: minor calcareous coatings

LABORATORY ANALYSIS

SOURCE NO. 100

PIT NO. 100-8

EXPOSURE: terrace on AFP



MATERIAL TYPE: gravelly sand, trace of silt

GENISIS (LANDFORM): active flood plain

PETROGRAPHIC ANALYSIS:

quartzite 70%
slate 14%
granodiorite 6%
diorite 5%
sandstone 2%
gneiss 2%
schist 1%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: blades and spheroids, subangular

REMARKS:

SOURCE NO. 100

PIT NO. 100-1

EXPOSURE: hand dug test pit

MATERIAL TYPE: medium to course sand, some gravel

GENESIS (LANDFORM): AFP

REMARKS:

SOURCE NO. 100

PIT NO. 100-2

EXPOSURE: hand dug test pit beside access road

MATERIAL TYPE: fine sand, some gravel with cobbles and boulders

GENESIS (LANDFORM): IFP

REMARKS:

SOURCE NO. 100

PIT NO. 100-3

EXPOSURE: surface of point bar

MATERIAL TYPE: gravel with abundant cobbles and boulders

GENESIS (LANDFORM): AFP

REMARKS:

SOURCE NO. 100

PIT NO. 100-4

EXPOSURE: surface exposure along access road

MATERIAL TYPE: silty fine sand, trace of gravel

GENESIS (LANDFORM): AFP

REMARKS:

SOURCE NO. 100

PIT NO. 100-5

EXPOSURE: hand dug test pit

MATERIAL TYPE: very dense gravelly fine sand

GENESIS (LANDFORM): IFP

REMARKS: some evidence of material having been moved, probably during construction of pumping station

SOURCE NO.

PIT NO.

EXPOSURE:

MATERIAL TYPE:

GENESIS (LANDFORM):

REMARKS:

SOURCE: 100

LANDFORM AND LOCATION: ACTIVE MEANDER PLAIN, BLANCHARD RIVER

PARAMETER	ENVIRONMENTAL CONCERN	EVALUATION
GEOTERRAIN:	POTENTIAL FOR EROSION	2
VEGETATION:	COMMERCIAL AND/OR AESTHETIC VALUE	1
TERRESTRIAL FAUNA:	GRIZZLY BEAR HABITAT WATERFOWL HABITAT	3
AQUATIC FAUNA:	TROUT AND SALMON IN BLANCHARD RIVER	5
SURFACE WATER:	POTENTIAL FOR SLUMPING, EROSION, SILTATION OR ALTERATION OF EXISTING DRAINAGE PATTERNS	3
LAND STATUS AND USE:	GAME SANCTUARY INDUSTRIAL USE (ABANDONED PUMPING STATION) SPORT FISHING RECREATION POTENTIAL	2
HERITAGE RESOURCES:	NO INVOLVEMENT	0
SPECIAL INTEREST:	YUKON/BRITISH COLUMBIA BOUNDARY	[illegible]

DETAILED SOURCE ASSESSMENT SHEET

SOURCE NO.	110
SAMPLE NOS.	not sampled
LANDFORM AND LOCATION	active flood plain along Blanchard River near kilometre post HR 153
MATERIAL	sandy gravel and gravelly sand (assumed)
ESTIMATED VOLUME	200 000 m^3 adjacent to river and another 20 000 m^3 in riverbed, 150 000 m^3 east of river and another 15 000 m^3 west of river.
AIRPHOTO NOS.	HIGH LEVEL A 11524-287
	LOW LEVEL A 24177-122

DETAILED ASSESSMENT

ENVIRONMENT

Physical

Four separate active flood plain deposits along both banks of the Blanchard River comprise Source No. 100. Each surface is approximateiy 3 m above river level, and steep slopes separate the areas from the highway. River width, gradient and depth are similar to those at Source No. 100. No cultural features were evident.

Biotic

Vegetation consists of willows and shrub birch with some open areas covered with grasses and herbs. Steeply sloping banks above the site are covered with balsam poplar and scattered white spruce with juniper in the understory. Fisheries and wildlife concerns are similar to Source No. 100.

Recreation

The source is entirely within the Kluane Game Sanctuary. Sport fishing is not active because of the steep slopes separating the areas from the highway.

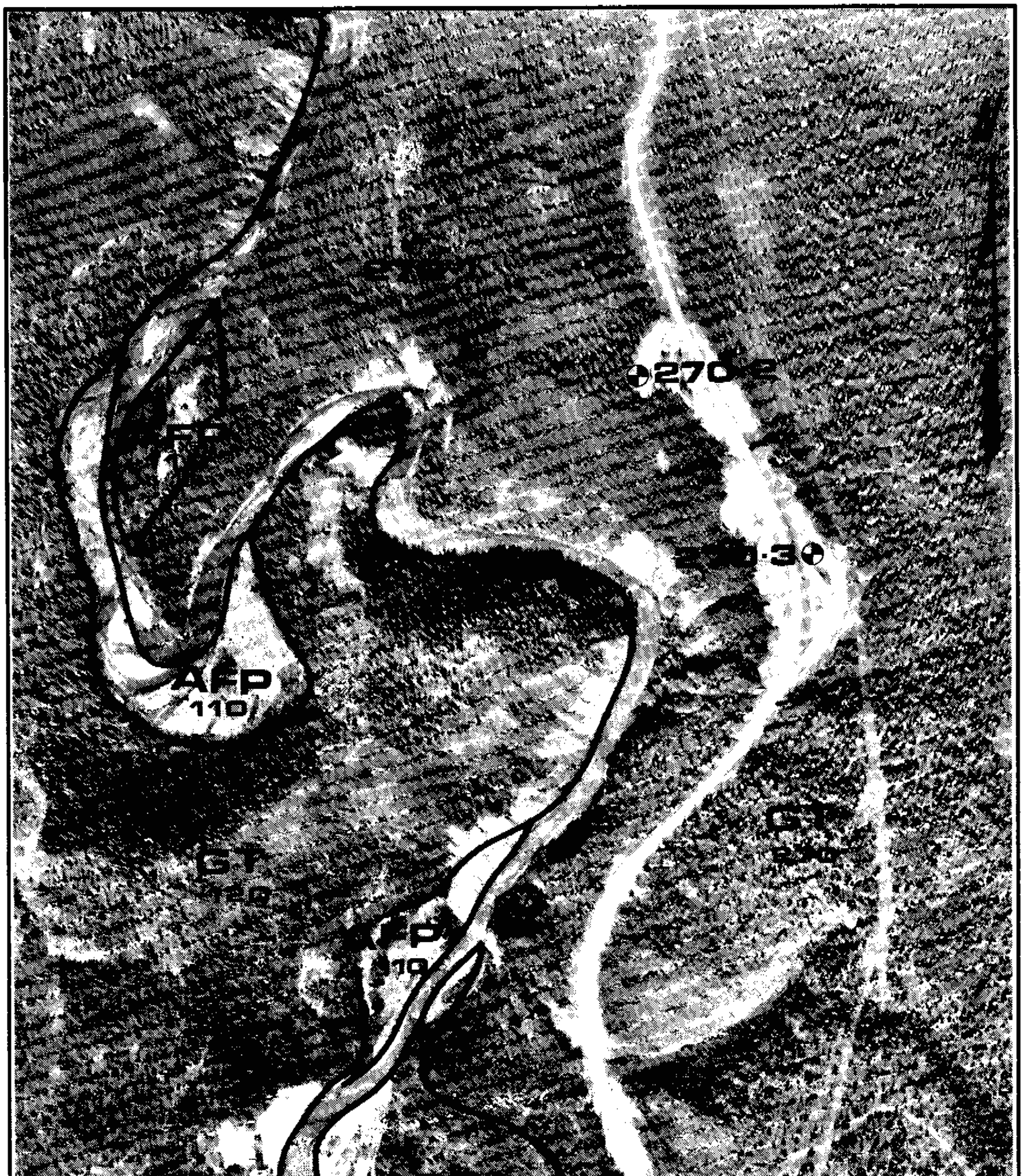
GRANULAR RESOURCES

Poor access did not permit sampling of the granular materials, however, it is expected that the grain size distribution and petrology of the granular materials would be similar to Source No. 100. Volumes of the sources were calculated using an average thickness of 3 m for those areas east of the river and 1 m for those on the west side. Overburden thicknesses are estimated to range from 0 to 0.15 m.

Because of steep slopes between the highway and the potential borrow sources, it would be necessary to construct an access road along the river from a point near Source No. 100. Such a road could have a potential for degradation of the river channel. A bridge would be required to remove materials from the west side of the river. An ice bridge would be feasible during winter months.

DEVELOPMENT

Difficult access will be the main deterrent to development of Source No. 110. The volume of materials available probably will not justify the expenditures that would be necessary to construct a suitable access road. Disturbance of fisheries is also a negative factor with respect to development. It is expected that the material uses and material handling requirements would be the same as Source No. 100.



Source Nos. 110, 120 and 270 Airphoto No. A24177-122

SOURCE: 110

LANDFORM AND LOCATION: ACTIVE MEANDER PLAIN, BLANCHARD RIVER

PARAMETER	ENVIRONMENTAL CONCERN	EVALUATION
GEOTERRAIN:	POTENTIAL FOR EROSION	1
VEGETATION:	COMMERCIAL AND/OR AESTHETIC VALUE	1
TERRESTRIAL FAUNA:	GRIZZLY BEAR HABITAT WATERFOWL HABITAT	3
AQUATIC FAUNA:	TROUT AND SALMON IN BLANCHARD RIVER	5
SURFACE WATER:	POTENTIAL FOR SLUMPING, EROSION, SILTATION, ALTERATION OF EXISTING DRAINAGE PATTERNS	2
LAND STATUS AND USE:	GAME SANCTUARY SPORT FISHING RECREATION POTENTIAL	2
HERITAGE RESOURCES:	NO INVOLVEMENT	0
SPECIAL INTEREST:	RAPIDS DOWNSTREAM	1

DETAILED SOURCE ASSESSMENT SHEET

SOURCE NO.	120
SAMPLE NOS.	not sampled
LANDFORM AND LOCATION	glaciofluvial terrace along Blanchard river approximate kilometre post HR152 to HR155
MATERIAL	stratified gravel sands and silts (assumed)
ESTIMATED VOLUME	requires further evaluation
AIRPHOTO NOS.	HIGH LEVEL A11524-287
	LOW LEVEL A24177-121

DETAILED ASSESSMENT

ENVIRONMENT

Physical

This source area exists as a large glaciofluvial terrace bordered on the east by the valley of the Blanchard River and on the west by Tatshenshini River valley. Within the Yukon Territory the terrace is approximately two miles long. Difficult access prevented an on-site inspection of the area, however an exposure along the Blanchard River revealed some 40 m of stratified gravels sands and silts.

Biotic

No assessment of environmental factors was made.

Recreation

Source No. 120 is within the boundary of the Kluane Game Sanctuary.

GRANULAR RESOURCES

Field observations indicate that a wide range of soil types exist within the terrace. A thick section of stratified gravels, sands and silts appears in Plate 120.1. Location of the photograph is shown by the arrow on the airphoto. A detailed sampling program would be necessary to locate and evaluate potential sources of useable granular materials. An estimate of granular resource volumes is not appropriate at this time. Access to the glaciofluvial terrace will present problems, if and when sufficient quantities of granular material are located. The Blanchard River would have to be bridged and relatively large elevation differences between the source and the highway would have to be overcome.

DEVELOPMENT

Development recommendations cannot be made until a detailed sampling program has been completed.

Source Nos. 110, 120 and 270 Airphoto No. A24177-122

DETAILED SOURCE ASSESSMENT SHEET

SOURCE NO. 130, 140 and 150

SAMPLE NOS. not sampled

LANDFORM AND LOCATION AC on east side of valley wall above road between kilometre posts HR154 and HR155.5

MATERIAL bouldery gravel with some sand

ESTIMATED VOLUME 1 000 000 m^3 (130), 500 000 m^3 (140), 500 000 m^3 (150)

AIRPHOTO NOS. HIGH LEVEL A11524-287

LOW LEVEL A24177-118 (only one available)

DETAILED ASSESSMENT

ENVIRONMENT

Physical

Sources 130, 140 and 150 are alluvial cones situated on the west facing mountain slopes well above the level of the Haines Road. These deposits consist of unsorted granular material accumulated under the twin agencies of running water and gravity. Small intermittent streams can be detected above the cone apices. Slope angles are approximately 10 degrees.

Biotic

Vegetation on the cones and on higher slopes consists entirely of shrub birch, willow and alder. On slopes below the cones vegetational cover includes scattered balsam poplar and aspen with an understory of kinnikinnick, empterum, and juniper.

Potential thinhorn sheep habitats lie above the cones. The entire valley is reported to be high-value grizzly bear habitat. Moose sign was observed at site 150. Fisheries concerns are minimal because of the substantial separation between deposits and larger streams and the lack of fine grained erodible materials in the deposits.

Recreation

The area is utilized for big game hunting and is a registered outfitter/guiding district. A telephone line and the abandoned pipeline right-of-way traverse the lower portions of the sources.

GRANULAR RESOURCES

Because of their remoteness, Source Nos. 130, 140 and 150 were viewed from a distance only. It is expected that these deposits contain unsorted sands, gravels, cobbles and boulders. Sand and gravel would predominate in the upper sections of the cones, and cobbles and boulders will be the principal grain sizes near the bases. The petrology of the sediments would reflect that of the mountain range from which they originate. Granodiorite is likely the main rock type. Volumes were calculated using an average thickness of 3 m.

Access to sources would require extensive road construction up slopes of 8 to 10 degrees. Haul roads would cross intermittent drainage courses. The average distance from the Haines Road to the base of each cone is 0.5 km.

DEVELOPMENT

Suitability of the granular materials in these sources is difficult to assess without sampling. It is expected that some processing would be required if the materials were to be used for any purpose except general fill. Environmental concerns do not appear to be limiting. The expense of constructing access roads may be a major deterrent to development.

Source Nos. 150 and 270 Airphoto No. A24177-118

SOURCE: 150

LANDFORM AND LOCATION: ALLUVIAL FAN DEPOSIT

PARAMETER	ENVIRONMENTAL CONCERN	EVALUATION
GEOTERRAIN:	POTENTIAL FOR EROSION	0
VEGETATION:	COMMERCIAL AND/OR AESTHETIC VALUE	1
TERRESTRIAL FAUNA:	GRIZZLY BEAR HABITAT SHEEP HABITAT	3
AQUATIC FAUNA:	NO INVOLVEMENT	0
SURFACE WATER:	POTENTIAL FOR SLUMPING AND EROSION	1
LAND STATUS AND USE:	INDUSTRIAL USE (ABANDONED PIPELINE) UTILITIES (TELEPHONE LINE) HUNTING AREA OUTFITTER/GUIDING AREA	1
HERITAGE RESOURCES:	NO INVOLVEMENT	0
SPECIAL INTEREST:	NONE	0

Source No. 160 Airphoto No. A24177-116

SOURCE NO. 160

PIT NO. 160-1

EXPOSURE: road cut

MATERIAL TYPE: very coarse gravel, some boulders

GENESIS (LANDFORM): AC

REMARKS: granodiorite is principal rock type

SOURCE NO. 160

PIT NO. 160-2

EXPOSURE: road cut

MATERIAL TYPE: coarse bouldery gravel

GENESIS (LANDFORM): AC

REMARKS: granodiorite is principal rock type

SOURCE: 160

LANDFORM AND LOCATION: ALLUVIAL FAN DEPOSIT

PARAMETER	ENVIRONMENTAL CONCERN	EVALUATION
GEOTERRAIN:	POTENTIAL FOR EROSION	0
VEGETATION:	COMMERCIAL AND/OR AESTHETIC VALUE	1
TERRESTRIAL FAUNA:	GRIZZLY BEAR HABITAT SHEEP HABITAT	3
AQUATIC FAUNA:	NO INVOLVEMENT	0
SURFACE WATER:	POTENTIAL FOR SLUMPING, EROSION, ALTERATION OF INTERMITTENT DRAINAGES	2
LAND STATUS AND USE:	INDUSTRIAL USE (ABANDONED PIPELINE) UTILITIES (TELEPHONE LINE) HUNTING AREA OUTFITTER/GUIDING AREA	1
HERITAGE RESOURCES:	NO INVOLVEMENT	0
SPECIAL INTEREST:	NONE	0

DETAILED SOURCE ASSESSMENT SHEET

SOURCE NO.	170
SAMPLE NOS.	170-1
LANDFORM AND LOCATION	AC straddling the Haines Road at kilometre post HR159
MATERIAL	gravel and sand, some boulders up to 2 m in diameter
ESTIMATED VOLUME	1 350 000 m^3
AIRPHOTO NOS.	HIGH LEVEL A11524-287
	LOW LEVEL A24177-114

DETAILED ASSESSMENT

ENVIRONMENT

Physical

Source No. 170 is a relatively large alluvial cone with numerous abandoned and intermittent stream channels. A relatively deeply incised stream borders the source on the south side. Both the Haines Road and the abandoned pipeline right-of-way cut across the centre position of the cone. Sample No. 170-1 was taken from an old borrow pit on the extreme south side of the source.

Biotic and Recreation

Biotic and recreational concerns are expected to be similar to other alluvial cones along the valley (Sites 150, 160 etc.).

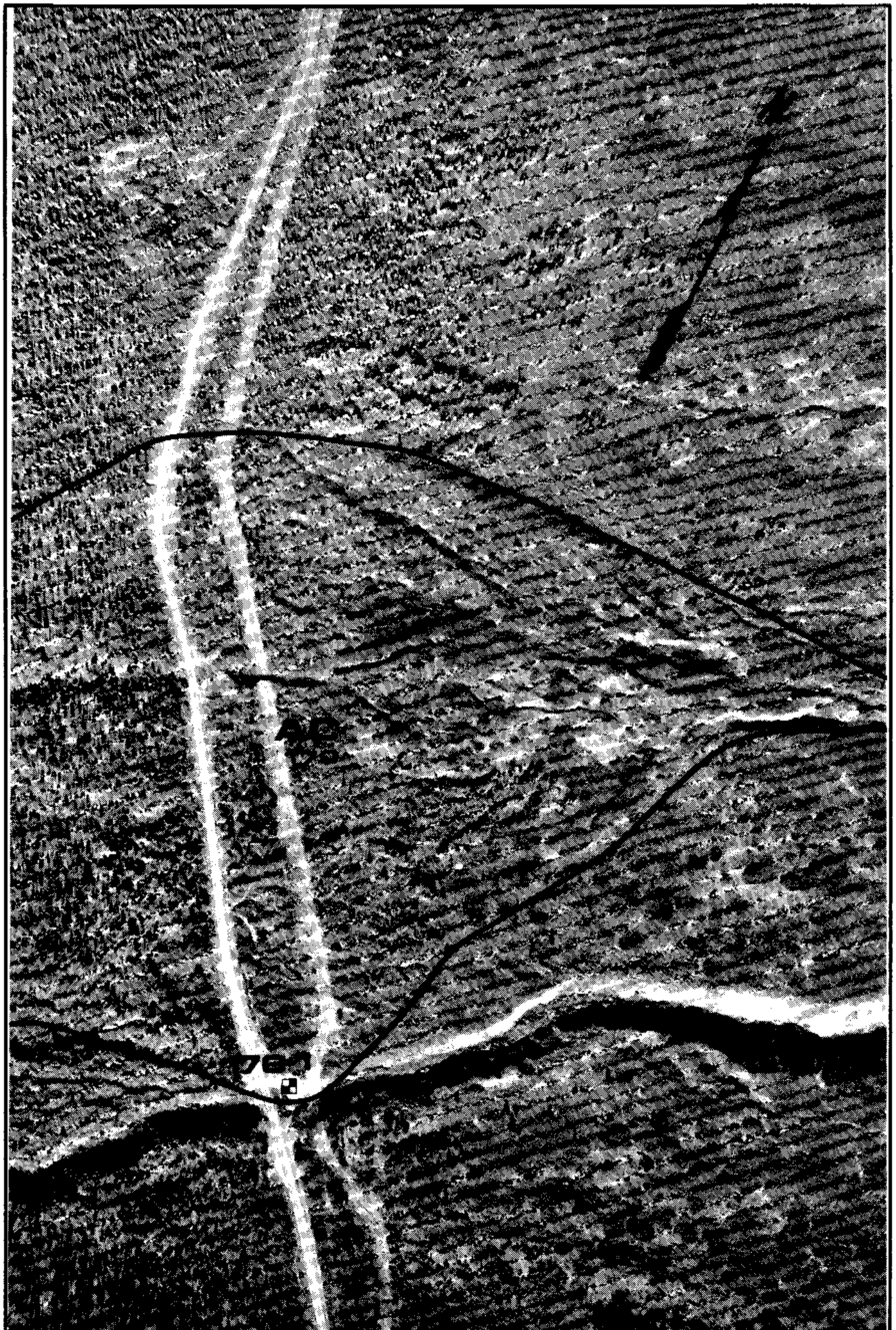
GRANULAR RESOURCES

Source 170 contains a wide range of grain sizes. Cobbles and boulders exist in a matrix of sand and gravel with some silt. The boulders average 0.5 m in diameter with the largest being 2 m. A petrographic analysis of the coarse sands and gravels revealed 70% granodiorite, 16% slate and 14% rhyolite. The particles are spherical, angular, and have a dull and rough surface texture. Recoverable volumes of granular material were estimated using an average thickness of 3 m. Road access to the source is excellent.

DEVELOPMENT

Analysis of Sample 170-1 indicates that the deposit at this location consists of boulders in a matrix of sand with some gravel and silt. Material with this grading requires extensive processing, although it is not known to what extent this single sample reflects the grain size distribution of the entire deposit. Useful aggregate could be developed using crushing and blending procedures. A two stage crushing operation would be required to process the boulders.

Environmental concerns regarding source development are minimal. The expense involved in processing the granular materials may be prohibitive.



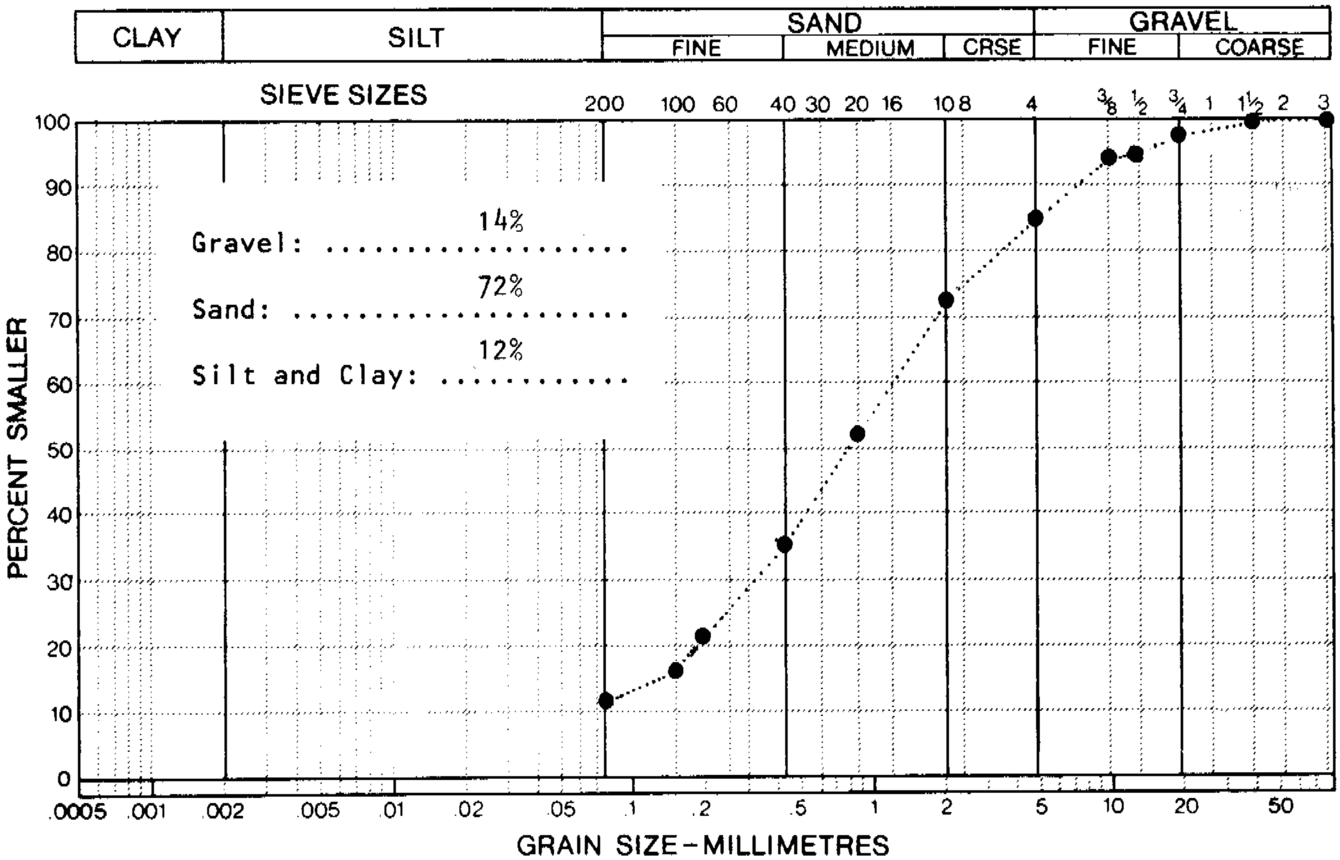
Source No. 170 Airphoto No. A24177-114

LABORATORY ANALYSIS

SOURCE NO. 170

PIT NO. 170-1

EXPOSURE: old borrow pit



MATERIAL TYPE: sand with some boulders, gravel and silt

GENISIS (LANDFORM): alluvial cone

PETROGRAPHIC ANALYSIS: granodiorite 70%
slate 16%
rhyolite 14%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: spheroidal, angular

REMARKS:

SOURCE: 170

LANDFORM AND LOCATION: ALLUVIAL FAN DEPOSIT

PARAMETER	ENVIRONMENTAL CONCERN	EVALUATION
GEOTERRAIN:	POTENTIAL FOR EROSION	0
VEGETATION:	COMMERCIAL AND/OR AESTHETIC VALUE	1
TERRESTRIAL FAUNA:	GRIZZLY BEAR HABITAT SHEEP HABITAT	3
AQUATIC FAUNA:	NO INVOLVEMENT	0
SURFACE WATER:	POTENTIAL FOR SLUMPING AND EROSION	1
LAND STATUS AND USE:	INDUSTRIAL USE (ABANDONED PIPELINE) UTILITIES (TELEPHONE LINE) HUNTING AREA OUTFITTER/GUIDING AREA	1
HERITAGE RESOURCES:	NO INVOLVEMENT	0
SPECIAL INTEREST:	NONE	0

DETAILED SOURCE ASSESSMENT SHEET

SOURCE NO. 180

SAMPLE NOS. 180-1

LANDFORM AND LOCATION AC bordering the Haines Road at kilometre post HR160

MATERIAL sand and gravel with some cobbles and boulders, trace of silt

ESTIMATED VOLUME 500 000 m^3

AIRPHOTO NOS. HIGH LEVEL A11521-418

LOW LEVEL A24177-112

DETAILED ASSESSMENT

ENVIRONMENT

Physical

Source No. 180 is comprised of two coalescing alluvial cones that extend downslope to the edge of the Haines Road. The base of the deposit is approximately 350 m wide. A telephone line and the pipeline right-of-way traverse the lower portion of the source area. From the road the cones slope upward to the east at 8 to 10 degrees.

Biotic and Recreation

The biotic setting and the recreational use of Source No. 180 are similar to the other alluvial cones.

GRANULAR RESOURCES

Source No. 180 consisted of 100% granodiorite in the form of gravel and sand with some cobbles and boulders and traces of silt. Maximum boulder size is 2 m with the average size being less than 0.5 m. In general the granular particles are spheroidal and angular. Surface textures are dull and rough to pitted. An average thickness of 3 m was used for volume estimations. Road access to the source is excellent.

DEVELOPMENT

The sand and gravel gradation in Source No. 180 is suitable as a sub-base course, and may also be marginally acceptable as a base course. Cobbles and boulders may have to be scalped or culled out. Washing, screening and blending may produce acceptable concrete aggregates, but it is expected that the deposit would produce only marginal asphalt due to the high silt contents.

Environmental concerns in the source area are not considered limiting.

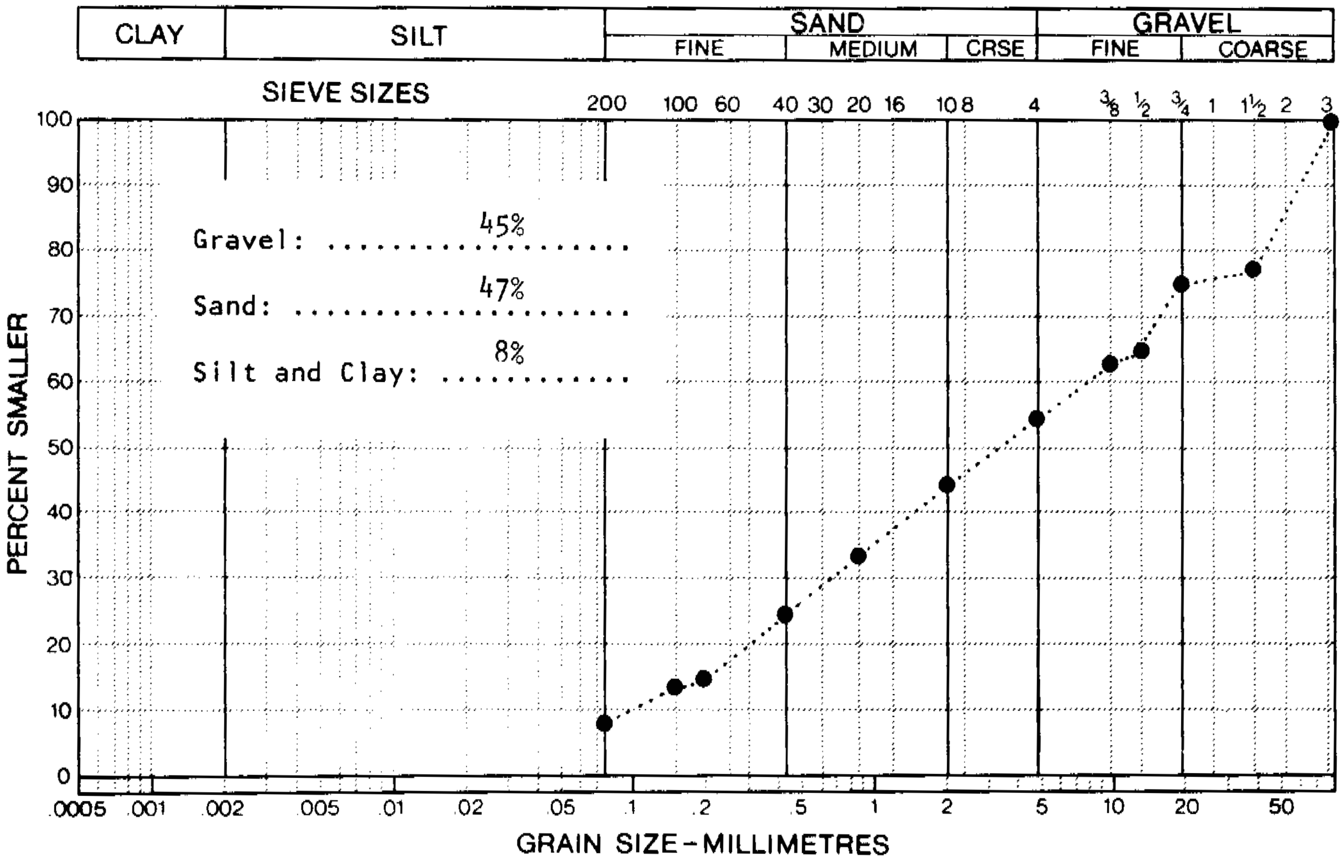
Source No. 180 Airphoto No. A24177-112

LABORATORY ANALYSIS

SOURCE NO. 180

PIT NO. 180-1

EXPOSURE: old borrow area



MATERIAL TYPE: sand and gravel, some cobbles and boulders, trace of silt

GENISIS (LANDFORM): alluvial cone

PETROGRAPHIC ANALYSIS: granodiorite 100%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: spheroidal, angular

REMARKS:

SOURCE: 180

LANDFORM AND LOCATION: ALLUVIAL FAN DEPOSIT

PARAMETER	ENVIRONMENTAL CONCERN	EVALUATION
GEOTERRAIN:	POTENTIAL FOR EROSION	0
VEGETATION:	COMMERCIAL AND/OR AESTHETIC VALUE	1
TERRESTRIAL FAUNA:	GRIZZLY BEAR HABITAT SHEEP HABITAT	3
AQUATIC FAUNA:	NO INVOLVEMENT	0
SURFACE WATER:	POTENTIAL FOR SLUMPING AND EROSION	1
LAND STATUS AND USE:	INDUSTRIAL USE (ABANDONED PIPELINE) UTILITIES (TELEPHONE LINE) HUNTING AREA OUTFITTER/GUIDING AREA	1
HERITAGE RESOURCES:	NO INVOLVEMENT	0
SPECIAL INTEREST:	NONE	0

36-0260

DETAILED SOURCE ASSESSMENT SHEET

SOURCE NO. 190

SAMPLE NOS. 190-2

LANDFORM AND LOCATION AC crossing Haines Road near kilometre post HR161

MATERIAL sand and gravel with some silt and boulders

ESTIMATED VOLUME 1 200 000 m^3

AIRPHOTO NOS. HIGH LEVEL A11521-418

LOW LEVEL A24177-110

DETAILED ASSESSMENT

ENVIRONMENT

Physical

Source No. 190 is one of the largest alluvial cones in the southern part of the study area measuring approximately 1,000 m long and 600 m in breadth at its widest point. The Haines Road, abandoned pipeline right-of-way and telephone line traverse the cone near its base.

Biotic and Recreation

Source 190 has a similar biotic setting and recreational utilization to the other alluvial cones in the area (see Source Nos. 130, 140 and 150).

GRANULAR RESOURCES

The granular materials in the source were observed in two road cuts. Both locations have sand and gravel with some silt, cobbles and boulders. Granodiorite (96%) and hard slate (4%) were the only rock types identified in the source. Granular volumes were estimated using an average cone thickness of 3 m. Road access to the source is excellent.

DEVELOPMENT

According to sample 190-2, this source is only suitable for general fill. More detailed investigation would be necessary to determine whether better material is available elsewhere in the deposit. Environmental concerns are not serious and development could be carried out if soil conditions warranted further assessment.

Source No. 190

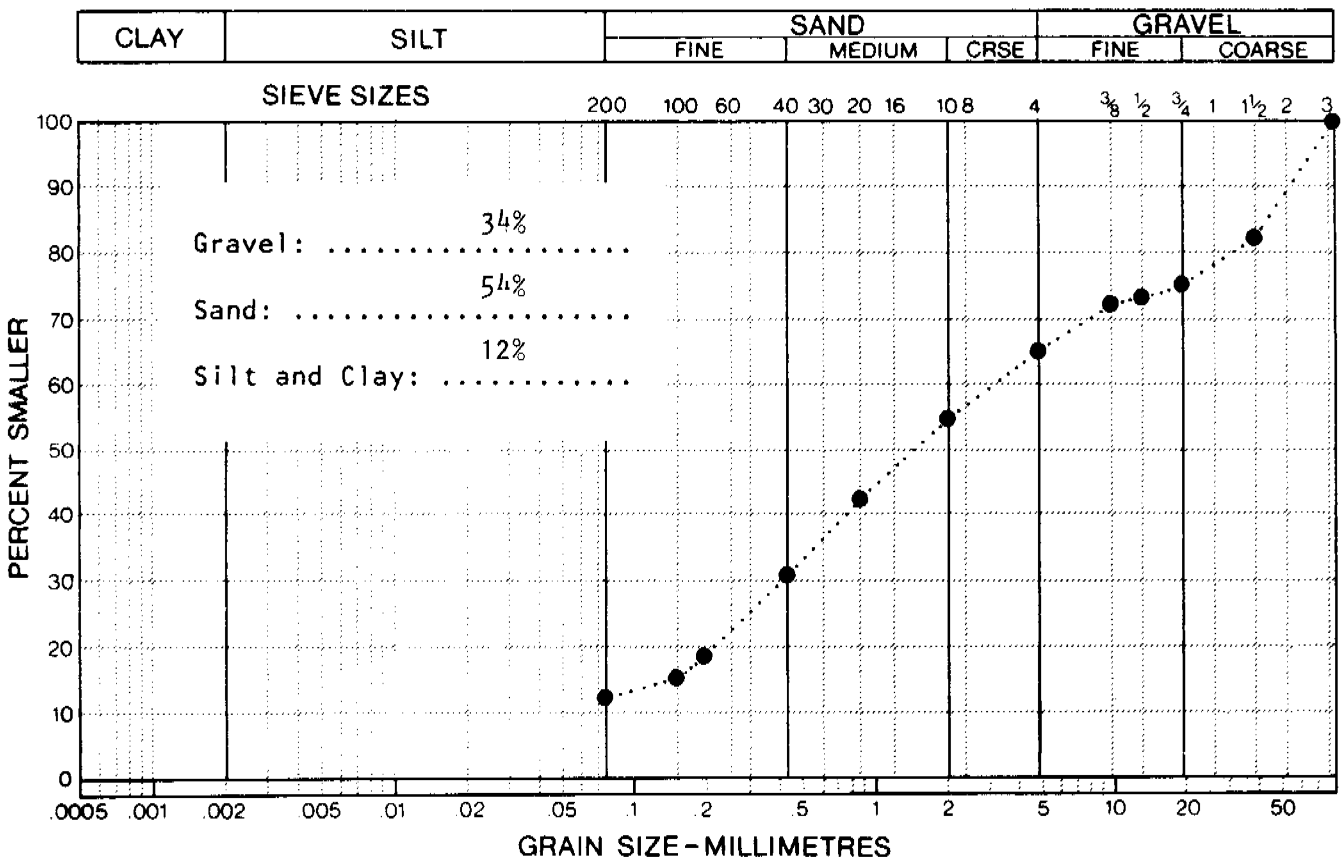
Airphoto No. A24177-112

LABORATORY ANALYSIS

SOURCE NO. 190

PIT NO. 190-2

EXPOSURE: road cut



MATERIAL TYPE: sand and gravel, some silt and boulders

GENISIS (LANDFORM): alluvial cone

PETROGRAPHIC ANALYSIS: granodiorite 96%
slate 4%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: spheroidal, angular

REMARKS:

SOURCE NO. 190

PIT NO. 190-1

EXPOSURE: road cut

MATERIAL TYPE: sand and gravel, some silt

GENESIS (LANDFORM): AC

REMARKS:

SOURCE NO.

PIT NO.

EXPOSURE:

MATERIAL TYPE:

GENESIS (LANDFORM):

REMARKS:

SOURCE: 190

LANDFORM AND LOCATION: ALLUVIAL FAN DEPOSIT

PARAMETER	ENVIRONMENTAL CONCERN	EVALUATION
GEOTERRAIN:	POTENTIAL FOR EROSION	0
VEGETATION:	COMMERCIAL AND/OR AESTHETIC VALUE	1
TERRESTRIAL FAUNA:	GRIZZLY BEAR HABITAT SHEEP HABITAT	3
AQUATIC FAUNA:	NO INVOLVEMENT	0
SURFACE WATER:	POTENTIAL FOR SLUMPING AND EROSION	1
LAND STATUS AND USE:	INDUSTRIAL USE (ABANDONED PIPELINE) UTILITIES (TELEPHONE LINE) HUNTING AREA OUTFITTER/GUIDING AREA	1
HERITAGE RESOURCES:	NO INVOLVEMENT	0
SPECIAL INTEREST:	NONE	0

36-0260

DETAILED SOURCE ASSESSMENT SHEET

SOURCE NO. 200

SAMPLE NOS. not sampled

LANDFORM AND LOCATION AC above Haines Road near kilometre post HR161

MATERIAL bouldery sand and gravel

ESTIMATED VOLUME 350 000 m^3

AIRPHOTO NOS. HIGH LEVEL A11521-418

LOW LEVEL A24177-109

DETAILED ASSESSMENT

ENVIRONMENT

Physical

Located east of and above the Haines Road, Source No. 200 is a relatively small alluvial cone. Several abandoned or intermittent stream channels within the cone are apparent in airphotographs.

Biotic and Recreation

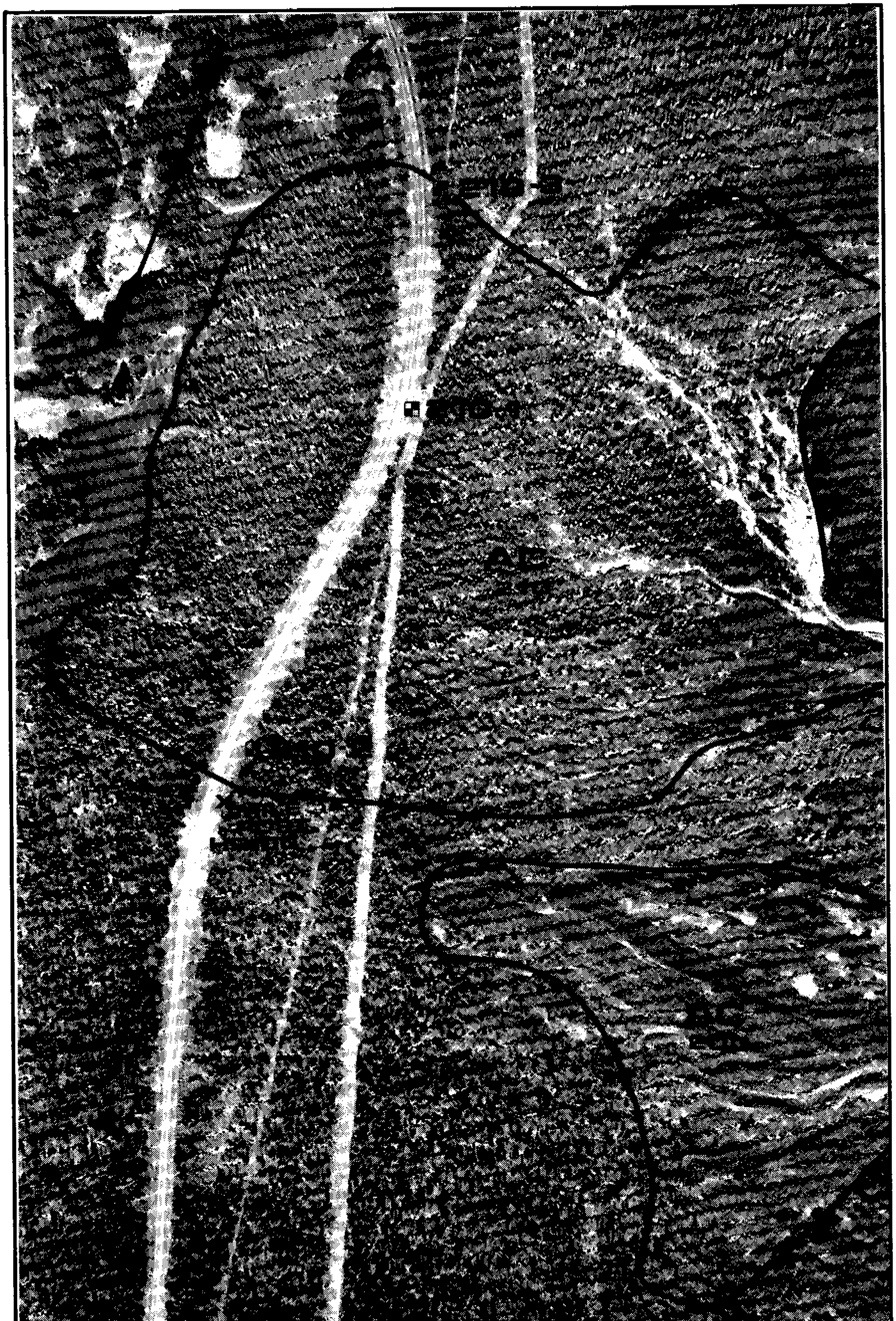
It is expected that Source No. 200 has a similar biotic setting and degree of recreational utilization as other alluvial cones in the area (see Source Nos. 130, 140, and 150) although the site was not specifically examined during field surveys.

GRANULAR RESOURCES

The source was not inspected in the field, however it can be assumed that the rock types and grain size distribution are similar to that found in adjacent cones. Volume estimations are based on an average thickness of 3 m. Access to the base of the source would require the construction of a short haul road. The base of the cone is approximately 200 m from the Haines Road.

DEVELOPMENT

A sampling program would be necessary to ascertain the quality of the granular materials in this Source. At present it can be assumed that the deposit is similar to the adjacent Source No. 210 and therefore should be considered for general fill only. Environmental concerns are minimal. In determining the quality of the source, consideration should be given to the economics involved in construction of a haul road, and the proximity of superior granular materials.



Source No. 200 and 210 Airphoto No. A24177-108

36-0260

DETAILED SOURCE ASSESSMENT SHEET

SOURCE NO.	210
SAMPLE NOS.	210-1 210-2 210-3
LANDFORM AND LOCATION	AC crossing the Haines Road near kilometre post HR161
MATERIAL	gravel, sand and silt
ESTIMATED VOLUME	2 000 000 m^3
AIRPHOTO NOS.	HIGH LEVEL A11521-418 LOW LEVEL A24177-108

DETAILED ASSESSMENT

ENVIRONMENT

Physical

Source No. 210 is a large coalescing alluvial cone that underlies the Haines Road for a distance of 650 m. Measurements taken along the road alignment indicate that the cone slopes towards its margins at angles ranging from 1 to 6 degrees. The base of the cone terminates against a large esker complex (Source No. 240). Several small abandoned stream channels characterize the surface of the cone. In addition to the Haines Road, the abandoned pipeline right-of-way and the telephone line cut across the source.

Biotic and Recreation

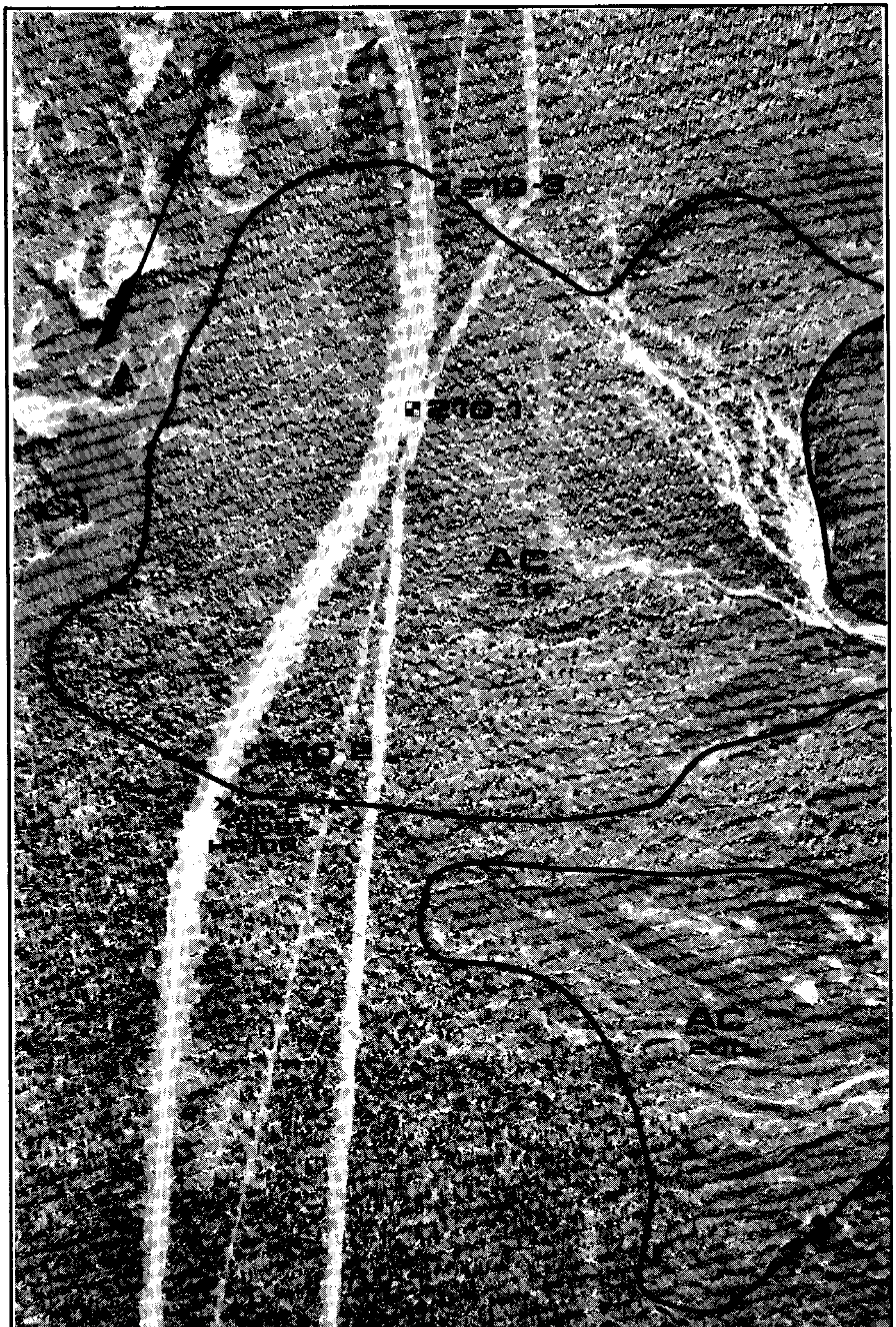
Source No. 210 has similar biotic setting and recreational utilization as the other alluvial cones in the area (see Source Nos. 130, 140 and 150).

GRANULAR RESOURCES

The alluvial cone was sampled at three locations across its base. In general the source sediments consist of sand and gravel with some silt and traces of cobbles. One sample taken from the north edge of the cone has a relatively high percentage of silt (32%) and a low percentage of gravel (2%). Granodiorite is the dominant rock type. Small amounts of rhyolite were found in the sample from the south edge of the cone. All of the particles are angular and roughly spheroidal in shape. Particle surface textures are dull and rough. Volume estimates were made using an average sediment thickness of 5 m. Road access to the source is excellent.

DEVELOPMENT

Sampling of Source No. 210 indicated that the central and north parts of the cone contain materials that have a high percentage of fines and therefore are useable only as general fill. A sample from the south edge of the source revealed material suitable for sub-bases and, with some screening of coarse gravels, material that could be utilized for asphalt aggregate. All of the alluvial cones investigated in this area can be expected to exhibit this characteristic non-uniformly of grain sizes. While excessive fines may preclude the use of much of the cone material, these fines may have selectively winnowed out in some areas. A more detailed investigation would be required to assess the extent of this potential borrow material. Environmental concerns at this site were not judged to be limiting.



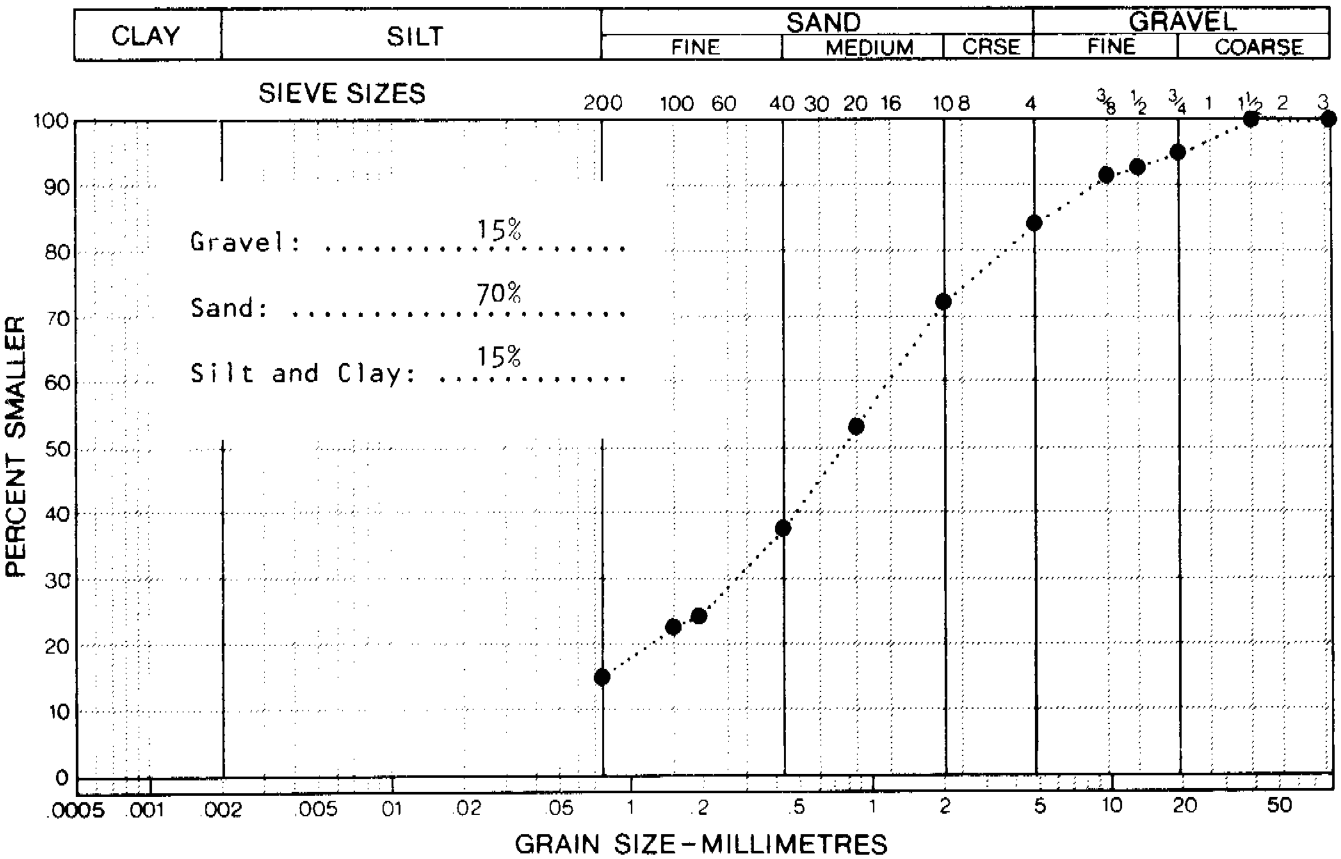
Source No. 200 and 210 Airphoto No. A24177-108

LABORATORY ANALYSIS

SOURCE NO. 210

PIT NO. 210-1

EXPOSURE: road cut



MATERIAL TYPE: sand, some gravel and silt, trace of cobbles

GENISIS (LANDFORM): alluvial cone

PETROGRAPHIC ANALYSIS: granodiorite 100%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: spheroidal, angular

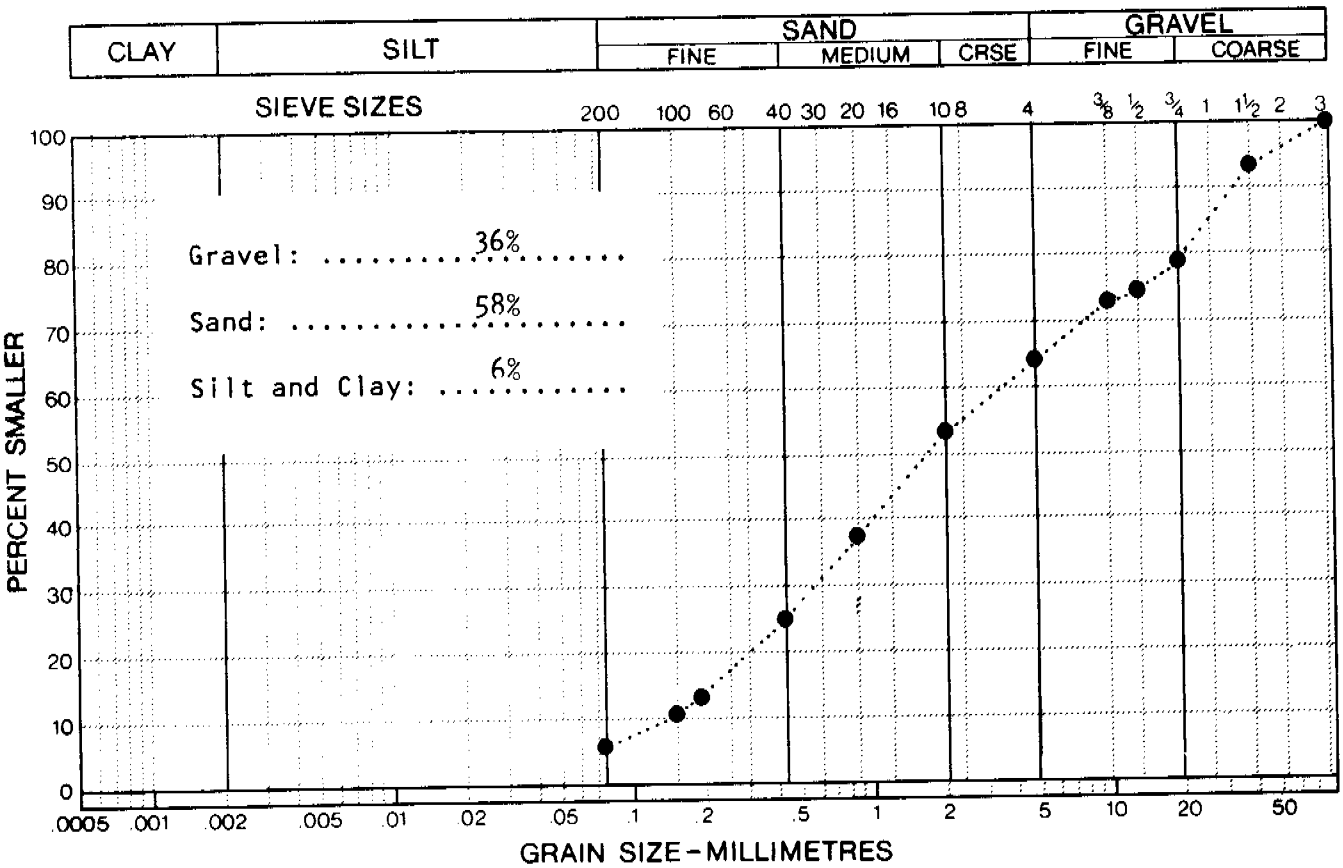
REMARKS:

LABORATORY ANALYSIS

SOURCE NO. 210

PIT NO. 210-2

EXPOSURE: road cut



MATERIAL TYPE: sand and gravel: trace of silt and cobbles

GENISIS (LANDFORM): alluvial cone

PETROGRAPHIC ANALYSIS: granodiorite 90%
rhyolite 10%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: spheroidal, angular

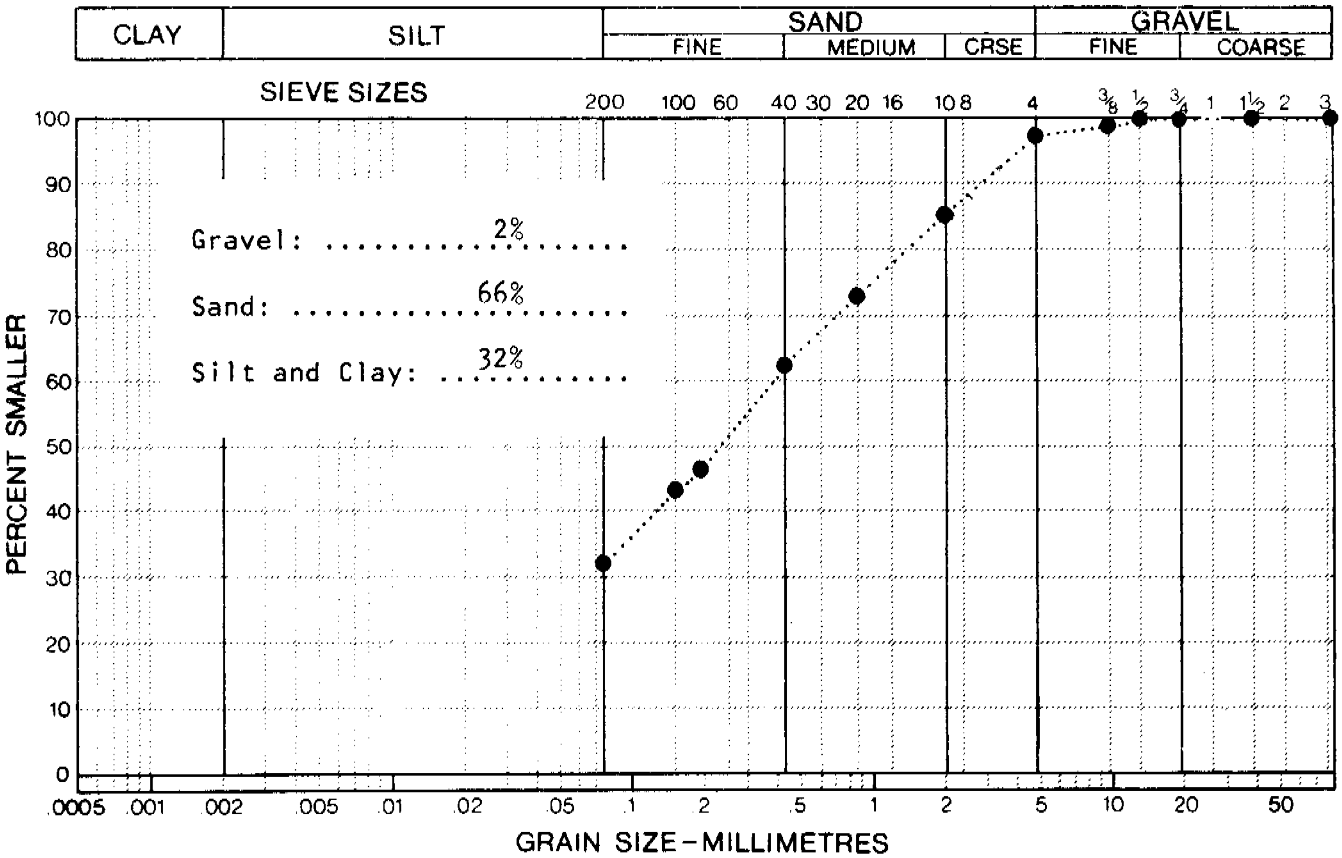
REMARKS:

LABORATORY ANALYSIS

SOURCE NO. 210

PIT NO. 210-3

EXPOSURE: road cut



MATERIAL TYPE: sand and silt, trace of gravel

GENISIS (LANDFORM): alluvial cone

PETROGRAPHIC ANALYSIS: granodiorite 100%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: spheroidal, angular

REMARKS:

SOURCE: 210

LANDFORM AND LOCATION: ALLUVIAL FAN DEPOSIT

PARAMETER	ENVIRONMENTAL CONCERN	EVALUATION
GEOTERRAIN:	POTENTIAL FOR EROSION	0
VEGETATION:	COMMERCIAL AND/OR AESTHETIC VALUE	1
TERRESTRIAL FAUNA:	GRIZZLY BEAR HABITAT SHEEP HABITAT	3
AQUATIC FAUNA:	NO INVOLVEMENT	0
SURFACE WATER:	POTENTIAL FOR SLUMPING AND EROSION	1
LAND STATUS AND USE:	INDUSTRIAL USE (ABANDONED PIPELINE) UTILITIES (TELEPHONE LINE) HUNTING AREA OUTFITTER/GUIDING AREA	1
HERITAGE RESOURCES:	NO INVOLVEMENT	0
SPECIAL INTEREST:	NONE	0

36-0260

DETAILED SOURCE ASSESSMENT SHEET

SOURCE NO. 220

SAMPLE NOS. not sampled

LANDFORM AND LOCATION AC east of Haines Road near kilometre post HR162

MATERIAL sand and gravel, some silt and boulders (assumed)

ESTIMATED VOLUME 500 000 m^3

AIRPHOTO NOS. HIGH LEVEL A11521-418

LOW LEVEL A24177-108

DETAILED ASSESSMENT

ENVIRONMENT

Physical

Source No. 220 is a relatively small alluvial cone located east of the Haines Road. The cone terminates against a large esker complex (Source No. 240). The abandoned pipeline right-of-way and the telephone line traverse the lower tip of the cone.

Biotic and Recreation

Based on observations of nearby similar sites Source No. 220 would be expected to have a similar boitic setting and degree of recreational utilization as alluvial cones previously described (see Source No. 130, 140 and 150).

GRANULAR RESOURCES

The source was not visited in the field but it can be assumed that the material type, grading and petrology are similar to the adjacent Source No. 210.

The estimate of material volume was made using an average thickness of 3 m. Access to the base of the source would require construction of a road approximately 150 m long, or utilization of the pipeline right-of-way.

DEVELOPMENT

Source No. 220 requires a sampling program to evaluate the possible utilization of the granular materials. Until further work is done, these materials should be considered to be of the same quality as Source No. 210 and therefore useful only as general fill. Environmental concerns in the source area were not directly evaluated but are not expected to be limiting based on examination of similar sites in the area. Road access costs should not be high.

Source Nos. 220, 240 Airphoto No. A24177-107

36-0260

DETAILED SOURCE ASSESSMENT SHEET

SOURCE NO. 230

SAMPLE NOS. none

LANDFORM AND LOCATION EKC on west side of Tatshenshini River at approximate kilometre post HR163

MATERIAL suspected sand and gravel

ESTIMATED VOLUME 4 500 000 m^3

AIRPHOTO NOS. HIGH LEVEL A11521-417

LOW LEVEL none available

DETAILED ASSESSMENT

ENVIRONMENT

Physical

The esker complex which comprises Source No. 230 is located above and west of the Tatshenshini River. This complex is a continuation of Source No. 240. Because of poor access the site was not visited, however, it appears from airphotographs that the physical characteristics of the two areas are similar.

Biotic

Vegetation and wildlife are expected to be the same as Source No. 240. The source is entirely within the Kluane Game Sancturary.

GRANULAR RESOURCES

Since the source area was originally a part of Source No. 240, it can be assumed that the material type, grading, petrology, and the overburden thickness are similar. Volumes of granular material were calculated in the same manner as Source No. 240.

Road access to the source would require construction of a bridge across the Tatshenshini River. In view of the proximity of abundant borrow material within Source No. 240, no development of this deposit is currently recommended.

36-0260

DETAILED SOURCE ASSESSMENT SHEET

SOURCE NO. 240

SAMPLE NOS. 240-1, 240-2, 240-4, 240-5

LANDFORM AND LOCATION esker complex near confluence of Takhanne and Tatshenshini Rivers, approximate kilometre post HR161 to HR164

MATERIAL sand and gravel, trace of silt; cobbles and boulders

ESTIMATED VOLUME 7 500 000 m^3

AIRPHOTO NOS. HIGH LEVEL A11521-417

LOW LEVEL A24177-107

DETAILED ASSESSMENT

ENVIRONMENT

Physical

Source No. 240 is an irregular shaped esker complex, situated between and above the Takhanne and Tatshenshini River valleys. Numerous accordant, well drained esker ridges 15 to 18 m high make up the complex. In general the ridges trend in a north-south direction in an anastamosing pattern. Inter-esker areas are 5 to 10 m lower than the ridge crests and generally dry. The Haines Road traverses the eastern side of the complex and a number of the esker ridges are exposed in cuts. The abandoned pipeline right-of-way and a telephone line also cross the site. A few of the esker ridges adjacent to the road have been used as borrow areas.

Biotic

Vegetation on the site is open and park-like with grassy hollows between ridges covered with spruce, balsam poplar and aspen. Kinnikinnick, juniper and some shrub birch, willow and alder form the understory. The vegetation is attractive and varied, with the thickest stands occupying north-facing slopes.

The area is good general habitat for moose, deer, small mammals and upland game birds. There are no aquatic concerns and little potential for erosion.

Recreation

Most of the esker ridges lie within the Kluane Game Sanctuary. Attractive landforms, dry terrain and open, varied vegetation make the site of particular interest for recreational use.

GRANULAR RESOURCES

The esker ridges, where examined, are composed of poorly stratified sands and gravels with some cobbles and boulders and traces of silt. Some of the ridges observed in road cuts are predominantly sand and other are predominantly gravel. Quartzite is the main rock type with the major accessory being granodiorite. Minor rock constituents include rhyolite, slate, diorite, sandstone, schist and gneiss. The individual particles are angular to subrounded and have a wide variety of shapes. Weathering is evident in the sandstone and schist. The volume estimate is based on the assumption that only 50% of the complex is effectively composed of eskers, and the remainder is composed of finer material not suitable as a granular resource, although a resistivity profile across one of the ridges suggests that this may be conservative.

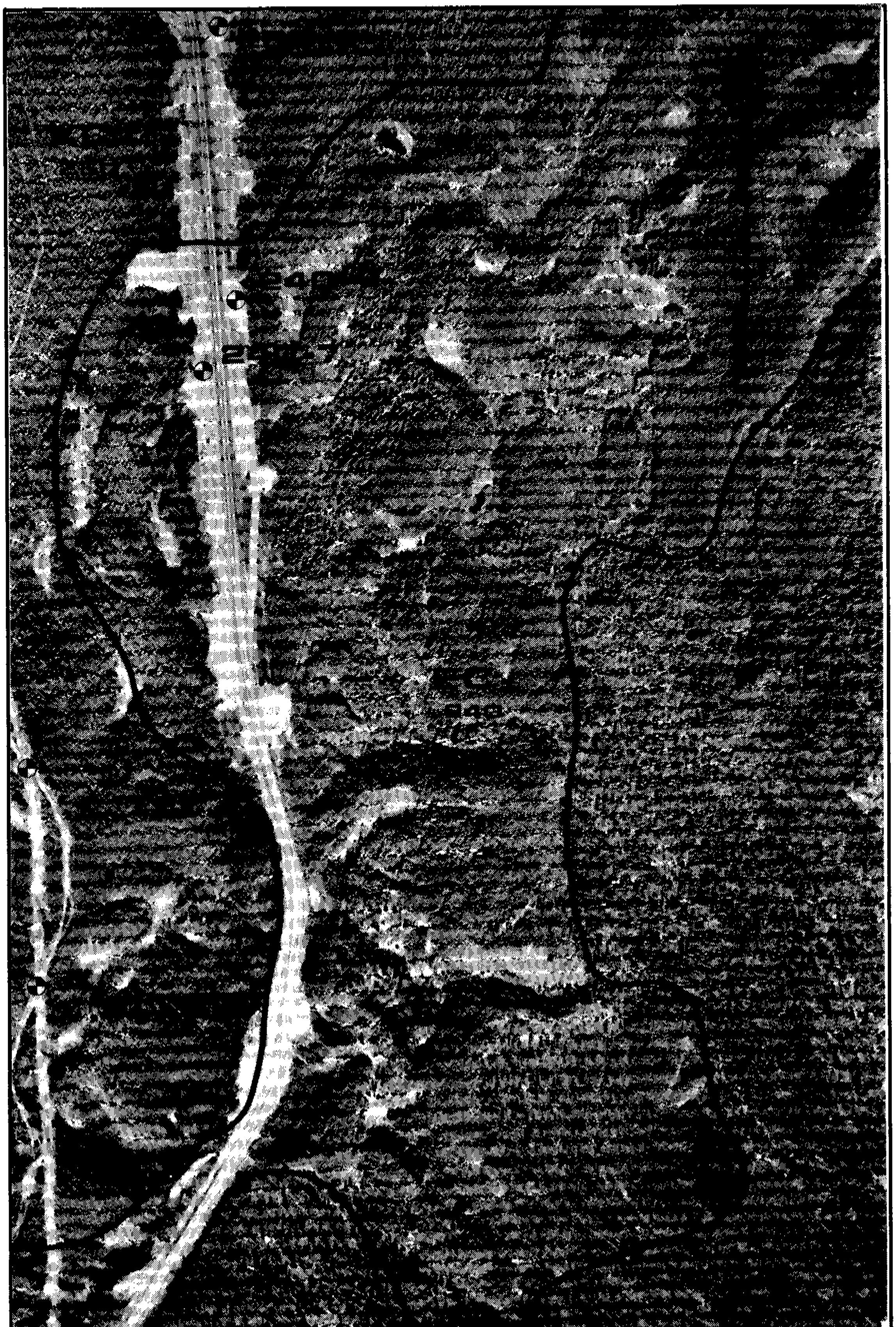
Access to the source is excellent. The Haines Road traverses the area for a distance of approximately 2.4 km.

DEVELOPMENT

The field investigation revealed that each esker, and in some cases certain parts of the same esker, has a characteristic grain size distribution. Some samples contained excellent material for concrete and asphalt aggregates, base courses and sub-bases while others contained sands suitable only for general fill or for blending with coarser materials. In general cobbles and boulders were present only in trace amounts. The quantity of deleterious substance (slate and weathered materials) ranged from 3 to 17 percent. Material handling processes anticipated for this source include some screening and blending. Environmental concerns for the source area are moderate but not necessarily limiting. Careful planning of gravel removal should be possible while maintaining habitat and recreational values.

The esker complex has excellent potential as a source of granular material, especially if development is carried out as a large scale operation. It is recommended that further sampling be done in order to accurately outline areas in which specific granular material can be exploited.

Source Nos. 220, 240 Airphoto No. A24177-107



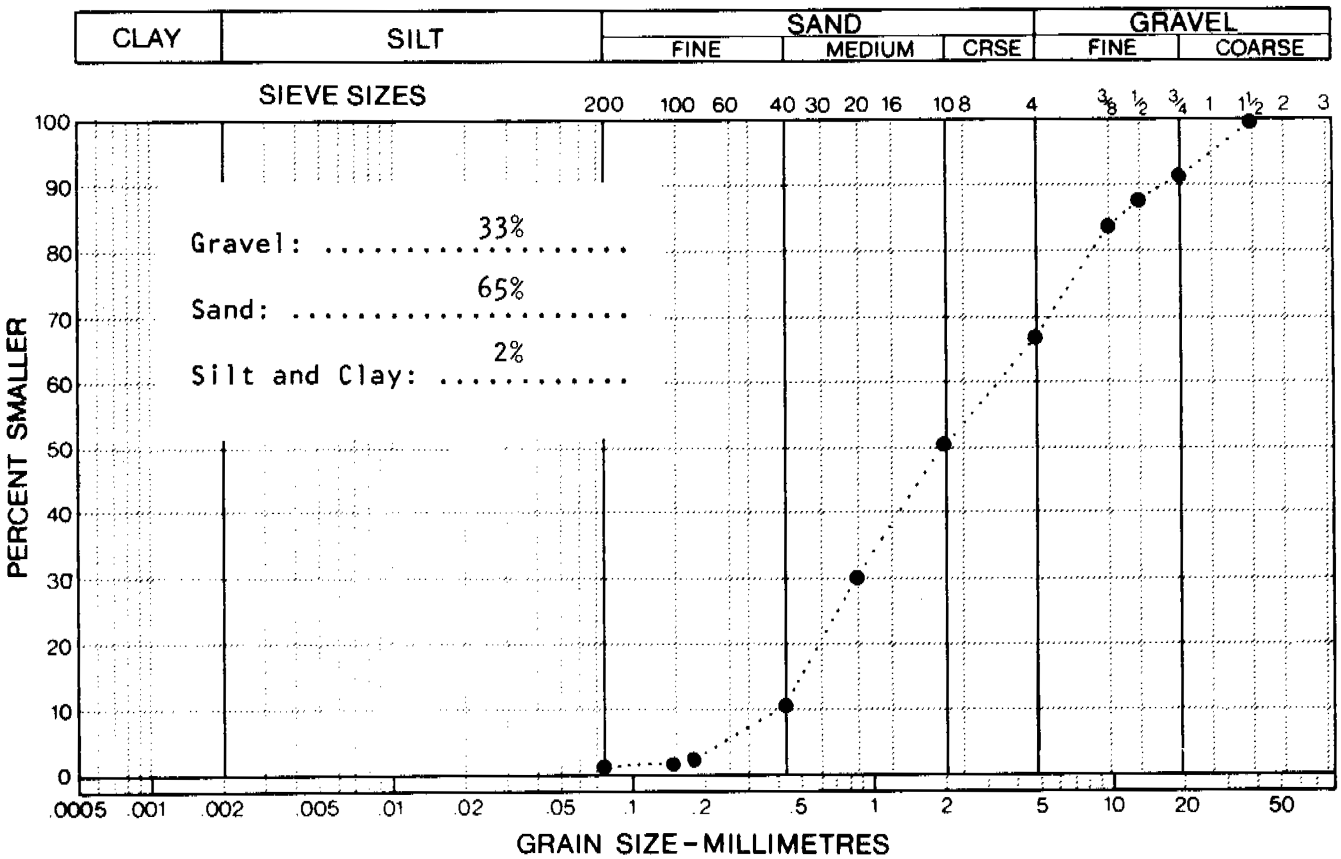
Source Nos. 240 and 250 Airphoto No. A24177-106

LABORATORY ANALYSIS

SOURCE NO. 240

PIT NO. 240-1

EXPOSURE: road cut



MATERIAL TYPE: sand and gravel, trace of silt, cobbles and boulders

GENISIS (LANDFORM): esker

PETROGRAPHIC ANALYSIS:
quartzite 77%
diorite 9%
granodiorite 7%
slate 5%
sandstone 1%
schist 1%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: blades and spheroids, subangular

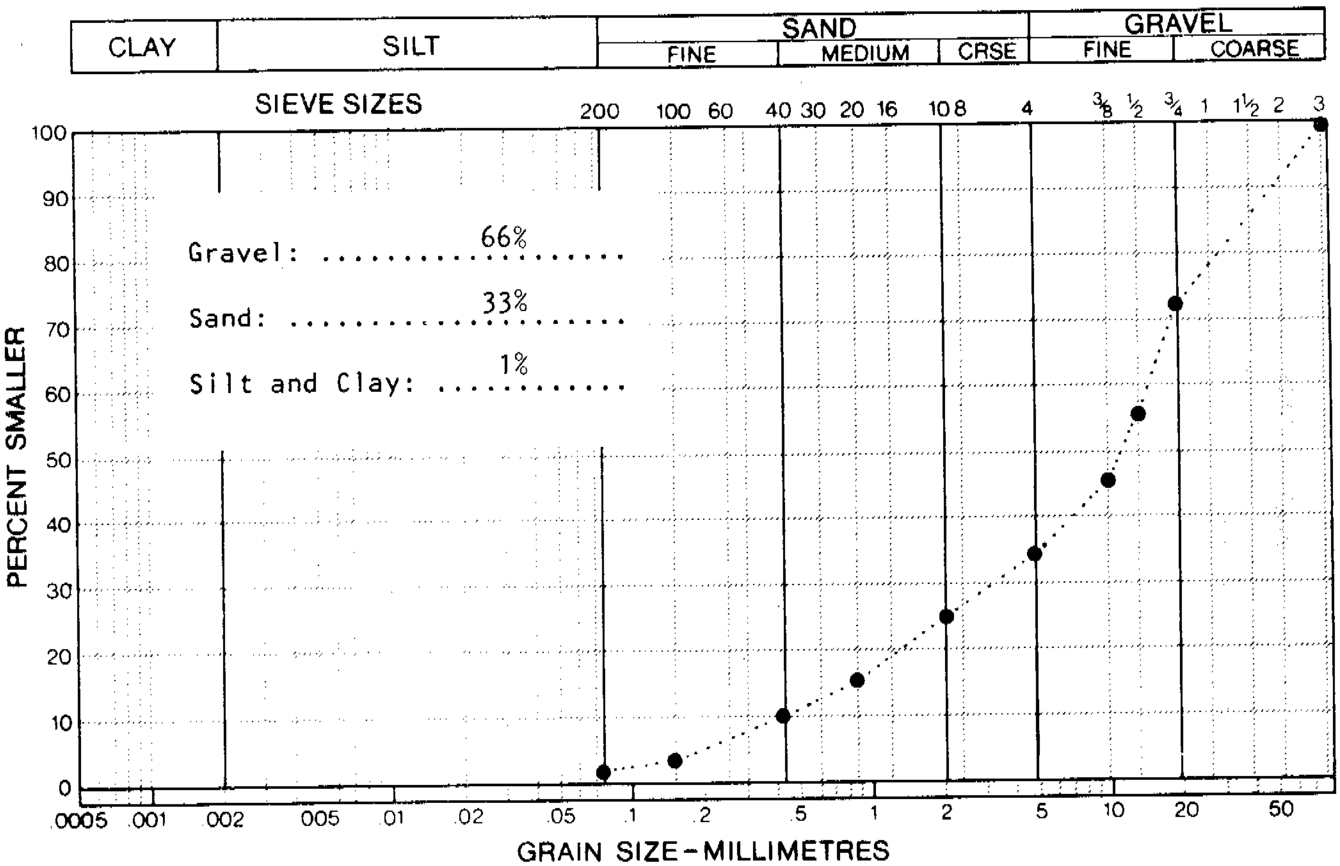
REMARKS: sample from sandy lens

LABORATORY ANALYSIS

SOURCE NO. 240

PIT NO. 240-1

EXPOSURE: road cut



MATERIAL TYPE: gravel and sand, trace of silt

GENISIS (LANDFORM): esker

PETROGRAPHIC ANALYSIS:

quartzite 59%
slate 14%
granodiorite 12%
diorite 8%
rhyolite 4%
sandstone 3%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: blades and rollers, angular

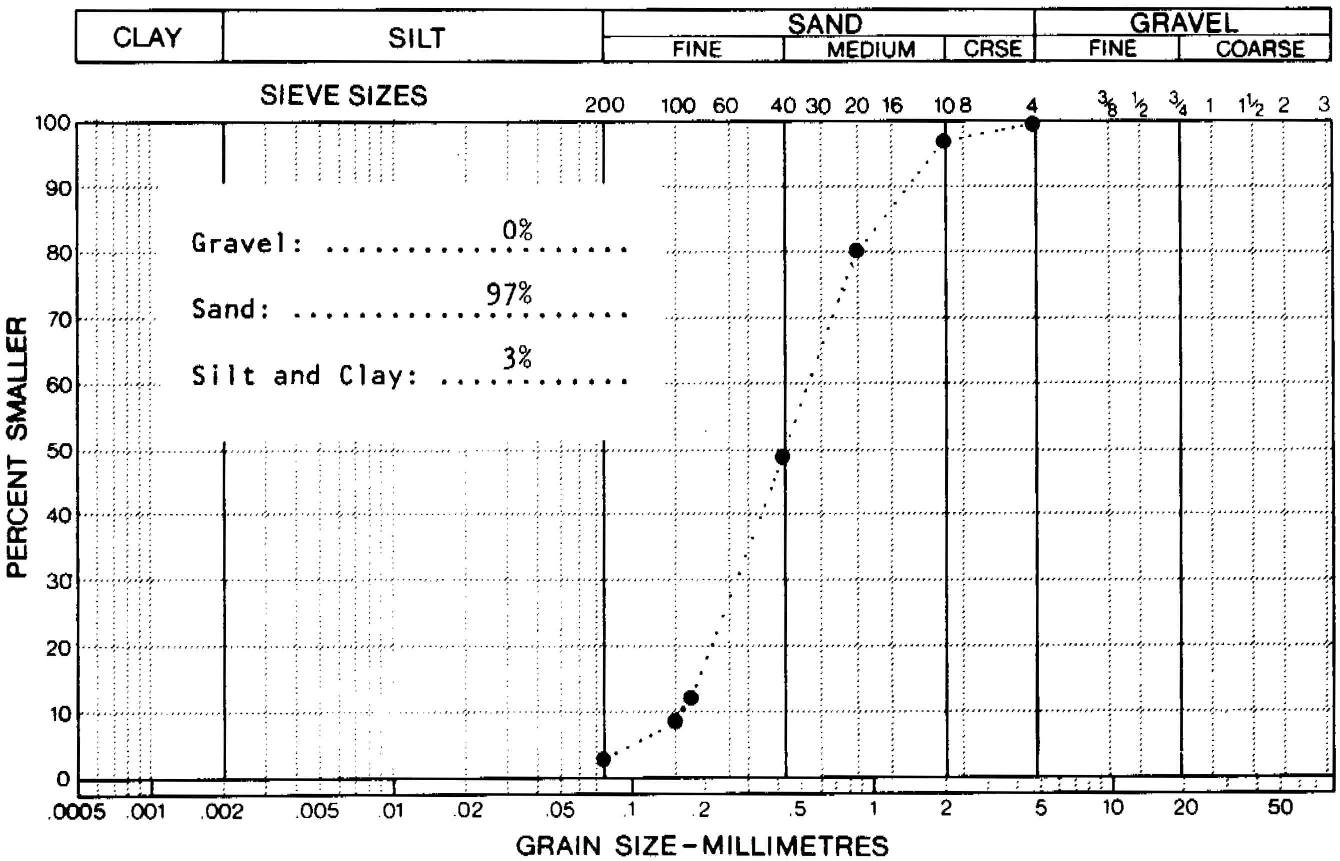
REMARKS: sample of gravel lens
minor calcareous coatings

LABORATORY ANALYSIS

SOURCE NO. 240

PIT NO. 240-2

EXPOSURE: road cut



MATERIAL TYPE: sand, trace of silt

GENISIS (LANDFORM): esker

PETROGRAPHIC ANALYSIS: sample not analysed

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS:

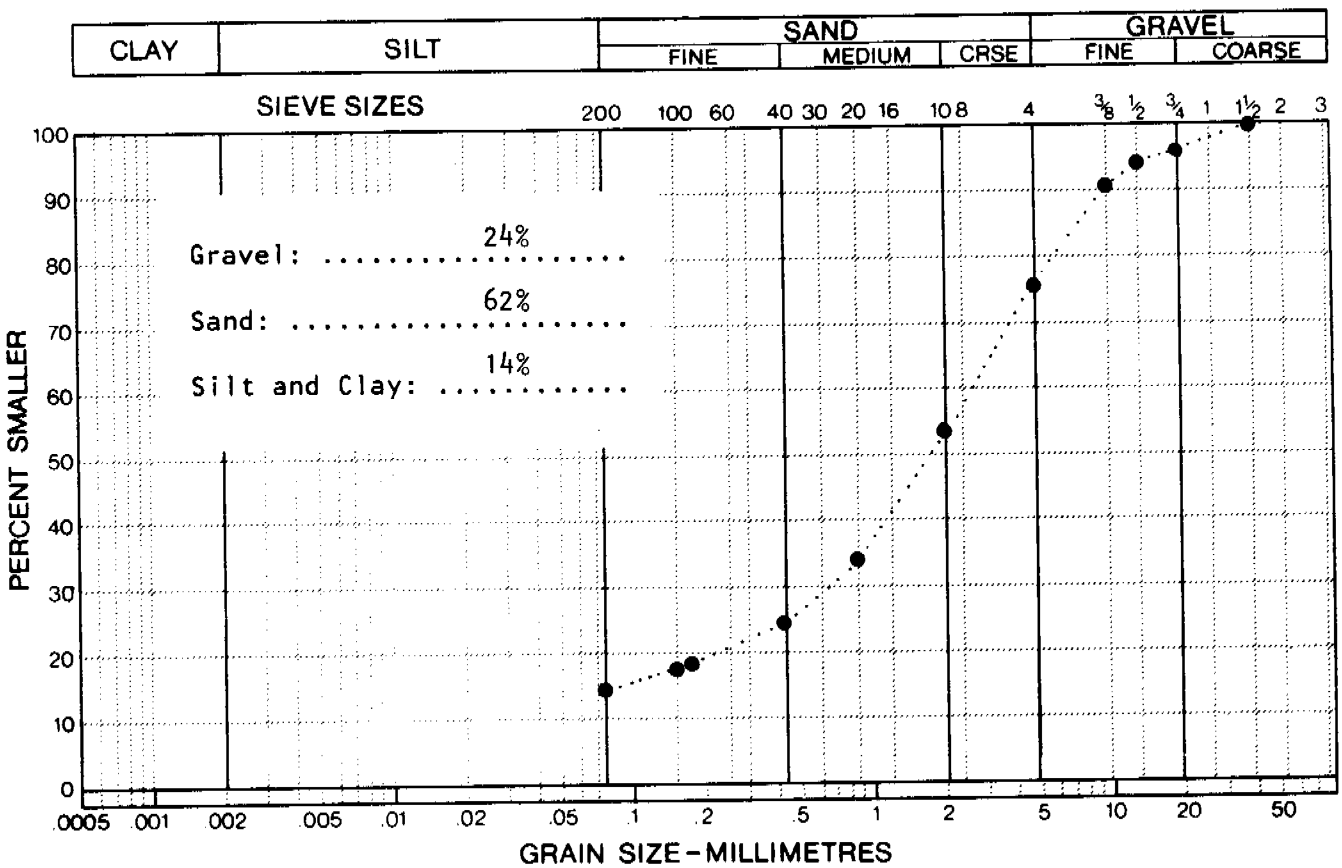
REMARKS: sample from sand lens

LABORATORY ANALYSIS

SOURCE NO. 240

PIT NO. 240-4

EXPOSURE: existing borrow area



MATERIAL TYPE: gravelly sand, some silt, cobbles and boulders

GENISIS (LANDFORM): esker

PETROGRAPHIC ANALYSIS:

quartzite 66%
granodiorite 12%
slate 8%
sandstone 4%
gneiss 4%
diorite 3%
schist 3%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: spheroids and blades, subangular

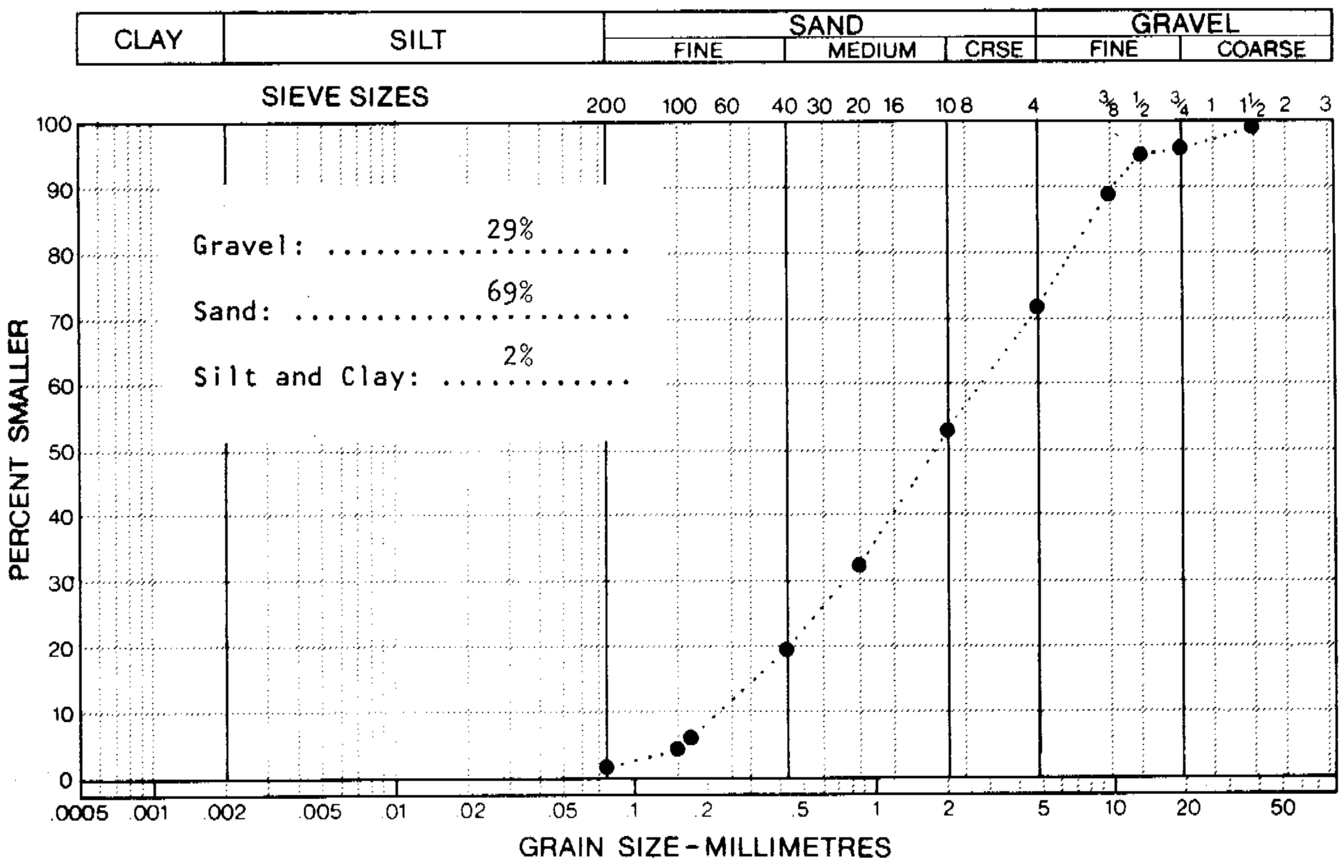
REMARKS: abundant calcareous coatings

LABORATORY ANALYSIS

SOURCE NO. 240

PIT NO. 240-2

EXPOSURE: road cut



MATERIAL TYPE: gravelly sand, trace of silt

GENISIS (LANDFORM): esker

PETROGRAPHIC ANALYSIS:
granodiorite 70%
quartzite 23%
rhyolite 4%
slate 3%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: blades and spheroids, subangular

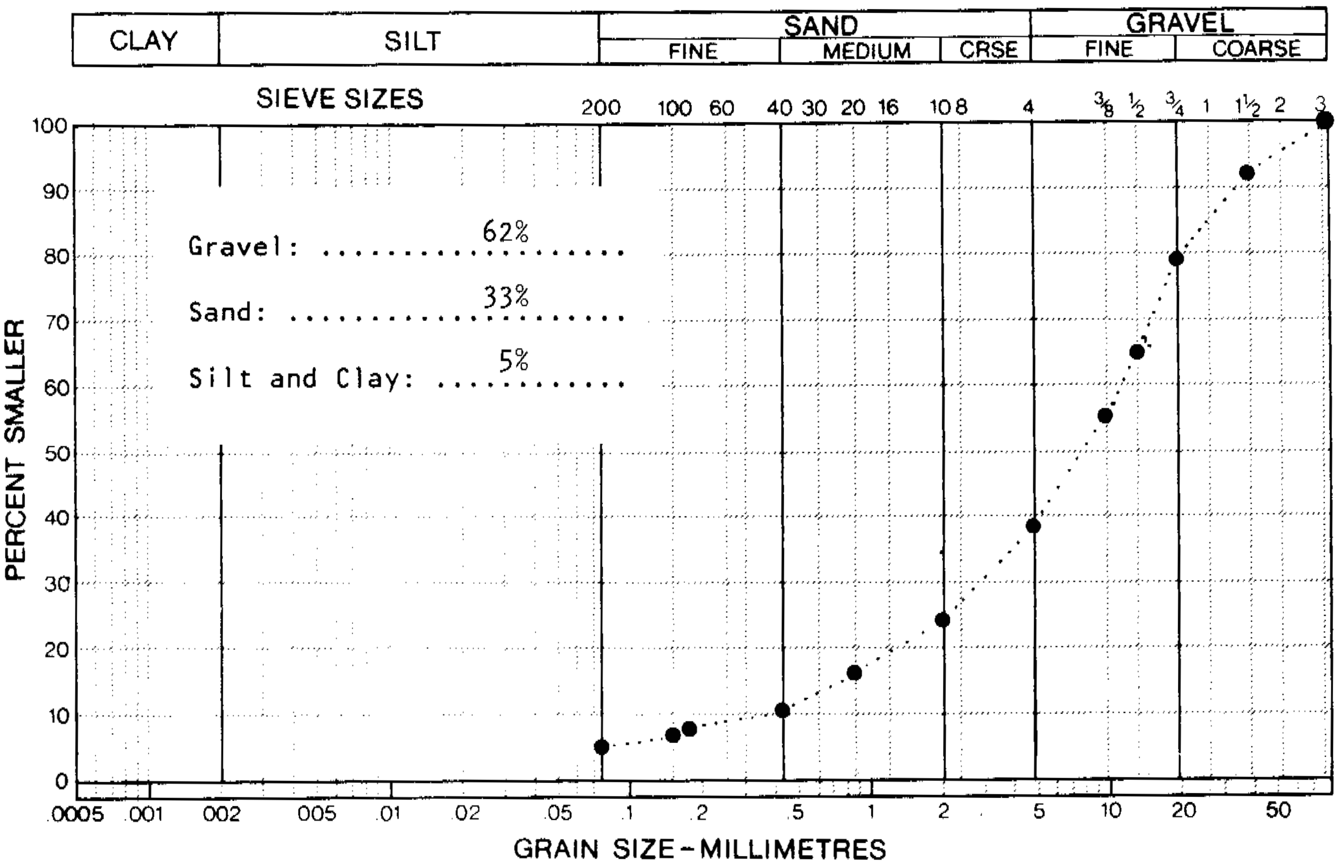
REMARKS: sample from road cut tabus

LABORATORY ANALYSIS

SOURCE NO. 240

PIT NO. 240-5

EXPOSURE: existing borrow area



MATERIAL TYPE: gravel and sand, trace of silt, abundant cobbles

GENISIS (LANDFORM): esker

PETROGRAPHIC ANALYSIS:
quartzite 49%
granodiorite 26%
diorite 18%
slate 5%
schist 2%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: blades and rollers, subangular

REMARKS:

SOURCE NO. 240

PIT NO. 240-3

EXPOSURE: hand dug test pit

MATERIAL TYPE: clayey silt with organics

GENESIS (LANDFORM): EC

REMARKS: pit dug in low area between eskers

SOURCE NO. 240

PIT NO. 240-6

EXPOSURE: hand dug test pit along road

MATERIAL TYPE: gravelly sand with organics

GENESIS (LANDFORM): EC

REMARKS: road traverses top of esker

<u>SOURCE NO.</u> 240

<u>PIT NO.</u> 240-7

<u>EXPOSURE:</u> road cut

<u>MATERIAL TYPE:</u> medium to coarse sand, trace of gravel

<u>GENESIS (LANDFORM):</u> EC

<u>REMARKS:</u>

<u>SOURCE NO.</u> 240

<u>PIT NO.</u> 240-8

<u>EXPOSURE:</u> road cut

<u>MATERIAL TYPE:</u> medium to coarse sand, trace of gravel

<u>GENESIS (LANDFORM):</u> EC

<u>REMARKS:</u>

SOURCE: 240

LANDFORM AND LOCATION: ESKER COMPLEX

PARAMETER	ENVIRONMENTAL CONCERN	EVALUATION
GEOTERRAIN:	POTENTIAL FOR EROSION	0
VEGETATION:	COMMERCIAL AND/OR AESTHETIC VALUE	2
TERRESTRIAL FAUNA:	GENERAL HABITAT	2
AQUATIC FAUNA:	NO INVOLVEMENT	0
SURFACE WATER:	NO IMPACT	0
LAND STATUS AND USE:	GAME SANCTUARY INDUSTRIAL USE (ABANDONED PIPELINE) UTILITIES (TELEPHONE LINE) RECREATION POTENTIAL	3
HERITAGE RESOURCES:	NO INVOLVEMENT	0
SPECIAL INTEREST:	ATTRACTIVE LANDFORM	3

DETAILED SOURCE ASSESSMENT SHEET

SOURCE NO. 250

SAMPLE NOS. none

LANDFORM AND LOCATION KC adjacent to Source Number 240

MATERIAL gravelly fine sand to sandy silt, trace of gravel

ESTIMATED VOLUME 1 000 000 m^3 based on 8% of material being coarse granular

AIRPHOTO NOS. HIGH LEVEL A11521-417

LOW LEVEL A24177-106

DETAILED ASSESSMENT

ENVIRONMENT

Physical

Source No. 250 has been designated geomorphologically as a kame complex. It is a relatively large undulating area which probably developed as a series of small deltas or fans built outward from a stagnant ice front. The existing outline of the source area is a result of post-glacial erosion by the Takhanne River to the north and the shape of the ancient ice front to the south. Except for scattered local depressions the source is well drained. An unmaintained gravel road, as well as the Haines Road, an abandoned pipeline right-of-way and a telephone line, cross the source.

Biotic

Both the tree, understory species and the wildlife utilization in the source area are similar to those in Source No. 240.

Recreation

Most of the source area lies within the Kluane Game Sancturary. The general relief affords scenic views to the north.

GRANULAR RESOURCES

The granular material in this deposit was observed in five test pits, and consisted of gravelly fine sand to sandy silt with traces of gravel. The north end of the source contained the finer grained materials (sandy silt) while the south end close to the eskers contained the gravelly sands. No samples were taken. Because of the genetic relationship of the source to the eskers, however, it can be assumed that the petrology of the sands and gravels is the same as Source No. 240. Volume estimates for this source are very approximate. An average mineable thickness of 12 m was used over the entire area with 8% of the material assumed to be coarse granular. Overburden thickness averages 0.15 m.

Access to the area is excellent. The Haines Road cuts across the northeast corner of the source and runs adjacent to the southeast margin.

DEVELOPMENT

Source No. 250 may be utilized for general fill. Isolated areas with better grade granular materials may be present but it is not expected that their limited volumes would justify the expense of development.

Source No. 250 Airphoto No. A24177-106

SOURCE NO. 250

PIT NO. 250-1

EXPOSURE: hand dug test pit along access road

MATERIAL TYPE: gravelly fine sand

GENESIS (LANDFORM): KC

REMARKS:

SOURCE NO. 250

PIT NO. 250-2

EXPOSURE: hand dug pit adjacent to pipeline right-of-way

MATERIAL TYPE: gravelly fine sand

GENESIS (LANDFORM): KC

REMARKS:

SOURCE NO. 250

PIT NO. 250-3

EXPOSURE: access road cut

MATERIAL TYPE: fine to medium sand, trace of gravel

GENESIS (LANDFORM): KC

REMARKS:

SOURCE NO. 250

PIT NO. 250-4

EXPOSURE: road cut

MATERIAL TYPE: sandy silt, trace of gravel

GENESIS (LANDFORM): KC

REMARKS:

SOURCE NO. 250

PIT NO. 250-5

EXPOSURE: access road cut

MATERIAL TYPE: sandy silt with trace of gravel

GENESIS (LANDFORM): KC

REMARKS:

SOURCE NO. 250

PIT NO. 250-6

EXPOSURE: road cut along Haines Road

MATERIAL TYPE: fine sandy silt

GENESIS (LANDFORM): KC

REMARKS:

DETAILED SOURCE ASSESSMENT SHEET

SOURCE NO.	260
SAMPLE NOS.	260-4 260-5
LANDFORM AND LOCATION	AMP along Takhanne River at kilometre post HR165
MATERIAL	fine silty and overlying coarse sand gravel
ESTIMATED VOLUME	150 000 m^3 (highly speculative)
AIRPHOTO NOS.	HIGH LEVEL A11521-363 LOW LEVEL A24177-104

DETAILED ASSESSMENT

ENVIRONMENTAL

Physical

Source No. 260 is made up of active meander plain deposits in the Takhanne River valley. Active meander plain terrain includes both the active and inactive portions of the flood plain of meandering streams.

The deposit extends approximately 1 100 m west from the Haines Road bridge and for a distance of 2 km eastward up the valley of the Takhanne River. The surface of the deposit exists at heights of 1.5 to 3 m above river level, is relatively flat but well drained.

The Haines Road as well as the abandoned pipeline right-of-way traverse the source. A small campsite/picnic site and a network of gravel roads leading to a nearby waterfall are located on the west side of the road.

Biotic

Vegetation is composed of scattered spruce and balsam poplar with shrub willow, birch and red osier dogwood. The surrounding valley sides are thickly covered with spruce aspen and balsam poplar, with spruce dominant on north-facing slopes. The entire Takhanne valley is reported to be high-value grizzly bear habitat. Moose sign was observed at the site, and there is some small potential for waterfowl use. At the highway bridge the Takhanne River is 20 to 30 m wide and flows through a shallow riffle 0.15 to 0.45 m deep. The water was very clear during field surveys. Filamentous algae covered the river bottom cobbles in some areas. The river, a part of the Tatshenshini-Alsek system, supports trout and grayling, with salmon occurring below the falls downstream from the highway crossing.

Recreation

West of the Haines Road the source is within the Kluane Game Sanctuary. A territorial camp/picnic site is located next to the Haines Road bridge. East of the highway, hunting and trapping are permitted. Sport fishing is active in the area. The river valley and falls are scenic and provide moderate tourist interest.

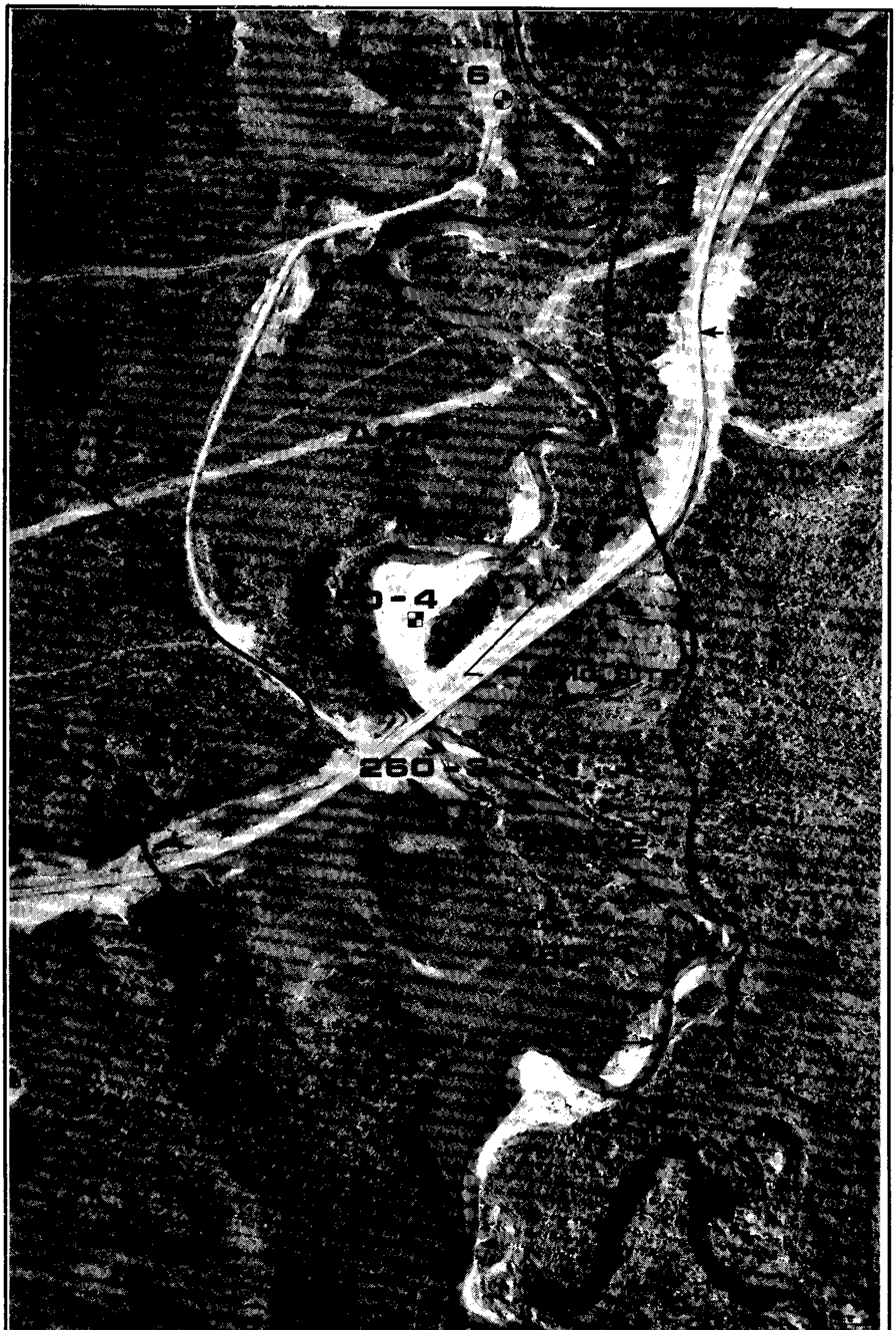
GRANULAR RESOURCES

Test pits excavated on the source area indicate that, except immediately adjacent to the river, the stratigraphy consists of fine silty sand overlying coarse sand and gravel. The thickness of the fine sand layer ranges from 0.3 m to in excess of 1.3 m. A petrographic analysis was performed on a sample taken from a point bar deposit, 1 m above river level. The rock types appear to be similar to bedrock exposures mapped upstream from the site. Granodiorite is the main constituent with quartzite as the major accessory. Traces of diorite, syenite and slate were also noted. All of these rock types are relatively hard and are subangular to subrounded. Organic overburden was absent in most places. Total recoverable volumes of coarse granular material are based on the assumption that 1.0 m of granular material would be available above the water table over 25% of the AMP area within k km of the highway.

Road access to the source is excellent. A number of gravel roads already exist throughout the source area.

DEVELOPMENT

Although this deposit contains some coarse gravelly material which would be suitable as concrete aggregate, negative factors such as the present land-use (camping, picnicing) are limiting factors. The potential impact of development on fishery resources and the proximity of alternate granular resources in Source No. 240 make development of this source undesirable at the present time.



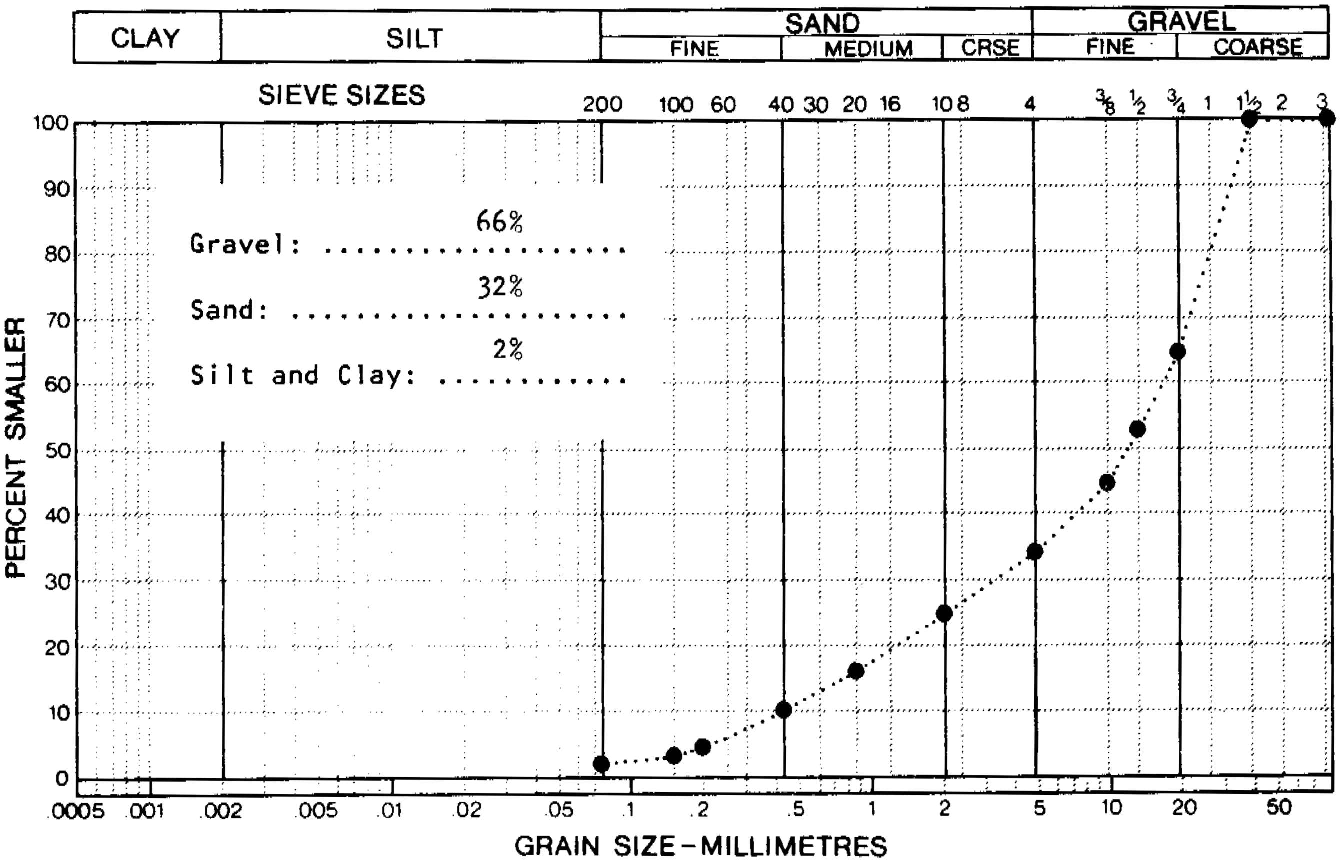
Source No. 260 Airphoto No. A24177-104

LABORATORY ANALYSIS

SOURCE NO. 260

PIT NO. 260-4

EXPOSURE: hand excavated test pit



MATERIAL TYPE: gravel and sand, trace of silt

GENISIS (LANDFORM): active meander plain (Takhanne R.)

PETROGRAPHIC ANALYSIS:
granodiorite 62%
quartzite 28%
diorite 6%
syenite 3%
slate 1%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: blades and rollers, subangular to subrounded

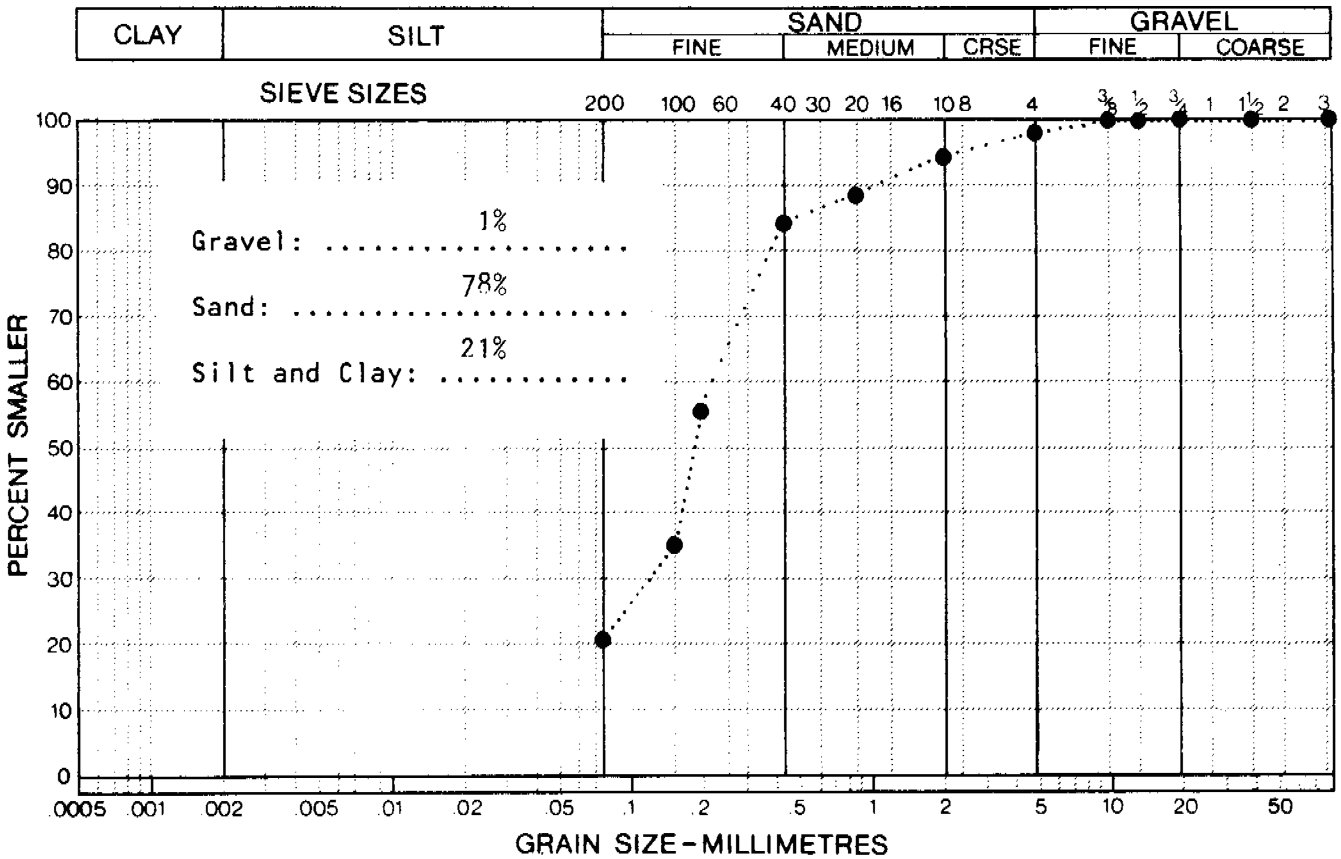
REMARKS:

LABORATORY ANALYSIS

SOURCE NO. 260

PIT NO. 260-5

EXPOSURE: hand excavated test pit



MATERIAL TYPE: silty sand, trace of gravel

GENISIS (LANDFORM): active meander plain (Takhanne R.)

PETROGRAPHIC ANALYSIS: sample not analysed

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS:

REMARKS:

SOURCE NO. 260

PIT NO. 260-1

EXPOSURE: hand dug test pit

MATERIAL TYPE: fine sand

GENESIS (LANDFORM): AMP

REMARKS: low thick vegetation

SOURCE NO. 260

PIT NO. 260-2

EXPOSURE: river bank

MATERIAL TYPE: medium sand overlying coarse gravel

GENESIS (LANDFORM): AMP

REMARKS:

SOURCE NO. 260

PIT NO. 260-3

EXPOSURE: river bank exposure

MATERIAL TYPE: very fine sand and some silt

GENESIS (LANDFORM): AMP

REMARKS: sand is uniform and micaceous

SOURCE NO. 260

PIT NO. 260-6

EXPOSURE: hand dug test pit adjacent to parking lot

MATERIAL TYPE: clayey silt

GENESIS (LANDFORM): AMP

REMARKS:

SOURCE: 260

LANDFORM AND LOCATION: ACTIVE MEANDER PLAIN, TAKHANNE RIVER

PARAMETER	ENVIRONMENTAL CONCERN	EVALUATION
GEOTERRAIN:	POTENTIAL FOR EROSION	3
VEGETATION:	COMMERCIAL AND/OR AESTHETIC VALUE	3
TERRESTRIAL FAUNA:	GRIZZLY BEAR HABITAT WATERFOWL HABITAT	4
AQUATIC FAUNA:	TROUT IN TAKHANNE RIVER SALMON IN TAKHANNE DOWNSTREAM FROM SITE	5
SURFACE WATER:	POTENTIAL FOR SLUMPING, EROSION, SILTATION AND ALTERATION OF EXISTING DRAINAGE PATTERNS	3
LAND STATUS AND USE:	GAME SANCTUARY (WEST OF HAINES ROAD) YTG CAMPSITE/PICNIC SITE INDUSTRIAL USE (ABANDONED PIPELINE) HUNTING/TRAPPING AREA OUTFITTER/GUIDING SPORT FISHING	4
HERITAGE RESOURCES:	NO INVOLVEMENT	0
SPECIAL INTEREST:	FALLS DOWNSTREAM FROM SITE	

DETAILED SOURCE ASSESSMENT SHEET

SOURCE NO. 270

SAMPLE NOS. 270-8
270-9

LANDFORM AND LOCATION T along east side of Blanchard and Tatshenshini Rivers extending from kilometre post HR151 to HR1633

MATERIAL highly variable, includes gravel, sand and silt

ESTIMATED VOLUME not estimated

AIRPHOTO NOS. HIGH LEVEL A11524-287

LOW LEVEL A24177-118

DETAILED ASSESSMENT

ENVIRONMENT

Physical

Source No. 270 is a long drift covered terrace bordered on the west by the Blanchard and Tatshenshini River valleys and on the east by the bedrock slopes and associated alluvial cones of the Boundary Ranges. Most of the Haines Road alignment between the B.C./Yukon boundary and Takhanne River is founded on Source No. 270 sediments.

Biotic

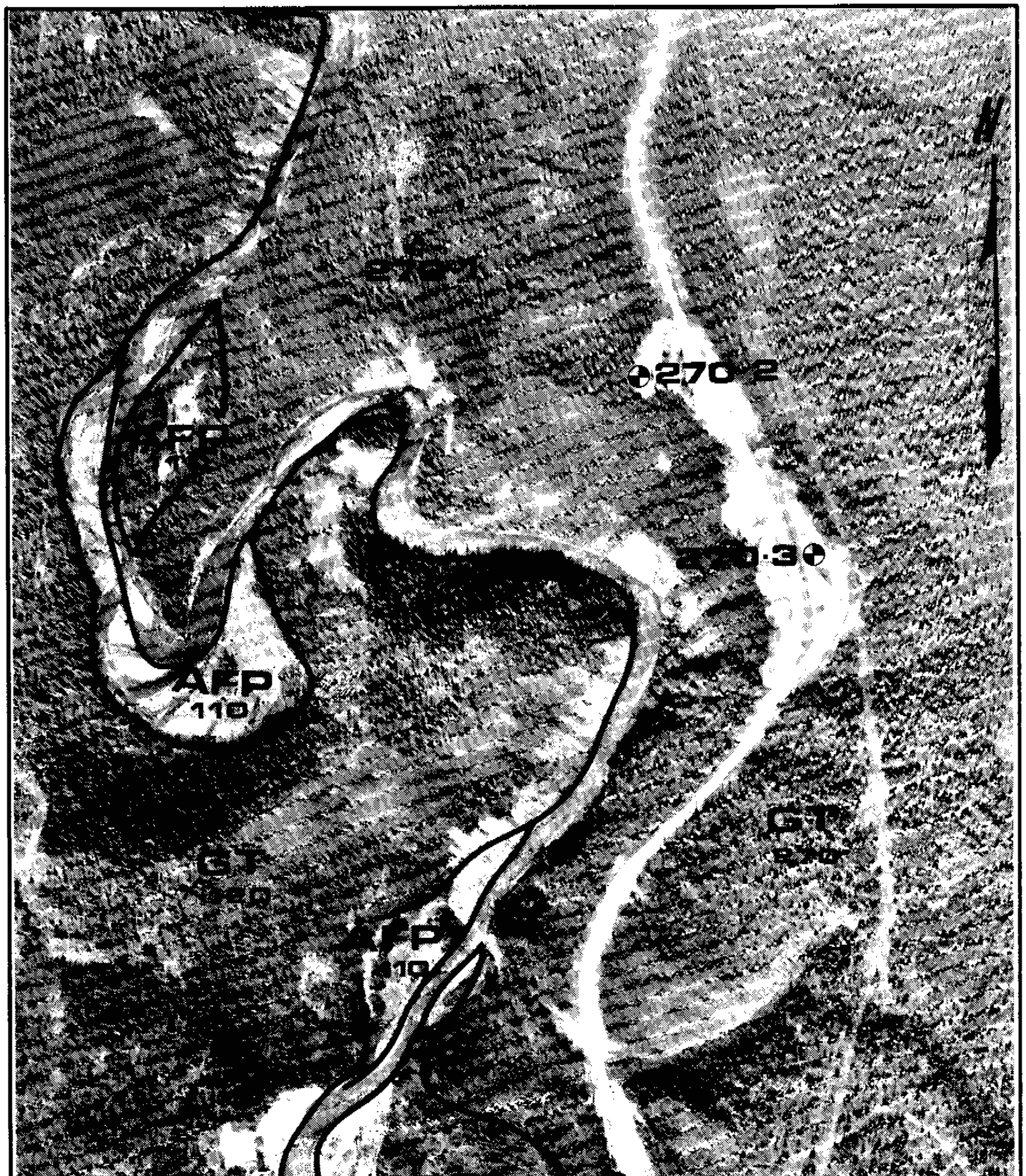
In general the forest vegetation consists of white spruce, trembling aspen and balsam poplar. Native grasses include wheat grass and rough fescue. Observations at specific sites were not made during field surveys.

GRANULAR RESOURCES

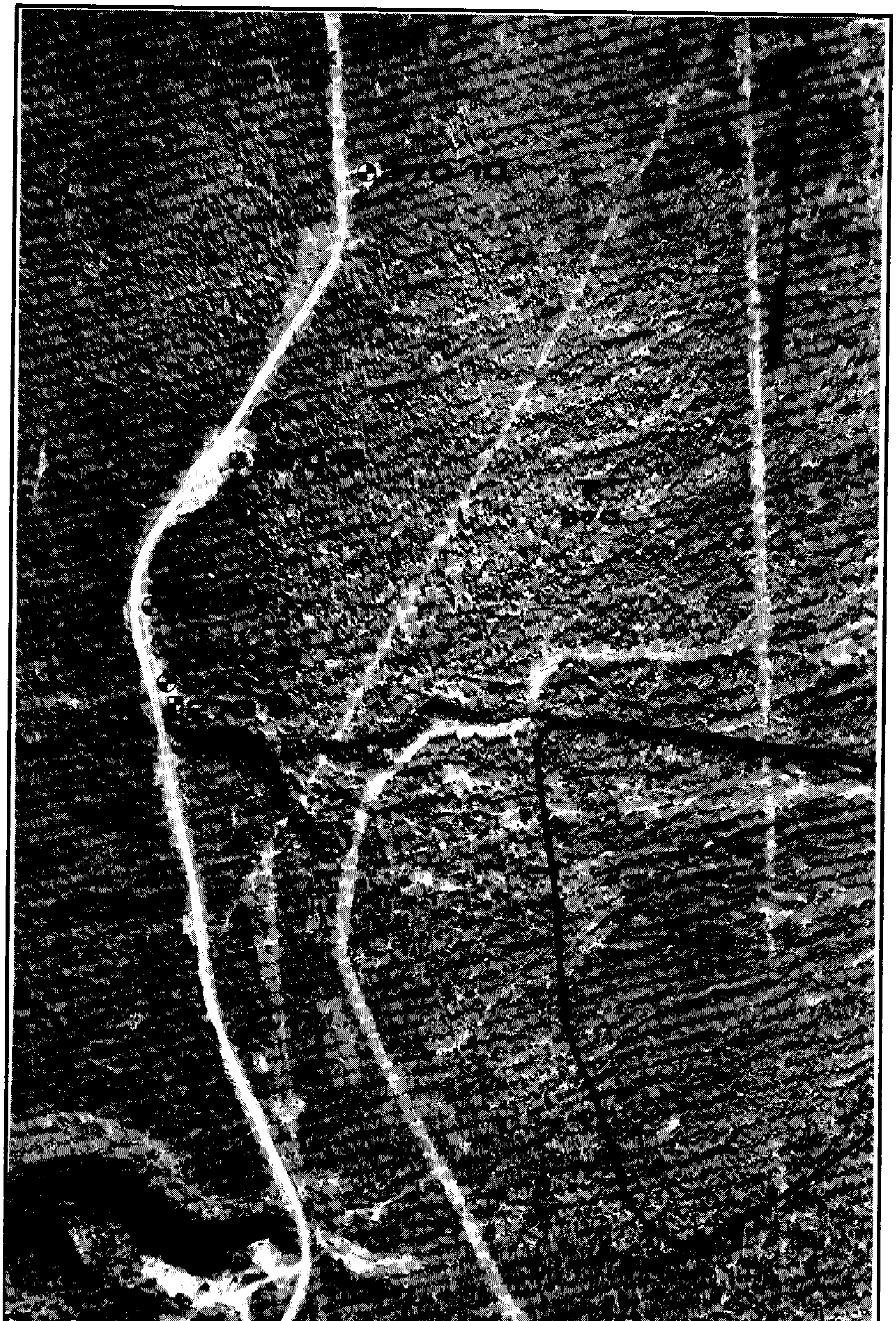
Highly variable gravel, sand and silt deposits were observed during the investigation of this deposit. Most of the material contains significant silt sizes, however, and therefore is only suitable as general fill. Granodiorite and quartzite are the main rock types.

DEVELOPMENT

Development of granular resources are not recommended on a large scale. Sand deposits with low silt contents may be used as blending material, and some of the existing borrow pits may continue to provide general fill on a controlled basis. Procedures should be initiated to prevent indiscriminant borrow pit development immediately adjacent to the Haines Road, or in specific areas where seasonal erosion may be a problem.



Source Nos. 110, 120 and 270 Airphoto No. A24177-122



Source Nos. 150 and 270

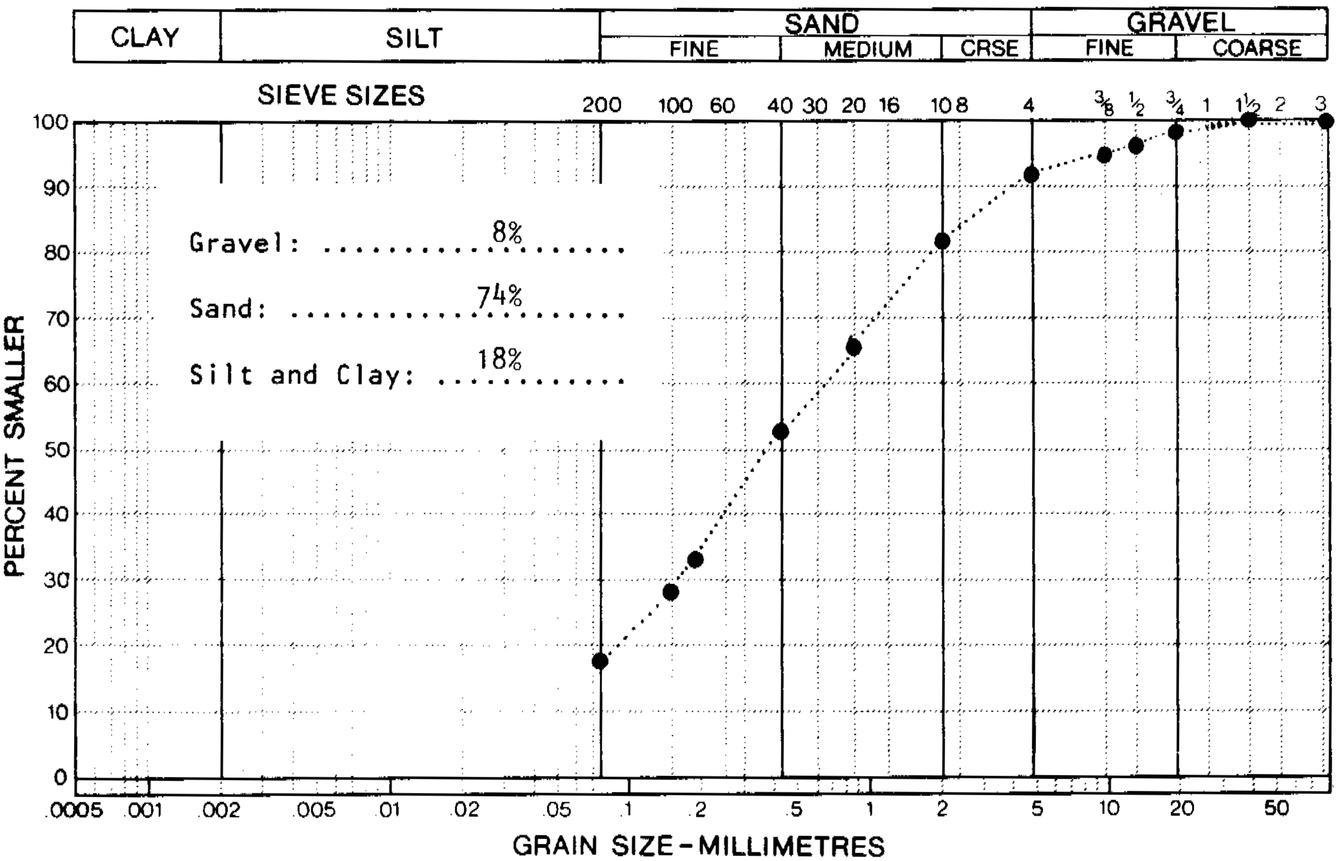
Airphoto No. A24177-118

LABORATORY ANALYSIS

SOURCE NO. 270

PIT NO. 270-8

EXPOSURE: abandoned borrow pit



MATERIAL TYPE: fine to medium sand, some silt, trace of gravel

GENISIS (LANDFORM): glaciofluvial terrace

PETROGRAPHIC ANALYSIS:
granodiorite 82%
quartzite 12%
greenstone 4%
sandstone 2%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: spheroidal, angular

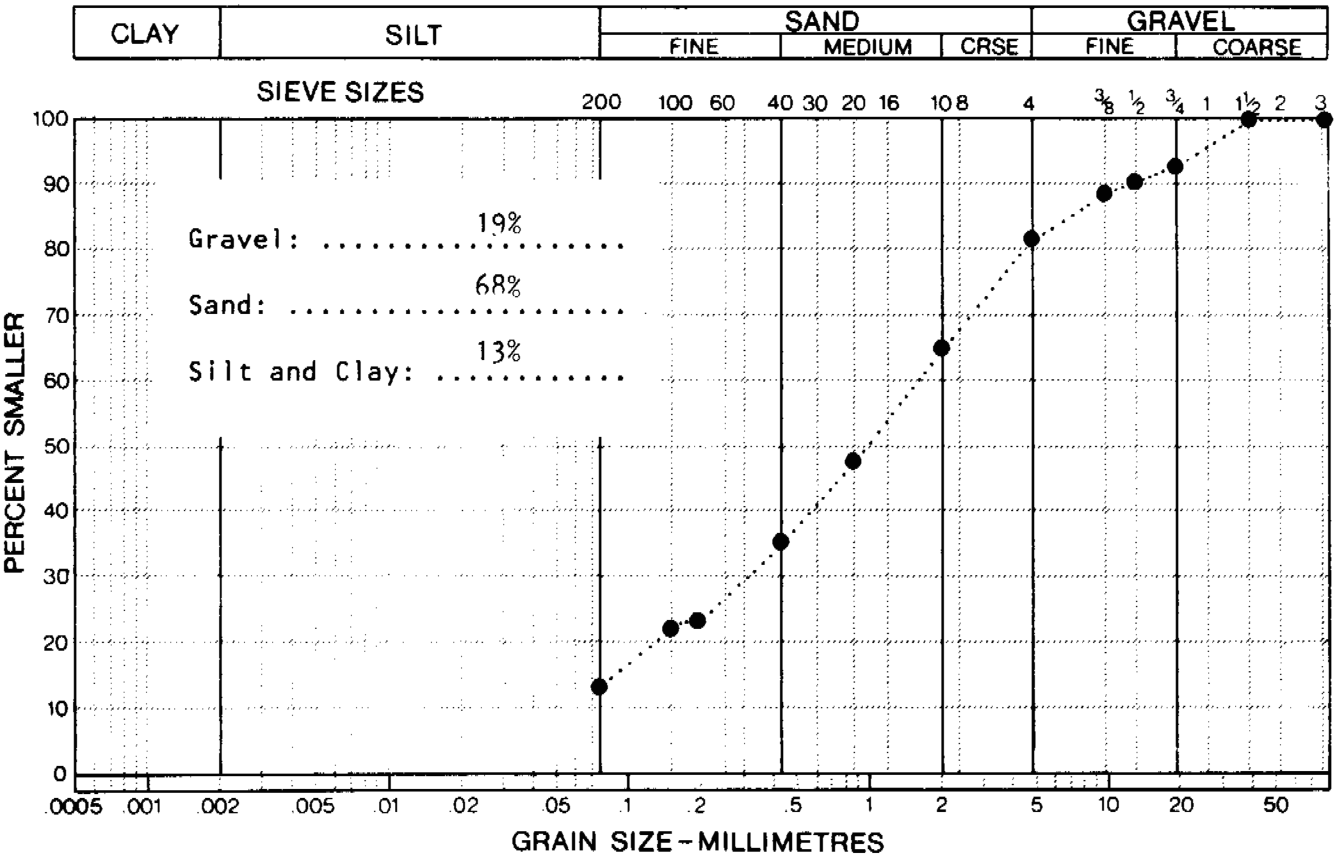
REMARKS:

LABORATORY ANALYSIS

SOURCE NO. 270

PIT NO. 270-9

EXPOSURE: abandoned borrow pit



MATERIAL TYPE: medium to fine sand, trace of gravel and silt, cobbles & boulders

GENISIS (LANDFORM): glaciofluvial terrace

PETROGRAPHIC ANALYSIS:
granodiorite 40%
quartzite 35%
schist 10%
slate 10%
diorite 5%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: spheroids, some blades, angular

REMARKS:

SOURCE NO. 270

PIT NO. 270-1

EXPOSURE: hand dug test pit

MATERIAL TYPE: organics (0-0.1 m) clayey silt with some cobbles

GENESIS (LANDFORM): T

REMARKS: 270-1 on lower terrace than road, very steep access and dense vegetation

SOURCE NO. 270

PIT NO. 270-2

EXPOSURE: surface exposure

MATERIAL TYPE: gravel

GENESIS (LANDFORM): T

REMARKS: surface indications suggest that this is a remnant of an old stockpile

SOURCE NO. 270

PIT NO. 270-3

EXPOSURE: road cut

MATERIAL TYPE: clayey silt, some boulders

GENESIS (LANDFORM): T

REMARKS:

SOURCE NO. 270

PIT NO. 270-4

EXPOSURE: 5 m vertical exposure along gully

MATERIAL TYPE: sandy coarse gravel, some silt, cobbles and boulders

GENESIS (LANDFORM): T

REMARKS:

SOURCE NO. 270

PIT NO. 270-5

EXPOSURE: road cut

MATERIAL TYPE: clayey silt

GENESIS (LANDFORM): T

REMARKS:

SOURCE NO. 270

PIT NO. 270-6

EXPOSURE: hand dug test pit along abandoned trail

MATERIAL TYPE: fine to medium sand with trace of silt

GENESIS (LANDFORM): T

REMARKS:

SOURCE NO. 270

PIT NO. 270-7

EXPOSURE: road cut

MATERIAL TYPE: fine to medium sand with some silt and gravel

GENESIS (LANDFORM): T

REMARKS:

SOURCE NO. 270

PIT NO. 270-10

EXPOSURE: road cut 6 m high

MATERIAL TYPE: silty sand, trace of gravel

GENESIS (LANDFORM): T

REMARKS:

DETAILED SOURCE ASSESSMENT SHEET

SOURCE NO.	280
SAMPLE NOS.	280-3
LANDFORM AND LOCATION	T (terrace deposits) between mountain slopes and Klukshu River valley from Takhanne River to approximately kilometre post HR175
MATERIAL	gravelly, sandy silt
ESTIMATED VOLUME	not applicable
AIRPHOTO NOS.	HIGH LEVEL AH521-363 and A11523-210
	LOW LEVEL A24177-88

DETAILED ASSESSMENT

ENVIRONMENT

Physical

Source No. 280 is a broad, drift covered terrace, believed to be bedrock controlled, which lies between the mountain slopes and the Klukshu River valley, and extends from the Takhanne River to approximately kilometre post HR175. Stella and Pringle Lakes occupy two low areas within the source. Numerous drift ridges segment the terrace deposits. The Haines Road crosses the terrace and several abandoned, low quality borrow pits have been excavated in the source.

Biotic

Vegetation consists of spruce with some aspen. The understory contains willows and shrub birch with empetrum and Labrador tea forming the ground cover. Moose, grizzly bear and beaver utilize the area. Aquatic fauna are of concern only in Stella Lake. Pringle Lake does not support fish populations.

Recreation

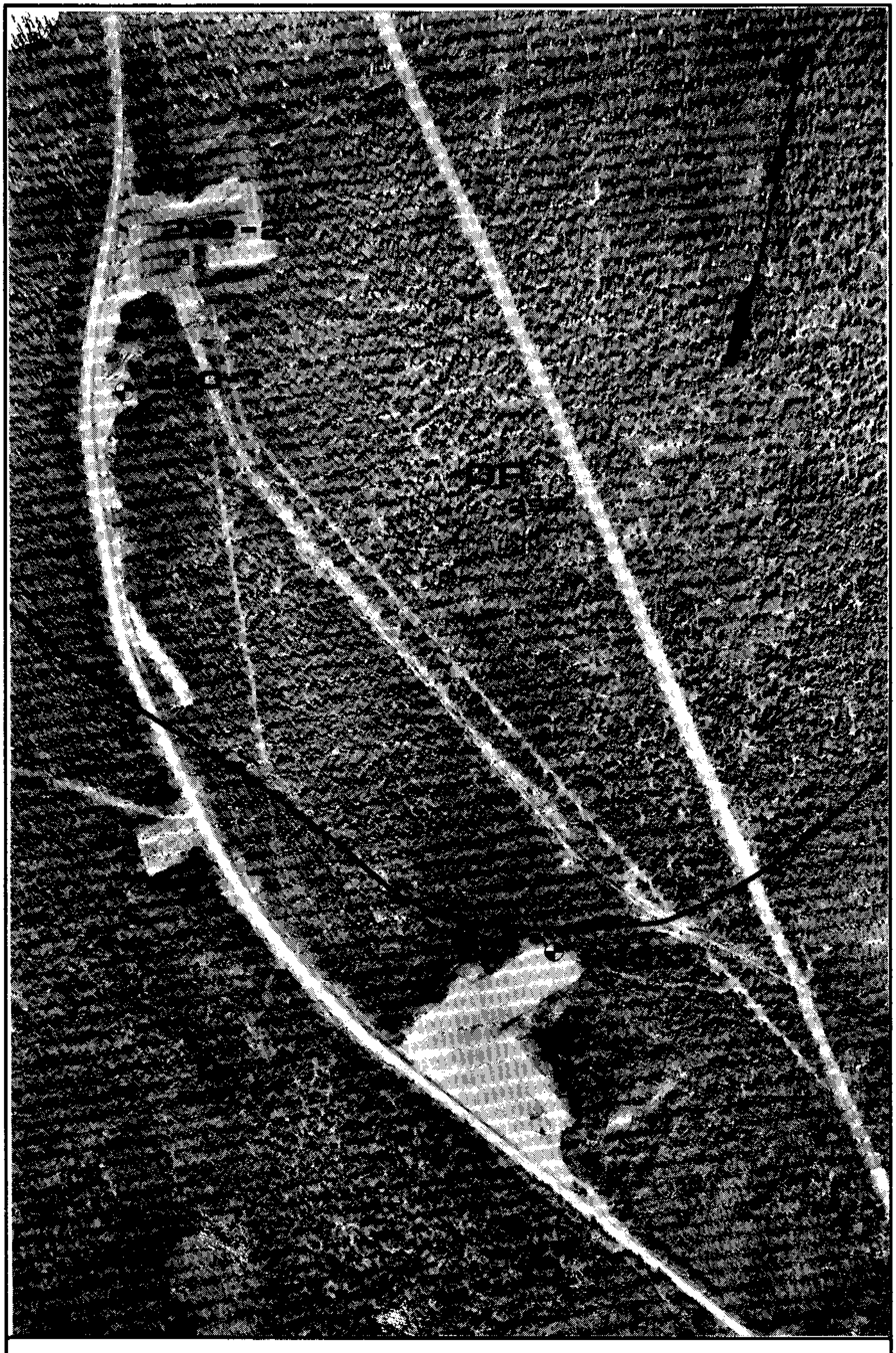
East of the Haines Road the source is within a registered outfitter/ guiding and trapping area. West of the road the source is within the Kluane Game Sanctuary.

GRANULAR RESOURCES

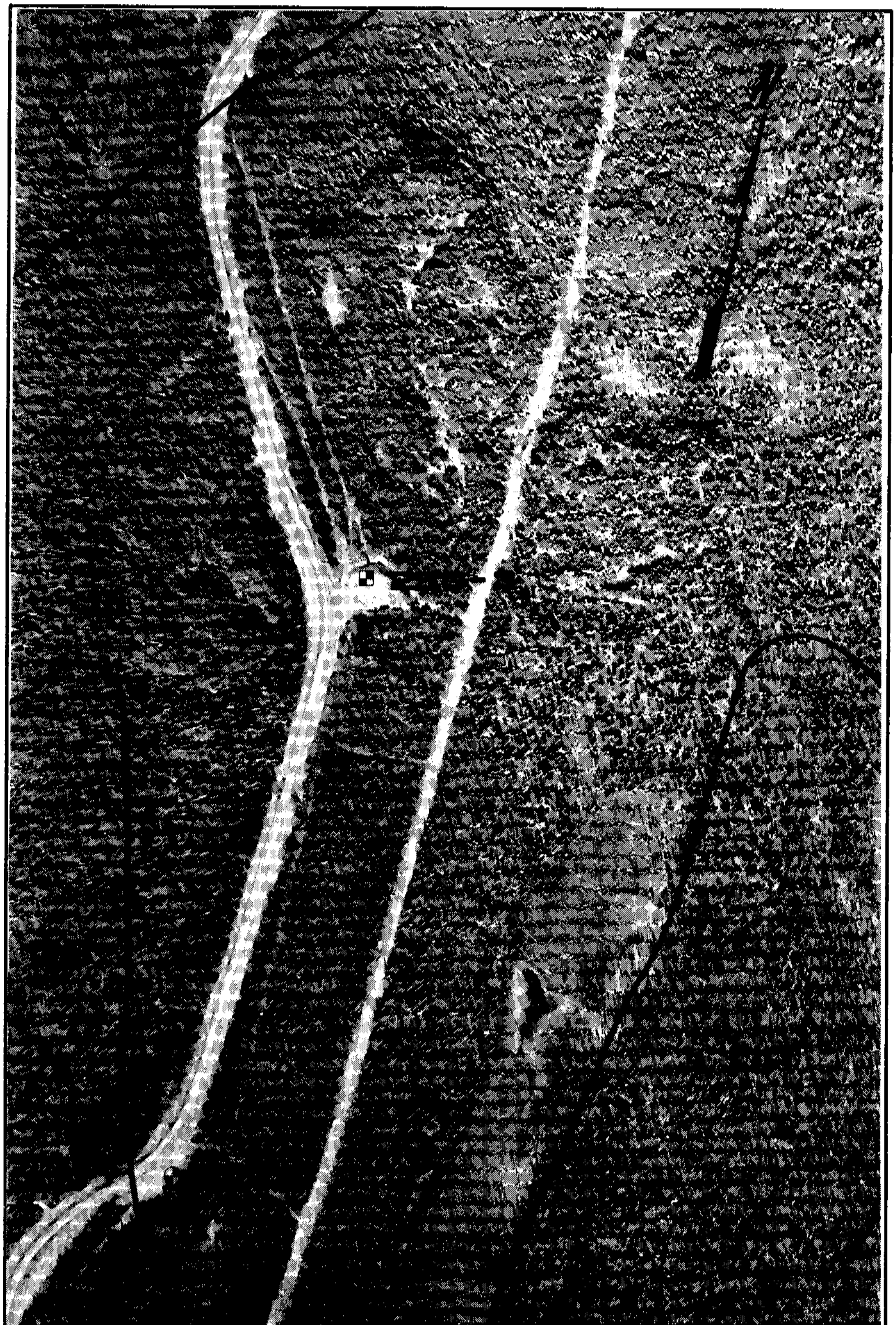
A variety of soil types were encountered in the drift cover ranging from gravelly silt to gravelly, silty sand.

DEVELOPMENT

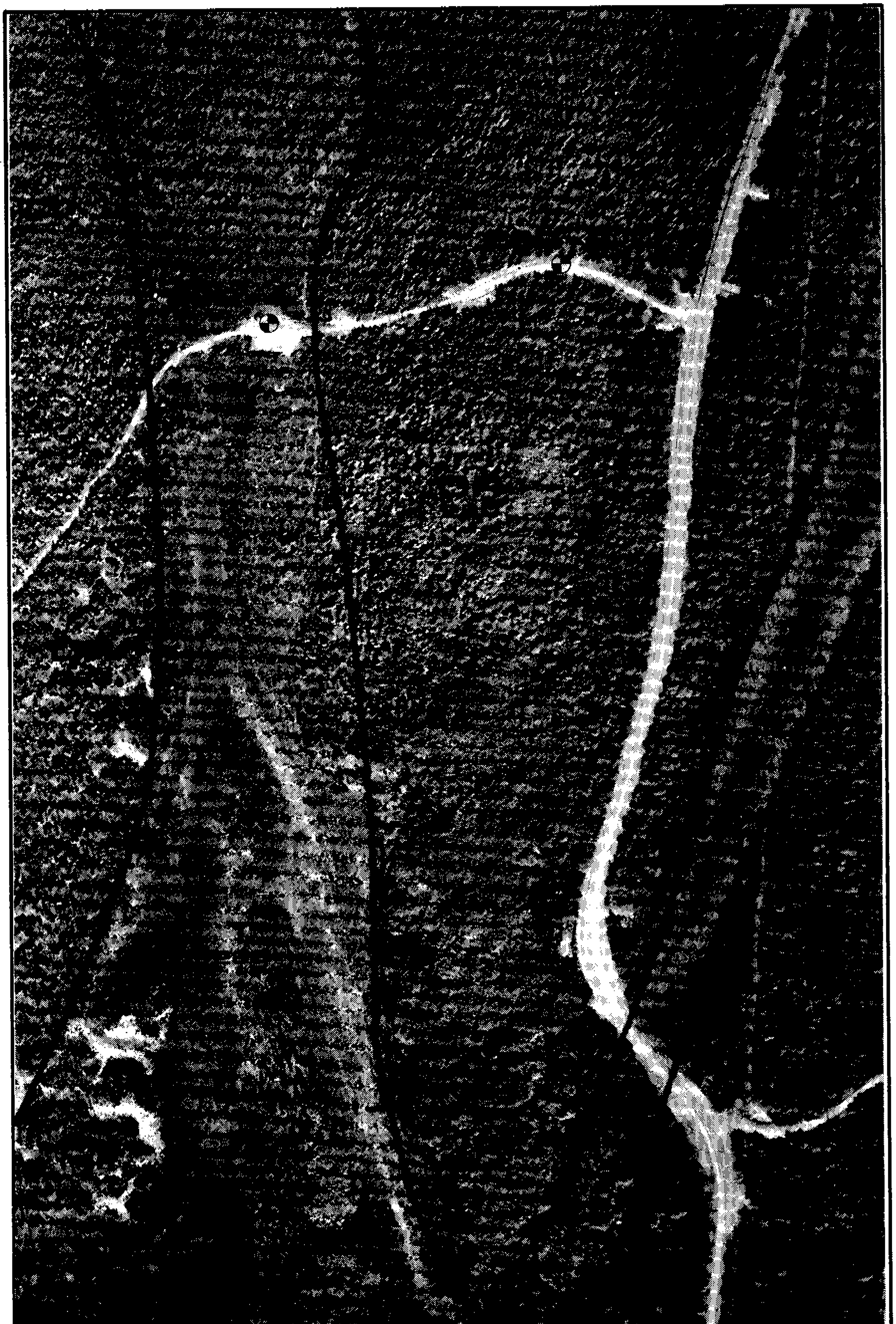
Source No. 280 is not recommended for development because of the poor quality of the granular resources. The silt content of the deposits is high. Local areas may contain material suitable as general fill.



Source Nos. 280 and 290 Airphoto No. A24177-97



Source No. 280 Airphoto No. A24177-88



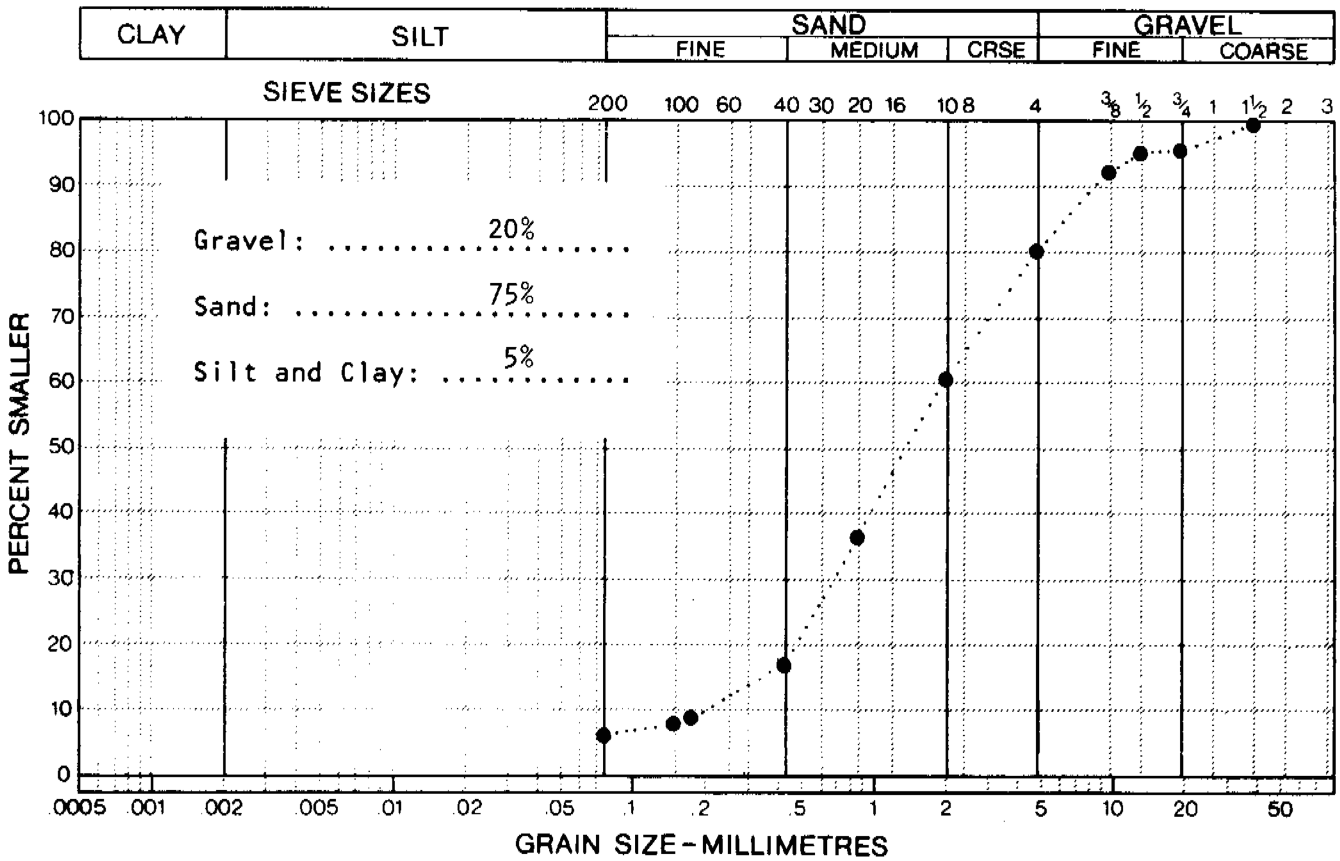
Source Nos. 280 and 290 Airphoto No. A24177-70

LABORATORY ANALYSIS

SOURCE NO. 280

PIT NO. 280-3

EXPOSURE: borrow pit



MATERIAL TYPE: sand, some gravel, trace of silt

GENISIS (LANDFORM): terrace deposits

PETROGRAPHIC ANALYSIS:

quartzite 75%
slate 10%
sandstone 8%
diorite 5%
granite 1%
gneiss 1%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: blades, angular

REMARKS: some clay coatings

SOURCE NO. 280

PIT NO. 280-1

EXPOSURE: borrow pit

MATERIAL TYPE: gravelly sandy silt

GENESIS (LANDFORM): T

REMARKS: terrace is apparently bedrock controlled

SOURCE NO. 280

PIT NO. 280-2

EXPOSURE: road cut

MATERIAL TYPE: gravelly sandy silt

GENESIS (LANDFORM): T

REMARKS:

SOURCE NO. 280

PIT NO. 280-4

EXPOSURE: abandoned pit along secondary access road

MATERIAL TYPE: silty some gravel

GENESIS (LANDFORM): T

REMARKS:

SOURCE NO.

PIT NO.

EXPOSURE:

MATERIAL TYPE:

GENESIS (LANDFORM):

REMARKS:

36-0260

DETAILED SOURCE ASSESSMENT SHEET

SOURCE NO.	290
SAMPLE NOS.	290-2 290-3
LANDFORM AND LOCATION	DR complex on terrace between Takhanne River valley and kilometre post HR175
MATERIAL	gravelly, sandy silt
ESTIMATED VOLUME	not estimated
AIRPHOTO NOS.	HIGH LEVEL A11521-363 and A11523-210 LOW LEVEL A24177-88 to 97

DETAILED ASSESSMENT

ENVIRONMENT

Physical

Source No. 290 is comprised of nine north-south trending, bedrock controlled, drift ridges of variable size. Bedrock outcrops were noted in the vicinity of kilometre post HR169. The Haines Road, telephone cut line and abandoned pipeline right-of-way traverse some of the larger ridges in the centre of the valley.

Biotic

The dominant tree species on the ridges is spruce. An understory of willow and shrub birch and a ground cover of empetrum and Labrador tea is characteristic of the area. There are no aquatic concerns associated with the area. Moose sign was plentiful and grizzly are reported to use the area.

Recreation

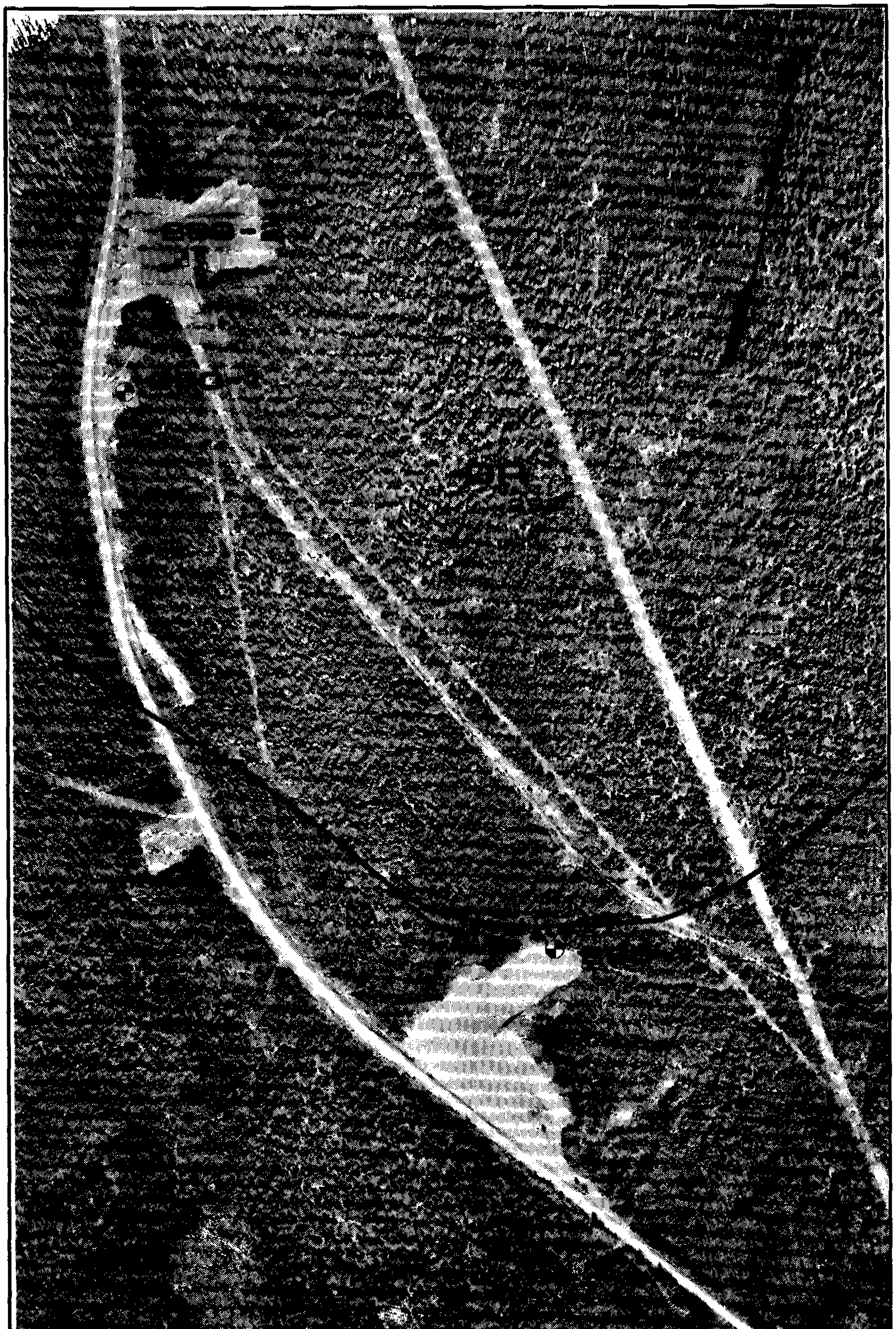
Drift ridges east of the Haines Road are within a registered outfitter/guiding and trapping area. West of the road the ridges are within the Kluane Game Sanctuary. The source has little recreational potential.

GRANULAR RESOURCES

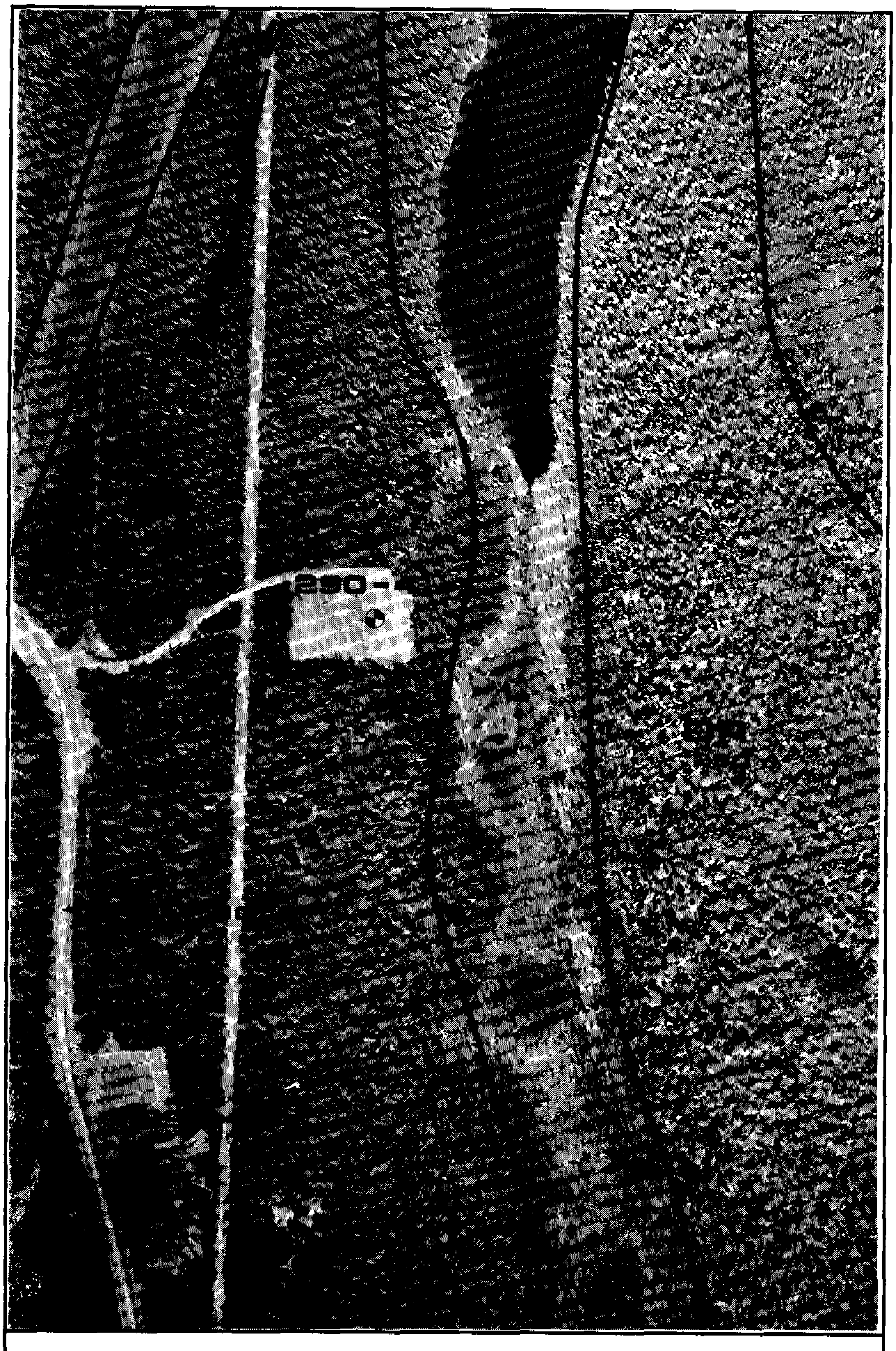
Granular materials are relatively scarce in the source area. In many places weathered slate bedrock has been excavated. The drift ridges consist mainly of silty material overlying weathered bedrock. Sulphate soundness tests showed a loss of 9.4% on the fine fraction and 4.3% on the coarse fraction after five cycles.

DEVELOPMENT

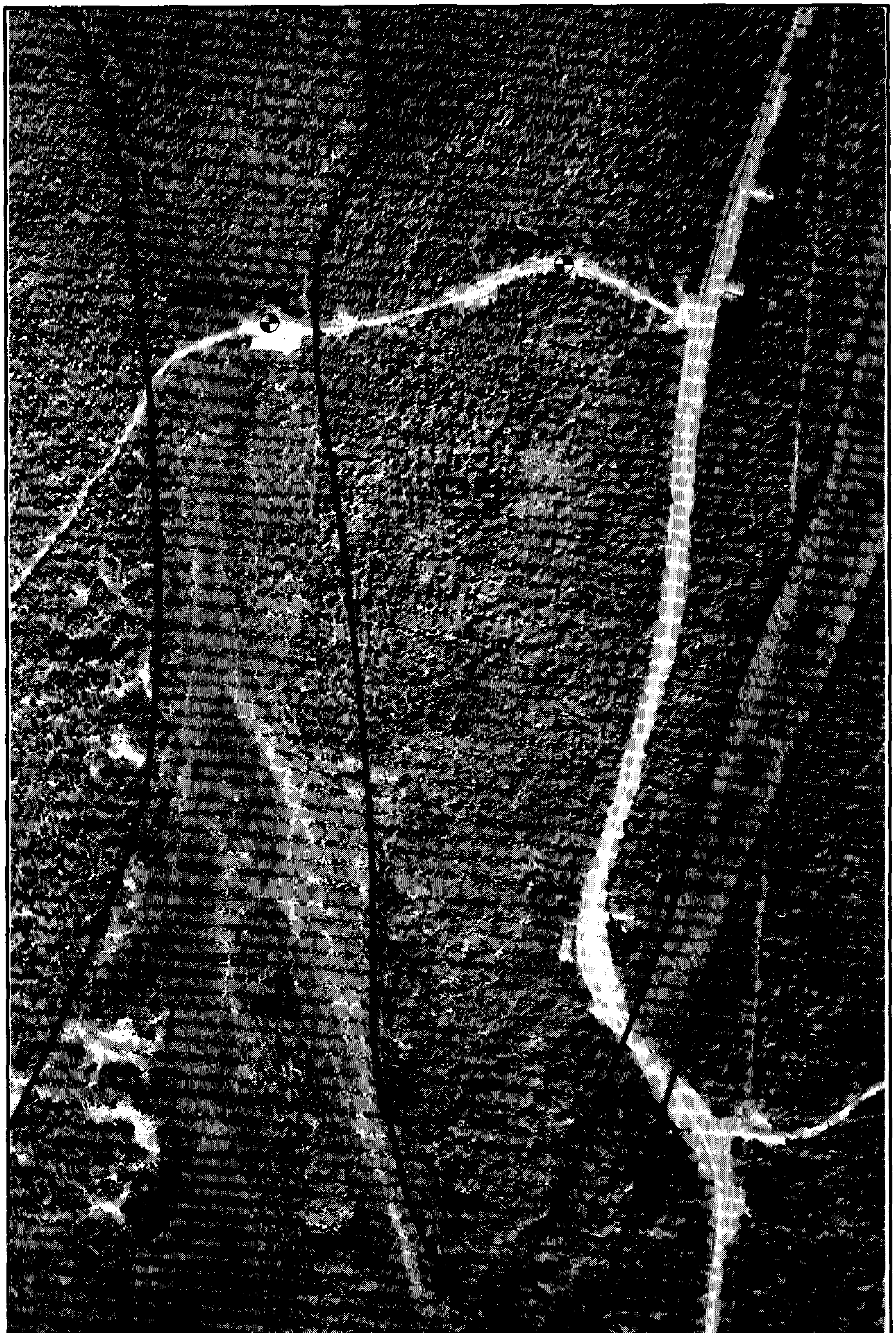
Source No. 290 is not recommended for development. Bedrock quarries may provide material which is suitable as general fill in embankments, but it is doubtful whether the weathered slate would perform adequately as a roadbed material when subjected to intense abrasion over long periods.



Source Nos. 280 and 290 Airphoto No. A24177-97



Source No. 290 Airphoto No. A24177-94



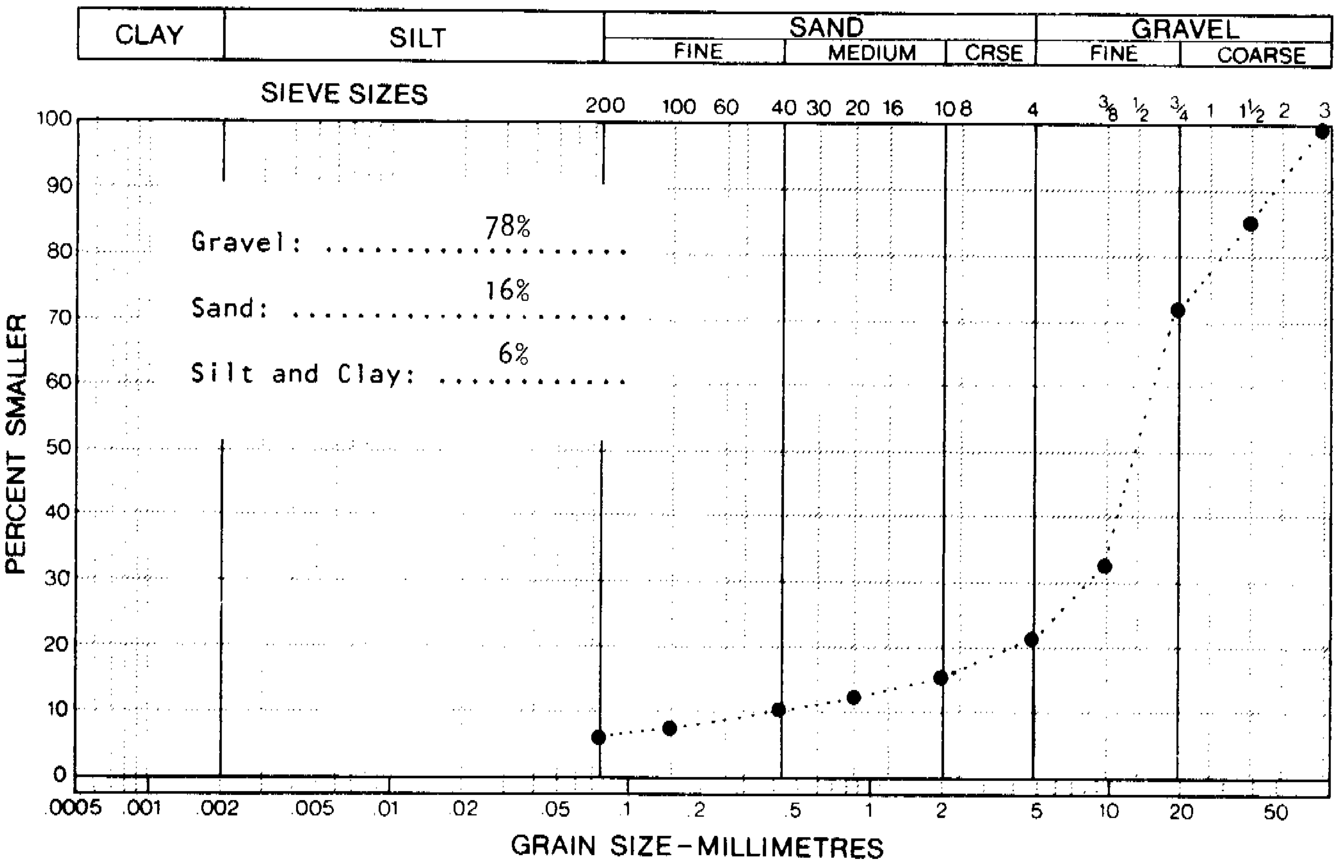
Source Nos. 280 and 290 Airphoto No. A24177-70

LABORATORY ANALYSIS

SOURCE NO. 290

PIT NO. 290-2

EXPOSURE: abandoned borrow pit in weathered bedrock



MATERIAL TYPE: gravel, some sand, trace of silt sized particles

GENISIS (LANDFORM): bedrock controlled drift ridge

PETROGRAPHIC ANALYSIS: slate 98%
quartzite 2%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: blades, angular

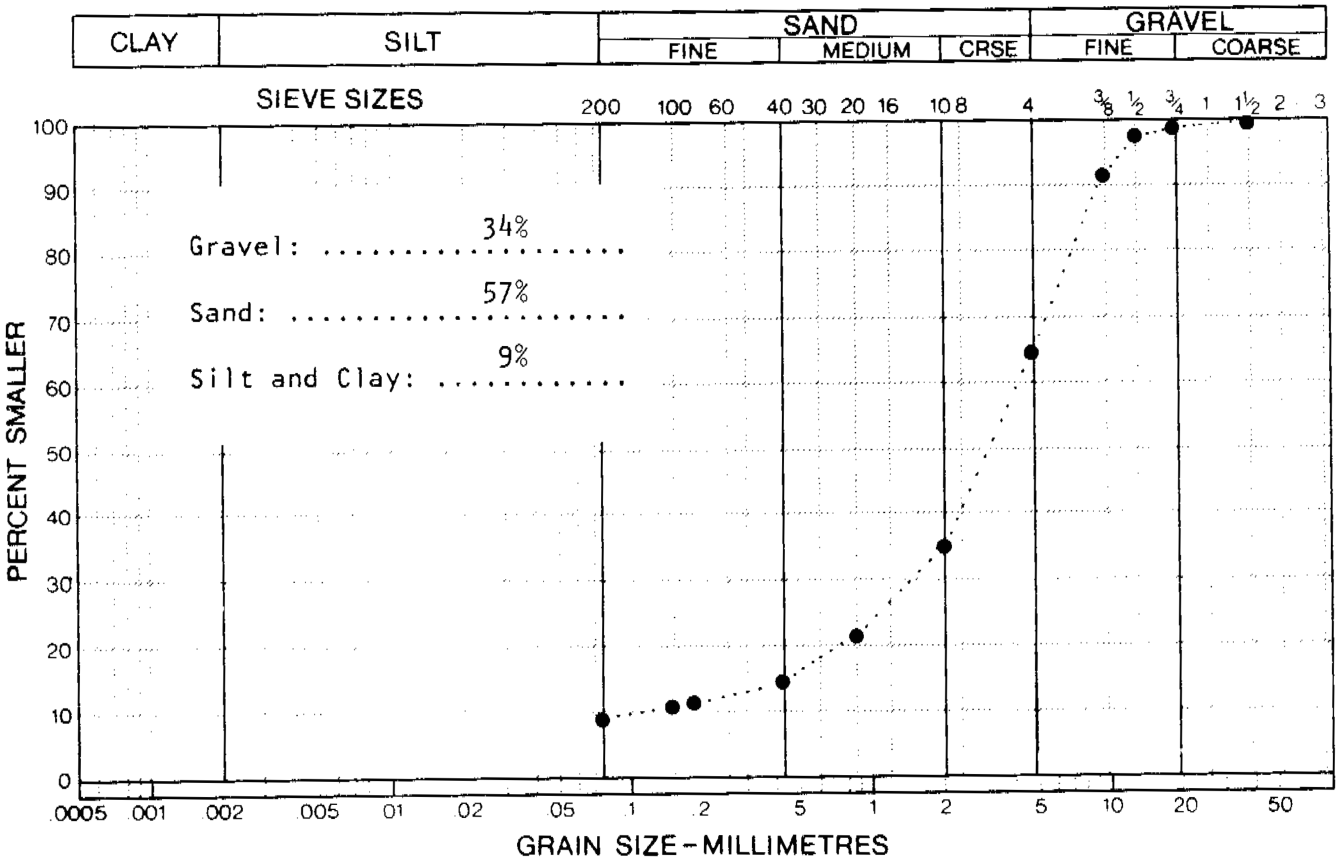
REMARKS: sulphate soundness loss after 5 cycles: coarse 43% fine 9.4%

LABORATORY ANALYSIS

SOURCE NO. 290

PIT NO. 290-3

EXPOSURE: borrow pit stockpile



MATERIAL TYPE: sand and gravel, trace of silt

GENISIS (LANDFORM): drift ridge

PETROGRAPHIC ANALYSIS: slate 98%
diorite 2%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: blades, angular

REMARKS:

SOURCE NO. 290

PIT NO. 290-1

EXPOSURE: road cut

MATERIAL TYPE: weathered slate (bedrock)

GENESIS (LANDFORM): DR

REMARKS: drift ridges are bedrock controlled

SOURCE NO. 290

PIT NO. 290-4

EXPOSURE: existing borrow pits, stockpile

MATERIAL TYPE: slate (bedrock)

GENESIS (LANDFORM): DR

REMARKS: material appeared to have been crushed

SOURCE NO. 290

PIT NO. 290-5

EXPOSURE: road cut

MATERIAL TYPE: gravelly silt

GENESIS (LANDFORM): DR

REMARKS: sample of overburden only

SOURCE NO.

PIT NO.

EXPOSURE:

MATERIAL TYPE:

GENESIS (LANDFORM):

REMARKS:

SOURCE: 290

LANDFORM AND LOCATION: DRIFT AREA

PARAMETER	ENVIRONMENTAL CONCERN	EVALUATION
GEOTERRAIN:	POTENTIAL FOR EROSION	2
VEGETATION:	COMMERCIAL AND/OR AESTHETIC VALUE	1
TERRESTRIAL FAUNA:	GRIZZLY BEAR HABITAT	2
AQUATIC FAUNA:	UPSLOPE FROM PRINGLE LAKE PRINGLE LAKE BARREN	1
SURFACE WATER:	POTENTIAL FOR SLUMPING, EROSION AND SILTATION	1
LAND STATUS AND USE:	GAME SANCTUARY (WEST OF HAINES ROAD) INDUSTRIAL (ABANDONED PIPELINE) UTILITIES (TELEPHONE LINE) HUNTING AREA OUTFITTER/GUIDING AREA TRAPPING AREA	2
HERITAGE RESOURCES:	NO INVOLVEMENT	0
SPECIAL INTEREST:	NONE	0

DETAILED SOURCE ASSESSMENT SHEET

SOURCE NO. 300 and 310

SAMPLE NOS. none taken

LANDFORM AND LOCATION AC on east side of valley above the Haines Road in the vicinity of kilometre post HR173

MATERIAL sand, gravel, cobbles and boulders (assumed)

ESTIMATED VOLUME 2 000 000 m^3 (300), 1 000 000 m^3 (310)

AIRPHOTO NOS. HIGH LEVEL A11523-209

LOW LEVEL not available

DETAILED ASSESSMENT

ENVIRONMENT

Physical

Source Nos. 300 and 210 are alluvial cones situated high above the Haines Road on the east side of the valley. Interpretation of aerial photographs reveals that these deposits slope steeply toward valley and have numerous abandoned stream channels.

Biotic

No biotic information was collected for these sources.

Recreation

The sources appear to have little recreational potential but are located in a registered outfitter/guiding and trapping area.

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GRANULAR RESOURCES

Granular resources in the two alluvial cones are expected to consist of unsorted sands, gravels, cobbles and boulders. Rock types should reflect the bedrock petrology of the source area which is mainly granodiorite and quartzite. Access to the sources is difficult. Volumes of granular material were estimated using an average thickness of 3 m.

DEVELOPMENT

Development of Source Nos. 300 and 310 would require construction of extensive haul roads. Sampling of the sources would be necessary before any detailed development plans would be drafted.

DETAILED SOURCE ASSESSMENT SHEET

SOURCE NO.	320
SAMPLE NOS.	320-2 320-3 320-10 320-12 320-13
LANDFORM AND LOCATION	KT on east side of valley bordering Klukshu River between kilometre post HR174 and HR190
MATERIAL	highly variable, uniform silt to sandy gravel
ESTIMATED VOLUME	no estimate made - see text
AIRPHOTO NOS.	HIGH LEVEL A11523-210, A11521-152, A11521-192 LOW LEVEL A24177-31,-45,-50,-52,-84,-85

DETAILED ASSESSMENT

ENVIRONMENT

Physical

Source No. 320 is a 16 km long segmented kame terrace situated east of and above the Klukshu River. Relatively steep slopes separate the terrace from the active meander plain and alluvial cone deposits. A number of small intermittent streams cross the terrace and flow into the Klukshu River. The Haines Road, abandoned pipeline right-of-way and the telephone line traverse the source at several locations.

Biotic

Tree cover at the south end of the terrace is mainly scattered spruce with some balsam poplar. The understory in this area consists of several willow species, empetrum and Labrador tea. Steeper southwest facing slopes at the north end support stands made up almost entirely of aspen and balsam poplar. Moose tracks and browse sign were observed in the area.

Recreation

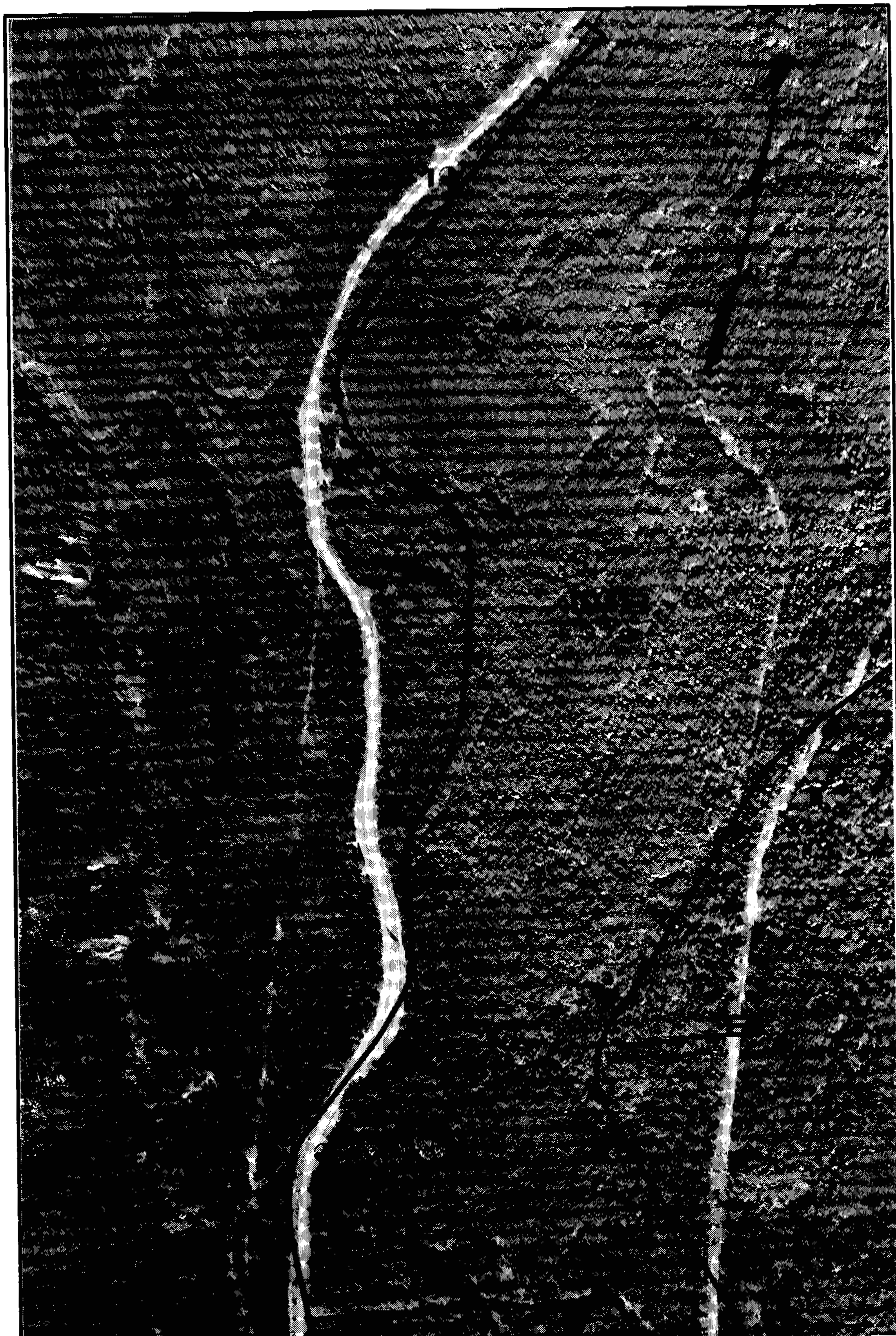
East of the Haines Road the terrace is within a registered outfitter guiding area and trapping area.

GRANULAR RESOURCES

A total of 13 locations were observed within the source. The soils ranged from uniform silt to sandy gravel. Quartzite is the major rock type with granodiorite and diorite the main accessory rocks. The deposits are very non-uniform: in one area sandy gravel (320-3), silty sand (320-4) and uniform silt (320-5) were found in close proximity within the same topographic high, and well stratified fluvial material was observed in contact with unstratified silty drift within the borrow pit at the north end of the deposit.

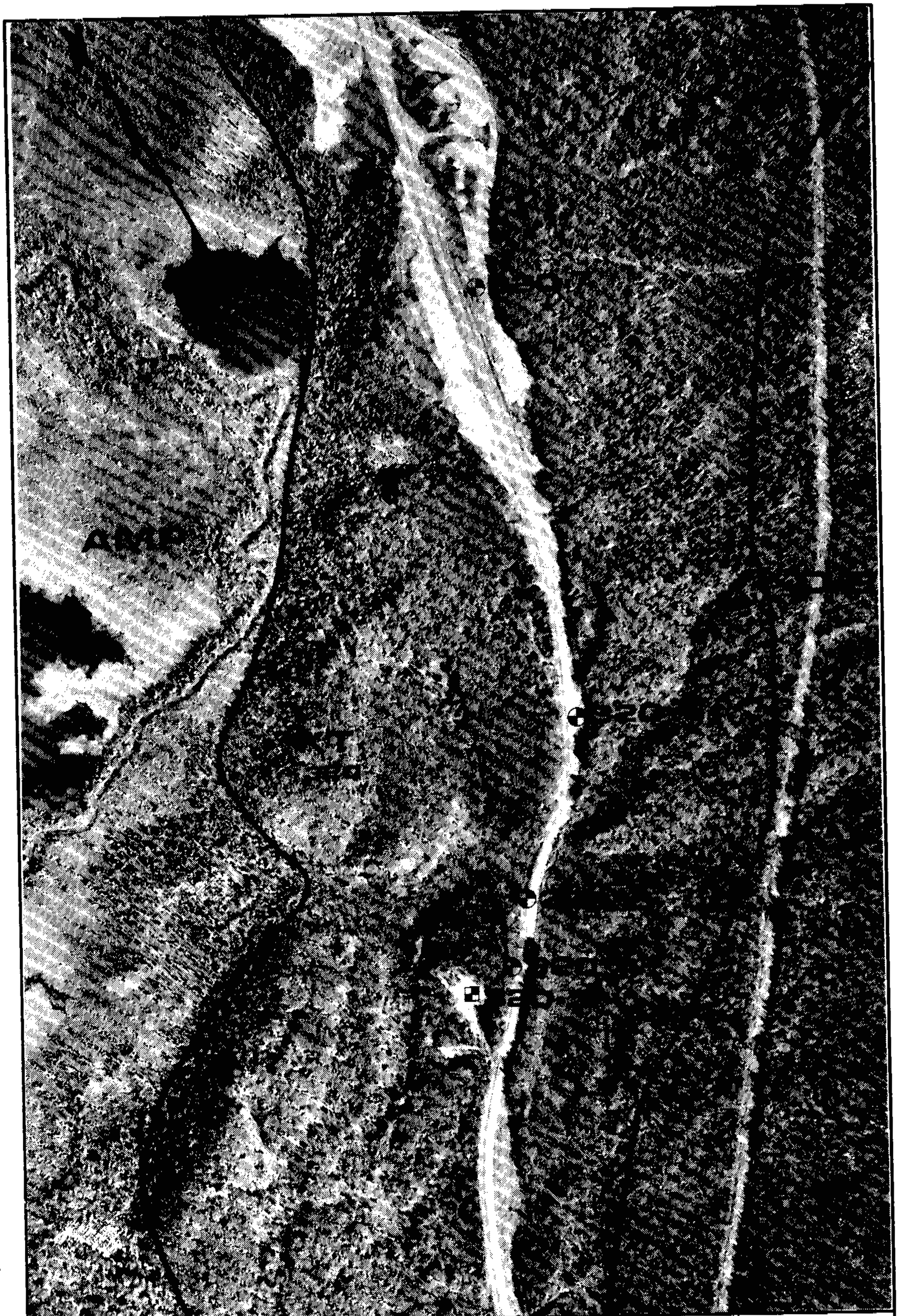
DEVELOPMENT

While some exposures of coarse granular materials were apparent during the investigation, the heterogeneity of areas and their limited extent preclude extensive development. Some sub-base material may be extracted on a very small scale (see location of 320-10 and 320-12). Acceptable general fill may be supplied on a large scale. Possible siltation of the Klukshu River would appear to be the main environmental concern in the face of development.

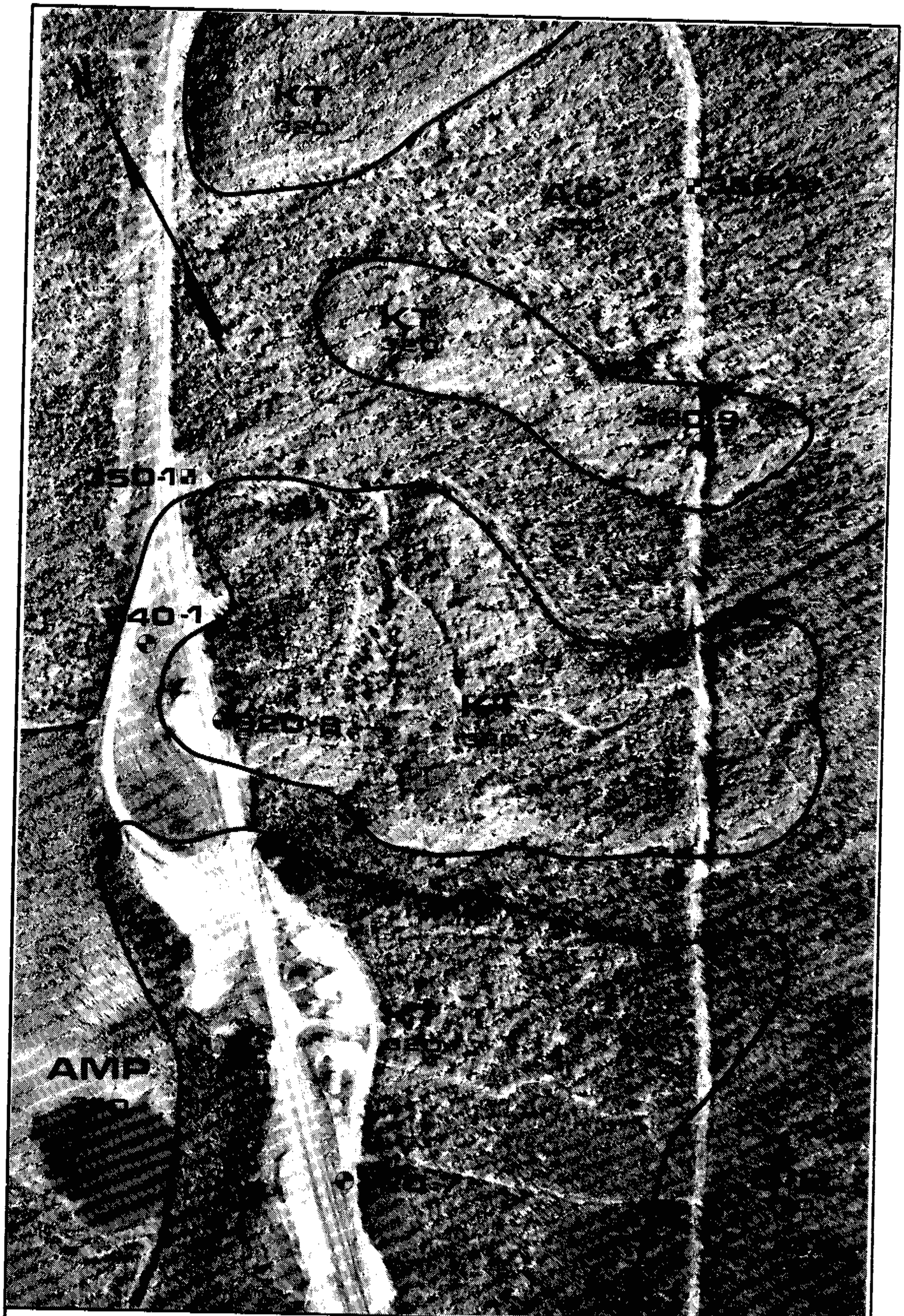


Source Nos. 320 and 370 Airphoto No. A24177-86

Source Nos. 320, 330 and 370 Airphoto No. A24177-53



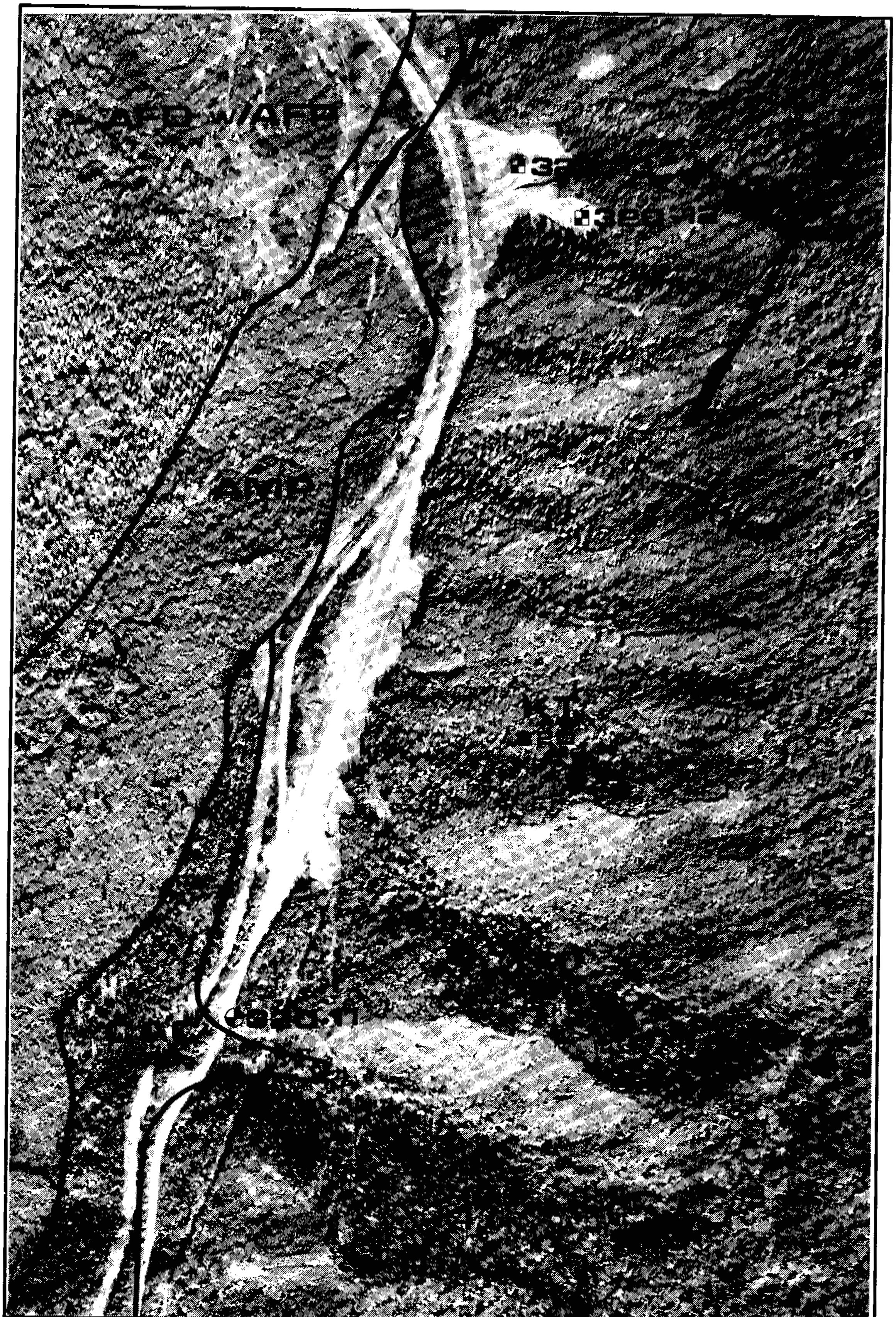
Source No. 320 Airphoto No. A24177-52



Source Nos. 320, 340

Airphoto No. A24177-50

Source No. 320 , 360 Airphoto No. A24177-45



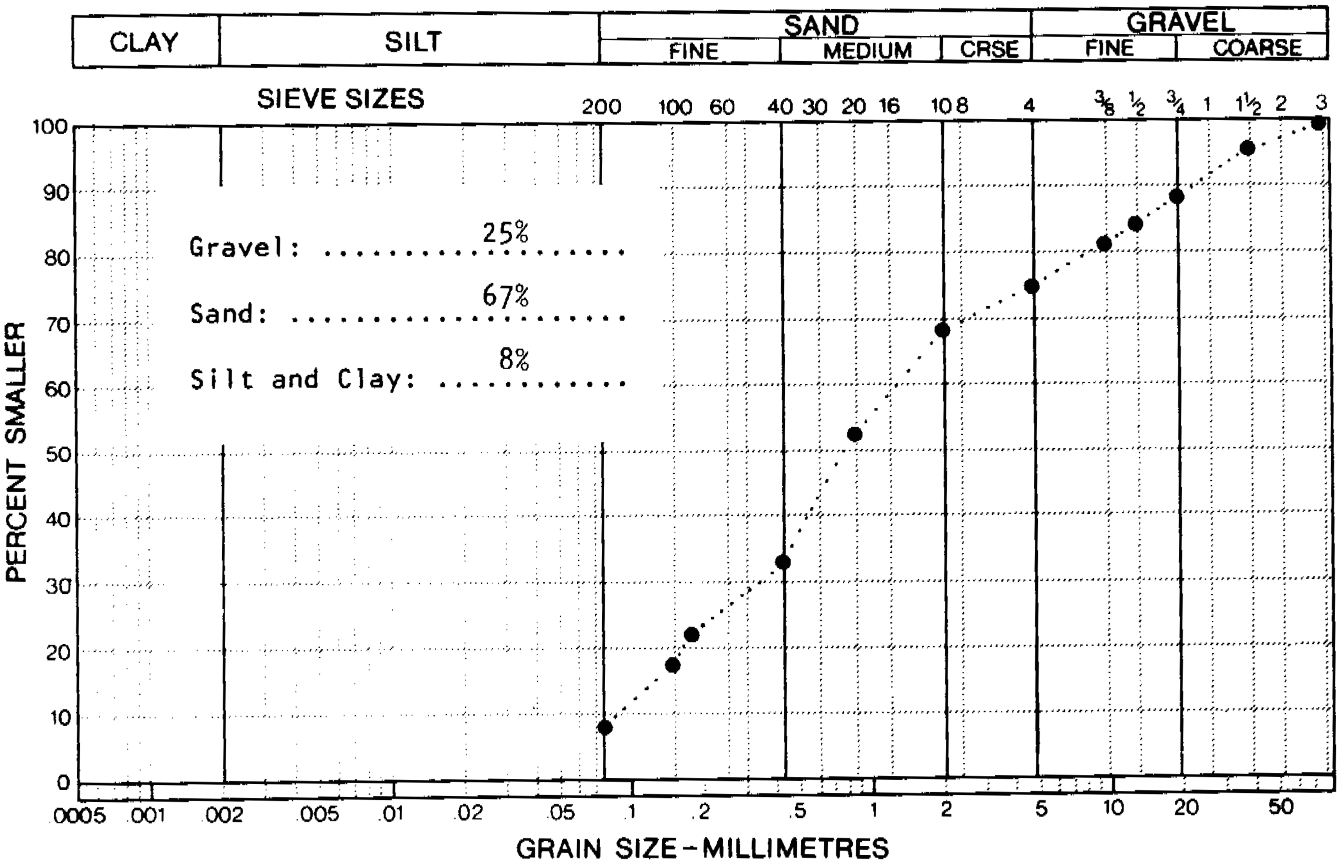
Source No. 320 Airphoto No. A24177-31

LABORATORY ANALYSIS

SOURCE NO. 320

PIT NO. 320-2

EXPOSURE: road cut



MATERIAL TYPE: gravelly sand, trace of silt

GENISIS (LANDFORM): kame terrace

PETROGRAPHIC ANALYSIS:
quartzite 65%
diorite 15%
granodiorite 10%
sandstone 6%
slate 3%
schist 1%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: blades, subangular

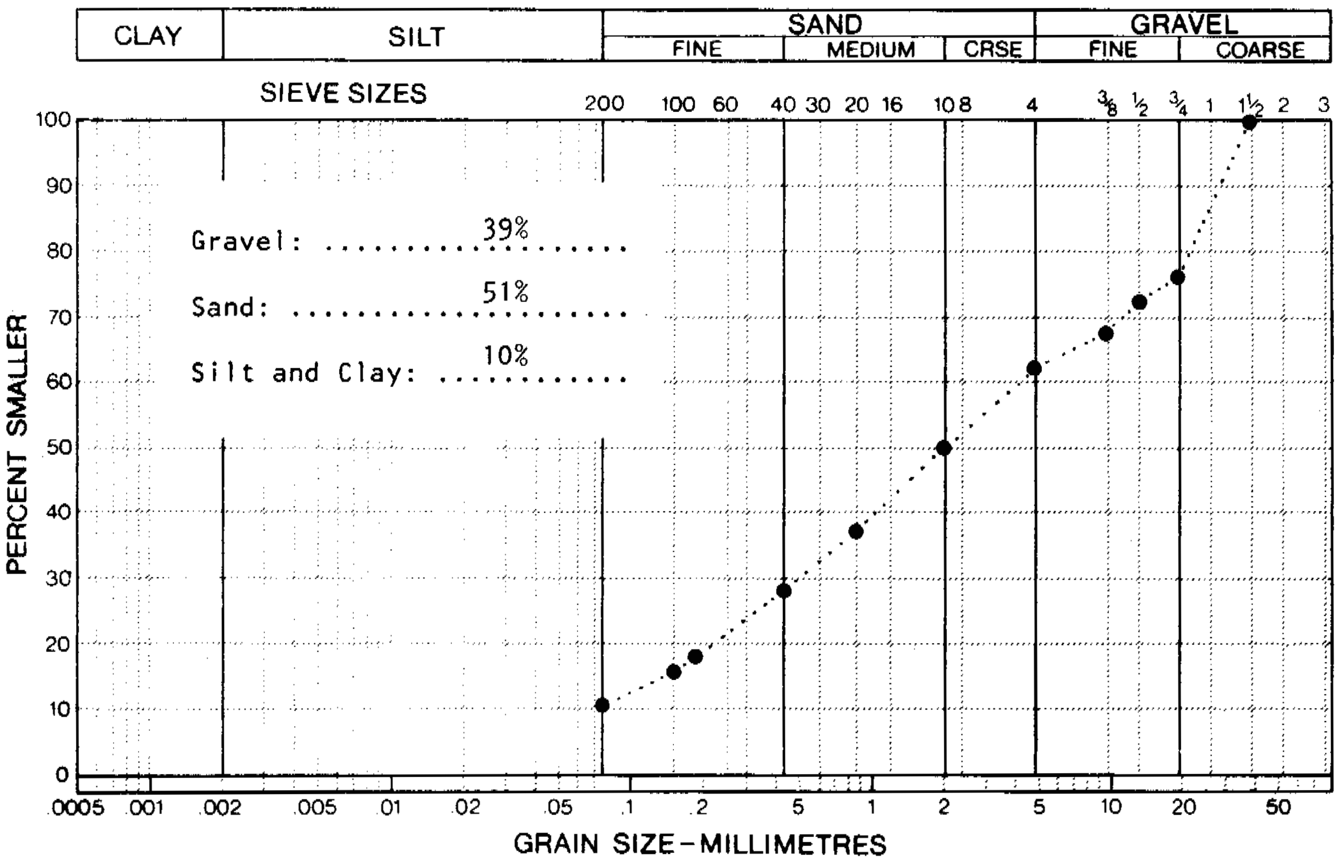
REMARKS:

LABORATORY ANALYSIS

SOURCE NO. 320

PIT NO. 320-10

EXPOSURE: road cut



MATERIAL TYPE: sand and gravel, trace of silt

GENISIS (LANDFORM): kame terrace

PETROGRAPHIC ANALYSIS:
quartzite 65%
granodiorite 17%
sandstone 10%
diorite 6%
schist 2%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: blades, subangular

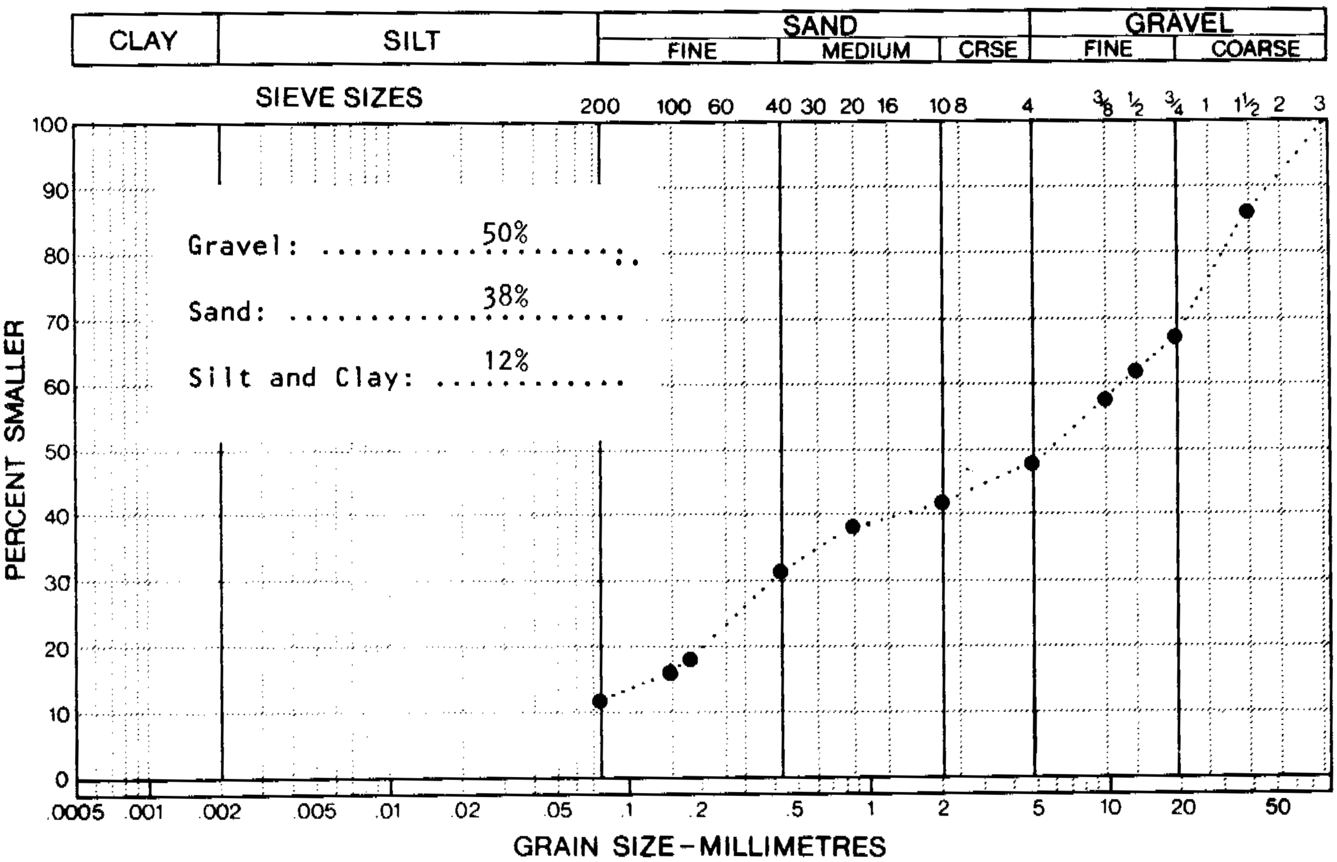
REMARKS: minor calcareous coatings

LABORATORY ANALYSIS

SOURCE NO. 320

PIT NO. 320-12

EXPOSURE: borrow pit



MATERIAL TYPE: gravel and sand, some silt

GENISIS (LANDFORM): kame terrace

PETROGRAPHIC ANALYSIS:

quartzite 67%
diorite 13%
granodiorite 10%
schist 5%
slate 4%
sandstone 1%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: blades, subangular

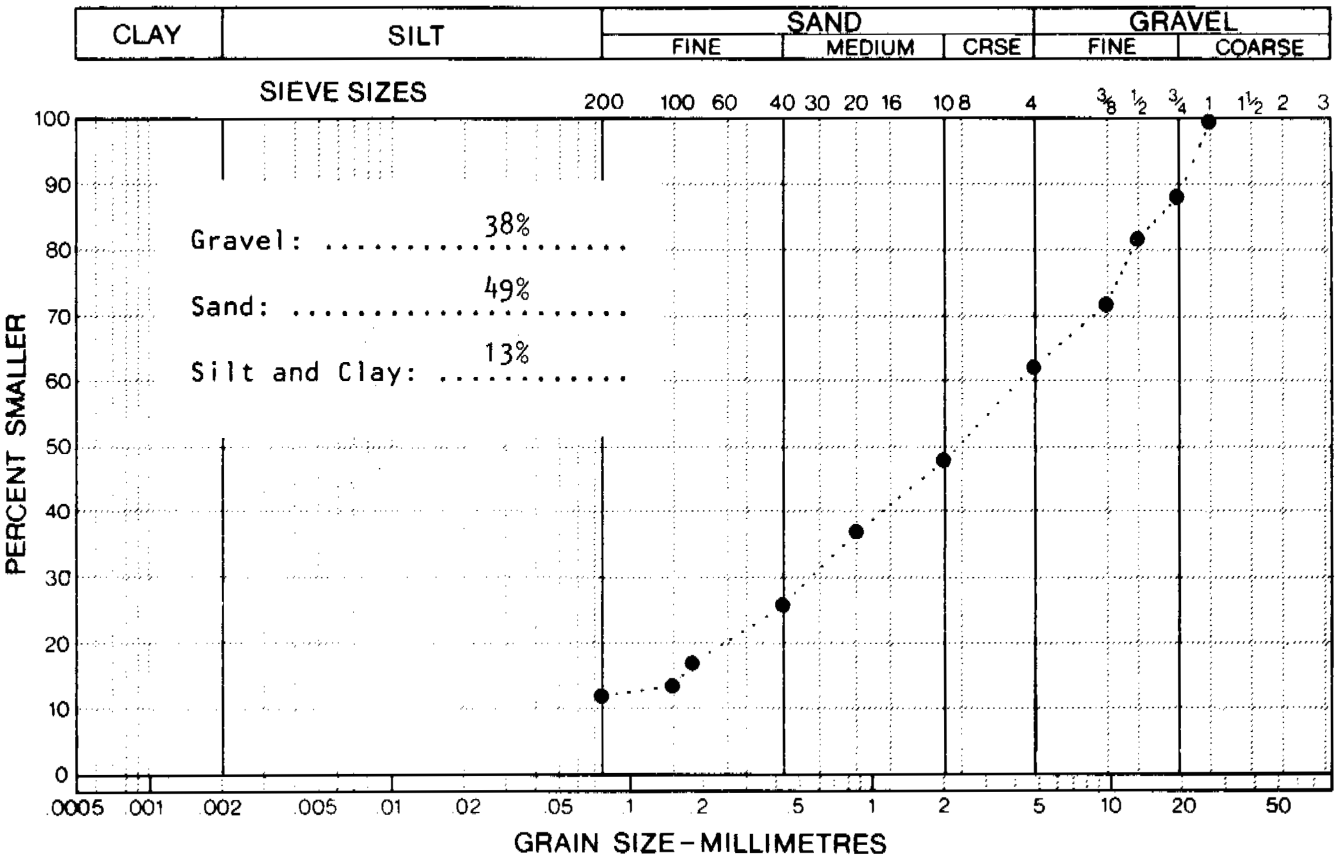
REMARKS: some calcareous coatings

LABORATORY ANALYSIS

SOURCE NO. 320

PIT NO. 320-13

EXPOSURE: stockpile



MATERIAL TYPE: sand and gravel, some silt

GENISIS (LANDFORM): kame terrace

PETROGRAPHIC ANALYSIS:
quartzite 65%
granodiorite 16%
diorite 11%
schist 4%
sandstone 3%
greenstone 1%

MAIN FRACTION PARTICLE SHAPE & ROUNDNESS: blades & spheroids, subangular

REMARKS: some calcareous coatings

SOURCE NO. 320

PIT NO. 320-1

EXPOSURE: road cut

MATERIAL TYPE: medium coarse sand, some silt, trace of gravel

GENESIS (LANDFORM): KT

REMARKS:

SOURCE NO. 320

PIT NO. 320-3

EXPOSURE: abandoned borrow pit

MATERIAL TYPE: sandy gravel

GENESIS (LANDFORM): KT

REMARKS: no samples tested

SOURCE NO. 320

PIT NO. 320-4

EXPOSURE: road cut

MATERIAL TYPE: silty sand, some gravel

GENESIS (LANDFORM): KT

REMARKS:

SOURCE NO. 320

PIT NO. 320-5

EXPOSURE: road cut

MATERIAL TYPE: uniform silt

GENESIS (LANDFORM): KT

REMARKS:

SOURCE NO. 320

PIT NO. 320-6

EXPOSURE: road cut

MATERIAL TYPE: uniform silt

GENESIS (LANDFORM): KT

REMARKS:

SOURCE NO. 320

PIT NO. 320-7

EXPOSURE: road cut near realignment

MATERIAL TYPE: sandy silt, some gravel

GENESIS (LANDFORM): KT

REMARKS: some aggregate also available from cut/fill of former embankment

SOURCE NO. 320

PIT NO. 320-8

EXPOSURE: road cut

MATERIAL TYPE: medium sand with layers of gravel

GENESIS (LANDFORM): KT

REMARKS: 10 - 12 m exposure is very well stratified; some silty and clayey layers also apparent. Flat topped knoll west of highway is capped with roadbed material but underlying material is identical to that examined on east side of roadway

SOURCE NO. 320

PIT NO. 320-9

EXPOSURE: pipeline cut

MATERIAL TYPE: sandy silt

GENESIS (LANDFORM): KT

REMARKS:

SOURCE NO. 320

PIT NO. 320-11

EXPOSURE: road cut

MATERIAL TYPE: sand and gravel

GENESIS (LANDFORM): KT

REMARKS:

SOURCE NO.

PIT NO.

EXPOSURE:

MATERIAL TYPE:

GENESIS (LANDFORM):

REMARKS:

SOURCE: 320

LANDFORM AND LOCATION: KAME TERRACE

PARAMETER	ENVIRONMENTAL CONCERN	EVALUATION
GEOTERRAIN:	POTENTIAL FOR EROSION	1
VEGETATION:	COMMERCIAL AND/OR AESTHETIC VALUE	1
TERRESTRIAL FAUNA:	GRIZZLY BEAR HABITAT WATERFOWL HABITAT	2
AQUATIC FAUNA:	TROUT AND SALMON IN KLUKSHU RIVER BELOW SITE	3
SURFACE WATER:	POTENTIAL FOR SLUMPING, EROSION, SILTATION AND ALTERATION OF EXISTING DRAINAGE PATTERNS	1
LAND STATUS AND USE:	INDUSTRIAL USE (ABANDONED PIPELINE) UTILITIES (TELEPHONE LINE) HUNTING/TRAPPING AREA OUTFITTER/GUIDING AREA SPORT FISHING SUBSISTENCE FISHING	2
HERITAGE RESOURCES:	NO INVOLVEMENT	0
SPECIAL INTEREST:	NONE	0