National Energy Board | Office national de l'énergie

CANADA

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OPERATIONS BUSINESS UNIT - SECTEUR DES OPÉRATIONS

Exploration & Production - Exploration et production

MESSAGE TO	CONTACT / AFFILIATION	FAX
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Ms. Mimi Fortier	Indian and Northern Affairs	(819) 953-5828
Mr. Bob Mahnic	Indian and Northern Affairs	(867) 669-2409
Mr. Innick Lamirande	Natural Resources Canada	(613) 995-5719
Mr. Scott Dallimore	Geological Survey of Canada	(250) 363-6565
Ms. Paul Latour	Environment Canada, Canadian Wildlife Service	(867) 873-8185
Mr. Rudy Cockney	Indian and Northern Affairs	(867) 777-2090
Mr. Bruce Hanna	Fisheries and Oceans Canada	(867) 669-4940
Mr. Brett Hudson	Government of the Northwest Territories	(867) 873-0114
Mr. Gordon Wray	Northwest Territories Water Board	(867) 669-2719
Mr. Greg Cook	Indian and Northern Affairs	(867) 669-2701
Mr. Ed Fercho	Japex Canada Limited, C/O Canadian Petroleum Engineering Inc.	(403) 233-0859
Mr. Paul Scott	Canadian Environmental Assessment Agency	(604) 666-6990

MESSAGE FROM:	John Korec, P.Geol.	Environmental Assessment Officer	
PHONE:	(403) 292-6614	FAX:	(403) 292-5876
DATE:	5 June 2001	# of Pages including this cover page	14

REMARKS/COMMENTAIRES:

Subject/Sujet:	Japex Canada Limited Mackenzie Delta Gas Hydrate Research and Development Project
CEAA project coordination	

IF YOU DO NOT RECEIVE THIS MESSAGE CLEARLY, PLEASE CALL (403) 299-2789
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311 Sixth Avenue S.W.
Calgary, Alberta
T2P 3H2

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National Energy Board / Office national de l'énergie

NEB: To be assigned
EISC: 03/01-10
5 June 2001

Distribution List

Japex Canada Limited (Japex) Mackenzie Delta Gas Hydrate Research and Development Project

National Energy Board (NEB) is in receipt of a Japex Canada Limited (Japex) Project Description dated March 2001 (prepared for Indian and Northern Affairs Canada and the Inuvialuit Environmental Impact Screening Committee). The proposed project would require a NEB authorization pursuant to paragraph 5(1)(b) of the *Canada Oil and Gas Operation Act* (COGOA) for an Approval to Drill a Well. Consequently, with respect to the *Canadian Environmental Assessment Act* (CEAA) the NEB would become a responsible authority upon receipt of an application.

Japex proposes to continue conducting its earlier, 1998 gas hydrate research in the Mackenzie Delta. The project consists of drilling three wells in a line approximately 50 to 100 m apart in the vicinity of its 1998 Malik 2L-38 well. The central well would include a core through the gas hydrate section (approximately 830 m to 1100 m below surface) and an extensive well logging program. The two outer wells, designated as observation wells, would not be cored but would be logged for the purpose of obtaining additional research data. The observation wells would monitor how gas hydrates respond to production testing activities in the central well.

The NEB has determined that, in accordance with paragraph 3(1)(a) of the CEAA *Regulations Respecting the Coordination by Federal Authorities of Environmental Assessment Procedures and Requirements* (CEAA Federal Coordination Regulations or FCR), the NEB requires an environmental assessment of the project under section 5 of the CEAA.

This letter is intended to address the federal coordination requirements under the CEAA, in particular to identify the responsible authorities (RA's) and federal authorities (FA's). As well, we seek your concurrence on:

- the scope of the project;
- the factors to be assessed;
- the scope of the factors to be assessed; and
- a timetable for conducting a joint CEAA screening.

Federal Coordination Regulation (CEAA) Section 5 Notification

Pursuant to section 5 of the Federal Coordination Regulations, the Board requests that you review the information provided and inform the Board by **19 June 2001** of your determination pursuant to subsection 6(1) of the Federal Coordination Regulations. In its Project Description, Japex indicates that the following authorizations may be required in addition to the NEB Approval to Drill a Well for 3 wells:

444 Seventh Avenue SW
Calgary, Alberta T2P 0X8

444, Septième Avenue S.-O.
Calgary (Alberta) T2P 0X8

Canada

Telephone/Téléphone : (403) 292-4800
Facsimile/Télécopieur : (403) 292-5503
http://www.neb.gc.ca

Japex Canada Limited. 5 June 2001
Mackenzie Delta Gas Hydrate Research and Development Project

- Approval of Project Description, Inuvialuit Environmental Impact Screening Committee, Inuvik;
- Land Use Permit, Indian and Northern Affairs Canada, Inuvik;
- Migratory Bird Sanctuary Permit, Canadian Wildlife Service, Yellowknife; and
- Water Licence, Northwest Territories Water Board, Yellowknife.

A March 2001 Japex Project Description report for the, "Mackenzie Delta Gas Hydrate Research and Development Project", replaces an earlier December 2000 report. The Project Description describes the project details, environmental information, traditional area use and community consultations pertinent to this project. The Development Summary and Figure 1 from the report are attached. If you require copies of the complete Project Description report, please contact Ed Fercho Canadian Petroleum Engineering at (403) 263-0752.

If you determine that you are likely to require an environmental assessment of the project, please advise the Board of any approvals or authorizations to be exercised by your department or agency. If you determine that you are in possession of any specialist or expert information or knowledge pursuant to paragraph 6(1)(c) of the Federal Coordination Regulations, please advise the Board of the nature of that information or knowledge and the person to contact for assistance. The Board further asks that you provide Japex with a copy of any response in respect of the above requests. A Faxback Response form has been included for your use.

If no response is received from you by the aforementioned date, the NEB will assume that your department or agency has no responsibility to undertake an environmental assessment and is not in possession of specialist or expert information or knowledge.

Inuvialuit Environmental Impact Screening

The Environmental Impact Screening Committee (EISC) has completed its environmental screening process pursuant to the Inuvialuit Final Agreement (IFA). As part of this process, the EISC reviewed the Project Description and solicited comments from the local Hunters and Trappers Committees and other interested groups. The EISC determined, on or about 27 April 2001, that the proposed activities would have no significant negative impact on the environment or Inuvialuit wildlife harvesting in the Inuvialuit Settlement Region [IFA Section 11(13)(a)]. The NEB will include the determination of the EISC in the CEAA screening report.

Section 8 Requirements of the CEAA Federal Coordination Regulations

With respect to section 8 of the FCR, the NEB request your review of, and comments on, the following in preparing any joint determination of the scope of the project, the factors to be considered, and the scope of those factors:

Japex Canada Limited.
Mackenzie Delta Gas Hydrate Research and Development Project

5 June 2001

A. *Scope of the Project*

1. Undertaking in relation to the physical work or physical activity triggering the CEAA.

The NEB considers the principal project to be the proposed three-well drilling operations related to gas hydrate research in the Mackenzie Delta - Inuvialuit Settlement Region, Northwest Territories.

2. Other associated physical works or physical activities that must be undertaken to carry out the project.

The NEB notes that for the project to proceed to completion, the following physical works and activities would need to be undertaken:

- transportation in August and September 2001 of a small oilfield drilling rig, including well consumables, construction equipment and a 55-person camp down the Mackenzie River by barge to the Taglu staging site;
- construction in November and December 2001 of a 20 km ice road from Taglu to an established ice road along the Middle Channel of the Mackenzie River - construction would involve ice profiling, flooding of thin ice sections, snow plowing and maintenance;
- construction of an ice road, as above, along the Middle Channel to the Tununuk and Inuvik/Tuk ice road, if one has not been previously established;
- construction of a short snow/ice road across the shoreline to the site of the wells;
- preparation of a three-well, snow/ice pad wellsite and a snow/ice containment berm;
- trucking in December 2001 of the drilling rig and camp from the Taglu staging area to the wellsite;
- drilling, testing and well monitoring operations beginning in mid-January 2002;
- operation of a camp for up to 55 people;
- disposal of waste drilling fluids and cuttings into a sump excavated into the permafrost zone;
- demobilization and removal of the drilling rig, camp and equipment along the ice roads to Inuvik at the completion of the project; and
- cleanup, reclamation and disposal of any remaining waste materials

12. Other undertakings in relation to the physical works and activities identified in items (1) and (2) above.

No further hydrocarbon exploration-related activities have been identified in relation to the physical works and activities for the proposed Japex project. Any additional hydrocarbon exploration activities would be subject to future examination under the COGOA and, consequently, under the CEAA.

B. Factors to be Assessed

The factors to be considered within the scope of an environmental assessment would be those set out in subsection 16(1) of the CEAA.

C. Scope of the Factors to be Assessed

The following spatial and temporal boundaries are identified for the Japex project.

1. Spatial Boundaries

   Local: Project footprint, the immediate area, i.e., within 1 km of the project operations;

   Subregional: Extending beyond the limits of the project operations, but limited to the project vicinity - between 1 km to 50 km of the project operations; and

   Regional: Extending beyond 50 km from the project operations to the entire region, i.e., Mackenzie Delta or the Beaufort Sea.

2. Temporal Boundaries

   Immediate: Less than two days;

   Short-term: More than two days but less than one year;

   Medium-term: One year or longer but less than ten years; and

   Long-term: More than ten years.

D. Proposed Process and Time Line

The NEB recommends the following process and time line.

As the screener, the NEB will consider all comments and information from the RA's and FA's, and the Environmental Impact Screening Committee (EISC). The following table outlines the proposed NEB time line for receiving RA's and FA's responses and conducting the screening. Depending on the review and any comments received, the process could extend somewhat beyond the suggested dates - in which case we would provide an updated time line. Please let us know if the proposed initial time line meets your needs.

Japex Canada Limited.
Mackenzie Delta Gas Hydrate Research and Development Project

5 June 2001

Coordinated Screening Process Step	Proposed Response Date
1. Request for comments on proposed coordinated screening (10 working days).	19 June 2001
2. Preparation of the draft CEAA Environmental Screening Report and proposal for coordinated date for screening determinations.	3 August 2001
3. RA and FA review and comments on the draft CEAA Environmental Screening Report (5 working days).	13 August 2001
4. CEAA Environmental Screening Report (5 working days)	20 August 2001
7. RA's CEAA determinations.	at RA's discretion

Section 9 Requirements of the CEAA Coordination Regulations

We trust that the foregoing information and recommendations, if agreed upon, will meet the requirements of sections 8 and 9 of the CEAA Coordination Regulations. If your department or agency is a responsible authority in respect of the Japex project, please indicate whether you concur with the above NEB recommendations for: the scope of the project; the factors to be assessed; the scope of the factors to be assessed; and the timetable for conducting a CEAA screening.

The NEB asks that you provide the Inuvialuit Environmental Screening Committee and Japex with a copy of any response in respect of the above requests. If you have any questions regarding the above, please contact John Korec, Environmental Assessment Officer at Tel: (403) 292-6614, Fax: (292) 5876, or email: jkorec@neb-one.gc.ca. Thank you.

Yours truly,

T.M. Baker
Chief Conservation Officer

jk/Attachments:
Faxback Form (1 page); Distribution List (1 page); Development Summary (5 pages); Figure 1(1 page)

Japex Canada Limited.
Mackenzie Delta Gas Hydrate Research and Development Project

5 June 2001

National Energy Board / Office national de l'énergie

***Canadian Environmental Assessment Act* - Faxback Response for Section 5 Notification**

Re: Japex Canada Limited - Mackenzie Delata Gas Hydrate Research and Development Project

NEB File: to be assigned

FAX TO: (403) 292-5876
T.M. Baker
Chief Conservation Officer
National Energy Board

Pursuant to the *Regulations Respecting the Coordination by Federal Authorities of Environmental Assessment Procedures and Requirements* (Regulations), please indicate to the National Energy Board (the NEB) by **19 June 2001** whether your Department/Agency (please check off the appropriate box):

a) has, or anticipates identifying, a responsibility under Section 5 of the *Canadian Environmental Assessment Act* (CEAA) to assess the environmental effects of the project(s);

NO ☐ YES ☐ If **YES**, please indicate the CEAA law list trigger(s):

Trigger: _____

b) can provide specialist advice to the NEB pursuant to Section 12(3) of the CEAA with respect to an environmental assessment of the proposed projects (i.e. an Expert Federal Authority);

NO ☐ YES ☐

c) requires additional information to make a determination referred to in a) or b) above.

NO ☐ YES ☐ If **YES**, please forward the request within 10 days after receiving this notification as per subsection 6(2) of the Regulations.

Please advise what role your Department or Agency plans to play in this review by faxing this response to the Chief Conservation Officer, T.M. Baker at (403) 292-5876. Please provide the following contact information:

Name: _____

Title/Department: _____

Address: _____

_____

Telephone: (___) _____ Facsimile: (___) _____

_____ _____

Date Authorized Signature for Responding Department or Agency

Japex Canada Limited.
Mackenzie Delta Gas Hydrate Research and Development Project

5 June 2001

Distribution List

Distribution	
Ms. Linda Graf Secretary **Environmental Impact Screening Committee** Inuvialuit Corporate Centre PO Box 2120 Inuvik, Northwest Territories X0E 0T0 Tel: (867) 777-2828 **Fax: (867) 777-2610**	Ms. Mimi Fortier Director **Indian and Northern Affairs** Northern Oil and Gas 10 Wellington St. Hull, Quebec K1A 0H4 Tel: (819) 997-0878 **Fax: (819) 953-5828**
Mr. Bob Mahnic Manager **Indian and Northern Affairs** Oil and Gas 4914-50th ST, PO Box: 1500 Yellowknife, Northwest Territories X1A 2R3 Tel: (867) 669-2618 **Fax: (867) 669-2409**	Mr. Iannick Lamirande Environmental Assessment Officer **Natural Resources Canada** Office of Environmental Affairs 580 Booth Street Ottawa, Ontario K1A 0E4 Tel: (613) 996-0055 **Fax: (613) 995-5719**
Mr. Scott Dallimore **Geological Survey of Canada** Pacific Geoscience Centre PO Box 6000 Sidney, British Columbia V8C 4B2 Tel: (250) 363-6423 **Fax: (250) 363-6565**	Mr. Paul Latour **Environment Canada** Canadian Wildlife Service Suite 301, 5204 50th Avenue Yellowknife, Northwest Territories X1A 1E2 Tel: (867) 669-4743 **Fax: (867) 873-8185**
Mr. Rudy Cockney District Manager, North Mackenzie District **Indian and Northern Affairs Canada** PO Box 2100 Inuvik, Northwest Territories X0E T0T Tel: (867) 777-3361 **Fax: (867) 777-2090**	Mr. Bruce Hanna Habitat Biologist **Fisheries and Oceans Canada** Western Arctic Area Suite 101, 5204 - 50th Avenue Yellowknife, Northwest Territories X1A 1E2 Tel: (867) 669-4900 **Fax: (867) 669-4940**
Mr. Brett Hudson Environmental Assessment Analyst **Government of the Northwest Territories** Resources, Wildlife and Economic Development PO Box 1320 600 - 5102-50th Avenue Yellowknife, Northwest Territories X1A 3S8 Tel: (867) 920-6392 **Fax: (867) 873-0114**	Mr. Gordon Wray Chairman **Northwest Territories Water Board** 2nd Floor, Goga Cho Building PO Box: 1500 Yellowknife, Northwest Territories X1A 2R3 Tel: (867) 669-2772 **Fax: (867) 669-2719**
Japex Canada Limited C/O Mr. Ed Fercho, President Canadian Petroleum Engineering Inc. 1700, 407 - 2nd Avenue SW Calgary, Alberta T2P 2Y3 Tel: (403) 263-0752 **Fax: (403) 233-0859**	Mr. Paul Scott Regional Director **Canadian Environmental Assessment Agency** Suite 320, Sinclair Centre 757 West Hastings Street Vancouver, British Columbia V6C 1A1 Tel: (604) 666-6989 **Fax: (604) 666-6990**

Please contact Mr. Ed Fercho, above if additional copies of the Project Description Report are required.

DEVELOPMENT SUMMARY

The research project will require the drilling of three 1200 metre wells adjacent to the Imperial Mallik L-38 and Mallik 2L-38 locations during the winter of 2001/2002. If it becomes necessary to deviate from the plan as described below, the proponent will first contact the appropriate regulatory agencies to obtain their approval. The program is planned according to the following steps:

1. Staging the Drilling Rig

A small conventional oilfield drilling rig, with a rated capacity of 1800 to 2000 metres, will be used to conduct the drilling. The drilling rig, well consumables, construction equipment, and a 55-man camp will be transported down the Mackenzie River by barge to the Taglu staging site (see Figure 1) in August and September 2001.

2. Access Road Construction

Approximately 20 km of ice road will be constructed northward from Taglu to reach the Mallik site. The road will follow the Harry Channel in the Delta (see Figures 1 and 2, pages 11 and 12).

The ice road will also be extended southward from Taglu to the Middle Channel where it will intersect any existing ice road (see Figure 1). If no other ice roads have yet been established in the Middle Channel, ice road construction will continue along the Middle Channel until it reaches Tununuk and the Inuvik/Tuk ice road. The construction of the ice road will take place after freeze-up, in November and December 2001. There are several weeks of contingency within the planned schedule in order to accommodate a delayed freeze-up date. The ice road will make use of existing routes as much as possible.

Operations to establish the ice roads include ice profiling, flooding of thin ice sections and the initial snow plowing required for opening the road. Snow and ice will be piled up to form ramps for crossing riverbanks. No banks will be cut to access the river. Maintenance snow plowing of the road will take place to enable vehicle access for the remaining duration of the project.

3. Wellsite Preparation

The well location (see Figure 3, page 13) will be prepared after freeze-up in early December 2001 in order to meet a scheduled spud date of January 1 2002. A short snow/ice road will provide access across the shoreline to the wellsite. No riverbank will be cut to access the site from the ice road. The

wellsite will be covered with a snow/ice pad and surrounded by a snow/ice containment berm. Snow blades on construction equipment at the wellsite will be fitted with mushroom shoes in order to minimize damage to the vegetation and soil cover during construction.

4. Rig and Camp Mobilization

The rig and camp will be mobilized from the staging area to the wellsite by truck in early December. The rig and camp will be placed on rig matting on top of the snow/ice pad. This procedure, which has been used in the past, will protect the ice pad from melting. All stationary fuel tanks will be double walled or will be located within a self-berm skid. Refueling of vehicles will take place using approved conventional fuel transfer equipment. The camp and drilling facilities will be set back from the water line by at several hundred metres. This will ensure effective control and cleanup in the event of any small spill. In order to support local businesses, construction and support equipment, camp accommodation, catering services, supplies, and fuel will be procured locally, to the greatest extent possible, and transported from Inuvik or Tuk to Mallik using the ice road. The rig move from the staging area will utilize truck transportation on the ice road. Construction personnel for the wellsite preparation and the rig move will be accommodated in one 10 to 12 man sleigh-mounted camp. The camp will be self-contained. Sanitary wastes will be pumped out for disposal in an approved manner.

5. Drilling and Testing Program

Drilling: A 1200 metre main test well will be drilled. The well will consist of: 15 m of 508 mm (20") diameter conductor pipe cemented to the surface; approximately 110 m of 339 mm (13 3/8") diameter surface casing cemented to surface; approximately 680 m of 244 mm (9 5/8") diameter surface casing cemented to the surface; and 1200 m of 178 mm (7") diameter production casing stage cemented to the surface.

The drilling program for the main well will take approximately 26.5 days beginning in mid January 2002. This includes approximately 10 days planned for coring the gas hydrates and conducting an extensive logging program.

Two 1200 metre observation wells, approximately 50 metres to either side of the main test well, will be drilled. Each of these wells will consist of: 20 m of 269 mm (11 3/4") diameter conductor pipe cemented to the surface; approximately 350 m of 219 mm (8 5/8") diameter surface casing cemented to surface; and1200 m of 140 mm (5 1/2") diameter production casing stage cemented to the surface.

Each of the observation wells will take approximately 13 days. No coring program and only limited logging will be conducted at the observation wells as they are in close proximity to the main well coring site.

The drilling program will utilize equipment that can operate with a minimal need for drilling sumps. Only a small sump is planned for the location next to the drilling rig. This sump will be excavated into the permafrost. Only approved biodegradable mud products and chemicals will be used in order to prevent environmental damage from the well fluids or cuttings. No oil-based drilling muds will be used. The surface level of the sump fluids will not be allowed to rise to within one metre of the ground level. The sump will be monitored to ensure that it does not contain any deleterious material.

Testing: The main test objective is to gain direct measurement of the rate at which dissociation of the gas hydrate occurs through pressure drawdown and thermal stimulation. The final test interval(s) has not yet been determined, however the planned procedure described below is independent of the interval properties.

The planned test procedure includes the following elements:

1. An initial closed chamber test in the hydrate zone to measure the rate of hydrate dissociation under pressure depletion.
2. A period on constant rate and temperature circulation to measure the rate of hydrate dissociation by initiating an aggressive thermal signal into the hydrate.
3. (optional) A final closed chamber test to measure the hydrate dissociation rate under pressure depletion (in this second case with a larger surface contact area due to the thermal stimulation)
4. (optional) A closed chamber and/or flow test of the underlying free gas zone below the hydrate interval by using through-tubing perforating techniques, and commingling production from the free gas and hydrate zones

The hydrate test interval will be perforated overbalanced using wireline conveyed casing guns prior to running and setting of the DST test tools. The completion/circulation fluid type has not been finalized, but will it probably be freeze-depressed brine.

The hydrate gas dissociation flow rate under simple pressure depletion is expected to very low. The thermal stimulation procedure will use hot brine circulated through coiled tubing. Heat loss to the uphole wellbore will be minimized by utilizing an insulating packer fluid, or alternately insulated tubing. Fracturing in combination with the circulation procedure may also be attempted. During this thermal stimulation process, produced gas from the hydrate will be entrained within the fluid returns circulated out of the wellbore. This fluid will be processed through a standard surface well test package with one or two levels of separation, and possibly through a Vacuum Recovery Unit. Each stage of separation will include equipment for low rate gas measurement. On-line gas chromatograph analysis may be utilized to characterize dissociated gas throughout the system. Extensive sampling of gas at each stage of separation will also be included. Pressure and temperature observation wells, depending upon proximity to the production

well, may also be used to detect gas hydrate dissociation during the thermal stimulation process. All produced gas will be flared, and any produced liquids retained in tanks for later disposal. Gas and liquid samples will be collected for all tests. All tests are expected to produce no H_2S and approximately 0.03% CO_2. Isotope identification may enhance the detection of gas that originates from gas hydrate dissociation. Hydrate formation within the wellbore can be eliminated by maintaining flow at low pressures, and/or by chemically lowering the hydrate formation temperature with the addition of methanol inhibitor. Special safety procedures and clear operating instructions have been included in this program addressing these issues. The coil-tubing unit will provide a hydrate removal contingency and the ability to displace accumulated wellbore fluids or solids with nitrogen.

Based on the simulation work performed to date, the free gas zone in the Mallik 3L-38 well will produce at a rate of ~ 28,000 m^3/d average (1.0 MM scf/d) over a one day flow period. During a direct thermal stimulation of a hydrate zone, the predicted gas production rate will be 0.15 – 0.30 $X10^3 m^3/d$ (0.005 – 0.010 MM scf/d). Assuming a 10 day thermal stimulation period, the expected hydrate gas production will be a maximum of 2.8 10^3m3 (0.10 MMscf). Total expected gas production during the planned testing at Mallik will therefore probably be less than ~ 40,000m^3 (~1.5 MM scf). All gas will be flared through an approved flare stack, except for the small volumes collected for laboratory analyses.

Expected production of formation water (both saline and fresh water) during all production testing is less than 20 m^3 (300 bbls). Water produced during the flow test of the free gas zone will be collected in storage tanks on the surface. Water produced during the thermal stimulation of the hydrate zone will be diluted into the water based heating fluid.

All produced fluids as well as completion products (NaCl or CaCl completion brines, gelled packer fluids, methanol, etc.) will be disposed of in an approved manner, either in a downhole disposal zone, or through surface treatment.

The entire testing program is estimated to take 18 days.

6. Demobilizing the Drilling Rig

On completion of the project, the rig and camp will be demobilized via the ice road to Inuvik or further south, unless another operator contracts it.

7. Cleanup, Reclamation and Disposal

Upon removal of the equipment from the site, all remaining combustible wastes will be burned in a smokeless incinerator. Non-combustible wastes will be trucked to approved disposal sites. Before backfilling, the cuttings sump will be checked to verify that it does not contain any deleterious materials. The sump will be backfilled with the original material which was excavated during its construction. The surface elevation of the backfilled sump will be a minimum of 1 metre above the ground level. Except for the sump, and the area within about one metre of the wellhead, the remainder of

the soils at the operating site will remain undisturbed under the ice pad for the duration of the project. Before the construction equipment is released at the end of the project, the ice pad will be scored in order to accelerate its melting in the spring.

GAS HYDRATE RESEARCH PROJECT

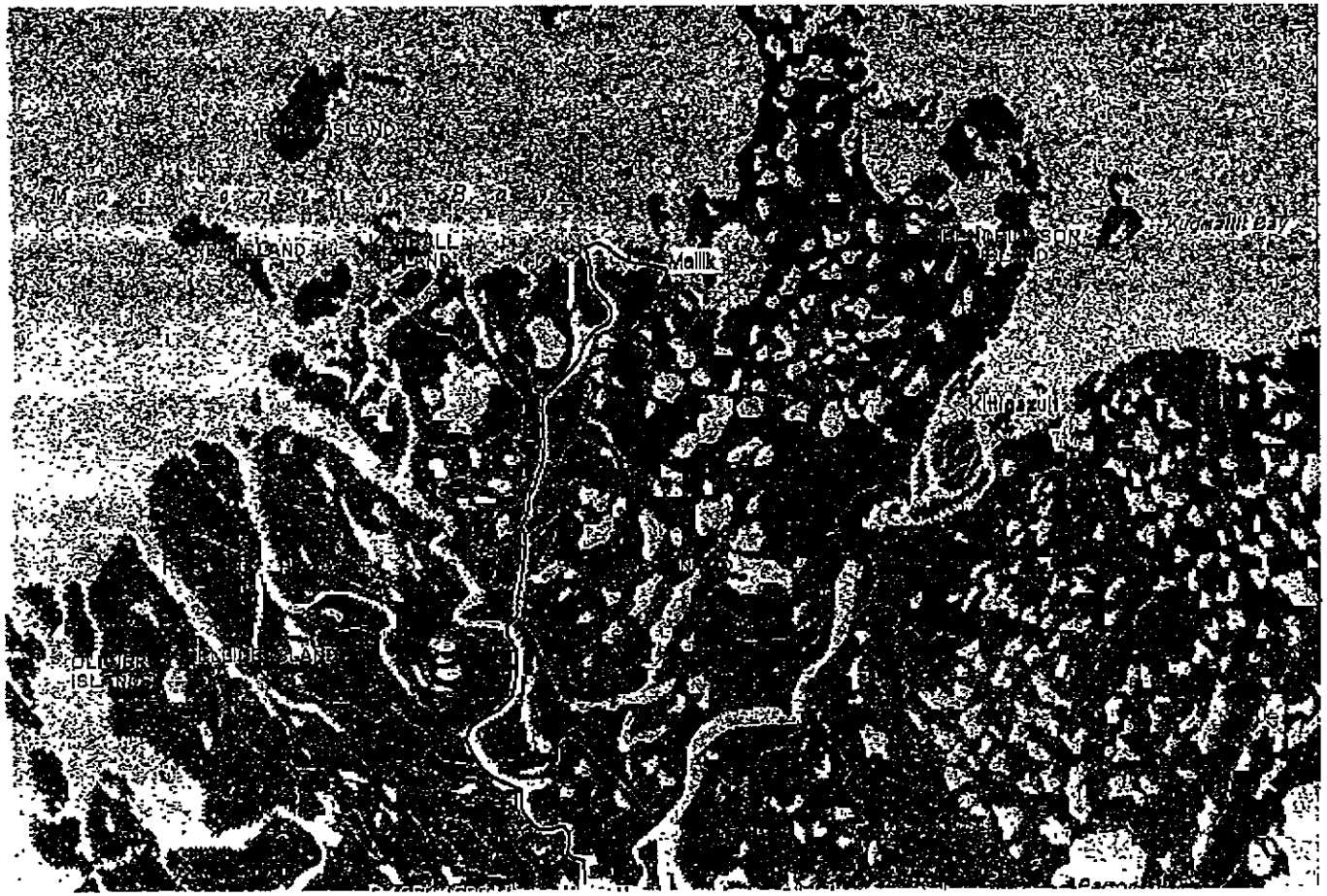

Figure 1