Summary of Information
Relating to the Kitsault Mine
Alice Arm, British Columbia

by

Department of Environment

and

Department of Fisheries and Oceans

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Summary of information relating to the Kitsault mine, Alice Arm, British Columbia.

Summary of Information Relating to the Kitsault Mine Development, Alice Arm, British Columbia

1. Introduction

Amax Canada Ltd. (formerly Climax Molybdenum of B.C.) is currently preparing to re-open the Kitsault mine which is situated in Alice Arm, approximately 144 km (90 miles) north of Prince Rupert, B.C. (Figure 1). The Kitsault mine was previously operated by the British Columbia Molybdenum Limited between 1968 and 1972. Several other mines had operated in the Alice Arm area prior to this period, such as Dolly Varden, Torbrit and Silver City, which was located near the present townsite of Kitsault. Between 1914 and 1936 Anyox which is situated near the junction of Alice Arm and Hastings Arm was the site of an active copper smelter.

1.2 Alice Arm

Alice Arm is one of two terminal branches of Observatory Inlet which extends from Portland Canal immediately south of the Alaskan/British Columbia border (figure 2). Alice Arm is typical of most B.C. glacial inlets, long, narrow and bordered by high mountains. The deepest point is approximately 394 metres (over 1200 feet) and a shallow sill is located near the mouth of Alice Arm, separating the arm from Observatory Inlet (figure 3). The two main river systems, the Kitsault and Illiance rivers, discharge into the head of Alice Arm. The Kitsault River is the main source of natural glacial silt to Alice Arm. Both rivers support salmon stocks which are chiefly chum, pink, chinook and coho salmon. Various species of groundfish, shrimp and crab also inhabit the sea bed of Alice Arm, the area most likely to be affected by tailings deposition.

1.3 B.C. Molybdenum - former operation

The Kitsault mine was originally operated by British Columbia Molybdenum Ltd. between 1968 and 1972. The mill capacity was approximately 6,000 tons per day. The tailings effluent, which consists of a slurry of fine sand

like material, after extraction of the molybdenum, was discharged directly into Lime Creek which flows into the head of Alice Arm. During the period of operation roughly 12.6 million tons of tailings were discharged into Alice Arm. As shown by figure 4 existing tailings deposits from the B.C. Molybdenum operation extend approximately 5 1/4 miles seaward of Lime Ck. This is based upon molybdenum analysis of the surface sediment in Alice Arm by Amax Canada Ltd. and Environment Canada. The primary source of molybdenum would be the B.C. Molybdenum tailings deposits. The area of tailings deposition is confined to Alice Arm and has not been detected beyond the sill which separates the arm from Observatory Inlet.

1.4 Amax Canada Ltd.

Amax Canada Ltd. is proposing to start operation in 1981 and will be producting about 12,000 tons of ore per day, twice that of the previous operation. The present ore reserves are expected to last about 26 years and represents some 100 million tons in total. The operations carried on at the Kitsault Mine include open pit mining and milling of the ore to produce a molybdenum concentrate. The milling operation involves crushing and grinding the rock, and removing the molybdenum minerals. About 20 tons of molybendum concentrates per day will be produced. The Kitsault mine will not involve smelting as in the case of Anyox. The tailings disposal system will consist of a pipeline from the mill which will be situated between the mouth of Lime Creek and Roundy Creeks and extend to a depth of 50 metres below the surface of Alice Arm.

2. Authorization under the Fisheries Act

After undertaking several feasibility studies of on-land tailings disposal, Amax Canada Ltd. applied for special provisions under the Fisheries Act to discharge tailings directly in Alice Arm. Based upon available information from studies by Amax Canada Ltd. and the federal Department of the Environment and of Fisheries and Oceans it was decided that marine disposal would be an acceptable environmental option over the long term, in view of the risks presented by a tailings dam, particularly after the mine had shut down. While disposal of tailings on land would be not impossible, it would be clearly a difficult proposition. Failure of a tailings dam could have greater environmental consequences (e.g., the destruction of fisheries and wildlife resources using the Kitsault/Illiance River estuary) than the

impacts predicted for marine disposal in Alice Arm. Although it is not possible to predict the possibility of a major tailings pond failure, and it might never occur, the difficulties of maintaining a tailings pond forever in an earthquake zone under heavy rain and snowfall conditions, lead the departments to recommend marine disposal of tailings under certain prescribed conditions. This, plus the fact that the area had previously been the site for marine tailings disposal (tailings which are now covered by natural sediments) lead the Departments to accept the application to discharge tailings directly into Alice Arm, under certain prescribed conditions.

2.1 Alice Arm Tailings Deposit Regulations

The Alice Arm Tailings Deposit Regulations (Appendix I), passed in April, 1979 authorized the deposit of tailings from the Kitsault Mine into Alice Arm. The Regulations contain several conditions including:

a) The outfall pipe must be 50 metres below the surface and the tailings must remain below the 100 metre level. The top 100 metres is biologically active, and keeping the tailings below 100 metres will limit the impact that the tailings might have, on fish and primary productivity in the top 100 metres. More important, discharging the tailings at depth will reduce mixing and limit spread of tailings.

b) The tailings must stay in Alice Arm and not pass West of a North-South line at 120 39' 45" which runs through the vicinity of Hans Point. The depth of Alice Arm and a natural ridge at Hans Point is expected to contain the tailings within this area.

c) Conditions also limit the quantity and character of the tailings that may be deposited. Although the solid portion of the tailings contain heavy metals (lead, zinc, cadmium) another condition requires that the company attempt to find practical means to remove the trace amounts of lead, zinc and cadmium minerals from the tailings.

d) Concentrations of metal dissolved in the tailings effluent may not exceed prescribed limits. Also the liquid portion of the tailings effluent must not be actutely toxic to fish. The Regulations prescribe a test procedure.

Figure 5 and 6 illustrate the horizontal and vertical boundaries in Alice Arm under the federal Alice Arm Tailings Deposit Regulations (AATDR). Figure 7 shows the relationship of existing tailings deposits from the previous B.C. Molybdenum operation to the boundaries prescribed by the Alice Arm regulations.

2.2 Monitoring Requirements

In addition to monitoring requirements for the Provincial Waste Management Branch permit, Amax Canada Ltd. under the AATDR will be required to monitor the mill tailings effluent and tailings deposition in Alice Arm to ensure compliance with the regulations. During the operation both the Department of Environment and Fisheries and Oceans will be periodically conducting independent studies to ensure compliance and will monitor the impact on the marine resources in Alice Arm.

Studies to be undertaken by Amax Canada Ltd. under the AATDR will include:

a) characterization of the effluent (weekly and monthly) regarding the dissolved metal content and acute toxicity

b) monitoring the total metal content in the solid portion of the mill tailings

c) further research to remove additional lead, zinc and cadmium from the tailings

d) monitor the tailings distribution in Alice Arm both suspended in the water and along the bottom in relation to the AATDR boundaries

As well as the legal monitoring requirements under the AATDR it is anticipated that both Amax Canada Ltd. and the Federal Government will be regularly conducting additional studies both inside and outside the area of tailings deposition. This will involve biological studies designed to measure the physical impact of tailings deposition as well as monitor the heavy metal content of various food fishes and food chain organisms.

3. Pre-operational Investigations

In addition to studies carried out by Amax Canada Ltd. which are summarized in a report by J.L. Littlepage entitled "Oceanographic and Marine Biological Surveys, Alice Arm and Hastings Arm, B.C. 1974-1977" the federal government has conducted a number of independent field investigations beginning in June, 1976. These included:

a) preliminary studies involving underwater observations and shoreline inspection of both the Alice Arm and Anyox area in June, 1976.

b) underwater surveys in both Alice Arm and Hastings Arm using the submersible Pisces IV to document the type and relative abundance of the marine life inhabiting the sea floor - October, 1976.

c) bottom trawls and shoreline studies in both Alice Arm and Hastings Arm to obtain a cross section of marine species for heavy metal analysis and to further evaluate their relative abundance - June, 1977 and October, 1978.

d) studies to evaluate the heavy metal distribution in the bottom sediments of Alice Arm and Hastings Arms and the associated pore waters. October, 1978 and May, 1980.

e) studies to determine pre-operational turbidity and suspended solids levels in Alice Arm to serve as baseline information for monitoring compliance with the Alice Arm Tailings Deposit Regulations. Further evaluation of the heavy metal content in marine sediment above and below the regulation boundaries was also carried out. May, 1980.

Results of investigations which have been completed can be summarized as follows:

3.1 Sediment Heavy Metal Content

In general terms, the deeper portions (10-32 cm) of core samples from Alice Arm reflected the metal concentrations which have been reported for the B.C. Molybdenum discharge. The surface layer (0-2cm), although showing levels above background, were considerably lower due to dilution by natural

sediment deposition which has taken place since 1972 when B.C. Molybdenum ceased operation. Depending upon the metal considered the most seaward extent of elevated metal content in the surface sediments ranges between 3 and 8 nautical miles from the original point of discharge (ie., Lime Ck) and tailings still remain inside the sill which separates Alice Arm from Observatory Inlet. A statistical estimation of the metal concentrations in the sediment near the source (i.e., Lime Ck) compared to sediment from outside Alice Arm (background) for the following metals was as follows:

Sediment Heavy metal content - ppm, dry wt.

Area	Copper	Lead	Zinc	Cadium
Background	56±13	21.3±4.5	124±14.9	2.4±1.4
Alice Arm (Lime Ck area)				
0-2	66.5	49.7	167.6	5.2
10-12 cm	78.0	81.7	209.2	11.0
20-22 cm	105.2	227.2	374.3	36.1
30-32 cm	86.6	130.2	382.3	28.1

3.2 Bottom Trawl and Submersible Observations

Crustaceans appear to be the most dominant marine species inhabiting the seafloor in the deeper portion of Alice and Hastings Arms. Of the potentially commercial species the spiny pink and sidestripe shrimp are the most numerous with tanner crab and the brown and Alaskan King crab present in fewer numbers. The shrimp catches in Alice Arm were comparable to those in Quatsino Sound and outer portions of Howe Sound which supports a limited commercial shrimp fishery. Without comparable data on king crab from other inlets in B.C. their relative abundance in Alice Arm cannot be determined. Fish species, eg., sole were not present in large numbers in the trawl catch nor commonly seen during the submersible observations and generally fewer in comparison to areas such as Quatsino Sound, Rupert Inlet and Howe Sound where similar studies have been undertaken. Studies however, have not taken into account seasonal differences in population.

3.3 Tissue Heavy Metal Content

Heavy metal analysis has been carried out on various species caught in the bottom trawls and collected from the shoreline of both Alice Arm and adjacent Hastings Arm. The results have been compared to other areas, eg., Howe Sound (Britannia Mine), Anyox (Smelter) and Quatsino Sound (Island Copper Mine). With the exception of mussels taken from the area around the mouth of Lime Creek there appeared to be no clear indication of heavy metal uptake in organisms taken from those areas of Alice Arm affected by B.C. Molybdenum tailings deposits. Copper, lead, zinc, cadmium, arsenic and mercury concentrations found in muscle tissue from 2 species of commercial shrimp, brown king crab, dungeness crab, pollock and sole were similar to those found in Quatsino Sound which lies outside the area of tailings deposits from the Island Copper Mine Rupert Inlet. Arsenic levels, although somewhat higher in Alice Arm than Quatsino Sound, again were similar to Hastings Arm, suggesting that these levels reflect natural background for the area. Analysis of tissue samples from Howe Sound and Anyox do indicate that, under certain conditions, when organisms

are exposed to very high heavy metal concentrations some metal uptake in the tissues will occur. In the case of Alice Arm, it is not anticipated that the organisms will be exposed to such high levels in either the water or sediment. However, the heavy metal content of various indicator and commercially important species will be closely monitored.

Summary of Information Pertaining to the Uranium Content in Kitsault Mine Tailings

Chemical analysis of the ore indicated that the uranium content of the Kitsault ore was the same as normal background in ordinary rock. The average of the 383 samples (which represented the whole ore-body) analysed for Amax Canada by Skyline Laboratories in Colorado gave an average that was less than 2.3 parts per million (ppm) uranium. The average of rock in the upper continental crust of the earth is considered to be about 3.5 ppm uranium (according to Dyck, 1964).

The average for stream sediments for 1778 samples over the Nass River area was 3.76 ppm according to the 1978 geochemical survey of the B.C. Dept. of Energy, Mines and Petroleum Resources.

Analysis of ten random samples (of the above 383 samples) were conducted by Bondary-Clegg and Company, a Canadian laboratory employed by Environment Canada showed results similar to the Skyline data.

Samples of sediment taken from Alice Arm in October, 1978 ranged from 1.0 to 1.5 ppm uranium, slightly less than that found in similar samples taken from Hastings Arm. A similar pattern was observed with radium 226, indicating that tailings deposits from the B.C. Molybdenum mine, which should reflect conditions that will exist during the Amax operation, did not result in an increase in radio-active material above normal background levels for the area.

June 26, 1980

Amax of Canada Ltd.,
Kitsault Mine, Alice Arm, B.C.

DFO Position Summary

Fisheries and Oceans consented to an exemption for the Kitsault Mine from the Federal Metal Mining Regulations to permit the disposal of mine tailings into the marine environment, based on the premise that the tailings will remain at depth, and will be totally confined within Alice Arm.

Effects on Fishery Resources

Salmon populations utilizing Alice Arm should not be adversely affected by the discharge. It was considered that failure of an on-land tailings impoundment at any time could destroy valuable fisheries and wildlife habitat in the Kitsault, Illiance or Nass rivers.

The tailings will result in the elimination or displacement of bottom-dwelling organisms and the modification of the bottom habitat; however, it is recognized that in relation to the resources of other B.C. inlets, the groundfish and crustacean (crabs, shrimps, prawns) populations within Alice Arm do not constitute a major fishery.

Intertidal shellfish outside of Alice Arm, such as cockles, and their larvae should not be adversely affected by the discharge.

It is anticipated that there will be an elevation in metal levels in aquatic organisms in the area of tailings accumulation. It is likely that the extent of metal elevations will be confined to Alice Arm, but routine monitoring programs will be carried out to assess the degree and extent of metal contamination from the tailings discharge. Should metal levels exceed acceptable standards, the company must act to decrease metal levels in the tailings discharge or, alternatively, cease the tailings discharge. Furthermore, the company must continually strive to reduce heavy metal levels in the tailings prior to their discharge into Alice Arm.

It is not expected that there will be any contamination of aquatic organisms by Radium 226.

Recovery and Recolonization

Following cessation of the discharge, deposition of natural silts over the tailings and successional events should lead to the re-establishment of benthic communities and fish stocks within Alice Arm.

Registration
SOR/79-345 10 April, 1979

FISHERIES ACT

Alice Arm Tailings Deposit Regulations

P.C. 1979-1112 4 April, 1979

His Excellency the Governor General in Council, on the recommendation of the Minister of Fisheries and the Environment, pursuant to subsections 33(12) and (13) and 33.1(3) of the Fisheries Act, is pleased hereby to make the annexed Regulations respecting the authorization to deposit deleterious substances in mill process effluent from the operation of the Kitsault Mine into the waters of Alice Arm, British Columbia.

REGULATIONS RESPECTING THE AUTHORIZATION TO DEPOSIT DELETERIOUS SUBSTANCES IN MILL PROCESS EFFLUENT FROM THE OPERATION OF THE KITSAULT MINE INTO THE WATERS OF ALICE ARM, BRITISH COLUMBIA

Short Title

1. These Regulations may be cited as the Alice Arm Tailings Deposit Regulations.

Interpretation

2. (1) In these Regulations,

"Act" means the *Fisheries Act*;

"Kitsault Mine" means the mine located within the aggregate of the areas, all situated in the Skeena Mining Division, Cassiar Land District, in the Province of British Columbia, to which Mineral Leases Numbers M 157 to M 191 inclusive (dated February 23, 1967 and issued by the Minister of Petroleum Resources of the Province of British Columbia) apply.

(2) In these Regulations, the following words and expressions, namely,

(*a*) "composite sample",
(*b*) "deposit",
(*c*) "final discharge point",
(*d*) "mill process effluent",
(*e*) "mine",
(*f*) "Minister", and
(*g*) "total suspended matter",

have the meanings assigned to those words and expressions in the *Metal Mining Liquid Effluent Regulations*.

Enregistrement
DORS/79-345 10 avril 1979

LOI SUR LES PÊCHERIES

Règlement sur les rejets de stériles dans le bras Alice

C.P. 1979-1112 4 avril 1979

Sur avis conforme du ministre des Pêches et de l'Environnement et en vertu des paragraphes 33(12) et (13) et 33.1(3) de la Loi sur les pêcheries, il plaît à Son Excellence le Gouverneur général en conseil d'établir le Règlement autorisant le rejet dans les eaux du bras Alice d'effluents des installations de préparation du minerai de la mine Kitsault, en Colombie-Britannique, et des substances nocives qu'ils contiennent, ci-après.

RÈGLEMENT AUTORISANT LE REJET DANS LES EAUX DU BRAS ALICE D'EFFLUENTS DES INSTALLATIONS DE PRÉPARATION DU MINERAI DE LA MINE KITSAULT, EN COLOMBIE-BRITANNIQUE, ET DES SUBSTANCES NOCIVES QU'ILS CONTIENNENT

Titre abrégé

1. Le présent règlement peut être cité sous le titre: *Règlement sur les rejets de stériles dans le bras Alice.*

Définitions

2. (1) Dans le présent règlement,

«Loi» désigne la *Loi sur les pêcheries*;

«mine Kitsault» désigne la mine située sur les concessions minières nos M 157 à M 191 inclusivement, (datées du 23 février 1967 et émises par le ministre des Ressources pétrolières de la Colombie-Britannique), toutes situées dans la Division minière de Skeena du district de Cassiar, en Colombie-Britannique.

(2) Dans le présent règlement, les termes et expressions

a) «échantillon composite»,
b) «rejeter»,
c) «point de rejet final»,
d) «effluents des installations de préparation du minerai»,
e) «mine»,
f) «Ministre», et
g) «matière totale en suspension»

ont le sens qui leur est attribué dans le *Règlement sur les effluents liquides des mines de métaux*.

Application

3. (1) These Regulations apply to the deposit of mill process effluent emanating from the operation of the Kitsault Mine into the waters of Alice Arm, British Columbia.

(2) The *Metal Mining Liquid Effluent Regulations* do not apply to the deposit of mill process effluent emanating from the operation of the Kitsault Mine into the waters of Alice Arm, British Columbia.

Substances Prescribed as Deleterious Substances

4. For the purpose of paragraph (*c*) of the definition "deleterious substance" in subsection 33(11) of the Act, the following substances contained in mill process effluent from the operations or processes of the Kitsault Mine are hereby prescribed as deleterious substances:

(*a*) arsenic;
(*b*) copper;
(*c*) lead;
(*d*) nickel;
(*e*) zinc;
(*f*) total suspended matter;
(*g*) radium 226; and
(*h*) cadmium.

Authorization

5. Subject to the conditions set out in sections 6 to 10, the operator of the Kitsault Mine is hereby authorized to deposit into the waters of Alice Arm total suspended matter in any concentration contained in mill process effluent and the deleterious substances prescribed by paragraphs 4(*a*) to (*e*) and 4(*g*) and (*h*) contained in mill process effluent, if

(*a*) the deposit is made in such a manner that the solid portion of the tailings from the mill process effluent does not pass west of a north-south line at 129°39′45″ west longitude that runs through the vicinity of Hans Point, British Columbia; and

(*b*) the solid portion of the tailings from the mill process effluent is not deposited on

(i) the bed of any part of the estuaries of the Illiance River or the Kitsault River, or

(ii) the bed of Alice Arm at any place that is less than 100 m below mean sea level, except as provided in section 7.

De-aeration and Treatment

6. (1) The mill process effluent shall be de-aerated and otherwise treated prior to being deposited into the waters of Alice Arm to prevent solid tailings particles contained therein from moving upward from the final discharge point of any outfall structure.

(2) Except as provided in section 7, the deposit of mill process effluent shall be made in such a manner that solid tailings particles do not remain in suspension in the waters of Alice Arm above a depth of 100 m (mean sea level).

Application

3. (1) Le présent règlement s'applique au rejet dans le bras Alice d'effluents des installations de préparation du minerai de la mine Kitsault, en Colombie-Britannique.

(2) Le *Règlement sur les effluents liquides des mines de métaux* ne s'applique pas au rejet dans le bras Alice d'effluents des installations de préparation du minerai de la mine Kitsault, en Colombie-Britannique.

Substances déclarées nocives

4. Aux fins de l'alinéa *c*) de la définition de «substance nocive», au paragraphe 33(11) de la Loi, sont déclarées nocives les substances suivantes contenues dans les effluents des installations de préparation du minerai provenant des opérations ou des procédés de la mine Kitsault:

a) l'arsenic;
b) le cuivre;
c) le plomb;
d) le nickel;
e) le zinc;
f) les matières totales en suspension;
g) le radium 226; et
h) le cadmium.

Autorisation

5. Sous réserve des conditions visées aux articles 6 à 10, l'exploitant de la mine Kitsault est autorisé à rejeter les effluents des installations de préparation du minerai dans le bras Alice, peu importe leur concentration en matières totales en suspension, ainsi que les substances nocives prescrites aux alinéas 4*a*) à *e*) et 4*g*) et *h*)

a) si ces rejets sont effectués de manière que la fraction solide des stériles de ces effluents ne franchit pas vers l'ouest la ligne tracée dans le sens nord-sud à la longitude 129°39′45″O, dans le voisinage de la pointe Hans, en Colombie-Britannique; et

b) si cette fraction solide des stériles n'est pas rejetée

(i) sur le fond de l'estuaire des rivières Illiance ou Kitsault, ou

(ii) sur le fond du bras Alice partout où il est à moins de 100 m sous le niveau moyen de la mer, sauf dans les cas prévus à l'article 7.

Désaération et traitement

6. (1) Les effluents des installations de préparation du minerai doivent être désaérés ou autrement traités avant leur rejet dans le bras Alice, pour empêcher les particules solides de stériles qu'ils contiennent de remonter vers le point de rejet final des exutoires.

(2) Sauf dans les cas prévus à l'article 7, le rejet des effluents des installations de préparation du minerai doit se faire de manière que les particules solides de stériles ne restent pas en suspension dans le bras Alice à moins de 100 m sous le niveau moyen de la mer.

Outfall Structure

7. (1) Subject to the terms of an order of the Minister referred to in subsection (2), the final discharge point of any outfall structure for the deposit of mill process effluent from the Kitsault Mine shall be not less than 50 m below mean sea level.

(2) Where the Minister has evidence that the deposit of mill process effluent is not made in accordance with subparagraph 5(*b*)(ii) or subsection 6(2), the Minister may, by an order made under subsection 33.1(2) of the Act, require the operator of the Kitsault Mine to extend the final discharge point of any outfall structure to a depth between 50 and 100 m below mean sea level.

(3) Solid tailings particles may

(*a*) be deposited on that portion of the bed of Alice Arm in the vicinity of the final discharge point of the outfall structure where the bed is at a depth of less than 100 m but more than 50 m below mean sea level; and

(*b*) be suspended in the waters of Alice Arm in the vicinity of the final discharge point of the outfall structure where the water is less than 100 m deep but more than 50 m deep (mean sea level).

(4) Where the Minister has made an order referred to in subsection (2) that requires the final discharge point of any outfall structure to extend to a depth greater than 50 m below mean sea level, the reference to 50 m below mean sea level in paragraphs (3)(*a*) and (*b*) shall be deemed to be references to the depth specified in the order.

Solid Portion of Mill Process Effluent

8. The mill process effluent shall not be deposited into the waters of Alice Arm unless

(*a*) the solid portion of the mill process effluent originates from ore mined from the Kitsault Mine; and

(*b*) the solid portion of mill process effluent deposited since the date of the coming into force of these Regulations does not exceed in weight 100,000,000 t.

Liquid Portion of Mill Process Effluent

9. (1) The mill process effluent shall not be deposited into the waters of Alice Arm unless, before any dilution of the liquid portion of the mill process effluent after it leaves the mill,

(*a*) the liquid portion of the mill process effluent passes the acute lethality test for fish, described in the schedule, and

(*b*) the monthly arithmetic mean of the dissolved concentration of any deleterious substance prescribed by section 4 contained in the liquid portion of the mill process effluent, listed in column I of an item of the table to this section, is less than the concentration set out in column II of that item and the daily dissolved concentration of the substance monitored in accordance with subsection (2) is less than the concentration, set out in column III of that item,

using composite samples.

Exutoires

7. (1) Sous réserve des conditions de l'ordonnance du Ministre visée au paragraphe (2), le point de rejet final des exutoires pour le rejet des effluents des installations de préparation du minerai de la mine Kitsault doit être à au moins 50 m sous le niveau moyen de la mer.

(2) Lorsque le Ministre a la preuve que le rejet des effluents des installations de préparation du minerai ne se conforme pas au sous-alinéa 5*b*)(ii) ou au paragraphe 6(2), il peut, au moyen d'une ordonnance décrétée en vertu du paragraphe 33.1(2) de la Loi, exiger de l'exploitant de la mine Kitsault la relocalisation de tout point de rejet final de l'exutoire à une profondeur variant entre 50 et 100 m sous le niveau moyen de la mer.

(3) Les particules solides de stériles peuvent

a) être rejetées sur la partie du fond du bras Alice, dans le voisinage du point de rejet final de l'exutoire, si le fond se trouve à plus de 50 et à moins de 100 m sous le niveau moyen de la mer; et

b) rester en suspension dans le bras Alice, dans le voisinage du point de rejet final de l'exutoire, à une profondeur variant entre 50 et 100 m sous le niveau moyen de la mer.

(4) Lorsque le Ministre a rendu l'ordonnance visée au paragraphe (2) qui exige la relocalisation du point de rejet final de l'exutoire à une profondeur de plus de 50 m sous le niveau moyen de la mer, cette profondeur est censée viser la limite de 50 m paraissant aux alinéas (3)*a*) et *b*).

Fraction solide des effluents des installations de préparation du minerai

8. Les effluents des installations de préparation du minerai ne peuvent être rejetés dans le bras Alice que

a) si leur fraction solide provient de minerais extraits de la mine Kitsault; et

b) jusqu'à ce que leur fraction solide représente 100,000,000 t depuis la date d'entrée en vigueur du présent règlement.

Fraction liquide des effluents des installations de préparation du minerai

9. (1) Les effluents des installations de préparation du minerai peuvent être rejetés dans le bras Alice si des examens d'échantillons composites établissent que la fraction liquide de ces effluents, avant sa dilution à la sortie des installations

a) satisfait au contrôle de létalité aiguë pour les poissons, décrit en annexe; et

b) si les moyennes arithmétiques mensuelles de la concentration des substances visées à l'article 4, contenues dans cette fraction liquide et figurant au tableau du présent article sont moindres que celles visées à la colonne II, et si la concentration journalière dissoute des substances contrôlées conformément au paragraphe (2) est inférieure à celles visées à la colonne III.

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(2) The daily dissolved concentration referred to in paragraph (1)(*b*) shall be monitored at the intervals and in the manner directed in writing by the Minister pursuant to subsection 33(14) of the Act.

TABLE

Item	Column I Substance	Column II Monthly Arithmetic Mean Concentration	Column III Daily Concentration
1.	arsenic	0.40 mg/ℓ	0.60 mg/ℓ
2.	copper	0.05 mg/ℓ	0.10 mg/ℓ
3.	lead	0.05 mg/ℓ	0.10 mg/ℓ
4.	nickel	0.20 mg/ℓ	0.4 mg/ℓ
5.	zinc	0.10 mg/ℓ	0.20 mg/ℓ
6.	radium 226	10.0 p Ci/ℓ	20.0 p Ci/ℓ
7.	cadmium	0.01 mg/ℓ	0.02 mg/ℓ

Recovery of Lead, Zinc, or Cadmium

10. Prior to and during the operation of the Kitsault Mine, the operator thereof shall, through research, work diligently toward the development of methods to recover and, if it is practical to do so, shall recover lead, zinc and cadmium from the tailings for sale as concentrates or for disposal on land as separate tailings.

(2) La concentration journalière dissoute visée à l'alinéa (1)*b*) doit être contrôlée aux intervalles et de la manière ordonnés par écrit par le Ministre conformément au paragraphe 33(14) de la Loi.

TABLEAU

Article	Colonne I Substance	Colonne II Moyenne arithmétique mensuelle de la concentration	Colonne III Concentration journalière
1.	Arsenic	0.40 mg/ℓ	0.60 mg/ℓ
2.	Cuivre	0.05 mg/ℓ	0.10 mg/ℓ
3.	Plomb	0.05 mg/ℓ	0.10 mg/ℓ
4.	Nickel	0.02 mg/ℓ	0.04 mg/ℓ
5.	Zinc	0.10 mg/ℓ	0.20 mg/ℓ
6.	Radium 226	10.0 p Ci/ℓ	20.0 p Ci/ℓ
7.	Cadmium	0.01 mg/ℓ	0.02 mg/ℓ

Récupération du plomb, du zinc ou du cadmium

10. Avant et pendant l'exploitation de la mine Kitsault, l'exploitant doit diligemment entreprendre la recherche nécessaire à la mise au point de méthodes de récupération du plomb, du zinc et du cadmium à partir des stériles et, si possible, les appliquer, afin de vendre ces métaux sous forme de concentrés ou de les épandre séparément sur le sol, sous forme de stériles distincts.

SCHEDULE

THE MEASUREMENT OF ACUTE LETHALITY IN THE LIQUID PORTION OF MILL PROCESS EFFLUENT

1. (1) For the purposes of this schedule, the applicable portions of section 231 of the publication Standard Methods for the Examination of Water and Wastewater, 13th edition (1971), published jointly by the American Public Health Association, American Water Works Association and the Water Pollution Control Federation shall be used as a basis for this test procedure except as otherwise provided in this schedule.

(2) The bioassay sample shall be the liquid portion of a composite sample.

(3) When the bioassay sample is transported or stored, the sample shall be kept in filled, sealed containers excluding any air.

(4) The sample shall not be aerated during storage and shall not be held more than five days prior to the commencement of this test procedure.

(5) Rainbow trout (*Salmo gairdneri* Richardson) shall be used as the test species of fish.

(6) Only healthy stocks of fish acclimated to fresh water shall be used as test fish.

ANNEXE

CONTRÔLE DE LA LÉTALITÉ AIGUË DE LA FRACTION LIQUIDE DES EFFLUENTS DES INSTALLATIONS DE PRÉPARATION DU MINERAI

1. (1) Aux fins de la présente annexe, les parties applicables de la section 231 du recueil «Standard Methods for the Examination of Water and Wastewater», 13e édition (1971), publiée conjointement par l'American Public Health Association, l'American Water Works Association et la Water Pollution Control Federation servant de fondement opératoire au présent contrôle, sous réserve des dispositions de la présente annexe.

(2) L'échantillon soumis au contrôle biologique doit être la fraction liquide d'un échantillon composite.

(3) L'échantillon soumis au contrôle biologique qui est transporté ou entreposé, doit être conservé dans des contenants hermétiques, remplis de manière à exclure toute trace d'air.

(4) L'échantillon ne doit pas entrer au contact de l'air pendant l'entreposage et ne doit pas être conservé plus de cinq jours avant le début des contrôles.

(5) L'espèce utilisée dans le contrôle doit être la truite arc-en-ciel (*Salmo gairdneri* Richardson).

(6) Seules des truites acclimatées à l'eau douce et en bonne santé doivent être utilisées pour le contrôle.

(7) Individual test fish shall weigh between 0.5 and 10 g and the length of the largest fish in a test vessel shall not be more than two times the length of the smallest fish in the same test vessel.

(8) A minimum of five test fish shall be exposed to a 100% concentration of the bioassay sample for a period of 96 hours and an equal number of control fish shall be exposed to control water during that period.

(9) The test is rendered invalid if more than 10% of the fish in the control water die.

(10) For every one g of fish, there shall be at least one ℓ of bioassay sample or control water for every 24 hours that the fish are exposed to the sample or control water.

(11) The water depth in any test vessel shall not be less than 15 cm.

(12) Immediately prior to the commencement of this test procedure, the pH of the bioassay sample shall be measured and if it is outside the pH range of 6.5 to 7.5, the pH shall be adjusted to 7.0 ± 0.5.

(13) If the dissolved oxygen concentration of the bioassay sample is less than 7 mg per litre, the sample shall be aerated, prior to the commencement of this procedure test, for not more than two hours at a rate of 5.0 to 7.5 cc of air per minute per litre.

(14) An aeration rate of 5.0 to 7.5 cc per minute per litre shall be applied to the bioassay sample and control water throughout the duration of the test.

(15) The temperature of the bioassay sample and the control water shall be 15 ± 1°C throughout the duration of the test.

(16) The total number of dead fish shall be counted after 96 hours or at the termination of the test and dead fish shall be removed at least once each day.

(17) If a sample of incoming water to the mine kills 10% or more of the fish placed in the sample during a 96 hour period when tested in accordance with the test procedure contained in this schedule, the bioassay sample is invalid.

2. A bioassay sample passes the acute lethality test if not more than 50% of the fish die when tested in accordance with the test procedure set out in section 1 of this schedule.

(7) Les poissons servant au contrôle doivent peser entre 0.5 et 10 g, et, dans un récipient donné, la longueur du plus gros poisson ne doit pas être plus du double de celle du plus petit poisson.

(8) Au moins cinq poissons doivent séjourner pendant 96 h dans l'échantillon soumis au contrôle biologique. Les témoins, en nombre égal, à ceux qui servent au contrôle, doivent rester dans le milieu témoin pendant le même nombre d'heures.

(9) Le contrôle est nul si plus de 10% des poissons témoins meurent.

(10) La proportion à observer est de 1ℓ d'échantillon soumis au contrôle biologique ou de 1ℓ de milieu témoin par gramme de poisson et par période de 24 h.

(11) La profondeur de l'eau dans les récipients utilisés doit être d'au moins 15 cm.

(12) On doit mesurer le pH de l'échantillon soumis au contrôle biologique immédiatement avant le début du contrôle. Si le pH est inférieur à 6.5 ou supérieur à 7.5, on doit l'ajuster à 7.0 avec un écart 0.5.

(13) Si la teneur en oxygène dissous dans l'échantillon soumis au contrôle biologique est inférieure à 7 mg/ℓ, cet échantillon doit être aéré, avant le début du contrôle, pendant une période ne dépassant pas 2 h, à raison de 5.0 à 7.5 cm^3/min/ℓ d'air.

(14) On doit aérer l'échantillon soumis au contrôle biologique et le milieu témoin à raison de 5.0 à 7.5 cm^3/min/ℓ pendant toute la durée du contrôle.

(15) On doit s'assurer que la température de l'échantillon soumis au contrôle biologique et du milieu témoin restent à 15 avec un écart de 1° C pendant toute la durée du contrôle.

(16) On doit noter le nombre total de poissons morts après 96 h, ou à la fin du contrôle. On doit retirer les poissons morts au moins une fois par jour.

(17) Si au moins 10% des poissons meurent dans un échantillon des eaux d'alimentation de la mine au cours d'un contrôle de 96 h, conforme à la présente méthode, on doit rejeter l'échantillon soumis au contrôle biologique.

2. L'échantillon soumis au contrôle biologique satisfait au contrôle de létalité aiguë réalisé selon l'article 1 de la présente annexe si la mortalité des poissons ne dépasse pas 50%.

QUEEN'S PRINTER FOR CANADA, OTTAWA, 1979 IMPRIMEUR DE LA REINE POUR LE CANADA, OTTAWA, 1979

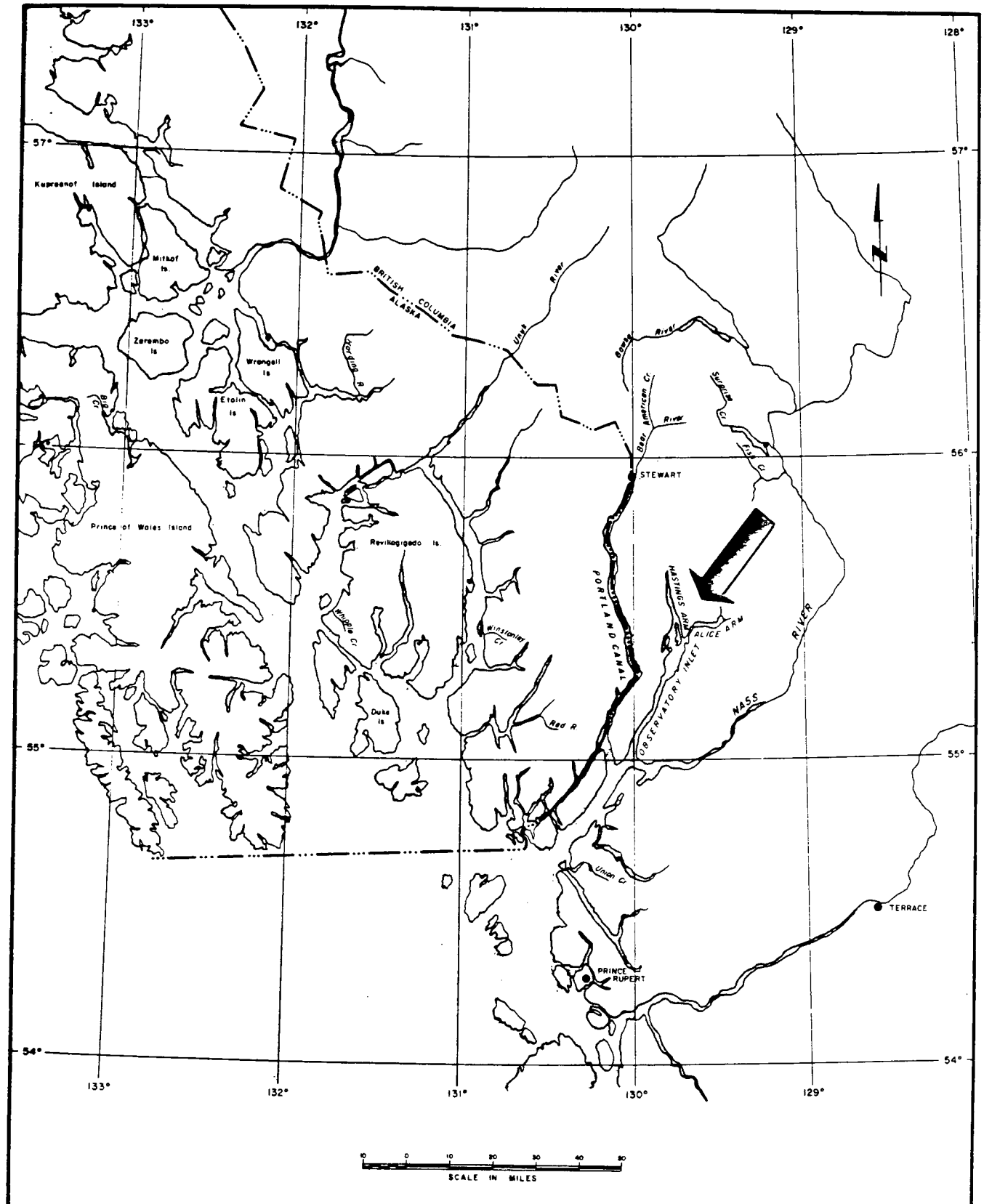

FIGURE 1.
MAP OF BRITISH COLUMBIA COAST

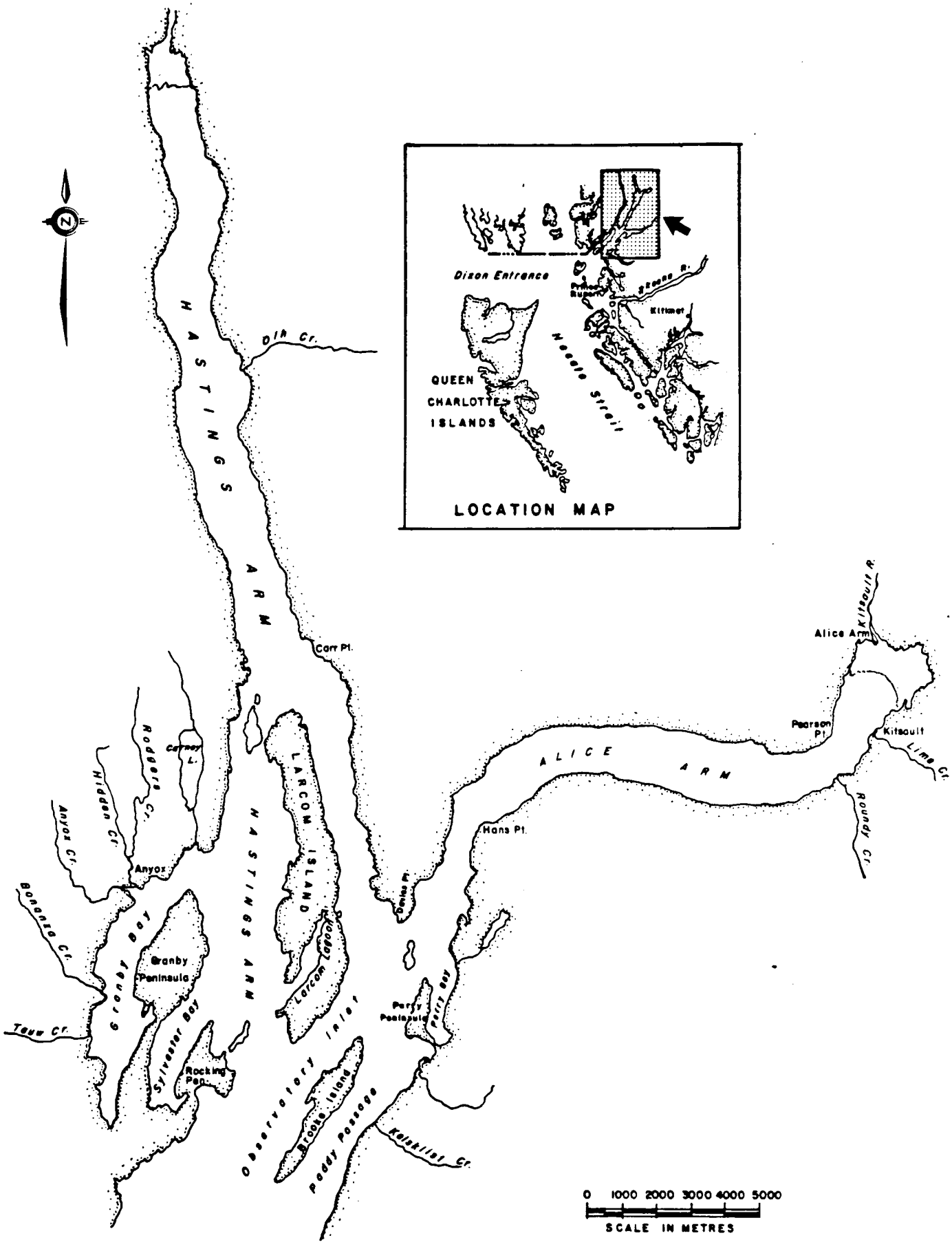

FIGURE 2 LOCATION MAP SHOWING ALICE ARM AND HASTINGS ARM

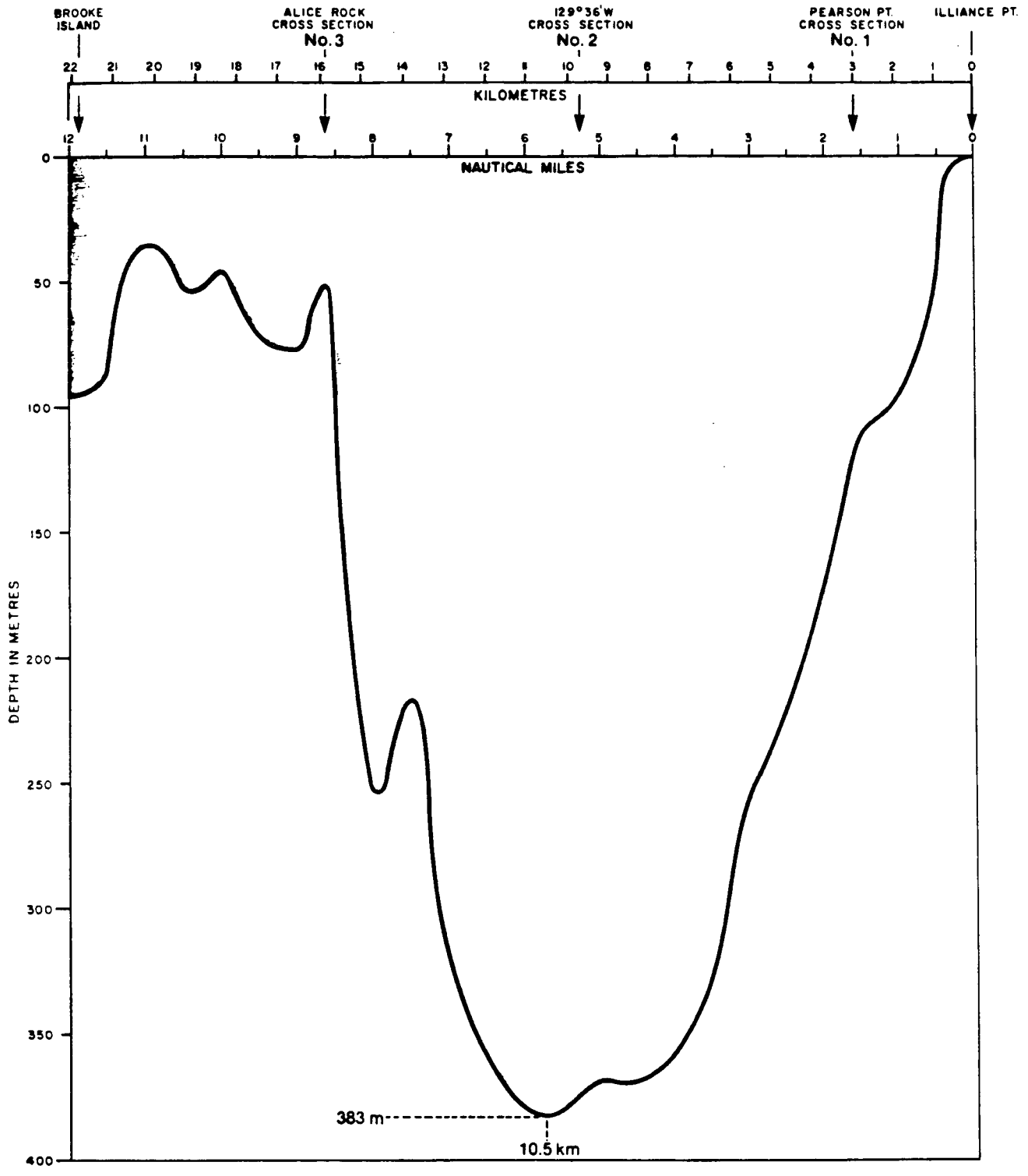

FIGURE 3
ALICE ARM LONGITUDINAL SECTION

(ILLIANCE / KITSAULT RIVER DELTA TO BROOKE ISLAND)

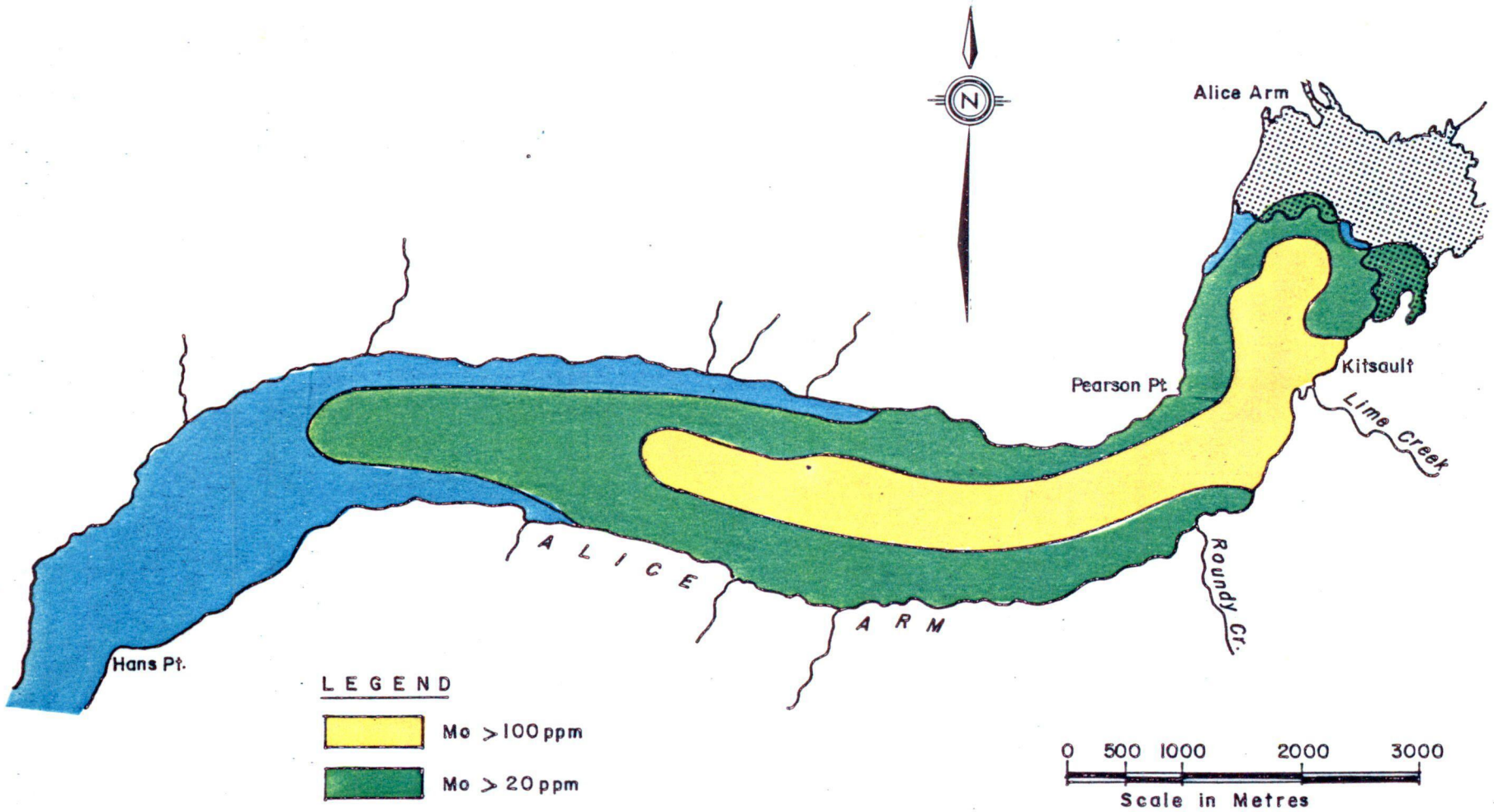

FIGURE 4 AREA OF B.C. MOLYBDENUM TAILINGS DEPOSITS - ALICE ARM, 1976
Based on Zn / Mo Analysis of Surface Sediments (Dobrocky Seatech, May 1976)

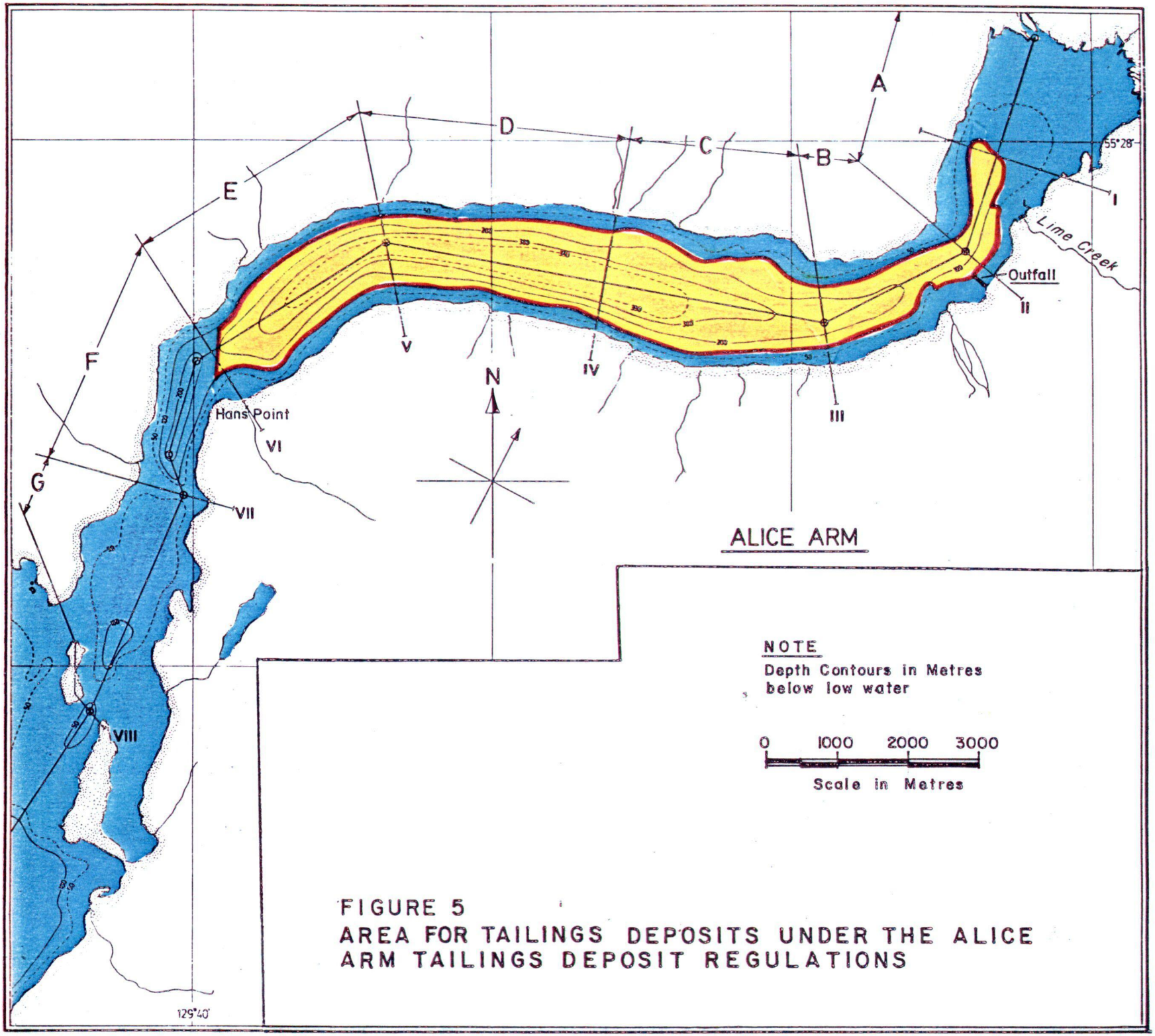

FIGURE 5
AREA FOR TAILINGS DEPOSITS UNDER THE ALICE ARM TAILINGS DEPOSIT REGULATIONS

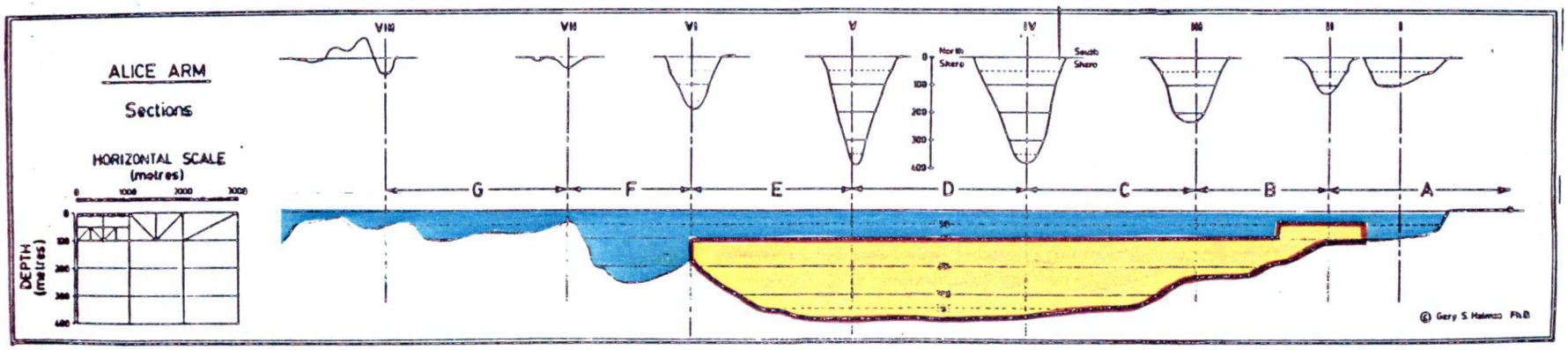

FIGURE 6
PROFILE SHOWING AREA FOR TAILINGS DEPOSITS UNDER THE ALICE ARM TAILINGS DEPOSIT REGULATIONS

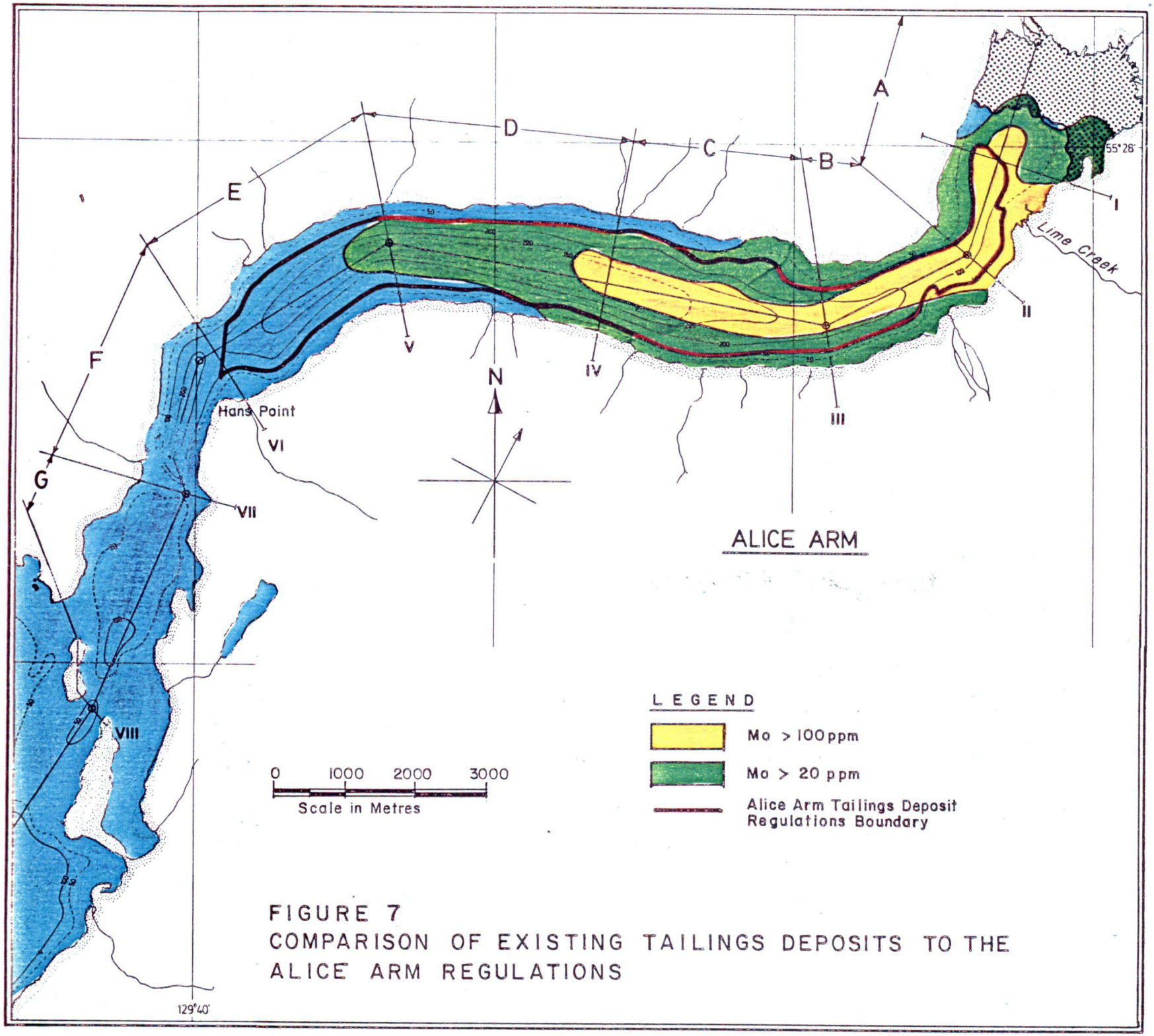

FIGURE 7
COMPARISON OF EXISTING TAILINGS DEPOSITS TO THE ALICE ARM REGULATIONS