

**FINAL REPORT ON A PROPOSAL
BY CANAMAX RESOURCES INC.
FOR THE DEVELOPMENT OF A
POTASH MINE AT RUSSELL, MANITOBA**

THE CLEAN ENVIRONMENT COMMISSION

FEBRUARY 23, 1989

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F O R W A R D

On December 19, 1988, The Clean Environment Commission submitted a Preliminary Report giving its conclusions and recommendations on the Manitoba Potash Project. In addition to the conclusions and recommendations which commence on page 28 of the present report, the Preliminary Report contained only brief descriptive and background material necessary to place the recommendations in context. The main material added to the final report is the account of submissions concerning the potash project which were presented to the Commission during the course of two public hearings, at Russell and Winnipeg, to review the project.

Final Report on a Proposal
by Canamax Resources Inc.
for the Development of a
Potash Mine at Russell, Manitoba

LICENCING REQUIREMENTS UNDER THE ENVIRONMENT ACT

On April 8, 1988, Canamax Resources Inc. submitted a proposal to the Environment Department, pursuant to the Environment Act, for the development of a potash mine and milling facility in the Rural Municipality of Russell. Potash mining and milling facilities are designated as a Class 3 development pursuant to the provisions of Manitoba Regulation 164/88 under the Environment Act. Accompanying this proposal was a detailed environmental impact assessment (EIA) which had been reviewed by a Provincial Technical Advisory Committee, the Interdepartmental Planning Board and the Provincial Land Use Committee of Cabinet. The Technical Advisory Committee are composed of representatives from government Departments appointed by the Minister of the Environment to review the project proposal.

Section 13 of the Environment Act provides that a licence may be issued in stages. A Stage 1 Licence was issued on September 29, 1988 by the Honourable Ed Connery, Minister of Environment and Workplace Safety and Health, with the requirement that public hearings be held and that a Stage 2 Licence be issued prior to development taking place at the site.

The Stage 1 licence stipulated that the environmental license would be issued in three stages, as follows:

- Stage 1 - Approval in Principle
- Stage 2 - Development and Construction
- Stage 3 - Operation

COMMISSION'S TERMS OF REFERENCE

On September 30, 1988, the Honourable Ed Connery requested the Clean Environment Commission to convene public hearings in Winnipeg and Russell and to provide him with recommendations for the content of a Stage 2 Licence by December 15, 1988. (Appendix A)

Mr. Connery requested that the Commission's review specifically include, but not be limited to, the following considerations:

1. A general review of the adequacy of the Proponent's environmental impact assessment with particular emphasis on:
 - (a) The adequacy of the Proponent's examination of alternative tailings management methods and the possibility of directing the Proponent to contribute funds to and undertake research in this area.
 - (b) The need for and the possible timing of the submission of a plan for the long term management and rehabilitation of the tailings area following closure of the operation.
2. Recommendations regarding limits, terms and conditions, if considered necessary, which should be applied to the development and construction phase of the operation.
3. Preliminary recommendations for limits, terms and conditions to be applied to the operational phase of the development.

Mr. Connery also anticipated a further review of the project being conducted prior to the operating phase, at which time a Stage 3 Licence would be issued imposing limits, terms and conditions on the operation.

A copy of the Stage 1 Licence dated September 29, 1988 is attached to this report as Appendix B.

COMMISSION'S TERMS OF REFERENCE (continued)

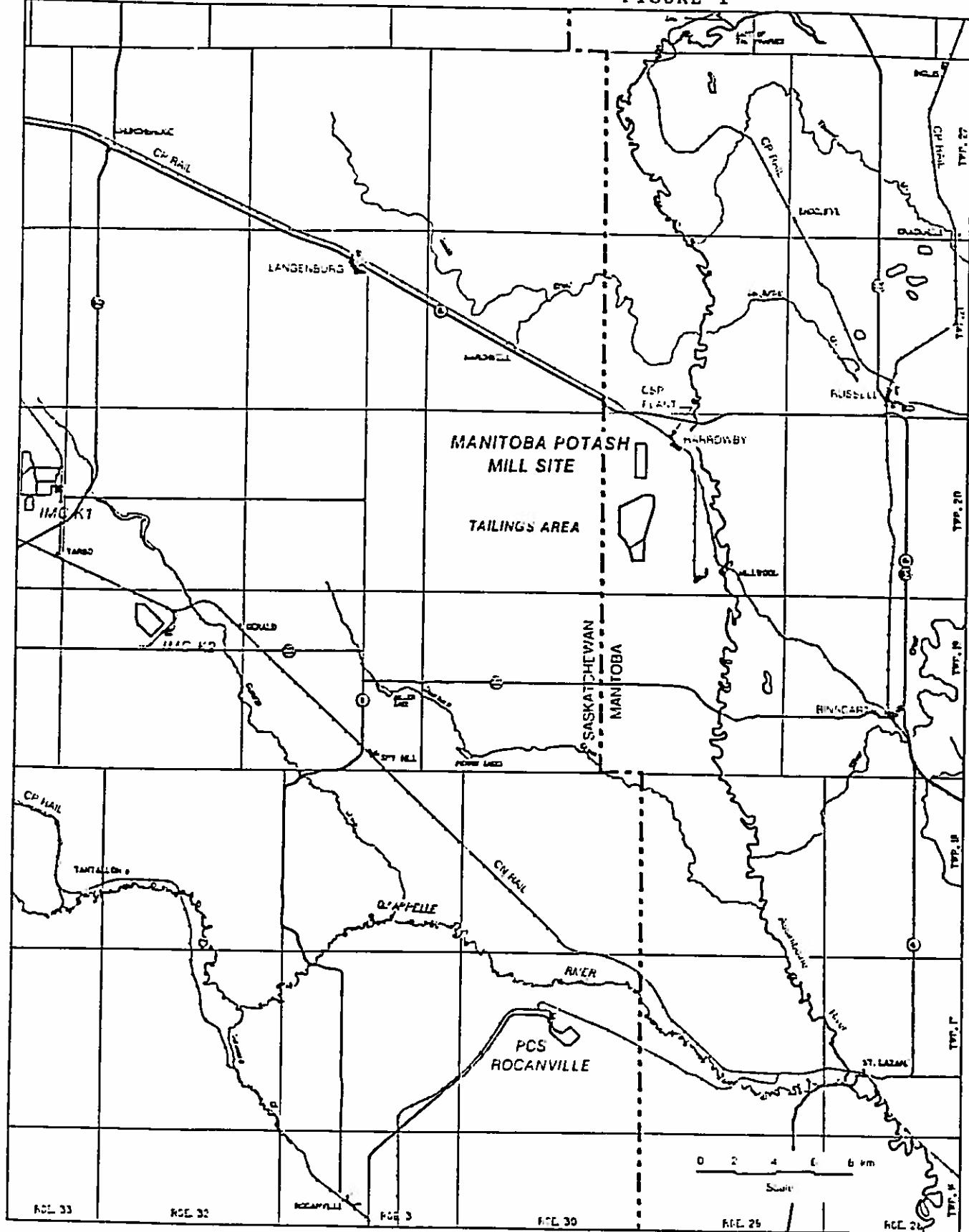
In accordance with the Minister's request, a preliminary report was submitted to his office on December 18th, 1988, providing recommendations for the content of a Stage 2 Licence. This final report includes the evidence, presentations, and arguments received at two hearings held in Russell and Winnipeg hearings. A list of exhibits received is included as Appendix C.

PROPOSED PROJECT

The Manitoba potash project is a joint venture between the Government of Manitoba and Canamax Resources Inc. to develop a potash project in western Manitoba. Assets of the project are held by a new entity, the Manitoba Potash Corporation, the shares of which are held 51 percent by Canamax Resources Inc. of Toronto, a public mining and exploration company, and 49 percent by the Province of Manitoba. In this arrangement, Canamax is responsible for all of the on-site activities including the feasibility study of the project. At this stage of the development, the Manitoba government's responsibility has involved marketing and financing activities.

The proposal called for the development of a major potash mineral deposit sufficient in size and grade to sustain a potash mine for twenty-five years or more. The project, to be located in the Rural Municipality of Russell, Manitoba, was expected to comprise above ground workings including shafts and a refinery and storage area centered in the southwest quarter of Section 29, Township 20, Range 29 west of the principal meridian, some 2.5 kilometres southwest of the settlement of Harrowby. There would be underground workings underlying some 34 sections or 88 square kilometres of land along the Manitoba side of the Manitoba-Saskatchewan border in a strip some three to five kilometres wide ranging from a point about two kilometres north to a point some eighteen kilometres south of Highway No. 16. There would also be a surface tailings disposal area covering approximately five square kilometres, or the equivalent of two sections of land, located in an area lying three kilometres southwest of Harrowby. (Figure 1)

FIGURE 1



PUBLIC PARTICIPATION & HEARINGS

Public participation in the examination and discussion of the potash mine proposal was provided by two public hearings by the Clean Environment Commission convened October 25, 1988 in Russell and October 27 & 28, 1988 in Winnipeg. Notice of these hearings was given by means of newspaper advertisements in the Winnipeg, Russell, Brandon and Dauphin newspapers. Copies of the advertisement were mailed to appropriate municipalities and provincial government departments in both Manitoba and Saskatchewan and to organizations and individuals thought to have a potential interest in the matter. Copies of the Environmental Impact Assessment (EIA) and a supplement together with comments provided by the Department of Environment and later clarifications by the proponent, were deposited in the public libraries in Russell, Brandon, Dauphin and Winnipeg and in the offices of the Environmental Management Division and the Clean Environment Commission in Winnipeg. The newspaper advertisements made reference to this material. The Russell hearing took place during the daytime since it was felt that interested persons would be available at that time whereas the Winnipeg hearing began in the evening, with a reconvention the following morning. Close to 30 persons were present in Russell whereas about 20 were in attendance at Winnipeg.

Position of The Manitoba Potash Corporation

The Manitoba Department of Energy and Mines, Canamax Resources Inc. and Kilborn Engineering (a consultant acting on behalf of Canamax Resources) made a presentation at both hearing locations. This presentation was based on Volume VI (Environmental) of the Technical and Economic Feasibility Study completed in August, 1987 by Kilborn Ltd. on behalf of Canamax Resources Inc. and the Province of Manitoba. An Appendix A consisting largely of responses by the proponent to questions posed by the Technical Advisory Committee was also part of the presentation. Spokespersons for the potash project included Mr. P. Tredger, Canamax Resources Inc., Mr. H. Duffield, Manitoba Energy and Mines and Messrs. H. Sambells and A. Banks of Kilborn Engineering.

PUBLIC PARTICIPATION & HEARINGS (continued)

The consultants had spent 2 1/2 years developing the technical and economic feasibility study. During this period they had attempted to keep in touch with the local residents, municipal jurisdictions, the regional planning board and representatives of the Provincial government. An open house had been held in Russell in January 1988 at which 200 people had been in attendance. In February 1987 the study plan had been approved by the technical advisory committee (consisting of representatives of government departments selected by the Minister of the Environment).

Mr. Tredger noted that the proponent of the project was the Manitoba Potash Corporation, shares of which are held 51% by Canamax Resources a public Canadian Company and 49% by the Province of Manitoba. Currently the proponent is seeking development financing in an amount exceeding \$500,000,000 with expectations that development of the project can begin in 1989. Following the start-up of the project, full production will not be attained for 5 years. The marketing predictions are that world demand is going to require a new potash mine by the mid 1990's and the Manitoba potash project is being cited to meet this opportunity. The feasibility study has basically confirmed that the Manitoba project is among the best undeveloped potash resource in the world. As a matter of record, he noted that the proponent has invested in excess of \$10,000,000 in the project to the present time.

The overall capital cost is expected to be \$540,000,000. The total financial package will be closer to \$700,000,000 with pre-production capital expense and interest included. Seventy percent of capital expenditures would flow to Manitoba companies. From the employment standpoint, some 1700 persons will be directly employed during construction with some 55 to 65% expected to be Manitobans. During the operation phase, some 360 permanent positions would be generated with 55 to 70% of that number being Manitobans.

PUBLIC PARTICIPATION & HEARINGS (continued)

Location

Mr. Duffield explained the location of the mine with respect to Russell, Binscarth and the International Minerals Corporation potash mines located near Esterhazy, Saskatchewan. The plant site itself will occupy approximately 64 hectares and the tailings pile about 500 hectares. Other mines which exploit the same potash deposit (the Esterhazy) are the most productive and cost efficient potash mines in the world. In effect, the proponent is building on the potash mining experience gained as a result of 25 to 30 years of operation of the potash industry in Saskatchewan at a location some 25 to 30 kilometres distance from the proposed Manitoba potash project site. Kilborn Engineering who were the principal consultants retained by the proponent to develop the technical and economic feasibility study were asked to examine tried and proven technology in terms of the development of the potash project.

Production

Extensive underground exploration work which was undertaken has demonstrated proven ore reserves of 28 years with some secondary mining method potential for an additional 25 to 45 years.

Production at the mine is to be 2,000,000 tonnes per year of potash as finished product. This potash production will require that close to 6,000,000 tonnes of ore be mined. The mining method to be used requires that a shaft be drilled to the level of the potash ore at approximately 850 metres below grade. Part of the substrata through which the shaft will be sunk is water bearing and, to compensate for water problems, the area surrounding the shaft must be frozen. Shaft development will take in excess of 2 years. Ore will be removed from mine "rooms" with at least 2/3 of the ore being left in place as pillars to support the ceilings. Ore will be raised to the surface

PUBLIC PARTICIPATION & HEARINGS (continued)

for processing. Potash crystals will be separated from sodium salts in a flotation circuit. The potash granules will then be graded into a saleable product from where it will be either loaded to rail cars or trucks or conveyed to storage.

The balance of the mined ore consists of salts or slimes that have little value, with the principal salt being sodium chloride. At one of the Saskatchewan mines (near Esterhazy) some small fraction of the sodium chloride is processed for use as a road de-icer.

Most of the waste salt will be stored in a tailings containment area. Part of the tailings area is a brine pond. Brine will be returned to the mill for re-use and excess brine will be injected into a deep geologic formation some 950 metres below the surface and below the depth of the mine. The cost of building this tailings containment area is estimated at \$11,000,000.

The cost of producing a tonne of fertilizer is estimated at \$26 to \$27.

Utilities

Freshwater supply for the operation will be withdrawn from the Assiniboine River at a rate of 0.06 cubic metres per second. This water supply will be used for domestic purposes, wash up water and steam production. This volume of water represents 1% of the Assiniboine River at the minimum flow period.

A conventional 2 cell sewage lagoon is proposed to treat sanitary sewage from the operation with the effluent to be discharged to the Assiniboine River.

PUBLIC PARTICIPATION & HEARINGS (continued)

A 230 KV electrical transmission line will be required to service the site. The right of way will be the subject of a separate E.I.A. being undertaken by Manitoba Hydro. A major gas pipeline will also be required that will utilize as much as possible existing rights of way or otherwise impact less useable land.

Geotechnical

The geotechnical program was an important element of the study. Approximately 42 test holes were drilled through the clay till which was found to be 2 to 16 metres thick at or near the location of the proposed tailings disposal area. At a number of test hole locations sand lenses, which were about one metre in thickness, were located in the till. These lenses were not at the location of the proposed mine tailings site. The permeability of the clay till was measured by both field and laboratory techniques at approximately 2.6×10^{-6} cm/sec. The permeability of the shale, which underlies the clay till, is approximately 1×10^{-7} cm/sec. Some of the test holes are utilized as monitoring wells from which water samples are collected from time to time for background purposes. Some of the appropriately placed test holes will be used as part of the on-going monitoring program. Generally, the water collected from the clay till from the observation wells is unfit for human consumption.

During February 1988, water samples were also collected from a glacier melt wash located 250 metres east of the proposed tailings area. This sampling was undertaken at the request of Mr. Doug Bily, an area farmer. Mr. Bily utilizes the water supply contained in the glacier melt wash on his property for cattle watering purposes. The quality of this water is acceptable for both human consumption and livestock watering.

A major fresh ground water aquifer in the area is the Hatfield formation which is located north east of the site of the potash operation.

PUBLIC PARTICIPATION & HEARINGS (continued)

There appears not to be a direct connection from the potash mine site to the Hatfield formation.

Heritage Resource

A study of heritage resources was undertaken in 1986. This study was confined to the mill site (64 hectares). The study will be continued during the next stage of development. There were no significant artifacts found during the study.

Fisheries and Wildlife

An examination of the wildlife habitat indicated the absence of prime habitat. The area contains little bush and few potholes, factors which normally enhance wildlife. It is not expected that the fishery in the Assiniboine River will be impacted by the project. Screens will be placed at the water intake to prevent fish damage. The presence of additional people in the area associated with the potash development will result in some stress on wildlife and the fishery from hunting and fishing.

Tailings Containment

The mill tailings pond is to be located in an area where the clay till is relatively shallow (less than 20 metres) since the containment dykes will be keyed to the underlying shale member to take advantage of the lower soil hydraulic conductivity of the shale. The tailings pond will be sited to maintain a 250 metre separation from the glacier melt water channel in order to protect this channel from contamination. Gravel and sand seams in the area will be avoided at the tailings pond location. The tailings pond dykes will be constructed from the glacial till.

PUBLIC PARTICIPATION & HEARINGS (continued)

All surfaces of the dykes in contact with the brine solution and the clay barrier beneath the dyke, that is keyed to the shale, will be constructed of till the impermeability of which will be enhanced by a brine addition process. This brine hydrated liner is intended to further reduce the soil's hydraulic conductivity and mitigate seepage losses.

A subsurface collection system located at the interface of the exterior edge of the brine enhanced barrier with the shale will collect any brine seepage and provide further defence against seepage migration. Any collected seepage will be returned to the brine ponds. There will also be a peripheral drain at the toe of the dyke to collect seepage. Ditches to collect surface run-off will be constructed to divert such water from the tailings containment site. A contingency containment dyke will be located downstream of the primary dykes to capture the brine in the event of a dyke failure.

Tailings will be placed in the tailings pond by means of a spigot. This is the common method of tailings placement. The back of the tailings pile will, however, be terraced because of a concern that the underlying shale might fail structurally as a result of the traditional technique of piling the tailings. The back of the tailings pile will also be set back 30 metres or more from the dyke in order to collect brine from the tailings and provide a margin of safety should the tailings pile fail. Brine collected from this area will be subsequently drained to the brine pond. Based on known information from studies, the height of the tailings pile is being set at 37.5 metres.

In order to monitor brine migration from the tailings pond there will be upwards of 30 or more observation holes located adjacent to the tailings containment area. If brine migrates outside of the containment area, a hydraulic containment system could be used to return the brine. Alternatively, deep collection ditches could be constructed to intercept the brine or cut off trenches, back-filled with clay till and bentonite, could be used to prevent further brine migration.

PUBLIC PARTICIPATION & HEARINGS (continued)

In terms of the measures that were being proposed by the proponent for brine containment, representatives from the Environmental Control Branch and Water Resources Branch, Messrs. Strachan and Render, both testified that the designed system represented very good engineering; however, both agreed that if the tailings pile was to be remain in place for a lengthy time period after mine closure, the system would fail without adequate maintenance and brine would migrate from the containment site.

Air Pollution Control

Proven air pollution control technology will be utilized in the mill facility in order to control the emission of suspended air borne particulate matter. Modelling of particulate emissions had demonstrated that the maximum dustfall will be orders of magnitude below the Manitoba air quality objectives. The only vegetation/soil damage expected from salt dust will be to aspen trees. From time to time some leaves of these trees may die off due to air borne salt dust.

Tailings Area Rehabilitation

Mr. Banks of Kilborn Ltd. presented brief post closure rehabilitation alternatives. This aspect was not addressed in the E.I.A. report but was later considered at the request of the technical advisory committee.

1. Proposed Method

The method selected by the consultants for handling waste salt is the proven technology consisting of above ground storage of the salt pile with containment and deep well disposal of excess brine. This is a well understood and proven method which is technically feasible and relatively economic. Disadvantages of

PUBLIC PARTICIPATION & HEARINGS (continued)

this method are that the tailings pile is aesthetically unattractive, that continuous monitoring is required and that seepage must be controlled over a very long period of time. The anticipated impacts, which may occur long after the mine has been closed, will have to be examined. This method would require an initial capital cost of \$11,000,000 and operating costs of \$600,000 per year. The operating cost would continue over the life of the tailings pile (hundreds of years).

An adjunct to the proposed method of tailings disposal is the increased use of injector wells to dispose of saturated brine into a subsurface geologic formation (the Winnipeqosis formation for example) which represents another technology to dispose of waste salt. Disadvantages are that there would be a need for 10-12 additional disposal wells and care would have to be taken to remove the insoluble components from the brine or else the geologic receiving formation will become plugged. The insoluble fraction would have to be disposed by some other means. This method would also require hydraulic pressures that could cause some disturbance in the area being mined. There is an unassessed environmental risk associated with deep well disposal. As well, additional brackish or freshwater sources would have to be found in which to dissolve the salt.

2. Alternative Method A

An alternative method would be to place granular tailings back into the mine. This would reduce the surface storage of salt and therefore reduce long term maintenance. Backfilling is more difficult and costly in a horizontal mine (rooms are only 2.5 metres high). Backfilling would also prevent the full recovery of the resource by selective solution mining (Alternative Method C) if this method becomes a reality. An

PUBLIC PARTICIPATION & HEARINGS (continued)

estimated additional \$25,000,000 capital and \$4,000,000 annual operational cost would be required throughout the life of the mine and it would only be possible to re-introduce 70-80% of the tailings to the mine so that a smaller tailings pile would still be necessary.

3. Alternative Method B

Another alternative would be to cap the pile with an impervious layer of clay at the end of the life of the mine. The clay would then be re-vegetated. The advantages are that the salt pile would be returned to a vegetated state with a reduced on-going maintenance program. There are a number of disadvantages which include a requirement for on-going monitoring; an unproven technology; an estimated cost of \$60,000,000, which is significant; and the amount of cover material required.

4. Alternative Method C

What appears to be an attractive but unproven alternative for disposal of the waste salt piles is known as selective solution mining. This is a process entailing the return of a saturated solution of the waste sodium chloride to the mine where as — a function of temperature — the sodium salt is deposited in the mine openings and the potassium salts are dissolved from the unmined pillars following which the solution is returned to the surface for processing into fertilizer. The mine is being designed to utilize this method to advantage should further research prove this method to be practical. The advantages are that the life of the mine would be approximately doubled, the cost of such a program is expected to be relatively low, and approximately 60 to 70% of the tailings on surface would be

PUBLIC PARTICIPATION & HEARINGS (continued)

utilized. The principal disadvantage is that the technology is only now emerging and is still unproven for this type of deposit.

The foregoing are possible alternatives; however, research and development is needed to positively identify a practical, economic and environmentally acceptable alternative.

One other method mentioned by the proponent but discounted as impractical was the surface burial of tailings.

Past Practice Elsewhere

Mr. Banks dealt with salt disposal methods at potash mine sites elsewhere. In Europe, salt is stacked on the surface with some being dissolved and discharged to river systems, such as the Rhine (to the detriment of the river). There is some backfilling of granular material into mines where the ore body is steeply declining. In England, the salt is slurried and discharged to the sea. In New Mexico, most salt is stored on the surface. In the U.S.S.R. the process is mainly surface storage with some dissolution and return to the river systems. In the Middle East, production is from the Dead Sea brines and the waste salt is returned to the sea. In Saskatchewan, most of the mines store the salt on the surface and return the brine to underground formations. Some granular salt is returned underground principally for support purposes. In New Brunswick, where there are steep deposits, some of the salt is returned to the formation; part is processed for highway de-icing; some is returned to the ocean. At various locations where mines have been abandoned, as in New Mexico and France, tailing piles exist and are expected to remain for some time to come.

PUBLIC PARTICIPATION & HEARINGS (continued)

Position of The Rural Municipality of Russell

Reeve George Witty spoke on behalf of the R.M. of Russell in which the mine is to be located. He had taken the trouble to drive around one of the potash operations near Esterhazy and talk with members of that community. He expressed satisfaction that, although the mine had been operating for 25 years, there were few environmental problems aside from a relatively small problem with corrosion associated with the chloride salts and some damage to aspen trees. In his view, if the mine is constructed and operated properly, particularly with improved technology, there should be even fewer problems than those experienced with the Saskatchewan mines.

He noted that some of the land near the south end of the potash mine property contains relatively granular and therefore permeable soil. His concern was for ground water contamination of farm water supplies in this area. He suggested the establishment of a trust fund, developed from a percentage of the profits of the potash operation, to defray farmers' costs to remedy any problem that might develop with a water supply.

The municipality, in discussion with Manitoba Hydro concerning construction of the electrical transmission line to serve the project, recommended that the use of good agricultural land for this purpose should be avoided. The proponent should examine carefully the use of the right of way for the gas pipeline that currently services the CSP plant at Harrowby.

In its favor, Mr. Witty concluded that the mine will produce revenue for the area and offer employment to young people who could be retained in the area.

PUBLIC PARTICIPATION & HEARINGS (continued)

Position of Mr. Doug Bily, Area Farmer

Mr. Bily is located on a farm east and south of the proposed tailings disposal area. A glacier melt wash is located on the Bily farm which contains a fresh water source that is used for cattle watering. The melt wash is also used by others in the district as a water supply. This provides an adequate supply of good quality water; however, the study undertaken by the proponent had made no reference to this water supply source. Mr. Bily wanted to draw attention to this water supply and the need to protect this source from contamination by salt migration from the potash operation.

Position of Manitoba Department of Energy & Mines

Mr. W. Bardswich, drew attention to the fact that 40% of the mineral reserves in the area to be mined were held by the Crown. The proponent is required to enter into a long term lease arrangement with Manitoba to obtain the right to mine this mineral. As part of that lease the proponent must, within 5 years, submit to the lessor a plan to identify measures to be taken to protect the environment as well as to rehabilitate the lands occupied by the operation to a use consistent with the adjoining lands. At the Winnipeg hearing, Mr. Banks agreed that, even with the disappearance of the salt pile, the underlying soil would remain salt saturated.

In response to questions, Mr. Duffield believed that even if the operation went bankrupt, there would be considerable recoverable assets which could be committed to a fund to provide for maintenance and rehabilitation. He did not anticipate that such an event would occur and stated that the Company will put forward a proposal to accept responsibility to take care of the on-going problem of salt disposal or to set up a fund that would provide for perpetual management of this operation.

PUBLIC PARTICIPATION & HEARINGS (continued)

It is also hoped that, once production of potash begins in Manitoba, research into tailings disposal and rehabilitation of potash mines can be undertaken cooperatively with the Governments of Saskatchewan and Canada. Up to now there has not been much research into these areas in Saskatchewan.

Position of The Manitoba Environmental Control Programs Branch

The presentation of Mr. Larry Strachan, Chief of Environmental Control Programs Branch of the Environment Department, identified two main environmental concerns with regard to the proposed project.

1. Tailings disposal and management
2. Tailings post operation management and rehabilitation

Mr. Strachan stated that the report submitted by the proponent is based on proven methods of tailing management which will require long term post operation care. At the request of the technical advisory committee, the proponent committed to participate in the research and development of alternate tailings management methods and to the use of new technology if this is found to be technically, economically and environmentally feasible. Mr. Strachan's opinion was that if the project proceeds to an operating stage with conventional surface tailings disposal, a change to use new technology would be "highly unlikely". A further concern was that the proponent has not identified, in the E.I.A., a specific plan to manage and rehabilitate the tailings area in the post operation phase. On the other hand, the proponent has agreed in the mineral lease agreement to put in place a plan to protect the environment from any damage and rehabilitate the lands to a use consistent with that of adjoining lands. There is also a provision to establish a mechanism by which funds would be made available to rehabilitate, maintain and manage the tailings disposal area after production has ceased. Mr. Strachan felt that the lease agreement could not be complied with based on current

PUBLIC PARTICIPATION & HEARINGS (continued)

information (that is the rehabilitation of the land to a use consistent with existing land uses in the area).

Mr. Strachan submitted a number of recommendations for Stage 2 licence requirements for the consideration of the Commission as follows:

1. A specific plan should be developed and presented for post operation management and rehabilitation of the proposed surface tailings disposal area. The proposed plan should identify a mechanism and responsibility to undertake and fund post operation management and rehabilitation.
2. A more definitive review of the application of alternative tailings management and disposal methods, in whole or in part, to the Manitoba Potash Project should be undertaken with specific focus on the technical, environmental and economic application of these methods compared to conventional surface tailings disposal. The review should include requirements and costs for post operation management and rehabilitation.
3. Following submission and review of the information submitted under (1) and (2) above, the Minister should approve the method of tailings disposal, management and rehabilitation to be employed in the project.
4. No construction of permanent facilities should take place until such time that the approved method of tailings disposal, management and rehabilitation has been agreed to by the proponent.

PUBLIC PARTICIPATION & HEARINGS (continued)

5. Consideration should be given by the proponent to provide technical and financial assistance to the neighboring municipalities to upgrade their municipal infrastructure (water and wastewater) that will be necessary to serve the increase in population which will result from the Manitoba Potash Project.

Note: Number 5 was omitted at the later Winnipeg hearing.

Mr. Strachan also presented recommendations for Stage 3 licencing requirements for the consideration of the Commission as follows:

1. All applicable Federal, Provincial and Municipal laws and regulations should be complied with.
2. Specific requirements for construction, monitoring and discharge of any surface impoundments for solids and/or liquids should be required. Data should be submitted on a regular basis.
3. Specific emission limits should be required for all discharge to the air from the mine and mill operation.
4. Periodic monitoring and submission of air emissions and ambient air should be required.
5. Contingency plans should be developed and approved to address any type of emergency discharge from, or catastrophic failure of, surface impoundments for solids and/or liquids, and any safety problems that may occur as a result of visibility and icing conditions on nearby roadways.

PUBLIC PARTICIPATION & HEARINGS (continued)

Positions of Environmental Organizations

(1) Manitoba Environmental Council

Mr. W. Neily, the Council representative, first noted that The Council was disturbed because there was not an opportunity to comment on the environmental impacts of the project before Stage 1 licencing approval. It was at an early stage that general public input would be most important. The Council also has a concern that the public are not adequately notified by only a single insertion newspaper advertisement of a hearing of the Commission. Also, the time from the newspaper advertisement notification to the actual hearing date (2 weeks) was totally inadequate to provide time for volunteer Council members to analyze a proposal of the size and complexity of the potash project and prepare for adequate participation in a hearing.

The Council's view is that all base line studies should be complete prior to issuance of a licence to begin construction. A weakness of the proponents E.I.A. is that no attempt was made to map the ecosystems of the local area and to identify impacts of the project on these ecosystems. In terms of evaluating the E.I.A., one or more ecologists or field biologists should be added to the technical advisory committee. As well as impacts from the potash project itself, the impacts on ecosystems resulting from construction of the water supply line, the electrical transmission line, the gas pipe line and the railway lines are important. At all of these locations, there should be an on site examination by a biologist of the existing ecosystems to determine potential impacts.

The Council representative concluded that the main concern is one of ensuring that negative impacts are minimized and that studies with emphasis on ecosystems are undertaken.

PUBLIC PARTICIPATION & HEARINGS (continued)

(2) Conservation Strategy Association of Manitoba

Mr. Nick Carter made a presentation as representative of this environmental organization.

He noted that as a result of approving the recommendations of the Task Force on the Environment and Economy, government is committed to looking at projects from a sustainable development point of view. In terms of a sustainable development, the Association requests that the economics of exploiting the mineral resource be presented for review. In this regard, some account must be taken of world wide movements towards biological methods of maintaining the fertility and structure of the soil. The decreasing ability of off-shore importers to afford products such as fertilizers is also very important in this regard. If the prime interest of Manitoba is in jobs and local economic development, would not a similar investment in other sectors (if there is to be government funding) produce as good or better results. The markets for this product appear uncertain and the environmental impact considerable. The Association urged the Commission to examine this question with the assistance of disinterested economists.

The sustainability of this project in terms of the energy demanded for mining and processing would also seem to require evaluation. Such questions as: What are the alternative uses for this power? What impact does this project have on Hydro plans?, etc., are important questions if all of the implications are to be examined.

The Association also believes that a research commitment to tailings disposal and de-commissioning is necessary. These costs should be factored into the overall cost. Research and development must continue, post operation tailings management and monitoring must be committed and the design of the facility must provide for this

PUBLIC PARTICIPATION & HEARINGS (continued)

management. In the view of the Association, these responsibilities should be assigned, accepted and made public before the issuance of the Stage 2 licence.

The Association recommends that biological data should be collected immediately to serve as a base line from which local impacts of the project can be assessed. A plan for systematic monitoring should also be developed.

In terms of impacts of the mine on the local population and the municipal infrastructure (water, sewer, schools, hospitals) it appears to the Association that the responsibility to assist the municipalities will fall upon government departments. Therefore, the E.I.A. should exhibit the intention of these departments, so that a systematic approach to necessary local changes may be demonstrated.

(3) Concerned Citizens of Manitoba

A letter was received from a representative of the Concerned Citizens of Manitoba (Mr. Hugh Arklie). The letter referred to a newspaper article printed in the Russell Banner on October 12, 1988. This newspaper was published before the date of the hearings. Remarks ascribed to the Minister in that article were stated to be prejudicial to the outcome of the current hearings of the Commission. In this respect the Commission hearings were thought to be a waste of time.

(4) Manitoba Environmentalists Inc.

Ms. Letty Last, in a letter submitted on behalf of the Manitoba Environmentalists Inc.. raised a series of questions concerning

PUBLIC PARTICIPATION & HEARINGS (continued)

impacts on wildlife, water and vegetation. This organization believes that questions of tailings disposal and groundwater impact were not adequately addressed. They also questioned the impacts of the operation on local communities including conditions when the mine closes. In their view, all of these questions should be addressed at this stage of the development and not during the operation or post operational period.

DISCUSSION AND ANALYSIS

It is clear that the principal environmental concern associated with a potash mine project is the handling, storage and disposal of both brine and mine and mill tailings.

Tailings and Brine Disposal - Rehabilitation

1. Proposed Method

There are approximately 10 potash mines in Saskatchewan employing mining methods similar to that proposed at Russell in similar geological formations. In all cases, approximately two thirds of the mineral that is mined is a waste salt (sodium chloride with some potassium salts and small quantities of insoluble materials such as clay, gypsum and anhydrite). In all cases, the waste salt and brine are stored on the surface of the ground and precautions are taken to prevent the migration of brine to aquifers or surface drains. Some of the saturated waste brine is returned to underground geological formations such as the Winnipegosis formation which is located below the evaporite formation from which the potash is mined.

DISCUSSION AND ANALYSIS (continued)

The foregoing summarizes the current, proven waste disposal technology employed in the potash mining field. The major problem with this technology is that the huge piles of waste salt will require hundreds of years to dissolve under the influence of natural precipitation. The brine that forms must be contained and disposed of in a satisfactory manner to prevent surface and groundwater pollution.

The storage time can be shortened by augmentation of the process water with additional fresh water to dissolve salt from the pile and injection of the brine into the underground disposal formation. There are some possible disadvantages to this method aside from additional cost. The method requires additional water, which may not be readily available, and may not be a responsible use of fresh water resources. Another major concern is with respect to the potential risk resultant from the injection of the saturated brine solution into the ground water disposal formation. This risk has not yet been fully assessed. More research is needed to explore this method of brine disposal which has also been utilized in oil field exploration and development.

There are a number of other untried or unproven alternatives for disposal of the salt piles.

2. Alternative Method A

Underground disposal entails the return of the waste salt in a granular form to the underground cavities or "rooms" in the mine. This method may not be practical in a horizontal mine such as the Russell potash deposit. Even where this is practical, all of the waste salt cannot be returned to the underground rooms. Another disadvantage is that once all possible back filling of the waste salt has occurred, the

DISCUSSION AND ANALYSIS (continued)

balance of the material in the unmined pillars could not be extracted by selective solution mining methods. There would also be an additional cost.

3. Alternative Method B

Capping of Tailings is a method in which the tailings pile would be covered with soil placed on the surface. The cap would have to be placed in such a manner as to prevent precipitation and resultant surface run-off from reaching the underlying salt, thus causing migration of the salt away from the containment area. This method would require an enormous quantity of soil and would also be capital intensive. The underlying salt pile would also exist for an indefinite future period.

4. Alternative Method C

Selective Solution Mining is an experimental but largely untried method of mining by means of which additional potash could be extracted from a mine beyond the conventional method of extraction by mining out "rooms" and leaving support "pillars". The method involves the return of sodium chloride brine into the area that has been mined. By a selective solution process, the saturated sodium salts would be deposited in the mine in exchange for the potassium salts in the unmined pillars. The potassium saturated brine would be returned to the mill where the potassium would then be removed from the solution as the desired product. This method is unproven and therefore uncertain.

DISCUSSION AND ANALYSIS (continued)

5. Burial of Potash Tailings

Burial of Potash Tailings is a method that seems completely impractical because of the size of the hole required and danger of groundwater contamination.

All of the alternative methods cited above would add to the cost of producing potash and, in the examples of capping and burial, the additional costs would be prohibitive. In all other cases, research programs are required to establish that the methodology will work in a specific mining situation, will be cost effective and will protect the environment.

At the hearing, the Commission learned that the Manitoba Department of Energy and Mines had issued a mineral lease to the proponent under authority of the Mines Act that required the proponent to submit a plan to the Department within 5 years that would stipulate measures and programs the proponent would carry out for purposes of protecting the environment from damage as well as for rehabilitation of the lands to a use "consistent with that of the adjoining lands".

In testimony before the Commission the proponent stated that not only was proven technology to be employed but also, because the project was new and could benefit from actual experience in Saskatchewan, additional measures would be taken in the Manitoba operation that would be a substantial improvement compared to operations in Saskatchewan and elsewhere in the world. These improvements were incorporated into the details of proposed tailings area construction and operation presented to the Commission.

Representatives of the Environmental Control Programs of the Environment Department and the Water Resources Branch (Hydrogeology) agreed that the proposal for tailings containment and operation prepared by the consultants had been engineered in an excellent manner with good improvements incorporated into the design over and above the Saskatchewan technology.

DISCUSSION AND ANALYSIS (continued)

Notwithstanding this, concerns were expressed about the long term security of the containment area and the rehabilitation that had been proposed.

The Environment Department representatives believed that management alternatives for the tailings area and rehabilitative measures to be employed should be submitted by the Company to the Minister for approval prior to the issuance of a Stage 2 Licence.

CONCLUSIONS

The Commission concludes that the major environmental issue associated with the potash project is the handling and disposal of the waste salt and subsequent brines that are formed.

The proven technology for management of this has been that employed at most of the Saskatchewan mines. The consultant for the Manitoba potash project proposed the use of this proven technology in connection with the management of the salt pile. In addition, some further improvements and safeguards were proposed.

As long as the salt containment system is maintained, it is believed that the salt brine will be prevented from migrating to the adjoining areas and to surface and groundwaters. However, it would be desirable and more acceptable if, in place of hundreds of years, the salt piles created could be smaller and diminished at a faster rate. This is the basic reason that the Commission has proposed that the proponent undertake studies to examine alternatives for the waste salt management and also identify financial and technical mechanisms to ensure satisfactory management of remaining salt and salt brine during the rehabilitation period. The Commission believes that these tailings management alternatives and rehabilitative measures should be identified and presented for consideration during hearings prior to the issuance of the Stage 3 - operation licence for the potash development.

RECOMMENDATIONS

A. Stage 2 Licence - Development and Construction

1. The Commission recommends that the proponent be required to design and construct its industrial waste facility in accordance with information contained in the documents submitted by Kilborn (Sask) Ltd. dated August, 1987 prepared on behalf of Canamax Resources Inc. and Manitoba Energy and Mines under title "Manitoba Potash Project - Technical and Economic Feasibility Study - Volume VI, Environmental" as well as Appendix "A" to Volume VI and a letter of February 17, 1988 from Kilborn Engineering to M. Boreskie of the Department of Municipal Affairs.

Some of the features documented in the these reports and documented at the Commission hearings that would ensure brine containment includes the following:

- Use of native clay till for dyke construction with a brine enhanced clay lining and the use of brine enhancement of the clay till to construct a barrier beneath the exterior dykes to the level of the underlying shale such that all of the surfaces of the containment area in contact with the brine will have a soil hydraulic conductivity of 1×10^{-7} cm per sec or less.
- Construction of a sub-soil drain at the exterior face of the brine enhanced clay barrier at the elevation of the shale layer as a first defence against brine seepage. Collected brine would then be returned to the brine pond.
- Construction of an external seepage collection ditch and a freshwater diversion ditch.

RECOMMENDATIONS (continued)

- Construction of a contingency containment dyke to take care of emergencies in the event that a dyke is breached.
- Maintenance of a minimum distance of 250 metres from any glacial melt water channels to the waste management system.
- The avoidance of granular soils such as sand lenses within the waste management containment area.
- Provision of a brine return system in the ponds that will maintain the brine level as low as possible consistent with the practical operation of the mill.
- Construction and operation of the brine ponds in a manner that meets the specifications set out in the Canmet Pit Slope Manual.
- Construction and operation of brine pipelines so that pipeline failures will result in the absence of brine migration from the containment disposal area.
- Piling of salt in a manner such that stability of the dykes is ensured. Both the dykes and the tailings pile shall be monitored for stability as necessary to meet the approval of the "director" of the Environment Department.
- Installation of a monitoring system to meet the approval of the "director" of the Environment Department.
- Installation of air emission control equipment satisfactory to the "director" of the Environment Department such that standard Departmental air quality objective limits for air emissions from the operation will be met.

RECOMMENDATIONS (continued)

2. A definitive review of the application of alternative tailings management and disposal methods, in whole or in part, should be undertaken with specific focus on the technical, environmental and economic application of these methods as compared to conventional surface tailings disposal. The review should include requirements and costs for post operation management and rehabilitation and should be developed for presentation and review at the Stage 3 licencing hearings.
3. A specific plan should be developed and presented for post operation management and rehabilitation of the proposed surface tailings disposal. The proposed plan should identify a mechanism and responsibility to undertake and fund post operation management and rehabilitation. This plan should be prepared for presentation and review at the Stage 3 licencing hearings.

B. Stage 3 Licence Considerations - Operation

The Commission recommends that:

1. All applicable Federal, Provincial and Municipal laws and regulations should be complied with.
2. Specific requirements for construction, monitoring and discharge of any surface impoundments for solids and/or liquids should be required. Data should be submitted on a regular basis.
3. Specific emission limits should be required for all discharge to the air from the mine and mill operation.

RECOMMENDATIONS (continued)

4. Periodic monitoring and submission of air emissions and ambient air data should be required.
5. Contingency plans should be developed and approved to address any type of emergency discharge from, or catastrophic failure of, surface impoundments for solids and/or liquids, and any safety problems that may occur as a result of visibility and icing conditions on nearby roadways.

Manitoba

APPENDIX A



Minister of
Environment and
Workplace Safety and Health

Room 156
Legislative Building
Winnipeg, Manitoba, CANADA
R3C 0V8

(204)945-3522

September 30, 1988

Mr. Stan Eagleton
Chairperson
The Clean Environment Commission
550 - 500 Portage Avenue
WINNIPEG, Manitoba
R3C 3X1

Dear Mr. Eagleton:

RE: CANAMAX RESOURCES INC. - MANITOBA POTASH PROJECT

On April 8, 1988, Canamax Resources Inc. submitted a Proposed to my Department, pursuant to The Environment Act, for the development of a potash mine and milling facility in the Rural Municipality of Russell. Accompanying this Proposal was a detailed environmental impact assessment which has been reviewed in detail by a Provincial Technical Advisory Committee, the Interdepartmental Planning Board and the Provincial Land Use Committee of Cabinet.

Section 13 of The Environment Act provides me with the authority to issue the Environment Act Licence in stages, and accordingly, I have recently issued a Stage 1 Licence to Canamax Resources Inc., which constitutes approval in principle for the project. This Stage 1 Licence also requires that public hearings be held and a Stage 2 Licence be issued prior to development taking place at the site (copy attached).

As a result, I am requesting the Clean Environment Commission to convene public hearings in Winnipeg and Russell prior to October 31, 1988, and provide me with recommendations for the content of a Stage 2 Licence by December 15, 1988.

I would ask that the Commission's review specifically include, but not be limited to, the following considerations:

(1) A general review of the adequacy of the Proponent's environmental impact assessment with particular emphasis on:

(a) The adequacy of the Proponent's examination of alternative tailings management methods and the possibility of directing the Proponent to contribute funds to and undertake research in this area.

Mr. Stan Eagleton
September 30, 1988
- Page 2 -

- (b) The need for and the possible timing of submission of a plan for the long term management and rehabilitation of the tailings area following closure of the operation.
- (2) Recommendations regarding limits, terms and conditions, if considered necessary, which should be applied to the development and construction phase of the operation.
- (3) Preliminary recommendations for limits, terms and conditions to be applied to the operational phase of the development.

I anticipate a further review of the project being conducted prior to the operating phase, at which time a Stage 3 Licence will be issued imposing limits, terms and conditions on the operation.

Copies of the Environmental Impact Assessment and all relevant material are available from Larry Strachan, Chief of Environmental Control Programs.

Sincerely,



Ed Connery
Minister

Attachment

cc: Mr. Larry Strachan, P. Eng., Chief
Environmental Control Programs

Environment Act Licence

Manitoba
Environment and
Workplace Safety
and Health

APPENDIX B

Licence No. 1226

Issue Date SEPTEMBER 29, 1988

In accordance with the Manitoba Environment Act (C.C.S.M. c. E125)

THIS LICENCE IS ISSUED TO:

CANAMAX RESOURCES INC. (MANITOBA POTASH PROJECT); APPLICANT

STAGE 1 LICENCE

WHEREAS: a Proposal for the development of a potash mine and milling facility in the Rural Municipality of Russell has been under review by the Manitoba Government since 1985;

AND WHEREAS: on April 8, 1988, pursuant to Section 12(3) of The Environment Act, Canamax Resources Inc. submitted both a Proposal for Stage 1 approval to develop a potash mine and milling facility in the Rural Municipality of Russell and a detailed Environmental Impact Assessment in support of the Proposal;

AND WHEREAS: the Environmental Impact Assessment has been reviewed by a Provincial Technical Advisory Committee, the Interdepartmental Planning Board and the Provincial Land Use Committee of Cabinet;

AND WHEREAS: Section 13 of The Environment Act provides the Minister with the authority to issue an Environment Act Licence in stages;

AND WHEREAS: it is deemed advisable to issue an Environment Act Licence for the project in stages as follows:

- Stage 1 - Approval in Principle
- Stage 2 - Development and Construction
- Stage 3 - Operation;

THEREFORE: a Stage 1 Environment Act Licence is hereby issued to Canamax Resources Inc., which constitutes approval in principle for the development of a potash mine and milling facility in the Rural Municipality of Russell, subject to the following condition;

- 1.. no construction of permanent facilities shall take place until public hearings are held by the Clean Environment Commission and a Stage 2 Environment Act Licence is issued by the Minister.

E. Connery
Honourable Ed Connery
Minister

A P P E N D I X C

CANAMAX RESOURCES INC.

File: 2913.0

L I S T O F E X H I B I T S

EXHIBITS SUBMITTED AT RUSSELL, MANITOBA
OCTOBER 25, 1988

1. Honourable Ed Connery, Minister of Environment and Workplace Safety and Health, Letter, dated September 30, 1988.
- 1.A. Department of Environment and Workplace Safety and Health, Stage 1 Environmental Licence No. 1226, dated September 29, 1988.
2. Canamax Resources Inc., Annual Report 1987.
3. Kilborn (Saskatchewan) Ltd., Manitoba Potash, Technical and Economic Feasibility Study Vol. VI Environmental, dated August, 1987.
4. E & M Drilling Company Ltd., Letter to Mr. Doug Bily, dated November 8, 1985.
- 4.A. W.M. Ward Technical Services Laboratory, Chemical Analysis Form, water analysis, Mr. D. Bily, dated October 10, 1988.
5. Larry Strachan, Chief, Environmental Control Programs, Environment and Workplace Safety and Health, Canamax Resources Inc. Submission to Clean Environment Commission Public Hearings, dated October 25 - 27, 1988.
- 5.A. Syd Hancock et al, Community Impact Monitoring Program, Final Report 1985 The Township of Atikokan and Ontario Hydro, dated November 25, 1986.
6. Larry Strachan, Chief, Environmental Control Programs, Environment and Workplace Safety and Health, Memo, "Manitoba Potash Project", dated October 3, 1988 with attachments.

A P P E N D I X C

CANAMAX RESOURCES INC.

File: 2913.0

L I S T O F E X H I B I T S

EXHIBITS SUBMITTED AT WINNIPEG, MANITOBA
OCTOBER 27 & 28, 1988

7. Manitoba Environmental Council, Presentation Concerning The Application By Canamax Resources Limited, dated October 27, 1988.
8. Conservation Strategy Association of Manitoba, Brief - Canamax Resources Inc. Proposed Potash Mining Operation, dated October 26, 1988.
9. Dave Wotton, Head, Terrestrial, Standards and Studies, Environment and Workplace Safety and Health, Speed Memo dated October 27, 1988 with attachments, subject "Vegetation Damage from Salts in Dustfall of Potash Mines".
10. W.A. Bardswich, Director, Mines Branch, Memoandum, dated October 27, 1988.
11. Lease agreement between Her Majesty the Queen and Manitoba Potash Corporation, dated August 14, 1980.