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ACRES INTERNATIONAL SUBMISSION TO THE NUNAVUT WATER BOARD ON NANISIVIK MINE'S CLOSURE AND RECLAMATION PLAN PREPARED FOR THE JUNE 3-4, 2004 PUBLIC HEARING IN ARCTIC BAY/NANISIVIK

MAY 28, 2004

EXECUTIVE SUMMARY

Nanisivik Mine submitted an initial Closure and Reclamation Plan in February 2002, as a result of their decision for permanent mine closure in October 2001. A pre-hearing conference to review the Closure and Reclamation Plan and to review the renewal application of the Nanisivik Mine water license was held on June 6, 2002. The public hearing followed the pre-hearing conference on July 22 and 23, 2002. Both the pre-hearing and the public hearing were held in Arctic Bay, Nunavut.

Since the first public hearing was held in Artic Bay in July 2002, technical meetings have been held to collect and discuss comments, inputs and to provide recommendations from the various agencies, consultants and other parties:

- Calgary, August 20, 2002,
- Iqaluit, March 29, 2003,
- Ottawa, September 22 and 23, 2003, and
- Yellowknife, May 4 and 5, 2004.

The meetings helped to provide direction, additional field work, and the design and finalization of the Closure and Reclamation Plan for the Nanisivik Mine. Major accomplishments include, but not limited to the following:

- Talik investigations at the West Twin Dike Area (WTDA).
- Design of the West Twin Dike's spillway to allow for surface runoff from the Surface Cell to the Reservoir of the WTDA.

- Completion of the Environmental Site Assessment (ESA) Phase II and ESA Phase III.
- Development and finalization of the issues related to the Human Health and Risk Assessment (HHERA).
- Finalization of the thermal cover designs for the tailings, waste rock and the landfill sites.
- Details on the developments of the proposed quarries to be used for closure and reclamation activities.

The majority of the basic fieldwork to gather background data, and the design studies have been completed. We believe that major issues related to the closure and reclamation has been addressed in the final Closure and Reclamation Plan. The current work should now focus on the implementation of the closure and reclamation plan. The current issues which will require some attentions are related to the following:

- Closure activities within the mine site, including Quality Assurance – Quality Control (QA/QC).
- Instrumentation and Monitoring Program, including community training for carrying out the work during the reclamation period.
- Contingency Plans to provide mechanism for additional remediation work, if required.

There are other remaining issues which still need to be addressed by the Nanisivik Mine. These include the detail schedule for all of the reclamation activities, outstanding activities for the summer 2004, additional details on activities related to reclamation work (portal stability, east adit treatment facilities, industrial and dock areas, roadways and the townsite). In their letter dated May 14, 2004, Nanisivik Mine has made a commitment to address the above.

As part of Acres International Limited team, Dillon Consulting Limited provided technical input and comments on the Human Health and Ecological Risk Assessment (HHERA) issues. The HHERA document submitted by Nansivik Mine was a part of the Closure and Reclamation Plan.

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May 28, 2004
P13808.03

Nunavut Water Board
P.O. Box 119
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Attention: Ms. Dionne Filiatrault, P.Eng.,
Manager of Technical Services

Dear Dionne:

Nanisivik Mine
Closure and Reclamation Plan
Submission for June 3-4, 2004
Public Hearing

Introduction

At the request of Nunavut Water Board (NWB), Acres International Limited (Acres) reviewed the 2004 Closure and Reclamation Plan documents that were submitted by the Nanisivik Mine, a division of Canzinco Ltd. (Nanisivik Mine). The documents were prepared as requirements of Part G of the Water License No. NWB1NAN0208, issued by NWB on October 1, 2002.

The Final Closure and Reclamation Plan (Water License Reference G item 3) was submitted on February 6, 2004. The submitted document contains 10 (ten) appended documents, listed as follows.

G-4 Engineering Design of Surface Reclamation Covers.
G-5 Assessment of Surface Cell and Test Cell Taliks.
G-6 Quarry Development and Reclamation Plan.
G-7 Detailed Design of the West Twin Dyke Spillway.
G-8 Rock Piles and Open Pits Closure Plan.
G-9 Closure Monitoring Plan.
G-13 2003 Phase III Environmental Site Assessment.
G-14 Human Health and Ecological Risk Assessment.
G-16 Waste Disposal Plan.
G-17 Landfill Closure Plan.

Out of the ten appendices, the Waste Disposal Plan (Reference G-16) was not complete and was subsequently resubmitted on March 3, 2004. The West Twin Disposal Area Closure Plan (Reference G-15) is the eleventh appendix to the Final Closure and Reclamation Plan, and was submitted on March 5, 2004.

As part of the Acres team, the Human Health and Ecological Risk Assessment document (Reference G-14) was reviewed by Dillon Consulting Limited (Dillon).

Background

Nanisivik Mine submitted an initial Closure and Reclamation Plan in February 2002, as a result of their decision to permanently close the Mine in October 2001. At that time, the existing water license No. NWB1NAN9702 would expire on September 30, 2002. A pre-hearing conference to review the Closure and Reclamation Plan and to review the renewal application of the Nanisivik Mine water license was held on June 6, 2002. A public hearing followed the pre-hearing conference on July 22 and 23, 2002. Both the pre-hearing and the public hearing were held in Arctic Bay, Nunavut. A subsequent technical meeting was held in Calgary on August 20, 2002 with participants consisting of technical consultants representing NWB (Acres), Nanisivik Mine (Gartner Lee and BGC Engineering), DIAND and Government of Nunavut (EBA Engineering and Brodie Consulting). A new water license for the Nanisivik Mine was issued on October 1, 2002.

Additional technical meetings were held in Iqaluit on March 29, 2003, and in Ottawa on September 22 and 23, 2003. The meeting in Iqaluit discussed the 2002 Environmental Site Assessment (ESA) Phase II, the Human Health and Ecological Risk Assessment (HHERA), and the Emergency Response Plan (ERP), submitted by Nanisivik Mine for NWB's approvals. The subsequent technical meeting, in Ottawa, was held specifically to discuss and finalize the HHERA report. An Acres representative was present at the Iqaluit meeting, and Dillon representatives were present for the meeting held in Ottawa.

The 2004 submissions of the Final Closure and Reclamation Plan by Nanisivik Mine contained in-depth and additional information on Nanisivik Mine's plan for closure and reclamation, including additional field works, technical design and studies, as well as planning details for the mine closure.

A technical meeting to review, comment and discuss these submissions was held on May 4 and 5, 2004 in Yellowknife, followed by a pre-hearing conference on May 6, 2004. The technical meeting was intended to review and discuss most of the technical issues related to the Nanisivik Mine's Final Closure and Reclamation plan by the various interested parties, before a second public hearing will take place. The 2004 public hearing is scheduled for June 3 and 4, 2004 in Arctic Bay/Nanisivik.

Acres Activities on the Nanisivik Mine

Acres was retained by NWB as an independent engineering consultant to provide technical assistance on a number of mining operations in Nunavut. Acres has been involved with the activities at the Nanisivik Mine since 1998. As requested by NWB, Acres provided reviews, comments and recommendations to NWB on the various technical documents submitted by the Mine as part of the requirements of the Water License.

Acres representative carried out a number of site visits to the Nanisivik Mine during the following periods:

- April 26 to 29, 1998,
- July 22 and 23, 1999,
- July 26, 2000,

- July 22 to 25, 2001,
- and a Public Hearing in July 22 and 23, 2002.

The Acres team, including the assistance of Dr. Bryan Leece and Dr. Ulysses Klee from Dillon on the HHERA issues, have been involved for the reviews of the technical documents since Nanisivik submitted the first draft of the Final Closure and Reclamation Plan in February 2002.

The following are our comments on the various aspects of the 2004 Final Closure and Reclamation Plan. These comments and observations were prepared for the Public Hearing to be held on June 3-4, 2004. It is understood that the scope of the public hearing is limited to the issues that are pertinent to the 2004 Final Closure and Reclamation Plan document and its appendices.

Review and Comments

1. General

Since the first public hearing was held in Artic Bay in July 2002, technical meetings have been held to collect and discuss comments, inputs and to provide recommendations from the various agencies, consultants and other parties.

As a result, the Nanisivik Mine's Closure and Reclamation Plan has evolved from the initial draft submitted in February 2002 to the current submissions in February-March 2004. Major accomplishments, which occurred within the past two and a half years include, but not limited to the following:

- Talik investigations at the West Twin Dike Disposal Area (WTDA).
- Design of the West Twin Dike's spillway to allow for surface runoff from the Surface Cell to the Reservoir of the WTDA.
- Completion of the Environmental Site Assessment (ESA) Phase II and ESA Phase III.
- Development and finalization of the issues related to the Human Health and Risk Assessment (HHERA).
- Finalization of the thermal cover designs for the tailings, waste rock and the landfill sites.
- Details on the developments of the proposed quarries to be used for closure and reclamation activities.

On the basis of the review process, that involved a number of experts from the various consultants, the technical contents of the Closure and Reclamation Plan documents presented for the Nanisivik Mine are considered to contain sound fundamental approaches to return the land to the conditions prior to the mining activities. Every effort has been made to allow for full and open discussion of any issues during the technical meetings. The documents are considered to provide a sound guideline for the Nanisivik Mine to carry out their closure and reclamation activities. It is important to recognize, that most of the issues that have

developed, discussed and been solved during the review process have undergone consensus among the various interested parties during these past two and a half years. The Plan should therefore be considered as a step in the right direction to preserve the site conditions and to protect the environment, the ecological system, the marine and terrestrial habitat, and more critically the people at Artic Bay and its surrounding area.

The Emergency Response Plan has been revised and finalized subsequent to the Technical meeting in Iqaluit. It is important that critical sections of the document containing contact personnel and their emergency phone numbers be updated.

2. Comprehensive Schedule for Closure and Reclamation Activities

There are immediate activities, which need to be completed in 2004, including drilling, sampling and testing, survey and mapping programs. These activities have been mentioned in the various documents. Nanisivik Mine should provide a complete list of these activities.

A Closure and Reclamation Plan must also contain a master schedule, showing the time line for each of the major activities. Although the actual dates may not be fixed and may still change, the schedule should show tentative dates or timeline including the following:

- estimate start and completion on each of the activities and/ or sub-activities
- activities which are continuous or intermittent
- activities which depend on completion of others and/or in critical path.

It is understood from the Nanisivik Mine letter dated May 14, 2004, that a schedule will be available for the public hearing on June 3 and 4, 2004.

3. Closure and Reclamation Periods

It is important to stress that the closure and reclamation periods are only tentative periods, and should only be used as a guide for the monitoring process, and to check the progress and effectiveness of the reclamation work. The Plan and the documents indicate that the process will be "open ended". The ultimate achievement for the site reclamation would be to return the site soil and water conditions to the original site conditions prior to the mining operation. Regular monitoring of the effluents from the WTDA, the creeks, and from the monitoring stations in vicinity of the Mine will show the degree of site recovery, and how well the reclamation activities work.

It is also important that contingency plans be in place, in case additional fieldwork is required. Installed instruments for monitoring activities may malfunction, become damaged and therefore replacement or repairs may be required during the reclamation periods. In particular, if such instruments provide critical data for the monitoring program, they will need to be replaced immediately. Nanisivik Mine may also consider ensuring that adequate instrumentation is functioning during the closure period. A plan for installation of the instrumentation must be developed in the early years of the closure period, while there is available equipments on-site to install those instruments. Alternatively, duplicate

instrumentation may also be considered, so that no critical data will be lost if some of the instrument cease to function.

4. Thickness of Cover Materials

Technical discussions were held in order to finalize the design thicknesses of the various covers for the tailings at the West Twin Dike Area (WTDA), for the waste rock piles in open pits, and for reclamation at the landfill facility. Geothermal modeling, sensitivity analysis, field test cell evaluations, as well as design calculations backed by parameters provided by additional geotechnical investigations have been carried out. They generally support the proposed 1.25 m thickness for the tailings cover, and 2.2 m cover thickness over the waste rock and over the landfill facility.

There is limited precedent on the long term performance of placement of cover materials over the tailings, waste rock and landfill site in an arctic environment. In addition, such available information is generally site specific and cannot be applied at other locations. In view of the above, and based on the technical information provided by the Nanisivik Mine, the proposed cover designs for Nanisivik are considered to be adequate. However, their performance after the placement of such cover will be important. In most cases, rigorous application of the Quality Assurance-Quality Control (QA/QC) during construction will play a significant role in the performance of such covers. Adequate instrumentation and monitoring programs must also be implemented to ensure that the performance of the cover materials can be observed and recorded over time.

Nanisivik Mine also mentions a 0.5 m cover thickness for fill to be placed above the concrete slab at the concentrate storage shed, if the slab is found to be intact and free from contaminants. However, it is not entirely clear in the documents on how to deal with reclamation in areas of suspected contamination, such as under the tank farms, land farm, industrial sites, etc. where no soil samples have been taken previously. No detailed directions are provided to complete the reclamation work after the soil is excavated in these areas. Some of the questions which need to be addressed include the following:

- If the confirmatory tests during the dismantling of these facilities suggest that some soil under these areas need to be excavated to meet the site specific Soil Quality Remediation Objectives (SQRO), what type and thickness of cover materials will be required to backfill the site?
- Is 1.25 m or 2.2 m cover thickness not applicable if the underlying contaminated soils are removed prior to remediation?
- Will the 0.5 m cover thickness be applied as a guide for backfilling thickness for landscaping purpose, i.e. in areas where there is no concern of contaminants in the underlying soil?
- If there is a big pit created after the excavation is made to remove contaminated soils, would it be necessary that the site be backfilled and contoured back to its surrounding or original ground area?

- If confirmatory testing does not encounter any contaminant under these structures, will the 0.5 m cover still be applied?

5. Taliks Investigation

A considerable amount of work has been carried out in the past two years to identify, characterize and model the presence of taliks under the surface cell of the WTDA. Comments, discussions, and reviews were made from the results of the investigations during the technical meeting in Yellowknife. Similar to the cover design, the presence of taliks under the tailing ponds is generally site specific. At the meeting in Yellowknife, a comment was made that a portion of the taliks under the tailings may proceed more slowly, and may not freeze within the time frame as indicated in the report (within 30 years). While this may not affect the integrity and stability of the dike, or the pore pressure conditions under the tailings, considerations remain that long term monitoring is a critical issue, which needs to be implemented appropriately to ensure that the reclamation work at the WTDA will proceed as anticipated. In addition, a contingency plan must be in place to carry out any additional work, if necessary, after the proposed closure period, or even after the proposed reclamation period.

The instrumentation and monitoring programs are therefore the most important mechanisms to provide early detections or early signs, if there will be problems related to the increased of pore pressure within the taliks zone, or if there are additional measures which are needed in the field beyond the closure periods. BGC Engineering has prepared tables containing a list of contingency plans and required actions to remediate the problems, if they occur. A comprehensive monitoring program, followed with quick responses and actions by the Nanisivik Mine will be required in the early years of the reclamation period.

6. Reclaimed Underground Mining Site

A number of technical papers were included as part of the Closure and Reclamation Plan, and discussions were made during the meeting in Yellowknife. A remaining issue that is associated with the underground mine site at Nanisivik is related to the stability concerns of the mine after the main pillars were removed. The drawings show that some of the pillars near the portal areas remain intact, and Nanisivik Mine may need to address this in view of the stability concerns at the portal areas. It is not clear in the documents on the details of sealing these portals. Are the current portals lined, and will the liners be removed prior to sealing of these portals? Details information related to the sealing of the portals, adits, openings, ventilation shafts, etc. should be fully documented. In addition, preventive measures such as warning signs near the portal, and along the alignment of the mine area should be placed to warn people of any potential subsidence as a result of mine caving. Instrumentation such as placement of survey monuments and their monitoring, as well as annual inspection by visual observation will be helpful in assessing the conditions of the closed mine areas. The inspection can be carried out in conjunction with the annual geotechnical inspection for the Mine.

In their letter dated May 14, 2004, Nanisivik Mine indicated that the mine stability issues, as well as closure of the portals will be prepared and submitted to NWB by the end of the year (2004).

7. Instrumentation and Monitoring Program

Nanisivik Mine provides a list of proposed instrumentation and their frequency readings for both the closure and reclamation periods. The number of instruments and the frequency of readings are reduced after the completion of the closure period (2 years).

Considering the importance of the monitoring program to evaluate Nanisivik Mine's compliance, as well as to closely monitor the site conditions, such as the taliks, permafrost aggradation, and water quality, Nanisivik Mine should consider that the number and frequency of instrument readings to remain open for changes and modifications. Observations and readings during the closure period will determine the necessity to reduce or increase the monitoring program in the subsequent years.

The past compliance records indicate that Nanisivik Mine has had some problems meeting the requirements for instrumentation monitoring, as well as some problem meeting the criteria set in the program. The performances of the water quality, taliks conditions, or permafrost aggradation depend on the design and implementation of the reclamation activities. Once these reclamation activities are completed, they will require additional measures to modify the designs only if it is required. On the other hand, Nanisivik Mine must make a commitment to carry out the monitoring program, and must have a program to monitor and report instrumentation readings on a timely basis.

BGC Engineering indicates in their annual geotechnical inspection reports about the need to properly manage a monitoring program. Training manual on the monitoring for various types of instrumentation, as well as monitoring guidelines should be produced to suit the conditions at Nanisivik. More critically, the monitoring program should also provide clear directions on the reporting of critical data, which may require immediate or further attention. Because the monitoring program will be carried out without presence of the current mining staff after the closure period, training of local residents of Arctic Bay must be carried out immediately. NWB held a public meeting with the residents of Arctic Bay on May 11, 2004. A NWB report summarizing this meeting, dated May 19, 2004 indicates that the local residents were not aware of this training program. Nanisivik Mine should provide a plan for the training program for monitoring of instrumentation, and should provide a schedule for implementation of this plan. The local residents will need some training and experience for performing those tasks, and therefore the program should start immediately.

8. HHERA

The Human Health and Ecological Risk Assessment (HHERA) document was completed and submitted in early 2003. Since then, various discussions, technical meetings have been carried out in Iqaluit and Ottawa to finalize this document and to develop the SQRO for the site. As part of the Acres team, Dillon presented their final comments on issues related to

this document in their letter dated May 13, 2004. If required, Dillon representative will be available to provide any additional comments or answer any questions related to the HHERA issues during the public hearing.

A letter from Dillon which summarized the HHERA issues is attached.

9. Plan for the Industrial, the Dock Areas and Town Complexes

There are still inadequate information and detail activities related to these three areas. It is understood that the infrastructures at the industrial complex will be taken over by a third party.

A map showing all of the structures in these two areas, and the demolition status for these structures will be helpful. A detailed plan and schedule to demolish, remove, or to leave any of the structures will be required, since they must be approved prior to the start of the work.

Detailed information on how the existing tank farms near the dock area will be reclaimed, including confirmatory test for any potential contaminations to the underlying soil should be discussed. Other related issues include any requirements for instrumentation and monitoring for this area and how to reclaim the site after the area is free of contamination.

It is still unclear on how all or some of the foundation slabs of the structures in the three areas will be reclaimed. A procedure will be required to determine how the confirmatory tests will be carried out in areas under the foundation slabs or footings if they will not be removed. Nanisivik Mine letter dated May 14, 2004 mentioned about 2.2 m cover in the industrial complex. This brings the remaining issues discussed previously in this report on cover thickness requirements, which remains to be clarified for these three areas.

10. East Adit Treatment Facilities

Nanisivik Mine indicated in their letter dated May 14, 2004 for their intended reclamation work in these facilities. A contingency plan was also indicated in the letter. It would be helpful if water quality sampling records in these areas be gathered and presented, so that an effective evaluation can be made to determine whether these facilities can be closed within the closure period of the mine. Remaining issues to predict the closure of these facilities include the following:

- Are the facilities currently active?
- Will these facilities be used during the closure period?
- How was the water quality collected from the sampling stations in the area changed after the mine closure in October 2001?

11. Strathcona Sound

Nanisivik Mine carried out a sampling program in the Strathcona Sound in 2003. A similar program should also be carried out in the future to show that the water quality in the area

improves over time. This program would be able to address the water quality and the conditions of the aquatic habitat in this area.

12. Reclamation of Mine Service Roads

The Final Closure and Reclamation Plan mentions that the roads servicing the dock, airport, East Twin Lake, and the town site belong to the Government of the Nunavut Territory. Service roads in the mine area and at the WTDA are the responsibility of the Mine, and therefore will be reclaimed. The proposed remediation work for reclaiming the roads will include removal of culverts, breaching of sections of the roadbed that interrupt natural drainage, re-contouring, etc. Some questions which need to be addressed include the following:

- Is the causeway located near the upper dump pond a part of the road which leads to the East Twin Lake, and therefore will not be reclaimed and breached?
- Will the road leading to Kuhulu Lake remain open for public after reclamation work?
- Are the roads to the East Adit and Ocean View areas, and to the Area 14 planned to be reclaimed? Would any of these two roads lead to the Kuhulu Lake?

A map which shows the existing road system, those sections that will remain open for public, and those that will be reclaimed by Nansivik Mine will be useful for planning of the reclamation activities. This map should clearly show sections which will be reclaimed. It should also show road sections where confirmatory soil testing will be conducted prior to the remediation work.

We trust that this information is suitable for your purpose. Should you have any further questions or concerns regarding the above, please do not hesitate to contact me.

Yours very truly,

RAH:sep
Attach
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R. A. Halim, P.Eng.
Senior Geotechnical Engineer

May 28, 2004

Dionne Filiatrault, P. Eng.,
Manager Technical Services
Nunavut Water Board & Nunavut Impact Review Board
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RE: Human Health & Ecological Risk Assessment: Nanasivik Mine Peer Review

Dear Ms. Filiatrault

At the request of the Nunavut Water Board, Dillon Consulting Limited undertook a peer review of the human health and ecological risk assessment (HHERA) prepared by Jacques Whitford Environmental Limited (JWEL) as part of the Nanasivik Mine Closure. The HHERA was conducted to determine the potential human health and/or ecological risks associated with the presence of metals and other contaminants in the environment at the Nanasivik Mine Site. The HHERA was also used to develop *Soil Quality Remediation Objectives* (SQROs) that would aid in the development of a remediation plan for the area. The SQROs represent levels of contaminants that do not pose a risk to human health or the environment.

The peer review was undertaken to ensure that the HHERA adequately addressed potential exposures for humans and ecological receptors and that the exposure and risk estimates developed in the HHERA were suitably protective of human health and the environment. The review also assessed the SQROs developed for the Nanasivik site to determine if these values would provide adequate protection of all receptors.

The peer review of the initial draft report identified several areas where clarification and additional information was needed to support the findings of the HHERA and the SQROs. The issues raised during the review process have been adequately addressed in the final report. The SQROs presented in the final report adequately address both potential human health and ecological concerns and will provide suitable protection for human health and the environment.

Sincerely,

Bryan Leece, Ph.D.
Senior Toxicologist/Risk Assessment Specialist
Dillon Consulting Limited