teckcominco

John Knapp
Site Manager

May 25, 2003

Nunavut Water Board
Box 119
Gjoa Haven, NU
X0B 1J0

Attention: Philippe di Pizzo, Executive Director

Dear Mr. Di Pizzo;

Re: Polaris Mine Reclamation and Closure Plan-Meltwater Control Procedures

Thank-you for the NWB's May 16th response to the Polaris submission regarding the above. Your response, coupled with those of Environment Canada, raise a number of issues. For clarity, the concerns and questions have been copied to this letter and I will deal with each as they are presented.

NUNAVUT WATER BOARD:

1) The introduction of water into the underground permafrost environment risks degradation of the thermal regime around the disposal chamber, at least temporarily.

This is a valid concern, however empirical evidence from operational activities indicates that it won't lead to problems. Polaris, as part of routine mine operation, backfilled excavated mine workings with a watery slurry that was allowed to freeze in place to provide support to overlying and adjacent structures. Once the material froze, which took 6 months or more, mining was undertaken in the areas immediately abutting the backfilled areas. No unsafe conditions were encountered during this activity. It is important to note that the rock and water mixture had a higher thermal capacity than the meltwater Polaris is proposing to place underground. Also, in general, the volume backfilled during operation were much greater than the 10,000 - tonne potential quantity of meltwater. Lastly, much of the backfilling was undertaken at greater depths, warmer rock temperatures, and under greater rock pressure conditions, than the location proposed for the meltwater. Adverse consequences are not expected, since they would have been more likely in the past than in the present situation.

Backfilling activity often took place during the Summer, which meant that the water, and associated rock, entered the mine at higher temperature than would be the case for the

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meltwater. In the case of the West Panhandle Zone (see drawing 'Mine Composite wrt Shoreline & LRD), Cemented Rockfill was utilized. This material was heated before placement, and because it contained cement, it generated additional heat as it cured. Although it was placed in voids within 35 meters of the ocean floor, no adverse conditions were noted.

These factors together lead us to conclude that the meltwater disposal will not pose a significant risk to the thermal regime or rock stability in the area being proposed.

2) Degradation of the thermal regime may result in some instability of the surrounding rock mass due to thawing propagating from the storage chamber to some distance into the rock. With design rationale and risk assessment for the proposed meltwater control procedures TeckCominco should provide additional details on the proposed ditching scheme and subsequent remediation to avoid degradation of the permafrost and erosion.

The ditching envisioned will divert non-contaminated meltwater, originating from outside the area of industrial disturbance, away from any potential sources of contamination. This is simply an upgrade to the ditching system employed at Polaris over the last several years. The enhancements will reduce the amount of water that can enter areas of contamination by connecting or extending existing ditching. Any water collected by the ditching will originate in non-contaminated areas, and will not differ from meltwater being generated on any other island in the Arctic. All ditching is established in gravels and generally along roadways immediately above the industrial facilities, and will be remediated as part of the project scope. No ditching will be undertaken in areas of tundra, in areas of plant growth, or in areas that are readily eroded. Additionally, the ditching will be less than half a meter in depth and will be contained within the active layer. Silt curtains and sediment containment socks will be utilized if required to maintain the clarity of the water being discharged.

The storage chamber would be used only to receive potentially contaminated water from within the area of industrial disturbance. This water would be from snow melting in the area of industrial disturbance, or from water that was not captured by the ditching. Please see Item 1 above.

3) What is the risk that there may be more meltwater discharge than estimated? What is the volume and retention time of the proposed settlement/remediation containment sump and is there a risk that it could be overtopped? Is there a contingency plan for dealing with extreme flows?

The volume estimate for the potentially contaminated meltwater that would require pumping is extremely conservative and assumes that all yearly precipitation that would fall within the area of industrial activity will report as meltwater. In fact, however, most snowfall blows away, and most accumulations of snow that don't blow away are mechanically removed. These removal efforts will continue until the melt begins. The removed snow is collected in previously contaminated areas outside of the drainage

basin discussed herein. These areas will ultimately be remediated as part of the project scope.

The sump used to collect potentially contaminated water will be approximately 75 m3. Overtopping is extremely unlikely due to the abundance of available pumps that can be employed to discharge the water. In the event that it does overtop however, it will merely flow back into the area from which it was originally collected and no additional contamination will result.

A contingency plan for extreme flows has been considered. It would rely on pumping the contaminated meltwater into Little Red Dog Quarry, where it would mix with the construction debris and infill soils. This option has many advantages. Firstly, over 500,000 m3 of containment volume would be available. Secondly, mixing of this water with the solid materials being placed will eliminate any possibility of subsidence or heaving once the water has frozen. Further, the discharge and storage would be isolated from the underground mine workings and would therefore be more easily endorsed by the Mine Inspection Services (WCB). Care would be taken to ensure that the pump discharge was directed so as to avoid washing in-fill soils away from the demolition debris. Lastly, in-pit containment of the meltwater is extremely cost effective. The only disadvantage to this option is that it may complicate the placement of demolition debris if the water level rose more quickly than expected

In-pit disposal of potentially contaminated meltwater was Polaris' first choice initially, but it was felt that it would be unacceptable to Regulators. The Reclamation and Closure Plan stated that sulfide contaminants would be placed underground. The meltwater will have some minor sediment loading, including some mineral sulfides, even if silt-control textiles are utilized. For this reason, Polaris felt this approach would not receive Regulatory approval. If, upon review, the Nunavut Waterboard and Environment Canada conclude that this option is preferable, Polaris would welcome receiving permission to implement this method.

4) What is the chemistry of the meltwater before and after remediation, including assessment of untreated water chemistry for direct underground disposal? This would include a check on the freezing point depression that may be associated with any contaminants.

Meltwater chemistry has not been established. However, since it is flowing from and over uncontaminated materials there is little reason to anticipate the uptake of undesirable species. This rationale is supported by the fact that Polaris draws its freshwater directly from Frustration Lake, which is merely a meltwater drainage basin. Further, due to the lack of soluble salts, there is no reason to expect an impact or depression of the water's freezing point.

The ice found in fissures and voids underground has a significant salt content and an associated freezing point depression yet it remains frozen year around even during

mining. The melt water that Polaris recommends introducing underground will be of significantly higher purity and will, therefore, freeze readily.

Lastly, any suspended particulate matter will consist of benign carbonaceous mineralization, or naturally occurring lead and zinc sulfide minerals which all originated from within the mine. There is no risk of adverse environmental effects arising from the introduction of a foreign material.

5) The underground storage volume is about 17% greater than the expected volume of meltwater to be stored. Assuming a 10% expansion due to freezing, this leaves about 7% freeboard volume in the disposal chamber. Therefore the roof of the chamber may not have much benefit of ice support, contrary to the idea proposed. In fact the presence of water may destabilize the roof, due to thawing of the haunch area, associated with the propagation of a thawing from into the surrounding rock mass.

Underground backfill activities undertaken during operations seldom achieved what is termed "tight-fill", which occurs when the void space is eliminated through specialized techniques. Despite the remaining void space, however, the support provided to the walls resulted in an enhancement to the overall stability of the workings (please see Item #1) and mining was subsequently conducted in immediately adjacent areas. Polaris does not anticipate that the recommended disposal of water underground will differ in effectiveness.

6) A thermal analysis should be carried out to assess the short-term effects of introducing the proposed volume of water into the underground permafrost environment, with regard to the following concerns:

a. Effects of stability of the rock mass surrounding the disposal chamber;

Polaris does not expect rock stability to be adversely affected for the reasons previously stated.

b. Consequences of potential rockfalls and need for installation of supplementary rock support prior to disposal;

Rockfalls in the area under consideration would not impact the project since there are no adjacent or overlying workareas that could be impacted.

Further, due to it's role during the facility's operation, the area under consideration already has supplementary rock support in place, consisting of 6 ft long "Swellex" rockbolts placed in 6 ft x 6 ft grids, which are standard for any development working such as this.

c. Time for freeze-back, based on meltwater chemistry, and estimated time for return to ambient conditions within the surrounding permafrost regime.

Based on previous observations during operation, the thermal regime should be restored within a few months. Some freezing will occur immediately, due to the low temperature of the meltwater when it is collected.

d. Confirmation that there is no risk of thaw bulb reaching adjacent talik zones, such as the ocean floor next to mine. What is the proximity of the disposal chamber to the nearest thawed zone, such as the adjacent ocean floor?

There is no risk that any thaw bulb could reach the ocean (see Drawing 'Mine Composite wrt Shoreline & LRD). Laterally the area under consideration is approximately 300 meters from the ocean, and vertically it is 40 meters below sealevel. There are no other thawed zones, as the mine workings are contained entirely within the area of continuous permafrost and permafrost extends a further 300 meters below the proposed disposal chamber. Talik zones were not encountered anywhere within the mine workings over the past 20 years of operation.

e. Confirmation that no geological structures may act as seepage paths, if and when thawed; Are there any major geological structures (i.e., faults, shear zones, etc.), that could act as a seepage conduit if and when thawed?

There are no structures or seepage paths in the area being recommended that could serve as a seepage conduit. This was evidenced repeatedly while in operation when meltwater from the surface entered the mine via the raisebore holes. Significant accumulations of resulted, but they did not migrate to other workings even though the distances between workings were much shorter than would be the case for the area being recommended.

f. Confirmation that liquids will not migrate from the disposal chamber.

There is no risk that the meltwater can migrate from the disposal chamber. It is shaped like a basin and has been developed in competent waste rock. There are no existing pathways, since underground voids and fissures are filled with ice. If some of this ice melts, the effect will be temporary, and the fissure or joint will seal itself quickly.

g. Consideration of risk to area designated for disposal of hydrocarbon contaminated soils; What I the proximity of the proposed disposal chamber to the area designated for underground disposal of hydrocarbon contaminated soils?

The KEX zone, designated for receiving soils contaminated with hydrocarbons, is laterally removed from the area being recommended for melt water by 600 meters (see Drawing 'Disposal Location wrt KEX zone). Also, the KEX area is 160 meters below the disposal chamber. The straight-line distance between the two areas is 620 meters. Both zones are in cold areas of the mine, well away from the –4 C thermocline which was viewed during operations as the point where the risk of thawing precluded safe mining.

h. Consideration of appropriate factors to account for long-term global warming to confirm that the disposal area will remain frozen;

Thermal modeling of global warming conservatively established the need for 1.8 meters of cover cap over Polaris landfills. The area being recommended for

receiving meltwater is overlain by 40 meters of rock. Global warming will not significantly impact the recommended meltwater receiving environment.

i. Installation and monitoring of thermistors around the disposal chamber to monitor the effects of water disposal and subsequent freeze-back, to confirm modeled predictions and verifies the assumed integrity.

Given the information provided, this measure is felt to be impractical and not required. Further, the necessary equipment and appropriate operating skills are not available and could not be arranged within the time available.

Lastly, the Project scope includes the provision for sealing all mine entrances, which would cutoff access for subsequent monitoring. Installation and monitoring thermistors from surface (40 meters away) is deemed impractical.

7) Does TeckCominco have an alternative for disposal of meltwater than the one presented in the submission of March 20, 2003?

A contingency plan has been considered. It would rely on pumping the contaminated meltwater into Little Red Dog Quarry, where it would mix with the construction debris and infill soils. This option has many advantages. Firstly, over 500,000 m3 of containment volume would be available. Secondly, mixing of this water with the solid materials being placed will eliminate any possibility of subsidence or heaving once the water has frozen. Further, the discharge and storage would be isolated from the underground mine workings and would therefore be more easily endorsed by the Mine Inspection Services (WCB). Care would be taken to ensure that the pump discharge was directed so as to avoid washing in-fill soils away from the demolition debris. Lastly, in-pit containment of the meltwater is extremely cost effective. The only disadvantage to this option is that it may complicate the placement of demolition debris if the water level rose more quickly than expected

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ENVIRONMENT CANADA:

Environment Canada recommends that the following conditions be applied throughout all phases of the project:

- Environment Canada requests information outlining where the soil excavated for the ditch system will be stored. Further, EC recommends that any soil excavated during the construction of new ditches from any areas of known hydrocarbon contamination be tested prior to disposal.

  The excavated soil will not be transported or stored remotely. Instead, it will be used to establish the walls of the ditch being established. In general, the ditches will be in uncontaminated areas so as to ensure that the collected water remains uncontaminated. Water ultimately destined for the ocean will not be routed through contaminated areas or ditches. If a ditch must be routed through a contaminated area, the soils involved will be tested before being utilized. If contamination remains, steps will be taken to minimize the likelihood of mobilizing contaminants by lining the ditch and installing geotextile fabrics as required.

- Environment Canada recommends that all interceptor ditches be backfilled upon completion of the reclamation and abandonment plan and regraded to match the existing landscape.

  See related comment (#2) from NWB and TCL response. The Reclamation and Closure plan commits to contouring and grading of the site to minimize the impact to natural watercourses. Ditching will be limited to the current area of industrial disturbance, and will be contoured and remediated as appropriate.

- Environment Canada requests information regarding the size of containment sump to be used, its expected freeboard, and its location in relation to water. Further, at the end of meltwater control program (i.e. by Spring 2004), the proponent shall ensure that all contaminated particulate from the bottom of the sump is removed and treated prior to disposal, and that the sump is backfilled and recontoured to match the existing landscape.

  The sump will be fabricated steel, approximately 75 m^3 in size. It was originally a process vessel used within the concentrator. It will have approximately 30 cm of freeboard which will be maintained by varying the pumping discharge rates. The sump will be located within the area of contamination where the water will be collecting. In the event the sump overflows, the water will merely pool in the area from which it was to be pumped from.

  The solids will be removed and disposed underground along with any other similar metal sulfide contaminated soils. The sump will be situated above ground, eliminating the need to backfill or recontour.

- TeckCominco Ltd. has indicated that there will be no need to pump meltwater underground after Summer 2003, as the barge, the concentrate storage shed, and the associated contaminated soils will have been remediated before Spring 2004. However, earlier in the letter, they indicate that the area of contamination includes the accommodations, barge, concentrate storage shed, and ancillary buildings. Unless the remediation of all contaminated areas is completed by Spring 2004, EC recommends that the meltwater control procedures be extended until the clean-up of all areas of contamination is complete.

Although the Accommodations complex and some ancillaries are located upslope of the industrial facilities, and will remain during the Spring of 2004, they are not situated on contaminated soils. They were mentioned in the original letter of March 20th only in the context of snow removal, which was necessary to minimize the amount of meltwater that would be generated and handled by the ditching system. Providing the contaminated soils associated with the industrial facilities (barge, concentrate shed, etc.) have been removed, there won't be any meltwater contamination in Spring 2004. In the event that contamination remains, it is expected that the area involved will be minimal, and appropriate meltwater control measures will be maintained to ensure compliance with the applicable regulations.

- The proponent has stated that silt containment is not mandatory. However, according to the Fisheries Act, Section 36(3), the deposition of deleterious substances of any type in water frequented by fish, or in any place under any conditions where the deleterious substance, or any other deleterious substance that results from the deposit of the deleterious substance, may enter any such water, is prohibited. The proponent shall not deposit, nor permit the deposit of sediment into any water body. Therefore, TeckCominco shall ensure that any meltwater that acquires additional sediment during its travel through newly excavated ditches receives treatment (such as the use of silt curtains or fences, or other similar preventative measures) prior to its release to the marine environment.

  The original March 20th TCL submission stated "this water will be passed through silt containment textiles (fences or socks) before being allowed to enter the ocean". Teckcominco Ltd. agrees with EC's viewpoint and remains committed to this approach.

- Environment Canada requests that TeckCominco Ltd. measure and record the actual amount of water that will be pumped into the underground storage vault. The proposed procedure provides estimates; however, it would be valuable to know the actual amount in order to determine the remaining storage capacity during the reclamation process.

  Teckcominco Ltd. feels it would be impractical to attempt flow measurements. However, the receiving chamber will remain accessible during the course of the reclamation project. It will be possible to approximately determine the remaining volume available, thereby more directly satisfying EC's concerns. The receiving chamber will be routinely inspected by the Mine Superintendent (and others) on a scheduled basis for as long as the mine workings remain accessible.

- In order to establish a baseline that can be used to respond to any potential accidents or malfunctions either with the piping system or the underground containment itself, EC recommends that TeckCominco Ltd. complete water chemistry testing of the meltwater to be disposed of underground.

  Please see response to the same concern expressed in NWB's submission (#4). The disposed water will be runoff, bearing minor sediment loading and minimal dissolved species. The sediment will consist of either naturally occurring surface mineralization, or carbonaceous and sulfide mineralization that originated from within the mine. As such, the placement of this material underground will not lead to any environmental

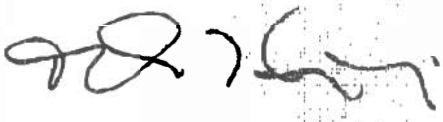
impact nor result in any adverse effects.

Teckcominco Ltd. requests that this matter receive your earliest possible attention. Melting has begun, and water is beginning to pool in low-lying areas of the operation. Steps are being taken, as described above, to minimize the accumulations and deal with the water flows, but these measures will not suffice. The resolution to this matter is rapidly becoming urgent.

Please feel free to contact me if the above leads to any concerns or further questions.

Yours truly,

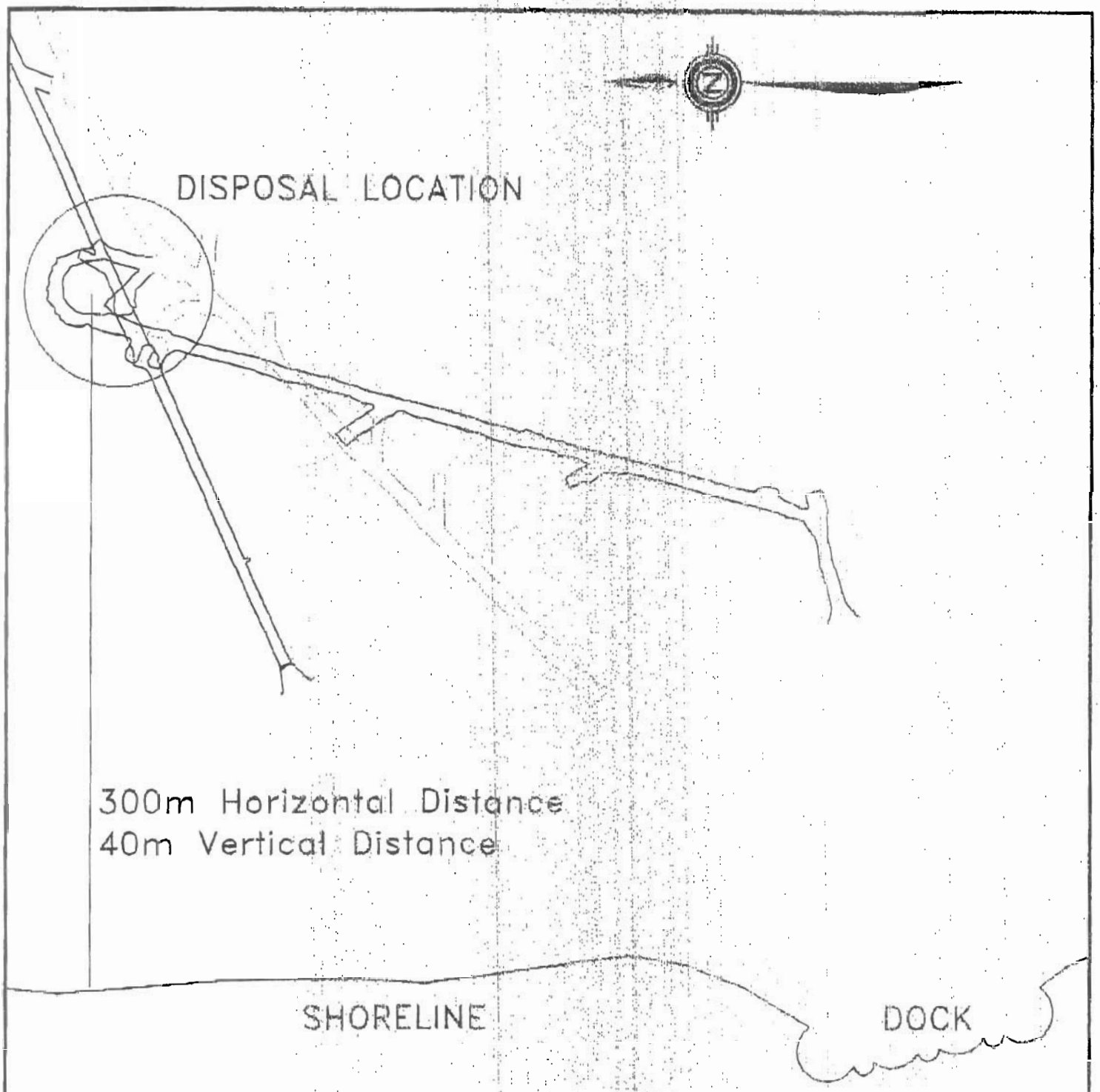
Cominco Mining Partnership



John Knapp
Site Manager
Polaris Reclamation Project

Enclosures (3)

cc: Mr. Carl MacLean, DIAND
Mr. Bruce Donald, Reclamation Manager, TCL
Mr. Bob Hutchinson, General Manager, Projects, TCL
Mr. Walter Kuit, Director, Environmental Affairs, TCL
Ms. Colette Meloche, Environmental Assessment Specialist, EC
Mr. Martin Van Rooy, MIS



POLARIS MINE

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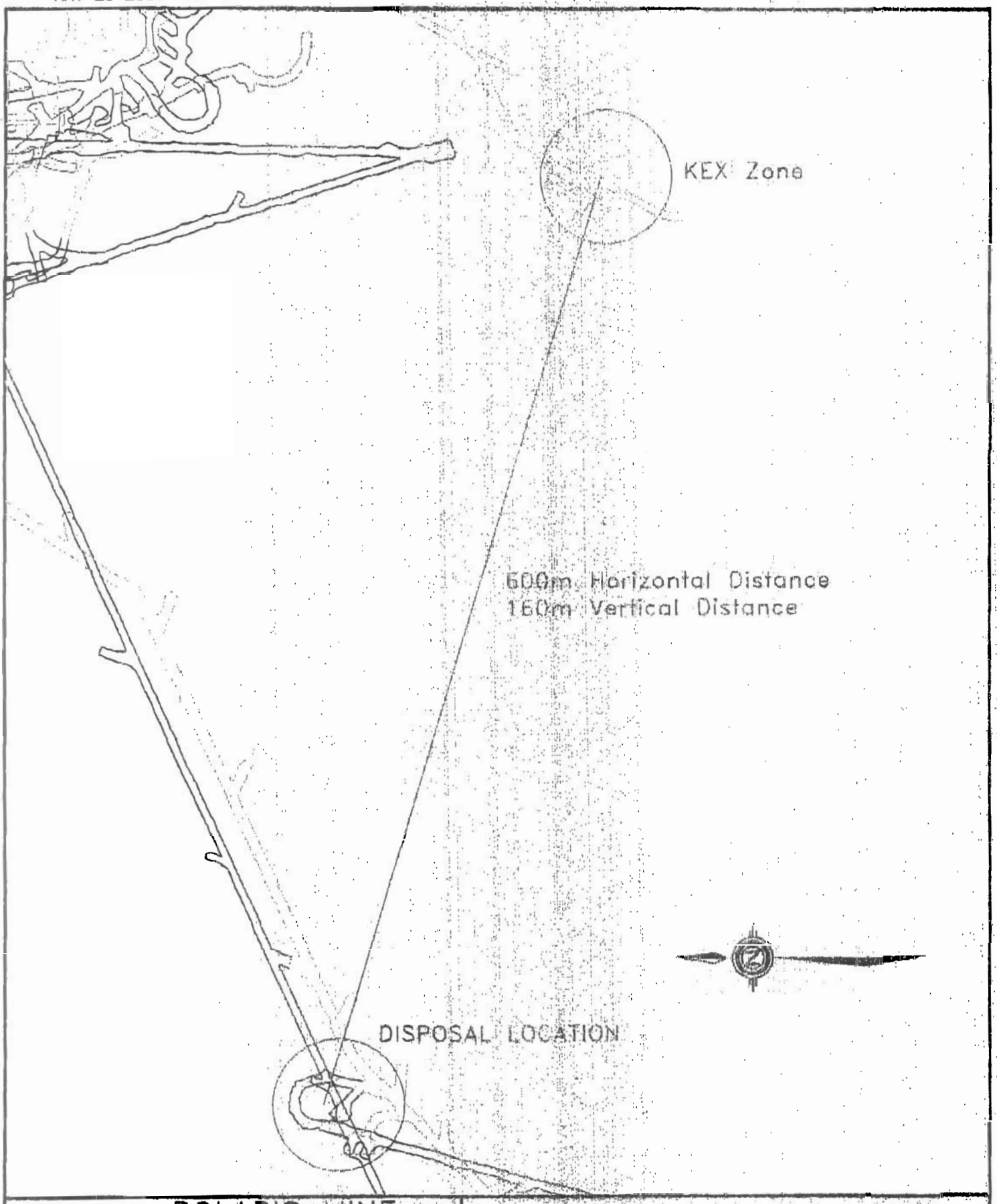
Disposal Location wrt Shoreline

DRAWN BY	SCALE	DATE	DWG #
TSF	NTS	May 2003	



POLARIS MINE

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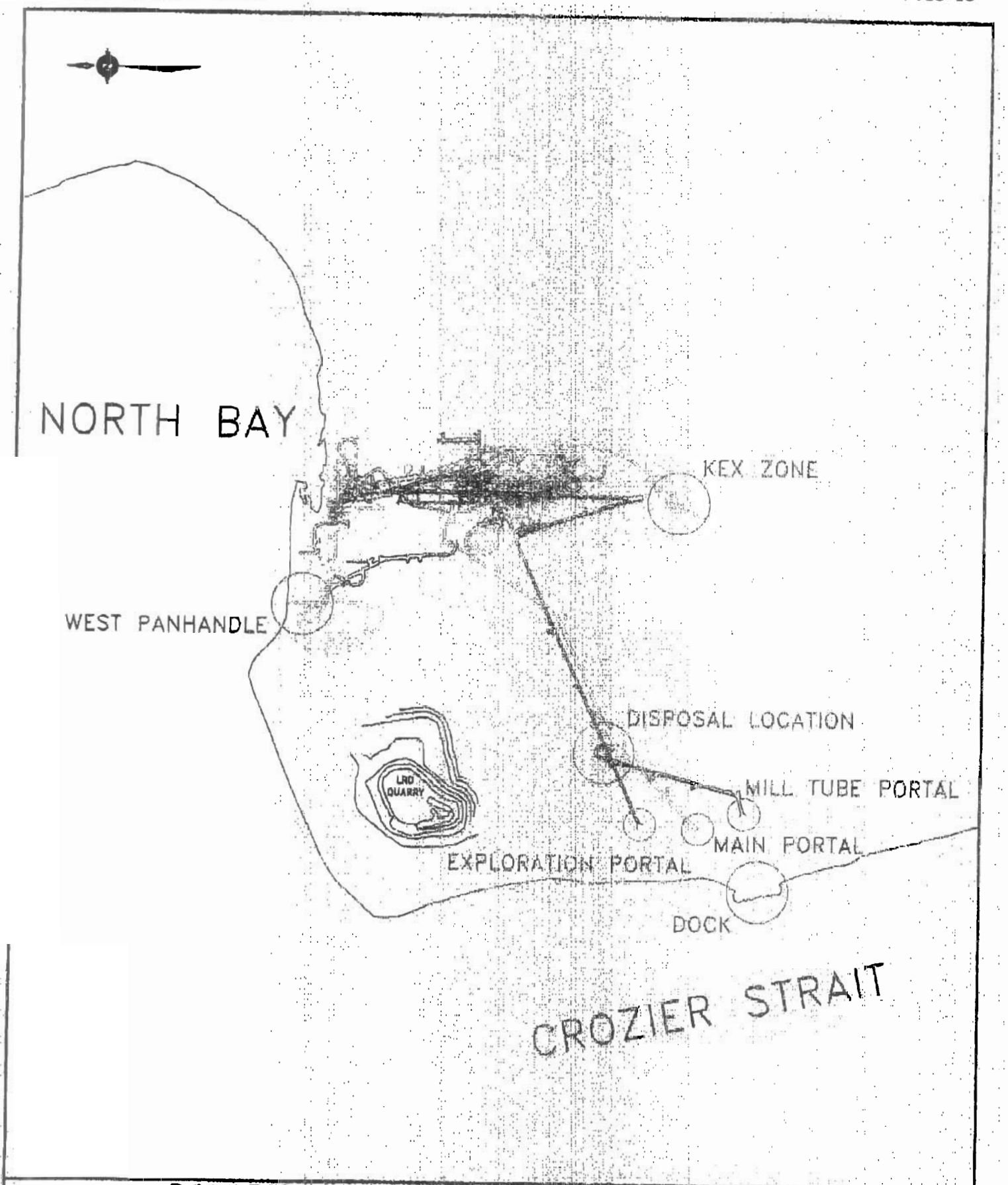
Disposal Location wrt KEX Zone

DRAWN BY: TSF | SCALE: NTS | DATE: May 2003 | DWG #



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POLARIS MINE

Mine Composite wrt Shoreline & LRD

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