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**Kennecott  
Minerals**

April 8, 1996

Mr. Larry Lynch  
Mine Reclamation Section  
Bureau of Solid Waste Management  
Wisconsin Department of Natural Resources  
101 South Webster Street - GEF II  
P.O. Box 7921  
Madison, WI 53707-7921

Dear Mr. Lynch:

Re: Flambeau Project Pit Backfill Plan Revision

Pursuant to procedures which have been established over the course of this project for submittal of minor changes to the mine plan, this letter describes proposed changes to the reclamation plan specifically pertaining to pit backfilling at the Flambeau Mine site near Ladysmith, Wisconsin. These changes are considered minor in that the main concepts used to develop the approved pit backfilling plan remain intact. The proposed changes are a result of detailed planning and reaction to observed conditions at the site.

The existing approved pit backfilling plan is part of the reclamation plan as set forth in Section 5 of the approved Mine Permit Application (MPA). Section 5.7 specifically relates to pit reclamation.

Three minor changes and one clarification to the pit backfilling plan are addressed in this letter. They are as follows:

<u>Affect to Plan</u>	<u>Description</u>	<u>Location in Existing Plan (Section, MPA)</u>
Minor Changes	In lieu of using lime (calcium oxide) at a rate of 2.5 pounds per ton, crushed limestone finer than $\frac{3}{8}$ inch will be used for acid neutralization in the pit backfill at a rate of 3.0 pounds per ton.	5.7.1.1
Minor Change	In lieu of commencing pit backfilling at the completion of mining, pit backfilling will begin while mining is still underway.	5.7.1

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<u>Affect to Plan</u>	<u>Description</u>	<u>Location in Existing Plan (Section, MPA)</u>
Minor Change	Mine backfilling equipment may include earthmovers, conveyors, etc. in addition to or in lieu of haul trucks to transport or move backfill into the pit.	5.7.2.1
Clarification	While the ultimate vertical sequence of placement of material in the backfilled pit will be as described in the MPA, access to the Type II material layer will be maintained during placement of the upper layers (Type I waste rock, sandstone and saprolite) in the eastern and western portions of the pit to allow for placement of ballast and track subgrade material from the site railroad spur with the Type II material.	5.7.2.1.3

The following text describes each minor change/clarification, provides justification for each minor change/clarification, and describes how each minor change/clarification is accommodated within the approved plan.

#### **Addition of Crushed limestone in Pit Backfill**

In Section 5.7.1.1 of the MPA, the current plan describes the addition of lime (calcium oxide, CaO) to bring the contact water within the backfill open pit to a pH of 6.5. The rate of application of CaO was estimated at 2.5 pounds per ton of Type II material and was based on current literature (at the time) and leaching studies performed on the Type II material. Testing of leachate from the Type II area, the results of which have been routinely submitted to the WDNR along with the turn-around-documents for the project, show that the field pH has primarily ranged between 6.0 and 7.0.

The approved reclamation plan proposed that 2.5 pounds of lime (CaO) be added to each ton of Type II waste rock during the backfilling process. The proposed addition of lime was based on the results of the laboratory tests which showed that an increase in intersitial water pH would control the potential oxidation of the sulfide minerals within the saturated waste.

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A review of the Type II stockpile leachate analytical data shows that the pH of the leachate is nearly neutral. Due to the near neutral pH of the leachate, and by inference the waste rock interstitial water, it is now recommended that crushed limestone be added to the Type II waste rock during backfilling rather than lime (CaO) to control the interstitial water pH. Since the neutralization potential of lime is 1.2 times that of limestone, the recommended application rate is 3 pounds of crushed limestone per ton of Type II waste rock (1.2x2.5 pounds CaO/ton of waste rock = 3 pounds limestone/ton of waste rock). This change in neutralizing materials is recommended for several reasons:

1. Calcium oxide (lime) is very reactive, and since little activity currently exists in the Type II stockpile leachate, the addition of lime should significantly increase the interstitial water pH. This reaction takes place regardless of whether acidic conditions have developed in the backfilled materials or not. If alkaline conditions are created by the addition of CaO, clarifier underflow (CUF) material may redissolve resulting in the release of additional metals.
2. Crushed limestone will only react when conditions dictate a need for a reaction. In other words, limestone buffering of lower pH water will take place at reaction rates dependent on the degree of acidity present. Waters at a pH of 7 or above will not react with crushed limestone, thus CUF will not redissolve.
3. Crushed limestone can be processed to provide a variety of particle sizes. It is anticipated that crushed limestone consisting of particles ranging in size from 3/8 inch down to P200, will be used for the project. The smaller particle sizes offer greater surface area per unit mass which enhances the potential reactivity of the material.

### **Pit Backfilling Will Commence Prior to the Completion of Mining**

Section 5.7.1 of the MPA states "Backfilling of the pit will commence at the completion of mining. As per Figure 5-1, this is scheduled to occur after the planned ore removal is completed." The proposed minor change is to begin backfilling prior to completion of ore removal. It is proposed that while mining the lowest portions of the west half of the open pit, the waste rock encountered will be deposited immediately in the east half of the open pit which will have already been mined to its final grades. Concurrent backfilling of Type II material from the Type II storage area will also commence upon completion of mining in the eastern half of the open pit.

This minor change is an outcome of detailed mine planning. Through its implementation, resources will be put to more efficient use to achieve the same ultimate goal of a properly backfilled pit. Time and energy that would be spent moving the last quantities of Type II material from the pit to the Type II storage area and then back into the pit can be better allocated to other purposes. Surface water within the backfill area would be handled the same way as outlined in the approved

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Reclamation Plan, namely directed to sumps and treated at the wastewater treatment plant. Crushed limestone would be added to the backfill material at a rate of 3 pounds per ton (see previous section). Figure A is attached to this letter and shows the anticipated time frame for backfilling the entire pit. Note that the backfilling process is scheduled to commence approximately 12 months sooner than originally planned due to the accelerated mining rate discussed in Flambeau's letter to you dated January 31, 1994 (WDNR File No. 2720) and the minor change discussed in this letter.

### **Mine Backfilling Equipment**

Within Section 5.7.2.1 of the MPA, a list of mine equipment expected to be used for backfilling is identified. The list was developed based on a backfilling concept using front-end loaders and haul-trucks to do the bulk of the backfilling.

Based on current mine planning, it is possible that other equipment such as earthmovers (scrapers), conveyors, etc. could be used as a means of moving material from the Type I and II storage areas, etc., into the pit. It is also possible that compaction equipment, such as a sheepsfoot roller, drum roller, vibratory compactor, etc. will be used to compact the backfill materials.

This information is provided to keep you informed of Flambeau's current thoughts regarding backfill planning and as a means of expanding the list of potential equipment for use in the backfilling process. Regardless of the type of equipment used in the backfilling process, backfilling will be accomplished using the lift thicknesses and compaction goals outlined in the MPA.

### **Sequencing of Pit Backfill**

Section 5.7.2.1.3 of the MPA describes the backfilling of the pit with Type I materials. From this description, it could be concluded that all of the Type II material will be placed into the pit prior to beginning Type I material backfilling. As a matter of clarification, backfilling of Type II material will continue after the backfilling of Type I material has commenced. This is mainly due to the fact that, as originally planned, the on-site rail spur will be one of the last items reclaimed. The ballast of the on-site railroad spur is planned to be placed with the Type II material in the pit. Therefore, an access area will be maintained in the approximate center of the pit down to the Type II material during filling of Type I material, sandstone and/or saprolite. The general cross-section of backfilled material will be maintained at the completion of backfilling. Attached is Figure B which illustrates the general topography of the access area and the surrounding backfilled pit.

### **Conclusion**

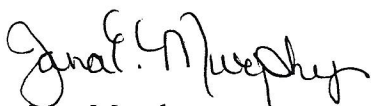
In conclusion, the minor changes and clarification presented in this letter serve to depict procedures and concepts that will be used during reclamation. These changes and the clarification will serve to

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protect the environment and adhere to the stringent requirements of the approved MPA. Since it is our opinion that these changes/clarifications are minor, they will be presented in the 1996 annual report as deviations.

It is our desire to initiate backfilling in the pit as early as June 1, 1996, therefore, we will be contacting you within two weeks to discuss the items presented in this letter.

Sincerely,



Jana Murphy  
Supervisor of Environmental Affairs



Tom Myatt  
General Manager

Attachments

cc: John Barnes, Flambeau  
Jeane Hull, KMC  
Ken Markart, WDNR  
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Tom Riegel, Town of Grant  
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Jim Hutchison, Foth & Van Dyke  
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