LORAX
ENVIRONMENTAL

June 6, 2001

Ferguson Simek Clark Engineers & Architects
4910-53rd Street,
Yellowknife NT X1A 2P4

Attention: **Ron Kent, P. Eng.**
Head, Environment Department

Dear Sir:

Re: REVIEW OF THE ACID ROCK DRAINAGE CHARACTERIZATION STUDIES CONDUCTED AT THE BOSTON PROPERTY

Lorax Environmental Services Ltd. (Lorax) was requested to review the technical merits of the acid rock drainage (ARD) assessments conducted for the Boston Property by Rescan Environmental Services Limited (Rescan), Brodie Consulting Limited (BCL) and Knight Piesold Limited (KP). This review was conducted at the request of Ron Kent at Ferguson Simek Clark Engineers and Architects (FSC) on behalf of the Kitikmeot Inuit Association (KIA). The documents supplied for review include:

1. Acid rock drainage characterization, Boston Property Waste Rock; Rescan Feb. 1999
2. Boston Gold Project ARD Potential Ore Stockpiles; BCL July 26, 2000
3. Review of Past ARD Characterization at the Boston Property; KP May 1, 2001
4. Hope Bay Joint Venture ARD Potential Ore Stockpiles, BCL May 14, 2001
5. Comments on ARD Potential; Nunavut Water Board May 22, 2001

The review is organized into four sections. Following a general statement of the overall ARD potential at the site, detailed comments on the Rescan 1999 report and data are provided. General comments on the BCL and KP reviews are then outlined. The review concludes with recommendations for monitoring of the current exploration disturbance and further characterization required prior to full mine development.

1. General Comments

Based on the existing data, this reviewer's overall assessment of the acid rock drainage (ARD) potential at the Boston Property is that there is a low potential for "acid" drainage. In direct contrast to comments and conclusions made in the Rescan report, it is unlikely that the overwhelming majority of the material sampled will produce low pH drainage water given the excess neutralization potential that appears to be present throughout the deposit. However, there are issues regarding arsenic and nickel leaching under pH neutral conditions and the actual amount of NP that is available from the iron carbonate minerals.

Rescan (1999) is a clearly written report, which presents a comprehensive data set in the appendices that allows a thorough review of the analysis conducted and conclusions reached in the report. The number of samples taken during the excavation of the decline is appropriate. However, the most significant shortcoming of the report is that it does not establish if the kinetic test samples are representative of their respective geologic units and does not revise the static test data with the results of the kinetic test data. The analytical methods used are, for the most part, appropriate for a project at the exploration stage. However, it appears that the data are often interpreted incorrectly or in an inconsistent manner. For example, due to the extreme excess of NP in the majority of the samples, many of the conclusions drawn in the Rescan report are appropriate; however, they are based on erroneous data interpretation (specifically in regards to NP depletion) or on arbitrary dilution factors.

The humidity cell data indicate that there is the potential for pH neutral arsenic (and possibly nickel) release. However, the extent of this arsenic-release potential for the existing material stored on surface can not be fully assessed due to the fact that a static test method was not used to correlate the kinetic test data to the static test sample population.

Prior to mine development, it may be prudent to delineate the extent of the material with the potential for metal release in order to allow segregation during operation and minimize the volume (and thus cost) of mine waste requiring special management techniques. These issues are discussed further in the recommendations at the end of this review.

2. Detailed Comments on Rescan 1999

Chapter 2

Page 2-1 to 2-3; Rescan describes the geology immediately surrounding the ore zone under the heading “Regional Geology” and describes the regional geology under the heading “Deposit Geology”.

Chapter 3

Page 3-5; states that the majority of samples have a low acid-generating potential and Pages 3-6 and 3-7 go on to outline regulatory criteria presented in DIAND (1993) and Price (1997). The report states on page 3-7 that …*In the Northwest Territories, an NPR of greater than 3 indicates the sample has a low potential for generating acid; and NPR between 1 and 3 indicates an uncertain potential for generating acid; and an NPR of less than 1 indicates that the sample has a high potential for generating acid.* The report then presents the ABA results on total sulphur vs. NPR graphs (Figures 3-1 and 3-2) that have quadrants labeled as having low, uncertain and high acid generating potential. However, the acid generating characteristics of the quadrants are not consistent with either set of regulatory guidelines. For example, the lower boundary of Quadrant II is positioned at an NPR=3.0 and Quadrant II is said to have *uncertain* acid generating potential; however, according to the DIAND regulatory guidelines, samples with NPR > 3.0 have a low potential for generating acid. This designation may be an attempt to correlate NPR with the interpretation of the $Ca+Mg/SO_4$ ratios observed in the kinetic test program (Chapter 4) but this is not stated in the report.

Page 3-8 paragraph 2; states that the majority of decline samples have *low* to *uncertain* potential for becoming net acid generators based on the apparently arbitrary designations presented in Figures 3-1 and 3-2. It is unclear why the *uncertain* designation has been given because it does not correspond with the regulatory guidelines stated above and there is no mention that it is based on the humidity cell results.

Page 3-8 paragraph 4; correctly states that the *results of paste pH, neutralization potential (NP) and total sulphur contents indicate a low acid-generating potential for the majority of rock types analyzed from drill core samples.*

Page 3-10 paragraph 2; correctly states that the CaNP – NP comparison suggests that iron carbonates are present. However, it goes on to state that *upon dissolution iron carbonates generate alkalinity and acidity in a 1:1 molar ratio, so unlike the dissolution* *of other carbonates, no net alkalinity is generated*. This statement is not necessarily true due to significant solid solution within iron-containing carbonate minerals. Thus, the actual alkalinity:acidity release ratio is dependent on the amount of Ca+Mg relative to Fe+Mn in the mineral.

Page 3-10 paragraph 3; states that the drill core *samples in Quadrant II with a higher potential for generating acid are those with total sulphur greater than 1.0% and an NPR of less than 6*. However, theoretical NP depletion ratios and regulatory NPR cut off values are in disagreement with this statement. Specifically, samples with an NPR greater than 3 (DIAND, 1993) or 4 (Price, 1997) have a low potential for generating acid.

Chapter 4

Page 4-1 paragraph 1; states that *the kinetic testwork was performed due to the potential for this material to be used as construction material and/or stockpiled on surface*. However, there is no attempt to document how the kinetic test samples were selected other than their relation to specific geologic units as designated by BHP geologists.

In order to apply the results of the kinetic testing to the respective geologic unit, there needs to be more information with respect to how well the kinetic sample represents the sample population. Geochemical variability is prevalent within all geologic sample populations. Knowing the extent of this variability and the position that the kinetic test sample occupies in the corresponding geologic unit sample population is required to establish if the leaching characteristics observed in the kinetic test are to be expected from the sample population as a whole or a subset of the sample population.

Page 4-1 paragraph 4; states that *a 1 kg sample is used to represent entire rock units which can be billions of kilograms in size. This can cause problems with sample representivity*. This statement is very true however, the report does not address this issue. This is directly related to the comment made in the previous paragraph and that it is the responsibility of the individual conducting the ARD assessment to select a sample for kinetic testing that is representative of the geologic unit. This should be done by evaluating the solid phase characteristics of the sample population and selecting a sample that is representative of the entire population or that can be used to establish leaching characteristics for a particular subset of the sample population.

Page 4-2 paragraph 2; states *that flushing of the material in the lab is higher than it will be in the field*. While this statement is true, the report makes no mention of this significant issue when interpreting carbonate dissolution rates and conducting the MINTEQ and PHREEQC calculations.

Page 4-2 paragraph 6 (last paragraph); states that *the various rates calculated from humidity cell data (e.g. sulphide oxidation rate, neutralization potential depletion rate, metal leaching rate) are usually considered "worst-case" values. Unfortunately, due to a lack of scientific data it is currently not possible to scale humidity cell results so that they more accurately reflect the rates that could be expected in the field.* Scientific data are available to evaluate the constraints of thermodynamic equilibrium on NP depletion. Although a tool (MINTEQ) is subsequently used that has this capability, the report does not account for the principles of carbonate thermodynamic equilibrium when applying the humidity cell results to carbonate depletion.

Page 4-3 paragraph 3; states *that the oxidation of one kilogram of pyrite generates 0.012 kJ of heat*. This number is in error by six orders of magnitude. The actual heat generation potential of one kilogram of pyrite is 1.2 x 10^4 kJ. However, this number is not used subsequently in the report.

Page 4-4 paragraph 3; states the kinetic test samples were selected to represent altered basalt, B2 mineralized zone and B3 alteration halo materials that have *the potential to be exposed on the surface, either as construction material or stockpile material*. However, no analysis or explanation is provided to indicate how well these three samples represent the corresponding geologic unit. Thus, it is unclear if the humidity cell leaching results apply to the entire geologic unit or if they provide a higher or lower release potential for particular elements.

Section 4.2.2 outlines the analytical methods used. The stated methods are standardized methods that are appropriate for mine waste characterization, provided the user has the ability to recognize the limitations of the tests and account for these limitations in the subsequent analysis.

Page 4-12; the whole rock analysis indicates that SiO_2 comprised 42.38% of the sample, which is in contrast to petrographic observations that silicate mineral abundance was limited to chlorite (13%), quartz (10%) and sericite (1%).

Page 4-13 last paragraph; states that fine-grained carbonate composes 76% of the sample. This is in contrast to the inorganic carbon content that suggests that the equivalent of 37% of the sample is in the form of calcium carbonate. Further testwork is required to determine the implication of this discrepancy on ARD predictions.

Page 4-13 last paragraph; provides the petrographic description of the rock. It seems odd that a rock described as a basalt (although it has been altered) does not contain any plagioclase feldspar, a mineral constituent that is essential in a basalt by definition. This oddity raises the questions:

- Was the feldspar completely replaced by carbonate?
- Was the mineralogic examination in error?
- Was there a rock type misnomer?
- Was the petrographic sample not representative of the humidity cell sample? and/or
- Was the humidity cell sample not representative of the unit as a whole?

Page 4-18 paragraph 3; states that a lack of correlation between the sulphate production rate of 0.9 mg/kg/wk and the NP consumption of 13.5 mg/kg/wk *suggest that there was sufficient consumption of neutralizing minerals to buffer any acidity that was being generated by sulphide oxidation*. However, the report does not indicate that the preferential NP consumption observed is a laboratory artifact produced by the kinetic test procedure and will not be replicated in the field (see explanation below).

Page 4-22 paragraph 2; states that *alkalinity was generated almost completely by the dissolution of calcium- and magnesium-bearing minerals because the Ca+Mg:alkalinity molar ratio was essentially one for the duration of testing*. The report fails to acknowledge that the most significant implication of a Ca+Mg:alkalinity ratio = 1 is that almost none of the NP dissolved in the test is in response to the neutralization of acid produced by sulphide oxidation. Thus, the use of Ca and Mg release rates to predict the time of NP depletion relative to the time to sulphide depletion based on sulphate release rates is not valid. As stated on page 4-18 paragraph 2, the release of Ca and Mg is indicative of the dissolution of neutralizing minerals such as carbonates. However, during humidity cell testing carbonates dissolve in response to two processes:

1) Direct neutralization of acid produced by sulphide oxidation; and
2) Dissolution in response to the dilute, slightly acidic deionized water used to rinse the samples.

The dissolution of carbonate in response to the second process is typically insignificant when a humidity cell sample releases sulphate concentrations above 10 mg/kg/cycle. Below this value, however, carbonate dissolution in response to the high volume of deionized water becomes significant. It should be noted that, the rate of carbonate dissolution due to rock interactions with deionized water will not be replicated in the field because of two constraints imposed in the field environment. The volume of percolating water relative to the mass of waste rock is much lower in a waste rock dump than in the humidity cell test as stated on page 4-2 paragraph 2 of the Rescan report.

In addition, there are thermodynamic constraints that will limit carbonate dissolution in the water percolating through a waste rock dump once the dilute rainwater or meltwater accumulates a critical dissolved calcium and carbonate inventory. This critical inventory will be accumulated quickly near the surface of the dump and subsequent to this, the percolating water will not be capable of dissolving more calcium carbonate because the water will be saturated with respect to calcite.

Page 4-22 last paragraph; states that *the "safe NP:AP ratio for the altered basalt at Boston would be approximately 16:1. Thus, if the NP:AP ratio is 16:1 or higher for any new altered basalt material analyzed by acid-base accounting, it can be classified as non-acid generating*. This statement explains the Uncertain Acid Generating Potential designation in Quadrant II (Figure 3-1, 3-2). However, the analysis on which this statement is based appears to be unfounded (see the comments above) and is incorrect.

Page 4-25 paragraph 3; states that *with the exception of arsenic, at least 99% of any given metal in Figures 4-8 to 4-10 was still present at the end of testing*. This is true, however, the metal antimony is conspicuously absent from the list. Similar to arsenic, antimony was being preferentially released from the altered basalt sample. At the completion of the humidity cell test, only 79.3% of the original antimony remained. The preferential depletion of arsenic and antimony give a clue as to the source of the arsenic release.

Sulfosalt or arsenide minerals may contain both arsenic and antimony, these minerals are often associated with gold deposits in mafic volcanic terrain and can be very reactive. Although these minerals were not reported to be present, the mineralogist appeared to be uncertain as to the form of arsenic in the humidity cell samples as outlined in Appendix D-1. Determining the presence, distribution and form of the arsenic in the critical geologic units that will be mined should be the primary focus of future characterization and monitoring programs if full-scale mining is proposed for the Boston Property.

Page 4-29 Table 4-1; compares humidity cell leachate concentrations to Canadian Water Quality Guidelines. This comparison is misleading due to the configuration of the humidity cell test that accelerates metal leaching rates as explained in Section 4.1.1.

Page 4-29 last paragraph; states *because the kinetic test results indicated that sulphide oxidation was minimal in the altered basalt sample, sulphides were probably not the source of arsenic…* Although the exact source of the arsenic cannot be irrefutably established from the available data, it is likely the sulphide-containing mineral believed to be arsenopyrite (Appendix D-1) is the source of arsenic. Arsenopyrite (FeAsS) has a 1:1 sulphur to arsenic ratio. Thus only a sulphur:arsenic ratio < 1 would indicate that arsenopyrite was not oxidizing and contributing to the observed sulphur and arsenic concentrations in the leachate. Although sulphate release was low, the molar release rate of sulphur was still 5 times greater than the arsenic release during the last 5 weeks of the test.

Page 4-30 Summary; correctly states that the altered basalt is unlikely to generate net acidity and that arsenic leaching may be a concern. It is this reviewer's recommendation that the form and extent of arsenic occurrence in this unit should be delineated prior to future mining. The representative nature of the humidity cell sample must be established to make a blanket statement for the altered basalt unit as a whole.

Page 4-37 and page 4-41; present an incorrect assessment of the carbonate depletion rate in the B2 mineralized zone relative to sulphate production for the same reasons as stated for the altered basalt (see comments above for page 4-18 paragraph 3 and page 4-22 paragraph 2). However, in this case the report concludes that this material will become net acid generating at some point in the future. Although the safe NPR cannot be exclusively established due to the constraints imposed by the design of the test, it is unlikely that this material will become net acid generating in the future due to an initial NPR = 3.1.

Page 4-48 last paragraph; reaches a conclusion that NP will be depleted prior to complete oxidation of sulphide. This conclusion is based on a faulty analysis.

Page 4-55,56 Section 4.3.4.3; refers to figures that indicate that the Ca+Mg:alkalinity ratio is slightly greater than in the previous humidity cells but still indicates that the majority of the carbonate dissolution is not produced from the neutralization of acid produced by sulphide oxidation. Thus, the safe NPR of 5 is again an over estimation of the true safe NPR (refer to comments above for page 4-22 paragraph 3). This section also states *If the original sample was representative of the B3 alteration halo…* , this statement again highlights the uncertainty with respect to the representivity of the kinetic test sample.

Page 4-69 Section 4.4; reiterates the conclusions reached from the previous 69 pages of figures, graphs and analysis.

Paragraph 1 concludes: that …*altered basalt and B3 alteration halo units is not expected to generate net acidity. However, metal leaching (especially for arsenic, copper and nickel) is relatively high and depending on drainage conditions seepage from this material may affect water quality before it is fully diluted by receiving waters.* I concur with the statement that this material will not generate acidity following a brief review of the available ABA data presented in Section 3 and the humidity cell test results. However, copper may not be significantly elevated in the waters draining the altered basalt under field pH neutral conditions, as humidity cell leachate concentrations do not accurately reflect field drainage concentrations and altered basalt humidity cell displayed the lowest copper concentrations relative to the other two samples. I concur that that elevated nickel concentration could be realized at the toe of the B3 alteration halo material. However, if further characterization of B3 alteration halo material indicates that the humidity cell sample is representative of this unit, then pH-neutral arsenic leaching will be concern associated with this material. Once again, analysis of water samples obtained from the ore stockpile drainage would help to establish if metal leaching from these materials is a concern under field conditions.

Paragraph 2 concludes that *Material from the B2 mineralized zone is predicted to generate net acidity in the long-term. When the neutralizing minerals are finally consumed, or their dissolution rate is no longer high enough to provide sufficient buffering, the leaching of metals from this material can be expected to increase*. This conclusion is not founded by the humidity cell results presented in the report. The NP dissolution rate was misinterpreted as described above for page 4-37.

Paragraph 3 states that …*To be conservative, the B2 mineralized zone material should still be considered as likely to generate net acidity in the long-term and steps should be taken to ensure that acid generation and metal leaching from this material does not affect the receiving environment*. This conclusion is overly conservative and scientifically unfounded as discussed in my comments from page 4-37 which refer to the laboratory artifacts produced by large relative volumes of deionized water to rock in humidity cell testing.

Chapter 5

The geochemical modelling exercise is not focussed and arbitrarily selects conditions that are not based on any actual understanding of what minerals could precipitate in a waste rock dump, and thereby control aqueous concentrations of metals. Nor does the interpretation outline the expected hydrologic conditions that could constrain dilution. In addition, the two chemical parameters of greatest concern at the site (arsenic and nickel) are not included in the modelling exercise. Thus, the model results have little practical significance to establishing an effective management plan at the site.

Page 5-1; two models are presented but the report does not indicate which model provides the most accurate results.

Page 5-2 last paragraph; states that *each type of predicted seepage was combined with rain water and the resulting solution was then combined with typical water from Spyder and Stickleback lakes at different dilution ratios (1:1; 1:1,000; 1:1,000,000).* The use of dilution in these quantities appears arbitrary and the rational for these dilution ratios is not given.

Page 5-3 last paragraph; states that *in order to extrapolate these predictions to the entire rock type one must assume that the sample was representative*… The samples could be representative, but there is no statistical examination to demonstrate this. Also, the wording of the report does not indicate any degree of certainty.

Page 5-5 paragraph 2; states that the assumptions were …*that laboratory leaching rates were representative of field leaching rates*… The report then references an unrelated section. However, there was an earlier statement made that laboratory leaching rates are not representative of field leaching rates. Thus, the logical extension is that the concentrations predicted by the model are not representative of those expected in the field.

Page 5-5 paragraph 3; states that …*a number of minerals would precipitate out of solution, including diaspore, hematite and threophrasite. The precipitation of these minerals would be expected to control the aqueous concentrations of aluminum, iron and nickel.* Diaspore has been observed to control aluminum concentrations. However, kinetic controls often come into play. Hematite is unlikely to control iron concentrations because it does not precipitate directly from solution under the pH and temperature conditions observed at the Boston site. I am not aware of any documented occurrence of threophrasite in mine waste. It has, however, been characterized in a laboratory. It is currently believed that the majority of nickel retained in oxidizing mine waste is not precipitated as secondary nickel hydroxides but is adsorbed/co-precipitated with goethite with minor amounts being taken up by phyllosillicate minerals.

Page 5-10 paragraph 2; states that *a 1:1 dilution might be expected in the immediate vicinity where seepage enters the lake.* There is no discussion of drainage area to substantiate this dilution ratio. The dilution ratio could also be 1:4 or 4:1. This is critical because other than iron, nickel and aluminum, the modeling exercise does not appear to have affected the seepage concentration in any way. Thus, the subsequent water quality predictions are based solely on arbitrary dilution ratios.

Page 5-15 Table 5-5; presents water quality data that have been impacted by the rock excavated in the area. A more useful geochemical modeling exercise that could produce conclusive results would be to evaluate these waters to determine if secondary minerals are controlling maximum metal concentrations.

Chapter 6

Page 6-1 paragraph 2; states that *B2 mineralized zone material will likely generate net acidity*. This conclusion is based on a faulty analysis as described in my comments for page 4-37.

In general, the spirit of the recommendations is valid, as the available data suggest that arsenic and nickel are being released from the materials. However, further work should be focussed to establish the source of metal loading and the actual impact to the receiving environment prior to implementing or bonding for a large-scale remediation program for all materials at site.

Further characterization work is required to determine what material has the potential to release arsenic and nickel under pH neutral conditions if full scale mining is proposed for the Boston Property. It appears that non-traditional ARD characterization methods will need to be used inconjunction with ABA tests to complete this task.

3. General Comments BCL and KP Letters

BCL July 26, 2000

Mr. Brodie makes a significant observation that *ICP metal scans were reportedly carried out, but the results are not included in the report*. An understanding of the solid phase arsenic and nickel distribution may assist in evaluating the potential for the release of these metals from the mine waste and developing an effective management plan. ICP metal scans were reported in the 1999 Rescan report only for the humidity cell samples but no information was provided for the numerous adit and drill core samples. It is important to understand the distribution of metals from the overall waste materials so that the representivity of the humidity cell samples or future field or laboratory leach samples can be established.

KP May 1, 2001

Page 3 paragraph 2; correctly states that *the dividing lines between quadrants being an NPR of 3 and total sulphur of 0.3% (based on DIAND published ARD guidelines*). However, the designation of "uncertain acid generating potential" in Quadrant II does not correspond with Guidelines for ARD Predictions in the North (DIAND, 1992) which state that "…Samples with a neutralization potential of 2 to 3 times greater than the acidity potential can be considered acid consuming".

Page 4 paragraph 2; reiterates a statement from the Rescan report that *samples were collected on a volumetric basis (one sample for every two rounds mucked out). This technique should have provided a good representation of the material removed*. I agree that this sample frequency should provide a good representation of the material removed provided the ore zone was sampled as well as the development rock from the decline. However, the Rescan report made no attempt to establish a relationship between the humidity cell samples and samples from the decline or the drill core samples.

Page 6; states a number of reasons why there may be a discrepancy between Mr. Brodie's observations and the data presented in the Rescan report. Another possible explanation for the discrepancy between observations at surface and the ABA results is that ABA reports % total sulphur and not % pyrite. The implications of this relationship is that if all of the measured sulphur is in the form of pyrite, a total gravimetric S% of 1% corresponds to approximately 1.9% FeS_2 (weight percent). Thus the maximum measured sulphur content of 5.68% corresponds to approximately 10.8 weight % pyrite.

Page 7 paragraph 4; reiterates the findings of the Rescan report that the *B2 mineralized zone may be potentially acid-generating*. As stated above in the review of the 1999 Rescan report, the conclusion that the B2 mineralized zone sample is potentially acid-generating is based on faulty interpretation of the humidity cell data.

Page 7 paragraph 5; states that the geochemical modelling conducted by Rescan suggests that *after minimal dilution, seepage from the three rock types would not significantly affect receiving water quality*. However, the Rescan report used arbitrary dilution factors and laboratory metal release rates, none of which are likely representative of site conditions.

Page 8 paragraph 2; restates an incorrect number for the heat generated by one kilogram of pyrite. The correct number is 1.2×10^4 kJ.

Page 8 paragraph 7; states that … *this issue* (placing a cover over the existing piles*) can be addressed if and when monitoring indicates that these materials are an active source of contaminant release.* I agree with this comment. Establishing the volume of flow and the chemistry of this flow at the site can be achieved during melt using actual site data rather than using the results of the Rescan modelling exercise. Once these parameters have been established, the impact to the receiving environment can be conclusively established and a well-informed decision can be made if management of the stockpiled material is required.

BCL May 14, 2001

This letter is essentially a response to the KP letter reviewed above. Additional response to this letter is not warranted, as comments to the KP letter also apply to many of the issues in the BCL letter.

4. Recommendations

The recommendations for monitoring and characterization are separated to address the following two issues faced at the Boston Property:

- The best procedure for establishing the potential impacts to the receiving environment from the existing material on surface near the exploration decline and to determine what remediation options should be considered, if any.
- The need for further monitoring and characterization to ensure future mine waste that is extracted from the deposit does not impact the receiving environment should full scale mine development proceed.

The characterization data available to date indicates that acidic conditions are not expected to form in the water draining the existing material on surface. Thus, the metal concentrations currently observed in the drainage waters are unlikely to increase and the impact on receiving waters could reasonably be assumed to be currently at a maximum. A useful exercise that could be carried out on the samples is to determine the available NP that is provided by the iron-containing carbonate minerals to allow an NP correction to be applied to the ABA results.

In order to make a decision on the required management of this exposed material, establishing the volume of flow and the chemistry of this flow at the site can be achieved during melt using actual site data. Once these parameters have been established, the impact to the receiving environment can be conclusively established and a well-informed decision can be made if management of the stockpiled material is required.

Another possible option that could be undertaken concurrently is the isolation and subsequent leachate monitoring of specific material types to establish the source of the majority of the metal release at the site. However, it is critical that the solid-phase characteristics of the isolated material is documented and correlated with a larger sample population to establish that the leachate characteristics are representative of a particular material type.

The potential for pH-neutral metal release and the amount of available NP from iron-containing carbonate minerals should be evaluated prior to further development of the deposit. The spatial extent of the material with pH-neutral metal release potential should be delineated to ensure that it can be segregated during operation. This procedure will allow what is likely a small portion of the waste rock to be placed in an appropriate waste management facility. If this material is not segregated and mixed with benign waste, then management options (*i.e.* cover) would be required to encompass the entire amount of waste produced and would likely be considerably more expensive than constructing a waste management facility for only material with metal leaching potential.

The sole use of traditional ARD assessment tools (*i.e.* ABA) will not adequately address the metal release or available iron-carbonate NP. A more detailed analysis will be required.

Another issue that should be evaluated prior to mine development is the geochemical leaching characteristics of the mine tailings. pH-neutral arsenic release from gold mine tailings derived from geologically similar deposits is currently a considerable liability for several mining companies in northern and central Canada.

Early characterization of this waste is another critical consideration required prior to mine development to ensure that appropriate management facilities can be designed and constructed to prevent a long-term liability at the Boston property.

Yours very truly,
LORAX ENVIRONMENTAL SERVICES LTD.

Bruce Mattson, M.Sc., P.Geo.
Acid Rock Drainage Specialist