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October 2, 2019

Derek Donald
Technical Advisor
Nunavut Water Board
P.O. Box 119
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Sent via Email: derek.donald@nwb-oen.ca

Re: Water License 2AM-DOH1335 – Naartok East Crown Pillar Recovery at Madrid North – Proposed Site-Specific Geochemical Criteria for use of Non-Mineralized Waste Rock for Construction

Dear Mr. Donald,

This correspondence is being provided to the Nunavut Water Board (NWB) in response to all intervener comments issued on or before September 12, 2019.

TMAC received comments from the following interested parties:

1. Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC)
2. Environment and Climate Change Canada (ECCC)
3. Kitikmeot Inuit Association (KIA)

TMAC responses to comments are located in Attachment A of this submission.

Should you have any questions please feel free to contact me at Oliver.curran@tmacresources.com.

Sincerely,

Oliver Curran
Vice-President, Environmental Affairs TMAC Resources Inc.

Cc:

Licencing (NWB)
Kyle Conway / Sarah Warnock (TMAC)
Adam Grzegorczyk (TMAC)
Shelley Potter (TMAC)
Ashley Mathai (TMAC)

Attachments:

- Attachment A: Proponent's Response to Comments Received Regarding the Naartok East Crown Pillar Recovery at Madrid North, Proposed Site-Specific Geochemical Criteria for use of Non-Mineralized Waste Rock for Construction
- Attachment B: Revised Table 2-1 from Appendix A
- Attachment C: Naartok East Crown Pillar Recovery - Waste Rock for Construction Flowchart

Attachment A – Proponent's Response to Comments Received Regarding the Naartok East Crown Pillar Recovery at Madrid North, Proposed Site-Specific Geochemical Criteria for use of Non-Mineralized Waste Rock for Construction

TMAC Resources Inc.

HOPE BAY PROJECT

Proponent's Response to Comments Received Regarding the Naartok East Crown Pillar Recovery at Madrid North, Proposed Site-Specific Geochemical Criteria for use of Non-Mineralized Waste Rock for Construction

October 2019

Prepared by:

TMAC Resources Inc.
Toronto, Ontario

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1. KIA-NECP-1

1.1 SUBJECT

Sample Selection Representativeness

1.2 REFERENCE

Table 3-1 (Attachment A)

1.3 SUMMARY

Validation of geochemical sample program datasets.

1.4 DETAILED REVIEW COMMENT

Expected volumes are a factor typically used to estimate an appropriate dataset size per lithology type to be included in a geochemical program. This information is not included in the report; however, Section 4.1.3. does qualitatively comment on projected volumes of the rock types sampled. Figure 3-1 provides an indication of sample location relative to the lateral extents of the surface of the crown pillar, but does not provide as much insight regarding the sample distribution at different levels below ground surface. Figures 4-3 to 4-7 (of Attachment A) do present vertical cross sections through the NE CPR quarry; however, the gap between NE-2 and NE-3 sections is large and it is difficult to assess the vertical spatial relationship of samples selected in this area in the NE CPR.

If more detailed, or quantitative, information regarding projected volumes and spatial distribution of waste rock to be encountered at NE CPR is available, it should be presented to assess the adequateness of geochemical program's sample distribution and (hence) the appropriateness of sample results. Only 27 of the 43 samples tested were from the two rock units to which this program is to be applied.

1.5 RECOMMENDATION/REQUEST

KIA requests that TMAC comments on the expected volumes of material to be excavated at NE CPR, as well as the vertical representation of the sample data set.

1.6 TMAC RESPONSE TO KIA-NECP-1

TMAC expects approximately 800,000 tonnes of waste rock to be excavated from the NE CPR.

In the NE CPR, waste rock is present in the hanging wall of the deposit, whereas the footwall is ore. Nine holes were selected that intersect the hanging wall and each hole sampled continuously. Each sample was a weight-averaged composite with sample selection based on geological contacts and bench depths. Accordingly, this sampling methodology allowed for a geological and geochemical assessment of waste rock on a blast round basis to assess the practicalities of waste rock segregation in the context of using waste rock for construction. There was occasional gaps in continuous vertical representation due to insufficient sample mass or unavailable samples of assay rejects, however the overall sample set is considered robust. All waste rock types that will be intersected by mining were included in the geochemical characterization program. The lower sample numbers for rock types 1aj and 5 is because these rock types are volumetrically less significant in the hanging wall. TMAC considers the sample set laterally and vertically representative.

2. KIA-NECP-2

2.1 SUBJECT

Sample Preparation

2.2 REFERENCES

Sections 3.1 and 5.3 (Attachment A)

2.3 SUMMARY

Comparison of geochemical program sample preparation to the proposed field classification methods.

2.4 DETAILED REVIEW COMMENT

The sample material in the geochemical program was comprised of coarse assay (-2 mm) rejects from TMAC's exploration drill program, whereby each assay sample represented approximately 1 m of core length (Section 3.1).

The proposed field classification method (in Section 5.3) involves the collection and sieving (to -2 mm) of drill core cuttings from each blast round, prior to pXRF analysis. This approach assumes the field method is comparable to the geochemical program method and (therefore) materials are expected to have similar solid-phase and leaching characteristics. However, samples generated from crushing competent drill core may not be analogous to finer blast-segregated cuttings that are collected in the field. The role of particle size and differences in geochemical characteristics between friable and competent material can influence the relative abundance of sulphide and arsenic-bearing minerals, as well as mineral weathering rates or leachability.

2.5 RECOMMENDATION/REQUEST

KIA requests that TMAC comment on the comparability of the proposed field method to the methods used as part of the geochemical program. Further clarity regarding these methods will help to assess the adequateness of the sample preparation methods included in the proposed field classification program.

2.6 TMAC RESPONSE TO KIA-NECP-2

Sample preparation by the commercial laboratory included creating two representative splits of each sample: pulps and coarse assay rejects (-2 mm). As per standard methods, analysis of acid-base accounting (ABA) and trace element content was conducted, including sulphur and arsenic on the pulverized (pulp) size fraction.

The objective of the pXRF trial was to assess the analytical capability of pXRF to reliably measure arsenic and sulphur content for both size fractions to establish operational sample preparation methods for pXRF. TMAC conducted pXRF analysis on the pulverized (pulps) and -2 mm split samples prepared by the lab thereby allowing a direct comparison between pXRF data on the pulp and -2 mm sample size fractions, and the lab data on the pulp size fraction. The comparison indicated that with a correction factor applied, pXRF analysis of either the pulp or -2 mm size fractions could quantify the arsenic and sulphur content as indicated by the lab. The field sample preparation methods includes screening sample material to the -2 mm size fraction based on the results of the pXRF trial. Also, the pXRF calibration factor for arsenic and sulphur is specific to the -2 mm size fraction.

3. KIA-NECP-3

3.1 SUBJECT

Arsenic Criterion – 1

3.2 REFERENCES

Figures 4-9 and 4-10, and Section 5 (Attachment A)

3.3 SUMMARY

Further discussion of the arsenic criterion basis.

3.4 DETAILED REVIEW COMMENT

The results shown in Figure 4-10 do not provide an adequate understanding of the appropriateness of the 70 ppm arsenic criterion. In contrast, the total sulphur criterion (of 1% total sulphur) can be comprehended based on the presentation and discussion of total sulphur versus potentially acid-generating (PAG) or non-PAG classifications of the samples tested (Figure 4-9).

KIA acknowledges that the basis of the arsenic criterion is found in Appendix A of Attachment A. However, the main report of Attachment A does not include a discussion as to the derivation of the criterion and presents this value for the first time in Table 5-1.

3.5 RECOMMENDATION/REQUEST

The main report of Attachment A should be revised to briefly summarize the technical basis of the arsenic criterion to afford better clarity for the reader.

3.6 TMAC RESPONSE TO KIA-NECP-3

TMAC will update the report with appropriate Figures and with the following text. Note that there were errors in Table 2-1 of Appendix A of the original submission and attached is a Revision of Table 2-1 (Attachment B).

The kinetic test program of waste rock and ore for Madrid North, Madrid South and Boston included 23 humidity cell and 10 barrel tests of the same rock types as NE CPR waste rock (Attachment B). The results from the kinetic tests from the aforementioned areas suggest that neutral pH leaching of arsenic, and to a lesser degree cobalt and nickel, were related to the presence of the trace sulphide mineral gersdorffite ((Fe,Co,Ni)AsS). Trace levels of gersdorffite were identified for samples with arsenic content greater than approximately 100 ppm. Conversely, samples containing lower solid-phase arsenic content exhibited lower arsenic leaching rates and concentrations in humidity cell and barrel tests, respectively. Given that the arsenic leaching potential is governed by similar controls, the combined kinetic test sample set for these deposits can be used to assess arsenic leaching of NE CPR waste rock. Arsenic leaching rates from humidity cell and barrel tests with arsenic content less than 70 ppm indicated the absence of gersdorffite and lower arsenic leaching rates suggesting an overall low risk of neutral pH arsenic leaching from NE CPR waste rock. TMAC notes that the barrel tests have been operating for approximately 10 years and continue to be monitored annually with the last sample collected in Summer 2019. Barrel monitoring results indicate that arsenic leaching from the barrels are stable.

4. KIA-NECP-4

4.1 SUBJECT

Arsenic Criterion - 2

4.2 REFERENCES

Appendix A (Attachment A)

4.3 SUMMARY

Consideration for a lower arsenic criterion.

4.4 DETAILED REVIEW COMMENT

Review of the geochemical results used to develop the arsenic criterion had the following irregularities noted:

a) The 30 kinetic test samples (Table 2-1) used to develop the 70 ppm arsenic criterion contained between 2 ppm to 630 ppm arsenic, with the exception of five samples without a recorded arsenic value. However, only three (of the 30) samples contained arsenic concentrations between 10 ppm and the arsenic criterion (i.e., HC-17: 11 ppm, HC-23: 27 ppm and HC-39: 64 ppm) and none from the two units deemed satisfactory for construction by the geochemical program (i.e., mafic metavolcanics and gabbro).

b) Review of the initial humidity cell (i.e., first flush) and maximum field barrel arsenic concentrations shows a wide range of values (from 0.0008 mg/L to 2.4 mg/L), with the highest reported value from a field barrel (W6) containing mafic metavolcanics and a solid-phase arsenic concentration of 120 ppm. The relationship between arsenic content and maximum concentrations from field barrels is shown in Figure 2-4 (in Appendix A); however, the number of samples shown in that figure is almost double the eight field barrels (i.e., labelled W2 – W4, W6 – W8, W11 and W14) shown in the previous Table 2-1. The relevance of the additional data used to develop this figure and potentially support the proposed 70 ppm arsenic criterion is not clear.

c) In Section 3.1, the report states that "For barrel containing for NE CPR rock types (1, 7a, 5) with As < 30 ppm, average and maximum concentrations were <0.002 and <0.037 mg/L, respectively and were the lowest of the overall sample set.

This statement indicates that material from rock types deemed suitable for construction (i.e., appropriate rock type and below the proposed arsenic criterion) could leach arsenic at concentrations above water quality guidelines of 0.005 mg/L.

The dataset used to develop the arsenic criterion is limited in its distribution of material containing arsenic concentrations between 30 ppm and 70 ppm, as well as its consideration for initial flush concentrations that could substantially exceed water quality guidelines and would need to be managed.

The 43-sample geochemical dataset described in the main report of Attachment A should have also considered soluble leach testing on the crushed drill core to expand the dataset on leachable arsenic.

4.5 RECOMMENDATION/REQUEST

KIA recommends that the arsenic criterion is lowered to <30 ppm until a larger dataset can be provided, as well as further consideration for initial flush chemistries that may contain elevated arsenic concentrations.

It is worth noting that material containing 30 ppm arsenic reflects anomalous solid-phase concentrations in comparison to average crustal abundances of 2 ppm (Ronov and Yaroshevsky, 1972). Therefore, the use of anomalous or arsenic-enriched material for construction should be implemented with care to ensure environmental protection.

4.6 TMAC RESPONSE TO KIA- NECP-4

The following data sets are not indicative of pH neutral arsenic leaching with the following rationale:

- Solid-phase trace element content with comparison to crustal abundance is screening method for data and not indicative of metal leaching potential.
- Leach tests, such as shake flask extractions do not quantify leaching rates indictive of sulphide oxidation, rather quantify readily available soluble products. Kinetic tests such as humidity cell and barrel tests provide rates sulphide oxidation rate and associated trace element release, specifically gersdorfite and pH neutral arsenic leaching.

Table 2-1 in Appendix A of the original submission presented data for 30 kinetic samples and as noted by the reviewer is missing arsenic content data. Attachment B of this submission is the revision of Table 2-1, which has the complete kinetic test sample set (53 samples), the missing arsenic data, and also contains the samples presented in Figure 2-5 of Appendix A of the original submission.

As part of the Hope Bay Phase 2 Water Licence Application, the geochemical characterization program for Madrid North included 420 samples analyzed for ABA and trace element content[1]. All kinetic test samples for Madrid North (and other deposits) were selected based on statistical analysis of each waste rock lithology and economical classification (waste rock and ore). The kinetic test program is therefore representative of the overall Madrid North deposit (of which NE CPR is one localized area). The humidity cell (HC) samples from all aforementioned areas are relevant to the development of the NE CPR arsenic criterion because the kinetic test program for Madrid North, Madrid South and Boston suggested that neutral pH leaching of arsenic was related to the presence of the mineral gersdorffite. The revised Table 2-1 (Attachment B) presents a summary of results for the 53 kinetic test samples of waste rock and ore for Madrid North, Madrid South and Boston[1],[2],[3].

Figure 2-1 in Appendix A of the original submission compares the gersdorffite (expressed as arsenic in ppm) to the solid-phase content of arsenic for kinetic test samples to establish the relationship between gersdorffite and arsenic content.

Both the HC and barrel tests demonstrate the relationship between arsenic content and pH neutral arsenic leaching rates. Some of the technical rationale to include both HC and barrel tests in a kinetic test program are described as follows:

- HC tests are operated according to a standardized protocol which allows for comparison of results within a sample set and between projects. Also the tests can be set up using a small quantity of sample (1 kg), are relatively easy to operate, and generate a robust data set in a relatively short period of time (<1 year) that can be used for source term water quality estimates and site-wide water and load balances.

- Barrel tests are operated in parallel because they contain a large quantity of sample (100's of kilograms) that weather and leach under site climatic conditions. Barrel tests are more challenging to set up due to material requirements of a unique rock type that is typically sourced from drill core.

- Barrel test data address issues of sample representativity and issues of scale that are inherent when testing small quantities of material, e.g. HC test. HC tests will produce higher leaching rates than barrel because of methodological differences between the tests, including grain size (-1/4" for HC tests vs. fines and coarse for barrels), temperature (room temperature vs. arctic climate, which affects rates of oxidation) and flushing of soluble products (high water to solids ratio for HC tests vs. meteoric rates of flushing for barrels).

As indicated by Table 3-1 from Appendix A of the original submission, the barrel tests do not have samples with arsenic contents between 30 to 70 ppm, however the HC tests have a number of samples within this range. Accordingly, interpretation of the HC test arsenic rates relative to solid-phase content is relevant to the derivation of the arsenic criterion because: i) the results of the HC tests can be methodically compared on a sample by sample basis with respect to arsenic content, e.g. arsenic range <70 ppm and >70 ppm; and ii) based on the methodological differences between HC and barrel tests, waste rock with arsenic contents within the range of <70 ppm (including those between

30 to 70 ppm) and >70 ppm are expected to have the same relative leaching relationship on a sample by sample basis when tested according to the barrel test methodology. This is demonstrated by the barrel test W6 (mafic metavolcanics) which has 120 ppm arsenic content and higher arsenic leaching rates relative to barrels with <30 ppm arsenic.

To illustrate this relationship, Table 1 embedded below presents a revision of Table 3-1 from Appendix A of the original submission – the shaded rows represent new data presented as part of this comment response. The new data includes an assessment of HC arsenic leaching rates for samples containing <30 ppm arsenic and indicates the following:

- For all HC samples, the arsenic stable leaching rates are <0.0073 mg/kg/week,
- When HC samples of only NE CPR rock types with <30 ppm arsenic are considered, the arsenic stable leaching rates are <0.0022 mg/kg/week. When comparing HC and barrel tests for NE CPR rock types with arsenic content <30 ppm, barrel arsenic leaching rates are two orders of magnitude lower than the HC tests.

Initial flush times are not necessarily indicative of oxidation rates because the delay between drilling and initiation of HC testing can result in oxidation of sample material resulting in the storage of soluble oxidation products that are solubilized upon initiation of the test. Similarly, the maximum barrel concentrations presented in Table 1 below can similarly be due to flushing of stored oxidation products. Solubilization of stored oxidation products is not representative of leaching rates for run-of-mine waste rock that will be unoxidized (or fresh) when excavated and therefore will not contain soluble products of weathering. TMAC notes that the barrel tests have been operating for approximately 10 years and continue to be monitored annually with the last sample collected in Summer 2019. Barrel monitoring results indicate that arsenic leaching from the barrels are stable, therefore the barrel arsenic average rates and concentrations are indicative of 10 years of weathering for waste rock under site-specific climatic conditions.

The kinetic test database (HC and barrel tests) provides the required data to derive the site-specific arsenic criterion of 70 ppm, e.g. flushing rates for arsenic in relation to the geochemical controls for neutral pH arsenic leaching, specifically gersdorffite and arsenic content. As such, TMAC maintains that a arsenic criterion of 70ppm remains appropriate.

All waste rock used as construction rock will be subjected to a verification monitoring program, including ABA and trace element content as analyzed by a commercial laboratory, and annual seepage monitoring, as outlined in Section 5.4 of the original submission.

Table 1: Revision of Table 3-1 from Appendix A (Comparison of Solid-Phase Arsenic Content with Gersdorffite and pH Neutral Arsenic Leaching[1]

As content	Variable			
	Figure	Parameter	Rock Type	Value
As < 100 ppm	Figure 2-1	Gersdorffite	All	Below detection
As < 70 ppm	Figure 2-2	HCT As stable rate	All	<0.0073 mg/kg/week
	Figure 2-3	Barrel As average rate	No barrel samples with arsenic content between 30 and 70 ppm	
As < 30 ppm	Figure 2-2	HCT As stable rate	All NE CPR rock types[1]	<0.0073 mg/kg/week <0.0022 mg/kg/week
	Figure 2-3	Barrel As average rate	All NE CPR rock types[1]	<0.0024 mg/kg/week <0.00003 mg/kg/week
	Figure 2-4	Barrel As maximum concentration	All NE CPR rock types	<0.31 mg/L <0.037 mg/L
	Figure 2-5	Barrel As average concentration	All NE CPR rock types	<0.00018 to 0.15 mg/L <0.002 mg/L

[1]Shading show additions to the table

5. KIA-NECP-5

5.1 SUBJECT

Gabbro Sample Dataset Representativeness.

5.2 REFERENCES

Section 4.1.3 (Attachment A)

5.3 SUMMARY

High arsenic content and release rate from kinetic test HC-41.

5.4 DETAILED REVIEW COMMENT

Section As discussed in Section 4.1.3, the nine gabbro samples tested contained uniformly low arsenic contents (i.e., <10 ppm) and geological interpolation of this unit suggests it may reflect a volumetrically significant waste rock type.

A review of the humidity cell data provided in Appendix A of Attachment A (Table 2-1) indicates one (of two) Madrid North gabbro kinetic tests contained a high arsenic solid-phase content (i.e., HC-41: 270 ppm) and presented a correspondingly elevated (stable) arsenic release rate of 0.27 mg/kg/wk. For comparison, the other gabbro kinetic test of Madrid North material (HC-40) had 7.1 ppm arsenic content and a substantially lower release rate (i.e., 0.0022 mg/kg/wk).

Given these results and the potential for a significant waste volume, it is not clear if the sample size of nine gabbro samples (with only two leaching rate values) is considered suitable to assess the ML potential of this rock type to be used as construction material.

5.5 RECOMMENDATION/REQUEST

KIA request that TMAC comment on the representativeness of the gabbro dataset used to develop the construction criteria and if the results from HC-41 suggest gabbro material has a higher potential to host elevated arsenic contents? Performing soluble leach tests on the -2mm crush for the nine drill core gabbro samples may help generate a more robust dataset.

5.6 TMAC RESPONSE TO KIA-NECP-5

Based on the screening criteria of 70 ppm, if NE CPR waste rock includes gabbro with arsenic content of 240 ppm (e.g. composition of HC-41), this rock would classified as not suitable for construction due to its potential for high arsenic leaching. TMAC notes that the Madrid North kinetic test samples, including HC-41, are from the larger Madrid North deposit, of which NE CPR is only a small area. To date, all geochemical characterization of gabbro waste rock from NE CPR indicates low sulphur and arsenic content, however this will be confirmed by the operational field monitoring verification program.

Soluble leach tests will not provide data with respect to metal leaching for the following reasons:

- Unoxidized, e.g. fresh rock such as drill core samples or rock that has recently been blasted has limited oxidation and therefore limited soluble oxidation products of arsenic.
- SFE tests are not considered representative of leaching due to the small volume of sample and the short test duration. In contrast to the duration of HC tests were months to years and the barrel tests continue to operate and represent arsenic leaching rates under site climatic conditions over a time frame of approximately 10 years.

6. KIA-NECP-6

6.1 Subject

Flow Chart Revision - 1

6.2 References

Figure 5-1 (Attachment A) and Attachment B

6.3 Summary

Additional pXRF steps to be included in construction flow chart.

6.4 Detailed Review Comment

The flow chart presented in Figure 5-1 (Attachment A) and Attachment B does not include the recommended step of taking replicate pXRF measurements if arsenic values are between 50 ppm and 90 ppm, as discussed in Section 5.2.1. This additional step mitigates the possibility for miscalculation by the field arsenic measurement method, as noted by the QA/QC results from the geochemical program.

As well, the flow chart should describe an appropriate QA/QC protocol for pXRF measurements (similar to the discussion in Section 3.3.2, page 8 of Attachment A), to support the use of this field method and valid results.

6.5 Recommendation/Request

The construction flow charts should be revised to include additional pXRF measurement steps, as identified as part of the geochemical QA/QC program, for verification of field measurements.

6.6 TMAC Response to KIA-NECP-6

TMAC has amended the flow chart provided in the submission to state when replicate pXRF measurements are required (See Attachment C of this submission).

7. KIA-NECP-7

7.1 Subject

Flow Chart Revision - 2

7.2 References

Attachment B

7.3 Summary

Corrections to the sulphur criterion presented in the flow chart.

7.4 Detailed Review Comment

In The flow chart in Attachment B details the total sulphur criteria in two spots, Step 3 and Step 4. Sulphur species can be measured as total, sulphide-sulphur or -sulphur. In Step 3, the "total" descriptor is omitted and should be included to be consistent with the findings of the geochemical study in Attachment A and the terminology used in Step 4.

In Step 4, a total sulphur value of 0.1% is noted as a criterion to be applied as part of confirmatory sampling. It is not clear what this criterion is based on or if it is an error.

7.5 Recommendation/Request

Revise the construction flow chart in Attachment B to contain consistent sulphur terminology and criterion values.

7.6 TMAC Response to KIA-NECP-7

TMAC has amended the flow chart to contain consistent sulphur ("total" sulphur) terminology (See Attachment C of this document). In regard to Step 4, the total sulphur value of 0.1% is specified as a criterion option as part of confirmatory sampling. The rationale for this is stated in Section 2.4 of Appendix D of the original submission. An ARD potential classification criterion is applied based on total sulphur content such that all wastes that contain less than 0.1% sulphide sulphur are classified as non-PAG irrespective of values of NP/AP. Any acidity produced by these low sulphide materials is expected to be readily consumed through reaction with silicate minerals or alkalinity produced by silicate weathering.

8. KIA-NECP-8

8.1 Subject

Drilling Brines and Blasting Concentrations.

8.2 References

Section 6.3 (Attachment A)

8.3 Summary

Validation of proposed blasting methods.

8.4 Detailed Review Comment

The report recommends that quarry development does not employ drilling brines and lower amounts of explosives are to be used. These actions will minimize the release of chloride and ammonia from excavated material, which are two leachable constituents of concern noted from waste rock at a nearby area.

8.5 Recommendation/Request

KIA requests that TMAC confirms this recommendation will be implemented as part of construction for the NE CPR.

8.6 TMAC Response to KIA- NECP-8

TMAC confirms that NE CPR drilling and blasting practices are similar to quarry development, which does not include the use of brines and uses lower amounts of explosives, therefore chloride and ammonia are not anticipated to be issues.

9. CIRNAC-1

9.1 SUBJECT

Validation of Arsenic Criterion

9.2 REFERENCE

SRK Consulting, prepared for TMAC Resources Inc. Classification of Waste Rock - Naartok East Crown Pillar Recovery, Madrid North, Hope Bay Project. Licence No. 2AM-DOH1335. August, 2019.

9.3 COMMENT

TMAC proposes to apply the following two site-specific criteria to determine the suitability of waste rock for construction: (1) total sulfur < 1.0wt%, and (2) total arsenic < 70ppm. These criteria are based on the results of a series of geochemical tests and analyses of 43 weight-averaged composite samples of four rock types (i.e., 18 samples for mafic metavolcanics, 9 for mafic volcanics with sediments, 7 for sedimentary units, and 9 for early gabbro). CIRNAC reviewed the data and considers the < 1.0wt% total sulfur criterion for non-PAG to be justified by the data. However, CIRNAC has concerns regarding the total-arsenic < 70ppm criterion for low arsenic leaching risk.

A statement made by the consultant reads as follows (page 20 of the SRK Report): "Figure 4-10 indicates that samples classified non-PAG have arsenic content less than 80 ppm. However, when the accounting for rock types other than sedimentary units (5), all samples were classified as non-PAG with arsenic as high as 800 ppm." CIRNAC agrees with the second statement, but seeks clarification on how SRK came to the interpretation in the first statement that samples classified non-PAG have arsenic content less than 80 ppm.

As arsenic can leach under neutral conditions, non-PAG waste rock that contains arsenic could also result in arsenic leaching. Although kinetic test (i.e., humidity cell) conducted on one early gabbro sample from the NE CPR (i.e., HC-40) indicated slow arsenic leaching rates (i.e., 0.004 – 0.002 mg/kg/week), CIRNAC cannot find evidence that appropriate leaching tests were conducted directly on the 43 composite samples. CIRNAC notes that early gabbro usually has much lower arsenic content than all other waste rock types from the NE CPR. Therefore, it is not clear how the total arsenic < 70ppm criterion was determined.

9.4 RECOMMENDATION/REQUEST

CIRNAC recommends that the criterion for arsenic leaching be validated or justified, particularly for mafic metavolcanics, which is the dominant waste rock type.

9.5 TMAC RESPONSE TO CIRNAC-1

Note that there were errors in Table 2-1 of Appendix A of the original submission and Attachment B of this submission is a Revision of Table 2-1.

The rationale for development of the arsenic criterion is provided in Appendix A of the original submission. A summary is provided herein.

The kinetic test program of waste rock and ore for Madrid North, Madrid South and Boston[1,2,3] included 23 humidity cell (HC) and 10 barrel tests. The results for all mine areas suggested that neutral pH leaching of arsenic, and to a lesser degree cobalt and nickel was related to the presence of the trace sulphide mineral gersdorffite ((Fe,Co,Ni)AsS). Trace levels of gersdorffite (i.e. above the analytical detection of the MLA mineralogical method) were identified for samples with arsenic content greater than approximately 100 ppm. Conversely, samples containing lower solid-phase arsenic content exhibited lower arsenic leaching rates and concentrations in HC and barrel tests, respectively. Given that the arsenic leaching potential is governed by similar controls, the combined kinetic test sample set for these deposits can be used to assess arsenic leaching of NE CPR waste rock.

The derivation of the arsenic criterion was based on Madrid North, Madrid South and Boston HC and barrel tests. Specifically, arsenic leaching rates and concentrations were assessed in the context of gersdorffite and arsenic content, the latter which are the geochemical controls on arsenic leaching. TMAC notes that the barrel tests have been operating for approximately 10 years and continue to be monitored annually with the last sample collected in Summer 2019. Barrel monitoring results indicate that arsenic leaching from the barrels are stable. Humidity cell and barrel tests with arsenic content of less than 70 ppm indicated that leaching rates were sufficiently to indicate low risk of neutral pH arsenic leaching from NE CPR waste rock.

10. CIRNAC-2

10.1 SUBJECT

Rationale for using Portable XRF for In-Situ Analyses

10.2 REFERENCE

SRK Consulting, prepared for TMAC Resources Inc. Classification of Waste Rock - Naartok East Crown Pillar Recovery, Madrid North, Hope Bay Project. Licence No. 2AM-DOH1335. August, 2019.

Oliver Curran, on behalf of TMAC Resources Inc. Letter to Derek Donald of the Nunavut Water Board Re: Water License 2AM-DOH1335 – Naartok East Crown Pillar Recovery at Madrid North – Proposed Site-Specific Geochemical Criteria for use of Non-Mineralized Waste Rock for Construction. August 14, 2019.

10.3 COMMENT

For practical reasons, TMAC proposes to use a portable XRF (pXRF) (Thermo Scientific Niton ZL3t GOKDD+) to conduct in-situ analyses of total sulfur and total arsenic. According to the letter submitted with this request, written by Oliver Curran (page 2):

The characterization program also established the viability of using portable X-ray fluorescence (pXRF) as a practical field tool to expedite the quantification of arsenic content and total sulphur content in waste rock. The field level arsenic pXRF screening is an additional practical mitigation to minimize the risk of neutral-pH ML in waste rock that has been classified as suitable for construction under the project-wide ML/ARD criteria specified in the 'Waste Rock for Construction Flowchart' (TMAC, 2019).

CIRNAC interprets the rationale behind choosing this approach to be due to the strong linear relationships between the results obtained in the lab and by the pXRF (i.e., Figures 4-11 to 4-14, and Equations 1 and 2). CIRNAC notes, however, that the linear relationships exhibited in the Figures are based on a logarithmic scale while the relationships exhibited in the Equations are not based on the same scale.

10.4 RECOMMENDATION/REQUEST

CIRNAC recommends that TMAC provide clarification as to why a logarithmic scale is used to demonstrate a linear relationship in Figures 4-11 to 4-14 but not in Equations 1 and 2.

10.5 TMAC RESPONSE TO CIRNAC-2

Figures 4-11 and 4-12 in the original submission, presents the arsenic data on a log scale. Given that arsenic content ranges over three orders of magnitude, figures are presented on a log scale for visual clarity.

The regression for arsenic presented as Equation 1 in Section 5.2.1 of the original submission, was derived based on Figure 3-1 in Appendix A, with arsenic data presented on a linear scale. Regardless, Microsoft Excel calculates the equivalent regression equation independent of whether data are presented in figures on a linear or log scale.

11. ECCC-1

Metal Leaching and Potentially Acid Generating Rock

11.1 REFERENCE

Classification of Waste Rock in Support of Segregating Construction Rock from Naartok East Crown Pillar Recovery, Madrid North, Hope Bay Project. Sections: 4.2 ARD Potential & 5.3 Field Classification Method

11.2 COMMENT

Figure 4-9 indicates that Acid Rock Drainage (ARD) classifications are sensitive to sulphur content, with all samples with sulphur less than (<) 1% classified as non-potentially acid generating (non-PAG). Conversely, all uncertain or PAG samples contained sulphur greater than (>) 1%. Figure 4-10 indicates that samples classified non-PAG have arsenic content less than 80 ppm. However, when the accounting for rock types other than sedimentary units (5), all samples were classified as non-PAG with arsenic as high as 800 ppm.

In section 5.3 Field Classification Method, TMAC Resources (the Proponent) stated that "All samples of sedimentary units (5) contained arsenic content above the criterion of 70 ppm and selected samples were classified as uncertain or PAG. All samples of rock type 5 classified as non-PAG contained <1% total Sulphur". Rock type 5 was the only rock type to be classified as uncertain or PAG, therefore, it is anticipated that all other waste rock types, including 1aj, will have a low risk for ARD. Nevertheless, a 1% sulphur criterion will be applied as a geochemical criterion to segregate waste rock. Rock type 5 will not be used for construction."

ECCC notes that the Proponent has used arsenic content as one of the criteria to indicate non-metal leaching rock. Although the Proponent has indicated that any rock containing less than 70 ppm is considered low potential to leach arsenic (metal leaching, Figure 5.1). However, no information has been provided on how much arsenic would be expected to leach out of the rock with a concentration of less than 70 ppm i.e. what proportion of the arsenic content of the rock is expected to leach out.

In addition, the proponent stated that a 1% sulphur criterion would be applied as a geochemical criterion to segregate waste rock". In general, as stated by the Prediction Manual for Drainage Chemistry for Sulphidic Geologic Materials - MEND Report 1.20.1 Dec. 2009, "the % sulphur capable of causing ARD should not be a generic number but depends on the magnitude of effective neutralization potential (NP)." In places, this number has been about 0.2-0.3 wt. percentage. Therefore, using as much as 1%, total sulphur without the corresponding neutralization potential for that unit seem insufficient as a tool to predict ARD or to segregate the rock that has potential for ARD.

ECCC notes the following:

• Not all rocks that contain sulphide minerals will become acid generating. It depends on the amount of neutralizing minerals and materials (such as limestone) that are present in the rocks. If there is balance, or if there is an excess of neutralizing minerals, the rocks may not generate metal leaching (ML) and ARD. If there is excess sulphide minerals, then ML/ARD will typically develop after all of the neutralizing minerals have dissolved. This can result in a significant time delay to the development of ML/ARD in rocks.

• The rocks at most metal and some coal mines contain high amounts of sulphide minerals. The excavating and crushing of ores during mining greatly increases the amount of rock surfaces that can be exposed to oxygen and water. Therefore, mining activities can have a high potential for ML/ARD.

• ML/ARD can occur from sulphide bearing mining wastes or from open pit or underground mine surfaces. Mining wastes often include mineralized rock that is not of ore grade (called waste rock) and tailings which are sand sized material left over from processing ore.

• Most mining operations leach metals to some degree. The potential for environmental impacts depends on many factors including the amount of metals in the mine drainage, the amount of acid-neutralizing ability in nearby rocks and water, the amount of dilution available in streams and how sensitive the receiving environment is.

11.3 Recommendation/Request

ECCC recommends that the proponent indicate the quantity or proportion of the arsenic content of the rock that is expected to leach out if the 70 ppm is used as threshold for low risk to leach arsenic. ECCC recommends that the Proponent demonstrate that rocks that has 1 % total sulphur also has enough carbonates or other neutralizing materials to neutralize the potential for acid generation.

11.4 TMAC Response to ECCC-1

Arsenic

Projections of arsenic leaching can be quantified based on kinetic test program for the Hope Bay Project. The kinetic test program of waste rock and ore for Madrid North, Madrid South and Boston[1,2,3] included 19 humidity cell (HC) and five barrel tests containing waste rock with equivalent lithologies to NE CPR and with less than 70 ppm arsenic.

The arsenic content of the 19 HC tests ranged form 2 to 64 ppm and operated between 1 and 3 years (49 to 155 weeks). Based on stable leaching rates of arsenic, the proportion of arsenic content that was leached during test operation was between 0.1 and 4.5%. For the HC test with 64 ppm arsenic, the proportion of arsenic removal was 0.5%.

The five field barrel tests contain 100's of kilograms of waste rock and are located at the Hope Bay Project site where they have been weathering under site climactic conditions for about 10 years. The barrels have arsenic contents ranging from 2.6 to 28 ppm. The last leachate monitoring sample was collected in Summer 2019 and results indicate that leaching rates are stable. Based on average leaching rates for arsenic, the proportion of arsenic content that had leached over the operational period of barrel test operation is between 0.2 and 0.5%.

Total Sulphur Content and Neutralization Potential

TMAC agrees with the MEND recommendation that in general, sulphur should not be used as a generic number for ARD classifications. The method of the proposed sulphur criterion is consistent with the general guidance of MEND (2009) and is based on industry best practices in that the criterion is site-specific and developed based on a comprehensive interpretation of the acid-base accounting (ABA) data that considers all NE CPR waste rock lithologies (refer to Appendix D of the original submission).

Figures 3-4 and 3-5 in Appendix D of the original submission compare the neutralization potential (NP) to acid potential (AP) and total inorganic carbon (TIC) to AP, respectively to assess the acid rock drainage (ARD) potential of each sample. The conclusion is that all samples are non-PAG except for three samples of sedimentary units that were classified as either uncertain or PAG.

Figure 4-9 of the original submission compares the total sulphur content and ARD classification (NP/AP) – this figure takes into account the ARD classifications of samples and indicates the following:

- All rock types with total sulphur content less than 1% are non-PAG. This includes i) rock type 7a (gabbro) samples which all have NP/AP ratios of greater than 3 and is a proposed construction rock type and ii) rock types 1aj (mafic metavolcanics with sediments) and 5 (sediments) that will not be used for construction on the basis the geochemical and geological conclusions)
- Sulphur contents in mafic metavolcanics can approach the 1% sulphur criterion but Figure 4-9 indicates that NP content is ten times higher than AP for the mafic metavolcanics sample at these sulphur contents, e.g. NP/AP = 10. As stated in Table 3-1 in Appendix D of the original submission, the buffering capacity for the NE CPR waste rock mafic metavolcanics sample set is high with median levels of NP and TIC of 200 and 250 kgCaCO3/t, respectively. These levels are consistent with the findings of SRK (2017a) that indicated Madrid North mafic metavolcanics waste rock samples (n=206) contained median levels of NP and TIC greater than 250 kgCaCO3/t.

The geochemical characterization of mafic metavolcanics waste rock samples from the overall Madrid North deposit (n=206) and samples localized to NE CPR indicates that mafic metavolcanics rocks, including those with 1 % total sulphur have sufficient levels of carbonate minerals.

[1] SRK Consulting (Canada) Inc., 2017a. Geochemical Characterization of Waste Rock and Ore from the Madrid North Deposit, Hope Bay Project. Prepared for TMAC Resources Inc., November 2017.

[2] SRK Consulting (Canada) Inc., 2017c. Geochemical Characterization of Waste Rock and Ore from the Boston Deposit, Hope Bay Project. Report Prepared for TMAC Resources Inc., November 2017.

[3] SRK Consulting (Canada) Inc., 2017b Geochemical Characterization of Waste Rock and Ore from the Madrid South Deposit, Hope Bay Project. Prepared for TMAC Resources Inc., November 2017

Attachment B – Revised Table 2-1 from Appendix A

Revised Table 2-1 of Appendix A

Table 2-1: Selected Mineralogy, Solids and Kinetic Test Data from Madrid North, Madrid South and Boston Kinetic Test Program

Rock Type	Descripton	Mine Area	Humidity Cell/ Barrel ID	Preliminary Economic Classification	Arsenopyrite (FeAsS)	Cobaltite (CoAsS)	Gersdorfite (Fe,Co,Ni)AsS	Arsenic Solids	Arsenic Release Rate[2]	Arsenic Concentrations HC initial	Arsenic Concentrations Barrel Av.	Arsenic Concentrations Barrel Max	Sulphur Solids as Total S	Sulphur SO4 Release Rate[2]	Cobalt Solids	Cobalt Release Rate[2]	Nickel Solids	Nickel Release Rate[2]
					%	%	%	ppm	mg/kg/week	mg/L	mg/L	mg/L	%S	mg/kg/week	ppm	mg/kg/week	ppm	mg/kg/week
1	Ultramafic to Mafic Metavolcanic Rocks	Madrid North	HC-9	Waste	bd	<0.01	bd	2.6	0.00023	0.001	--	--	0.07	0.66	33	0.000036	65	0.000065
		Madrid North	HC-3	Waste	--	--	--	6.7	0.0008	0.001	--	--	0.17	0.75	46	0.000033	68	0.000055
		Madrid North	HC-26	Ore	bd	bd	0.015	630	0.0067	0.068	--	--	3.9	25	70	0.0003	390	0.0021
		Madrid North	HC-8	Mixed	bd	<0.01	0.011	120	0.013	0.027	--	--	0.26	2.2	70	0.000029	480	0.00012
		Madrid North	HC-25	Waste	bd	0.013	0.014	110	0.065	0.28	--	--	0.4	2.1	47	0.00047	150	0.00076
		Madrid North	HC-28	Ore	bd	<0.001	0.02	430	0.077	0.037	--	--	1.3	10	44	0.00055	130	0.00089
		Madrid North	HC-27	Waste	bd	<0.01	0.014	120	0.16	0.081	--	--	0.15	1.3	45	0.00062	140	0.00055
		Madrid North	HC-24	Ore	bd	<0.001	0.029	630	0.16	0.15	--	--	2.2	3.1	47	0.00025	260	0.001
		Madrid South	HC-63	Waste	bd	bd	<0.01	7.3	0.00048	0.0047	--	--	0.16	0.57	42	0.000013	100	0.000032
		Madrid South	HC-61	Waste	<0.01	0.01	0.014	210	0.056	0.46	--	--	0.83	1.1	51	0.0011	98	0.00058
		Boston	HC-31	Waste	bd	<0.01	<0.01	84	0.032	0.03	--	--	0.13	1.1	37	0.00031	65	0.00018
		Boston	HC-55	Waste	bd	<0.01	0.013	140	0.023	0.022	--	--	0.29	1	47	0.00027	230	0.00042
		Boston	HC-12	Ore/Waste	bd	<0.01	<0.01	160	0.08	0.022	--	--	0.14	0.9	45	0.00065	93	0.00059
		Madrid North	W7	Waste	bd	bd	bd	2.6	0.000002	--	0.00019	0.004	0.07	0.023	33	0.00000036	65	0.0000029
		Madrid North	W4	Waste	--	--	--	6.7	0.0000097	--	0.0006	0.014	0.17	0.028	46	0.00000029	68	0.0000014
		Madrid North	W6	Mixed	bd	bd	0.011	120	0.0018	--	0.088	2.4	0.26	0.087	70	0.0000015	480	0.000027
		Madrid South	W15	Waste	--	--	--	24	0.00003	--	0.00077	0.021	0.31	0.082	43	0.0000032	100	0.00000078
		Boston	B3	Ore/Waste	--	--	<0.01	160	0.0041	--	0.15	7.4	0.14	0.052	45	0.00018	93	0.00068
1 mixed	Mixed Ultramafic to Mafic Metavolcanic Rocks	Boston	HC-10	Waste	bd	<0.01	0.02	110	0.023	0.014	--	--	0.16	0.84	56	0.000078	160	0.0003
		Boston	B1	Waste	--	--	0.02	110	0.00083	--	0.066	1.3	0.16	0.056	56	0.0000047	160	0.00006
1aj/1oj	Mafic Metavolcanic Rocks with Sediments	Madrid North	HC-17	Waste	bd	<0.01	bd	11	0.00032	0.0025	--	--	0.37	1.7	57	0.000022	190	0.00003
		Madrid North	W11	Mixed	--	--	--	160	0.00042	--	0.015	0.31	0.66	0.25	76	0.0000018	420	0.000015
		Boston	HC-32	Waste	bd	<0.01	0.034	290	0.13	0.18	--	--	0.86	2.2	53	0.00055	220	0.00085
		Boston	HC-33	Waste	0.015	<0.01	0.013	370	0.18	0.14	--	--	0.33	1.8	51	0.0006	220	0.00089
		Boston	B4	Waste	--	--	--	140	0.000053	--	0.008	0.38	0.6	1.1	44	0.00025	58	0.00026
2pg	Pale Green Pillow	Madrid North	HC-4	Mixed	--	--	--	3.1	0.00021	0.0012	--	--	0.1	1.1	42	0.000028	140	0.00011
		Madrid North	HC-18	Waste	bd	<0.01	bd	10	0.0073	0.0018	--	--	0.12	0.8	46	0.000029	150	0.000045
		Madrid North	W3	Mixed	--	--	--	3.1	0.00021	--	0.015	0.31	0.1	0.016	42	0.00000056	140	0.0000038
2pg mixed	Mixed Pale Green Pillow	Madrid North	HC-19	Waste	bd	<0.001	bd	8.2	0.00032	0.0047	--	--	0.24	4.8	51	0.000055	140	0.00022
5	Sedimentary Units (Argillite)	Madrid North	HC-21	Waste	bd	<0.001	bd	86	0.00018	0.0008	--	--	3.5	41	41	0.0001	76	0.00019
		Madrid North	HC-20	Waste	bd	<0.001	0.094	160	0.33	1.1	--	--	0.43	2.9	15	0.0015	95	0.018
		Boston	HC-11	Waste	bd	<0.01	<0.01	28	0.0002	0.0025	--	--	0.32	12	25	0.000027	19	0.000062
		Boston	HC-35	Waste	bd	<0.01	<0.01	56	0.0063	0.032	--	--	0.2	1.1	17	0.00017	38	0.00026
		Boston	HC-34	Waste	bd	bd	<0.001	74	0.00081	0.0042	--	--	0.81	6.1	15	0.00012	29	0.00029
		Boston	B2	Waste	--	--	<0.01	28	0.000016	--	0.002	0.037	0.32	0.17	25	0.0000035	19	0.0000086
		Boston	B5	Ore/Waste	--	--	--	120	0.00067	--	0.027	0.61	0.26	0.033	41	0.000044	78	0.000077
5a+1	Mixed Sedimentary Units	Madrid North	W14	Mixed	--	--	--	410	0.01	--	0.73	19	0.85	0.25	55	0.000046	340	0.0011
7a	Early Gabbro	Madrid North	HC-40	Waste	bd	<0.001	bd	7.1	0.0022	0.0063	--	--	0.11	1.1	45	0.000017	110	0.00003
		Madrid North	HC-41	Waste	bd	<0.001	0.035	270	0.27	0.2	--	--	0.27	1.6	52	0.00041	180	0.00092
		Madrid North	W8	Waste	--	--	--	8.5	0.0000078	--	0.00068	0.022	0.08	0.024	33	0.00000033	70	0.0000017
7ac mixed	Mixed Early Gabbro	Madrid South	HC-62	Waste	bd	bd	bd	7.3	0.00046	0.0019	--	--	0.2	23	29	0.000017	160	0.00005
9	Late Porphyry Granitoid	Madrid South	HC-60	Waste	bd	bd	bd	2.7	0.0025	0.033	--	--	0.02	0.48	6.9	0.000028	8.7	0.000034
		Madrid South	HC-64	Waste	<0.01	<0.01	0.018	130	0.097	0.11	--	--	0.27	1	40	0.00087	93	0.00072
		Madrid South	W16	Waste	--	--	--	12	0.00051	--	0.0059	0.25	0.04	0.04	8.8	0.000034	17	0.0000019
11c	Diabase	Madrid North	HC-22	Waste	bd	bd	bd	3.1	0.00062	0.008	--	--	0.02	2.2	20	0.000017	25	0.00012
		Madrid North	HC-23	Waste	bd	bd	bd	27	0.0013	0.016	--	--	0.07	1.5	22	0.0000093	52	0.000019
12q	Quartz vein	Boston	HC-37	Waste	<0.001	bd	0.07	550	0.14	0.24	--	--	1.5	4.8	49	0.00083	210	0.0023
		Boston	HC-38	Ore	bd	<0.01	<0.01	230	0.0012	0.013	--	--	3	14	35	0.00017	37	0.00029
13a	Deformation Zone	Madrid North	HC-30	Waste	bd	bd	bd	2	0.00016	0.0022	--	--	0.55	4.1	80	0.000017	310	0.00003
		Madrid North	HC-39	Waste	bd	bd	<0.01	64	0.0029	0.063	--	--	0.54	1.7	14	0.000056	24	0.00029
		Madrid North	HC-5	Waste	<0.01	<0.01	<0.01	73	0.037	0.035	--	--	0.16	0.87	30	0.00029	45	0.00019
		Madrid North	HC-29	Waste	bd	<0.001	0.01	77	0.065	0.31	--	--	0.19	1	36	0.00064	120	0.00053
		Madrid North	W2	Waste	<0.01	<0.01	<0.01	73	0.0052	--	0.38	13	0.16	0.14	30	0.000048	45	0.000056

Notes:

[2]Rate is average for barrel tests and stable rate for humidity cell test (HCT).

Attachment C – NE CPR Site-Specific Waste Rock for Construction Flowchart

NAARTOK EAST CPR- Waste Rock for Construction
SITE-SPECIFIC PROCESS FOR SUITABILITY DETERMINATION

TMAC RESOURCES

PURPOSE: Testing is required to demonstrate the geochemical suitability of waste rock for construction (low risk of ARD and/or metal leaching). The following process has been developed for use by TMAC Geology to assess whether Naartok East CPR waste rock is suitable for construction. See notes below for additional details regarding each of the process steps.

STEP 1: CONFIRM SUITABILITY OF BLAST GEOLOGY VIA DRILLHOLE RECORDS

✗ → **ML WASTE ROCK NOT FOR USE IN CONSTRUCTION, TO BE STORED IN WASTE ROCK AREA**

✓ ↓

STEP 2: PROCEED TO COLLECT REPRESENTATIVE SAMPLES FROM A MINIMUM OF 25% OF BLAST HOLES EVENLY SPACED THROUGHOUT BLAST PATTERN

✓ ↓

STEP 3: ASSESS ROCK TYPE AND TAKE pXRF MEASUREMENTS OF EACH SAMPLE (see Note 1)
NON-PAG/LOW RISK OF ML IF:
ROCK TYPE 1 OR 7A AND
CALIBRATED PXRF: % TOTAL SULPHUR ≤ 1% AND ARSENIC ≤ 70 PPM

✗ → **ML WASTE ROCK NOT FOR USE IN CONSTRUCTION, TO BE STORED IN WASTE ROCK AREA (See note 2)**

✓ ↓

WASTE ROCK SUITABLE FOR CONSTRUCTION, NOTIFY ENVIRONMENTAL SUPERVISOR AND PIT SUPERINTENDENT. VERIFY VOLUMES AND PLACEMENT IN CONSTRUCTION IS RECORDED BY PIT SUPERINTENDENT. REPEAT AT STEPS 1-3 EVERY BLAST

✓ ↓

STEP 4: CONFIRMATORY SAMPLING EVERY 20,000 TONNES FOR EXTERNAL LAB SUBMISSION :
(See Note 3)
NON-PAG/LOW RISK OF ML IF:
NP/AP RATIO GREATER THAN 3 *OR*
TOTAL SULPHUR CONTENT OF LESS THAN 0.1%
AND
ARSENIC ≤ 70 PPM

✗ → **MONITORING AND FURTHER INVESTIGATION AS PER WASTE ROCK, ORE AND BACKFILL MANAGEMENT PLAN**

✓ ↓

PERFORM POST-CONSTRUCTION INSPECTIONS AND MONITORING

NOTES:

1. For samples with calibrated pXRF content between 50 and 90 ppm, take triplicate pXRF arsenic measurements of each sample and classify samples based on the maximum pXRF arsenic value.
2. If rock is determined to be ML, store in waste rock area. Subject to professional judgement, waste rock suitability is re-assessed at the next blast round, and Steps 2-3 can be repeated prior to use.
3. During blasting, the construction waste rock will be inspected every 20,000 tonnes. At these intervals, a representative sample of blasted rock is collected and sent for lab testing of total Sulphur, ABA and SFE.
    1. ABA to include: Paste pH, Total sulphur by Leco, sulphate by HCl leach, total inorganic carbon, modified NP (MEND 1991) and trace elemental content by aqua regia digestion followed by ICP finish
    2. Shake Flask Leachate analysis to include pH, EC, SO4, acidity, alkalinity, chloride, ammonia, and low-level dissolved metals