APPENDIX G
NOISE AND VIBRATION TECHNICAL SUPPORT DOCUMENT

CÔTÉ GOLD PROJECT
TECHNICAL SUPPORT DOCUMENT:
NOISE AND VIBRATION

FINAL

Submitted to:
IAMGOLD Corporation
401 Bay Street, Suite 3200
Toronto, Ontario
M5H 2Y4

Submitted by:
AMEC Environment & Infrastructure,
a Division of AMEC Americas Limited
160 Traders Blvd., Suite 110
Mississauga, Ontario
L4Z 3K7

January 2014

TC121522

TABLE OF CONTENTS

PAGE

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

GLOSSARY AND ABBREVIATIONS

AC	Alternating Current
Cm	Centimetres
dBA	A-weighted Decibel sound level
dBL	Linear Decibel sound level
DFO	Department of Fisheries and Ocean
EA	Environmental Assessment
kg	Kilogram
EIS	Environmental Impact Statement
Km	kilometre
km/h	Kilometres per hour
kV	Kilo Volt
kW	Kilo Watt
L_{eq}	Energy equivalent sound level over a specific time period
M	Metre
m^3	Cubic metres
$m^{3/}yr$	Cubic metres per year
m^3/d	Cubic metres per day
m^3/s	Cubic metres per second
mg/kg	Milligrams per kilogram
Mm	Millimetre
Mm/s	Millimetre per second
Mm^3	Million cubic metres
MNR	Ontario Ministry of Natural Resources
MOE	Ontario Ministry of the Environment
MRA	Mine Rock Area
Mt	Million tonnes (metric)
MW	Megawatt
NPC	Noise Pollution Control
POR	Point of Reception
PPV	Peak Particle Velocity
RMS	Root Mean Square
ToR	Terms of Reference
Tpd or t/d	Metric tonnes per day
TMF	Tailings Management Facility
TSD	Technical Support Document
US FTA	United States Federal Transportation Authority
°C	Degrees Celsius

EXECUTIVE SUMMARY

AMEC has prepared this technical support document for the Côté Gold Project (the Project) with the aim of predicting the Project noise and vibration effects on surrounding sensitive receptors. A summary of these effects for each Project phase is provided below.

The noise and vibration regional study area is defined as the area that extends approximately 10 km from the main Project noise sources. The local study area has been defined as a 5 km region from the main Project noise sources. It is not expected that the noise and vibration effects of the Project would be measurable, audible (for noise) or perceptible (for vibration) beyond the regional study area. Sensitive receptors have been defined for this TSD within the regional study area. Receptors include residential cottages, recreational access points and tourist establishment areas. Noise and vibration effects have been predicted at each of these receptors for this TSD.

A baseline data collection program was conducted to gather current noise levels near the Project site. Results of the baseline data collection indicate measured ambient noise levels at the representative location of 44 dBA L_{eq} (1hr) during the daytime (07:00 – 19:00), and 34 dBA L_{eq} (1hr) during nighttime (19:00 – 07:00).

Guidelines and regulatory requirements applied in the prediction of noise and vibration effects include the following:

- Noise:
  - NPC-115 (Ministry of the Environment (MOE), 1981) and NPC-118 (MOE, 1979) apply to noise effects from construction equipment;
  - NPC-119 (MOE, 1982) applies to noise effects from blasting;
  - NPC-300 (MOE, 2013) applies to noise effects from Project operations.
- Vibration:
  - NPC-119 (MOE, 1982) applies to vibration effects from blasting; and
  - ISO 2631-2 (ISO, 1985) provides guidance on perceptibility of blast vibration at receptor locations.

<u>Noise</u>

Noise levels, for both the construction and operations phases, have been assessed using the A-weighted noise scale (dBA). The A-weighted noise scale is used for the prediction of effects as it is adjusted to reflect human hearing.

Noise levels have been assessed over a time period of one hour, using the energy equivalent noise level (L_{eq}) as required by the applicable guidelines (NPC-300; MOE 2013). Noise levels are modelled for daytime (07:00 – 19:00) and nighttime (19:00 – 07:00) separately as the operation scenarios and the criteria for these periods are different. Noise from the construction and operations phases have been modelled using an acoustic software program (Cadna/A), a computerized version of the ISO 9613 environmental noise propagation algorithm. The predicted noise levels for both construction and operations phases are assessed against both NPC-300 guideline limits for compliance, and are compared to the ambient noise levels in the area to determine the change in ambient noise with the Project.

Blasting noise levels have been assessed on a linear noise scale (dBL), which is consistent with the applicable noise guidelines (NPC-119; MOE, 1982). Blasting noise has been predicted at sensitive receptors using MOE Blasting Noise and Vibration Model (NPC-119; MOE, 1982). Blasting noise has been assessed against the applicable guideline limits for compliance and then compared to ambient noise levels in the area to determine the change in ambient noise with the Project.

Vibration

Vibration levels from blasting are assessed based on the maximum peak particle velocity (PPV, mm/s), which is consistent with the applicable guidelines (NPC-119). Blasting vibration has been predicted using MOE Blasting Noise and Vibration Model (NPC-119). The predicted blasting vibration has been assessed against the applicable criteria and is compared to ISO 2631-2 (ISO, 1985) perceptible vibration level to determine if the blast vibration may be perceptible at the receptor locations.

Prediction of Effects

The prediction of noise and vibration effects considers noise and vibration effects to surrounding sensitive receptors, and considers the MOE's noise and vibration guidelines.

The following noise mitigation measures have been considered for the Project:

- equipment noise levels are not to exceed those noted in Appendix I;
- operation of the air-track drill in the pit to be limited to daytime hours (7:00 to 19:00);
- operation of track dozer TD3 (on the ore stockpile) to be limited to daytime hours (7:00 to 19:00) for Years 1 through 6. This requirement can be removed Year 7 onwards;
- both MRA and ore haul truck traffic during nighttime (19:00 to 07:00) should be limited to a maximum of 6 trucks each in any given hour for Years 1 through 6 (i.e., 6 trucks/hr for each MRA route and ore haul route) and increasing them to 15 trucks/hr from Year 7 onwards (daytime truck traffic can be increased to accommodate the night truck limits to meet the material movement requirements). Alternatively, provide quieter trucks for MRA and ore haul routes and the maximum sound power level of the trucks should be limited to 117 dBA.

For the construction phase, it is expected that daytime noise levels at receptor locations will be at, or below, baseline ambient noise levels. Nighttime noise levels may exceed baseline ambient noise levels at some receptor locations. Blasting noise levels are expected to exceed baseline ambient noise levels, but will meet applicable MOE guidelines. Blasting vibration levels may be perceptible at some receptor locations but are not expected to cause structural damage.

For the operations phase, it is expected that daytime noise levels at receptor locations will be at, or below baseline ambient noise levels. Nighttime noise levels may exceed baseline ambient noise levels at some receptor locations. Blasting noise levels are expected to exceed baseline ambient noise levels, but will meet applicable MOE guidelines. Blasting vibration levels may be perceptible to some receptor locations but are not expected to cause structural damage.

During the closure phase, the noise effects are expected to be lower than the effects for the construction phase. To be conservative, it is assumed that noise effects during closure are identical to the construction phase effects. No activities are planned to occur at nighttime. No vibration effects are anticipated as no blasting activities are planned during the closure phase.

Noise and vibration effects are not considered in the post-closure phase, as the vast majority of the noise sources will be decommissioned during the closure phase. To be conservative, it is assumed that daytime noise effects during the first years of the post-closure will be less than the closure phase noise effects. Once pumping ceases, noise levels are expected to revert to current baseline conditions. No activities are planned to occur at night-time. No vibration effects are anticipated as no blasting activities are planned during the post-closure phase.

IAMGOLD intends to monitor noise and vibration during the construction and operations phases to provide ongoing oversight on noise and vibration effects from the Project.

1.0 INTRODUCTION AND PROJECT OVERVIEW

The Côté Gold Project (the Project) is an advanced stage gold exploration project located in the Chester and Neville Townships, District of Sudbury, in north-eastern Ontario, approximately 20 km southwest of Gogama, 130 km southwest of Timmins, and 200 km northwest of Sudbury (see Figure 1). IAMGOLD proposes to construct, operate and eventually rehabilitate a new open pit gold mine on the property.

The proposed site layout places the required mine-related facilities in close proximity to the open pit, to the extent practicable. The proposed site layout is presented in Figure 2 showing the approximate scale of the Côté Gold Project. The site plan will be refined further as a result of ongoing consultation activities, land purchase agreements and engineering studies.

The Project is anticipated to require completion of an Environmental Assessment (EA) pursuant to the Canadian *Environmental Assessment Act, 2012* and an Individual Environmental Assessment pursuant to the Ontario *Environmental Assessment Act*. This technical support document (TSD) has been prepared by AMEC and is one of a series of technical reports to support the EA for the Project.

1.1 Noise

Noise effects are expected during the construction, operations and closure phases of the Project. The prediction of noise effects consists of estimating the noise emissions from major noise sources on the Project, including, construction noise, operation of the processing plant and crusher, generators and mobile equipment.

Project noise levels are predicted using the A-weighted noise scale (dBA), which is the noise level that best reflects how people hear noise. For reference, Table 1-1 (Harris, 1997) provides a list of noise levels in dBA for the corresponding activities. These represent average noise levels, and could vary based on the situation and proximity to the activity.

Table 1-1: Noise Level Reference, Common Activities

Activities	Noise Level (dBA)	Apparent Loudness
Jet plane takeoff	130	Deafening
Thunder, artillery, elevated train, factory	110	Very Loud
Noisy office, average street noise, radio/TV	70	Loud
Average home/office, conversation, quiet radio/TV	50	Moderate
Quiet home/office, quiet conversation	30	Faint
Rustle of leaves	10	Very Faint

Source: Harris (1997).

Some Project construction activities and extraction of material from the working face of the pit during the operations phase requires the use of explosives. These activities have the potential to generate elevated noise levels from blasting at sensitive receptor locations. Noise levels from blasting activities are predicted using the linear noise scale (dBC).

1.2 Vibration

Vibration from Project activities are expected to occur during the construction and operations phases. During construction, some blasting may occur to develop and construct the watercourse realignments and potentially some pre-stripping of the open pit. Vibrations from blasting are considered with respect to the potential to cause physical damage to structures. Vibration levels from blasting are assessed based on peak particle velocity (PPV) in mm/s to address structural damage, and root mean square (RMS) in mm/s to determine perceptibility of the vibration.

2.0 METHODOLOGY

2.1 Spatial Boundaries

The noise and vibration regional study area (see Figure 3) is defined as an area that extends approximately 10 km from the main Project noise sources. It is not expected that the effects of the Project would be measurable, audible or perceptible beyond the regional study area.

The noise and vibration local study area (see Figure 4) generally corresponds to the area in the vicinity of the Project where most of the noise and vibration effects of the Project are expected to occur. This can be the area where effects may be predicted or measured within a reasonable degree of accuracy, and where effects would be considered audible or perceptible. The local study area is defined as an area that extends approximately 5 km from the main Project noise sources.

The local noise study area also includes a 1 km buffer on either side of the selected transmission line alignment.

2.2 Temporal Boundaries

The temporal boundaries of the EA will span all phases of the Project:

- construction;
- operations;
- closure; and
- post-closure.

2.3 Selection of Effects Assessment Indicators

The effects assessment indicators selected for the Noise and Vibration TSD and the rationale for selection of these indicators is presented in Table 2-1.

Table 2-1: Effects Assessment Indicators Selected for Noise and Vibration

Effect Assessment Indicator	Rationale for Selection
Daytime Noise Level	Project activities will occur during the daytime. Noise created by these activities has the potential to affect nearby receptor locations.
Nighttime Noise Level	Some Project activities will occur during the nighttime. Noise created by these activities has the potential to affect nearby receptor locations.
Blasting Noise Level	During construction activities, some blasting may be required. During operations, regular blasting will occur in the open pit. These activities will generate noise which has the potential to affect nearby receptor locations.

Effect Assessment Indicator	Rationale for Selection
Blasting Vibration Level	During construction activities, some blasting may be required. During operations, regular blasting will occur in the open pit. These activities will generate vibrations which has the potential to affect nearby receptor locations.

2.4 Baseline

A noise baseline study was completed for the Côté Gold Project and is appended to this document (see Appendix II). A representative rural location was selected for the baseline measurements as the similar ambient is expected anywhere within the regional study area. The measurement location is shown in Figure 5. The current measured ambient noise levels at the representative location are 44 dBA for the daytime (07:00 – 19:00) and 34 dBA for the nighttime (19:00 – 07:00).

A baseline vibration measurement was not conducted as there were no vibration sources existing in the area, and a baseline measurement was therefore considered to be neither justified nor meaningful.

2.5 Guidelines and Regulatory Requirements

Guidelines and regulatory requirements applied in the prediction of noise and vibration effects include the following:

- Noise:
  - NPC-115 (MOE, 1981) and NPC-118 (MOE, 1979) apply to noise effects from construction equipment;
  - NPC-119 (MOE, 1982) applies to noise effects from blasting;
  - NPC-300 (MOE, 2013) applies to noise effects from Project operations.
- Vibration:
  - NPC-119 (MOE, 1982) applies to vibration effects from blasting; and
  - ISO 2631-2 (ISO, 1985) provides guidance on perceptibility of blast vibration at receptor locations.

2.6 Prediction of Effects

2.6.1 Noise Effects

The noise software program (CadnaA) prediction model (version 4.3.143), developed by DataKustik GmbH is widely accepted for evaluating noise and is an accepted model by the MOE. The CadnaA model is used for the prediction of noise for this Project. The model algorithms are based on ISO 9613 standard (ISO, 1996a; ISO 1996b). The model takes the following factors into account:

- source sound levels;
- source directivity;
- distance attenuation;
- source-receptor geometry including heights and elevations;
- barrier effects of the building and surrounding topography;
- ground and air (atmospheric) attenuation; and
- meteorological effects on noise propagation.

Noise sources are characterized by entering the sound power and/or sound pressure octave band spectrum associated with each noise source. Other parameters including building dimensions, frequency of use, hours of operation, and enclosure attenuation ratings also define the nature of noise emissions.

The ISO 9613 prediction method is conservative as it assumes that all receptors are downwind from the noise source or that a moderate ground based temperature inversion exists. In addition, ground cover and physical barriers, either natural (terrain-based) or constructed and atmospheric absorption are included as they relate specifically to the Project.

Noise levels have been assessed over a time period of one hour, using the energy equivalent noise level (L_{eq}) as required by the applicable guidelines (NPC-300; MOE, 2013). Noise levels are modelled for daytime (07:00 – 19:00) and nighttime (19:00 – 07:00) separately as the operation scenarios and the criteria for these periods are different.

The Project blasting noise levels are predicted using the MOE Blasting Noise and Vibration Prediction Model NPC-119 (MOE, 1982). Using charge size per delay (i.e., explosive used in kg) and the separation distance between the blast location and assessment receptor, the absolute noise levels expected at the sensitive receptors are determined.

For comparison to NPC-119 absolute limits, the predictions are based on generic environmental and topographical conditions and no adjustments are made to suit site specific conditions. For comparisons to ambient noise levels, air absorption effects (20°C, RH 50%, α 0.50) were applied to the NPC-119 predictions to afford a more representative blast noise level at the sensitive receptors. For the purpose of this assessment, the blasting location is considered to be any point on the outer perimeter of the open pit.

2.6.2 Vibration Effects

The vibration levels for the Côté Gold Project blasting are predicted using the MOE Blasting Noise and Vibration Prediction Model NPC-119. Using the proposed charge size per delay (i.e., explosive used in kg) and the separation distance between the blast location and assessment receptor, absolute ground-borne vibration levels expected at the sensitive receptors are determined.

The predictions are based on generic environmental and topographical conditions and no adjustments are made to suit site specific conditions. For the purpose of this effects prediction, the entire open pit area is considered as the blasting location, therefore the distance from the outer perimeter of the open pit to the receptor is considered as the distance to the receptor. This is a conservative approach for predicting vibration effects from blasting operations.

To determine perceptibility of vibration, the PPV values determined from the NPC-119 prediction were converted to RMS values losing a square root crest factor.

2.6.3 Sensitive Receptors

For the purpose of this assessment, noise and vibration receptors (also known as points of reception or POR) have been identified within the regional study area. Figure 6 and Table 2-2 illustrate the sensitive receptors that have been identified for this assessment.

Table 2-2: Sensitive Receptors

Receptor Description	Receptor ID	UTM X-Coordinate	UTM Y-Coordinate
Cottage Residential Site	POR1	420,455	5,268,836
Cottage Residential Site	POR2	422,756	5,270,608
Cottage Residential Site	POR3	424,509	5,272,995
Cottage Residential Site	POR4	425,268	5,270,202
Cottage Residential Site	POR5	426,120	5,277,325
Cottage Residential Site	POR6	427,190	5,270,757
Cottage Residential Site	POR8	427,946	5,281,356
Cottage Residential Site	POR9	433,115	5,273,945
Cottage Residential Site	POR10	433,567	5,280,206
Cottage Residential Site	POR11	433,734	5,283,384
Cottage Residential Site	POR12	433,968	5,269,586
Cottage Residential Site	POR13	438,861	5,265,090
Cottage Residential Site	POR15	439,555	5,276,019
Recreation Access Point	POR16	434,274	5,269,574
Recreation Access Point	POR17	434,396	5,257,593
Recreation Access Point	POR18	435,242	5,272,650
Recreation Access Point	POR19	438,150	5,276,474
Recreation Access Point	POR20	435,996	5,260,512
Recreation Access Point	POR21	436,805	5,266,498

Receptor Description	Receptor ID	UTM X-Coordinate	UTM Y-Coordinate
Recreation Access Point	POR22	434,600	5,254,261
Tourist Establishment Area	POR23	435,685	5,259,744
Tourist Establishment Area	POR24	438,706	5,274,551
Tourist Establishment Area	POR25	443,197	5,269,688
Cottage Residential Area	POR27	434,343	5,278,895
Cottage Residential Area	POR28	433,553	5,278,145
Cottage Residential Area	POR29	433,605	5,276,770
Cottage Residential Area	POR30	434,151	5,275,717
Cottage Residential Area	POR31	434,180	5,270,514

The effect location considered for all cottage residential area receptors are at 4.5 m above grade at the UTM coordinates in Table 2-2, as they are the worst-effect locations (i.e., the highest window level for a 2 storey house) for the purposes of this noise effects assessment.

The effect location for all Recreation Access Point and Tourist Establishment Area receptors are at 1.5 m above grade within a 30 m radius of the UTM coordinates in Table 2-2, consistent with MOE NPC-300.

3.0 PREDICTION OF EFFECTS

3.1 Construction Phase

3.1.1 Daytime Noise Level

Daytime construction activities at the Project site are expected at the open pit, MRA, ore processing plant, various facilities including the maintenance garage, fuel and lube facility, warehouse, administration complex, accommodations complex, explosives manufacturing and storage facility, crushing and screening plants, tailings management facility (TMF), on-site access roads and pipelines, power infrastructure and fuel storage facilities, potable and process water treatment facilities, domestic and industrial solid waste handling facilities, water management facilities and drainage works, including watercourse realignments.

However the main construction activities are expected at the open pit, MRA and TMF areas and therefore, equipment anticipated for these locations along with the truck routes have been considered in the noise model. A list of construction noise sources used in the model is provided in Table 3-1.

Table 3-1: Construction Noise Sources

Noise Source	Equipment Model	Sound Level (dBA)	Open Pit	MRA	TMF
Wheel loader	L-1850	119	2	N/A	N/A
Wheel dozer	854K	114	1	N/A	N/A
Diesel generator	CAT 1.5 MW	85 dBA at 15 m	1	1	1
Track dozers	CAT D10T	119	2	1	1
Diesel shovel	Hitachi EX8000	118	1	0	0
Water truck	Generic	115	1	1	1
Motor grader	CAT 16M	112	N/A	1	1
Truck Route	CAT 740	109	1	1	1

The following truck routes were considered for the construction noise assessment (at five round-trips per hour were considered in the assessment).

- open pit to TMF area 1;
- open pit to TMF area 2; and
- open pit to MRA.

Noise levels were modelled using Cadna/A to determine the predicted noise level at each sensitive receptor in Table 2-2. A 1-hr L_{eq} noise level, in dBA, was determined based on the worst case operation of all construction equipment operating simultaneously. Noise levels were then compared to the ambient noise level.

The daytime construction noise effects have been predicted at the sensitive receptors in the regional study area. The predicted construction noise levels are presented in Table 3-2 and in Figure 7.

Table 3-2: Daytime Construction Noise Levels at Sensitive Receptors

Receptor ID	Construction Noise Level at Receptor, Daytime (dBA)
POR1	30
POR2	34
POR3	36
POR4	38
POR5	33
POR6	44
POR8	29
POR9	42
POR10	30
POR11	26
POR12	39
POR13	30
POR15	29
POR16	38
POR17	28
POR18	36
POR19	30
POR20	30
POR21	33
POR22	24
POR23	30
POR24	30
POR25	26
POR27	31
POR28	33
POR29	35
POR30	36
POR31	40

Construction phase daytime noise levels in the regional and local study areas are predicted to be at levels below or equal to daytime baseline levels of 44 dBA.

It is expected that most transmission line construction activities will be carried out by small vehicles. Most of the terrain is easily accessible such that tower construction is expected to occur from the ground. In some rare cases, where specific tower locations are inaccessible by ground vehicles there may be some helicopter noise (over a single day) associated with the final erection of each tower (Bonneville Power Administration, 2012).

Noise generated due to the construction of the transmission line has not been included in the noise model. Several receptors are located near the transmission line. A forest buffer will be retained as practicable, to reduce noise effects to nearby land users. It is expected that the majority of construction activities will occur during the winter season. Construction at any given location along the transmission line corridor will also only be for a short period of time.

3.1.2 Nighttime Noise Level

Construction activities will be conducted during the nighttime throughout the construction phase of the Project. It is assumed that the daytime construction activities described in Section 3.1.1 will also be carried out during the nighttime. The nighttime construction noise effects have been predicted at the sensitive receptors in the regional study area. These predicted noise levels are presented in Table 3-3 and in Figure 8.

Table 3-3: Nighttime Construction Noise Levels at Sensitive Receptors

Receptor ID	Nighttime Construction Noise Level at Receptor (dBA)	Nighttime Noise Level Increase above Ambient (dB)
POR1	30	—
POR2	34	—
POR3	**36**	2
POR4	**38**	4
POR5	33	—
POR6	**44**	10
POR8	29	—
POR9	**42**	8
POR10	30	—
POR11	26	—
POR12	**39**	5
POR13	30	—
POR15	29	—
POR16	**38**	4
POR17	28	—
POR18	**36**	2
POR19	30	—
POR20	30	—
POR21	33	—
POR22	24	—
POR23	30	—
POR24	30	—
POR25	26	—
POR27	31	—
POR28	33	—
POR29	**35**	1
POR30	**36**	2
POR31	**40**	6

Bold numbers indicate noise levels higher than nighttime ambient noise baseline (34 dBA).
— = not applicable

Nighttime construction noise levels will be audible at a number of receptor locations. In some cases this will be marginally above ambient (1 dB - 2 dB), including receptors POR3, POR18, POR29 and POR30. In others, there is expected to be clearly audible construction noise above ambient (3 dB - 5 dB) at receptors POR4, POR12 and POR16. At receptors POR6, POR9 and POR31 the nighttime construction noise may be considered obtrusive with levels above ambient (above 5 dB), where construction noise mitigation should be considered during nighttime operations.

We note that the construction noise assessment is based on a worst-case hour, and the specific duration of the construction activity in the vicinity of any sensitive receptor should be considered in the practical application of construction noise mitigation.

No nighttime construction activities are anticipated for the transmission line alignment.

In summary, for the majority of the sensitive receptor locations in the local and regional study area, construction noise levels are expected to be above nighttime baseline levels (34 dBA) and below 40 dBA. Nighttime construction noise levels are predicted to be above 40 dBA for two receptors in the local study area (POR6 and POR9).

3.1.3 Blasting Noise Level

Blasting noise related to construction is assessed separately from standard construction noise. This includes blasting related to the removal of material for watercourse realignments, road alignments or other construction activities.

Construction blasting is expected to occur within the TMF, the open pit and MRA boundaries. The closest distances to each sensitive receptor from either of these components has been considered for the purpose of this assessment, and are provided in Table 3-4.

Table 3-4: Construction Blasting Distances to Receptors

Receptor ID	Distance to Closest Project Component (km)	Closest Project Component
POR1	8.50	TMF
POR2	5.50	TMF
POR3	4.00	TMF
POR4	3.50	TMF
POR5	5.00	TMF
POR6	1.25	TMF
POR8	7.50	TMF
POR9	4.00	TMF
POR10	6.25	TMF
POR11	9.75	TMF
POR12	2.75	TMF
POR13	7.00	MRA
POR15	6.25	TMF
POR16	2.75	TMF
POR17	6.50	MRA
POR18	4.00	TMF
POR19	8.00	TMF

Receptor ID	Distance to Closest Project Component (km)	Closest Project Component
POR20	5.25	MRA
POR21	5.50	MRA
POR22	9.50	MRA
POR23	5.50	MRA
POR24	6.75	TMF
POR25	12.00	TMF
POR27	5.25	TMF
POR28	4.25	TMF
POR29	3.50	TMF
POR30	2.50	TMF
POR31	2.00	TMF

Blasting is not expected to be required to construct the transmission line.

Noise from the Project due to construction blasting is predicted using the MOE Blasting Noise and Vibration Prediction Model NPC-119 ("Guidelines on Information Required for Assessment of Blasting Noise and Vibration"; MOE 1982) for the charge size per delay (i.e., explosive used in kg) used. In addition to the charge size, the separation distance between the blast location and the receptor (see Table 3-4) is used for the prediction to calculate the absolute noise level. The MOE empirical formula for the blasting noise addresses two conditions: (a) in front of the working face (i.e., no screening), and (b) behind the working face (with screening). Worst-case scenario results (behind the working face, with screening) are considered in the effects prediction.

A maximum blast charge per delay of 250 kg for noise has been determined for the construction blasting locations based on the distance to the closest receptor (see Figure 9). Based on the 250 kg charge size, blast noise levels (in dBL) have been determined at each receptor based on the distances in Table 3-4, such that routine monitoring is not required.

Blast noise levels at the receptors were assessed in accordance with MOE guideline publication NPC-119. The guideline has two limits: a cautionary limit of 120 dBL when routine noise monitoring is not conducted and an upper limit of 128 dBL when noise monitoring is conducted. For the purposes of this effects prediction, the cautionary limit of 120 dBL for blasting noise at the nearest residences has been adopted.

Blast noise levels were also compared to the daytime ambient noise level as the blasting is expected during daytime only. Notwithstanding that the blast noise (dBL) and ambient noise levels (dBA) are in different units, and time averages are different (blast noise is impulsive whereas ambient noise is steady state over 1-hr), the values are considered comparable for the purpose of this assessment in determining audibility of the blast noise at the receptors. However, a 5 dB correction has been applied to the ambient noise level to account for the impulse nature of the blast noise (Beis, 2003). The predicted construction blasting noise levels are presented in Table 3-5.

Table 3-5: Construction Blasting Noise Levels at Sensitive Receptors

Receptor ID	Construction Blasting Noise Level at Receptor (dBL)	Construction Blasting Noise Level at Receptor with Air Absorption (dBL)[(1)]
POR1	109	67
POR2	111	84
POR3	112	92
POR4	113	96
POR5	111	86
POR6	118	118
POR8	110	72
POR9	112	92
POR10	111	79
POR11	109	60
POR12	114	100
POR13	110	75
POR15	111	79
POR16	114	100
POR17	110	78
POR18	112	92
POR19	109	69
POR20	111	85
POR21	111	84
POR22	109	61
POR23	111	84
POR24	110	76
POR25	108	48
POR27	111	85
POR28	112	91
POR29	113	96
POR30	114	102
POR31	115	105

[(1)] Includes a correction for air absorption at 20°C, RH 50%, α 0.50.

Construction blast noise levels are above the ambient daytime levels of 39 dBA (including the 5 dB correction for impulse blast noise) for all sensitive receptors, and are expected to be audible. However, all construction blast noise levels are within noise limits of 120 dBL set out in NPC-119.

3.1.4 Blasting Vibration Level

As described in Section 3.1.3, blasting is expected to occur during the construction phase at the TMF, MRA and/or open pit areas, but could also be required sporadically at roads and/or watercourse realignments. For mining projects, ground-borne vibration is mainly generated during blasting activities to remove material for construction purpose. Blasting is not expected to be required to construct the transmission line.

Vibrations from the Project construction blasting are predicted using the MOE Blasting Noise and Vibration Prediction Model NPC-119 for the charge size per delay used. In addition to the charge size, the separation distance (see Table 3-4) between the blast location and the receptor is used for the model from which the absolute ground-borne vibration is calculated. The predictions are based on generic environmental and topographical conditions and no adjustments have been made to suit site specific conditions.

The maximum construction blast charge per delay of 250 kg for ground-borne vibration has been determined based on the distance to the closest receptor location (see Figure 9). Based on the 250 kg charge size, blast vibration levels (PPV mm/s) have been determined at each receptor based on distances presented in Table 3-4.

Blast vibration levels at the receptors were assessed in accordance with MOE guideline publication NPC-119. The guideline has two limits: a cautionary limit of 10 mm/s PPV when routine vibration monitoring is not conducted and an upper limit of 12.5 mm/s when vibration monitoring is conducted. For the purposes of this assessment, the cautionary limit of 10 mm/s PPV for construction blasting vibration at the nearest residences has been adopted, such that routine monitoring at the nearest residences will not be required.

Blast vibration levels were also compared to the perceptible vibration limit for humans in residential buildings during nighttime at each receptor, as outlined in ISO 2631-2 (ISO, 1985). This was defined as a maximum root-mean squared (RMS) velocity limit of 0.14 mm/s at frequencies between 10 Hz and 100 Hz. Vibration levels above this level may be perceived as noticeable or felt.

Blasting effect on fish and spawning habitats during construction has been modelled. An assessment of setback distances for fish and spawning habitats during construction is provided in Appendix III. Effect assessment and associated mitigation measures (including monitoring requirements) for fish and spawning is provided in the Aquatic Biology TSD.

The predicted construction blast vibration levels are presented in Table 3-6.

Table 3-6: Construction Blasting Vibration Levels at Sensitive Receptors

Receptor ID	Construction Blasting Vibration Level at Receptor (PPV, mm/s)	Construction Blasting Vibration Perceptible Level at Receptor (RMS, mm/s) (1) (2)
POR1	0.05	0.04
POR2	0.11	0.08
POR3	0.17	0.12
POR4	0.21	**0.15**
POR5	0.12	0.09
POR6	1.03	**0.73**
POR8	0.07	0.05
POR9	0.17	0.12
POR10	0.09	0.06
POR11	0.04	0.03
POR12	0.31	**0.22**

Receptor ID	Construction Blasting Vibration Level at Receptor (PPV, mm/s)	Construction Blasting Vibration Perceptible Level at Receptor (RMS, mm/s) (1) (2)
POR13	0.07	0.05
POR15	0.09	0.06
POR16	0.31	**0.22**
POR17	0.08	0.06
POR18	0.17	0.12
POR19	0.06	0.04
POR20	0.11	0.08
POR21	0.11	0.08
POR22	0.05	0.03
POR23	0.11	0.08
POR24	0.08	0.06
POR25	0.03	0.02
POR27	0.11	0.08
POR28	0.16	0.11
POR29	0.21	**0.15**
POR30	0.36	**0.25**
POR31	0.50	**0.35**

(1) Includes a correction of S 2 crest factor to adjust PPV to RMS vibration level.
(2) Bold numbers indicate perceptible blast vibration levels (above 0.14 mm/s) at receptor locations.

Construction blast vibration levels are above the perceptible vibration limit at the following receptors: POR4, POR6, POR12, POR16, POR29, POR30 and POR31. Vibration from blasting may be felt at these locations. Blast vibration levels for all other sensitive receptors are at or below the perceptible vibration limit, and are not expected to be felt at these locations.

All construction vibration levels are below the NPC-119 limit at sensitive receptors, and are not considered to be high enough to cause damage to buildings at the sensitive receptor locations.

3.2 Operations Phase

3.2.1 Daytime Noise Level

Operational noise is generated from a variety of activities at the Project site. This includes noise from mining operations in the open pit (e.g., blasting and heavy equipment operation), processing activities (ore processing plant) and other ancillary and supporting facilities. The major noise sources that are anticipated from the mining operations at the Project include heavy equipment such as blast-hole-drills, air-track-drills, excavators, electrical shovels, track dozers, wheel loaders, wheel dozers, motor graders and on-site truck traffic. Noise emissions from the ore process plant will be minimal as most of the plant equipment is enclosed within the plant building. The primary sources of noise from the ore process plant will come from the primary crusher, dust collectors, emergency generators and substation transformers.

The distribution of operational equipment (i.e., noise sources) has been assumed, and locations are shown in Figures 10 and 11. A list of operational noise sources is provided in Appendix I. Noise levels were modelled using Cadna/A to determine the predicted noise level at each sensitive receptor listed in Table 2-2. A 1-hr L_{eq} noise level, in dBA, was determined based on the predictable worst-case operational effect (i.e., all equipment operating simultaneously).

The applicable guideline used for the Côté Gold Project operational noise is NPC-300. The guideline also stipulates that the assessment consider the potential noise effect during a predictable worst-case hour of operation, which is defined as a situation when the highest expected noise level from the Project coincides with the lowest one-hour background sound. NPC-300 states that energy equivalent noise level L_{eq} (1hr) from stationary noise sources in Class 3 Areas shall not exceed the higher of 45 dBA or background noise, during daytime hours (0700 - 1900h).

The measured existing ambient sound levels for daytime hours surrounding the Project site were lower than the guideline exclusionary limits (see Section 2.4). Therefore, the applicable criteria limit for the Project (exclusionary limits) during the daytime (07:00 to 19:00) is 45 dBA.

In addition to assessing predicted noise levels to the NPC-300 limits, the predicted noise levels are also compared to the ambient noise levels to assess change in ambient noise levels due to the Project.

The operational noise effects are predicted at the sensitive receptors in the regional study area. Operational noise has been modelled and assessed for two operating scenarios – Year 1 and Year 7, which have different equipment usage, open pit depth and stockpiling barrier effects.

The following noise mitigation measures have been considered for the daytime operation of the Project:

- equipment noise levels are not to exceed those noted in Appendix I;
- operation of the air-track drill in the pit to be limited to daytime hours (7:00 to 19:00); and
- operation of track dozer TD3 (on the ore stockpile) to be limited to daytime hours (7:00 to 19:00) for Years 1 through 6.

The predicted daytime operations noise levels, taking into account the mitigation measures outlined above, are presented in Table 3-7 and in Figures 12 and 13.

Table 3-7: Daytime Operational Noise Levels at Sensitive Receptors

Receptor ID	Year 1 Daytime Operational Noise Level at Receptor (dBA)	Year 7 Daytime Operational Noise Level at Receptor (dBA)
POR1	33	34
POR2	35	35
POR3	35	38
POR4	39	40
POR5	31	35
POR6	41	43

Receptor ID	Year 1 Daytime Operational Noise Level at Receptor (dBA)	Year 7 Daytime Operational Noise Level at Receptor (dBA)
POR8	27	31
POR9	35	38
POR10	28	29
POR11	20	24
POR12	40	41
POR13	34	37
POR15	29	33
POR16	39	40
POR17	33	31
POR18	34	39
POR19	29	28
POR20	35	37
POR21	37	39
POR22	30	34
POR23	34	37
POR24	30	34
POR25	29	29
POR27	29	33
POR28	30	32
POR29	31	34
POR30	32	36
POR31	39	40

Daytime operational noise levels at receptor locations are expected to be at or below baseline noise levels (44 dBA) and therefore meet the MOE NPC-300 noise criteria of 45 dBA.

With regards to the transmission line, corona noise is the most common noise associated with AC transmission lines during foul weather conditions and is heard as a crackling or hissing sound. However, during detriment weather conditions, other noises such as wind and/or rain will likely be more audible than the corona noise. AC transmission lines are not known to generate audible noise issues associated with them during fair-weather conditions (Cartier & Sterns, 1981). Therefore, operational noise associated with the transmission line is considered not to exceed baseline conditions at receptor locations along the transmission line corridor.

3.2.2 Nighttime Noise Level

Operational activities will also be conducted during the nighttime. It is assumed that the daytime operation activities described in Section 3.2.1 will also be carried out during the nighttime. The distribution of operational equipment (i.e., noise sources) has been assumed, and locations are shown in Figures 10 and 11. A list of operational noise sources is provided in Appendix I.

The applicable guidelines used for the Côté Gold Project operational noise is NPC-300. The guideline also stipulates that the assessment consider the potential noise effect during a predictable worst-case hour of operation, which is defined as a situation when the highest expected noise level from the Project coincides with the lowest one-hour background sound.

NPC-300 states that energy equivalent noise level L_{eq} (1hr) from stationary noise sources in Class 3 Areas shall not exceed the highest of 40 dBA, or background noise, during the early evening (19:00 – 23:00) and nighttime (23:00 – 07:00) periods.

The measured existing ambient sound levels for evening and nighttime hours surrounding the Project site were lower than the guideline exclusionary limits (see Section 2.4). Therefore, the applicable criteria limit for the Project (exclusionary limits) during the evening and nighttime (19:00 – 07:00) is 40 dBA.

In addition to assessing predicted noise levels to the NPC-300 limits, the predicted noise levels are also compared to the ambient noise levels to assess change in ambient noise levels due to the Project.

The operational noise effects are predicted at the sensitive receptors in the regional study area. Operational noise has been modelled and assessed for two scenarios – Year 1 and Year 7, which have different equipment usage, open pit depth and stockpiling barrier effects.

The following noise mitigation measures have been considered for the daytime operation of the Project:

- equipment noise levels are not to exceed those noted in Appendix I;
- operation of the air-track drill in the pit to be limited to daytime hours (7:00 to 19:00);
- operation of track dozer TD3 (on the ore stockpile) to be limited to daytime hours (7:00 to 19:00) for Years 1 through 6. This requirement can be removed Year 7 onwards;
- Both MRA and ore haul truck traffic during nighttime (19:00 to 07:00) should be limited to a maximum of 6 trucks each in any given hour for Years 1 through 6 (i.e., 6 trucks/hr for each MRA route and 6 trucks/hr for the ore haul route) and increasing them to 15 trucks/hr from Year 7 onwards (daytime truck traffic can be increased to accommodate the night truck limits to meet the material movement requirements). Alternatively, provide quieter trucks for MRA and ore haul routes and the maximum sound power level of the trucks should be limited to 117 dBA.

The predicted nighttime operations noise levels, taking into account the mitigation measures outlined above, are presented in Table 3-8 and in Figures 14 and 15.

Table 3-8: Operational Noise Levels at Sensitive Receptors

Receptor ID	Year 1 Nighttime Operational Noise Level at Receptor (dBA)	Year 1 Noise Level Increase above Ambient (dB)	Year 7 Nighttime Operational Noise Level at Receptor (dBA)	Year 7 Noise Level Increase above Ambient (dB)
POR1	32	—	31	—
POR2	34	—	32	—

Receptor ID	Year 1 Nighttime Operational Noise Level at Receptor (dBA)	Year 1 Noise Level Increase above Ambient (dB)	Year 7 Nighttime Operational Noise Level at Receptor (dBA)	Year 7 Noise Level Increase above Ambient (dB)
POR3	34	—	**36**	2
POR4	**38**	4	**37**	3
POR5	30	—	33	—
POR6	**40**	6	**40**	6
POR8	26	—	29	—
POR9	34	—	**35**	1
POR10	27	—	26	—
POR11	19	—	22	—
POR12	**39**	5	**39**	5
POR13	33	—	**35**	1
POR15	28	—	31	—
POR16	**38**	4	**38**	4
POR17	31	—	29	—
POR18	33	—	**37**	3
POR19	28	—	26	—
POR20	33	—	34	—
POR21	**35**	1	**37**	3
POR22	28	—	31	—
POR23	33	—	**35**	1
POR24	29	—	31	—
POR25	27	—	27	—
POR27	28	—	31	—
POR28	29	—	29	—
POR29	30	—	32	—
POR30	31	—	34	—
POR31	**37**	3	**38**	4

Bold numbers indicate noise levels higher than nighttime ambient noise baseline (34 dBA).
— = not applicable

Operational noise levels are expected to meet nighttime MOE NPC-300 noise limits for all sensitive receptors. However, noise levels may exceed the nighttime ambient noise levels at the following receptors and may be audible: POR3, POR4, POR6, POR9, POR12, POR13, POR16, POR18, POR21, POR23 and POR31.

With regards to the transmission line, corona noise is the most common noise associated with AC transmission lines during foul weather conditions and is heard as a crackling or hissing sound. However, during detriment weather conditions, other noises such as wind and/or rain will likely be more audible than the corona noise. AC transmission lines are not known to generate audible noise issues associated with them during fair-weather conditions (Cartier & Sterns, 1981). Therefore, operational noise associated with the transmission line is considered not to exceed baseline conditions at receptor locations along the transmission line corridor.

3.2.3 Blasting Noise Level

Blasting noise related to operations is assessed separately from standard operational noise. Blasting noise mainly includes blasting related to the open pit activities. The extraction of material from the working face of the open pit mine requires the use of explosives. This generates the potential concern of blast noise levels at the sensitive receptors. Blasting activities are currently planned to occur during the daytime only.

Operational blasting is considered only at the open pit. The closest distance to each sensitive receptor from this component has been considered in this assessment. Operational blast distances are provided in Table 3-9.

Table 3-9: Operational Blasting Distances to the Open Pit

Receptor ID	Distance from Open Pit (km)
POR1	8.50
POR2	7.25
POR3	7.50
POR4	5.00
POR5	10.50
POR6	4.00
POR8	14.00
POR9	6.75
POR10	13.00
POR11	15.75
POR12	4.50
POR13	9.00
POR15	12.25
POR16	4.50
POR17	9.75
POR18	7.00
POR19	11.25
POR20	8.00
POR21	6.50
POR22	12.25
POR23	8.50
POR24	11.00
POR25	13.00
POR27	11.75
POR28	11.00
POR29	10.00
POR30	9.00
POR31	5.50

No blasting is required to operate the transmission line.

Blast noise assessment for the Project is based on theoretical (predictive) methods; not on-site measurements, as the Project is neither constructed nor operating. Blast noise levels from the

Project are predicted using the same model as during the construction phase (see Section 3.1.3).

A maximum blast charge per delay for noise has been determined for the open pit. This charge size has been used in the blast noise assessment. Based on the 536 kg charge size, blast noise levels (in dBL) have been determined at each receptor with the distances provided in Table 3-9.

Blast noise levels at the receptors were assessed in accordance with MOE guideline publication NPC-119 criteria. The guideline has two limits: a cautionary limit of 120 dBL when routine noise monitoring is not conducted and an upper limit of 128 dBL when noise monitoring is conducted. For the purpose of this assessment, the cautionary limit of 120 dBL for blasting noise at the nearest residences has been adopted such that routine monitoring is not required.

Blast noise levels were compared to the daytime ambient noise level as it is expected during daytime only. Notwithstanding that the blast noise (dBL) and ambient noise levels (dBA) are in different units, and time averages are different (blast noise is impulsive whereas ambient noise is steady state over 1-hr), the values are considered comparable for the purpose of this assessment in determining audibility of the blast noise at the receptors. However, a 5 dB correction has been applied to the ambient noise level to account for the impulse nature of the blast noise (Beis, 2003). The predicted operational blasting noise levels are presented in Table 3-10.

Table 3-10: Operational Blasting Noise Levels at Sensitive Receptors

Receptor ID	Blasting Noise Level at Receptor (dBL)	Blasting Noise Level with Air Absorption at Receptor (dBL)(1)
POR1	110	68
POR2	111	75
POR3	111	73
POR4	113	88
POR5	109	57
POR6	114	94
POR8	108	38
POR9	111	78
POR10	109	44
POR11	108	29
POR12	113	91
POR13	110	65
POR15	109	48
POR16	113	91
POR17	110	61
POR18	111	76
POR19	109	53
POR20	111	71
POR21	111	79
POR22	109	48
POR23	110	68
POR24	109	54

Receptor ID	Blasting Noise Level at Receptor (dBL)	Blasting Noise Level with Air Absorption at Receptor (dBL)(1)
POR25	109	44
POR27	109	50
POR28	109	54
POR29	110	60
POR30	110	65
POR31	112	85

(1) Includes a correction for air absorption at 20deg C, RH 50%, α 0.50.

Operational blast noise levels are above the ambient daytime levels of 39 dBA (including the 5 dB correction for impulse blast noise) for all sensitive receptors, and are expected to be audible. However, operational blasting noise levels at all sensitive receptors are below the MOE NPC-119 criteria.

3.2.4 Blasting Vibration Level

Blasting is expected during the operational phase at the open pit area. The extraction of material from the working face of the open pit mine requires the use of explosives. This generates the potential concern of ground-borne vibration at the sensitive receptors. Blasting activities are currently planned to occur during the daytime only.

Vibration assessment for the Côté Gold Project site is based on theoretical (predictive) methods; not on site measurements, as the Project is in the design stage. Vibration from the Project construction blasting is predicted using the same methodology as the construction phase (see Section 3.1.4).

A maximum blast charge per delay of 536 kg has been determined for the open pit. Based on the 536 kg charge size, blast vibration levels (PPV mm/s) have been determined at each receptor.

Blast vibration levels at the receptors were assessed in accordance with MOE guideline publication NPC-119. The guideline has two limits: a cautionary limit of 10 mm/s PPV when routine vibration monitoring is not conducted, and an upper limit of 12.5 mm/s when vibration monitoring is conducted. For the purpose of this assessment, the cautionary limit of 10 mm/s PPV for construction blasting vibration at the nearest residences has been adopted, such that routine monitoring at the nearest residences will not be required.

Blast vibration levels were also compared to the perceptible vibration limit for humans in a residential building at each receptor, as outlined in ISO 2631-2 (ISO, 1985). This was defined as a maximum RMS velocity limit of 0.14 mm/s at frequencies between 10 Hz and 100 Hz. Vibration levels above these frequencies may be perceived as noticeable or felt.

Blasting may have an effect on fish and spawning habitats during operations. An assessment of setback distances for fish and spawning habitats during operations is provided in Appendix III.

Effects assessment and associated mitigation for fish and spawning is presented in the Aquatic Biology TSD (prepared by…give a proper citation for this reference).

The operational blasting effects have been predicted at the sensitive receptors in the regional study area. The predicted blasting vibration levels are presented in Table 3-11.

Table 3-11: Operational Blasting Vibration Levels at Sensitive Receptors

Receptor ID	Blasting Vibration Level at Receptor (PPV, mm/s)	Blasting Vibration Level at Receptor (RMS, mm/s) (1) (2)
POR1	0.10	0.07
POR2	0.13	0.09
POR3	0.12	0.08
POR4	0.22	**0.16**
POR5	0.07	0.05
POR6	0.31	**0.22**
POR8	0.05	0.03
POR9	0.14	0.10
POR10	0.05	0.04
POR11	0.04	0.03
POR12	0.26	**0.18**
POR13	0.09	0.06
POR15	0.06	0.04
POR16	0.26	**0.18**
POR17	0.08	0.06
POR18	0.13	0.09
POR19	0.06	0.05
POR20	0.11	0.08
POR21	0.15	0.10
POR22	0.06	0.04
POR23	0.10	0.07
POR24	0.07	0.05
POR25	0.05	0.04
POR27	0.06	0.04
POR28	0.07	0.05
POR29	0.08	0.05
POR30	0.09	0.06
POR31	0.19	0.14

(1) Includes a correction of S 2 crest factor to adjust PPV to RMS vibration level.
(2) Bold numbers indicate perceptible blast vibration levels (above 0.14 mm/s) at receptor locations.

Operational blast vibration levels are above the perceptible vibration limit of 0.14 mm/s at receptors POR4, POR6, POR12 and POR16. These are noted to be within the local study area. Vibration from blasting is expected to be felt at these locations. Blast vibration levels for all other sensitive receptors are at or below the perceptible vibration limit, and are not expected to be felt at these locations. However, all construction vibration levels are below the NPC-119 limit at sensitive receptors, and are not considered to be high enough to cause damage to buildings at the sensitive receptor locations.

3.3 Closure Phase

3.3.1 Daytime Noise Level

There may be noise and vibration effects associated with the closure phase of the Project, mainly due to demolition. However they are expected to be lower than the effects for the construction phase. To be conservative, it is assumed that noise effects during closure are identical to the construction phase effects. Therefore, a detailed noise and vibration assessment of the closure phase is not considered in this TSD.

It is expected that most transmission line decommissioning activities will be carried out by small vehicles. Noise generated during the closure phase has not been included in the noise model. A forest buffer will be retained as practicable, to reduce noise effects to nearby land users. Closure activities at any given location will also only be for a short period of time.

3.3.2 Nighttime Noise Level

No nighttime activities are expected to occur during the closure phase.

3.3.3 Blasting Noise Level

No blasting activities are expected to occur during the closure phase.

3.3.4 Blasting Vibration Level

No blasting activities are expected to occur during the closure phase.

3.4 Post-Closure Phase

3.4.1 Daytime Noise Level

Noise and vibration effects are not considered in the post-closure phase, as the vast majority of the noise sources will be decommissioned during the closure phase. However, some pumping and limited vehicle traffic will continue for several years during the post-closure phase. To be conservative, it is assumed that daytime noise effects during the first years of the post-closure will be less than the closure phase noise effects. Once pumping ceases, noise levels are expected to revert to current baseline conditions.

3.4.2 Nighttime Noise Level

No nighttime activities are expected to occur during the post-closure phase.

3.4.3 Blasting Noise Level

No blasting activities are expected to occur during the post-closure phase.

3.4.4 Blasting Vibration Level

No blasting activities are expected to occur during the post-closure phase.

4.0 CONCLUSIONS

The prediction of noise and vibration effects considers noise and vibration effects to surrounding sensitive receptors, and considers the Ontario Ministry of Environment noise and vibration guidelines.

The following noise mitigation measures have been considered for the Project:

- equipment noise levels are not to exceed those noted in Appendix I;
- operation of the air-track drill in the pit to be limited to daytime hours (7:00 to 19:00);
- operation of track dozer TD3 (on the ore stockpile) to be limited to daytime hours (7:00 to 19:00) for Years 1 through 6. This requirement can be removed Year 7 onwards;
- both MRA and ore haul truck traffic during nighttime (19:00 to 07:00) should be limited to a maximum of 6 trucks each in any given hour for Years 1 through 6 (i.e., 6 trucks/hr for each MRA route and ore haul route) and increasing them to 15 trucks/hr from Year 7 onwards (daytime truck traffic can be increased to accommodate the night truck limits to meet the material movement requirements). Alternatively, provide quieter trucks for MRA and ore haul routes and the maximum sound power level of the trucks should be limited to 117 dBA.

For the construction phase, it is expected that daytime noise levels at receptor locations will be at or below baseline ambient noise levels. Nighttime noise levels may exceed baseline ambient noise levels at some receptor locations. Blasting noise levels will exceed baseline ambient noise but will meet applicable MOE guidelines. Blasting vibration levels may be perceptible to some receptor locations but are not expected to damage structures. Some nighttime construction activities may require noise mitigation to address noise levels at the nearest receptors.

For the operations phase, it is expected that daytime noise levels at receptor locations will be at or below baseline ambient noise levels. Nighttime noise levels may exceed baseline ambient noise levels at some receptor locations. Blasting noise levels will exceed baseline ambient noise but will meet applicable MOE guidelines. Blasting vibration levels may be perceptible to some receptor locations but are not expected to damage structures.

During the closure phase, the noise effects are expected to be lower than the effects for the construction phase. To be conservative, it is assumed that noise effects during closure are identical to the construction phase effects. No activities are planned to occur at nighttime. No vibration effects are anticipated as no blasting activities are planned.

Noise and vibration effects are not considered in the post-closure phase, as the vast majority of the noise sources will be decommissioned during the closure phase. To be conservative, it is assumed that daytime noise effects during the first years of the post-closure will be less than the closure phase noise effects. Once pumping ceases, noise levels are expected to revert to current baseline conditions. No activities are planned to occur at nighttime. No vibration effects are anticipated as no blasting activities are planned.

IAMGOLD intends to monitor noise and vibration during the construction and operations phases to provide ongoing oversight on noise and vibration effects from the Project.

5.0 REFERENCES

AMEC, 2013. Côté Gold Project Noise Baseline Report.

Beis D., Hansen C., 2003. Engineering Noise Control Theory and Practice, Table 4.10.

Bracken T-D, 2010. Bonneville Power Administration/Big Eddy – Knight 500-kV Project Appendix E Electrical Effects.

Bonneville Power Administration, 2012. I-5 Corridor Reinforcement Project Draft EIS Chapter 9 Noise.

Canadian Standards Association, 2007. C227.4-06 (R2011) Three-Phase, Pad-Mounted Distribution Transformers with Separable Insulated High-Voltage Connectors.

Cartier V-L., and Sterns R-D., 1981. Formulas for Predicting Audible Noise from Overhead High Voltage AC and DC Lines.

Harris D, 1997. Noise Control Manual for Residential Buildings.

ISO, 1985. ISO 2631-2 (Draft) Evaluation of human exposure to whole-body vibration – Part 2: Continuous and shock-induced vibration in buildings (1 to 80 Hz).

ISO, 1996a. ISO-9613-1. Acoustics – Attenuation of Sound during propagation outdoors. Part 1 – Calculation of the Absorption of Sound by the Atmosphere.

ISO, 1996b. ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation.

MOE, 1979. Ministry of Environment, 1979. NPC-118 Motorized Conveyances.

MOE, 1981. Ministry of Environment, 1981. NPC-115 Construction Equipment.

MOE, 1982. Ministry of Environment, 1982. NPC-119 Blasting.

MOE, 1983. Ministry of Environment, 1983. NPC-207 Impulse Vibration on Residential Buildings.

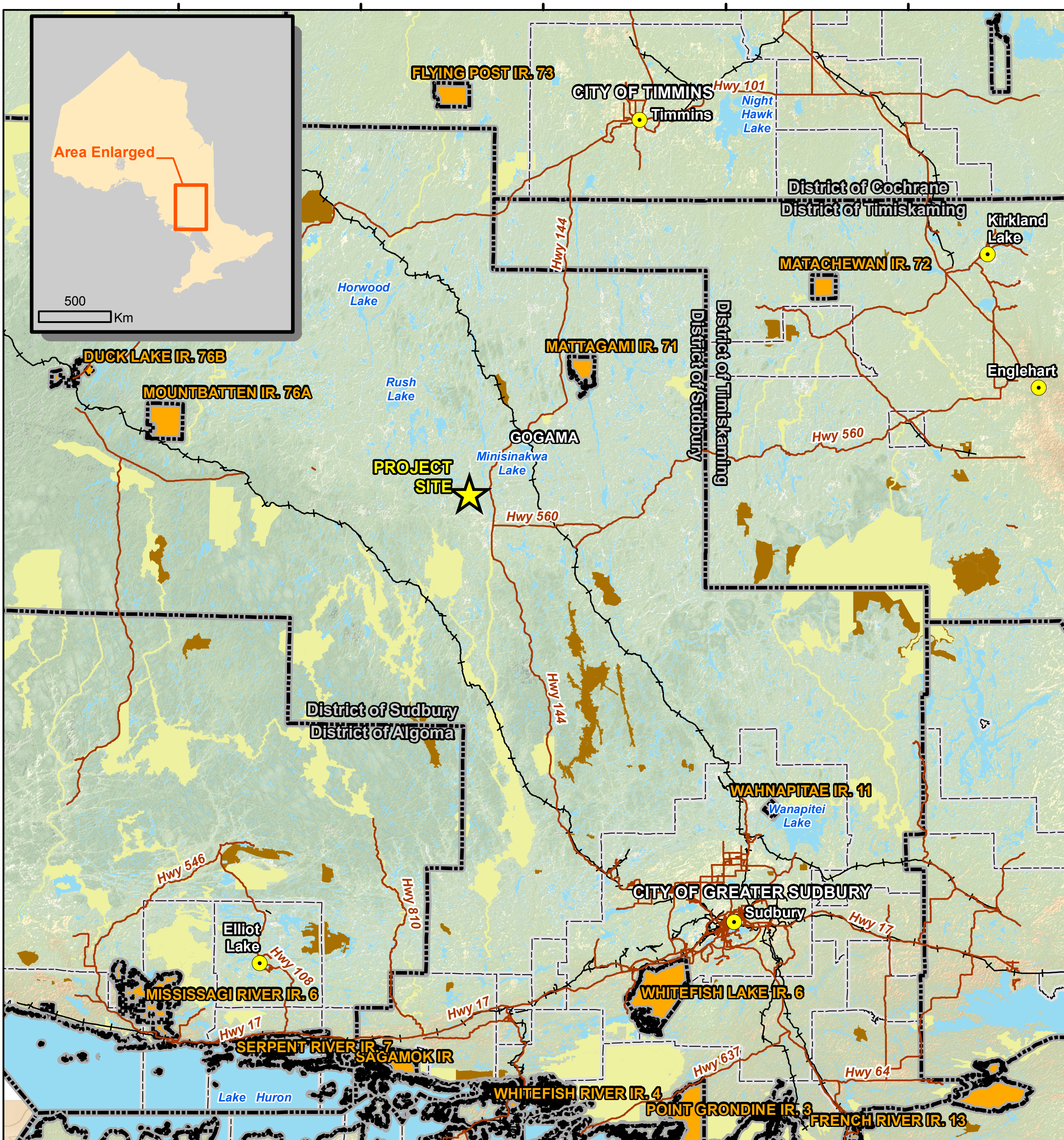
MOE, 1985. Ministry of Environment, 1985. Guidelines on Information Required for the Assessment of Blasting Noise and Vibration.

MOE, 2013. Ministry of Environment, 2013. NPC-300 Environmental Noise Guideline for Stationary and Transportation Sources – Approval and Planning

USDoT, 2006. United States Department of Transportation, 2006. Transit Noise and Vibration Impact Assessment. Pg 12-8

Wright D-G., and Hopky G-E., 1998. Guidelines for the Use of Explosives n or Near Canadian Fisheries Waters.

FIGURES



Path: P:\EM\Projects\2012\TC121522 IAMGOLD Cote Project\GIS\EA\EA_DRAFT\MXD\ProjectLocation.mxd, Author: ken.brookes, modified by sandra.marquez, 01 November 2013

LEGEND

- Project Site Location
- Regional Communities
- Major Roads
- Railway
- Lower Tier Municipality Boundary
- Upper Tier Municipality Boundary
- First Nation Reserve
- Conservation Reserve (Regulated)
- Provincial Park
- Waterbody / Large Watercourse
- Wooded Area

0 20 40 60 80 100 Kilometres

NOTES:
- All base data on this map was extacted from Land Information Ontario, MNDM, OBM Ontario Digital Geospatial Database and Ontario Road Network Database.

Datum: NAD83
Projection: UTM Zone 17N

N S E W

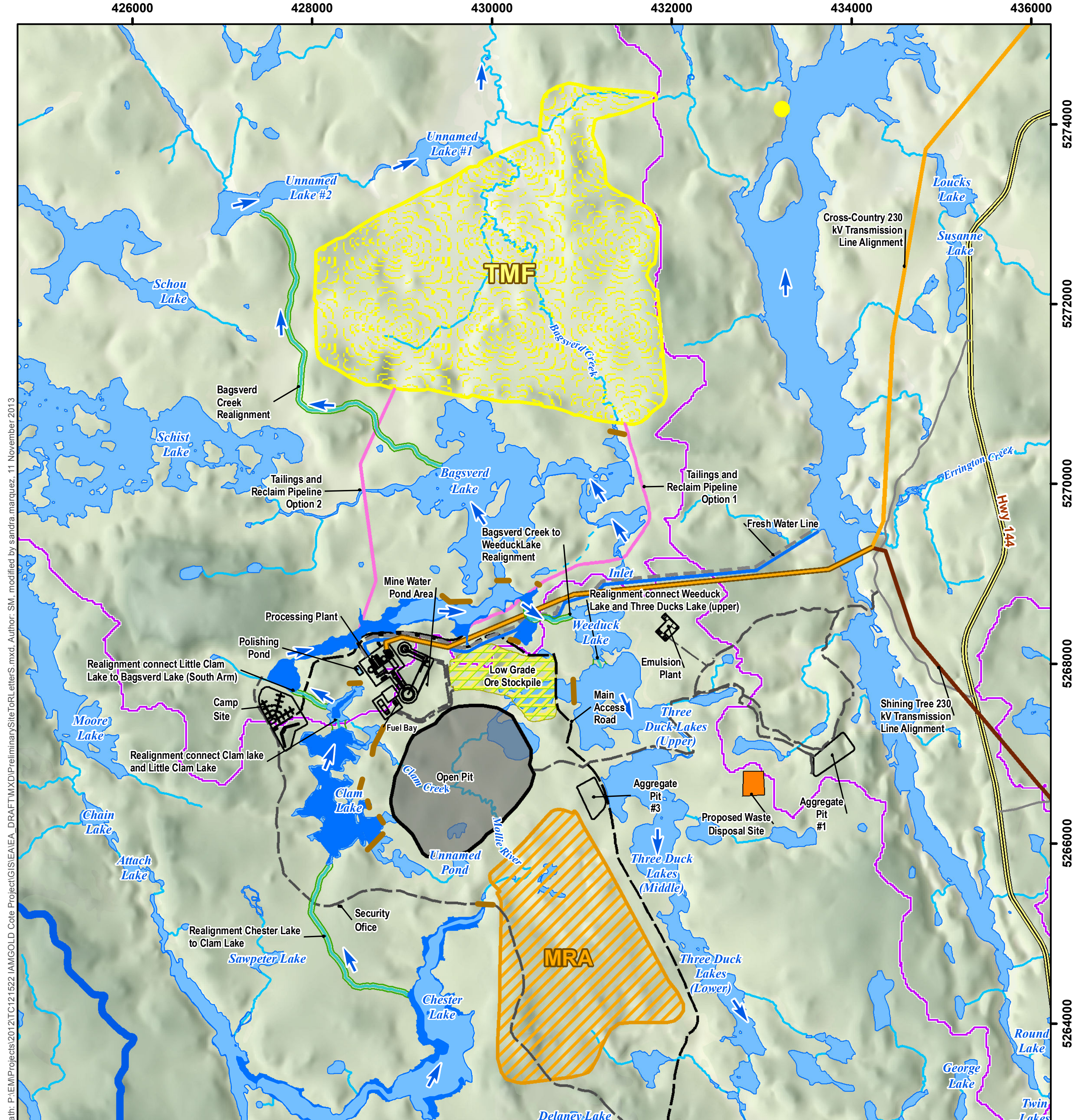
IAMGOLD® CORPORATION

amec

CÔTÉ GOLD PROJECT

Project Location

PROJECT N°: TC121522	FIGURE: 1
SCALE: 1:1,450,000	DATE: December 2013



LEGEND

- Existing Intermittent Watercourse
- Existing Permanent Watercourse
- Existing Waterbodies
- Highway
- Local Road
- Subwatershed Boundary
- Wooded Area
- Open Pit
- Potential Discharge Location
- Facilities
- Dam
- Main Access Road
- Access Road
- Cross-Country 230 kV Transmission Line Alignment
- Shining Tree 230 kV Transmission Line Alignment
- Tailings and Reclaim Pipeline
- Fresh Water
- Water Realignment
- Proposed Water Flow Direction
- Proposed Lake Area
- Polishing Pond
- Low Grade Ore Stockpile
- Proposed Mine Rock Area (MRA)
- Proposed Tailings Management Facility (TMF)
- Proposed Landfill

NOTES:
- Ontario base data extracted from Land Information Ontario (MNR)
- TMF and subwatershed provided by Golder Associates.
- Watercourse realignment and proposed lake area provided by Calder Engineering.
- Surface infrastructure, open pit, landfill, MRA and transmission lines provided by IAMGOLD.
- Mesomikenda Lake is preferred discharge option, but others are being investigated.

Datum: NAD83
Projection: UTM Zone 17N

0 1 2 3 4 5 Kilometres

N E S W

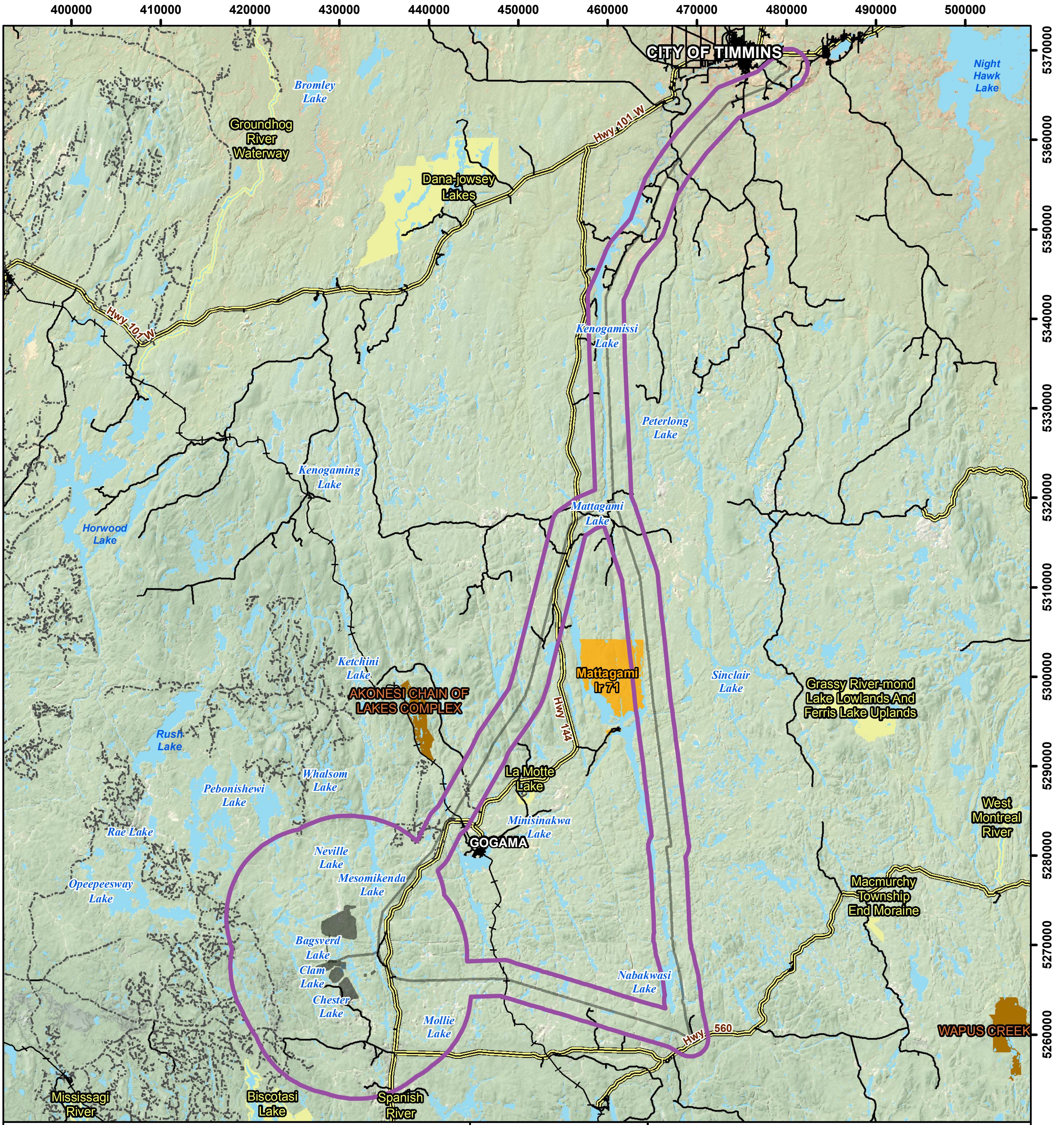
IAMGOLD CORPORATION

amec

CÔTÉ GOLD PROJECT

Preliminary Site Plan

PROJECT N°: TC121522	FIGURE: 2
SCALE:1:57,000	DATE: December 2013



Path: P:\EMProjects\2012\TC121522 IAMGOLD Cote Project\GIS\Noise_Vibration\MXD\Noise_VibrationRSA.mxd, Author: ken.brookes, modified by sandra.marquez, 19 November 2013

LEGEND

- Proposed Site Facilities
- Regional Study Area
- Waterbody / Large Watercourse
- Wooded Area
- Railway
- Highway/Expressway
- Local Road
- Resource / Recreation Road
- First Nation Reserve
- Provincial Park
- Conservation Reserve (Regulated)

0 10 20 30 40 50 Kilometres

NOTES:
- All base data on this map was extacted from Land Information Ontario, MNDM, OBM Ontario Digital Geospatial database and Ontario Road Network Database.

Datum: NAD83
Projection: UTM Zone 17N

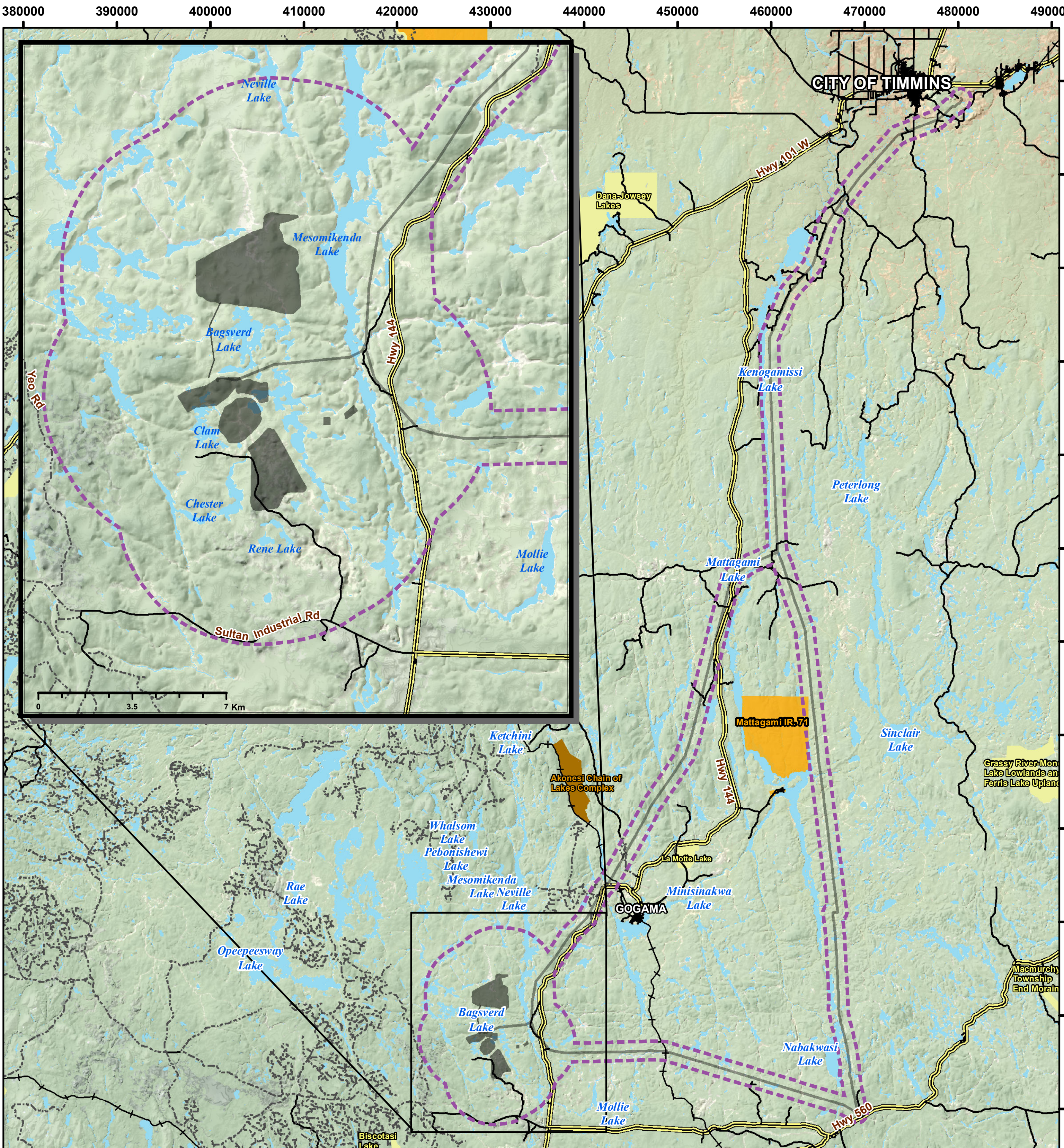
IAMGOLD CORPORATION

amec

CÔTÉ GOLD PROJECT

Noise and Vibration Regional Study Area

PROJECT N^{o}: TC121522	FIGURE: 3
SCALE: 1:570,000	DATE: December 2013



LEGEND

- Proposed Site Facilities
- Local Study Area
- Waterbody / Large Watercourse
- WoodedArea
- Railway
- Highway/Expressway
- Local Road
- Resource / Recreation Road
- First Nation Reserve
- Conservation Reserve (Regulated)
- Provincial Park

0 10 20 30 40 50 Kilometres

NOTES:
- All base data on this map was extacted from Land Information Ontario, MNDM, OBM Ontario Digital Geospatial database and Ontario Road Network Database.

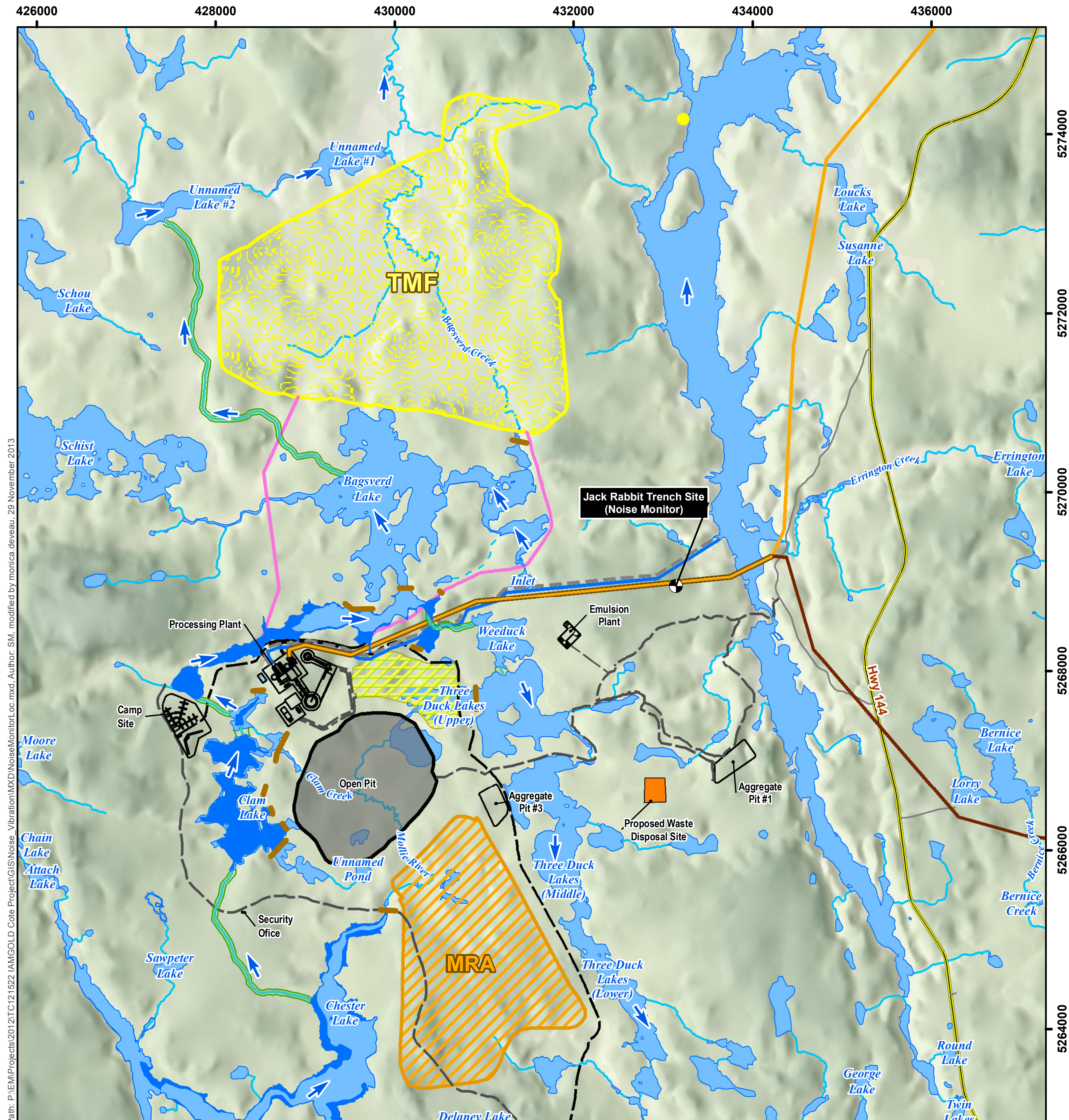
Datum: NAD83
Projection: UTM Zone 17N

IAMGOLD CORPORATION
amec

CÔTÉ GOLD PROJECT

Noise and Vibration Local Study Area

PROJECT N^{o}: TC121522	FIGURE: 4
SCALE: 1:560,000	DATE: December 2013



Path: P:\EM\Projects\2012\TC121522 IAMGOLD Cote Project\GIS\Noise_Vibration\MXD\NoiseMonitorLoc.mxd, Author: SM, modified by monica.deveau, 29 November 2013

LEGEND

- Noise Monitor Location
- Existing Intermittent Watercourse
- Existing Permanent Watercourse
- Highway
- Local Road
- Existing Waterbodies
- Wooded Area
- Open Pit
- Potential Discharge Location
- Facilities
- Dam
- Main Access Road
- Access Road
- Cross-Country 230 kV Transmission Line Alignment
- Shining Tree 230 kV Transmission Line Alignment
- Tailings and Reclaim Pipeline
- Fresh Water
- Water Realignment
- Proposed Water Flow Direction
- Proposed Lake Area
- Polishing Pond
- Low Grade Ore Stockpile
- Proposed Mine Rock Area (MRA)
- Proposed Tailings Management Facility (TMF)
- Proposed Landfill

NOTES:
- Ontario base data extracted from Land Information Ontario (MNR)
- TMF and subwatershed provided by Golder Associates. Watercourse realignment and proposed lake area provided by Calder Engineering.
- Surface infrastructure, open pit, landfill, MRA and transmission lines provided by IAMGOLD.
- Mesomikenda Lake is preferred discharge option, but others are being investigated.

0 1 2 3 4 5 Kilometres

Datum: NAD83
Projection: UTM Zone 17N

N E S W

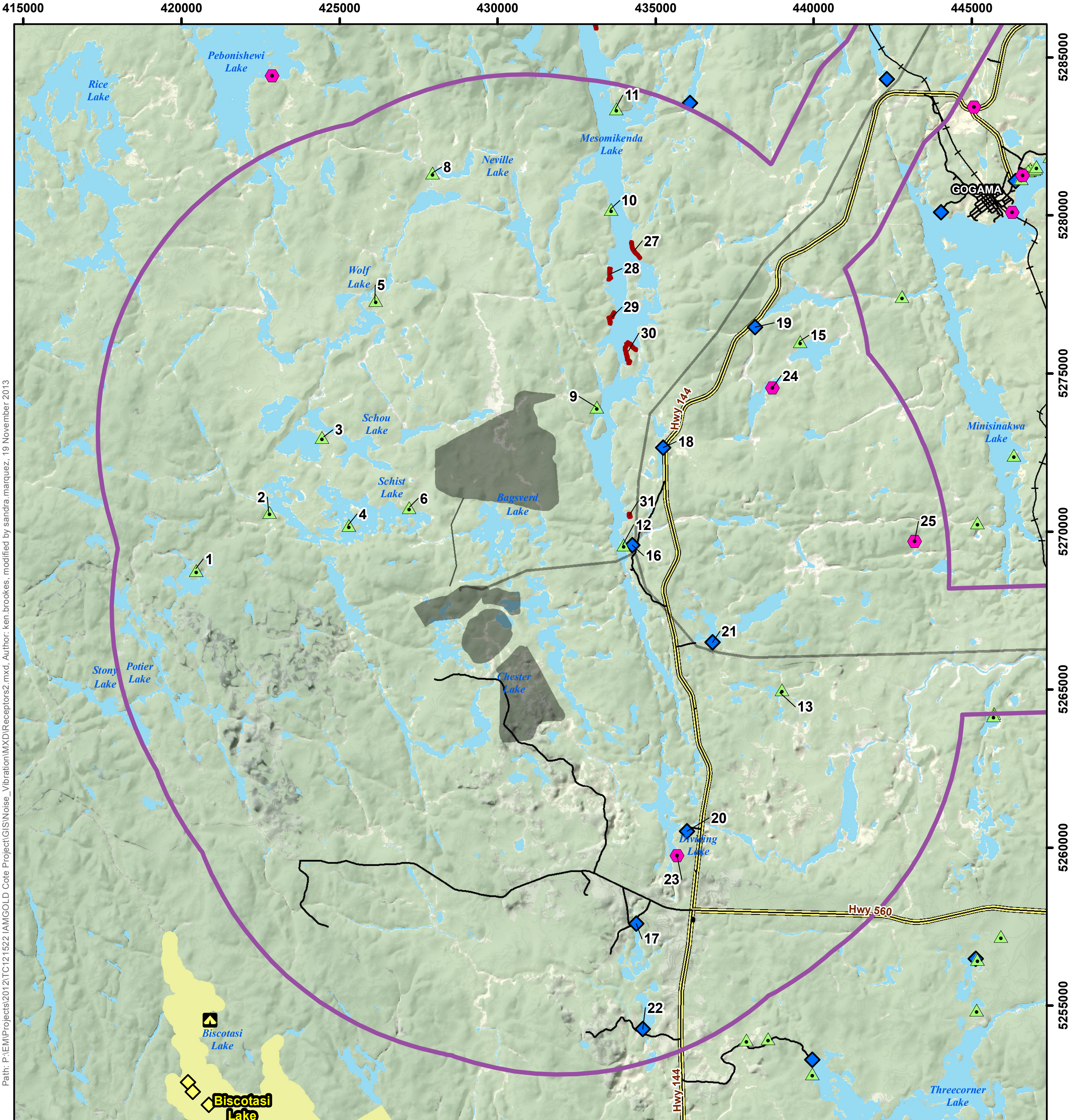
IAMGOLD CORPORATION

amec

CÔTÉ GOLD PROJECT

Noise Baseline Monitoring Location

PROJECT N^{o}: TC121522	FIGURE: 5
SCALE:1:57,000	DATE: December 2013



Path: P:\EM\Projects\2012\TC121522 IAMGOLD Cote Project\GIS\Noise_Vibration\MXD\Receptors2.mxd, Author: ken.brookes, modified by sandra.marquez, 19 November 2013

LEGEND

- Proposed Site Facilities
- Regional Study Area
- Railway
- Highway/Expressway
- Local Road
- Waterbody / Large Watercourse
- Provincial Park

Receptors
(Labelled with ID number)

- Recreational Camping Area
- Tourist Establishment Area
- Cottage Residential Site
- Recreation Access Point
- Designated Camping Site
- Cottage Residential Area

NOTES:
- All base data on this map was extracted from Land Information Ontario, MNDM, OBM Ontario Digital Geospatial database and Ontario Road Network Database.
- Cottage Residential Areas provided by Ontario MNR, Queen's Printer for Ontario, July. 2013 Additional cottage residential areas in Whalen, Somme and Neville and part of Potier were provided by Mesomikenda Cottagers Association on December 2012.

Datum: NAD83
Projection: UTM Zone 17N

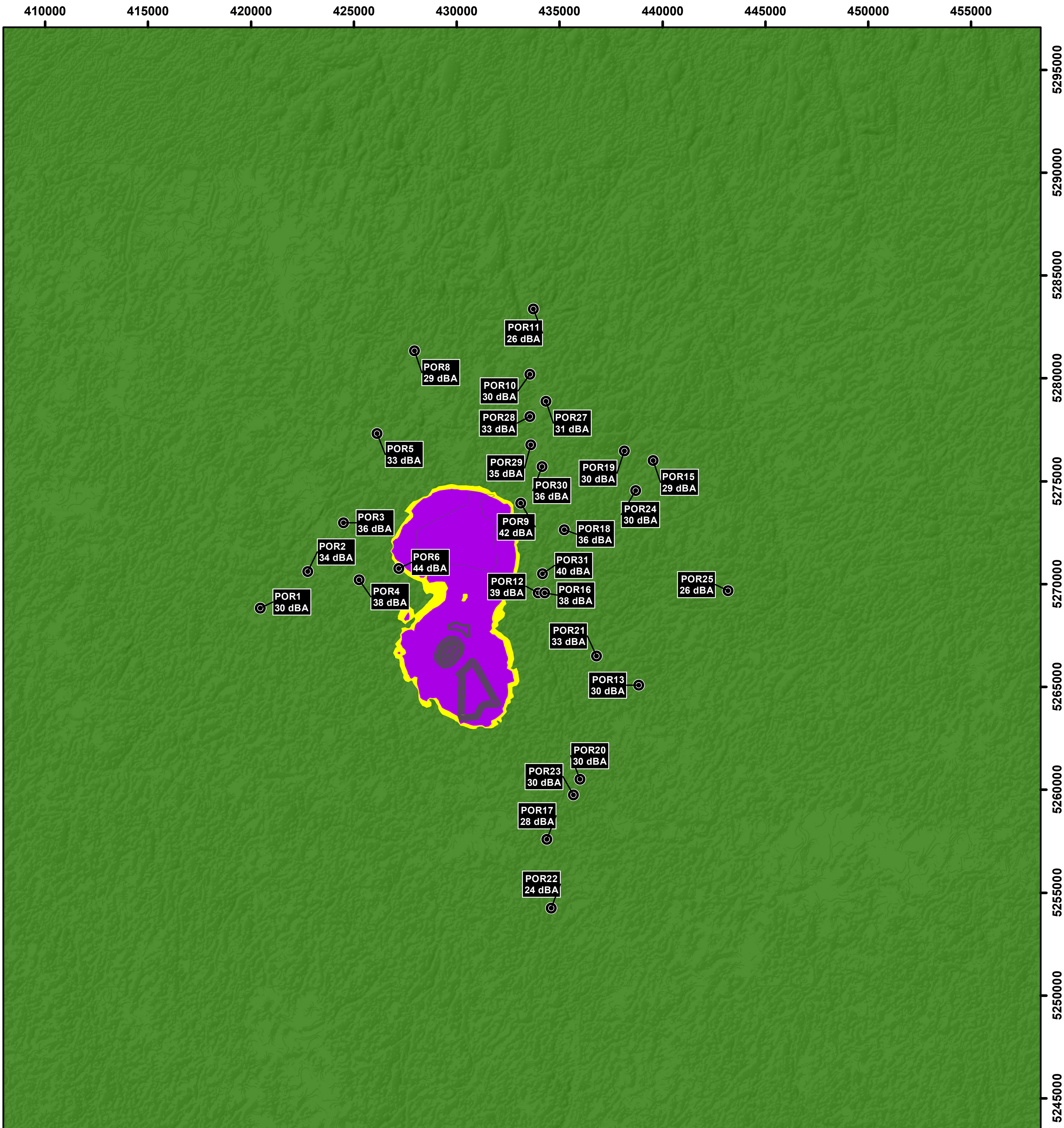
0 3 6 9 12 15 Kilometres

IAMGOLD CORPORATION — amec

CÔTÉ GOLD PROJECT

Sensitive Receptors

PROJECT N°: TC121522	FIGURE: 6
SCALE: 1:162,000	DATE: December 2013



Path: P:\EM\Projects\2012\TC121522 IAMGOLD Cote Project\GIS\Noise_Vibration\MXD\ConstructionDaytime_2.mxd, Author: SM, modified by sandra.marquez, 19 November 2013

LEGEND

- Receptors
- > 45 dBA
- 45 - 44 dBA
- > 44 dBA
- Proposed Mine features

NOTES:
-

IAMGOLD CORPORATION

amec

CÔTÉ GOLD PROJECT

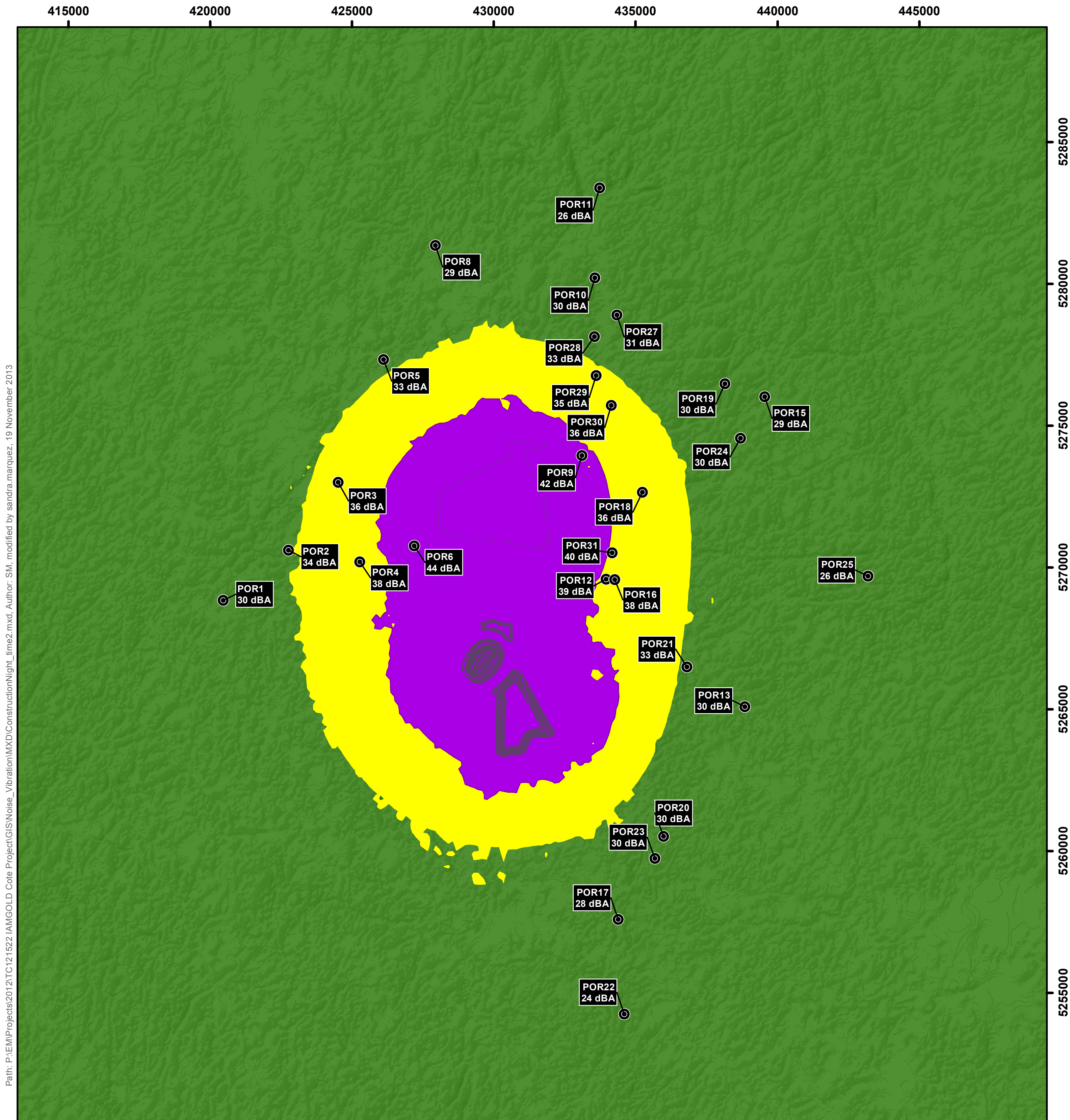
Daytime Construction Noise Levels

Datum: NAD83
Projection: UTM Zone 17N

0 5 10 15 20 25 Kilometres

N W E S

PROJECT N°: TC121522	FIGURE: 7
SCALE: 1:250,000	DATE: December 2013



LEGEND

- Receptors
- > 40 dBA
- 40 - 34 dBA
- < 34 dBA
- Proposed Mine features

0 3 6 9 12 15 Kilometres

NOTES:
-

Datum: NAD83
Projection: UTM Zone 17N

IAMGOLD CORPORATION

amec

CÔTÉ GOLD PROJECT

Nighttime Construction Noise Levels

PROJECT N^{o}: TC121522	FIGURE: 8
SCALE: 1:180,000	DATE: December 2013

Path: P:\EM\Projects\2012\TC121522 IAMGOLD Cote Project\GIS\Noise_Vibration\MXD\BlastingSeparation.mxd, Author: SM, modified by sandra.marquez, 19 November 2013

LEGEND

- Nearest Receptor Cottage Residential
- Existing Intermittent Watercourse
- Existing Permanent Watercourse
- Highway
- Local Road
- Existing Waterbodies
- Wooded Area
- Potential Discharge Location
- Fresh Water
- Water Realignment
- Proposed Water Flow Direction
- Facilities
- Dam
- Main Access Road
- Access Road
- Cross-Country 230 kV Transmission Line Alignment
- Shining Tree 230 kV Transmission Line Alignment
- Tailings and Reclaim Pipeline
- Proposed Lake Area
- Low Grade Ore Stockpile
- Proposed Tailings Management Facility (TMF)

0 1 2 3 Km

NOTES:
- Ontario base data extracted from Land Information Ontario (MNR)
-TMF and subwatershed provided by Golder Associates.Watercourse realignment and proposed lake area provided by Calder Engineering.
- Mesomikenda Lake is preferred discharge option, but others are being investigated.
- Cottage Residential Areas provided by Ontario MNR, Queen's Printer for Ontario, July. 2013 Additional cottage residential areas in Whalen, Somme and Neville and part of Potier were provided by Mesomikenda Cottagers Association on December 2012.

Datum: NAD83
Projection: UTM Zone 17N

N W E S

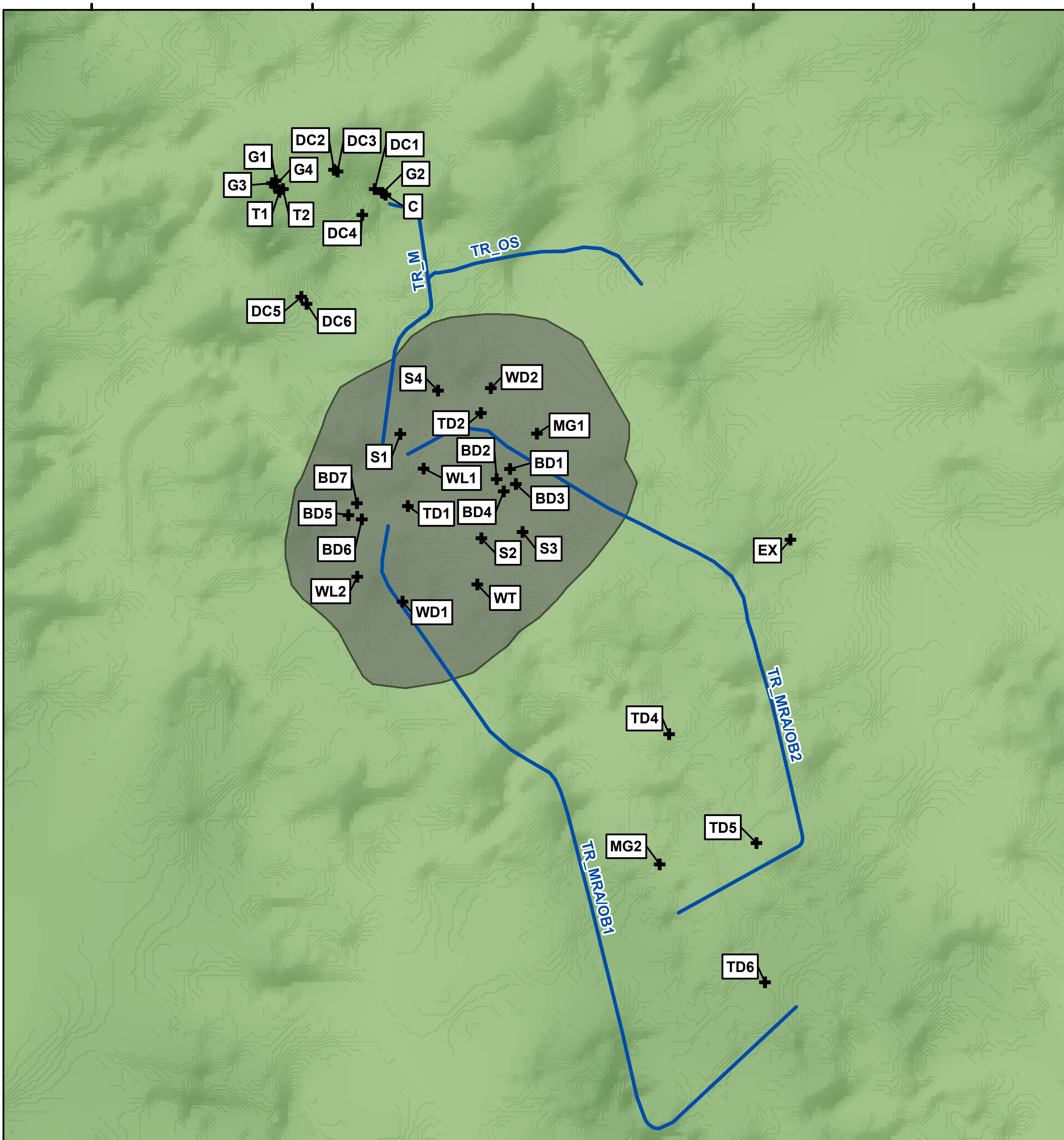
IAMGOLD® CORPORATION

amec

CÔTÉ GOLD PROJECT

Construction Blasting Separation Distance to Nearest Receptor

PROJECT N°: TC121522	FIGURE: 9
SCALE:1:35,000	DATE: December 2013



Path: P:\EM\Projects\2012\TC121522 IAMGOLD Cote Project\GIS\Noise_Vibration\MXD\OperationalNoiseSourceLocY1_2.mxd, Author: SM, modified by monica.deveau, 29 November 2013

LEGEND

- Noise Source Location
- Noise Contour line
- Open Pit

0 0.5 1 1.5 2 Kilometres

NOTES:
-

Datum: NAD83
Projection: UTM Zone 17N

N E S W

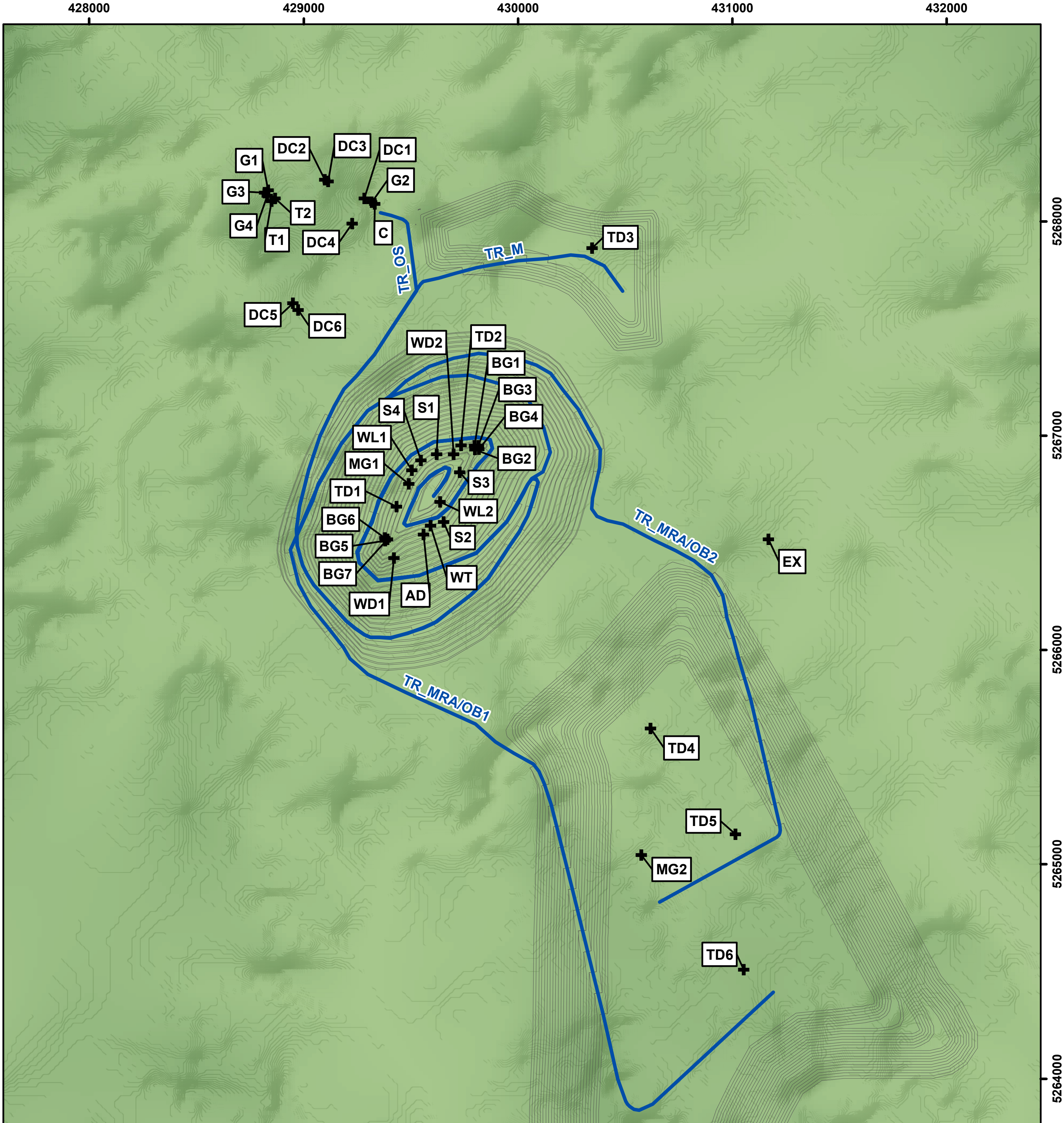
IAMGOLD CORPORATION

amec

CÔTÉ GOLD PROJECT

Operational Noise Source Locations Year 1

PROJECT N°: TC121522	FIGURE: 10
SCALE: 1:24,000	DATE: December 2013



Path: P:\EM\Projects\2012\TC121522 IAMGOLD Cote Project\GIS\Noise_Vibration\MXD\OperationalNoiseSourceLocY7_2.mxd, Author: SM, modified by monica.deveau, 02 December 2013

LEGEND

- ✚ Noise Source Location
- Noise Contour line
- Proposed Mine features

NOTES:
-

IAMGOLD CORPORATION

amec

CÔTÉ GOLD PROJECT

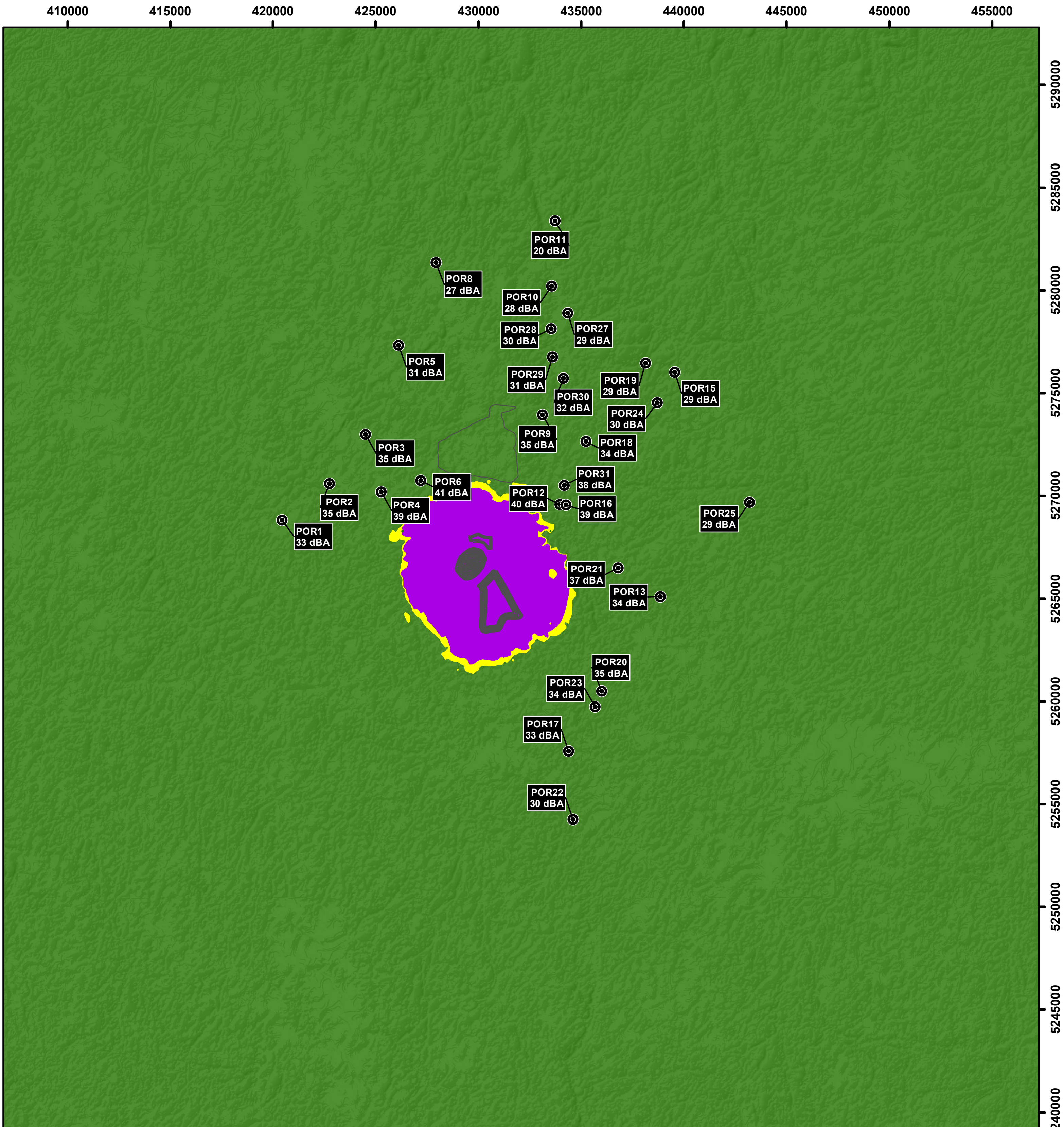
Operational Noise Source Locations Year 7

Datum: NAD83
Projection: UTM Zone 17N

0 0.5 1 1.5 2 Kilometres

N W E S

PROJECT N°: TC121522	FIGURE: 11
SCALE: 1:24,000	DATE: December 2013



Path: P:\EM\Projects\2012\TC121522 IAMGOLD Cote Project\GIS\Noise_Vibration\MXD\year1_day_2.mxd, Author: SM, modified by sandra.marquez, 28 November 2013

LEGEND

- Receptors
- Proposed Mine features
- > 45 dBA
- 45 - 44 dBA
- < 44 dBA

NOTES:
-

Datum: NAD83
Projection: UTM Zone 17N

0 5 10 15 20 25 Kilometres

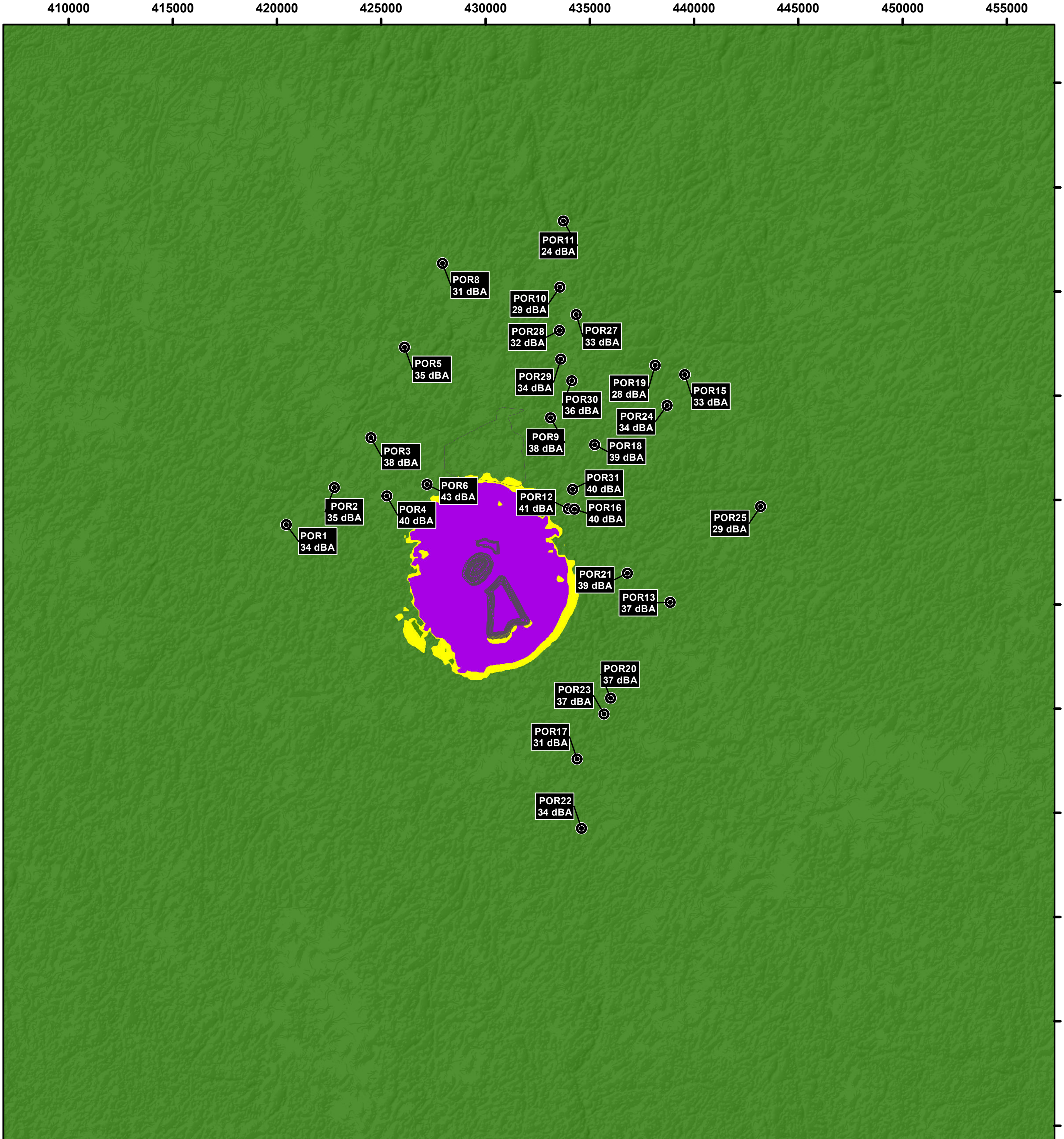
N E S W

IAMGOLD CORPORATION
amec

CÔTÉ GOLD PROJECT

Daytime Operational Noise Contour Year 1

PROJECT N°: TC121522	FIGURE: 12
SCALE: 1:250,000	DATE: December 2013



Path: P:\EM\Projects\2012\TC121522 IAMGOLD Cote Project\GIS\Noise_Vibration\MXD\year7_day_2.mxd, Author: SM, modified by monica.deveau, 29 November 2013

LEGEND

- Receptors
- Proposed Mine features
- > 45 dBA
- 45 - 44 dBA
- < 44 dBA

NOTES:
-

IAMGOLD CORPORATION

amec

CÔTÉ GOLD PROJECT

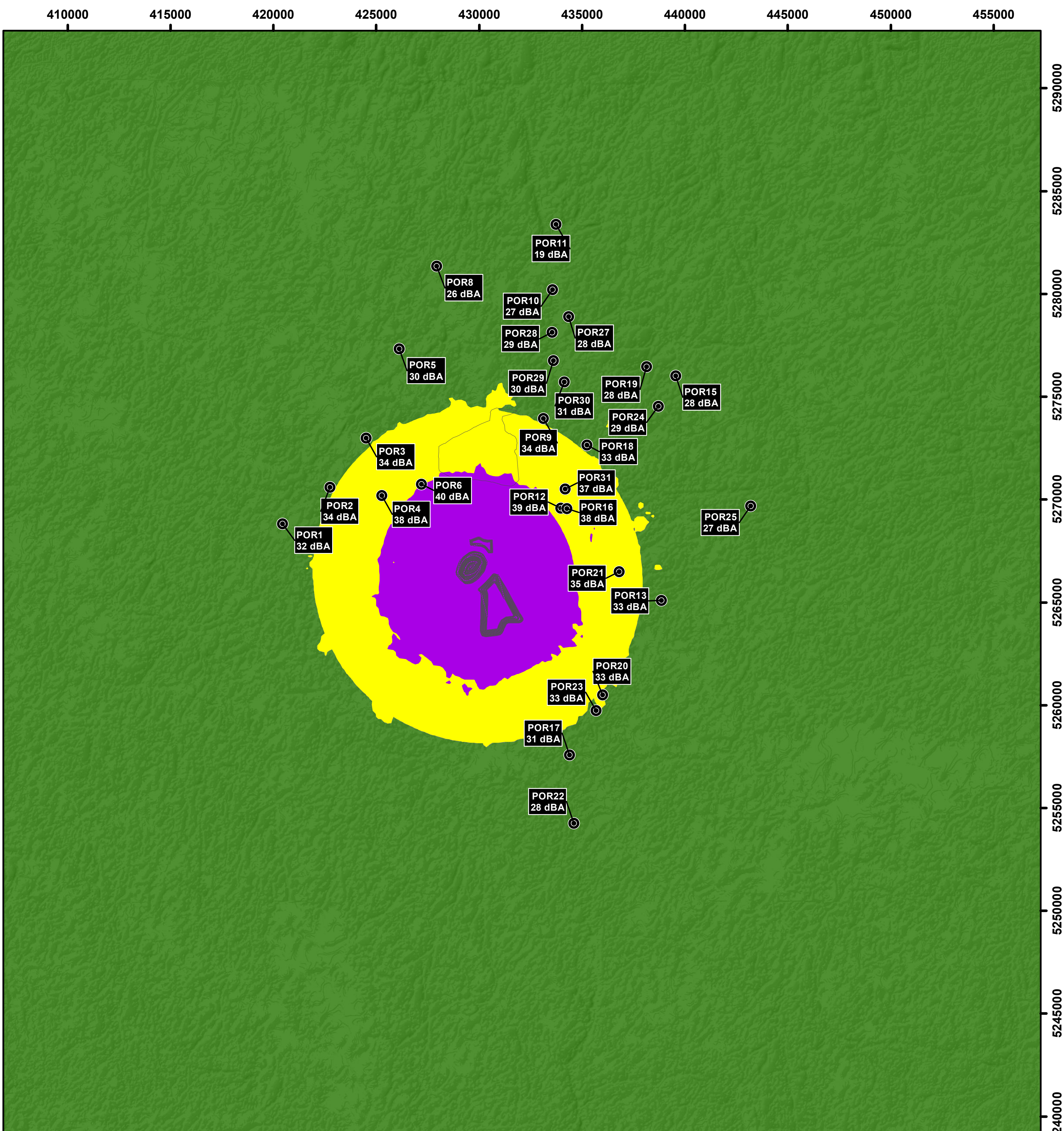
Daytime Operational Noise Contour Year 7

Datum: NAD83
Projection: UTM Zone 17N

0 5 10 15 20 25 Kilometres

N W E S

PROJECT N°: TC121522	FIGURE: 13
SCALE: 1:250,000	DATE: December 2013



LEGEND

- Receptors
- Proposed Mine features
- > 40 dBA
- 40 - 34 dBA
- < 34 dBA

NOTES:
-

Datum: NAD83
Projection: UTM Zone 17N

0 5 10 15 20 25 Kilometres

N W E S

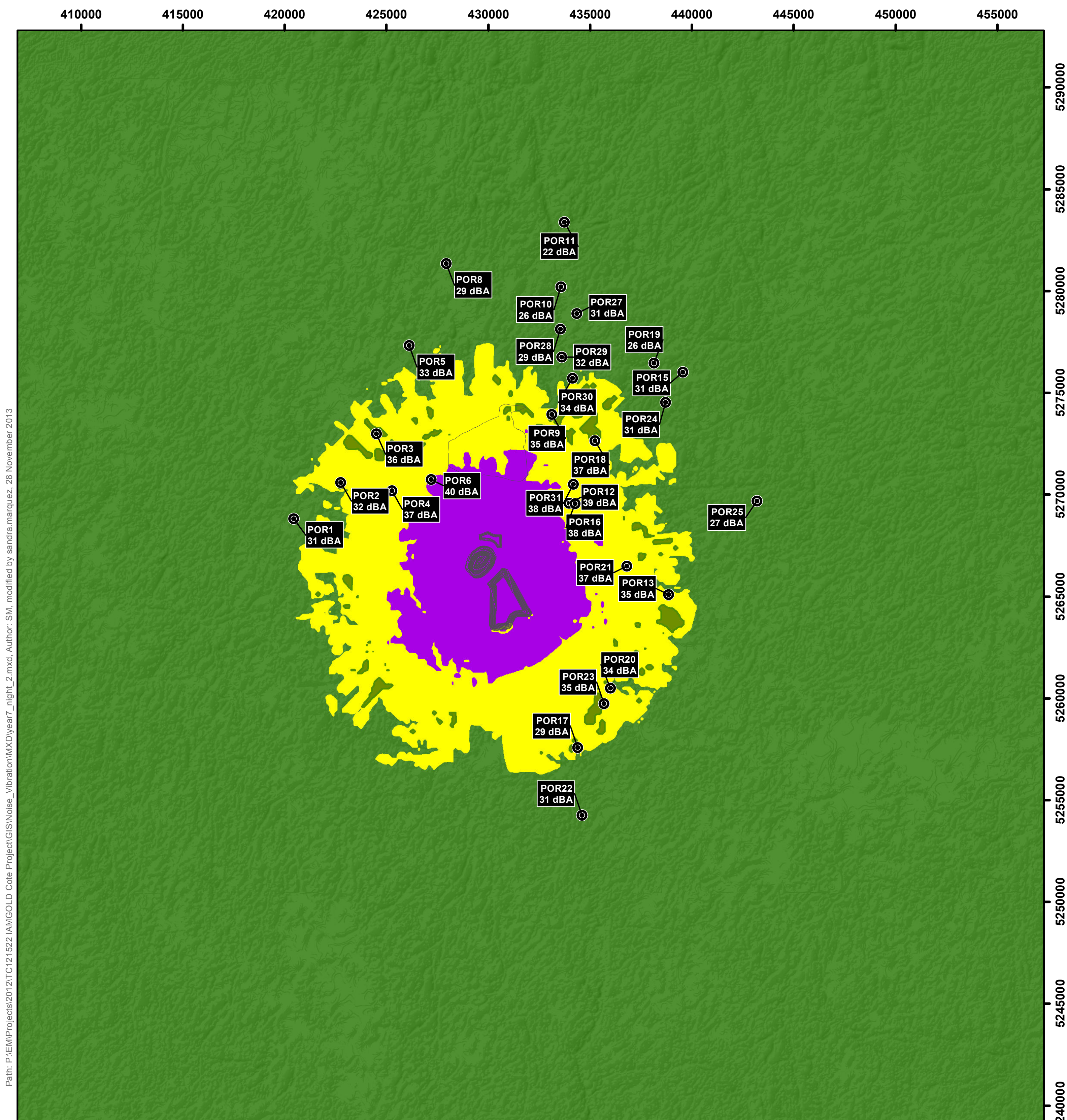
IAMGOLD CORPORATION

amec

CÔTÉ GOLD PROJECT

Nighttime Operational Noise Contour Year 1

PROJECT N°: TC121522	FIGURE: 14
SCALE: 1:250,000	DATE: December 2013



LEGEND

- Receptors
- Proposed Mine features
- > 40 dBA
- 40 - 34 dBA
- < 34 dBA

NOTES:
-

IAMGOLD CORPORATION

amec

CÔTÉ GOLD PROJECT

Nighttime Operational Noise Contour Year 7

Datum: NAD83
Projection: UTM Zone 17N

0 5 10 15 20 25 Kilometres

N E S W

PROJECT N°: TC121522	FIGURE: 15
SCALE: 1:250,000	DATE: December 2013

APPENDIX I:
NOISE DATA

Table I-1: Equipment Noise Data

Source ID	Source Description	Sound Power Level (dBA)
AD	Air Track Drill	120
BD1	Blast Hole Drill 1	118
BD2	Blast Hole Drill 2	118
BD3	Blast Hole Drill 3	118
BD4	Blast Hole Drill 4	118
BD5	Blast Hole Drill 5	118
BD6	Blast Hole Drill 6	118
BD7	Blast Hole Drill 7	118
C	Crusher	116
DC1	Dust Collector 1	109
DC2	Dust Collector 2	109
DC3	Dust Collector 3	109
DC4	Dust Collector 4	109
DC5	Dust Collector 5	109
DC6	Dust Collector 6	109
EX	Excavator (Caterpillar 390DL)	109
G1	Generator 1	117
G2	Generator 2	117
G3	Generator 3	117
G4	Generator 4	117
MG1	Motor Grader 1	112
MG2	Motor Grader 2	112
S1	Diesel Drive Shovel 1	118
S2	Diesel Drive Shovel 2	118
S3	Electric Drive Shovel 3	114
S4	Electric Drive Shovel 4	114
T1	Substation Transformer 1	108
T2	Substation Transformer 2	108
TD1	Track Dozer 1	119
TD2	Track Dozer 2	119
TD3	Track Dozer 3	119
TD4	Track Dozer 4	119
TD5	Track Dozer 5	119
TD6	Track Dozer 6	119
WD1	Wheel Dozer 1	114
WD2	Wheel Dozer 2	114
WL1	Wheel Loader 1	119
WL2	Wheel Loader 2	119
WT	Water Truck	115
TR1	MRA and Ore Hauling Truck	122
TR2	Overburden Truck	109

APPENDIX II:
NOISE BASELINE

APPENDIX III:
WATER OVERPRESSURE – EFFECTS TO FISH

Water Overpressure - Effects to Fish

The Federal Fisheries Act includes provisions to protect fish and their habitats. Blasting in or adjacent to fish habitats may generate a disturbance, injury and/or death to fish and marine mammals and their habitats. Blasting may also affect spawning habitats. This can sometimes occur at a considerable distance away from the habitat.

To address this, the following blasting assessment has been prepared in accordance with the Department of Fisheries and Oceans (DFO) for impact to fish and marine habitats. A setback distance assessment has been prepared for both construction and operational blasting charges as per Reference (Wright and Hopky, 1998).

The interpretation of these setback distances, and their potential impact on fish or other wildlife, are discussed in the Aquatic Biology TSD.

General Guidelines

A 100 kPa guideline is established for various substrates for fish habitats (Wright and Hopky, 1998). The setback distance (in meters) for rock (considered the worst-case substrate condition) is represented in Table III-1.

Table III-1: Setback Distance (m) from Blasting to Fish Habitat

Substrate Type	Weight of Explosive Charge (kg)							
	0.5	**1**	**2**	**5**	**10**	**25**	**50**	**100**
Rock	3.6	5.0	7.1	11	15.9	25.0	35.6	50.3

As the explosive charges used on the Project are higher than 100 kg per charge, a regression analysis has been prepared on the data above to develop the following equation for the setback distance for fish habitat from blasting for the Project:

$$\text{Setback Distance} = 5.0215 * (\text{charge})^{0.4994}$$

A 13 mm/sec vibration guideline criterion is established for various substrates for spawning habitats (Wright and Hopky, 1998). The setback distance (in meters) for all substrates is represented in Table III-2.

Table III-2: Setback Distance (m) from Blasting to Spawning Habitat

Substrate Type	Weight of Explosive Charge (kg)						
	.5	**1**	**5**	**10**	**25**	**50**	**100**
All Substrates	10.7	15.1	33.7	47.8	75.5	106.7	150.9

As the explosive charges used on the Project are higher than 100 kg per charge, a regression analysis has been prepared on the data above to develop the following equation for the setback distance for fish habitat from blasting for the Project:

$$\text{Setback Distance} = 15.11 * (\text{charge})^{0.4994}$$

Construction Blasting

A maximum charge size of 250 kg per delay for construction has been established in this document for the Project. Based on this charge size, the construction blasting setbacks are:

- 79 m to achieve the 100 kPa guideline for fish habitat
- 238.5 m to achieve the 13 mm/sec guideline for spawning habitat

Operational Blasting

A maximum charge size of 536 kg per delay for operations has been established in this document for the Project. Based on this charge size, the operational blasting setbacks are:

- 116 m to achieve the 100 kPa guideline for fish habitat
- 349 m to achieve the 13 mm/sec guideline for spawning habitat

Reference:

Wright D-G. and G-E. Hopky. 1998. Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters.