Noise Impact Analysis

Rockridge Quarry

Proposed Quarry Operation

Municipality of Trent Lakes
County of Peterborough

June 6, 2017
Project: 116-0383

Prepared for

2329059 Ontario Limited

Prepared by

John Emeljanow, B.Eng., P.Eng.

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Document Version Index:

Version	Date	Description of Changes
1.0	June 6, 2017	Final - Issued for Use

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this report is to:

- identify the potential noise sources;
- outline the sound exposure levels expected at surrounding noise sensitive neighbours during the operation of the quarry; and
- provide recommendations for mitigation measures required to meet the Ministry of the Environment and Climate Change (MOE) environmental noise guidelines.

This noise impact assessment only evaluates the potential noise impacts from the steady noise sources operating on-site and does not evaluate the noise and vibration from blasting. Blasting has been addressed by others.

1.2 SITE

The proposed quarry site is just to the northeast of the intersection of County Roads 36 and 507 in the Municipality of Trent Lakes.

The site is identified as:

Lot 21, Concession 8
(Formerly Galway - Cavendish & Harvey township)
Municipality of Trent Lakes
county of Peterborough

See Figure 1 for a Key Plan.

The land uses in the general area include an existing quarry operation immediately to the south of the proposed Rockridge Quarry, an existing licenced quarry to the southwest, across County Road 36, rural residential and vacant wooded lands to the north and County Road 507 to the west with a commercial use (Ultramar Gas Station), rural residential and vacant woodlots beyond.

1.3 NOISE SENSITIVE RECEPTORS

See Figure 2 for the noise sensitive receptor locations. Receptor R1 is located to the southwest of the site on the west of the side of County Road 36. Receptors R2 and R3 are located to the west of the site on the west side of County Road 507. Receptor R4 is to the northwest of the site, on the west side of County road 507. Receptor R5 is to the north of the site on the east side of County Road 507. All receptors are two storey dwellings except for R2, which is a single storey dwelling. These receptor locations are the closest to the proposed quarry operation. Other receptors are further removed and will benefit from increased distance attenuation and are expected to receive similar or lower resultant sound exposures from the proposed quarry operations.

The closest noise sensitive uses to the east are much farther removed and inherently expected to comply with the noise guideline limits.

2.0 PROGRAMME OF OPERATION

Initially, overburden will be removed to expose the rock. These activities should be relatively short lived. Overburden material will be stored on site and later used for the rehabilitation process.

Aggregate extraction will generally progress from the south to the north and from the east to the west.

Normal activity at the site would involve two front end loaders loading trucks with material for shipment off-site. The trucks would be loaded from stockpiles of aggregate at the permanent processing plant location at the southwest corner of the site. A maximum of 1,500,000 tonnes of aggregate per year could be shipped from the site. Based on this extraction limit, a worst case (i.e., maximum) of 27 truck loads of aggregate could be shipped in an hour.

Rock drilling will be done on the site to create holes which will accommodate the explosive material. Once an adequate number of holes have been created, they will be filled with explosives and the rock will be blasted away from the quarry face creating a “muck pile” at the base of the working face.

The processing of aggregate material from the muck pile will be done on the site. A front end loader will load dedicated on-site haul trucks with material from the muck pile for transport to the permanent processing plant. A permanent processing plant will initially be established at the southwest corner of the southern extension of the site. The permanent processing plant will include crushing and screening plants. The plant may be re-located to Area 2 once extraction in that area has created a large enough spot for the plant. Figure 2 shows the operational plan, including the proposed extraction sequence.

It is expected that all equipment will operate at the bottom elevation of a lift except for the rock drill which operates atop the working face.

A dimension stone operation is also proposed for the site. This will involve a front end loader and excavator extracting stone and loading flat bed trucks to ship the dimensional stone off site. The dimension stone operations are only anticipated for the easterm portion of the site.

3.0 ENVIRONMENTAL NOISE GUIDELINES

The applicable noise guideline limits for the proposed quarry operation are in MOE Publication NPC-300, "Environmental Guideline, Stationary and Transportation Sources - Approval and Planning.

As per NPC-300, an aggregate extraction facility is a stationary noise source. Please note that the MOE terminology "stationary source" refers to the site as a whole, including the composite effect of all of the individual sound sources, even if the latter can actually move around the site. Thus, source, as referred to above, means the site (operation) as a whole.

The MOE noise guidelines require that the noise assessment determine the "predictable worst case" impacts. Thus, the assessment needs to evaluate the largest possible excess over the noise guideline limits based on the proposed operations in any hour of operation.

3.1 ON-SITE OPERATIONS

Noise sensitive receptors in this case are residential uses. The receptors further removed from County Road 36 (i.e. R3, R4 and R5) are considered to be in a Class 3 Area, according to the MOE definition. A Class 3 Area is an area that has an existing acoustical environment dominated by the sounds of nature. A Class 2 area has an acoustical environment that is dominated by the activities of people, usually road traffic, during the daytime (07:00 to 19:00) but has a low evening and night background sound level defined by the natural environment and in frequent human activity. See Glossary of Terms for definitions of Class 1, Class 2 and Class 3 areas.

The environmental sound level guidelines for Class 2 and 3 Areas are found in the MOE Publication NPC-300, *"Stationary and Transportation Sources - Approval and Planning."* For Class 2 and 3 Areas, the sound from the source (L_{eq} in any hour) should not exceed the ambient one hour L_{eq} at the receptors of concern, in the corresponding hour.

Notwithstanding the above, for a Class 2 Area, no mitigation is required for any source that does not exceed 50 dBA (one hour L_{eq}), at any off-site receptor of concern between the hours of 0700 and 1900 hours (daytime). Between 1900 and 0700 hours (nighttime), a 45 dBA limit is applicable. For a Class 3 Area, the daytime and nighttime noise guideline limits are 45 dBA and 40 dBA, respectively. These guideline sound limits are referred to as "exclusion limits".

3.2 OFF-SITE HAUL ROUTE

There are no specific statutes, regulations, formal policies under the Planning Act or guidelines applicable to adding licensed motor vehicles to public roadways and dealing with noise.

4.0 APPLICABLE ENVIRONMENTAL NOISE GUIDELINES

To be conservative, the MOE exclusion limits have been applied for activities in the Rockridge Quarry. These are the most stringent applications of the noise guideline limits.

5.0 ANALYSIS

5.1 ON-SITE OPERATIONS

A quarry operation is a dynamic, continually changing process, that moves across the site. The site operations consist of various components:

- site preparation, including the removal of trees and the stripping of overburden;
- drilling and blasting;
- the transporting and processing of aggregate;
- the rehabilitation of the quarry; and
- miscellaneous construction activities.

Construction activities, including site preparation and rehabilitation, are not chronic and are excluded from the stationary noise source assessment as per MOE guidelines. However, equipment used for construction must comply with the sound emission limits outlined in MOE Publication NPC-115, “Construction Equipment”.

The hours of operation at the quarry are proposed to be:

- 0600 to 1900 hours Monday to Saturday for processing in Areas 1 and 2 and the loading and moving of material from the working face to the processing plant;
- 0700 to 1900 hours Monday to Saturday for stripping, rehabilitation, maintenance, general construction activities, drilling and processing in Area 3; and
- Loading and shipping of material offsite, anytime.

A rock drill will operate on top of the working face to create blast holes. The blast will remove the rock from the working face and create a muck pile on the quarry floor. A front end loader operating at the bottom of the working face, will load material from the muck pile at the base of the working face into dedicated haul trucks. The trucks will haul the material to the permanent processing plant at the southwest corner of the souther portion of the site. The permanent processing plant will include crushing and screening plants. Stockpiles of final material will be located in this area. Two front end loaders will operate in the permanent plant location and will be used to load trucks which will ship the material off site.

In addition to the above production quarry operation, a dimension stone operation will also occur on the site. This will involve a front end loader and an excavator which will extract the dimension stone and load it onto flat bed trucks for shipment off site.

Note that other equipment with similar sound emission levels can be used on the site without impacting off-site sound exposures. For example, an excavator can be used instead of a front end loader. However, the noise assessment is considered to reflect a worst case operating scenario.

The equipment sound emission levels used in our analysis are:

Type	Maximum Sound Emission Level (dBA)
Front End Loader	76 @ 15 m
Rock Drill	89 @ 15 m
Excavator	80 @ 15 m
Dedicated Haul Trucks	81 @ 15 m
Permanent Processing Plant	90 @ 15 m
Shipping Trucks	78 @ 15 m

To ensure noise emissions comply with the recommendations of this report, we recommend that sound emission levels from equipment to be used on site be measured to ensure they do not exceed the levels outlined herein or, for equipment brought on site on an as-needed basis, they have appropriate portable Certificates of Approval (C's of A) or Environmental Compliance Approvals (ECA's).

To assess the noise impact at the noise sensitive receptor locations, a 3-D acoustical model of the proposed quarry operations was developed using the CadnaA Version 4.6 environmental noise modelling software. The model uses the prediction algorithms outlined in International Standards Organization Standard 9613-2:1996, "*Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*". The modelling technique is an approach that is acceptable to the MOE.

5.2 HAUL ROUTE

As indicated previously, the MOE do not have noise guidelines for adding licensed vehicle traffic to public roadways. However, the draft MOE *Noise Guidelines for Landfill Sites* does address haul routes. The haul route requirements outlined in the landfill guidelines are often used for quarry applications. It states that an access route shall be selected which will result in a minimum noise impact. It is understood in this case that County Road 36 will be used as the haul route for 95% of the truck traffic with 75% heading south and 20% heading west. 5% of the haul trucks are proposed to go north on County Road 507.

6.0 RESULTS

The worst case analysis results are provided in Table 1. Note that for each receptor, the locations of the sources corresponding to the highest sound exposures may vary. The worst case unmitigated sound exposure of 65 dBA is predicted at R2. At R1, R3, R4 and R5, worst case unmitigated sound exposures of 48 dBA, 64 dBA, 50 dBA, and 52 dBA, respectively, are predicted.

The unmitigated worst case sound exposures exceed the MOE noise guideline limits by up to 19 dBA. Thus, noise mitigation measures are required.

6.1 MITIGATION RECOMMENDATIONS

The largest excess above the MOE noise guideline limits occurs at R2. This receptor is closest to the extraction area.

One of the most significant noise sources is the drill. The drill must operate atop the working face. Drill technology has been improving with quieter drills becoming available. Thus, we recommend that a quieter drill having a maximum sound emission level of 80 dBA at 15 m, such as the Atlas Copco SmartRig fitted with a noise control shroud (product information in Appendix C) be used on this site.

Our analysis indicates that, in combination with the quieter rock drill, a perimeter sound barrier along a portion of the western boundary of the site ranging in height from 6 m to 9 m is required to mitigate the worst case sound exposures at the receptor locations to within the MOE noise guideline limits. Figure 3 shows the sound barrier locations. In addition, for extraction in Area 4 or 5 and the processing plant is operating in Area 2 or 3, a 4.5 m high local sound barrier is needed to screen the processing plant from Receptors R2 and R3. The local barrier can be constructed using aggregate stockpiles and must be no more than 25 m from the processing plant.

Since the extraction will be done in phases, starting from the southern-most portion of the site, the entire extents of the sound barriers shown in Figure 3 do not need to be built prior to commencing extraction. The berms are required as follows:

- Prior to the start of aggregate extraction, 3.5 m high berms are needed at the southwest corner of the site, as shown on Figure 4, to provide acoustical screening for the haul trucks entering and leaving the site.

- Prior to aggregate extraction occurring in Area 3, the berm at the southwest corner of the site needs to be increase to 7 m in height and extend northward, as shown on Figure 5.

- Prior to aggregate extraction occurring in Area 4, the 7 m high berm needs to be increased to 9 m in height. In addition, a 6 m high berm is needed to the north of the 9 m berm, as shown on Figure 3.

According to the MOE, a sound barrier means a wall, berm, wall/berm combination or similar structure. The minimum surface density (face weight) of a sound barrier is 20 kg/m^2. The barrier must be structurally sound, appropriately designed to withstand wind and snow load, and constructed without cracks or surface gaps. Any gaps under the barrier that are necessary for drainage purposes should be minimized and localized, so that the acoustical performance of the barrier is maintained. Sound barriers can be constructed from a variety of materials including wood, masonry, composites, etc., provided the above requirements are met.

The berm phasing shown on Figures 3 to 5 represent the latest the indicated berms should be constructed. If desired, the berms can be constructed earlier in the life of the quarry which will result in somewhat lower off site sound exposures.

Any changes to the noise mitigation and/or equipment should be reviewed by a qualified acoustical consultant to ensure compliance with the MOE noise guideline limits.

6.2 OFF-SITE HAUL ROUTE

The haul route proposal is that 95% of the haul trucks will use County Road 36 and 5% will go north on County Road 507. County Road 36 is a haul route and is already being used by multiple quarries as their haul route. Since there already is a significant amount of heavy truck traffic on

County Road 36, the expected noise impacts due to the addition of the Rockridge Quarry truck traffic is expected to be less than 3 dBA. This assumes a lower volume of truck traffic from the Rockridge Quarry as from the existing other area quarries. The impact is considered insignificant.

Thus, based on the above, the use of County Road 36 as the haul route except for any local deliveries going north on County Road 507, is considered appropriate acoustically as insignificant noise impacts are predicted from the addition of the Rockridge Quarry truck traffic.

7.0 RECOMMENDATIONS

1. The sound emission level for all pieces of equipment used for construction activities including site preparation and rehabilitation must comply with the limits outlined in MOE Publication NPC-115, “Construction Equipment”.

2. Back-up beepers are exempt from assessment by the MOE stationary noise source guidelines. However, to reduce off-site noise impacts, we recommend alternative technologies be used on all equipment operating at the site. Details regarding a potential alternative are included in Appendix C.

3. Sound emissions from equipment to be used on-site should be measured to confirm that they comply with the levels outlined within this report. For the rock drill, the maximum emission level is 80 dBA at 15 m.

4. Sound barriers be constructed as shown on Figure 3. The sound barriers may be constructed according to the timings shown in Figures 4 to 5.

5. When aggregate extraction is occurring in Area 4 or 5 and the processing plant is operating in Area 2 or 3, a 4.5 m high stockpile screen is to be located no more than 25 m from the processing plant to provide acoustical screening towards Receptors R2 and R3.

6. The hours of operation are:

    - 0600 to 1900 hours Monday to Saturday for processing in Areas 1 and 2 and the loading and moving of material from the working face to the processing plant;
    - 0700 to 1900 hours Monday to Saturday for stripping, rehabilitation, maintenance, general construction activities, drilling and processing in Area 3; and
    - Loading and shipping of material offsite, anytime.

7. Off-site noise audit measurements be completed when drilling and processing are being done on the site to confirm the MOE noise guideline limits are met. The audit measurements must be done by a qualified acoustical engineer.

8. To ensure noise emissions comply with the recommendations of this report, sound emission levels from equipment to be used on site be measured to ensure they do not exceed the levels outlined herein or, for equipment brought to the site on an as-needed basis, they have appropriate C of A’s or ECA’s.

9. If other or new equipment is brought to the site, the sound emissions be checked to ensure the equipment is in compliance with this noise study.

10. If alternate noise mitigation measures are to be implemented, they be reviewed by a qualified acoustical consultant to ensure the MOE noise guideline limits will be met.

8.0 CONCLUSIONS

With the appropriate implementation of the mitigation measures outlined herein, the sound exposures from the worst case operations on the site will be in compliance with MOE noise guideline limits.

As the operation moves over the site, elevation, distance and sound exposure vary relative to off-site receptors. Thus, the noise analysis has been approached on the basis of determining worst case conditions to ensure that the data presented does not under-predict the potential off-site sound exposures. The interpretation of the sound exposure predictions must take this into account.

9.0 REFERENCES

1. "Model Municipal Noise Control By-Law", Final Report, Ontario Ministry of the Environment, August 1978.

2. "Noise Emission Levels for Vehicles in Ontario", Ontario Ministry of Transportation and Communications, November 1985, H05-85-02.

3. “Stationary and Transportation Sources - Approval and Planning”, Ontario Ministry of the Environment, Publication NPC-300, October 2013.

4. “Noise Guidelines for Landfill Sites (Draft)”, Ontario Ministry of the Environment, October 1998.

5. PC STAMSON 5.04, “Computer Program for Road Traffic Noise Assessment”, Ontario Ministry of the Environment.

6. “Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation”, ISO 9613-2, December 15, 1996.

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GLOSSARY OF TERMS

Class 1 Area (MOE definition):

means an area with an acoustical environment typical of a major population centre, where the background sound level is dominated by the urban hum.

Class 2 Area (MOE definition):

means an area with an acoustical environment that has qualities representative of both Class 1 and Class 3 Areas, and in which a low ambient sound level, normally occurring only between 2300 and 0700 hours in Class 1 Areas, will typically be realized as early as 1900 hours.

Other characteristics which may indicate the presence of a Class 2 Area include:

- absence of urban hum between 1900 and 2300 hours;
- evening background sound level defined by natural environment and infrequency human activity; and
- no clearly audible sound from stationary sources other than from those under impact assessment.

Class 3 Area (MOE definition):

means a rural area with an acoustical environment that is dominated by natural sounds having little or no road traffic, such as the following:

- a small community with less than 1000 population;
- agricultural area;
- a rural recreational area such as a cottage or a resort area; or
- a wilderness area.

Construction (MOE definition):

"Construction" includes erection, alteration, repair, dismantling, demolition, structural maintenance, painting, moving, land clearing, earthmoving, grading, excavating, the laying of pipe and conduit whether above or below ground level, street and highway building, concreting, equipment installation and alteration and the structural installation of construction components and materials in any form or for any purpose, and includes any work in connection therewith.

Construction Equipment (MOE definition):

"Construction equipment" means any equipment or device designed and intended for use in construction, or material handling, including but not limited to, air compressors, pile drivers, pneumatic or hydraulic tools, bulldozers, tractors, excavators, trenchers, cranes, derricks, loaders, scrapers, pavers, generators, off-highway haulers or trucks, ditchers, compactors and rollers, pumps, concrete mixers, graders, or other material handling equipment.

Conveyance (MOE definition):

"Conveyance" includes a vehicle and any other device employed to transport a person or persons or goods from place to place but does not include any such device or vehicle if operated only within the premises of a person.

dB - Decibel:

See Sound (Pressure) Level.

dBA - A weighted decibel:

A nationally and internationally standardized frequency weighting applied to the sound level spectrum to approximate the sensitivity of the human hearing mechanism as a function of frequency (pitch).

L_{eq} - The energy equivalent continuous sound level:

The constant sound level over the time period in question, that results in the same total sound energy as the actually varying sound. Must be associated with a time period.

L_x - Statistical Sound Level Descriptor:

The sound level exceeded for x% of the time. For all practical purposes, L_{90} is the residual (lowest) ambient sound level.

Sound (Pressure) Level:

Measured in decibels (dB) it is the logarithmic ratio of the instantaneous energy of a sound to the energy at the threshold of hearing. Mathematically:

$$SPL \ (dB) = 20 \log \left(\frac{p}{p_0}\right)$$

where p is the pressure due to the sound and p_o is the pressure at the threshold of hearing, taken as 20 micro Pascals.

Stationary Source (MOE definition):

"Stationary source" means a source of sound which does not normally move from place to place and includes the premises of a person as one stationary source, unless the dominant source of sound on those premises is construction or a conveyance.

TABLE 1

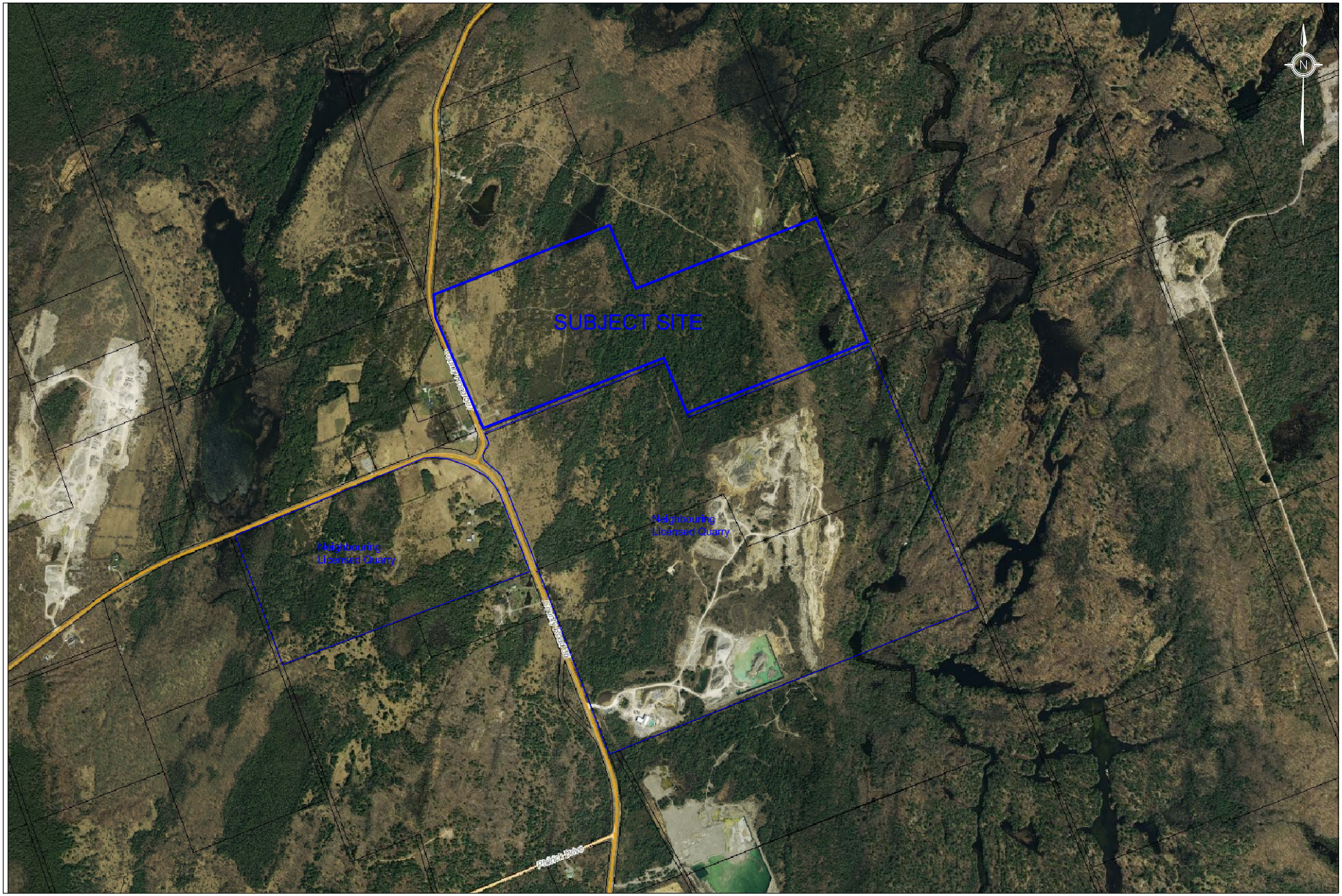
WORST CASE UNMITIGATED SOUND EXPOSURES

Receptor	Predicted Sound Level (dBA)		MOE Noise Guideline Limit (dBA)	
	Daytime	Nighttime	Daytime	Nighttime
R1	48	40	50	45
R2	65	44	50	45
R3	64	43	45	40
R4	50	38	45	40
R5	52	39	45	40

TABLE 2

WORST CASE SOUND EXPOSURES WITH RECOMMENDED MITIGATION MEASURES

Receptor	Predicted Sound Level (dBA)		MOE Noise Guideline Limit (dBA)	
	Daytime	Nighttime	Daytime	Nighttime
R1	43	40	50	45
R2	46	33	50	45
R3	45	33	45	40
R4	43	26	45	40
R5	45	29	45	40



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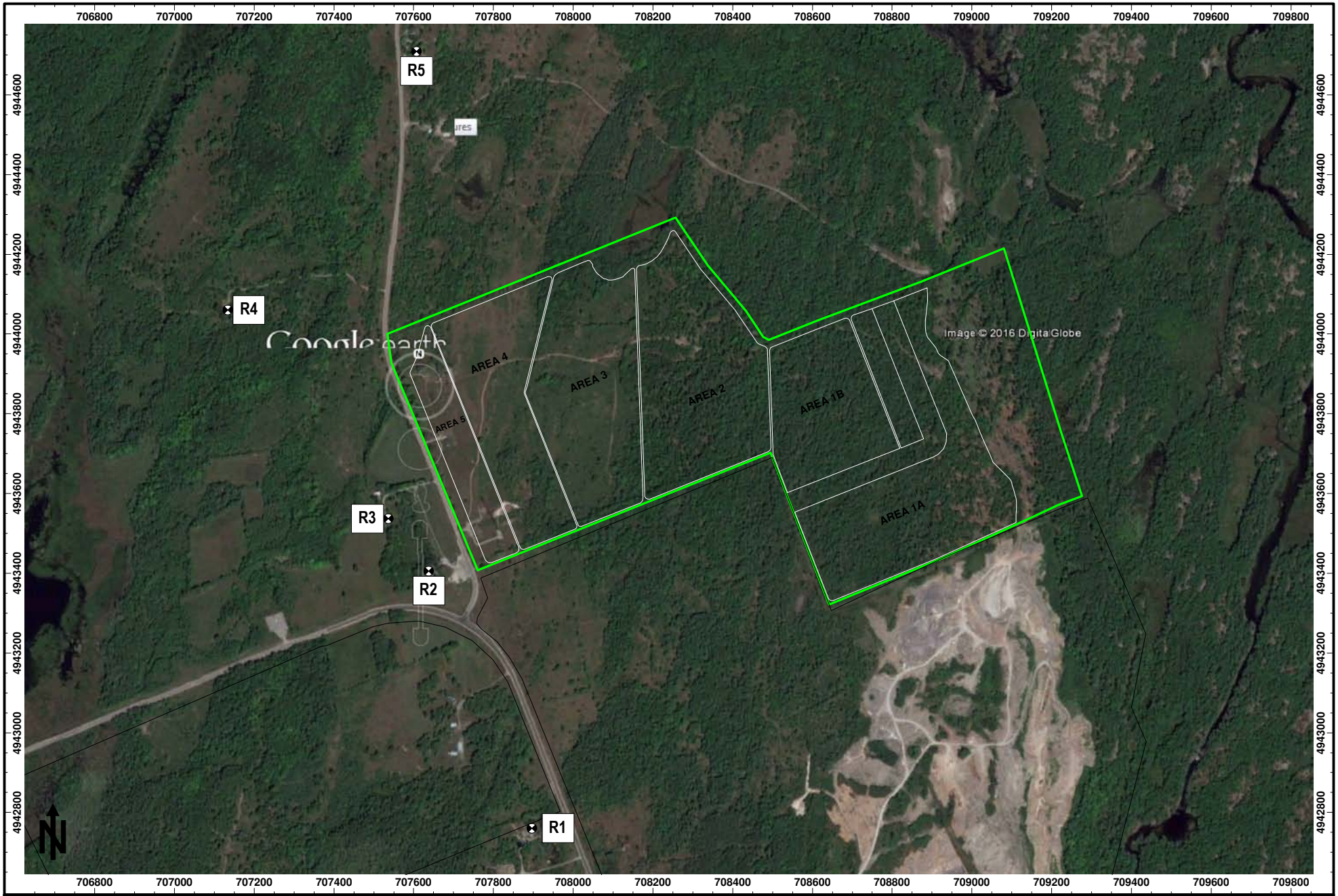
Title: Key Plan		Date: 2017-06-02	Figure: 1
Project Name: Rockridge Quarry		Project No.: 116-0383	



VALCOUSTICS Canada Ltd. consulting acoustical engineers	Title **Noise-Sensitive Receptor Locations**	Date **2017-06-02**	Figure **2**
	Project Name **Rockridge Quarry**	Project No. **116-0383**	

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Date Plotted: 02.06.17

VALCOUSTICS Canada Ltd. consulting acoustical engineers	Title: **Berm Requirements**	Date: **2017-06-06**	Figure: **3**
	Project Name: **Rockridge Quarry**	Project No.: **116-0383**	

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Date Plotted: 06.06.17

VALCOUSTICS Canada Ltd. consulting acoustical engineers	Title: **Berm Requirements Prior to Area 3 Extraction (Phase A, B & C)**	Date: **2017-06-06**	Figure: **4**
	Project Name: **Rockridge Quarry**	Project No.: **116-0383**	

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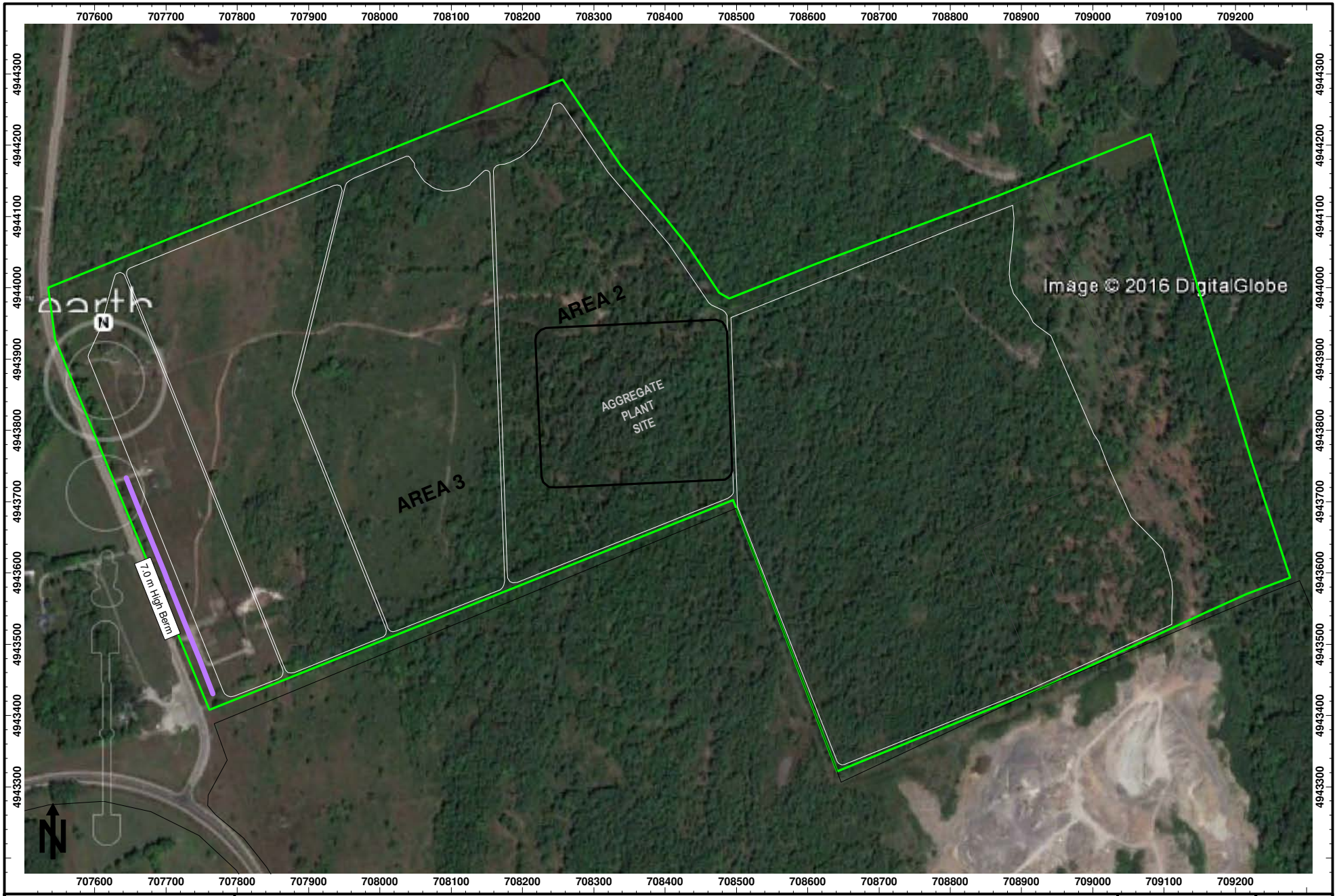
Date Plotted: 06.06.17



VALCOUSTICS Canada Ltd. consulting acoustical engineers	Title: **Berm Requirement Prior to Area 4 Extraction (Phase D)**	Date: **2017-06-06**	Figure: **5**
	Project Name: **Rockridge Quarry**	Project No.: **116-0383**	

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Date Plotted: 06.06.17

APPENDIX A

SAMPLE CALCULATIONS

Configuration	
Parameter	Value
General	
Country	International
Max. Error (dB)	0.00
Max. Search Radius (m)	2000.00
Min. Dist Src to Rcvr	0.00
Partition	
Raster Factor	0.50
Max. Length of Section (m)	1000.00
Min. Length of Section (m)	1.00
Min. Length of Section (%)	0.00
Proj. Line Sources	On
Proj. Area Sources	On
Ref. Time	
Reference Time Day (min)	960.00
Reference Time Night (min)	480.00
Daytime Penalty (dB)	0.00
Recr. Time Penalty (dB)	6.00
Night-time Penalty (dB)	10.00
DTM	
Standard Height (m)	270.00
Model of Terrain	Triangulation
Reflection	
max. Order of Reflection	1
Search Radius Src	100.00
Search Radius Rcvr	100.00
Max. Distance Source - Rcvr	1000.00 1000.00
Min. Distance Rvcr - Reflector	1.00 1.00
Min. Distance Source - Reflector	0.10
Industrial (ISO 9613)	
Lateral Diffraction	some Obj
Obst. within Area Src do not shield	On
Screening	Excl. Ground Att. over Barrier
	Dz with limit (20/25)
Barrier Coefficients C1,2,3	3.0 20.0 0.0
Temperature (°C)	10
rel. Humidity (%)	70
Ground Absorption G	1.00
Wind Speed for Dir. (m/s)	3.0
Roads (RLS-90)	
Strictly acc. to RLS-90	
Railways (Schall 03 (1990))	
Strictly acc. to Schall 03 / Schall-Transrapid	
Aircraft (???)	
Strictly acc. to AzB	

Receiver
Name: R03
ID: R3
X: 707536.74
Y: 4943536.95
Z: 300.70

Point Source, ISO 9613, Name: "Processing Plant", ID: "PRCSG"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	l/a	Optime	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
10	708041.78	4943876.44	291.50	0	D	32	-34.6	0.0	0.0	0.0	0.0	66.7	0.0	-4.9	0.0	0.0	11.0	0.0	0.0	-107.5
10	708041.78	4943876.44	291.50	0	D	63	96.6	0.0	0.0	0.0	0.0	66.7	0.1	-4.9	0.0	0.0	12.1	0.0	0.0	22.6
10	708041.78	4943876.44	291.50	0	D	125	106.4	0.0	0.0	0.0	0.0	66.7	0.3	1.1	0.0	0.0	7.7	0.0	0.0	30.7
10	708041.78	4943876.44	291.50	0	D	250	107.5	0.0	0.0	0.0	0.0	66.7	0.6	-1.0	0.0	0.0	11.9	0.0	0.0	29.4
10	708041.78	4943876.44	291.50	0	D	500	113.2	0.0	0.0	0.0	0.0	66.7	1.2	-2.4	0.0	0.0	15.7	0.0	0.0	32.1
10	708041.78	4943876.44	291.50	0	D	1000	115.4	0.0	0.0	0.0	0.0	66.7	2.2	-2.4	0.0	0.0	18.4	0.0	0.0	30.5
10	708041.78	4943876.44	291.50	0	D	2000	116.5	0.0	0.0	0.0	0.0	66.7	5.9	-2.4	0.0	0.0	21.2	0.0	0.0	25.1
10	708041.78	4943876.44	291.50	0	D	4000	115.2	0.0	0.0	0.0	0.0	66.7	19.9	-2.4	0.0	0.0	24.1	0.0	0.0	6.8
10	708041.78	4943876.44	291.50	0	D	8000	108.0	0.0	0.0	0.0	0.0	66.7	71.1	-2.4	0.0	0.0	27.1	0.0	0.0	-54.5

Point Source, ISO 9613, Name: "Dimension Stone Operation", ID: "DIM"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	l/a	Optime	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
15	707743.78	4943618.12	295.50	0	D	32	-36.4	0.0	0.0	0.0	0.0	57.9	0.0	-3.2	0.0	0.0	10.6	0.0	0.0	-101.8
15	707743.78	4943618.12	295.50	0	D	63	92.3	0.0	0.0	0.0	0.0	57.9	0.0	-3.2	0.0	0.0	12.2	0.0	0.0	25.3
15	707743.78	4943618.12	295.50	0	D	125	96.4	0.0	0.0	0.0	0.0	57.9	0.1	4.8	0.0	0.0	6.3	0.0	0.0	27.2
15	707743.78	4943618.12	295.50	0	D	250	104.5	0.0	0.0	0.0	0.0	57.9	0.2	6.2	0.0	0.0	7.4	0.0	0.0	32.7
15	707743.78	4943618.12	295.50	0	D	500	106.0	0.0	0.0	0.0	0.0	57.9	0.4	0.8	0.0	0.0	15.6	0.0	0.0	31.3
15	707743.78	4943618.12	295.50	0	D	1000	108.2	0.0	0.0	0.0	0.0	57.9	0.8	0.0	0.0	0.0	19.2	0.0	0.0	30.2
15	707743.78	4943618.12	295.50	0	D	2000	106.0	0.0	0.0	0.0	0.0	57.9	2.1	0.0	0.0	0.0	20.0	0.0	0.0	25.9
15	707743.78	4943618.12	295.50	0	D	4000	101.0	0.0	0.0	0.0	0.0	57.9	7.3	0.0	0.0	0.0	20.0	0.0	0.0	15.8
15	707743.78	4943618.12	295.50	0	D	8000	93.1	0.0	0.0	0.0	0.0	57.9	26.0	0.0	0.0	0.0	20.0	0.0	0.0	-10.9

Point Source, ISO 9613, Name: "Rock Drill", ID: "RD"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	l/a	Optime	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
20	707719.00	4943621.11	303.00	0	D	32	-49.4	0.0	0.0	0.0	0.0	57.1	0.0	-3.0	0.0	0.0	9.1	0.0	0.0	-112.5
20	707719.00	4943621.11	303.00	0	D	63	86.8	0.0	0.0	0.0	0.0	57.1	0.0	-3.0	0.0	0.0	10.1	0.0	0.0	22.6
20	707719.00	4943621.11	303.00	0	D	125	97.9	0.0	0.0	0.0	0.0	57.1	0.1	3.1	0.0	0.0	5.5	0.0	0.0	32.2
20	707719.00	4943621.11	303.00	0	D	250	100.4	0.0	0.0	0.0	0.0	57.1	0.2	1.4	0.0	0.0	9.2	0.0	0.0	32.6
20	707719.00	4943621.11	303.00	0	D	500	106.8	0.0	0.0	0.0	0.0	57.1	0.4	0.0	0.0	0.0	12.9	0.0	0.0	36.4
20	707719.00	4943621.11	303.00	0	D	1000	106.0	0.0	0.0	0.0	0.0	57.1	0.7	0.0	0.0	0.0	15.6	0.0	0.0	32.6
20	707719.00	4943621.11	303.00	0	D	2000	105.2	0.0	0.0	0.0	0.0	57.1	1.9	0.0	0.0	0.0	18.4	0.0	0.0	27.8
20	707719.00	4943621.11	303.00	0	D	4000	100.0	0.0	0.0	0.0	0.0	57.1	6.6	0.0	0.0	0.0	20.0	0.0	0.0	16.4
20	707719.00	4943621.11	303.00	0	D	8000	90.9	0.0	0.0	0.0	0.0	57.1	23.5	0.0	0.0	0.0	20.0	0.0	0.0	-9.6

Point Source, ISO 9613, Name: "Front End Loader", ID: "FEL"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	l/a	Optime	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
28	707731.12	4943613.31	295.50	0	D	32	-39.4	0.0	0.0	0.0	0.0	57.4	0.0	-3.0	0.0	0.0	11.3	0.0	0.0	-105.1
28	707731.12	4943613.31	295.50	0	D	63	91.8	0.0	0.0	0.0	0.0	57.4	0.0	-3.0	0.0	0.0	13.2	0.0	0.0	24.2
28	707731.12	4943613.31	295.50	0	D	125	93.9	0.0	0.0	0.0	0.0	57.4	0.1	4.7	0.0	0.0	7.8	0.0	0.0	23.9
28	707731.12	4943613.31	295.50	0	D	250	100.4	0.0	0.0	0.0	0.0	57.4	0.2	6.2	0.0	0.0	8.9	0.0	0.0	27.7
28	707731.12	4943613.31	295.50	0	D	500	99.8	0.0	0.0	0.0	0.0	57.4	0.4	0.8	0.0	0.0	17.2	0.0	0.0	24.1
28	707731.12	4943613.31	295.50	0	D	1000	102.0	0.0	0.0	0.0	0.0	57.4	0.8	0.0	0.0	0.0	20.0	0.0	0.0	23.8
28	707731.12	4943613.31	295.50	0	D	2000	101.2	0.0	0.0	0.0	0.0	57.4	2.0	0.0	0.0	0.0	20.0	0.0	0.0	21.8
28	707731.12	4943613.31	295.50	0	D	4000	98.0	0.0	0.0	0.0	0.0	57.4	6.8	0.0	0.0	0.0	20.0	0.0	0.0	13.8
28	707731.12	4943613.31	295.50	0	D	8000	86.9	0.0	0.0	0.0	0.0	57.4	24.4	0.0	0.0	0.0	20.0	0.0	0.0	-14.9

Line Source, ISO 9613, Name: "Haul Trucks", ID: "HT"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	l/a	Optime	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
41	707805.64	4943636.95	295.65	0	D	32	-65.8	20.1	0.0	0.0	0.0	60.2	0.0	-3.8	0.0	0.0	9.5	0.0	0.0	-111.7

Line Source, ISO 9613, Name: "Haul Trucks", ID: "HT"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	l/a	Optime	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
41	707805.64	4943636.95	295.65	0	D	63	62.4	20.1	0.0	0.0	0.0	60.2	0.0	-3.8	0.0	0.0	10.3	0.0	0.0	15.7
41	707805.64	4943636.95	295.65	0	D	125	70.5	20.1	0.0	0.0	0.0	60.2	0.1	5.1	0.0	0.0	2.6	0.0	0.0	22.5
41	707805.64	4943636.95	295.65	0	D	250	80.0	20.1	0.0	0.0	0.0	60.2	0.3	6.5	0.0	0.0	2.9	0.0	0.0	30.1
41	707805.64	4943636.95	295.65	0	D	500	82.4	20.1	0.0	0.0	0.0	60.2	0.6	1.0	0.0	0.0	10.6	0.0	0.0	30.1
41	707805.64	4943636.95	295.65	0	D	1000	78.6	20.1	0.0	0.0	0.0	60.2	1.0	0.0	0.0	0.0	14.1	0.0	0.0	23.3
41	707805.64	4943636.95	295.65	0	D	2000	75.8	20.1	0.0	0.0	0.0	60.2	2.8	0.0	0.0	0.0	16.9	0.0	0.0	16.0
41	707805.64	4943636.95	295.65	0	D	4000	70.6	20.1	0.0	0.0	0.0	60.2	9.4	0.0	0.0	0.0	19.8	0.0	0.0	1.3
41	707805.64	4943636.95	295.65	0	D	8000	64.5	20.1	0.0	0.0	0.0	60.2	33.5	0.0	0.0	0.0	20.0	0.0	0.0	-29.2
46	707920.91	4943679.34	293.40	0	D	32	-65.8	21.6	0.0	0.0	0.0	63.3	0.0	-4.5	0.0	0.0	9.5	0.0	0.0	-112.6
46	707920.91	4943679.34	293.40	0	D	63	62.4	21.6	0.0	0.0	0.0	63.3	0.0	-4.5	0.0	0.0	9.8	0.0	0.0	15.4
46	707920.91	4943679.34	293.40	0	D	125	70.5	21.6	0.0	0.0	0.0	63.3	0.2	1.6	0.0	0.0	4.1	0.0	0.0	22.9
46	707920.91	4943679.34	293.40	0	D	250	80.0	21.6	0.0	0.0	0.0	63.3	0.4	-0.2	0.0	0.0	6.8	0.0	0.0	31.3
46	707920.91	4943679.34	293.40	0	D	500	82.4	21.6	0.0	0.0	0.0	63.3	0.8	-1.6	0.0	0.0	9.5	0.0	0.0	32.0
46	707920.91	4943679.34	293.40	0	D	1000	78.6	21.6	0.0	0.0	0.0	63.3	1.5	-1.6	0.0	0.0	11.3	0.0	0.0	25.7
46	707920.91	4943679.34	293.40	0	D	2000	75.8	21.6	0.0	0.0	0.0	63.3	4.0	-1.6	0.0	0.0	13.5	0.0	0.0	18.2
46	707920.91	4943679.34	293.40	0	D	4000	70.6	21.6	0.0	0.0	0.0	63.3	13.4	-1.6	0.0	0.0	16.1	0.0	0.0	1.0
46	707920.91	4943679.34	293.40	0	D	8000	64.5	21.6	0.0	0.0	0.0	63.3	47.9	-1.6	0.0	0.0	18.9	0.0	0.0	-42.3
90	708053.43	4943850.60	290.90	0	D	32	-65.8	13.8	0.0	0.0	0.0	66.6	0.0	-5.0	0.0	0.0	11.3	0.0	0.0	-125.0
90	708053.43	4943850.60	290.90	0	D	63	62.4	13.8	0.0	0.0	0.0	66.6	0.1	-5.0	0.0	0.0	12.4	0.0	0.0	2.0
90	708053.43	4943850.60	290.90	0	D	125	70.5	13.8	0.0	0.0	0.0	66.6	0.2	1.0	0.0	0.0	8.1	0.0	0.0	8.3
90	708053.43	4943850.60	290.90	0	D	250	80.0	13.8	0.0	0.0	0.0	66.6	0.6	-1.1	0.0	0.0	12.4	0.0	0.0	15.2
90	708053.43	4943850.60	290.90	0	D	500	82.4	13.8	0.0	0.0	0.0	66.6	1.2	-2.5	0.0	0.0	16.2	0.0	0.0	14.6
90	708053.43	4943850.60	290.90	0	D	1000	78.6	13.8	0.0	0.0	0.0	66.6	2.2	-2.5	0.0	0.0	19.0	0.0	0.0	7.0
90	708053.43	4943850.60	290.90	0	D	2000	75.8	13.8	0.0	0.0	0.0	66.6	5.8	-2.5	0.0	0.0	21.8	0.0	0.0	-2.2
90	708053.43	4943850.60	290.90	0	D	4000	70.6	13.8	0.0	0.0	0.0	66.6	19.8	-2.5	0.0	0.0	24.7	0.0	0.0	-24.3
90	708053.43	4943850.60	290.90	0	D	8000	64.5	13.8	0.0	0.0	0.0	66.6	70.7	-2.5	0.0	0.0	27.5	0.0	0.0	-84.1
93	708053.49	4943791.35	290.90	0	D	32	-65.8	19.8	0.0	0.0	0.0	66.2	0.0	-4.9	0.0	0.0	9.8	0.0	0.0	-117.1
93	708053.49	4943791.35	290.90	0	D	63	62.4	19.8	0.0	0.0	0.0	66.2	0.1	-4.9	0.0	0.0	9.8	0.0	0.0	10.9
93	708053.49	4943791.35	290.90	0	D	125	70.5	19.8	0.0	0.0	0.0	66.2	0.2	1.0	0.0	0.0	4.0	0.0	0.0	18.8
93	708053.49	4943791.35	290.90	0	D	250	80.0	19.8	0.0	0.0	0.0	66.2	0.6	-1.0	0.0	0.0	6.3	0.0	0.0	27.7
93	708053.49	4943791.35	290.90	0	D	500	82.4	19.8	0.0	0.0	0.0	66.2	1.1	-2.4	0.0	0.0	8.1	0.0	0.0	29.1
93	708053.49	4943791.35	290.90	0	D	1000	78.6	19.8	0.0	0.0	0.0	66.2	2.1	-2.4	0.0	0.0	8.8	0.0	0.0	23.6
93	708053.49	4943791.35	290.90	0	D	2000	75.8	19.8	0.0	0.0	0.0	66.2	5.6	-2.4	0.0	0.0	10.0	0.0	0.0	16.1
93	708053.49	4943791.35	290.90	0	D	4000	70.6	19.8	0.0	0.0	0.0	66.2	18.9	-2.4	0.0	0.0	11.7	0.0	0.0	-4.1
93	708053.49	4943791.35	290.90	0	D	8000	64.5	19.8	0.0	0.0	0.0	66.2	67.3	-2.4	0.0	0.0	13.9	0.0	0.0	-60.8
98	708021.55	4943723.00	290.90	0	D	32	-65.8	18.8	0.0	0.0	0.0	65.3	0.0	-4.8	0.0	0.0	9.7	0.0	0.0	-117.2
98	708021.55	4943723.00	290.90	0	D	63	62.4	18.8	0.0	0.0	0.0	65.3	0.1	-4.8	0.0	0.0	9.8	0.0	0.0	10.8
98	708021.55	4943723.00	290.90	0	D	125	70.5	18.8	0.0	0.0	0.0	65.3	0.2	1.2	0.0	0.0	4.0	0.0	0.0	18.6
98	708021.55	4943723.00	290.90	0	D	250	80.0	18.8	0.0	0.0	0.0	65.3	0.5	-0.8	0.0	0.0	6.4	0.0	0.0	27.3
98	708021.55	4943723.00	290.90	0	D	500	82.4	18.8	0.0	0.0	0.0	65.3	1.0	-2.2	0.0	0.0	8.5	0.0	0.0	28.6
98	708021.55	4943723.00	290.90	0	D	1000	78.6	18.8	0.0	0.0	0.0	65.3	1.9	-2.2	0.0	0.0	9.7	0.0	0.0	22.7
98	708021.55	4943723.00	290.90	0	D	2000	75.8	18.8	0.0	0.0	0.0	65.3	5.0	-2.2	0.0	0.0	11.3	0.0	0.0	15.2
98	708021.55	4943723.00	290.90	0	D	4000	70.6	18.8	0.0	0.0	0.0	65.3	17.0	-2.2	0.0	0.0	13.4	0.0	0.0	-4.1
98	708021.55	4943723.00	290.90	0	D	8000	64.5	18.8	0.0	0.0	0.0	65.3	60.7	-2.2	0.0	0.0	15.9	0.0	0.0	-56.4

Line Source, ISO 9613, Name: "Shipping Trucks", ID: "SHIP_TRK"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	l/a	Optime	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
3	708322.80	4943660.12	300.40	0	DEN	32	-68.1	25.0	0.0	0.0	0.0	69.0	0.0	-4.2	0.0	0.0	8.9	0.0	0.0	-116.9
3	708322.80	4943660.12	300.40	0	DEN	63	57.1	25.0	0.0	0.0	0.0	69.0	0.1	-4.2	0.0	0.0	8.9	0.0	0.0	8.2
3	708322.80	4943660.12	300.40	0	DEN	125	65.2	25.0	0.0	0.0	0.0	69.0	0.3	1.8	0.0	0.0	3.0	0.0	0.0	16.1
3	708322.80	4943660.12	300.40	0	DEN	250	68.7	25.0	0.0	0.0	0.0	69.0	0.8	-0.5	0.0	0.0	5.3	0.0	0.0	19.1
3	708322.80	4943660.12	300.40	0	DEN	500	71.1	25.0	0.0	0.0	0.0	69.0	1.5	-1.9	0.0	0.0	6.7	0.0	0.0	20.8
3	708322.80	4943660.12	300.40	0	DEN	1000	71.3	25.0	0.0	0.0	0.0	69.0	2.9	-1.9	0.0	0.0	6.7	0.0	0.0	19.6
3	708322.80	4943660.12	300.40	0	DEN	2000	70.5	25.0	0.0	0.0	0.0	69.0	7.7	-1.9	0.0	0.0	6.7	0.0	0.0	14.0
3	708322.80	4943660.12	300.40	0	DEN	4000	68.3	25.0	0.0	0.0	0.0	69.0	26.1	-1.9	0.0	0.0	6.8	0.0	0.0	-6.6
3	708322.80	4943660.12	300.40	0	DEN	8000	62.2	25.0	0.0	0.0	0.0	69.0	93.0	-1.9	0.0	0.0	6.9	0.0	0.0	-79.8
5	708102.63	4943569.05	300.40	0	DEN	32	-68.1	22.0	0.0	0.0	0.0	66.1	0.0	-3.8	0.0	0.0	8.6	0.0	0.0	-117.0
5	708102.63	4943569.05	300.40	0	DEN	63	57.1	22.0	0.0	0.0	0.0	66.1	0.1	-3.8	0.0	0.0	8.6	0.0	0.0	8.2
5	708102.63	4943569.05	300.40	0	DEN	125	65.2	22.0	0.0	0.0	0.0	66.1	0.2	2.3	0.0	0.0	2.5	0.0	0.0	16.1
5	708102.63	4943569.05	300.40	0	DEN	250	68.7	22.0	0.0	0.0	0.0	66.1	0.6	0.2	0.0	0.0	4.7	0.0	0.0	19.2
5	708102.63	4943569.05	300.40	0	DEN	500	71.1	22.0	0.0	0.0	0.0	66.1	1.1	-1.2	0.0	0.0	6.1	0.0	0.0	21.0
5	708102.63	4943569.05	300.40	0	DEN	1000	71.3	22.0	0.0	0.0	0.0	66.1	2.1	-1.2	0.0	0.0	6.3	0.0	0.0	20.1

Line Source, ISO 9613, Name: "Shipping Trucks", ID: "SHIP_TRK"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	l/a	Optime	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
5	708102.63	4943569.05	300.40	0	DEN	2000	70.5	22.0	0.0	0.0	0.0	66.1	5.5	-1.2	0.0	0.0	6.5	0.0	0.0	15.7
5	708102.63	4943569.05	300.40	0	DEN	4000	68.3	22.0	0.0	0.0	0.0	66.1	18.6	-1.2	0.0	0.0	7.0	0.0	0.0	-0.1
5	708102.63	4943569.05	300.40	0	DEN	8000	62.2	22.0	0.0	0.0	0.0	66.1	66.2	-1.2	0.0	0.0	7.8	0.0	0.0	-54.7
7	707955.86	4943508.34	300.40	0	DEN	32	-68.1	22.0	0.0	0.0	0.0	63.5	0.0	-3.4	0.0	0.0	8.2	0.0	0.0	-114.4
7	707955.86	4943508.34	300.40	0	DEN	63	57.1	22.0	0.0	0.0	0.0	63.5	0.1	-3.4	0.0	0.0	8.3	0.0	0.0	10.7
7	707955.86	4943508.34	300.40	0	DEN	125	65.2	22.0	0.0	0.0	0.0	63.5	0.2	3.8	0.0	0.0	1.2	0.0	0.0	18.6
7	707955.86	4943508.34	300.40	0	DEN	250	68.7	22.0	0.0	0.0	0.0	63.5	0.4	1.0	0.0	0.0	4.1	0.0	0.0	21.7
7	707955.86	4943508.34	300.40	0	DEN	500	71.1	22.0	0.0	0.0	0.0	63.5	0.8	-0.4	0.0	0.0	5.9	0.0	0.0	23.3
7	707955.86	4943508.34	300.40	0	DEN	1000	71.3	22.0	0.0	0.0	0.0	63.5	1.5	-0.4	0.0	0.0	6.5	0.0	0.0	22.2
7	707955.86	4943508.34	300.40	0	DEN	2000	70.5	22.0	0.0	0.0	0.0	63.5	4.1	-0.4	0.0	0.0	7.6	0.0	0.0	17.8
7	707955.86	4943508.34	300.40	0	DEN	4000	68.3	22.0	0.0	0.0	0.0	63.5	13.8	-0.4	0.0	0.0	9.1	0.0	0.0	4.4
7	707955.86	4943508.34	300.40	0	DEN	8000	62.2	22.0	0.0	0.0	0.0	63.5	49.1	-0.4	0.0	0.0	11.1	0.0	0.0	-39.1
23	707869.12	4943464.64	300.40	0	DEN	32	-68.1	15.8	0.0	0.0	0.0	61.6	0.0	-3.0	0.0	0.0	7.3	0.0	0.0	-118.3
23	707869.12	4943464.64	300.40	0	DEN	63	57.1	15.8	0.0	0.0	0.0	61.6	0.0	-3.0	0.0	0.0	7.8	0.0	0.0	6.4
23	707869.12	4943464.64	300.40	0	DEN	125	65.2	15.8	0.0	0.0	0.0	61.6	0.1	4.9	0.0	0.0	0.4	0.0	0.0	13.8
23	707869.12	4943464.64	300.40	0	DEN	250	68.7	15.8	0.0	0.0	0.0	61.6	0.4	1.5	0.0	0.0	4.4	0.0	0.0	16.6
23	707869.12	4943464.64	300.40	0	DEN	500	71.1	15.8	0.0	0.0	0.0	61.6	0.7	0.0	0.0	0.0	6.8	0.0	0.0	17.8
23	707869.12	4943464.64	300.40	0	DEN	1000	71.3	15.8	0.0	0.0	0.0	61.6	1.2	0.0	0.0	0.0	8.2	0.0	0.0	16.0
23	707869.12	4943464.64	300.40	0	DEN	2000	70.5	15.8	0.0	0.0	0.0	61.6	3.3	0.0	0.0	0.0	10.1	0.0	0.0	11.3
23	707869.12	4943464.64	300.40	0	DEN	4000	68.3	15.8	0.0	0.0	0.0	61.6	11.1	0.0	0.0	0.0	12.4	0.0	0.0	-1.1
23	707869.12	4943464.64	300.40	0	DEN	8000	62.2	15.8	0.0	0.0	0.0	61.6	39.8	0.0	0.0	0.0	15.0	0.0	0.0	-38.4
33	708547.64	4943613.75	297.90	0	DEN	32	-68.1	23.3	0.0	0.0	0.0	71.1	0.0	-5.1	0.0	0.0	11.0	0.0	0.0	-121.9
33	708547.64	4943613.75	297.90	0	DEN	63	57.1	23.3	0.0	0.0	0.0	71.1	0.1	-5.1	0.0	0.0	11.9	0.0	0.0	2.3
33	708547.64	4943613.75	297.90	0	DEN	125	65.2	23.3	0.0	0.0	0.0	71.1	0.4	5.3	0.0	0.0	3.0	0.0	0.0	8.7
33	708547.64	4943613.75	297.90	0	DEN	250	68.7	23.3	0.0	0.0	0.0	71.1	1.1	0.6	0.0	0.0	9.6	0.0	0.0	9.7
33	708547.64	4943613.75	297.90	0	DEN	500	71.1	23.3	0.0	0.0	0.0	71.1	2.0	-1.0	0.0	0.0	13.5	0.0	0.0	8.9
33	708547.64	4943613.75	297.90	0	DEN	1000	71.3	23.3	0.0	0.0	0.0	71.1	3.7	-1.0	0.0	0.0	16.2	0.0	0.0	4.7
33	708547.64	4943613.75	297.90	0	DEN	2000	70.5	23.3	0.0	0.0	0.0	71.1	9.8	-1.0	0.0	0.0	19.0	0.0	0.0	-5.0
33	708547.64	4943613.75	297.90	0	DEN	4000	68.3	23.3	0.0	0.0	0.0	71.1	33.2	-1.0	0.0	0.0	21.9	0.0	0.0	-33.6
33	708547.64	4943613.75	297.90	0	DEN	8000	62.2	23.3	0.0	0.0	0.0	71.1	118.5	-1.0	0.0	0.0	24.8	0.0	0.0	-127.9
62	708676.88	4943503.54	297.40	0	DEN	32	-68.1	20.4	0.0	0.0	0.0	72.1	0.0	-5.5	0.0	0.0	10.3	0.0	0.0	-124.7
62	708676.88	4943503.54	297.40	0	DEN	63	57.1	20.4	0.0	0.0	0.0	72.1	0.1	-5.5	0.0	0.0	10.4	0.0	0.0	0.3
62	708676.88	4943503.54	297.40	0	DEN	125	65.2	20.4	0.0	0.0	0.0	72.1	0.5	1.9	0.0	0.0	3.2	0.0	0.0	7.9
62	708676.88	4943503.54	297.40	0	DEN	250	68.7	20.4	0.0	0.0	0.0	72.1	1.2	-0.6	0.0	0.0	5.9	0.0	0.0	10.5
62	708676.88	4943503.54	297.40	0	DEN	500	71.1	20.4	0.0	0.0	0.0	72.1	2.2	-2.0	0.0	0.0	7.7	0.0	0.0	11.4
62	708676.88	4943503.54	297.40	0	DEN	1000	71.3	20.4	0.0	0.0	0.0	72.1	4.2	-2.0	0.0	0.0	8.5	0.0	0.0	8.8
62	708676.88	4943503.54	297.40	0	DEN	2000	70.5	20.4	0.0	0.0	0.0	72.1	11.0	-2.0	0.0	0.0	9.8	0.0	0.0	-0.1
62	708676.88	4943503.54	297.40	0	DEN	4000	68.3	20.4	0.0	0.0	0.0	72.1	37.4	-2.0	0.0	0.0	11.5	0.0	0.0	-30.4
62	708676.88	4943503.54	297.40	0	DEN	8000	62.2	20.4	0.0	0.0	0.0	72.1	133.3	-2.0	0.0	0.0	13.8	0.0	0.0	-134.7
84	708606.35	4943515.34	297.40	0	DEN	32	-68.1	15.4	0.0	0.0	0.0	71.6	0.0	-5.4	0.0	0.0	10.7	0.0	0.0	-129.6
84	708606.35	4943515.34	297.40	0	DEN	63	57.1	15.4	0.0	0.0	0.0	71.6	0.1	-5.4	0.0	0.0	11.1	0.0	0.0	-4.9
84	708606.35	4943515.34	297.40	0	DEN	125	65.2	15.4	0.0	0.0	0.0	71.6	0.4	5.3	0.0	0.0	1.2	0.0	0.0	2.1
84	708606.35	4943515.34	297.40	0	DEN	250	68.7	15.4	0.0	0.0	0.0	71.6	1.1	3.2	0.0	0.0	4.6	0.0	0.0	3.7
84	708606.35	4943515.34	297.40	0	DEN	500	71.1	15.4	0.0	0.0	0.0	71.6	2.1	-0.6	0.0	0.0	10.0	0.0	0.0	3.4
84	708606.35	4943515.34	297.40	0	DEN	1000	71.3	15.4	0.0	0.0	0.0	71.6	3.9	-1.1	0.0	0.0	12.8	0.0	0.0	-0.5
84	708606.35	4943515.34	297.40	0	DEN	2000	70.5	15.4	0.0	0.0	0.0	71.6	10.3	-1.1	0.0	0.0	15.3	0.0	0.0	-10.2
84	708606.35	4943515.34	297.40	0	DEN	4000	68.3	15.4	0.0	0.0	0.0	71.6	35.1	-1.1	0.0	0.0	18.1	0.0	0.0	-39.9
84	708606.35	4943515.34	297.40	0	DEN	8000	62.2	15.4	0.0	0.0	0.0	71.6	125.0	-1.1	0.0	0.0	21.0	0.0	0.0	-138.9
95	708481.59	4943722.50	300.40	0	DEN	32	-68.1	13.8	0.0	0.0	0.0	70.7	0.0	-4.3	0.0	0.0	9.1	0.0	0.0	-129.7
95	708481.59	4943722.50	300.40	0	DEN	63	57.1	13.8	0.0	0.0	0.0	70.7	0.1	-4.3	0.0	0.0	9.1	0.0	0.0	-4.6
95	708481.59	4943722.50	300.40	0	DEN	125	65.2	13.8	0.0	0.0	0.0	70.7	0.4	1.5	0.0	0.0	3.2	0.0	0.0	3.2
95	708481.59	4943722.50	300.40	0	DEN	250	68.7	13.8	0.0	0.0	0.0	70.7	1.0	-0.8	0.0	0.0	5.6	0.0	0.0	6.1
95	708481.59	4943722.50	300.40	0	DEN	500	71.1	13.8	0.0	0.0	0.0	70.7	1.9	-2.2	0.0	0.0	7.0	0.0	0.0	7.6
95	708481.59	4943722.50	300.40	0	DEN	1000	71.3	13.8	0.0	0.0	0.0	70.7	3.5	-2.2	0.0	0.0	7.0	0.0	0.0	6.2
95	708481.59	4943722.50	300.40	0	DEN	2000	70.5	13.8	0.0	0.0	0.0	70.7	9.3	-2.2	0.0	0.0	7.0	0.0	0.0	-0.4
95	708481.59	4943722.50	300.40	0	DEN	4000	68.3	13.8	0.0	0.0	0.0	70.7	31.6	-2.2	0.0	0.0	7.0	0.0	0.0	-24.9
95	708481.59	4943722.50	300.40	0	DEN	8000	62.2	13.8	0.0	0.0	0.0	70.7	112.5	-2.2	0.0	0.0	7.0	0.0	0.0	-112.0
100	708499.93	4943718.50	299.40	0	DEN	32	-68.1	12.3	0.0	0.0	0.0	70.8	0.0	-4.5	0.0	0.0	9.3	0.0	0.0	-131.4
100	708499.93	4943718.50	299.40	0	DEN	63	57.1	12.3	0.0	0.0	0.0	70.8	0.1	-4.5	0.0	0.0	9.3	0.0	0.0	-6.3
100	708499.93	4943718.50	299.40	0	DEN	125	65.2	12.3	0.0	0.0	0.0	70.8	0.4	1.3	0.0	0.0	3.4	0.0	0.0	1.5
100	708499.93	4943718.50	299.40	0	DEN	250	68.7	12.3	0.0	0.0	0.0	70.8	1.0	-1.0	0.0	0.0	5.8	0.0	0.0	4.4
100	708499.93	4943718.50	299.40	0	DEN	500	71.1	12.3	0.0	0.0	0.0	70.8	1.9	-2.4	0.0	0.0	7.2	0.0	0.0	6.0
100	708499.93	4943718.50	299.40	0	DEN	1000	71.3	12.3	0.0	0.0	0.0	70.8	3.6	-2.4	0.0	0.0	7.2	0.0	0.0	4.5

Line Source, ISO 9613, Name: "Shipping Trucks", ID: "SHIP_TRK"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	l/a	Optime	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
100	708499.93	4943718.50	299.40	0	DEN	2000	70.5	12.3	0.0	0.0	0.0	70.8	9.5	-2.4	0.0	0.0	7.2	0.0	0.0	-2.2
100	708499.93	4943718.50	299.40	0	DEN	4000	68.3	12.3	0.0	0.0	0.0	70.8	32.1	-2.4	0.0	0.0	7.2	0.0	0.0	-27.1
100	708499.93	4943718.50	299.40	0	DEN	8000	62.2	12.3	0.0	0.0	0.0	70.8	114.6	-2.4	0.0	0.0	7.2	0.0	0.0	-115.7

Line Source, ISO 9613, Name: "Dimension stone trucks", ID: "DIM_TRK"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	l/a	Optime	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
75	707761.60	4943555.63	295.40	0	D	32	-79.4	20.2	0.0	0.0	0.0	58.1	0.0	-3.2	0.0	0.0	10.8	0.0	0.0	-124.8
75	707761.60	4943555.63	295.40	0	D	63	45.8	20.2	0.0	0.0	0.0	58.1	0.0	-3.2	0.0	0.0	12.5	0.0	0.0	-1.3
75	707761.60	4943555.63	295.40	0	D	125	53.9	20.2	0.0	0.0	0.0	58.1	0.1	4.8	0.0	0.0	6.6	0.0	0.0	4.6
75	707761.60	4943555.63	295.40	0	D	250	57.4	20.2	0.0	0.0	0.0	58.1	0.2	6.4	0.0	0.0	7.5	0.0	0.0	5.4
75	707761.60	4943555.63	295.40	0	D	500	59.8	20.2	0.0	0.0	0.0	58.1	0.4	1.0	0.0	0.0	15.7	0.0	0.0	4.9
75	707761.60	4943555.63	295.40	0	D	1000	60.0	20.2	0.0	0.0	0.0	58.1	0.8	0.0	0.0	0.0	19.5	0.0	0.0	1.8
75	707761.60	4943555.63	295.40	0	D	2000	59.2	20.2	0.0	0.0	0.0	58.1	2.2	0.0	0.0	0.0	20.0	0.0	0.0	-0.8
75	707761.60	4943555.63	295.40	0	D	4000	57.0	20.2	0.0	0.0	0.0	58.1	7.4	0.0	0.0	0.0	20.0	0.0	0.0	-8.2
75	707761.60	4943555.63	295.40	0	D	8000	50.9	20.2	0.0	0.0	0.0	58.1	26.4	0.0	0.0	0.0	20.0	0.0	0.0	-33.3
78	707801.87	4943479.93	295.40	0	D	32	-79.4	18.4	0.0	0.0	0.0	59.7	0.0	-3.7	0.0	0.0	9.7	0.0	0.0	-126.7
78	707801.87	4943479.93	295.40	0	D	63	45.8	18.4	0.0	0.0	0.0	59.7	0.0	-3.7	0.0	0.0	11.1	0.0	0.0	-2.9
78	707801.87	4943479.93	295.40	0	D	125	53.9	18.4	0.0	0.0	0.0	59.7	0.1	5.0	0.0	0.0	4.4	0.0	0.0	3.1
78	707801.87	4943479.93	295.40	0	D	250	57.4	18.4	0.0	0.0	0.0	59.7	0.3	6.5	0.0	0.0	5.1	0.0	0.0	4.2
78	707801.87	4943479.93	295.40	0	D	500	59.8	18.4	0.0	0.0	0.0	59.7	0.5	1.0	0.0	0.0	13.1	0.0	0.0	3.9
78	707801.87	4943479.93	295.40	0	D	1000	60.0	18.4	0.0	0.0	0.0	59.7	1.0	0.0	0.0	0.0	16.8	0.0	0.0	0.9
78	707801.87	4943479.93	295.40	0	D	2000	59.2	18.4	0.0	0.0	0.0	59.7	2.6	0.0	0.0	0.0	19.7	0.0	0.0	-4.4
78	707801.87	4943479.93	295.40	0	D	4000	57.0	18.4	0.0	0.0	0.0	59.7	8.9	0.0	0.0	0.0	20.0	0.0	0.0	-13.1
78	707801.87	4943479.93	295.40	0	D	8000	50.9	18.4	0.0	0.0	0.0	59.7	31.7	0.0	0.0	0.0	20.0	0.0	0.0	-42.1
102	707840.56	4943453.82	295.40	0	D	32	-79.4	15.1	0.0	0.0	0.0	61.0	0.0	-4.0	0.0	0.0	8.8	0.0	0.0	-130.1
102	707840.56	4943453.82	295.40	0	D	63	45.8	15.1	0.0	0.0	0.0	61.0	0.0	-4.0	0.0	0.0	9.6	0.0	0.0	-5.7
102	707840.56	4943453.82	295.40	0	D	125	53.9	15.1	0.0	0.0	0.0	61.0	0.1	5.3	0.0	0.0	2.1	0.0	0.0	0.6
102	707840.56	4943453.82	295.40	0	D	250	57.4	15.1	0.0	0.0	0.0	61.0	0.3	6.5	0.0	0.0	2.5	0.0	0.0	2.2
102	707840.56	4943453.82	295.40	0	D	500	59.8	15.1	0.0	0.0	0.0	61.0	0.6	1.0	0.0	0.0	10.1	0.0	0.0	2.3
102	707840.56	4943453.82	295.40	0	D	1000	60.0	15.1	0.0	0.0	0.0	61.0	1.2	0.0	0.0	0.0	13.5	0.0	0.0	-0.5
102	707840.56	4943453.82	295.40	0	D	2000	59.2	15.1	0.0	0.0	0.0	61.0	3.0	0.0	0.0	0.0	16.3	0.0	0.0	-6.0
102	707840.56	4943453.82	295.40	0	D	4000	57.0	15.1	0.0	0.0	0.0	61.0	10.3	0.0	0.0	0.0	19.1	0.0	0.0	-18.3
102	707840.56	4943453.82	295.40	0	D	8000	50.9	15.1	0.0	0.0	0.0	61.0	36.8	0.0	0.0	0.0	19.9	0.0	0.0	-51.7

APPENDIX B

CURRICULUM VITAE

JOHN EMELJANOW, P.Eng.

Principal Acoustical Engineer

Mr. Emeljanow (John) has been employed with Valcoustics Canada Ltd. for over 27 years. He is a Principal Engineer, a Designated Consulting Engineer with the Professional Engineers of Ontario, a graduate of the Ministry of the Environment's Acoustics Technology in Land Use Planning Course and has given evidence as an expert witness before the Ontario Municipal Board, dealing with environmental acoustics issues in land use planning. John has acted as project manager on a number of major architectural and environmental projects. His responsibilities include noise/vibration measurement, analysis, design computations, and report preparation. In addition, John was an active contributor to the acoustics section of the Architectural Design Standards for Ontario Courthouses prepared for the Ministry of the Attorney General.

EXPERIENCE:

Architectural acoustics involving the interaction of sound and architectural elements within a space to obtain the desired acoustical environment. This involves control of reverberation, ambient sound level, location of sound absorbing and sound reflecting surfaces as well as isolation of sound to and from adjacent spaces. Representative projects are: Niagara Convention Centre; Durham Consolidated Courthouse; Brampton Consolidated Courthouses; Upper Canada College Expansion, Toronto; Toronto Stock Exchange Renovations (The Design Exchange); Sunnybrook Health Science Centre Expansion and Renovation, Toronto; Metro Convention Centre Expansion, Toronto; Canary Wharf (DS5), London; Sudbury Regional Hospital; and GTAA Infield Development, Mississauga.

Environmental noise and vibration studies to determine impact of ground and air transportation and stationary sources of sound on adjacent land use, both existing and proposed, as well as selection and analysis of noise mitigation measures, including sound barriers, architectural elements, and operational techniques. Projects are prepared for private and government sectors, involving residential, industrial and commercial development. Representative projects include: Walker Brothers Quarry, Thorold; Keele Valley Landfill Vertical Expansion, Maple; Canadian National Railway Lands Redevelopment, Toronto; The Woodbridge Expansion Area, Vaughan; Rimply Manufacturing Plant, Newmarket; Honda Canada Manufacturing Minivan Plant, Alliston; Sheppard Subway, Toronto; and Highway 11, Burk's Falls to Powassin.

Mechanical system noise and vibration analyses to control the impact of air-borne and structure-borne sound from mechanical equipment on adjacent spaces through the design of demising surfaces, as well as the control of noise generated and transmitted through HVAC systems. Representative projects include: the New Princess Margaret Hospital, Toronto; National Trade Centre, Toronto; IBM Facility for Software Development, Markham; Niagara College – Glendale Campus, Niagara Falls; The American School, Shanghai; Guelph General Hospital; and Xiamen Conference Centre, China.

EDUCATION:

B.Eng.
McMaster University, June 1989, Mechanical Engineering

Course on Noise Control in Land Use Planning; Ministry of the Environment and Energy, Toronto, June 1989

PROFESSIONAL AFFILIATION:

Registered Professional Engineer, Professional Engineers of Ontario
Designated Consulting Engineer, Professional Engineers of Ontario

PUBLICATIONS & PRESENTATIONS:

- "A Technique for Comparing Alternative Transportation Corridor Alignments Based on Noise Impact", presented at Inter-Noise 92, Toronto, Ontario, July 1992.
- "Environmental Noise Aspects of Landfill Site Selection", Canadian Acoustics, Vol. 21, No. 3, September 1993.
- "Acoustical Challenge of Quarry Design", Canadian Acoustics, Vol. 22, No. 3, September 1994.
- "NPC-300 Environmental Noise Guideline – Stationary and Transportation Sources – Approval and Planning", Seminar for Municipalities, December 9, 2013 (co-presenter).
- "Environmental Acoustics in Land Use Planning", Seminar in Acoustics for the City of Mississauga, June 24-26, 2014 (co-presenter).
- "Environmental Acoustics in Land Use Planning", Seminar in Acoustics for the City of London, July 9-11, 2014 (co-presenter).
- "Workshop: Noise and Vibration for New Development in Proximity to Railway Operations", Prepared for the FCM-RAC Proximity Steering Committee, June 26, 2015 (co-presenter).

APPENDIX C

NOISE MITIGATION PRODUCTS

Atlas Copco Surface Drill Rigs

SmartRig™ ROC D7C, D9C and F9C

Smart up your drilling business

SmartRig ROC D7C hole range 64 – 115 mm (2½ – 4½″)
SmartRig ROC D9C hole range 76 – 115 mm (3 – 4½″)
SmartRig ROC F9C hole range 89 – 127 mm (3½ – 5″)

Atlas Copco

Drill smarter
with SmartRig

Thanks to the SmartRig™ from Atlas Copco you can now drill smarter holes. Each hole you drill saves you time and earns you money.

With its high shift capacity, low energy consumption and innovative modules that improve productivity, we can safely say that SmartRig is a ground-breaking rig. The options available make it one of the quietest running rigs of its kind, with greatly reduced setup time and efficient high precision drilling – under any conditions.

The unique SmartRig features all add up to a set of tools that enable you to optimize operations, to maintain your competitive edge and maximize profitability. Smarter drilling with SmartRig.

SmartRig gives you:

- High productivity
- Outstanding safety & ergonomics
- Environmental friendliness
- Excellent documentation of the work progress

Silenced
The Silenced SmartRig's noise level is approximately 10 dB (A) below that of other rigs on the market, making it one of the world's quietest running rigs.

ROC Manager
Planning & analysis of drilling and blasting. Design drill patterns, log deviation data and analyse MWD (Measure While Drilling) results.

Hole navigation
For high precision drilling, fast set-up, monitoring, project integration and control.

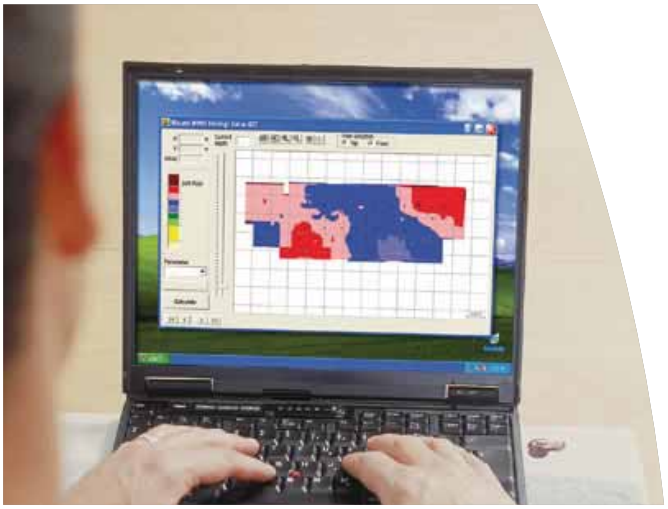
SMARTRIG™

SmartRig modules

Hole navigation for accuracy, fast set-up and high precision drilling

The **Hole Navigation System** adds a new dimension to the extensive automation already available on a SmartRig to complete pre-planned drill patterns after initial set-up. All drilling functions are monitored and controlled to provide a record of hole alignment, burden and spacing. Drill rig operations can also be integrated with other equipment such as dozers, dumpers and graders, using the same set-out input data on a common computer system used at the project site.

The precision of the navigation system optimizes drilling and blasting results, improves fragmentation and decreases the amount of explosives needed, substantially lowering your overall production costs. By using hole navigation, you will also profit from reduced setup time and efficient high precision drilling – under any weather conditions. The net result is a significant increase in rig utilization and substantial savings in both time and money.



Outstanding planning and control with ROC Manager

The **ROC Manager** is, together with the **Hole Navigation System** (HNS), simply put, your best friend when it comes to planning and control of the drilling and blasting operations. ROC Manager runs on a standard PC and can be used to consolidate data about multiple rigs at multiple sites. You can use ROC Manager to design drill patterns and analyze drilling results.

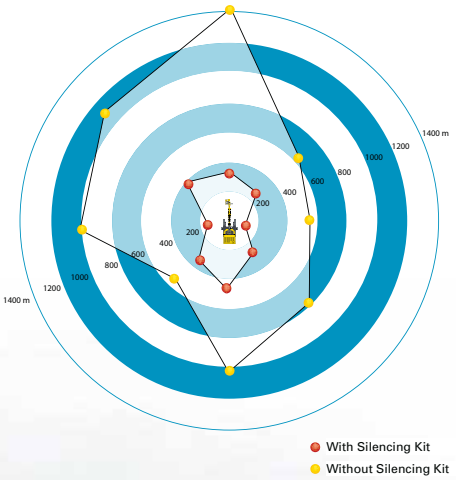
Reduced set-up time and increased efficiency with Automatic Feed Alignment & Rod Adding System

SmartRig's **Automatic Feed Alignment** reduces set-up time and cancels out operator error by setting the feed to predefined angles at the touch of a button. The **Automatic Rod Adding System** enables the operator to drill automatically to a given depth, while carrying out other duties such as maintenance checks or grinding bits. The net result is a significant increase – about 10-15 % – in rig utilization. Operation is easy and setup time is reduced.

The rig can be equipped with a laser plane receiver that gives you an accurate reference height. All holes can then be drilled to exactly the same depth. There is no need for sight rods or manual marking of bench heights. The advantages of accurately drilling all holes to the same depth are considerable. Overdrilling is not necessary and the costs for secondary breaking, crushing, loading and haulage are considerably reduced.

Drill anywhere at anytime with the Silenced SmartRig

With a noise level approximately 10 dB (A) below that of other rigs on the market, the **Silenced SmartRig** is one of the worlds quietest running rigs. A perfect choice for civil engineering work sites in restricted urban areas. The advanced silencing system consists of several components which work to reduce the overall noise level. The Silenced version is available for SmartRig ROC D7C and D9C.



Noise level with and without Silencer
The noise mat shows the breakthrough difference of sound level with and without Silencer, and shows that the Silenced SmartRig can work up to 1 km nearer to settlements and buildings. The reference sound level is 55 dB (A). This is a common max sound level (in northern Europe) when drilling close to urban areas. The area should be used as an indication only.

More ground-breaking features ahead

At Atlas Copco, we are continuously innovating to improve your productivity. More additional options to the SmartRig will be available in the future. Keep ahead of the competition with SmartRig.

No matter how you finally decide to equip your SmartRig, every SmartRig delivered from us at Atlas Copco comes with highly intelligent standard equipment. Innovative equipment that has been developed with a focus on improving productivity.

More power with less fuel

The SmartRig delivers the exact right amount of power for each phase of the drilling operation from its new Stage 3/Tier III engine. This makes it possible to reduce fuel consumption by up to 30 % compared to similar rigs on the market.

Increased drilling efficiency

Using the SmartRig **Rock Drill Control System**, the service life length of drilling consumables, such as the shank adapter and drill steel, increases by more than 20 per cent. The system works by adjusting drilling power to suit the ground conditions, with the three vital control parameters being rotation pressure, drill dampening pressure and penetration rate.

The latter two are factory-set as default values according to the basic rock types: hard, medium or soft. For harder rock, the power is increased automatically. If voids are encountered, the speed is automatically reduced. For softer rock, different levels of control pressures are set. In addition to better economy in consumables, the risk of drill strings getting stuck in blast holes is reduced, resulting in increased rig availability and overall drilling productivity.

Superb operator ergonomics and safety

With the SmartRig control system, electrical signals are generated to control the hydraulic valves. This introduces the concept of a “dry cab”, with no hydraulic pipe work and gauges, considerably reducing both the noise for the operator and the risk of oil leakage. Control gauges and instruments are replaced by a display unit. This releases space in the cab, increases visibility, and improves operator ergonomics.

Easy maintenance & environmentally friendly

With 30 % less hoses and hose meters there is less need for maintenance and less risk of spillage, making the SmartRig environmentally friendly. Service is trouble-free with easy fault finding and self diagnostics.

The SmartRig™ family

The SmartRig comes in three different power classes; all with their unique characteristics, but all featuring the intelligence and efficiency of the SmartRig concept. Contact your local Atlas Copco dealer now for a smarter drilling business.

SmartRig ROC D7C

A crawler rig with power, flexibility and excellent rough terrain capabilities. Characteristics that elevate surface drilling to impressive new levels of quality, productivity and cost effectiveness. Ideal for construction and quarrying.

SmartRig ROC D9C

All the advantages of the SmartRig ROC D7C, but with a more powerful rock drill and more flushing air. A perfect choice when taking assignments focused on high productivity.

SmartRig ROC F9C

A powerful tophammer rig with SmartRig intelligence. Its top-of-the-range power and remarkable versatility make the SmartRig ROC F9C ideal for large-scale quarries and construction work.

Quick facts SmartRig ROC D7C, D9C and F9C

Main application area:	☐ DIMENSION STONE INDUSTRY	☒ CONSTRUCTION	☒ AGGREGATE QUARRIES
	☒ LIMESTONE QUARRIES *(mainly ROC F9C)*	☐ SELECTIVE MINING	☐ OPEN PIT MINING
Drilling method:	☒ TOPHAMMER	☐ DOWN-THE-HOLE	☐ COPROD
Rock drill:	ROC D7C COP 1840	ROC D9C COP 2560	ROC F9C COP 2560
Drill steel:	ROC D7C T38, T45, T51	ROC D9C T45, T51	ROC F9C T45, T51
Hole diameter:	64 mm (2½ ") – ROC D7C – 115 mm (4½")	76 mm (3 ") – ROC D9C – 115 mm (4½")	89 mm (3½") – ROC F9C – 127 mm (5")
Maximum hole depth:	28 m (92')		
Engine power: rating at 2200 rpm (rpm varies for different type of rigs)	ROC D7C 168 kW (225 HP)	ROC D9C 168 kW (225 HP)	ROC F9C 224 kW (300 HP)
Rock drill power output:	ROC D7C 20 kW (26,8 HP)	ROC D9C 25 kW (33,5 HP)	ROC F9C 25 kW (33,5 HP)

9851 2425 01c 0808 Örebro, Sweden

Atlas Copco

www.atlascopco.com