ENVIRONMENTAL NOISE IMPACT STUDY

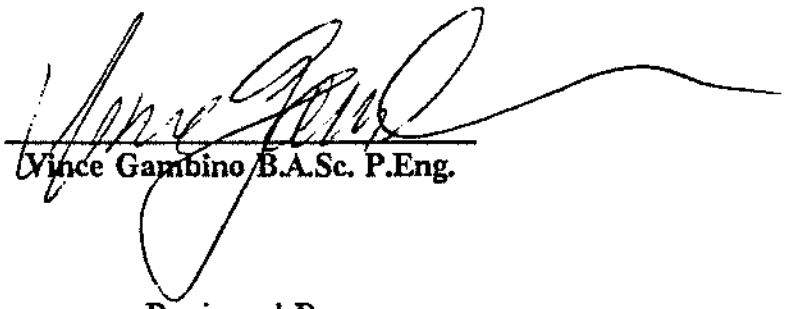
GRAVEL PIT, ORO

COUNTY OF SIMCOE

Prepared for:

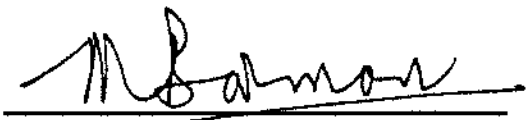
JAMES DICK CONSTRUCTION LIMITED

Prepared By:



Vince Gambino B.A.Sc. P.Eng.

Reviewed By:



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May 23, 1991

EXECUTIVE SUMMARY

This study addresses the noise impact of the proposed James Dick Construction gravel pit expansion in the Township of Oro on the surrounding community.

The applicable MOE guidelines, NPC-131 and NPC-132 have been used in the preparation of this report, and the resultant sound level limit of 44.5 dBA was established for the subject area which has been addressed as acoustically rural.

In order to assess the noise impact of the proposed pit, it was necessary to observe work pattern and equipment operation procedures at the Mara Quarry in Gamebridge, Ontario which is operated by James Dick Construction Limited. Operation during both pit start up and operation at the extraction limits were modelled at the designated critical points of reception. The noise assessment used in this study is based on a worst case scenario as determined by observations as well as discussions with representatives from James Dick Construction Limited. Consideration in this report has been given to both off site truck traffic (NPC-131) and on site equipment (NPC-132).

The preliminary drawings for the proposed pit which include provisions for a 1.8m high berm and a 15m tree screen results in a gravel pit operation noise impact of up to 49.5 dBA at the critical receptors. Therefore, an approximate 5 dB reduction in levels is required in order to achieve levels that are within acceptable limits as defined by MOE. Similarly, a 4 dB excess was calculated for off site truck traffic noise at the nearest point of reception.

The levels can be reduced down to acceptable levels by incorporating a 6m berm for mitigating both off site truck traffic noise and on site equipment noise. In addition, pit access road modifications and restrictions on front and loader operation within 100m of the extraction limits at the critical reception points are required in order to reduce levels to the acceptable limits as identified in this study. At source noise control in the form of partial enclosures and/or 'in-ground' operation have been further recommended for processing equipment in order to limit the noise impact to acceptable levels. A tree screen has not been recommended since its effectiveness is limited for depths which are less than 30m and for the type which seasonally loses its foliage.

With the recommendations listed, the proposed gravel pit can operate within acceptable limits as defined by publications NPC-131 and 132 as issued by MOE.

TABLE OF CONTENTS

1.0 INTRODUCTION

Barman Swallow Associates has been retained by James Dick Construction Limited to carry out an environmental noise study for the subject gravel pit in the Township of Oro, County of Simcoe.

The purpose of this noise study is to address the noise impact of the proposed gravel pit on the neighbouring residences. The gravel pit is to be located at the west 1/2 Lot 7, 8 and 9, Concession 7. A key plan is given in Figure 1 and the gravel pit layout is shown in Figure 2.

Figure 2 also shows the identified receptor locations (ie. A, B and C). The nearest residence A, is located approximately 60m from the limits of extraction of the current pit and about 60m from the site access road on the east side. There is also a residence located east of Concession 7 and about 175m from the extraction limits of the current pit. Receptor C is the nearest receptor to the proposed pit expansion area. This receptor is located about 75 m from the extraction limits and about 1200m from the designated material processing area.

1.1 BACKGROUND INFORMATION

The background information for this gravel pit is based on reference 1, (application for zoning amendment document issued by Keewatin-Aski Ltd.) as well as observations of material processing activities at the Mara Quarry in Gamebridge, Ontario which is also operated by James Dick Construction. The sequence of extraction operation of the proposed pit is shown in Figure 3. Other information pertaining to the pit is as follows:

1. The proposed gravel pit hours of operation are from 0600 to 1800 hours from Monday to Thursday and from 6am to 5pm on Fridays. There is no proposed weekend operation.

2. The gravel pit will be opened as shown in Figure 3 and material extraction will proceed to a depth of 30m below grade level at the pit start up location. Extraction will then proceed towards the southwest and eastward as shown in Figure 3.

3. The quarry operation will entail the use of up to 20 dump truck deliveries per hour during peak periods of operation (i.e. 40 truck passbys per hour worst case along the site access road). This is based on annual expectations of 30,000 trucks at about 30 tons per truck and is subject to economic conditions.

4. The operation will entail the use of the following material handling equipment:

- 2 primary crushers
- 2 screening plants
- vibratory feeders
- idling trucks
- front end loaders

5. It is understood there will be no blasting at the site.

6. The existing noise environment consists of occasional road traffic on Concession 7 as well as noise from current material processing and associated truck traffic from other pits in the area; however, the pre-existing noise environment is dominated by sounds of nature. The lowest background sound level (i.e. 1 hour L90) measured over a 100 hour period was 34.5 dBA (i.e. a level of 34.5 dBA is exceeded 90% of the time). The background sound level monitoring data is shown in Appendix A.

2.0 CRITERIA AND GUIDELINES

The noise impact methodology in this study is based on MOE publications, NPC-131 (off site truck traffic), NPC-132 and NPC-133 (stationary sources) as defined in the 'Model Municipal Noise Control Bylaw' issued by MOE. Specifically, publication NPC-132 addresses the noise impact due to stationary noise operation in a predominantly rural area. This guideline indicates that noise from a stationary source, as quantified by the predicted 1 hour LEQ, shall not, in any hour of operation, exceed the existing one hour ninetieth percentile sound level, L90, of natural sounds of the environment by more than 10 dB at a given point of reception(i.e. defined as within 30m of the nearest dwelling or camp area).

2.1 STATIONARY SOURCES

A Larson Davis LD700 programmable noise monitor was mounted in order to obtain a representation of background sound levels in the subject area. The monitor was placed in a quiet area about 1.5 km south of the pit which was far removed from any of the current material processing activities in the area. The monitoring period ranged from December 21 to December 24, 1990 during which time pit activity was minimal (non-existent in most cases) in the area. In addition, the data was obtained under acceptable weather and instrumentation conditions as defined by MOE in their publication, NPC-103. The sound level data, as shown in Appendix A indicates a lowest 1 hour L90 of 34.5 dBA; hence the applicable sound level limit for the project is 44.5 dBA.

2.2 OFF SITE TRUCK TRAFFIC

It should also be stated that truck traffic to and from the pit along the site access road shall meet the limits outlined on NPC-131. In general, noise from truck traffic shall not exceed a 1 hour LEQ 55 dBA as per NPC-131.

3.0 NOISE LEVEL PREDICTION

3.1 UNATTENUATED NOISE IMPACT

The general operation of the proposed gravel pit is discussed in Section 1.1. Equipment duty cycles are listed in Table 1 along with noise level estimates as obtained from measurements and information in the Barman Swallow Associates database. A source height estimate and an equipment duty cycle assignment (based on experience and observation) is also indicated. The latter quantity refers to the equipment use as a percentage of time at full throttle, typical driveby operation and idle conditions. A profile of the front end loader working patterns is shown in Figure 5a. Additional background information on equipment handling procedures and pit operation sequences is continued in Appendix B. It should be stated that the estimated effective source height is about 3.0m for the overall pit operation. Similarly, the receptor height chosen is 1.5m. From this information, the source to receptor geometry can be established in order to facilitate noise level calculations.

The predicted noise impact (unattenuated for the pit configuration shown in the drawings) at the identified critical points of reception A, B and C is listed in Table 2. The predicted level takes into consideration that the sound from a stationary point noise source spreads spherically and attenuates at a rate of 6dB per doubling of distance. Further, excess attenuation from barriers (Fresnel number calculated at 250 Hz), ground effect, vegetation screens and air absorption may result in additional sound reduction, over and above the 6dB per doubling of distance.

It should also be noted that the overall levels are subject to variation due to atmospheric effects such as wind or temperature inversion; whereby levels would increase for a downwind receptor and similarly decrease for an upwind receptor.

Noise predictions have been made for both the pit opening (see Figure 3) and material extraction procedures at the proposed extraction limits in order to address the worst case noise impact from gravel pit operation. Sample calculations as well as additional information on the methodology used is included in Appendix C. It should be noted that the noise impact includes back-up beeper and tail gate banging events (corrected as per MOE adjustments pertaining to tonality and quasi-steady impulse noise); however, due to the short duration of these specific noise events, the resultant 1 hour LEQ is not significantly affected.

Noise levels from operation during pit start-up range from 40 to 49 dBA at the critical points of reception, which are above the guidelines. For material extraction at the proposed limits (about 30m below grade), levels are also as high as 5 dB above the applicable Ministry Guidelines at the critical receptor locations. It should be noted that these unmitigated levels are anticipated with the noise control measures shown in the preliminary drawings by James Dick Construction and Keewatin-Aski Limited. These unmitigated levels account for the attenuation from the proposed 1.8m perimeter berm and 15m tree screen combined, as well as any other existing vegetation in the area.

In order to meet the sound level limit of 44.5 dBA as outlined in this study an additional 5 dB insertion loss (minimum) is required at the start-up. Such a reduction would also ensure that the limits are satisfied for material handling activities at the extraction limits. It will be necessary to employ noise control in the form of a property-perimeter wraparound berm as well as proximity limitations on the use of material handling by front end loaders with respect to the critical receptor locations.

In addition, Table 2a shows that noise levels from off site truck traffic associated with the gravel pit are slightly above the NPC-131 limits for a maximum total of 40 truck passbys per hour at location A. The truck traffic entering and exiting the pit entrance is shown in Figure 5b. The resultant level at the critical receptor A is 59 dBA which is 4 dB above acceptable limits as defined in NPC-131. Typical hourly volumes of 24 to 28 truck passbys would normally be expected. The typical 1 hour LEQ would be 1 dB lower, ie., 58 dBA at receptor A.

3.2 ATTENUATED NOISE IMPACT AT CRITICAL POINT OF RECEPTION

It has been identified above that the worst case noise impact occurs at location A for material extraction operation at the property limits. In order to effectively mitigate these levels, it is necessary to incorporate a higher berm than that originally proposed. It is also necessary to limit the extent of equipment use near the extraction limits. These measures are necessary in order to realize noise levels that are within acceptable limits as defined by MOE (ie., 44.5 dBA sound level limit).

The attenuated scenario includes the attenuation effects of a 6m berm as well as a limitation on the extent of front end loader operation at a distance of at least 100m from the extraction limits with respect to locations A, B and C. The attenuated noise impact is summarized in Tables 3a and 3b for each critical point of reception.

4.0 CONCLUSIONS

The conclusions in this study are as follows:

1. The residential areas of reception are classified to be acoustically rural.

2. The applicable sound level limit for this area as outlined by MOE publication NPC-132 is 44.5 dBA.

3. The unmitigated gravel pit as proposed results in a noise excess of 5 dB above the Ministry Guidelines. Therefore, additional mitigation to the originally proposed 1.8m berm/tree screen is required in order to realize acceptable noise levels.

4. Off site truck traffic on the concession road is up to 4 dB above the MOE guidelines as per NPC-131 at receptor A. Mitigation is therefore required in order to realize acceptable levels.

5.0 RECOMMENDATIONS

In order to meet the applicable Ministry Guidelines it is recommended to implement the following noise control concepts.

1. It is recommended to incorporate a 6m berm as shown in Figure 6 with 'wraparound' provisions made so as to limit noise flanking around the ends of the berm. A tree screen is not required since its noise mitigation effectiveness is limited for depths less than 30m.

2. It is recommended that crushing and screening operation shall be located as shown in the operational plan drawing dated December 6, 1990 (No. 2 of 6). This will minimize the extent of the noise impact from this equipment on the existing residences.

3. In order to meet the 44.5 dBA sound level limit, it is recommended to limit the number of front end loaders to a single unit for material extraction within 100m of the western boundary near receptor A, and within 100m of the east and west extraction limits with respect to location C. Associated truck traffic will be decreased accordingly in conjunction with the front end loader restrictions at the extraction limits as per Figure 6 and 7.

4. A 6m berm (no tree screen required) which has also been recommended to mitigate processing equipment noise (see item 1 in recommendations) near receptor A is required in order to realize noise levels from truck traffic in and out of the quarry that are within acceptable limits as defined by the MOE publication NPC-131 for peak volumes of 40 truck passbys (i.e. round trips) per hour. The pit haul route entrance is acceptable where indicated; however, lower levels will be realized if the road entrance is moved further north. In addition, the road should be kept in a well maintained condition (ie., smooth and free of pot holes and discontinuities) for at least 200m in order to reduce noise from tailgate banging.

   It should also be stated that when the mitigated noise levels from off site truck traffic are combined with the noise impact from stationary equipment, the resultant impact is below 55 dBA; hence, NPC-131 and NPC-132 are simultaneously satisfied.

5. It is recommended to place the crusher, screen and feeder operations underground in order to reduce noise levels. This noise control measure or equivalent at source mitigation (ie., local enclosures, etc.) should be designed so as to provide a minimum 5 dB insertion loss for processing equipment. A conceptual illustration is shown in Figure 7.

6. It is recommended that daily operation shall commence no earlier than 6am and shall not go beyond 7pm on any given day.

7. All equipment shall meet the NPC-115 requirement of 85 dBA at 15m at full throttle as measured according to SAE J88. The equipment manufacturer or consultant shall certify this by measurements that the equipment meets this condition.

8. At the end of the pit start up period, material extraction shall proceed at levels that are at least 25 to 30m below grade, as proposed, in order to realize acceptable noise levels.

9. Pit opening and material extraction shall proceed in accordance with the procedure and sequences shown in Figure 3 and outlined in Reference 1. Any changes in the procedures should be evaluated by the consultant.

10. Monitoring of noise levels during pit start-up should be performed in order to ensure that the sound level limits outlined in this study are satisfied.

6.0 REFERENCES

1. Keewatin-Aski Limited, 'Application for Zoning Amendment For West 1/2 Part Lots 7, 8 &9 Concession 7, Township of Oro', February 1991.

2. Ministry of the Environment - Ontario, 'Model Municipal Noise Control By-Law,' August, 1978

3. Beranek, Leo L., "Noise and Vibration Control", INCE, 1988 Edition.

TABLE 1 Equipment Noise Levels

Equipment	1 Reference Noise Levels (dBA at 15m)	Duty Cycle Max/Idle/Driveby (%)	Overall Level (dBA)	Estimated Source Height (m)
Crusher (2)	85/80	80/20/0	87	3.0
Screen Plant (2)	85/80	80/20/0	87	3.5
Loaders at limits(2)	85/70/80	20/15/65	84	3.0
Feeder and other equipment	86/75	80/20	85	3.5
Truck-full throttle (2)	85	5+	For	2.5
Truck-idle (2)	65	85+	80+ two	2.0
Truck-driveby (2)	80	10+	trucks	2.2

Notes
1. Duty Cycles based on observations at Mara Quarry (numbers shown represent maximum idle and driveby conditions where applicable.
2. See Figures 3 to 5 for work pattern descriptions.
3. Corrected for tonality (beepers) and quasi steady impulse (tailgate banging) where applicable
+ indicates duty cycles for truck operation.

TABLE 2a Unattenuated Noise Impact at Critical Points of Reception from Gravel Pit Operation (all in dBA)

Loc.	Condition	Source Levels Crusher(s)	Screen Plant(s)	Loaders	Feeder	Trucks	Total
A	Start-up	44	44	41	42	37	49
	limit	43	43	45	41	41	49.5
B	Start-up	36	36	33	34	29	42
	limit	42	42	39	40	35	47
C	Start-up	34	34	31	32	27	40
	limit	37	37	47	35	30	48

Note: See Figure 2 for identification of receptor locations

TABLE 2b Unattenuated Noise Impact (levels in dBA at 60m) From Truck Traffic Along Site Access Road (includes 1.8m berm + tree screen) at Receptor A.

Location	Number of Trucks Per Hour 10	20	30	40
60m from road	53	56	58	59

Note: see truck noise calculation worksheet in Appendix C

(sample printout from STAMSON 4.1)

TABLE 3a Attenuated Noise Impact At Critical Receptors

Loc.	Condition	Crusher(s)	Screen Plant(s)	Loaders	Feeder	Truck	Total
A.	Start-up	37	37	39	35	35	44
	Limit	37	37	40	35	36	44
B.	Start-up	33	33	35	31	31	40
	Limit	36	36	35	34	31	43
C.	Start-up	27	27	28	24	29	35
	Limit	31	31	42	29	29	43

Note: Includes mitigation as outlined in Section 5.0 of report (equipment restrictions, berm(s) and plant noise control)

TABLE 3b Attenuated Noise Impact (dBA at 60m) From Gravel Pit Truck Traffic at Receptor A

	Number of Trucks per hour			
Location	10	20	30	40
60m from road	49	52	53	54

Note: Includes effects of 6m berm near receptor A

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Description	Date

REVISIONS

CLIENT:
JAMES DICK CONSTRUCTION LIMITED

PROJECT:
GRAVEL PIT, ORO
PROPOSED EXPANSION

DRAWING:
KEY PLAN

SCALE: NTS
DATE: 28/3/91
DRAWN BY: VG
DRAWING NO.: FIG. 1

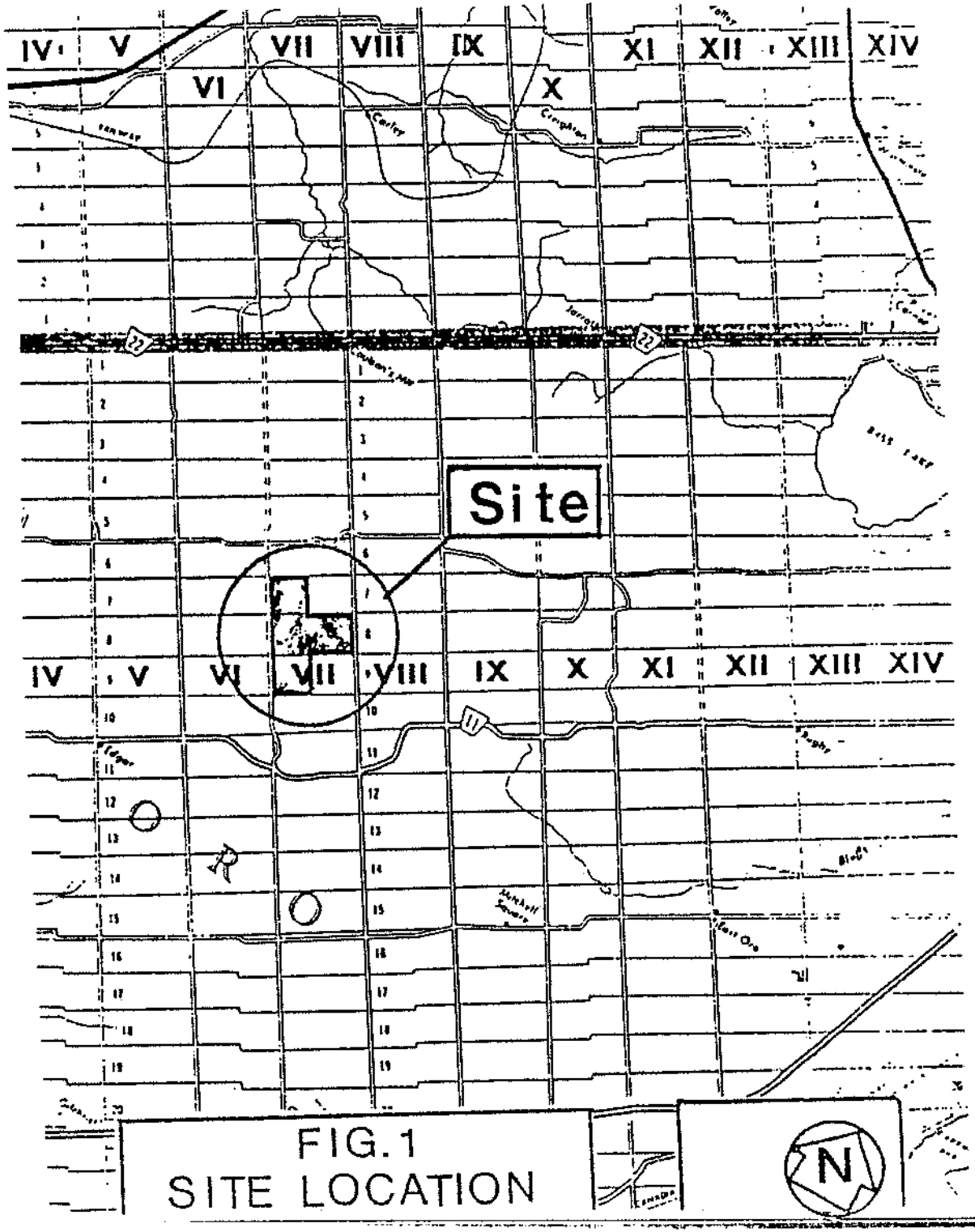
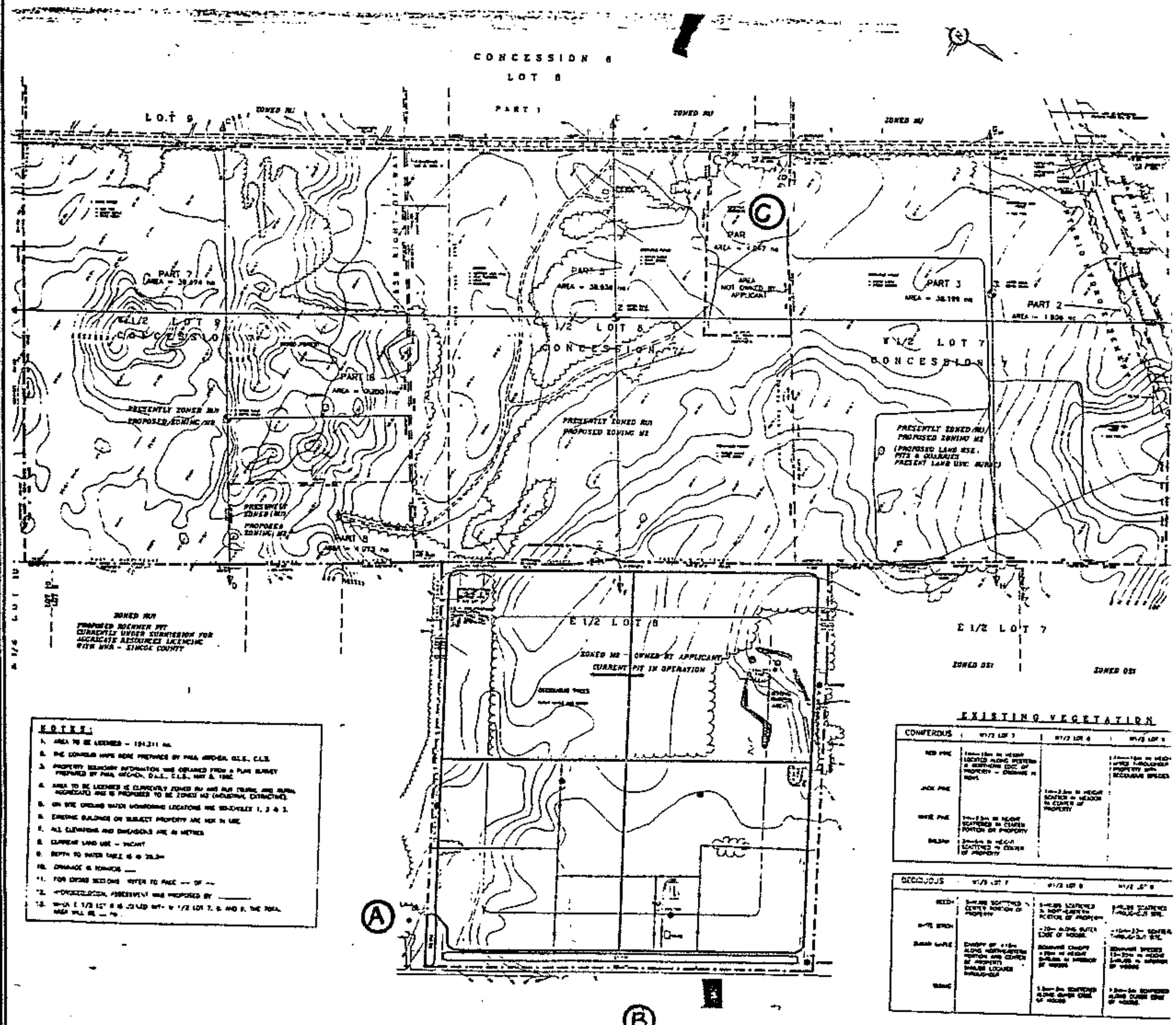


FIG. 1
SITE LOCATION



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Description	Date

REVISIONS

CLIENT:
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CONSTRUCTION
LIMITED

PROJECT:
GRAVEL PIT, ORO
PROPOSED EXPANSION

DRAWING:
SITE PLAN OF PIT
and IDENTIFICATION
of CRITICAL
RECEPTORS

SCALE: ~13000 : 1

DATE: 28/3/91

DRAWN BY: VG

DRAWING NO.: FIG. 2

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Description	Date

REVISIONS

CLIENT:
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CONSTRUCTION
LIMITED

PROJECT:
GRAVEL PIT,
ORO

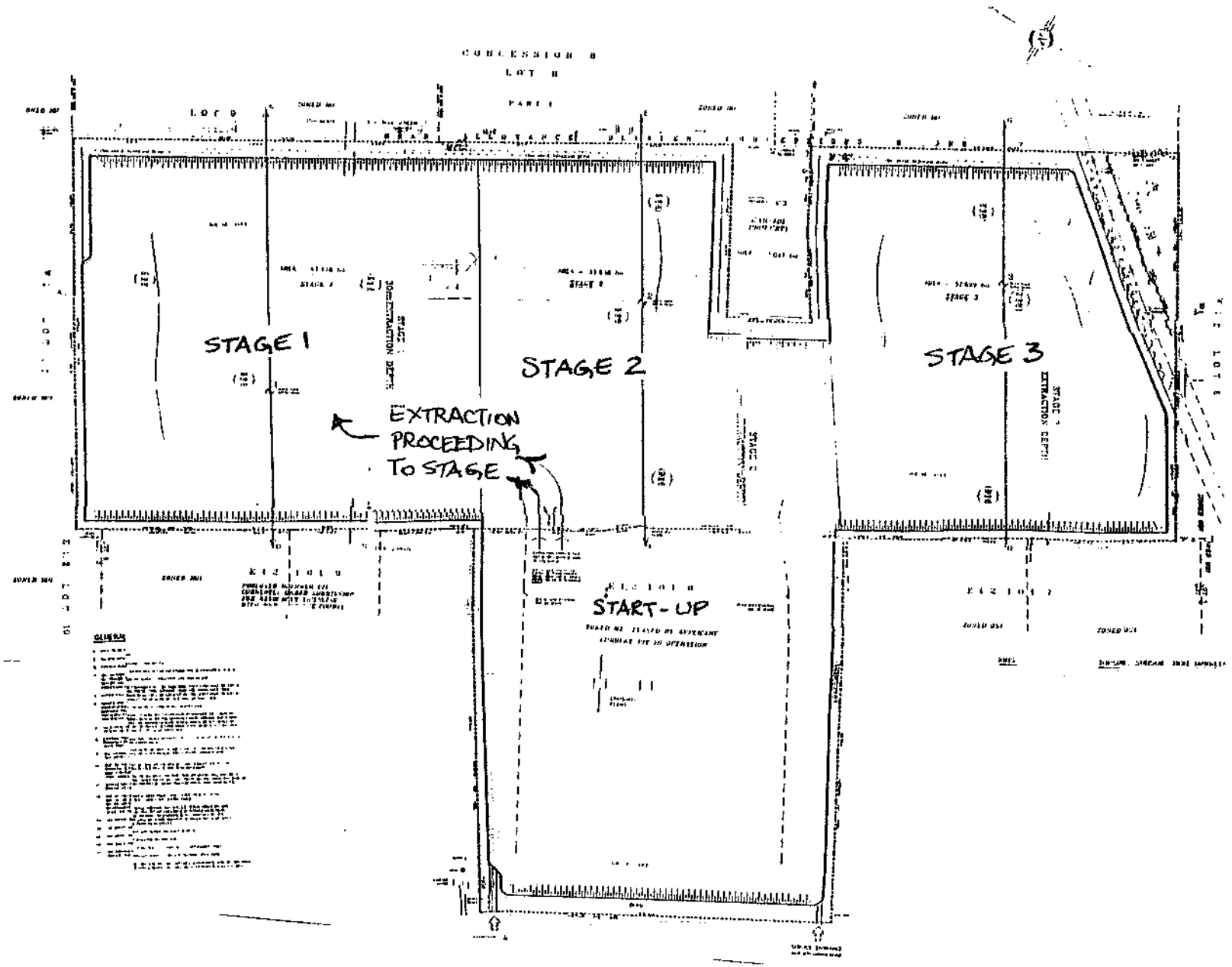
DRAWING:
SEQUENCE OF
GRAVEL PIT
EXTRACTION STAGES

SCALE: 10000:1

DATE: 28/3/91

DRAWN BY: VG

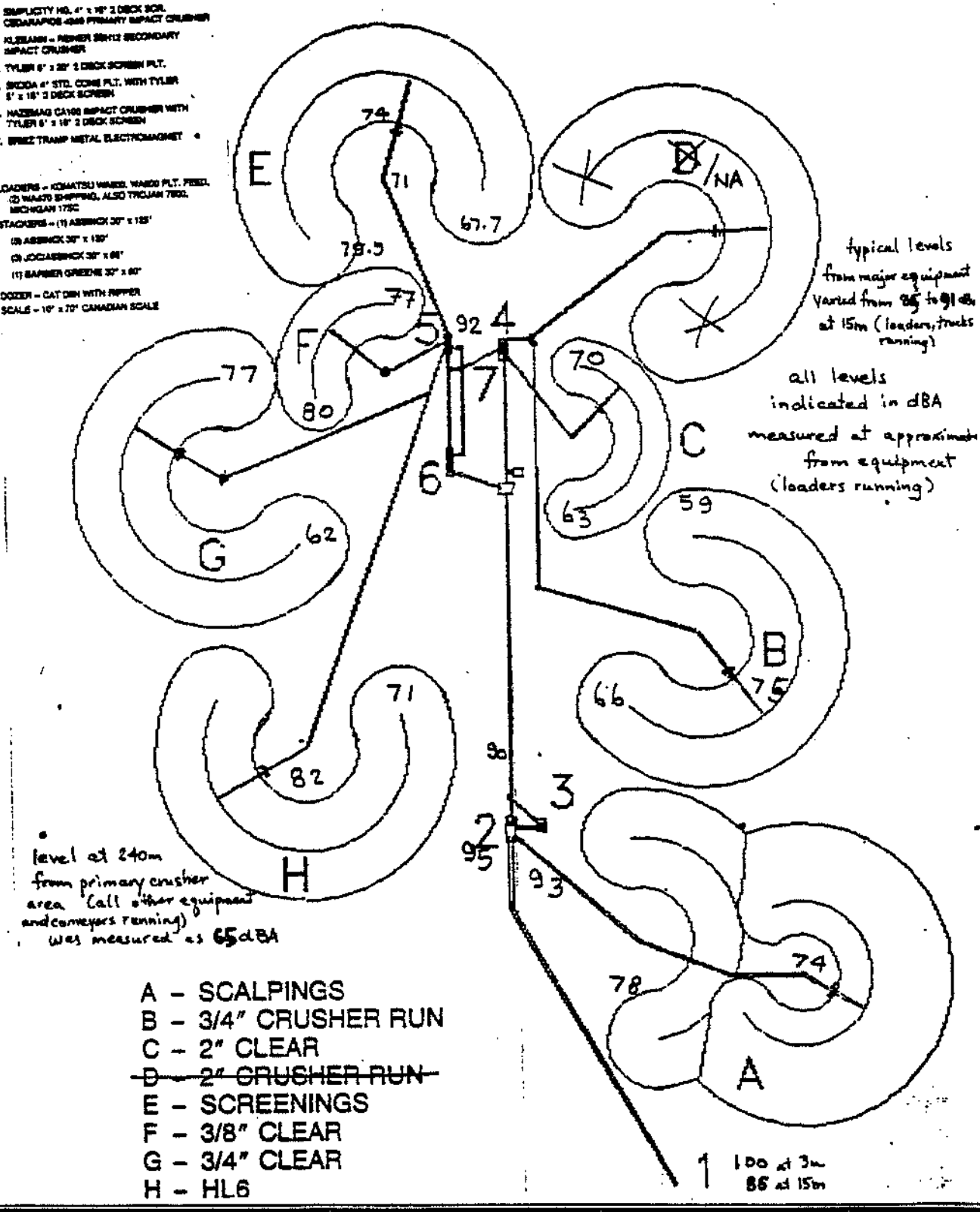
DRAWING NO: FIG 3



PLANT EQUIPMENT

1. CEDARAPIDS 40" x 89" VIBRATORY FDR.
2. SIMPLICITY HD, 4' x 16' 2 DECK SCR. CEDARAPIDS 4848 PRIMARY IMPACT CRUSHER
3. KLEEMANN – REMER SBH12 SECONDARY IMPACT CRUSHER
4. TYLER 6' x 20' 2 DECK SCREEN PLT.
5. SKODA 4' STD. CONE PLT. WITH TYLER 5' x 16' 2 DECK SCREEN
6. NAZEMAG CA166 IMPACT CRUSHER WITH TYLER 6' x 16' 2 DECK SCREEN
7. BRIEZ TRAMP METAL ELECTROMAGNET

LOADERS – KOMATSU WA600, WA600 PLT. FEED, (2) WA470 SHIPPING, ALSO TROJAN 7800, MICHIGAN 175C
STACKERS – (1) ABBRICK 30" x 135'
(3) ABBRICK 30" x 135'
(3) JOCIABRICK 30" x 66'
(1) BARBER GREENE 30" x 60'
DOZER – CAT D8N WITH RIPPER
SCALE – 10' x 70' CANADIAN SCALE



typical levels from major equipment varied from 85 to 91 dBA at 15m (loaders, trucks running)

all levels indicated in dBA measured at approximate from equipment (loaders running)

level at 240m from primary crusher area (all other equipment and conveyors running) was measured as 65 dBA

A – SCALPINGS
B – 3/4" CRUSHER RUN
C – 2" CLEAR
~~D – 2" CRUSHER RUN~~
E – SCREENINGS
F – 3/8" CLEAR
G – 3/4" CLEAR
H – HL6

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Description	Date

CLIENT: JAMES DICK CONSTRUCTION LIMITED

DRAWING: NOISE LEVELS MEASURED NEAR CRUSHING, PROCESSING, EQUIPMENT

PROJECT: PROPOSED EXPANSION

SCALE: 3200:1

DATE: 28/3/91

DRAWN BY: VG.

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Description	Date

REVISIONS

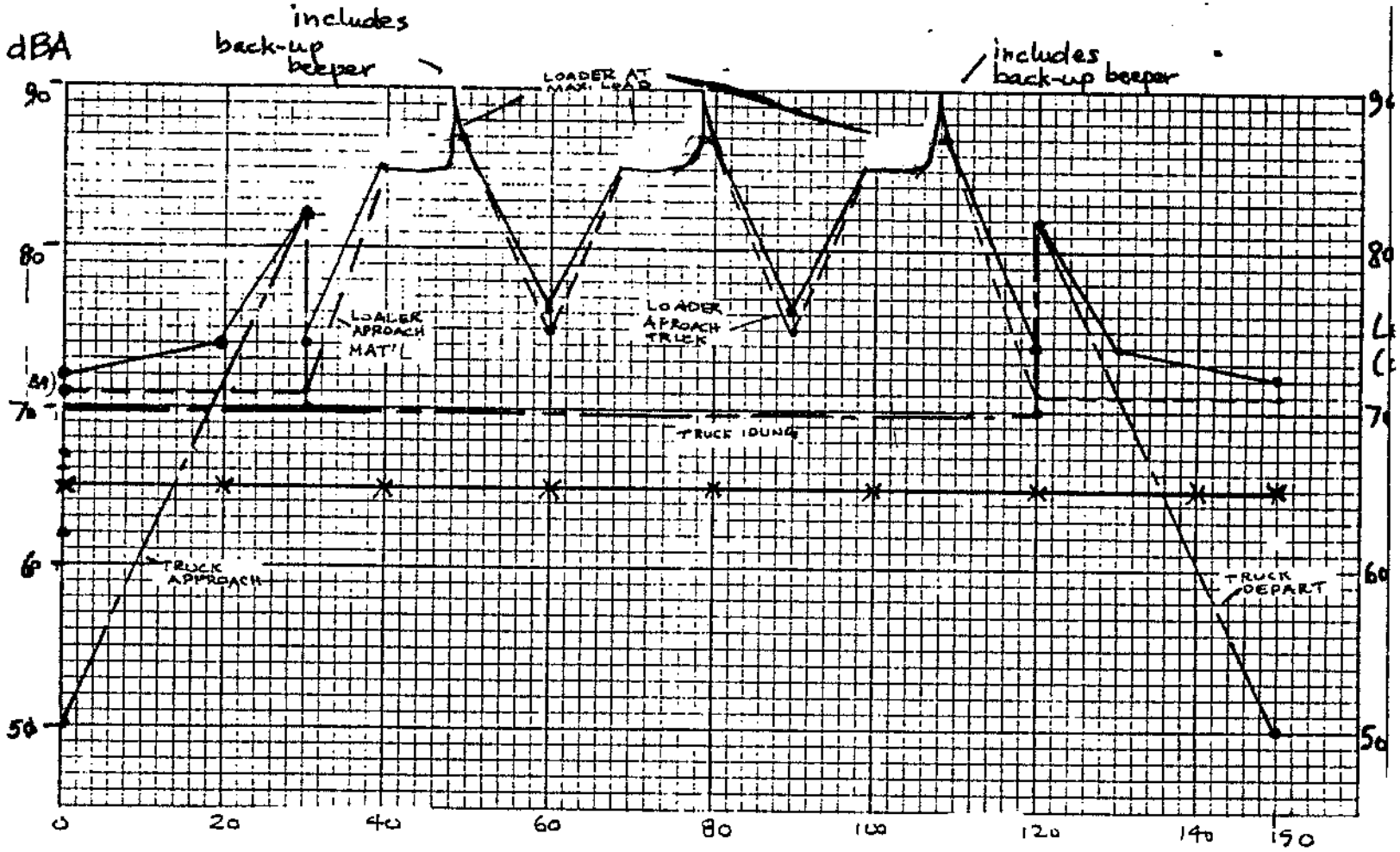
CLIENT:
JAMES DICK
CONSTRUCTION
LIMITED

PROJECT:
GRAVEL PIT, ORO
PROPOSED EXPANSION

DRAWING:
FRONT END
LOADER
SOUND PROFILE

SCALE: NTS
DATE: 28/3/91
DRAWN BY: VG

FRONT END LOADER PROFILE
(Dref = 15m)



Loader cycle only : single event LEQ = 82 dBA : (dref = 15m)
20 cycles for 2 loaders (1hr LEQ : 84 dBA)

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Description	Date

REVISIONS

CLIENT:
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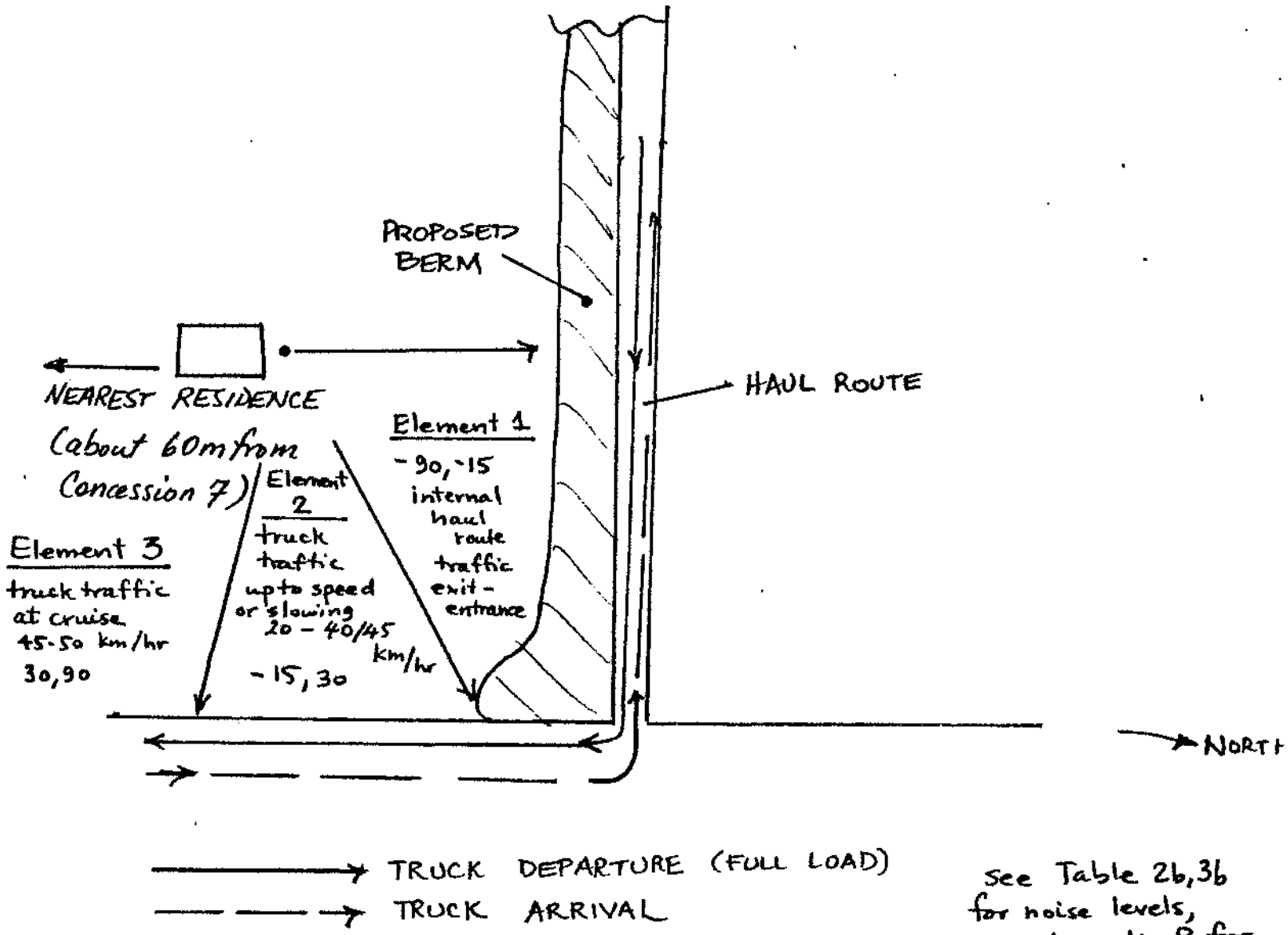
CONSTRUCTION
LIMITED

PROJECT:
GRAVEL PIT, ORO
PROPOSED EXPANSION

DRAWING:
TRUCK TRAFFIC
ENTRY / EXIT
PROFILE

SCALE: NTS
DATE: 28/3/91
DRAWN BY: VG



See Table 2b, 3b for noise levels, see Appendix B for sample calculations

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Description	Date

REVISIONS

CLIENT:
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PROJECT:
GRAVEL PIT,
ORO

DRAWING:
RECOMMENDED BERM LAYOUT FOR PROPOSED PIT and EQUIPMENT RESTRICTIONS

SCALE: 10000:1

DATE: 28/3/91

DRAWN BY: VG

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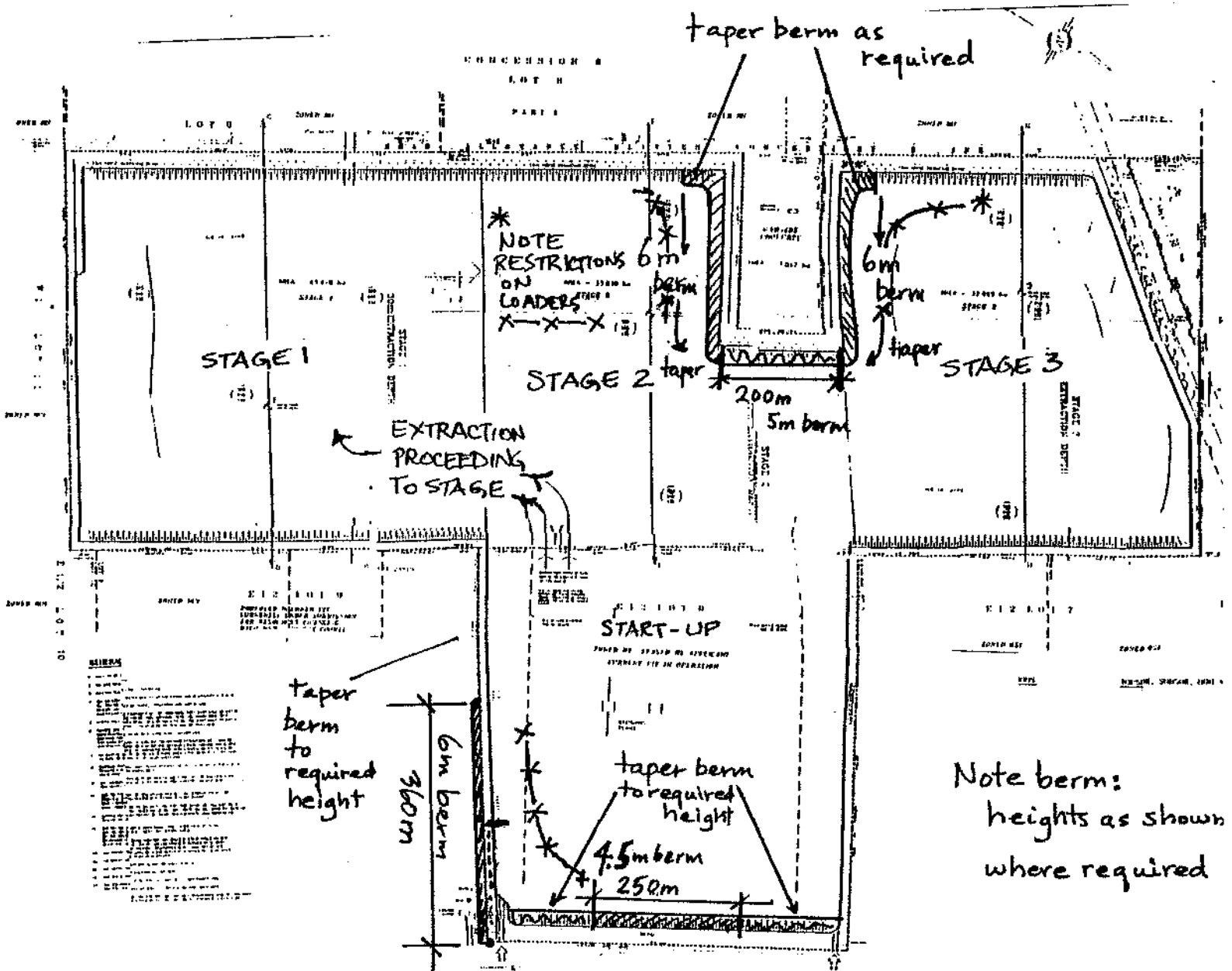

NOTES: INTERNAL HAUL ROUTE FOR 200m (– – –) SHOULD BE KEPT IN GOOD REPAIR

X——X——X——X INDICATES AREA WHERE FRONT END LOADERS ARE RESTRICTED TO A SINGLE UNIT

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escription	Date

REVISIONS

CLIENT:
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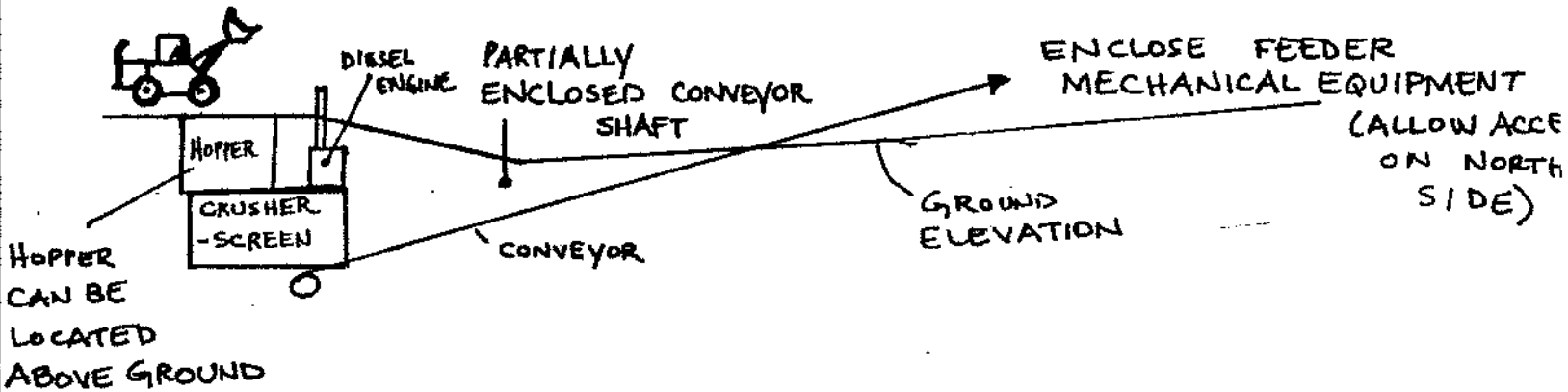
PROJECT:
GRAVEL PIT, ORO
PROPOSED EXPANSION

DRAWING:
CONCEPTUAL
NOISE CONTROL
FOR IN-GROUND
EQUIPMENT

SCALE: NTS
DATE: 28/3/91
DRAWN BY: VG
DRAWING NO.: FIG. 7

CONCEPTUAL ILLUSTRATION OF LOCATING CRITICAL PROCESSING EQUIPMENT IN GROUND

ELEVATION

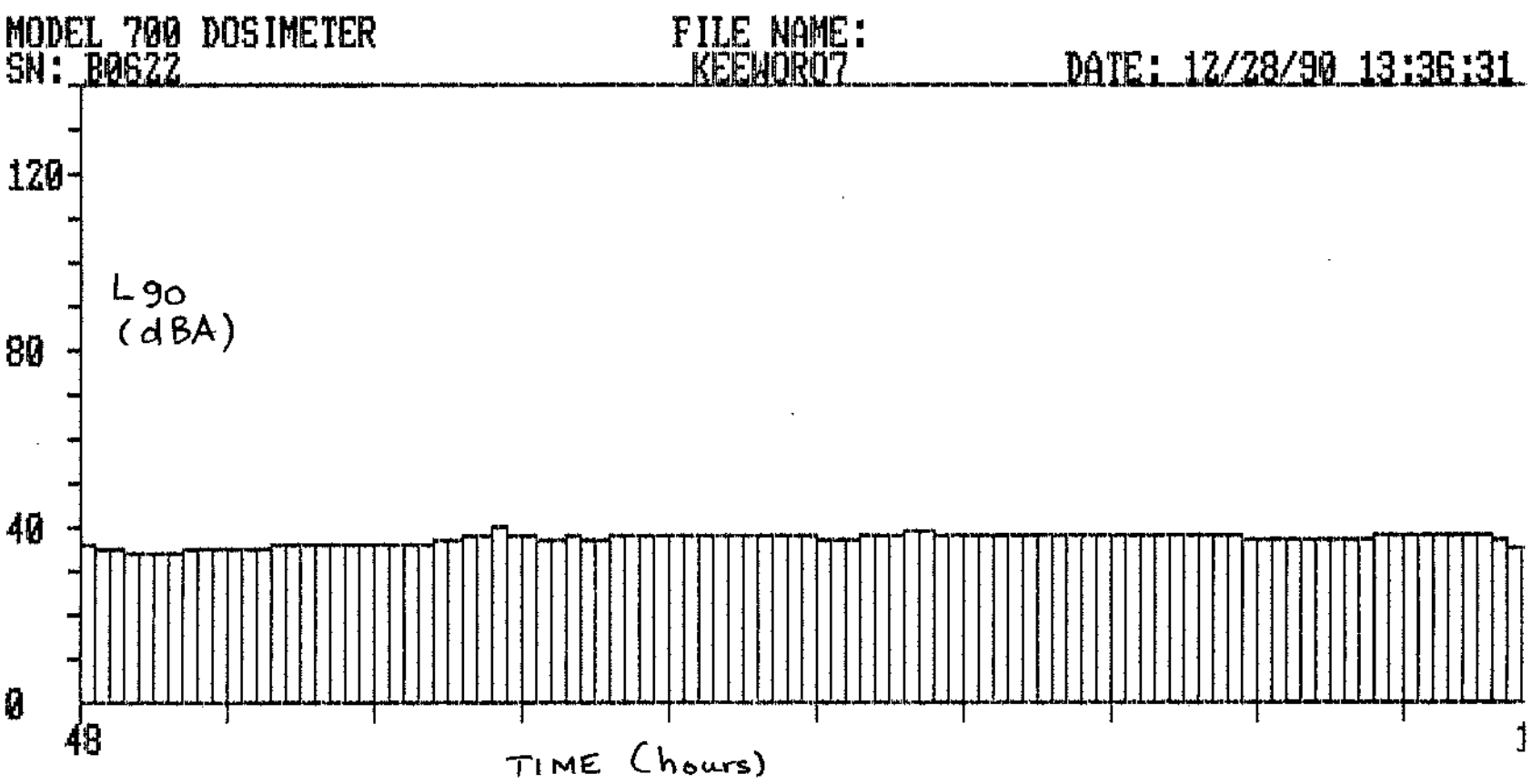


APPENDIX A

SUMMARY OF BACKGROUND NOISE LEVEL MONITORING SURVEY

BSA 25/3/91

BACKGROUND NOISE MONITORING SURVEY



lowest 1 hr. L90 : 34.5 dBA → 44.5 dBA sound level limit according to NPC-132

INTERVAL HISTORY

FILE: KEEWOR07

#	L01	L10	L50	L90	LMIN	LMAX	PEAK	INTEG LEVEL	SEL	PEAK EXCED COUNT	OVER LOAD COUNT	RMS EXCEED COUNT	DATE	TIME
49	72	48.5	37.5	36	34.5	80	94.5	57	92.5	0	0	0	20 DEC	15:35:03
50	67	42.5	36.5	35	34	74	87.5	51	86.5	0	0	0	20 DEC	16:35:03
51	65.5	41.5	36	35	34	75	89.5	49.5	85.5	0	0	0	20 DEC	17:35:03
52	62.5	38.5	35	34.5	34	73.5	90	47.5	83	0	0	0	20 DEC	18:35:03
53	57.5	37.5	35	34.5	34	71	89.5	45	81	0	0	0	20 DEC	19:35:03
54	56.5	37	35	34.5	34	71.5	85.5	44.5	80	0	0	0	20 DEC	20:35:03
55	49	36	35	34.5	34	68	84	42	77.5	0	0	0	20 DEC	21:35:03
56	42.5	36	35	35	34	75	90.5	44	79.5	0	0	0	20 DEC	22:35:03
57	39	35.5	35	35	34.5	60.5	73	36.5	72	0	0	0	20 DEC	23:35:03
58	35.5	35.5	35	35	34.5	36.5	57	35	71	0	0	0	21 DEC	0:35:03
59	46	36	35.5	35	35	70	84.5	42.5	78	0	0	0	21 DEC	1:35:03
60	36	36	35.5	35	35	37	56.5	35.5	71	0	0	0	21 DEC	2:35:03
61	41	36	36	35.5	35	63	76.5	37.5	73.5	0	0	0	21 DEC	3:35:03
62	37.5	36.5	36.5	36	35.5	66	94.5	37.5	73	0	0	0	21 DEC	4:35:03
63	37.5	36.5	36.5	36	36	38.5	57	36.5	72	0	0	0	21 DEC	5:35:03
64	58.5	37.5	36.5	36.5	36	73.5	92.5	45.5	81	0	0	0	21 DEC	6:35:03
65	64	40.5	37	36.5	36	74.5	89	49.5	85	0	0	0	21 DEC	7:35:03
66	73	46	37	36.5	36	81.5	94	57.5	93	0	0	0	21 DEC	8:35:03
67	54.5	37.5	36.5	36.5	36	65	86.5	42	77.5	0	0	0	21 DEC	9:35:03
68	63	39	36.5	36	36	74.5	89	48	84	0	0	0	21 DEC	10:35:03
69	61	37.5	36.5	36	35.5	77.5	90.5	49	84.5	0	0	0	21 DEC	11:35:03
70	65.5	38.5	36.5	36	35.5	71.5	91.5	49	84.5	0	0	0	21 DEC	12:35:03
71	50.5	37	36.5	36	36	70	82.5	42	78	0	0	0	21 DEC	13:35:03
72	63.5	38.5	37	36.5	30	70	88	47.5	83	0	0	0	21 DEC	14:35:03
73	65.5	39	37.5	37	36.5	76	93	50.5	86	0	0	0	21 DEC	15:35:04
74	66	44	38	37.5	36.5	73.5	94	50	85.5	0	0	0	21 DEC	16:35:04
75	64.5	45.5	39	38	37	71	108.5	48.5	84	0	0	0	21 DEC	17:35:04
76	59.5	41.5	38.5	38	37	70.5	108	46	81.5	0	0	0	21 DEC	18:35:04
77	64.5	49	42	40	38	74.5	107.5	50.5	86	0	0	0	21 DEC	19:35:04
78	44.5	41	39	38	37.5	55.5	87.5	39.5	75	0	0	0	21 DEC	20:35:04
79	59	39.5	38.5	38	37.5	70	90.5	46	81.5	0	0	0	21 DEC	21:35:04
80	58.5	38.5	38	37.5	37	68.5	90.5	45	80.5	0	0	0	21 DEC	22:35:04
81	43	38	38	37.5	37	47.5	82	41	76.5	0	0	0	21 DEC	23:35:04
82	53.5	38.5	38	38	37.5	72.5	91.5	45	80.5	0	0	0	22 DEC	0:35:04
83	41.5	38.5	38	37.5	37.5	62.5	85.5	38.5	74	0	0	0	22 DEC	1:35:04
84	43	38.5	38	37.5	37.5	50	80.5	38.5	74	0	0	0	22 DEC	2:35:04
85	39.5	38.5	38	38	37.5	47	75	38	74	0	0	0	22 DEC	3:35:04
86	45.5	39	38.5	38	37.5	53	88	39	74.5	0	0	0	22 DEC	4:35:04
87	39.5	38.5	38.5	38	37.5	58.5	89.5	38.5	74	0	0	0	22 DEC	5:35:04
88	49.5	39	38.5	38	37.5	69.5	98.5	43.5	79	0	0	0	22 DEC	6:35:04
89	59.5	39	38.5	38	37.5	68.5	88	45	80.5	0	0	0	22 DEC	7:35:04
90	45.5	41.5	38.5	38	37.5	73	91.5	49.5	85	0	0	0	22 DEC	8:35:04
91	57	39.5	38.5	38	37.5	75	103.5	47.5	83.5	0	0	0	22 DEC	9:35:04
92	68.5	41	38.5	38	37.5	76	91.5	52	87.5	0	0	0	22 DEC	10:35:04
93	68	44	38.5	38	37.5	74.5	89	52.5	88	0	0	0	22 DEC	11:35:04
94	65	39	38.5	38	37.5	77	92.5	51	86.5	0	0	0	22 DEC	12:35:04
95	66.5	42	38.5	38	37.5	73.5	89.5	51	86.5	0	0	0	22 DEC	13:35:04
96	67.5	41	38.5	38	30.5	73.5	90.5	51.5	87	0	0	0	22 DEC	14:35:04
97	64.5	41.5	39	38.5	37.5	73	102.5	49	84.5	0	0	0	22 DEC	15:35:05
98	63	40.5	38.5	38	37.5	75.5	88.5	48.5	84	0	0	0	22 DEC	16:35:05
99	59.5	38.5	38	37.5	37.5	67.5	87.5	44.5	80	0	0	0	22 DEC	17:35:05
100	58.5	38.5	38	37.5	37.5	74.5	91.5	46	81.5	0	0	0	22 DEC	18:35:05
101	41	38.5	38	37.5	37.5	66	79	40.5	76	0	0	0	22 DEC	19:35:05
102	44	39	38	38	37.5	65	98.5	40	75.5	0	0	0	22 DEC	20:35:05
103	50.5	39	38.5	38	37.5	64.5	87.5	43	78.5	0	0	0	22 DEC	21:35:05
104	51	41	38.5	38	37.5	73	94.5	44.5	80	0	0	0	22 DEC	22:35:05
105	63	49.5	41.5	39	38	75	111.5	49.5	85	0	0	0	22 DEC	23:35:05
106	64	51.5	42.5	39	38	75.5	115.5	50.5	84.5	0	0	0	23 DEC	0:35:05
107	65.5	53.5	42	38.5	37.5	76	113.5	52	87.5	0	0	0	23 DEC	1:35:05
108	55	44.5	39.5	38.5	37.5	68.5	107.5	44	79.5	0	0	0	23 DEC	2:35:05
109	51.5	42.5	39	38	37.5	67	97.5	42	77.5	0	0	0	23 DEC	3:35:05
110	51	42.5	39	38.5	37.5	61.5	80.5	41.5	77	0	0	0	23 DEC	4:35:05

OVERALL LEQ: 48.2

INTERVAL HISTORY

FILE: KEEWORD7

#	L01	L10	L50	L90	LMIN	LMAX	PEAK	INTEG LEVEL	SEL	PEAK EXCED COUNT	OVER LOAD COUNT	RMS EXCEED COUNT	DATE	TIME
111	49.5	40	38.5	38	37.5	58.5	80	40	75.5	0	0	0	23 DEC	5:35:05
112	49.5	39.5	38.5	38	37.5	59.5	78.5	40	75.5	0	0	0	23 DEC	6:35:05
113	44.5	39	38.5	38	37.5	53.5	74.5	39	74.5	0	0	0	23 DEC	7:35:05
114	55	42	38.5	38	38	64	81.5	42.5	78	0	0	0	23 DEC	8:35:05
115	57.5	39.5	38.5	38	38	69.5	90.5	45	80.5	0	0	0	23 DEC	9:35:05
116	55.5	40.5	38.5	38	38	77	94	47	83	0	0	0	23 DEC	10:35:05
117	50.5	40.5	38.5	38	38	63.5	82.5	41	76.5	0	0	0	23 DEC	11:35:05
118	56.5	43	38.5	38	38	72.5	88.5	45	81	0	0	0	23 DEC	12:35:05
119	55.5	39.5	38.5	38	37.5	64.5	78	42	77.5	0	0	0	23 DEC	13:35:05
120	54	38.5	38	38	31	73	86.5	44	79.5	0	0	0	23 DEC	14:35:05
121	54.5	39.5	38	38	37.5	66	80.5	43	78.5	0	0	0	23 DEC	15:35:06
122	49.5	38.5	38	38	37.5	61.5	74.5	40	75.5	0	0	0	23 DEC	16:35:06
123	47.5	38.5	38	38	37.5	61.5	76.5	39.5	75	0	0	0	23 DEC	17:35:06
124	44.5	38.5	38	38	37.5	66.5	80	41	76.5	0	0	0	23 DEC	18:35:06
125	40	38.5	38	38	37.5	61	75	39	74.5	0	0	0	23 DEC	19:35:06
126	42.5	39	38.5	38	37.5	59.5	74.5	39.5	75	0	0	0	23 DEC	20:35:06
127	39.5	38.5	38	38	37.5	65.5	79.5	39.5	75	0	0	0	23 DEC	21:35:06
128	42	38.5	38	37.5	37	59.5	75.5	39	74.5	0	0	0	23 DEC	22:35:06
129	39	38.5	38	37.5	37	55	67	38	74	0	0	0	23 DEC	23:35:06
130	39	38	37.5	37.5	37	62.5	76.5	38.5	74	0	0	0	24 DEC	0:35:06
131	39.5	38	37.5	37	37	43.5	59.5	37.5	73	0	0	0	24 DEC	1:35:06
132	38	38	37.5	37	37	38.5	59	37.5	73	0	0	0	24 DEC	2:35:06
133	38	38	37.5	37	37	64.5	82.5	38.5	74	0	0	0	24 DEC	3:35:06
134	45.5	38	37.5	37	37	78	91.5	46	83.5	0	0	0	24 DEC	4:35:06
135	39	38	37.5	37	37	41.5	78	37.5	73	0	0	0	24 DEC	5:35:06
136	45	40	38	37.5	37	54.5	79.5	39	74.5	0	0	0	24 DEC	6:35:06
137	47.5	41.5	39	38	37	65	78	40.5	76.5	0	0	0	24 DEC	7:35:06
138	49.5	41.5	39	38	37	65	79	41.5	77	0	0	0	24 DEC	8:35:06
139	58	42	39	38	37.5	78.5	95.5	49.5	85	0	0	0	24 DEC	9:35:06
140	56	45	40	38.5	37.5	75.5	91.5	47	83	0	0	0	24 DEC	10:35:06
141	55.5	43	39.5	38.5	37.5	76.5	92	47.5	83	0	0	0	24 DEC	11:35:06
142	53	45.5	41	38.5	37.5	61.5	74	43.5	79	0	0	0	24 DEC	12:35:06
143	52.5	42.5	39.5	38	37	63.5	75.5	42	78	0	0	0	24 DEC	13:35:06
144	58	46.5	41	38	31.5	67.5	80.5	45.5	81	0	0	0	24 DEC	14:35:06
145	60.5	48.5	39.5	37.5	36	70	85	46.5	82	0	0	0	24 DEC	15:35:07
146	60	41	37	35	34.5	67.5	81	44.5	80	0	0	0	24 DEC	16:35:07
147	57	42	37.5	35.5	34.5	68	82	43.5	79	0	0	0	24 DEC	17:35:07

OVERALL LEQ: 43.3

$\frac{62}{99} \times 10^{4.82} + \frac{37}{99} \times 10^{4.33}$ → 46.9 dBA (entire period) LEQ

36.2 dBA (" ") L_{90}

Sound level limit = 34.5 + 10 → 44.5 dBA

APPENDIX B

BACKGROUND INFORMATION

BSA 25/3/91

ARMAN
SWALLOW
ASSOCIATES

Greensboro Dr. Suite 401
exdale, Ontario
9W 1C3

el. (416)245-7501

scription Date

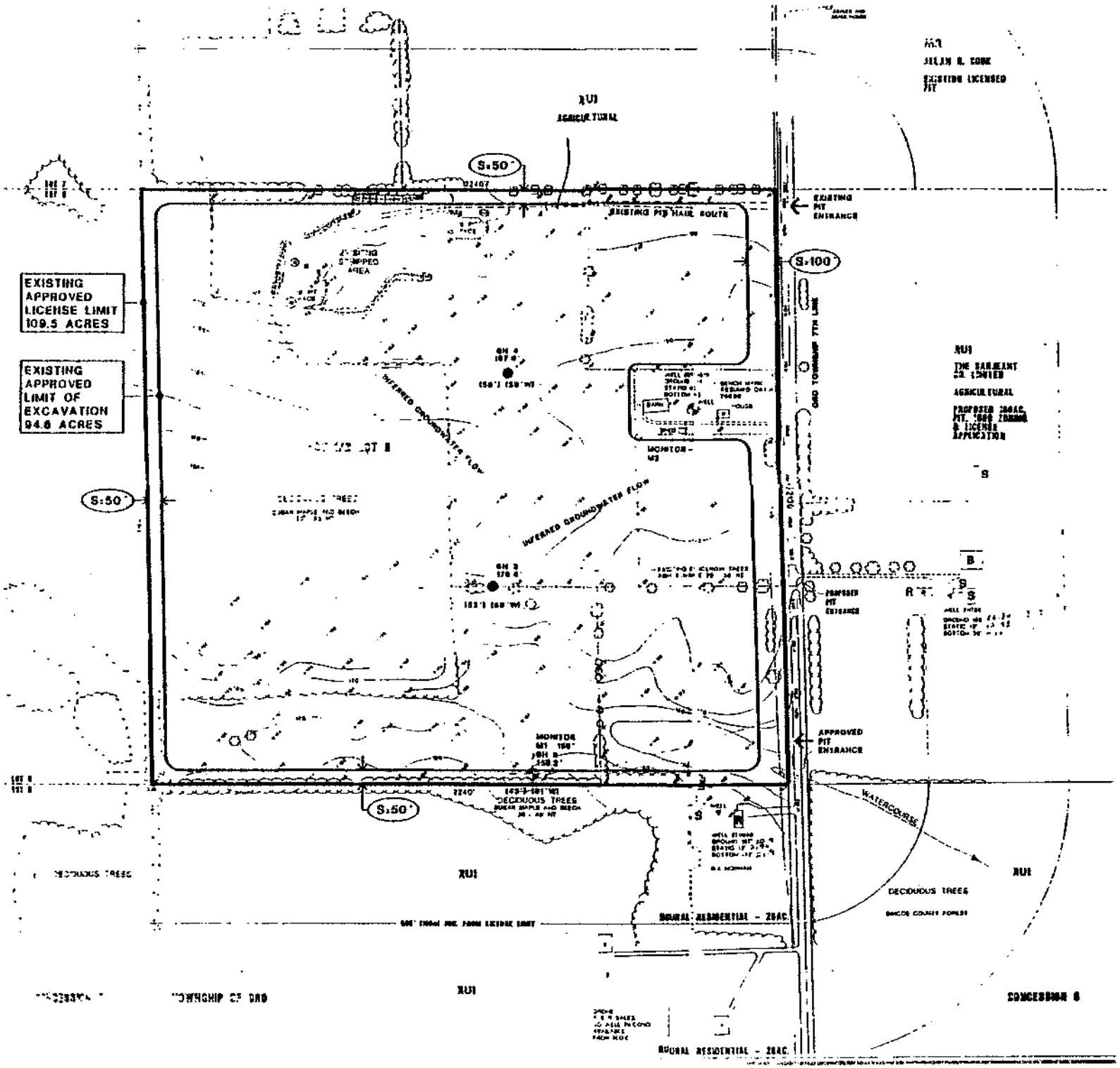
REVISIONS

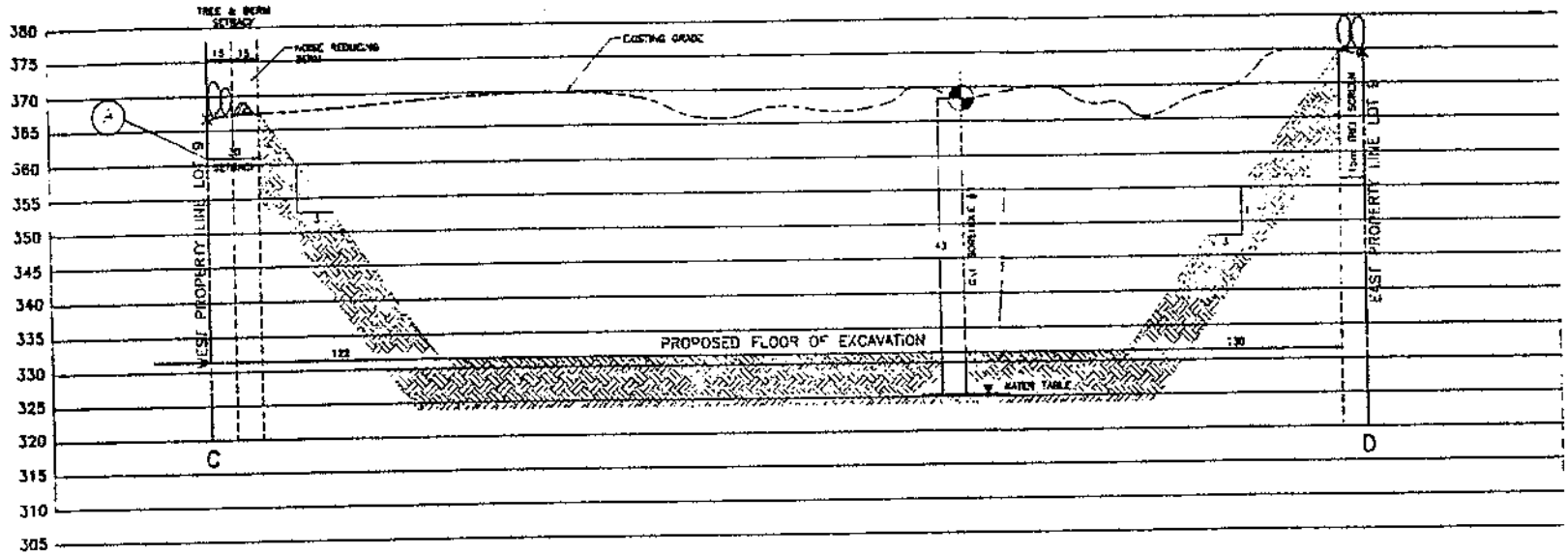
LIENT:
AMES DICK
ONSTRUCTION LTD.

ROJECT:
RAVEL PIT, ORO

RAWING:
EXISTING PIT

CALE: NTS
ATE: 19/3/91
RAWN BY:
RAWING NO: APP B



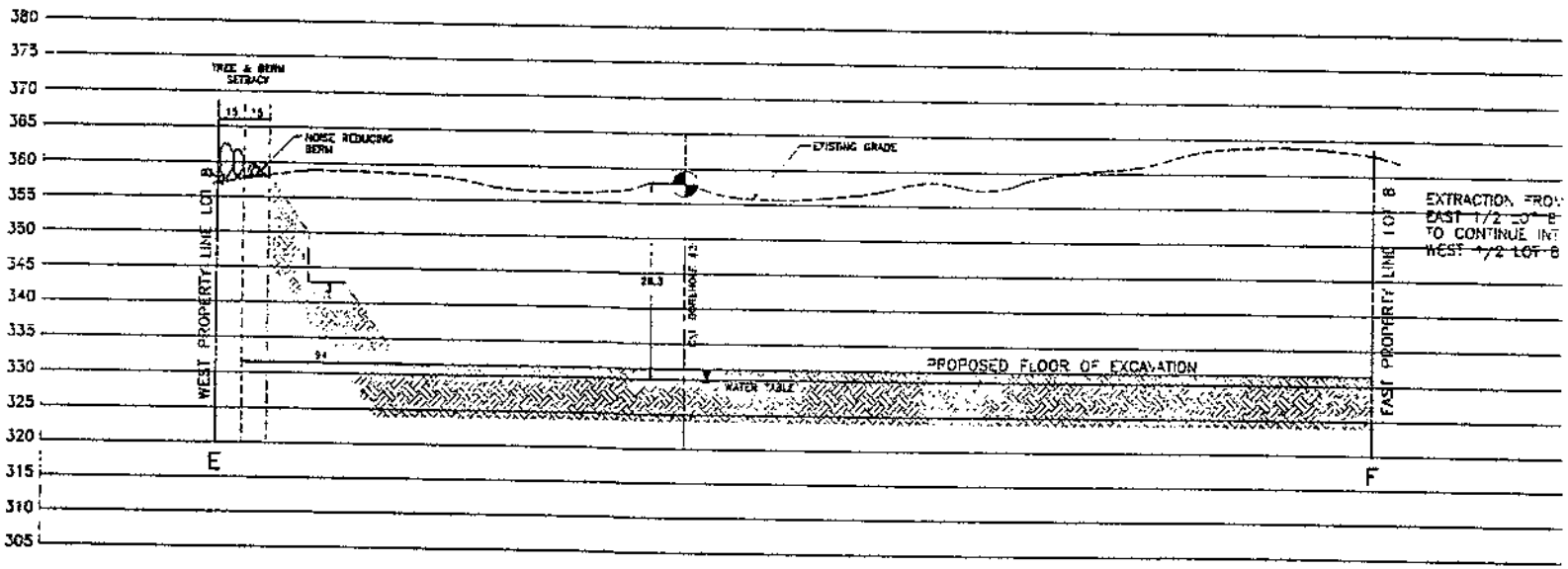


WEST – EAST CROSS-SECTION

WEST 1/2 LOT 9

VERT. SCALE AS SHOWN

HORZ. SCALE 1:2000

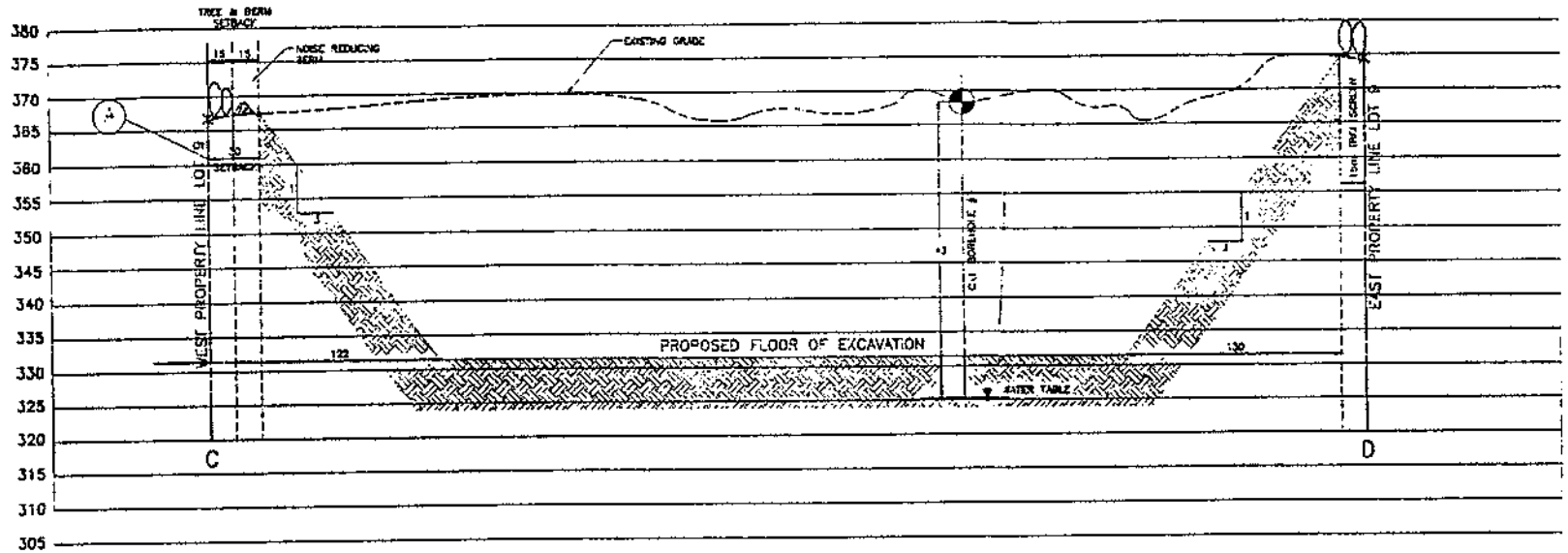


WEST – EAST CROSS-SECTION

WEST 1/2 LOT B

VERT. SCALE AS SHOWN

HORZ. SCALE 1"=200'

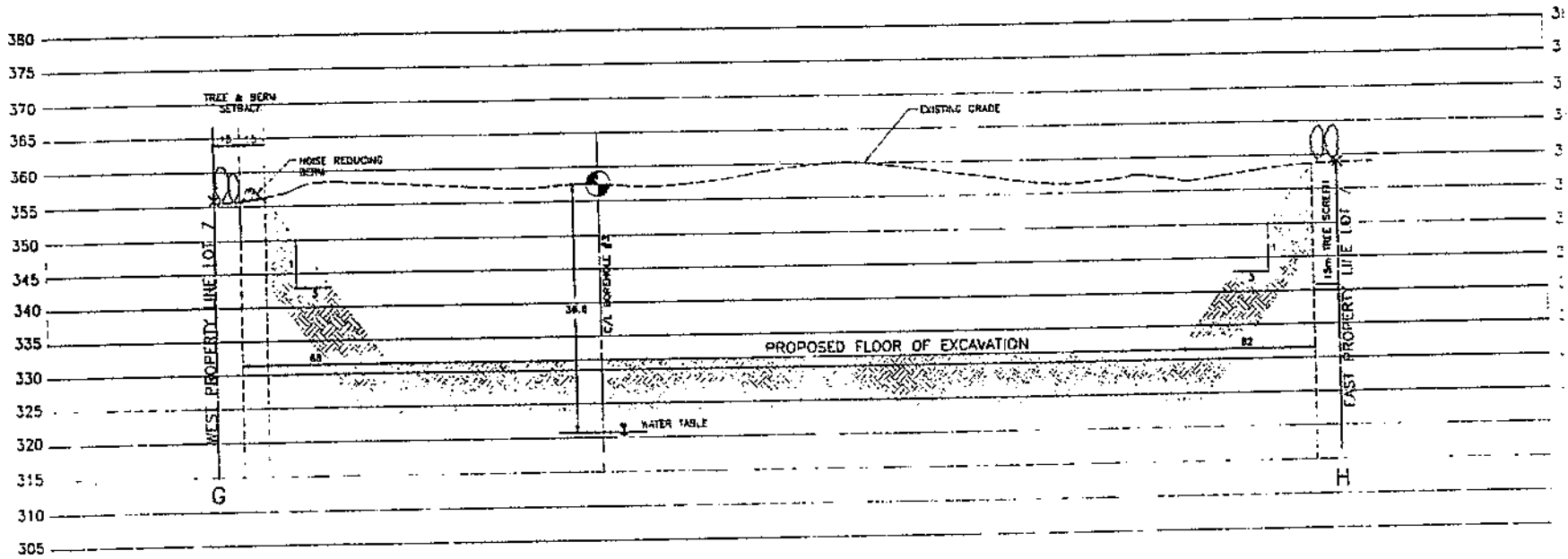


WEST – EAST CROSS-SECTION

WEST 1/2 LOT 9

VERT. SCALE AS SHOWN

HORZ. SCALE 1:2000



WEST – EAST CROSS-SECTION

WEST 1/2 LOT 7

VERT. SCALE AS SHOWN
HORZ. SCALE 1:2000

OFFICES: CONCORD, SIOUX LOOKOUT, THUNDER BAY, ONT.

KEEWATIN-ASKI LTD
CONSULTING ENGINEERS & PLANNERS

150 RIVERMEDE ROAD, SUITE #202, CONCORD, ONT., L4K 3M8
TEL.: (416) 669-9765 FAX: (416) 669-9766

FILE: 89651/L651MR7
DATE: March 7, 1991

Barman Swallow
1 Greensboro Drive, Suite 401
Rexdale, Ontario
M9W 1C8

ATTENTION: VINCE GAMBINO

Dear Vince:

RE: **TONNAGE INFORMATION**

In response to your telephone call requesting data on tonnage, I have the following information:

- the existing pit (E 1/2 Lot 8) is licensed for unlimited tonnage as per Greg Sweetnam of James Dick Construction. Therefore, we will be applying for the pit extension to also be unlimited.

- we estimate in the order of 30,000 trucks per year if a truck carries an average load of 30 tonnes.

I hope this is sufficient information to base your report on. If you need more information, please do not hesitate to contact us.

Yours truly,
KEEWATIN-ASKI LTD.

P. Leigh

Patricia Leigh

PL/pat

Publication NPC-115

Construction Equipment

1. Scope

This Publication sets sound emission standards for various items of new construction equipment according to the date of manufacture of the equipment.

2. Technical Definitions

The technical terms used in this Publication are defined in Publication NPC-101 - Technical Definitions.

3. Sound Emission Standards

Tables 115-1 to 115-4 inclusive list Residential Area sound emission standards and Quiet Zone sound emission standards for specific items of new construction equipment measured in accordance with the procedures indicated.

TABLE 115-1

Quiet Zone and Residential Area Sound Emission Standards for Excavation Equipment, Dozers, Loaders, Backhoes or Other Equipment Capable of Being Used for Similar Application

Maximum Sound Level as determined using Publication NPC-103 - Procedures, section 6 ✱ dBA		
Date of Manufacture	Power Rating Less than 75 kW	Power Rating 75 kW and larger
January 1, 1979 to December 31, 1980	85	88
January 1, 1981 and after	83	85

TABLE 115-2

Sound Emission Standards for Pneumatic Pavement Breakers

Standard	Date of Manufacture	Maximum Sound Level as measured using Publication NPC-103 - Procedures, section 7 dBA
Quiet Zone Sound Emission Standard	Jan. 1, 1979 and after	85
Residential Area Sound Emission Standard	Jan. 1, 1979 to Dec. 31 1980	90
	Jan. 1, 1981 and after	85

TABLE 115-3

Sound Emission Standards for Portable Air Compressors

Standard	Date of Manufacture	Maximum Sound Level as measured using Publication NPC-103 - Procedures, section 7 dBA
Quiet Zone Sound Emission Standard	Jan. 1, 1979 to Dec. 31, 1980	76
	Jan. 1, 1981 and after	70
Residential Area Sound Emission Standard	Jan. 1, 1979 and after	76

TABLE 115-4

Sound Emission Standard for Tracked Drills

Standard	Date of Manufacture	Maximum Sound Level as measured using Publication NPC-103 - Procedures, section 6. dBA
Quiet Zone and Residential Area Sound Emission Standard	Jan. 1, 1981 and after	100

6. Exterior Sound Level Measurement Procedure For Powered Mobile Construction Equipment - SAE J88a

SAE J88a Recommended Practice is adopted by the Ministry with the following change:

Where ANSI Type 1 sound level meter specification is referred to, reference shall be made instead to Publication IEC-179 (1973) for Precision sound level meters. (General Purpose Sound Level Meter)

7. MEMAC Test Code For the Measurement of Sound From Pneumatic Equipment

The MEMAC Test Code For The Measurement Of Sound From Pneumatic Equipment is adopted by the Ministry with the following additional requirement:

For measurement of percussive machines the sound level meter used shall meet the specifications of IEC Publications 179 and 179A (1973). (Impulse Sound Level Meter)

8. Exterior Sound Level Measurement Procedure For Small Engine Powered Equipment - SAE J 1046

SAE J 1046 - Recommended Practice, is adopted by the Ministry with the following changes:

(1) Where ANSI Type 1 sound level meter specification is referred to, reference shall be made instead to IEC Publications 179 and 179A (1973). (Impulse Sound Level Meter)

(2) Replace clause 3.1.1 with the following:
The minimum dimensions of the measurement zone are defined as a path of travel 1.2 m wide by 14 m long plus an adjacent area having the base along the edge of the path of travel and the apex 7 m from the midpoint of the base.

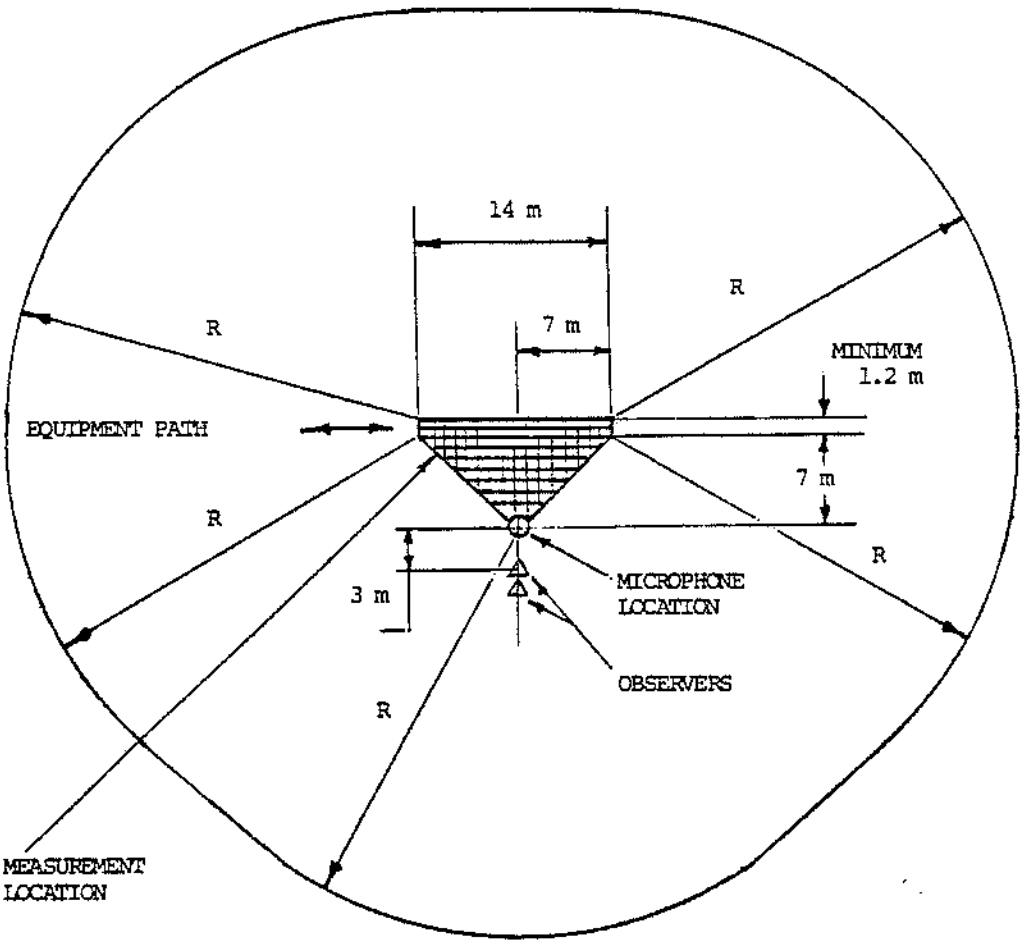
(3) Replace Fig. 1 with Fig. 103-1, hereof.

(4) In section 3.3 Measurements, all references to 25 ft. shall be changed to 7 m.

9. Procedure for Measurement of the Maximum Exterior Sound Level of Stationary Trucks with Governed Diesel Engines-CSA Z107.22-M1977

(1) CSA Z107.22-M1977 standard is adopted by the Ministry with the following change:

A General Purpose Sound Level Meter shall be used.



REF. US EPA 550/9-74-011

R = 30 m MINIMUM RADIUS

TEST SITE CONFIGURATION FOR EXTERIOR SOUND LEVEL MEASUREMENT

PROCEDURE FOR SMALL ENGINE POWERED EQUIPMENT - SAE J 1046

FIG. 103-1

APPENDIX C

SAMPLE CALCULATIONS

BSA 25/3/91

CALCULATION PROCEDURE:

Sound source quantification based on observation of equipment work pattern.

SPL (singel event LEQ) = 10 leq ($N.10^{SPL\,1/10} + M\,10^{SPL\,2/10} + K.10^{SPL\,3/10} + \ldots$)

Where N, M, K are the ratios corresponding to specific material handling tasks for specific sources

For peak period operation Single event LEQ = 1 hr. LEQ

$$\text{SPL @ receptor} = \sum_{\text{all sources}} \text{SPL (events)} - 20 \log \left(\frac{D}{Dref} \right) - A_b - G.eff$$

Where 20log (D/Dref) - defines attenuation of sound from a stationary point source by spherical spreading.

A_b - barrier attenuation from shielding mechanisms (based on Kurze-Anderson model which is less conservative than the CMHC model but applicable for an area which is predominantly grass covered soft ground with an absence of reflective surfaces. Max. permissible barrier attenuation of 24 dB (after Beranek, Ch. 7, Noise and Vibration Control). This model is more suitable for the subject topography than the CMHC barrier model.

A_b = fn (dsb, dsr, dbr, hr, hs, N (f))

Where N (f) is the Fresnel # at 250 Hz and d_{ij}, h_i define source-receptor and topography conditions.

Geff: Refers to excess attenuation from ground effect as obtained from the CMHC model (i.e. ref. 3). This model is more conservative than most ground effect models, but applicable for an area which is predominantly grass-covered soft ground. Ground effect is a function of effective total height where

$$heff = h_r + h_s + h_t + h_b$$

which define receptor, source, terrain and barrier heights.

Wind and temperature gradients can cause levels to increase for receptors located downwind from the source and similarly decrease for upwind receptors at times by as much as 15 dB.

SAMPLE CALCULATION AT LOCATION C

Unmitigated Noise Impact

	hs (m)	hb (all)	hr	dsb (in)	dbr	heff (m)	PLD	Ab (all)	dist.	g.eff.	vege. (in dB)	subtotal	impact (dB)
Pit Start-Up	364	366	366	1000	215	22	0.0	-	-38	-9	-5	-52	40
Extraction Limit													
Processing Eq.	335	366	366	1000	215	40	0.08	-7	-38	-5	-	-50	41.5
Loaders	335	366	366	90	60	40	2.0	-17	-20	-	-	-37	47.0
													48.0

Mitigated Noise Impact

Extraction Limit	hs (m)	hb (all)	hr	dsb (in)	dbr	heff (m)	pld	Ab (all)	dist.	g.eff.	vege. (in dB)	source	subtotal	Total (dBA)
Process Equip.	335	370	366	1000	215	48	0.21	-9	-38	-4	-	-5	-56	35.5
Loaders	335	370	366	90	60	48	3.3	-20	-20	-	-	-3	-43	41.0
														43.0

Note: See prediction methodology outline (See Table 1 in report for source data)

TRUCK NOISE

UNH 1/5

TAMSON 4.1

I N I S T R Y O F T H E E N V I R O N M E N T

OISE ASSESSMENT AND SYSTEMS SUPPORT

.MMARY REPORT

ilename: trucks.te Time Period: 24 hours
ETRIC
ate: 01-04-1991 18:43:32

oad data, segment # 1: truck/haul

ar traffic volume	:	0	veh/TimePeriod *
edium truck volume	:	0	veh/TimePeriod *
eavy truck volume	:	960	veh/TimePeriod *
osted speed limit	:	40	km/h
oad gradient	:	10	%
oad pavement	:	2	(Opengraded friction course)

Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT)	:	960
Percentage of Annual Growth	:	0.00
Number of Years of Growth	:	0.00
Medium Truck % of Total Volume	:	0.00
Heavy Truck % of Total Volume	:	100.00
Day (16 hrs) % of Total Volume	:	100.00

ata for Segment # 1: truck/haul

ngle1	:	-90.00 deg	Angle2 : -15.00 deg
ood depth	:	0	(No woods.)
o of house rows	:	0	
urface	:	2	(Reflective ground surface)
eceiver source distance	:	60.00 m	
eceiver height	:	1.50 m	
opography	:	4	(Elevated; with barrier)
arrier angle1	:	-90.00 deg	Angle2 : -15.00 deg
arrier height	:	1.80 m	
levation	:	8.00 m	
arrier receiver distance	:	30.00 m	
ource elevation	:	0.00 m	
eceiver elevation	:	8.00 m	
arrier elevation	:	3.00 m	
eference angle	:	0.00	

oad data, segment # 2: truck/turn

ar traffic volume	:	0	veh/TimePeriod *
edium truck volume	:	0	veh/TimePeriod *
eavy truck volume	:	960	veh/TimePeriod *
osted speed limit	:	40	km/h
oad gradient	:	2	%
oad pavement	:	2	(Opengraded friction course)

Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT)	:	960
Percentage of Annual Growth	:	0.00
Number of Years of Growth	:	0.00
Medium Truck % of Total Volume	:	0.00
Heavy Truck % of Total Volume	:	100.00
Day (16 hrs) % of Total Volume	:	100.00

ata for Segment # 2: truck/turn

nglei	:	-15.00 deg	Angle2 : 15.00 deg
ood depth	:	0	(No woods.)
o of house rows	:	0	
urface	:	1	(Absorptive ground surface)
eceiver source distance	:	60.00 m	
eceiver height	:	1.50 m	
opography	:	3	(Elevated; no barrier)
levation	:	1.00 m	
eference angle	:	0.00	

oad data, segment # 3: truck/move

ar traffic volume	:	0	veh/TimePeriod *
edium truck volume	:	0	veh/TimePeriod *
eavy truck volume	:	960	veh/TimePeriod *
osted speed limit	:	48	km/h
oad gradient	:	2	%
oad pavement	:	2	(Opengraded friction course)

Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT)	:	960
Percentage of Annual Growth	:	0.00
Number of Years of Growth	:	0.00
Medium Truck % of Total Volume	:	0.00
Heavy Truck % of Total Volume	:	100.00
Day (16 hrs) % of Total Volume	:	100.00

ata for Segment # 3: truck/move

nglei	:	15.00 deg	Angle2 : 90.00 deg
ood depth	:	0	(No woods.)
o of house rows	:	0	
urface	:	1	(Absorptive ground surface)
eceiver source distance	:	60.00 m	
eceiver height	:	1.50 m	
opography	:	1	(Flat/gentle slope; no barrier)
eference angle	:	0.00	

UNM 4,

esult summary

	source height (m)	Road Leq (dBA)	Total Leq (dBA)	
1.truck/haul	2.40	57.86	57.86	*
2.truck/turn	2.40	48.18	48.18	
3.truck/move	2.40	51.00	51.00	
Total			59.04	dBA

* Bright Zone !

UNM 5/5

arrier table for segment # 1: truck/haul

arrier eight	Elev of Barr Top	Road dBA	Tot Leq dBA
3.30	6.30	52.74	52.74
3.80	6.80	52.21	52.21
4.30	7.30	51.40	51.40
4.80	7.80	50.47	50.47
5.30	8.30	49.53	49.53
5.80	8.80	48.63	48.63
6.30	9.30	47.79	47.79
6.80	9.80	47.02	47.02
7.30	10.30	46.30	46.30
7.80	10.80	45.65	45.65

TRUCK NOISE MIT 1/5

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TAMSON 4.1

 I N I S T R Y   O F   T H E   E N V I R O N M E N T

OISE ASSESSMENT AND SYSTEMS SUPPORT

JMMARY REPORT

ilename: trucks.te                Time Period: 24 hours
ETRIC
ate: 01-04-1991 18:41:29

oad data, segment # 1: truck/haul
-----------------------------------

ar traffic volume          :      0 veh/TimePeriod  *
edium truck volume         :      0 veh/TimePeriod  *
eavy truck volume          :    960 veh/TimePeriod  *
osted speed limit          :     40 km/h
oad gradient               :     10 %
oad pavement               :      2        (Opengraded friction course)

 Refers to calculated road volumes based on the following input:

   24 hr Traffic Volume (AADT or SADT):    960
   Percentage of Annual Growth        :   0.00
   Number of Years of Growth          :   0.00
   Medium Truck % of Total Volume     :   0.00
   Heavy Truck  % of Total Volume     : 100.00
   Day (16 hrs) % of Total Volume     : 100.00

ata for Segment # 1: truck/haul
--------------------------------

nglei                      : -90.00 deg   Angle2 : -15.00 deg
ood depth                  :      0        (No woods.)
o of house rows            :      0
urface                     :      2        (Reflective ground surface)
eceiver source distance    :  60.00 m
aceiver height             :   1.50 m
opography                  :      4        (Elevated; with barrier)
arrier anglei              : -90.00 deg   Angle2 : -15.00 deg
arrier height              :   6.00 m
levation                   :   8.00 m
arrier receiver distance   :  30.00 m
ource elevation            :   0.00 m
eceiver elevation          :   8.00 m
arrier elevation           :   3.00 m
eference angle             :   0.00
```

oad data, segment # 2: truck/turn

ar traffic volume	:	0	ven/TimePeriod *
edium truck volume	:	0	veh/TimePeriod *
eavy truck volume	:	960	ven/TimePeriod *
osted speed limit	:	40	km/h
oad gradient	:	2	%
oad pavement	:	2	(Opengraded friction course)

Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT)	:	960
Percentage of Annual Growth	:	0.00
Number of Years of Growth	:	0.00
Medium Truck % of Total Volume	:	0.00
Heavy Truck % of Total Volume	:	100.00
Day (16 hrs) % of Total Volume	:	100.00

ata for Segment # 2: truck/turn

ngle1	:	-15.00 deg	Angle2 : 15.00 deg
ood depth	:	0	(No woods.)
o of house rows	:	0	
urface	:	1	(Absorptive ground surface)
eceiver source distance	:	60.00 m	
eceiver height	:	1.50 m	
opography	:	3	(Elevated; no barrier)
levation	:	1.00 m	
eference angle	:	0.00	

oad data, segment # 3: truck/move

ar traffic volume	:	0	veh/TimePeriod *
edium truck volume	:	0	veh/TimePeriod *
eavy truck volume	:	960	veh/TimePeriod *
osted speed limit	:	45	km/h
oad gradient	:	2	%
oad pavement	:	2	(Opengraded friction course)

Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT)	:	960
Percentage of Annual Growth	:	0.00
Number of Years of Growth	:	0.00
Medium Truck % of Total Volume	:	0.00
Heavy Truck % of Total Volume	:	100.00
Day (16 hrs) % of Total Volume	:	100.00

ata for Segment # 3: truck/move

ngle1	:	15.00 deg	Angle2 : 90.00 deg
ood depth	:	0	(No woods.)
o of house rows	:	0	
urface	:	1	(Absorptive ground surface)
eceiver source distance	:	60.00 m	
eceiver height	:	1.50 m	
opography	:	1	(Flat/gentle slope; no barrier)
eference angle	:	0.00	

esult summary

	source height (m)	Road Leq (dBA)	Total Leq (dBA)
1.truck/haul	2.40	48.28	48.28
2.truck/turn	2.40	48.18	48.18
3.truck/move	2.40	51.00	51.00
Total			54.13 dBA

arrier table for segment # 1: truck/haul

arrier eight	Elev of Barr Top	Road dBA	Tot Leq dBA
7.50	10.50	46.04	46.04
8.00	11.00	45.40	45.40
8.50	11.50	44.81	44.81
9.00	12.00	44.26	44.26
9.50	12.50	43.75	43.75
10.00	13.00	43.26	43.26
10.50	13.50	42.81	42.81
11.00	14.00	42.42	42.42
11.50	14.50	42.08	42.08
12.00	15.00	41.77	41.77