APPENDIX 3

NOISE IMPACT ASSESSMENT FOR THE SOUTHERN EXTENSION OF THE ENVIRONMENTAL NOISE BUND AND WASTE ROCK DUMP

ACOUSTIC ASSESSMENT

WASTE DUMP NOISE MODELLING - SOUTHERN BUND EXTENSION

FOR

KALGOORLIE CONSOLIDATED GOLD MINES

BY

HERRING STORER ACOUSTICS

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OUR REF: 2359-4-03033

CONTENTS

1.0 INTRODUCTION

Noise modelling has been carried out to assess attenuation achieved by the proposed southern noise bund extension for varying waste dump heights from existing ground levels to a maximum height of +80m above existing ground levels, or 0mRL reference the top of Mt Charlotte. The proposed noise bund is at heights varying from -20mRL to -40mRL and a central access road currently has 3 possible configurations, hence, there are 3 different bund scenarios, which have been modelled

Furthermore, there are 4 noise source or dumping locations and 3 receiver locations, which have been included in this assessment. Therefore, for each source location point and bund scenario, there are 9 resultants at each receiver point being at current ground level up to +80m above current ground level. Additional to these single point calculations, noise contour calculations have been carried out for the noise source point 3 and each of the bund scenarios for waste dumping at +10m above existing ground levels. All related plots, ground contours and noise contours are included in the attached appendices.

2.0 SUMMARY

The results of modelling generally show that for the noise source points and representative receiver points which were used, the opening and associated gap for the light vehicle access road reduces the barrier effect of the bund. Notwithstanding this, resultant noise levels where there is no benefit from the bund, are still within the assigned noise level criteria for each location. The following summary compares the range of modelled resultant noise levels to the range of assigned noise levels for each receiver location.

Receiver Location	Modelled Results	Assigned Range#
East Waverley Street	31 to 56 dB(A)	55 to 60 dB(A)
Cnr Columbia & Dwyer Sts.	23 to 47 dB(A)	51 to 55 dB(A)
Cnr King & Lionel Sts.	21 to 41 dB(A)	41 to 45 dB(A)

Note: # This is the Assigned Noise Level for the overnight period 2200hrs to 0700hrs

The upper end of the modelled results range represents worst case scenarios where there is no attenuation from the noise bund

The noise contours show a trend of leakage through the gap where the source point is in line with the gap. Given the mobility of mining, there is always going to be some points for some of the time which are directly in line with the gap in the bund, which is understood to be required to provide light vehicle access to Pad 18.

Given the above summary of ranges of modelled results, it can be seen that the noise bund southern extension provides significant attenuation for mining activities to the east of the bund and is therefore recommended as a most

useful form of noise control. Additionally, it will be seen as an extension to the existing noise bund which has been in place for in excess of 10 years, and has proven to be not only an effective noise barrier, but also a positive visual barrier between mining and urban areas.

The nearest receiver point at East (of) Waverley Street is the least affected by the reduction in bund performance due to the access road traverse, particularly for source location 2 and all three bund scenarios. It can be seen by comparing the resultants at this location for all bund scenarios and all waste dump heights that the plateau of maximum noise levels is not noted as with other results. Such a plateau of maximum resultants indicates that only the relative heights and distances between noise sources and receivers are affecting the result, and that they are independent of the bund for these maximum values.

Construction of the noise bund will be carried out in accordance with Regulation 13 of the Environmental Protection (Noise) Regulations 1997, primarily with respect to times of construction, the implementation of a Noise Management Plan, and consultation as required, with potentially affected property occupiers.

3.0 CRITERIA

The Environmental Protection (Noise) Regulations 1997 (As Amended) are the enforceable regulations under the Environmental Protection Act, and in Table 1 and Schedule 3 of these Regulations, Assigned Noise Levels are determined for an area based on circles of 100 metres and 450 metres centred on the point of measurement. Calculations have been carried out to determine Assigned Noise Levels over areas of Kalgoorlie – Boulder adjacent to the general KCGM mining areas. For this proposal, three locations representative of near, mid-field and far residential areas from the subject bund and mining activities have been chosen for the purposes of assessing resultant noise levels from mining activities with the current noise bund and waste dump area proposals. For each of these locations, the Assigned Noise Levels have been calculated for comparison to the modelled resultant noise levels. Assigned Noise Levels are different for different time periods during the day and night. There are three different time periods during any 24 hour period for determination of Assigned Noise Levels with the overnight period 2200hrs to 0700hrs having the lowest Assigned Noise Levels. Also, the modes of measurement are different dependent on the time that a noise source is present. The L_{A10} Assigned Noise Levels are not to be exceeded for more than 10% of the representative assessment period, and the L_{A1} Assigned Noise Level, for not more than 1% of the representative assessment period. Unless noted otherwise, this assessment will use the L_{A10} criteria.

The following table provides all relevant Assigned Noise Levels for the receiver locations used in this study.

ASSIGNED NOISE LEVELS AT RECEIVER LOCATIONS USED IN MODEL

LOCATION	TIME OF DAY	ASSIGNED NOISE LEVEL		
		L_{A10}	L_{A1}	L_{Amax}
East Waverley Street	0700 – 1900 hours Monday to Saturday	65-70	75-80	85-90
	0900 – 1900 hours Sunday & public holidays	60-65	70-75	80-85
	1900 – 2200 hours all days	60-65	70-75	80-85
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	55-60	65-70	75-80
Corner Columbia & Dwyer Streets	0700 – 1900 hours Monday to Saturday	61-65	71-75	81-85
	0900 – 1900 hours Sunday & public holidays	56-60	66-70	76-80
	1900 – 2200 hours all days	56-60	66-70	76-80
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	51-55	61-65	71-75
Corner King & Lionel Streets	0700 – 1900 hours Monday to Saturday	51-55	61-65	71-75
	0900 – 1900 hours Sunday & public holidays	46-50	56-60	66-70
	1900 – 2200 hours all days	46-50	56-60	66-70
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	41-45	51-55	61-65

Ranges are provided as there will be variations within the vicinity of each of these locations due to variations in land usage within each of the abovementioned circles relative to each location.

Other noise level standards have been written and are applicable to the KCGM Kalgoorlie operations. The “Noise Level Standards for Kalgoorlie Consolidated Gold Mines Pty Ltd” (October 1991), Part D, “General Noise Level Standards” States in D1 that noise levels shall not exceed the ambient noise level present at the time by more than 5 $dBL_{A.}$ There are also other noise level standards for different times of day and night which are not based on the ambient noise levels.

Noise levels associated with this proposal will aim to comply with the Environmental Protection (Noise) Regulations 1997 and also standards specific to KCGM Kalgoorlie operations.

4.0 METHODOLOGY

Land contours, noise source locations, receiver locations and equipment noise levels were input into the computer modelling programme SoundPlan. Calculations were primarily carried out as single point locations with one of the noise source locations computed to give full noise contours more as an indication of the broad area trend as compared to the single point results. This location and scenario was chosen for no other reason than to show this trend.

Land contours were obtained from KCGM, these were provided for 3 different bund scenarios which primarily differed by way of the orientation of the light vehicle access road passing through the bund to provide access to Pad 18 pit equipment and personnel muster point. From our earlier discussions, we had suggested looking at different layouts which minimised the direct line-of-sight via this access road. Scenario 1 has the road generally in a north-west direction, Scenario 2 has the road with a bend in the middle, and Scenario 3 has the road in a northerly direction and further south. For all scenarios, the bund heights are -40mRL north of the road cutting and -20mRL south of the road cutting. In all cases, the slopes at the cutting increase the effective road width, hence broadening the line-of-sight field and providing a widened corridor for unattenuated noise transmission.

Noise source locations used were as provided by KCGM. Specifically, these were:

Source location 1	18800, 46400
Source location 2	18400, 45600
Source location 3	19600, 45800
Source location 4	19600, 45000

These points were chosen as being representative of haul roads and waste dumping locations. Locations 1 & 2 nearer to the bund are the locations representative of haul roads in the current planning and include trucks travelling only. Locations 3 & 4 include trucks dumping and a dozer for local clean up. As location 4 is further away, trucks have also been included travelling to and from this tip head.

Each point was modelled from current ground level to 0m RL in 10 metre increments to reflect the construction of the waste dumps over time. In levels relative to the current ground levels, this generally represents commencing at current ground level, and increasing the height to +80 metres above ground level.

Receiver locations were determined to represent a cross section of varying residential locations at varying distances from mining activities. The following points were used:

East Waverley Street
Cnr Columbia & Dwyer Streets
Cnr King & Lionel Streets

East Waverley Street represents an area where there appear to be some residential locations in what is understood to be an industrial area. Specifically, this location is nearest to mining activities and is east of Waverley Street between Oroya and Chaffers Streets. The status of dwellings in this vicinity is not known, however on a recent inspection, several buildings looked as though they were residential dwellings.

The other two locations represent areas which are more residential in content. Being further away, these have a greater noise reduction due to the distance factor, but less barrier effect due to the noise bund.

At noise source locations 1 & 2, 2 haultrucks have been used for each noise source representing trucks on a haulroad.

At noise source locations 3 & 4 KCGM predicts three CAT 793 haultrucks dumping and one CAT D10R dozer. Noise levels of this equipment have been taken from our file data, most of which has been measured at the Kalgoorlie minesite. For location 4, two trucks have also been included travelling to and from the tip head. As per KCGM advice, these trucks were located at 19800, 45800.

Land contour plans in Appendix 2 show all the above detailed locations and features and should be referred to accordingly.

5.0 RESULTS

A summary of the single point results is included in Appendix 1 for each of the noise source locations and includes bund scenarios 1, 2 & 3, the 3 noted receiver locations, and waste dump heights from current ground level to 0mRL; i.e. the maximum height currently permitted.

Source Point 1

Minimum noise bund attenuation results for most of the haulroad heights because of the access road opening and associated end slopes which reduce the barrier effect to most receiver locations. Bund 1 scenario is the best result for the nominated receiver points because the road opening is further to the north. It is certain that for receiver locations further to the north, that there would be a reduced barrier effect due to the orientation and location of the opening. Even with the noise barrier effect nullified, resultant noise levels are, at the most, 56 dB(A) which is still within the Regulatory criteria.

Source Point 2

This location is further south and therefore is not exposed to the road cutting, therefore, gains most benefit from the bund southern extension. The greatest noise reduction achieved at the nearest location east of Waverley Street is from 50 dB(A) for no bund (refer to highest results) down to 31 dB(A), or a reduction of 19 dB(A). Similarly, for the most distant of the receiver locations chosen, ie. Cnr of King & Lionel Streets, the greatest noise reduction achieved is from 37 dB(A) for no bund (refer to highest results), down to 20 dB(A), or a reduction of 17 dB(A).

Source Point 3

As this location is further away from the noise bund, the reductions due to the bund are less, but the distance attenuation is greater. For the nearest location east of Waverley Street, the results for no barrier effect are 53 dB(A), down to a best attenuated result of 34 dB(A), or a reduction of 19 dB(A). For the most distant location at the Corner of King & Lionel Streets, all results are the same at 41 dB(A) showing that the noise bund has no effect under these circumstances however, due to the

distance factor, the results are 12 dB(A) less than at the nearest Waverley Street location.

Source Point 4

As this point is further away again from the noise bund, the results show that the bund has little effect for all but the east Waverley Street location for bund scenarios 1 & 2, but the results are less due to the greater distances from the receiver points. For bund scenario 3, there is almost a direct straight line between this source location and the 3 receiver points and therefore, all results are the same and represent no attenuation from the bund configuration used. Even with the above facts, all modelled results are still within the regulatory criteria.

The noise contour plots have been carried out for source point 3, source locations at +10m above existing ground level, and bund scenarios 1, 2 & 3. Attenuation offered by the noise bund is clearly seen from these plots attached in Appendix 2. Leakage via the road gap is most evident for bund scenario 1, where the road is almost directly in line with this source point and the three receiver locations. This profile would be considered typical for any source / receiver points which have line-of-sight, or close to line-of -site between them.

6.0 NOISE MANAGEMENT

6.1 There are no specific engineering management controls recommended as a result of this study. However, general management practices are recommended as follows:

1) Ensure the “quietest reasonably available” equipment available is used on this site.

2) Monitoring of sound pressure levels should be carried out during construction. Continuous monitoring will be undertaken as part of KCGM’s monitoring program established in 1993.

3) Construction activities (i.e. earth bunding) be restricted to 0700 to 1900 hours on any day, except a Sunday or Public Holiday. If work outside these hours is required then the following procedures should be initiated:

i) A noise management plan is prepared and given to the Chief Executive Officer (of Department of Environment) at least 7 days before construction commences and is approved by the Chief Executive Office (of Department of Environment).

ii) Written notice is given to the occupiers of all premises at which noise emissions received are likely to exceed those levels specified under Regulation 7 of the proposed construction work.

iii)It was reasonably necessary for the construction work to be carried out at that time.

4) All mobile equipment used during construction be fitted with 'Smart Alarms'.

5) Operator training in 'least noisy' operation of equipment and also awareness of proximity to residences.

6) Larger trucks to be utilised where feasible in order to reduce number of truck cycles.

7.0 CONCLUSION

1. Operations should be planned to avoid direct line-of-sight situations during the most critical times which would generally be the overnight periods when ambient noise levels are lowest and regulatory assigned noise levels are also lowest. This should be considered as a best practice option as results with no bund attenuation still meet regulatory Assigned Noise Levels.

2. Other access road layouts through the bund may be investigated although we understand that the current 3 proposals have pursued most possibilities. It will be difficult to find an arrangement which will provide the total potential noise bund attenuation between all possible noise source and receiver locations at all times, given particularly the noise bund slopes at the road traverse which effectively widen the opening. Since a wide scope of road options have been included, it is anticipated that most would leave line-of-sight for some locations for some of the time. With the mobile nature of activities however, time in these areas could be minimised during the more critical overnight period; keeping in mind that all assessments meet the regulatory criteria without bund attenuation and also that the assessments are against the night time criteria.

3. The results generally meet regulatory overnight criteria with no noise bund attenuation, however, with the added attenuation provided by the proposed noise bund, any adjustments for tonality (if applicable) could more readily be accommodated whilst still having adjusted noise levels being less than the corresponding Assigned Noise Levels at each location. Construction of the noise bund as currently proposed is therefore endorsed.

4. Construction of the noise bund will be carried out between 0700 and 1900 hours on any day which is not a Sunday or public holiday in accordance with Regulation 13 (2) of the Environmental Protection (Noise) Regulations 1997. Other requirements of this regulation such as the implementation of a Noise Management Plan and use of the least noisy equipment reasonably available will be incorporated into the planning and construction programmes. Where any work outside of the above times may be necessary from time to time, then a consultation process shall be incorporated into the Noise Management Plan and implemented as and when needed.

For: **HERRING STORER ACOUSTICS**

Allan Herring

20 October 2003

APPENDIX 1

SOUND PLAN RESULTS

Equipment Located at Point 1

Bund 1

Scenario	Location		
	Cnr Columbia & Dwyer Streets	**Cnr King & Lionel Streets**	**East Waverley Street**
Ground Level	27.6	20.5	30.8
+10m	28.0	21.2	36.1
+20m	29.8	23.5	36.4
+30m	32.8	27.9	37.0
+40m	41.9	40.0	38.2
+50m	47.3	40.0	40.0
+60m	47.3	40.0	42.9
+70m	47.3	40.0	50.1
+80m	47.3	40.0	55.8

Bund 2

Scenario	Location		
	Cnr Columbia & Dwyer Streets	**Cnr King & Lionel Streets**	**East Waverley Street**
Ground Level	22.5	22.2	38.9
+10m	39.6	39.1	55.7
+20m	47.3	40.0	55.8
+30m	47.3	40.0	55.8
+40m	47.3	40.0	55.8
+50m	47.3	40.0	55.8
+60m	47.3	40.0	55.8
+70m	47.3	40.0	55.8
+80m	47.3	40.0	55.8

Bund 3

Scenario	Location		
	Cnr Columbia & Dwyer Streets	**Cnr King & Lionel Streets**	**East Waverley Street**
Ground Level	29.5	22.2	30.9
+10m	36.1	30.4	40.8
+20m	47.3	40.0	45.5
+30m	47.3	40.0	55.7
+40m	47.3	40.0	55.7
+50m	47.3	40.0	55.8
+60m	47.3	40.0	55.8
+70m	47.3	40.0	55.8
+80m	47.3	40.0	55.8

Summary

For Point 1, Bund 1 is most effective, then Bund 3 (where noise goes over smaller bund) and Bund 2 (where noise goes through road gap)

Worst Case noise levels are 53 dB(A) at Columbia & Dwyer, 45 dB(A) at King & Lionel and 61 dB(A) at East Waverly Street for Bund 1 scenario

Note: Where noise level no longer increases with increasing source RL, barrier is providing no reduction due to large distances between source to bund and receiver to bund.

Equipment Located at Point 2

Bund 1

Scenario	Location		
	Cnr Columbia & Dwyer Streets	**Cnr King & Lionel Streets**	**East Waverley Street**
Ground Level	26.2	19.7	31.3
+10m	28.8	22.8	31.7
+20m	34.9	36.1	32.5
+30m	42.6	36.5	33.3
+40m	42.6	36.5	34.4
+50m	42.6	36.5	35.9
+60m	42.6	36.5	37.9
+70m	42.6	36.5	41.9
+80m	42.6	36.5	50.4

Bund 2

Scenario	Location		
	Cnr Columbia & Dwyer Streets	**Cnr King & Lionel Streets**	**East Waverley Street**
Ground Level	26.2	19.7	31.3
+10m	28.8	22.8	31.7
+20m	34.9	36.1	32.5
+30m	42.6	36.5	33.3
+40m	42.6	36.5	34.4
+50m	42.6	36.5	35.9
+60m	42.6	36.5	37.9
+70m	42.6	36.5	41.2
+80m	42.6	36.5	50.4

Bund 3

Scenario	Location		
	Cnr Columbia & Dwyer Streets	**Cnr King & Lionel Streets**	**East Waverley Street**
Ground Level	26.2	19.7	31.3
+10m	28.8	22.8	31.7
+20m	34.9	36.1	32.5
+30m	42.6	36.5	33.3
+40m	42.6	36.5	34.4
+50m	42.6	36.5	35.9
+60m	42.6	36.5	37.9
+70m	42.6	36.5	41.2
+80m	42.6	36.5	50.4

Summary

For Point 2, all bunds provide the same effectiveness.
Worst Case noise levels are 48 dB(A) at Columbia & Dwyer, 42 dB(A) at King & Lionel and 56 dB(A) at East Waverly Street for either bund scenario
Note: Where noise level no longer increases with increasing source RL, barrier is providing no reduction due to large distances between source to bund and receiver to bund.

Equipment Located at Point 3

Bund 1

Scenario	Location		
	Cnr Columbia & Dwyer Streets	**Cnr King & Lionel Streets**	**East Waverley Street**
Ground Level	47.3	41.4	34.1
+10m	47.3	41.4	34.6
+20m	47.3	41.4	35.1
+30m	47.3	41.4	35.8
+40m	47.3	41.4	36.5
+50m	47.3	41.4	37.5
+60m	47.3	41.4	38.6
+70m	47.3	41.4	40
+80m	47.3	41.4	41.9

Bund 2

Scenario	Location		
	Cnr Columbia & Dwyer Streets	**Cnr King & Lionel Streets**	**East Waverley Street**
Ground Level	47.3	41.4	52.9
+10m	47.3	41.4	52.9
+20m	47.3	41.4	52.9
+30m	47.3	41.4	52.9
+40m	47.3	41.4	52.9
+50m	47.3	41.4	52.9
+60m	47.3	41.4	52.9
+70m	47.3	41.4	52.9
+80m	47.3	41.4	52.9

Bund 3

Scenario	Location		
	Cnr Columbia & Dwyer Streets	**Cnr King & Lionel Streets**	**East Waverley Street**
Ground Level	47.3	41.4	43.5
+10m	47.3	41.4	48.8
+20m	47.3	41.4	52.8
+30m	47.3	41.4	52.9
+40m	47.3	41.4	52.9
+50m	47.3	41.4	52.9
+60m	47.3	41.4	52.9
+70m	47.3	41.4	52.9
+80m	47.3	41.4	52.9

Summary

For Point 3, Bund 1 is most effective, then Bund 3 (where noise goes over smaller bund) and Bund 2 (where noise goes through road gap)

Worst Case noise levels are 47 dB(A) at Columbia & Dwyer, 41 dB(A) at King & Lionel and 42 dB(A) at East Waverly Street for Bund 1 scenario

Note: Where noise level no longer increases with increasing source RL, barrier is providing no reduction due to large distances between source to bund and receiver to bund.

Equipment Located at Point 4

Bund 1

Scenario	Location		
	Cnr Columbia & Dwyer Streets	**Cnr King & Lionel Streets**	**East Waverley Street**
Ground Level	44.1	38.7	31.2
+10m	44.1	38.7	31.7
+20m	44.1	38.7	32.2
+30m	44.1	38.7	32.7
+40m	44.1	38.7	33.4
+50m	44.1	38.7	34.1
+60m	44.1	38.7	35
+70m	44.1	38.7	36
+80m	44.1	38.7	37.2

Bund 2

Scenario	Location		
	Cnr Columbia & Dwyer Streets	**Cnr King & Lionel Streets**	**East Waverley Street**
Ground Level	44.1	38.7	31.3
+10m	44.1	38.7	31.8
+20m	44.1	38.7	32.3
+30m	44.1	38.7	32.9
+40m	44.1	38.7	33.5
+50m	44.1	38.7	34.3
+60m	44.1	38.7	35.2
+70m	44.1	38.7	36.3
+80m	44.1	38.7	37.6

Bund 3

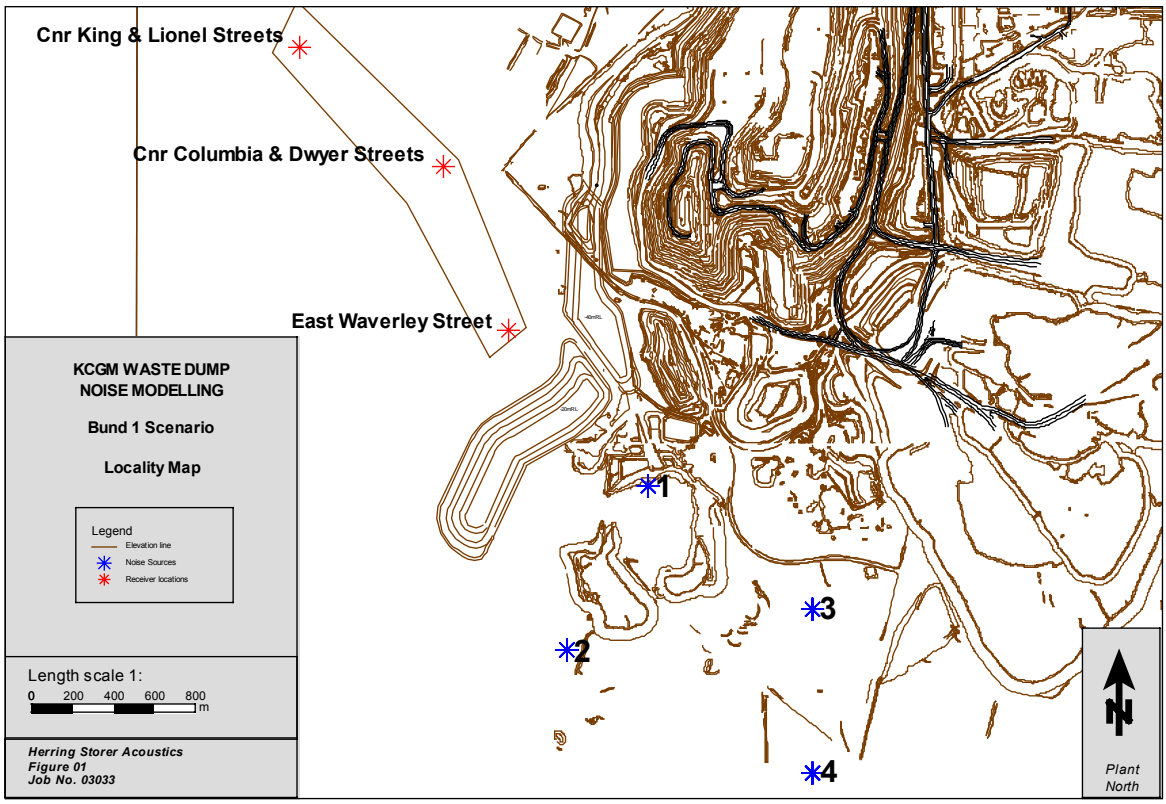
Scenario	Location		
	Cnr Columbia & Dwyer Streets	**Cnr King & Lionel Streets**	**East Waverley Street**
Ground Level	44.1	38.7	49.2
+10m	44.1	38.7	49.2
+20m	44.1	38.7	49.2
+30m	44.1	38.7	49.2
+40m	44.1	38.7	49.2
+50m	44.1	38.7	49.2
+60m	44.1	38.7	49.2
+70m	44.1	38.7	49.2
+80m	44.1	38.7	49.2

Summary

For Point 4, Bund 1 is most effective, then Bund 2 and Bund 3 (where noise goes through gap)
Worst Case noise levels are 44 dB(A) at Columbia & Dwyer, 39 dB(A) at King & Lionel and 37 dB(A) at East Waverly Street for Bund 1 scenario
Note: Where noise level no longer increases with increasing source RL, barrier is providing no reduction due to large distances between source to bund and receiver to bund.

APPENDIX 2

LAND AND NOISE CONTOURS


Cnr King & Lionel Streets
Cnr Columbia & Dwyer Streets
East Waverley Street
KCGM WASTE DUMP
NOISE MODELLING
Bund 1 Scenario
Locality Map
Legend
Elevation line
Noise Sources
Receiver locations
Length scale 1:
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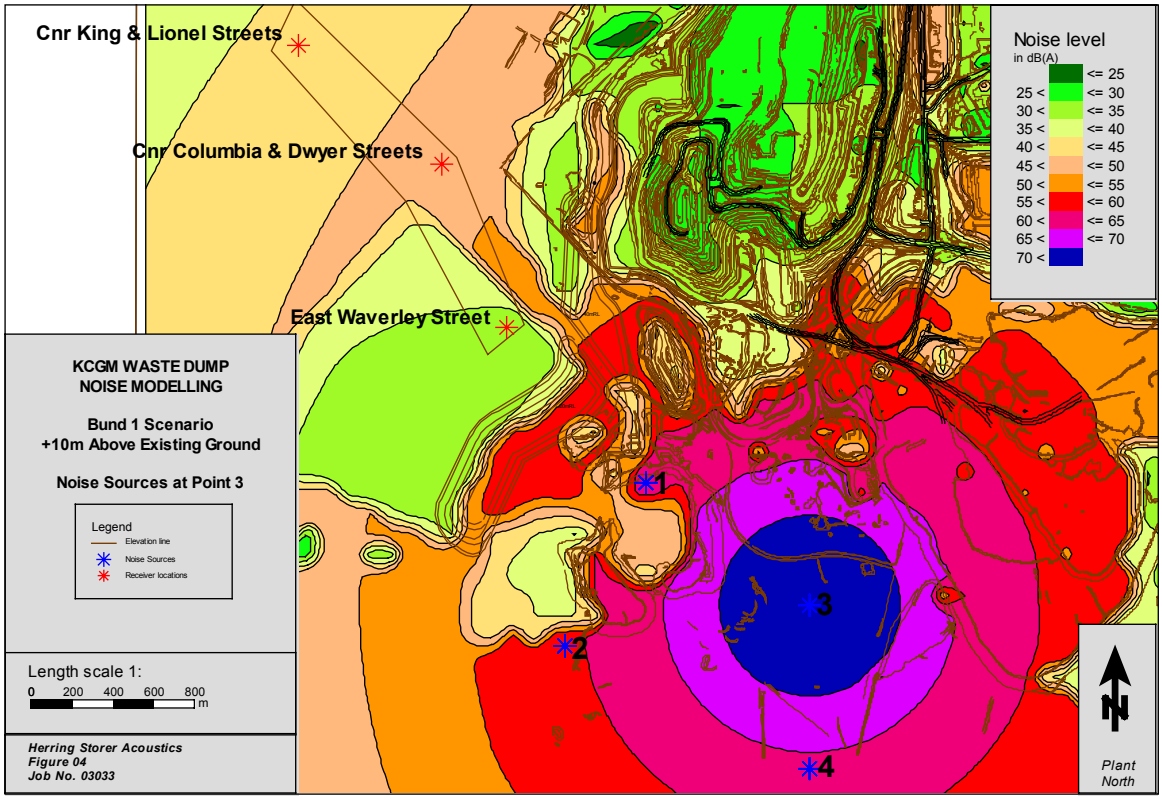
m
Herring Storer Acoustics
Figure 01
Job No. 03033
1
2
3
4
Plant North


Cnr King & Lionel Streets
Cnr Columbia & Dwyer Streets
East Waverley Street
Noise level
in dB(A)
<= 25
25 < <= 30
30 < <= 35
35 < <= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 < <= 65
65 < <= 70
70 <
KCGM WASTE DUMP
NOISE MODELLING
Bund 1 Scenario
+10m Above Existing Ground
Noise Sources at Point 3
Legend
Elevation line
Noise Sources
Receiver locations
Length scale 1:
0 200 400 600 800
m
Herring Storer Acoustics
Figure 04
Job No. 03033
1
2
3
4
Plant North