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ENVIRONMENTAL NOISE MANAGEMENT STRATEGY FOR THE WAGERUP 3 EXPANSION PROJECT

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CONTENTS

1 SUMMARY

This report contains details of noise control and noise management methods required to achieve the noise emission criteria for the Wagerup 3 Expansion Project. An equipment list showing the allocation of noise budgets for plant areas within the Refinery is given and it is demonstrated that the noise emission criteria can be achieved provided that noise budgets are not exceeded.

There is no reserve noise budget to allow for increases in equipment noise levels attributable to unforeseen engineering problems. The Contractor must closely monitor identified key plant areas and equipment items throughout the various phases of the project to ensure compliance with the noise emission criteria.

Because of the large number of noise sources that contribute to the noise received at nearby residences there are no sources that have a controlling impact. Therefore, compliance with the project's noise emission criteria can only be achieved by limiting noise emissions from all new plant.

The noise emission criteria are to be achieved through a combination of quiet design for the Expansion Project and noise reductions from equipment in the existing refinery.

The acoustical measures required for the design of the plant to meet the project noise requirements are outlined in this document. These measures shall be reviewed and updated or modified as required as the design is developed to ensure compliance with the noise emission criteria.

2 INTRODUCTION

This document describes the noise control philosophy to ensure that the Expansion Project complies with the target noise emissions as specified in section 3.

Noise limits are provided in terms of sound power levels and/or sound pressure levels for all relevant equipment and plant areas as a design basis to meet the noise emission criteria for the project. Where both sound power level and sound pressure level limits are provided, the most stringent requirement shall be met.

In proposing noise limits for equipment items and plant areas, due consideration has been given to the distribution of noise sources within the Refinery and the location of noise sensitive premises surrounding the Refinery.

2.1 Scope

This document reviews noise from fixed noise sources at the Wagerup refinery. This includes the first 150 modules (approximately 1.1km) of the head end of the overland conveyor #371 (which is considered as part of the bauxite stockpile area of the refinery) since this part of the conveyor also impacts refinery neighbours.

The remainder of the ore transport system from the Willowdale mine (including conveyor #372, the Bancel and Arundel drive stations and the proposed extension of the system to Larego) has also been reviewed.

Noise impacts and noise management strategies at the Port of Bunbury are also considered.

Noise from transport and trains is not included.

3 NOISE EMISSION CRITERIA

Alcoa of Australia has committed to no increase in noise impacts from refinery or mine operations.

Figure A1 in Appendix B presents the current 35 dB(A) noise contour surrounding the Refinery.

Figure A2 in Appendix B presents the current 35 dB(A) noise contour for the ore transport system only, i.e. excluding the contribution from the Refinery.

4 NOISE CONTROL PHILOSOPHY

The detailed engineering phase of the expansion project will involve implementation of the sound power allocation table provided in section 8 of this report. This table is an equipment list that specifies the maximum sound power level (and, where appropriate, sound pressure level) that an item may have. Noise reductions are also specified in a separate table for existing plant items which, although not directly affected by the expansion, will require noise mitigation measures to compensate for noise emissions from new plant introduced as part of the expansion project.

Appendix C provides noise contours surrounding the refinery for the expanded operations assuming successful implementation of the sound power budget, thus demonstrating that the sound power budget can achieve the noise emission criteria.

Based on the sound power allocation table, equipment noise data requisition sheets shall be prepared for all relevant items of equipment specifying noise limits. These data sheets shall be provided to prospective equipment suppliers who will be required to provide noise emission guarantees. The submitted data sheets shall be examined in detail as part of routine checking.

Meeting the project requirements will be heavily dependant on controlling noise emissions from the following areas:

- Stockpiles
- Mills
- Power / steam generation
- Precipitation
- Calcination.

Consequently, close co-operation will be required with selected vendors for equipment within these areas.

Expansion provides opportunity to reduce noise from existing plant and this should be reviewed before considering existing plant not affected by the expansion.

Where noise sources are not contained within buildings or enclosures, attempts shall be made to locate the equipment such that there is no line-of-sight between the equipment and any noise sensitive receiver by taking advantage of existing tanks and buildings. Wherever possible, new plant and equipment should be located towards the centre of the refinery to maximise the screening effect of the existing structures. Any new buildings or tanks, which do not themselves emit significant noise, should, wherever possible, be located so that they provide a barrier between new or existing sources and noise sensitive receivers.

Noise emissions from new equipment located at the periphery of the existing refinery will need to be carefully controlled because the source to receiver distances are smaller and there will be no screening effect from other buildings.

Any source with sound power level greater than 100 dB(A) has potential to cause an increase in noise received at noise sensitive premises.

4.1 Noise Control Engineering – General Principles

4.1.1 Motors

Electric motors should be specified with a maximum sound pressure level of 80 dB(A) @ 1m when loaded. This should be readily achievable for all but very large motors, in which case noise control measures will need to be reviewed on a case by case basis and consideration should be given to equipment location, screening or acoustic enclosures. Low speed motors are inherently quieter than high speed motors, and, therefore, high pole motors (e.g. 6 pole or 8 pole) are preferable to low pole motors.

It should be noted that manufacturers typically provide noise data for motors in their unloaded condition. It is important, therefore, that when requesting noise data it should be emphasised that loaded noise levels are required, and it is for this operating mode that noise level should be guaranteed.

4.1.2 Gearboxes

Large gearboxes, and gearboxes achieving a large speed reduction have the potential to be very noisy. The most effective way to avoid noisy gearboxes is to reduce the input speed of the gearbox, ie use a low speed motor, ie 6 pole, 8 pole, etc motor in preference to a 4 pole motor with higher speed reduction gearbox. Alternatively, lower noise devices such as cyclo-drives could be considered.

4.1.3 Pumps

In many instances, noise from pump units is dominated by noise emissions from the drive motor. Therefore, motor / pump assemblies should be specified with a maximum sound pressure level of 80 dB(A) @ 1m. For larger units this limit may not be achievable, in which case noise control measures will need to be reviewed on a case by case basis and consideration should be given to equipment location, screening or acoustic enclosures. Acoustic lagging may also be required for some discharge piping (refer section 4.1.6)

4.1.4 Air Coolers

Large air coolers should be avoided wherever possible because they produce high noise levels over a large area. If alternative cooling methods are not practical then air coolers should employ the latest noise control technology. The coolers should be fitted with low speed, low noise fan blades. Reduction in noise is generally achieved through reduction in tip speed of the fan blades. This may mean that more fans are required to achieve the desired air flow. Variable speed drives should also be considered so that fan speeds, and consequently noise emissions, are reduced during the night when cooling demand is lower. Drive motors should also be specified as low noise units.

4.1.5 Control Valves

Control valves should be specified with a maximum sound pressure level of 80 dB(A) @ 1m from the downstream piping. Valves should be selected such that there is no possibility of cavitation over the entire operating range. Where appropriate, VVVF control should also be considered in place of control valves.

4.1.6 Piping Systems

Piping noise contributes significantly to noise emissions from some areas in the existing refinery. Consequently a study of piping noise should be undertaken during the detailed design stage of the expansion project. Particular care should be taken to minimise flow generated noise within pipes and to eliminate cavitation and pipe hammer for all possible flow conditions. Due consideration should be given to piping layouts, piping schedules, resonant effects, piping supports, acoustic lagging, etc.

4.1.7 Conveyors

Noise from conveyors is very sensitive to changes in conveyor speed. Therefore, conveyors should be designed to operate at the lowest possible speeds (for example by increasing belt width). Low noise, large diameter conveyor idlers should be used and belt washers or turnovers provided to prevent dirt build up which increases noise emissions. High noise emissions also occur from drive stations and transfers which should be acoustically enclosed.

4.1.8 Fans and Blowers

Suction and discharge silencers should be fitted to fans and blowers and noise reduction devices should be fitted wherever possible. The design of suction and discharge ducts should allow for maintenance access to the silencers so that they can be serviced on a regular (e.g. annual) basis.

4.1.9 Hydraulic Drives

Hydraulic drives have the potential be extremely noisy and are often very tonal in characteristic. Wherever possible electric motor drives should be used. If hydraulic drives are used they should be acoustically enclosed and the hydraulic piping should be acoustically lagged and resiliently mounted to supporting structures.

5 SPECIFIC PLANT AREAS

Noise control measures for some specific plant areas are discussed below. The information provided is for guidance only and alternative approaches may be considered provided it can be demonstrated that the noise budgets are still achieved. For those areas which are not discussed in the following sections the generic noise controls described in section 4.1 should provide adequate noise reductions. Appendix A includes a plot plan for the expansion project and a map of the ore transportation system.

5.1 Overland Conveyor# 371 – 1st 150 Modules

The carrying capacity of the overland conveyor will be increased by increasing the belt width from 915mm to 1050mm and increasing the speed from 5.5 m/s to 5.9 m/s. Both of these factors have the potential to cause an increase in noise emissions from the conveyor. In particular, it is known that noise emissions are particularly sensitive to conveyor speed which must be kept as low as possible. To compensate for this potential increase in noise emissions it is proposed that large diameter, low noise, machined idlers are installed for at least one kilometre of the conveyor from the refinery. Noise generated by conveyor idlers is significantly increased if dirt is allowed to build up on the idlers. It is important, therefore, that either belt washing facilities are provided to prevent dirt build up or belt turnover stations are installed.

There will be a new conveyor drive at the head of the overland conveyor within the refinery. This represents a new source of noise and, therefore, noise emissions must be controlled to the extent that it does not significantly contribute to overall refinery noise emissions. This can be achieved by a combination of low noise equipment specifications and acoustic enclosures.

5.2 Ore Transport System

Potential increases in noise impacts from the ore transport system can arise as a result of:

a) Increase in speed and belt width of the existing conveyor #371
b) Noise emissions from the extension of the conveying system to Larego

The proposed conveying system involves transporting of ore from a new crushing station (Larego) situated some 5 km to the south east of the Arundel drive station. It is planned to construct a curved extension of the existing 371 conveyor system.

Appendix A shows the proposed ore transportation system.

There are very few residences that are impacted by noise from the ore transport system, and none are in the vicinity of the proposed extension path. Hence, the most significant noise impact for residences is the increase in capacity of the existing conveyor #371. Noise reductions will, therefore, be required for those sections of conveyor #371 nearest to the residences. The required reductions can be achieved by appropriate selection of machined and balanced (M/B) conveyor idlers. Table 5-1 below lists the relevant sections of the conveyor and suggested changes to idler configuration.

Table 5-1 Proposed changes to conveyor #371 idlers

Conveyor Section	Existing Idlers	Proposed Idlers
Modules 390 – 413	127mm	152mm (M/B)
Modules 414 – 500	152mm (M/B)	178mm (M/B)
Modules 501 – 657	152mm (M/B)	178mm (M/B)
Modules 844 – 1142	127mm (M/B)	178mm (M/B)
Modules 1143 – End of existing conveyor	127mm	178mm (M/B)

Note that the table above provides suggestions for modifications to conveyor #371 which should provide the noise reductions necessary to achieve the sound power budget provided in section 8. However, Alcoa has extensive data from acoustic tests on various idler configurations and for varying conveyor speeds, and this information should be used to confirm the final selection of idlers.

Small increases in noise emissions from other sections of conveyor #371 can be tolerated since they do not significantly contribute to the noise received at the residences.

The first 600m of the extension to conveyor #371 has the potential to increase noise impacts at the nearest affected residence. Therefore, to achieve the sound power budget specified in section 8, it is anticipated that large diameter machined and balanced conveyor idlers will be required. Beyond this point the conveyor has minimal impact and the sound power budget should be achievable using standard idlers.

Note that noise emissions from conveyor idlers are lowest when the idlers are new. Noise emissions typically increase with age, wear, and as a result of dirt build-up. The noise emission values provided in section 8 are the maximum allowable values. Consequently, the acceptable noise emission levels for newly installed idlers should be 3dB below those specified.

5.3 Stockpiles (Area 15)

5.3.1 Transfer Station & Sample Plant

Noise emissions from the C371/396 transfer station (including sample plant and pan feeder) will not be allowed to increase from their current level. Increased capacity and drop height will lead to an increase in product handling noise levels, and, therefore, noise control measures will need to be investigated to reduce noise from this source. Options include modifying the hopper design to allow ore to build up on the sides providing a buffer for impacting ore, applying treatments to the sides of the hopper, or enclosing the transfer station. Enclosing the entire transfer station may be the only practical option to achieve the required noise reduction.

The drives for the pan feeder and sample plant will be upgraded and low noise equipment should be sought and the drives should be acoustically enclosed.

5.3.2 Stockpile Conveyors (B100, B200, C100, C200 & 395)

Stockpile conveyors are a significant source of noise for residents to the north of the refinery. After the expansion all four reclaim conveyors will operate simultaneously during stockpile changeovers. (Currently only two of the three existing conveyors operate at any given time.) All these conveyors should be fitted with large diameter, low noise idlers and belt washing facilities should be provided to prevent dirt build up on the idlers. This is particularly important for conveyor B100, which is not shielded by the stockpiles, and conveyors C100 & C200, which are elevated as they approach the storage bins in building 25.

5.3.3 Stockpile Conveyor Drives

Conveyor drives and transfer hoppers for conveyors B100 & B200 are also a very significant source of noise for residents to the north of the refinery. To prevent any increase in noise emissions from these sources, noise controls will have to be applied to the existing hoppers and low noise drive units should be specified. Non impact transfer chutes should be investigated or alternatively the transfer hoppers could be acoustically enclosed.

Low noise drive motors should be sought for conveyors C100 and C200 or the drives should be acoustically enclosed.

5.3.4 Stacker & Reclaimer

Noise from the reclaimer primarily originates from the transfer hopper to the stockpile conveyors. Modifications to this area of the reclaimer will be necessary to reduce noise emissions from impacting ore. Options include modifying the hopper design to reduce impact forces, applying treatments to the sides of the hopper and covering the top of the hopper. Similar controls will also be required for the new reclaimer.

Low noise drive motors should be specified for both the upgraded stacker and the new reclaimer.

5.4 Milling (Area 25)

The existing SAG mills are currently amongst the most significant noise sources for northern residences. The capacity of these mills is to be increased and 2 new ball mills will be introduced. Consequently a very low sound power budget is proposed for both the existing SAG mill and the new ball mills. This can only realistically be achieved by fully enclosing the mills.

5.5 Digestion (Building 30)

In order for the proposed new unit not to cause an increase in received noise levels its sound power level should be at least 5 dB below that for an existing unit. This is achievable by specification of low noise pumps and motors and by careful design of piping systems and selection of control valves. (Noise emissions from the existing units originate primarily from the contact heater pumps and live steam piping.)

If possible noisy equipment should be located in the south east corner of the unit so as to minimise noise propagation to the north and west of the refinery.

5.6 Thickeners (Building 35)

5.6.1 Filtrate tanks (35A)

There is a direct line of sight from this area of the plant to residences to the south east of the plant. Consideration should be given to the location of new equipment in this area such that any new tanks provide acoustic screening for noise generating equipment. That is, new pumps should be located to the north or north east of tanks in the area and should be specified as low noise units. Acoustic enclosures will be required for new pumps in this area if the specified sound power limit cannot be achieved.

5.7 Heat Exchange (Building 40)

In order for the proposed new unit not to result in an increase in received noise levels its sound power level should be at least 5 dB below that for an existing unit. This may be achievable by specification of low noise pumps and motors and by careful design of piping systems. Other noise control considerations include screening or enclosing equipment with particular emphasis on reducing noise propagation to the south and west of the refinery. Consideration should be given to locating pumps to the east of the existing sub-station in the area, i.e. separate from the unit itself, so as to take advantage of the shielding that would be provided by the substation building.

5.8 Precipitation

Noise control design for the new precipitation building is of critical importance in achieving the design criteria for the project because of the proposed location of the unit and the potential for elevated noise sources. Compliance with the design criteria cannot be achieved by duplication of the existing equipment and consequently a very low sound power budget is proposed for this unit. Noise control considerations include specification of low noise pumps and motors, screening or enclosing of all ground level sources, locating ground level noise sources to take advantage of shielding from the precipitation tanks, and specification of low noise valves and piping systems.

The existing precipitation plant includes many elevated noise sources on top of the tanks including agitator drives, cyclones and green liquor valves. The most effective way to mitigate noise from similar equipment for the expansion is to fully enclose the top of the precipitator tanks, i.e. provide a roof over the unit. Alternatively, individual noise control treatments could be used for each noise source, but this approach has not proved effective for the existing precipitation building. If individual treatments are used then the maximum sound pressure level at 1m from any elevated noise source should not exceed 72 dB(A).

Even accounting for these noise controls, noise reductions from the existing precipitation plant will also be required to meet Alcoa's noise objective. Therefore, all existing agitator drives with a sound power level of 95 dB(A) or greater will require a 5 dB reduction in their noise emissions.

An air fin cooler has been proposed near the precipitation unit. The sound power limit specified in section 8 for this unit is only likely to be achieved by employing variable speed fan drives so that fan tip speeds are reduced at night when cooling demands are lowest. If the sound power limit proves too onerous then consideration would have to be given to an alternative cooling system.

5.9 Calcination (Building 50)

Noise control design for the new calciners is of paramount importance in achieving the design criteria for the project. The existing calciners are amongst the most significant noise sources for residences to the south of the refinery. Compliance with the design criteria cannot be achieved by duplication of the existing equipment and consequently a very low sound power budget is proposed for the new units. The location and orientation of the new units should be carefully considered to minimise noise impacts. Consideration should also be given to full or partial screening to the buildings to prevent noise breakout, and blowers should be fully enclosed (as per the current unit 4 calciner blowers) and fitted with appropriate silencers. Blower discharge ducting should be acoustically lagged and have increased wall thickness compared to existing ducting.

Even accounting for these noise controls, noise reductions from the existing calcinations units will be also required to meet Alcoa's noise objective. A 5 dB reduction is required from all blower inlets. This could be achieved by upgrading the existing intake silencers and/or modifying the blowers to reduce noise at source. (It is understood that the existing blowers have recently been modified resulting in reduced noise levels. If this is the case, and a minimum of 5 dB reduction has been achieved, then further reductions would not be required.)

5.10 Power / Steam Generation (Building 110)

Power generation at the refinery is significant source of noise emission. Two new GT / HRSG units are proposed for the expansion and these have the potential to cause a significant noise impact. Consequently a very stringent noise limit has been specified for these units. This will require a detailed noise control review. Consideration will need to be given to high performance intake and exhaust silencers, duct wall noise breakout, enclosing of auxiliary equipment, increased wall thickness for the HRSG, control of combustion noise and concrete enclosures for the gas turbines.

The existing turbine hall will also be extended to the south. The cladding system for the turbine hall extension should be acoustically rated and noise breakout from roof vents, louvres etc should be minimised by applying appropriate acoustic treatments.

Even accounting for the noise controls described above, noise reductions from the existing power generation plant will be required to meet Alcoa's noise objective. A 5 dB reduction is required from the intakes for the boiler FD fans and from the exhaust stack. This can be achieved by installing silencers at the air intakes and fitting splitter silencers in the discharge ducting.

5.11 Residue Disposal Area

Noise from the hydraulic drive for the existing superthickener is excessive and needs to be reduced. Similar noise controls will be required for the new superthickener drive.

The sound power limits specified for the new mud pumping station and sand separation plant should be achievable by specification of low pumps and motors and by careful design of piping systems.

5.12 Oxalate Removal Kiln

A new kiln is proposed for the expansion project. In order to mitigate noise emission from this kiln the induced draft fans and purge air should be acoustically treated by lagging or enclosing the fan casings and drive motors.

6 PROJECT CONTROL

6.1 Development and Use of Noise Model

Alcoa has a noise model for the existing refinery. This model has been used to define Alcoa's current noise impacts. Appendix B presents the 35 dB(A) and 40 dB(A) noise contours generated by this model. The contours represent the worst-case envelope – i.e. worst case sound propagation in all directions simultaneously.

A noise model for the expansion project has been developed from the existing model of the refinery and has been used to define the sound power budget presented in section 8. Appendix C presents the 35 dB(A) and 40 dB(A) noise contours generated by this model assuming the successful implementation of the sound power budget.

On completion of the preliminary design stage of the expansion project the expansion noise model shall be updated and the sound power budget expanded to include specific equipment items. The updated sound power budget shall then be used as a basis for preparation of noise data requisition sheets during the detailed design stage of the project.

Throughout the detailed design stage of the project the noise model shall be continuously updated to reflect design developments and to incorporate noise data received from equipment suppliers.

On completion of the detailed design stage of the expansion project the expansion noise model shall be used to demonstrate that the proposed design can meet Alcoa's noise emission objective.

After the construction stage of the expansion project results from noise commissioning tests shall be used to update the noise model which will then represent the as-built plant.

6.2 Preparation of Equipment Noise Specifications

A preliminary sound power budget is provided in section 8 which specifies noise limits for plant areas and generic equipment items. On completion of the preliminary design stage of the expansion project this sound power budget shall be updated with noise limits specified for individual equipment items.

Early in the detailed design stage of the project, noise data requisition sheets shall be prepared for release during the equipment tendering process. Noise guarantees shall be sought from potential suppliers and shall be incorporated into contractual arrangements with the successful suppliers.

6.3 Noise Testing

Prior to delivery of equipment to site, noise test runs shall be undertaken at the supplier's works. Where necessary, suitable noise test procedures shall be developed in advance. Noise test data shall be reviewed to ensure the equipment is capable of meeting its specified noise

limits prior to accepting delivery. Where equipment fails to meet noise specifications, remedial noise control measures shall be developed at the supplier's expense.

Commissioning noise tests shall also be required for all equipment delivered to site as a final check that the equipment meets its noise specification. Where equipment fails to meet noise specifications, remedial noise control measures shall be developed at the supplier's expense. Commissioning tests shall also include noise monitoring at appropriate locations beyond the refinery boundaries to demonstrate that Alcoa's noise objective has been met.

A noise verification report shall be prepared as part of the commissioning process which presents the results of noise testing, noise monitoring and noise modelling.

7 REVIEW OF NOISE IMPACTS AT BUNBURY PORT

7.1 Existing Situation

Alcoa has previously reviewed noise impacts from its existing operations at the Bunbury port. (Herring Storer Acoustics report reference 0457-1-01029-5, December 2001.) Worst-case noise levels of 35 dB(A) and 31 dB(A) have been predicted for nearby residences to the south-west and north-east of the port facilities respectively.

Since this review was undertaken the only change to the equipment operated at the port is an upgrade of the ship loader dust collector fan. Site measurements undertaken recently show that the new equipment is approximately 3 dB quieter than the old equipment.

The ship loader dust collector fan was identified as the most significant contributor to noise received at residences to the south-west of the port operation. (The contribution from the next most significant source was 10 dB below that of the ship loader dust collector.) Therefore, it is likely that worst-case noise levels will have also reduced by approximately 3 dB to the south-west of the port. Noise from the ship loader dust collector fan was insignificant at residences to the north-east of the port.

Based on the above, it is expected that current worst-case noise levels will be 32 dB(A) and 31 dB(A) at nearby residences to the south-west and north-east of the port facilities respectively.

7.2 Changes Proposed for Port Operations

In reviewing noise impacts at Bunbury, the following changes to existing operations have been assumed.

1. The existing caustic unloading facility will be relocated inside the rail loop (to the north east of the current location). A duplicate of the existing facility will also be constructed at the new location. Trains will access the new facilities via a new spur off the existing rail loop.
2. The conveying system between the four alumina vaults and the storage bins will be duplicated. The existing conveyor will service two of the vaults and the new conveyor will service the remaining two vaults.
3. The number and frequency of trains and ship loading operations will increase.

7.3 Potential Noise Impacts & Noise Management Strategy

7.3.1 Caustic Unloading

There are no significant environmental noise sources associated with the existing caustic unloading facility. Provided that any new equipment is selected in accordance with the generic noise control philosophy outlined in section 4, changes to the facility should have no noticeable noise impacts at nearby residences.

7.3.2 Conveyor Duplication

The existing conveyors between the Alumina vaults and storage bins are fully enclosed and do no contribute to noise received either to the south-west or north-east of the port. Provided that the duplicate conveyors are also enclosed they too should not contribute to noise impacts. New auxiliary equipment such as dust collectors and conveyor drives must not be any noisier than existing equipment and should be selected in accordance with the generic noise control philosophy outlined in section 4. (I.e. any noise controls installed on existing equipment should also be installed for new equipment associated with the conveyor.)

7.3.3 Train Operations and Shiploading

The increase in frequency of train movements and ship loading operations, while increasing the duration of activities at the port, should not increase absolute noise levels unless;

a) longer trains are used which require a second locomotive, or
b) caustic and alumina trains are on site simultaneously.

However, rail noise impacts are beyond the scope of this document.

8 ALLOCATION OF SOUND POWER LEVELS

Table 8-1 Sound Power Allocation Table

Area	Description	Sound Power Level	Sound Pressure Level
371	Overland Conveyor	83 dB(A) /m	70 dB(A) @ 3m*
371	Overland Conveyor Head Drive	95 dB(A)	
15	Transfer Station	105 dB(A)	
15	Conveyor 395	83 dB(A) /m	70 dB(A) @ 3m*
15	Conveyor B100	83 dB(A) /m	70 dB(A) @ 3m*
15	Conveyor B200	83 dB(A) /m	70 dB(A) @ 3m*
15	Conveyor C100	83 dB(A) /m	70 dB(A) @ 3m*
15	Conveyor C200	83 dB(A) /m	70 dB(A) @ 3m*
15	B100 Conveyor Drive / transfer	110 dB(A)	
15	B200 Conveyor Drive / transfer	110 dB(A)	
15	C100 Conveyor Drive	110 dB(A)	
15	C200 Conveyor Drive	110 dB(A)	
15	Upgraded stacker	104 dB(A)	
15	New reclaimer	105 dB(A)	
15	Existing reclaimer	105 dB(A)	
25	Ball Mills	104 dB(A) per mill	
25	SAG Mill 3	107	
25	SAG Mill 4	108	
25	SAG Mill 5	108	
25A	New BSD & Recirc pumps	95dB(A) / pump unit	80 dB(A) @ 1m
30	Digestion	109 dB(A)	
30A	Liquor pumps at Test Tanks	95dB(A) / pump unit	80 dB(A) @ 1m
35A	Filtrate tanks	95dB(A) / pump unit	80 dB(A) @ 1m
35C	Pumps at washers	95dB(A) / pump unit	80 dB(A) @ 1m
35C	Cyclone building	104 dB(A)	
35D	Thickener overflow pumps	95dB(A) / pump unit	80 dB(A) @ 1m
35E	Mud wash water pumps	95dB(A) / pump unit	80 dB(A) @ 1m
35G	Hose/Filter water pumps	95dB(A) / pump unit	80 dB(A) @ 1m
35F	Pumps at thickeners	95dB(A) / pump unit	80 dB(A) @ 1m
35F	Cyclone building	101 dB(A)	
35H	Mud wash overflow pumps	95dB(A) / pump unit	80 dB(A) @ 1m
HEC	High Efficiency Causticisation	106 dB(A)	
40	Heat exchange	106 dB(A)	
45	Precipitation ground level sources	100 dB(A) total	
45	Precipitation elevated sources	101 dB(A) total	72 dB(A) @ 1m / source
45	Vacuum pumps	99dB(A) total	
45	Air fin coolers	107 dB(A)	
45A	Pumps	95dB(A) / pump unit	80 dB(A) @ 1m
50	Calcination	110 dB(A) / unit	
110	Power generation	104 dB(A) / GT	
42B/C	Evaporation	108 dB(A)	
42A	Evaporatoration storage tank pumps	95dB(A) / pump unit	80 dB(A) @ 1m

Area	Description	Sound Power Level	Sound Pressure Level
43	Condensate facilities	95dB(A) / pump unit	80 dB(A) @ 1m
259	Superthickener drive	100 dB(A)	
259	Mud pumping station	102 dB(A)	
259	Sand separation plant	102 dB(A)	
47	Oxalate kiln	100 dB(A)	
Ore Transport System			
371	Conveyor 371 modules 390 - 413		69 dB(A) @ 3m*
371	Conveyor 371 modules 413 – 500		69 dB(A) @ 3m*
371	Conveyor 371 modules 500 – 657		71 dB(A) @ 3m*
371	Conveyor 371 modules 850 – 1140		70 dB(A) @ 3m*
371	Conveyor 371 modules 1140 - 1160		70 dB(A) @ 3m*
371	600m extension of conveyor 371		70 dB(A) @ 3m*
371	Remaining extension of conveyor 371 to Larego		75 dB(A) @ 3m*

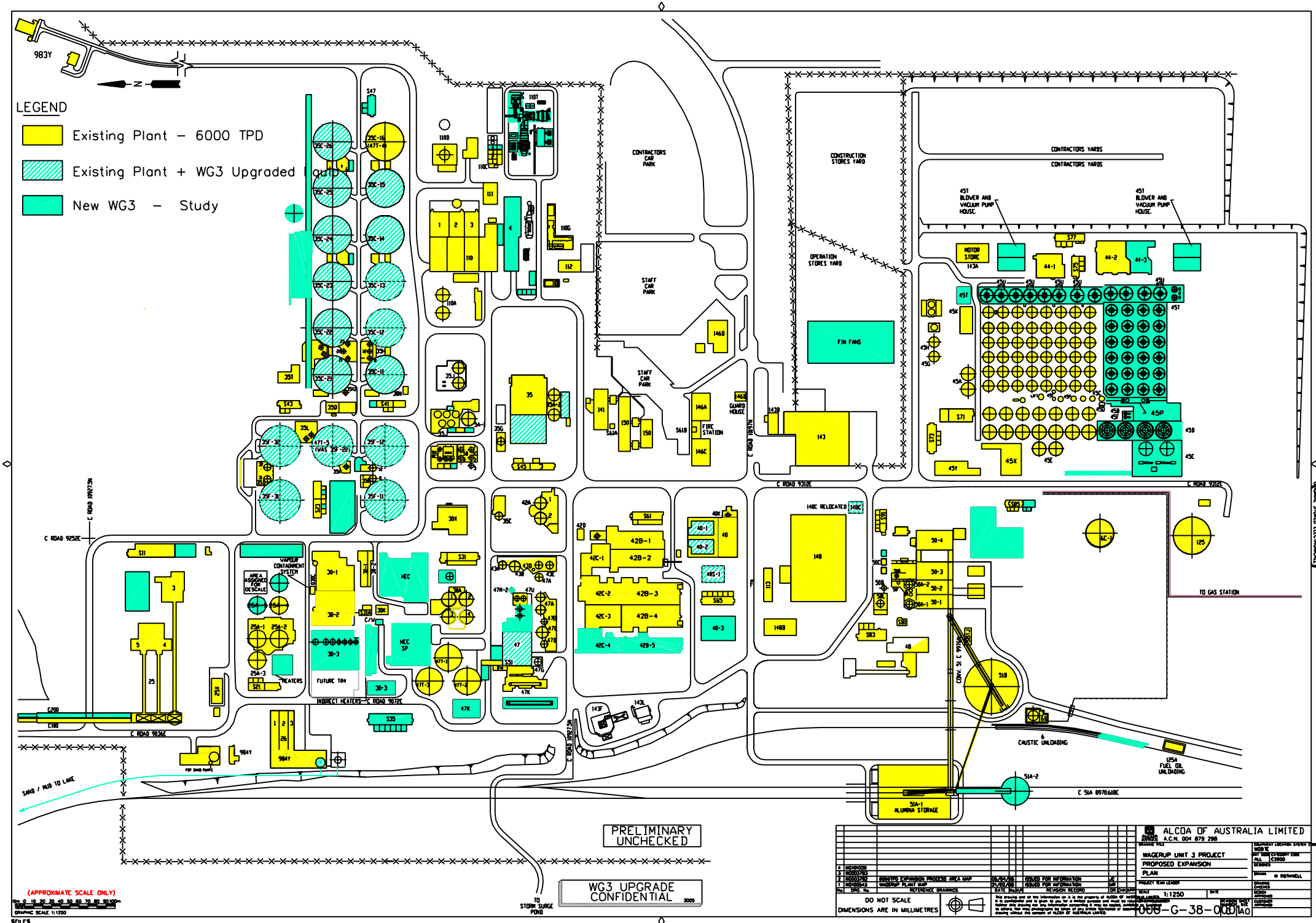
**** Note that noise emissions from conveyor idlers are lowest when the idlers are new. Noise emissions typically increase with age, wear, and as a result of dirt build-up. The noise emission values provided in the table above are the maximum allowable values. Consequently, the acceptable noise emission levels for newly installed idlers should be 3dB below those specified***.

In addition to the noise limits specified in Table 8-1, the following noise reductions from existing plant items are also required to achieve Alcoa's noise objective.

Table 8-2 Noise Reductions applied to existing sources

Building No.	Description	Reduction dB
110	Power Station FD fan intakes	5
110	Power Station exhaust stack (FD fan discharge ducts)	5
50	Calciner blower intakes	5
259	Superthickener hydraulic drive	9
45	Agitator drives (13 noisiest)	5

9 APPENDIX A – EXPANSION PLOT PLAN AND ORE TRANSPORTATION SYSTEM


LEGEND
Existing Plant – 6000 TPD
Existing Plant + WG3 Upgraded Equip
New WG3 – Study
CONTRACTORS CAR PARK
CONSTRUCTION STORES YARD
CONTRACTORS YARDS
OPERATION STORES YARD
STAFF CAR PARK
FIN FANS
FIRE STATION
GUARD HOUSE
MOTOR STORE
451 BLOWER AND VACUUM PUMP HOUSE
C ROAD 9252E
C ROAD 9312E
C ROAD 9036E
C ROAD 9072E
VAPOUR CONTAINMENT SYSTEM
HEC
HEC SP
FUTURE TRN
HEATERS
INDIRECT HEATERS
CAUSTIC UNLOADING
FUEL OIL UNLOADING
ALUMINA STORAGE
TO GAS STATION
SAND / MUD TO LAKE
TO STORM SURGE POND
PRELIMINARY UNCHECKED
WG3 UPGRADE CONFIDENTIAL
(APPROXIMATE SCALE ONLY)
ALCOA OF AUSTRALIA LIMITED
A.C.N. 004 879 298
WAGERUP UNIT 3 PROJECT
PROPOSED EXPANSION
PLAN
SCALE 1:1250
DO NOT SCALE
DIMENSIONS ARE IN MILLIMETRES
WAGERUP EXPANSION PROCESS AREA MAP
WAGERUP PLANT MAP
ISSUED FOR INFORMATION
ISSUED FOR INFORMATION
000-G-38-0000 A0


404000
406000
408000
410000
412000
6360000
6358000
6356000
6354000
Conveyor 372
Bancel Drive Stn.
To be Upgraded
Conveyor 371
Transfer Stn.
Arundel
Drive Stn.
371 Tailend Drive
(to be removed)
Proposed Extn of
Conveyor 371
Proposed Larego
Crusher Site

10 APPENDIX B – CURRENT NOISE CONTOURS

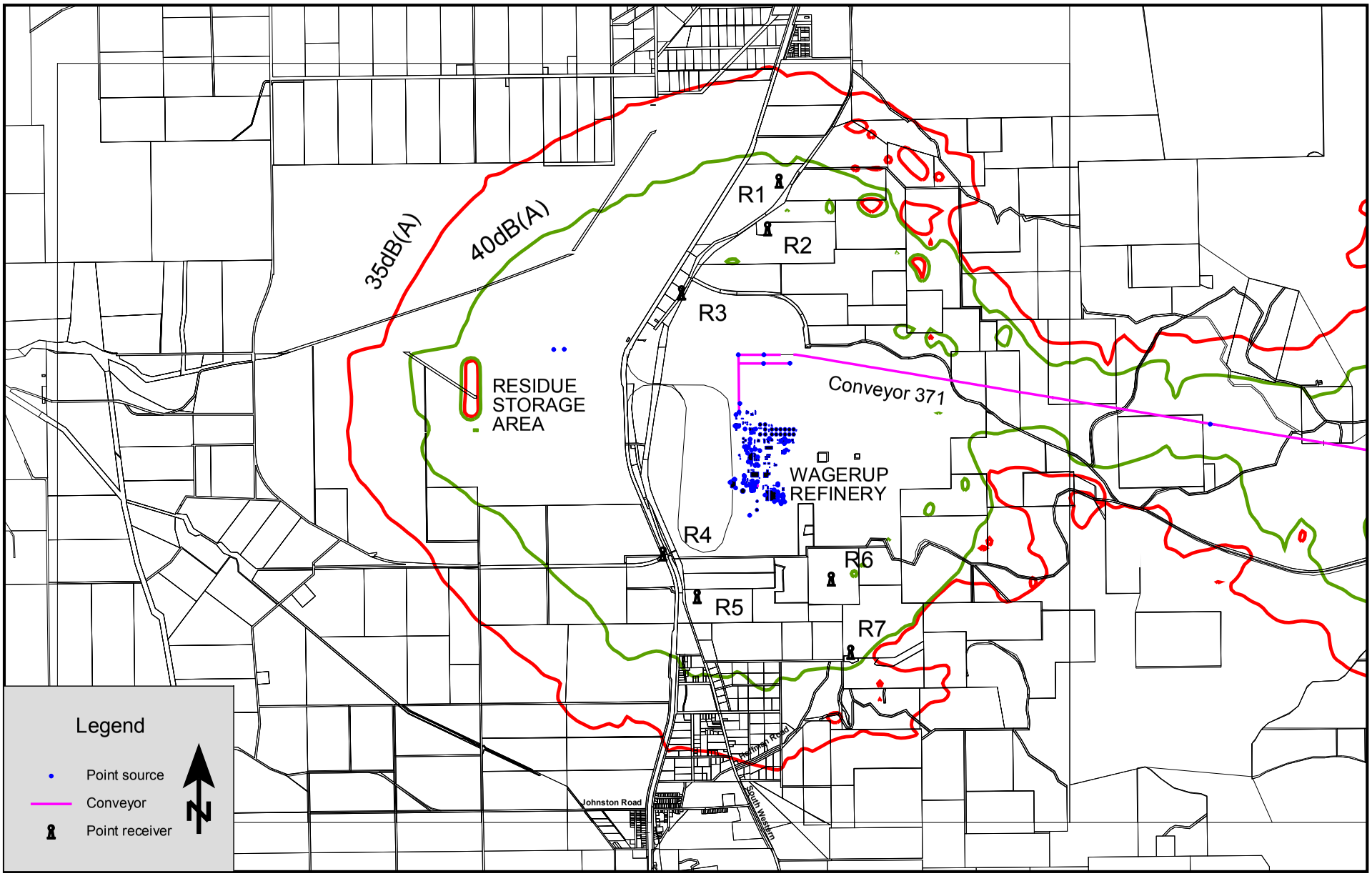


Figure A1. Noise Contours for Existing Refinery

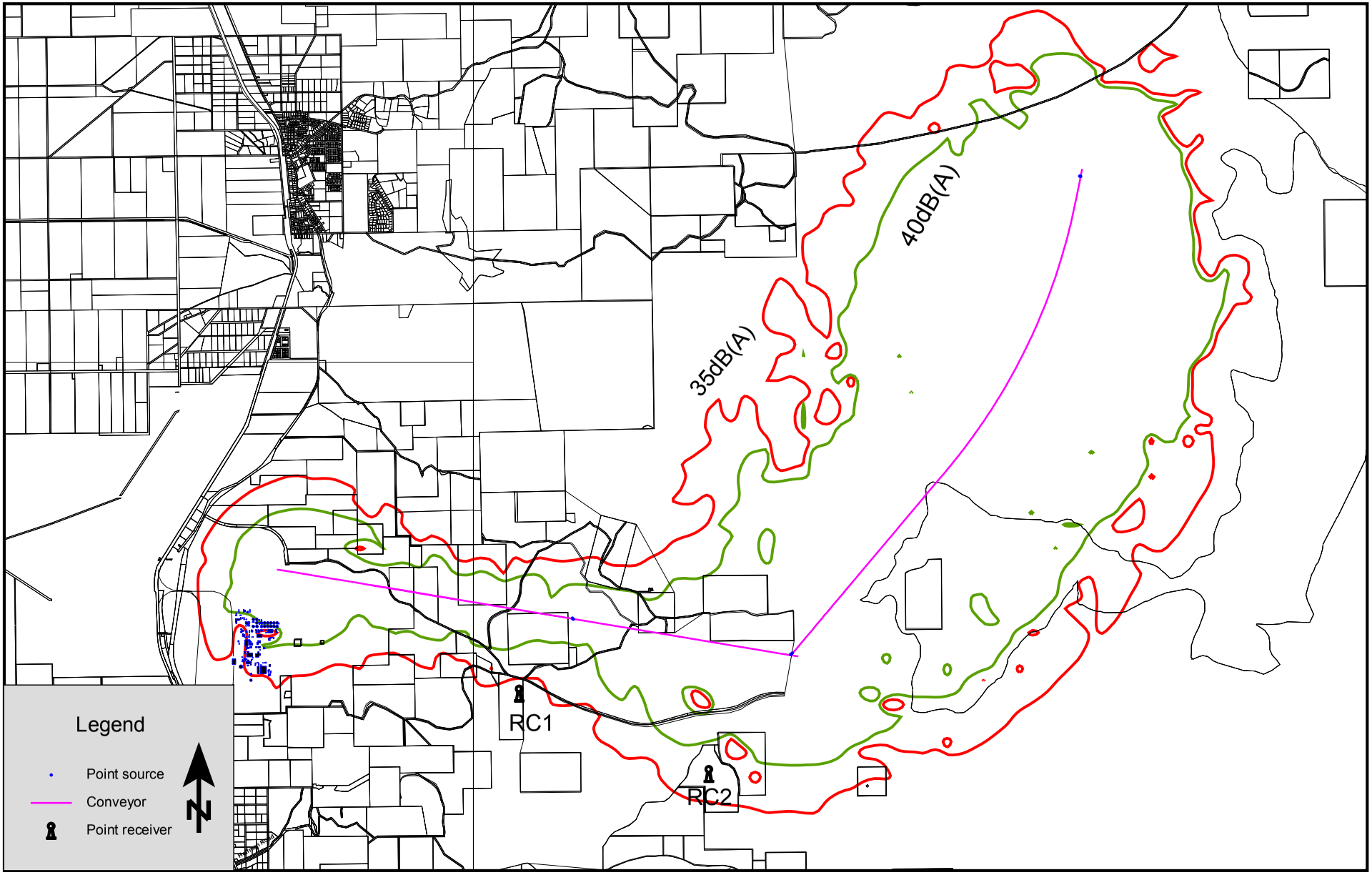


Figure A2. Noise Contours for Existing Overland Conveyors.

11 APPENDIX C – NOISE CONTOURS FOR EXPANDED PLANT

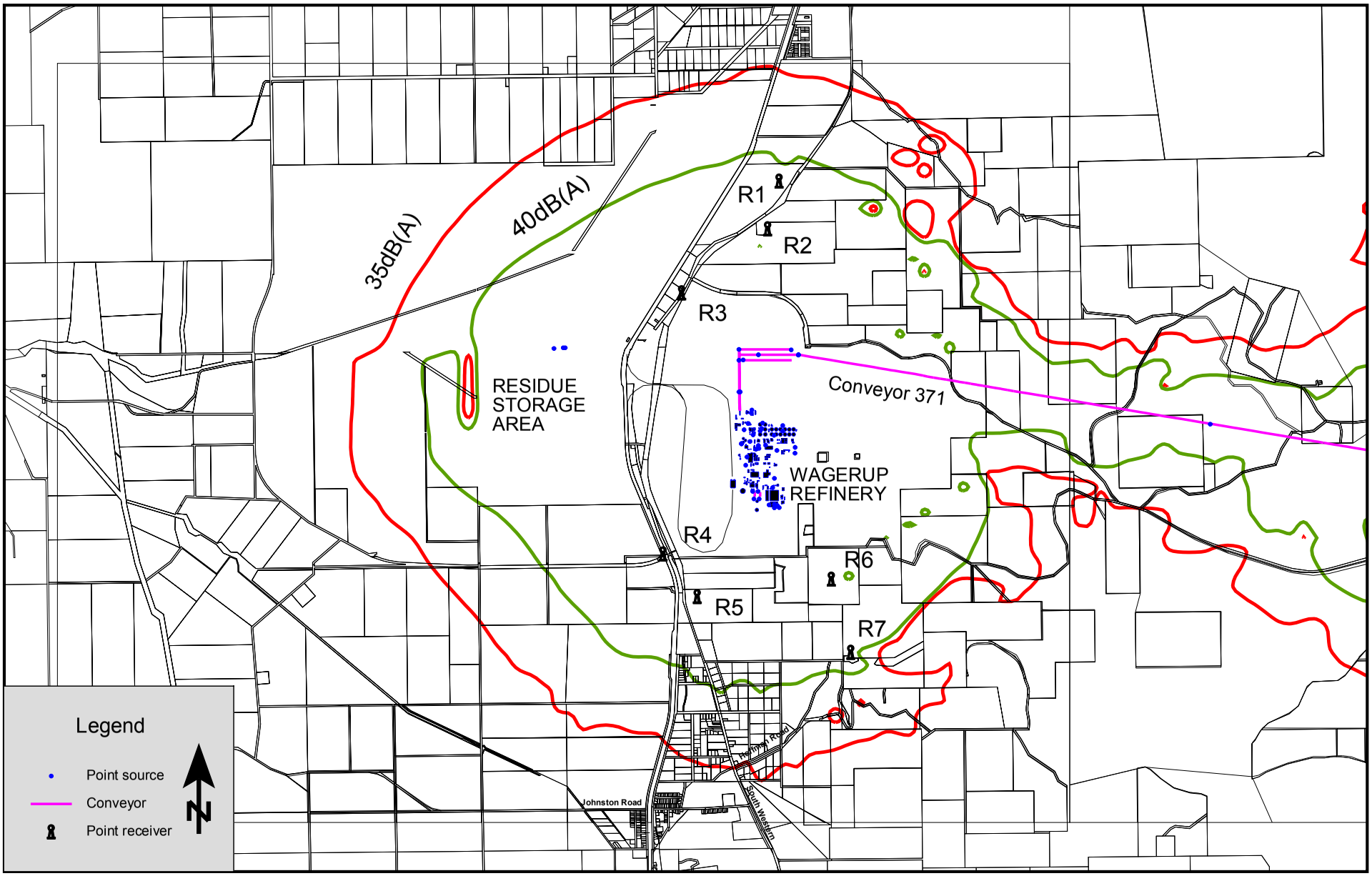


Figure C1. Noise Contours for Expanded Refinery - With Noise Control.

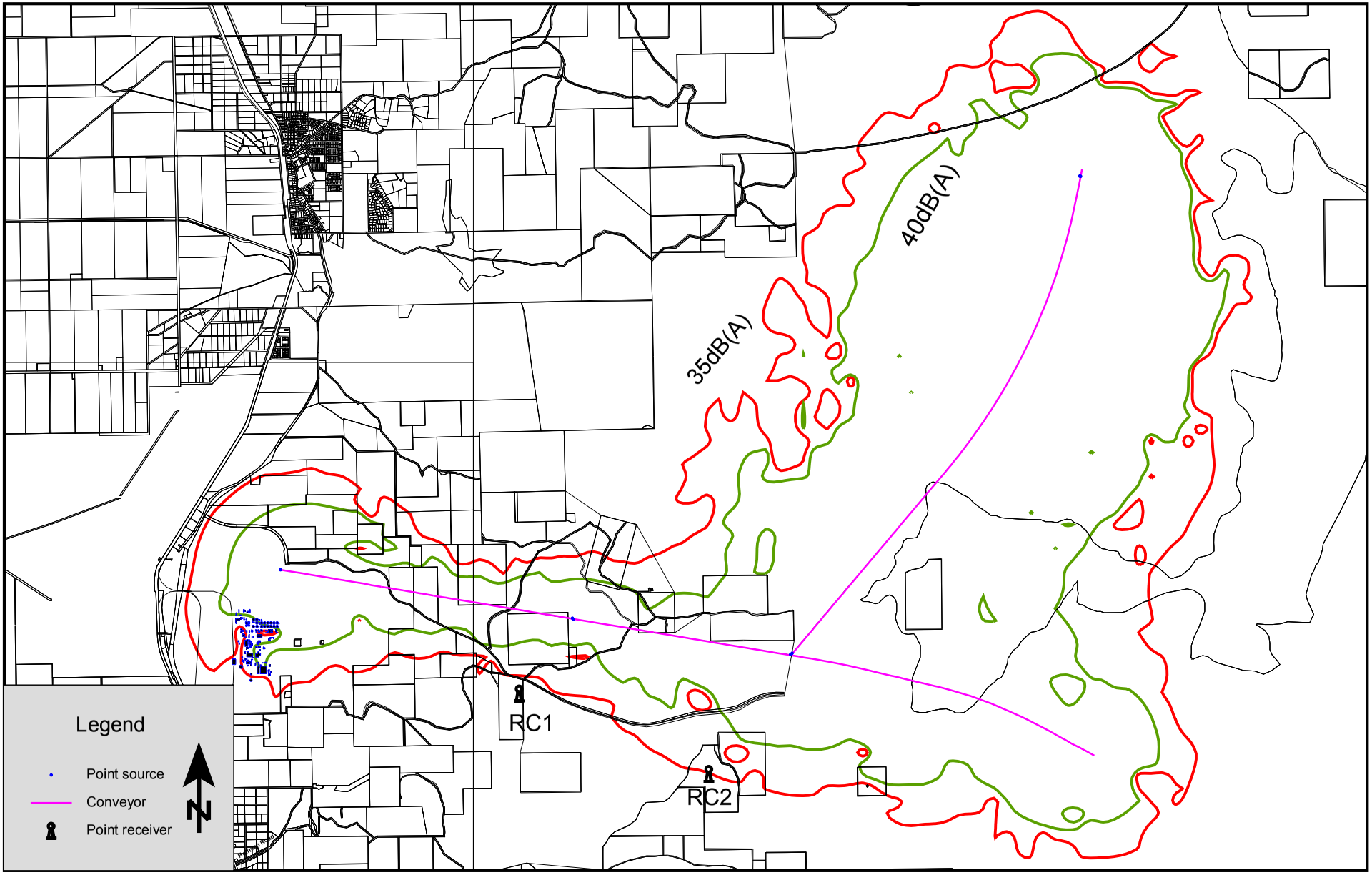


Figure C2. Noise Contours for Expanded Overland Conveyors - With Noise Control.