Sinclair Knight Merz

Utah Point Berth Project

Noise Impact Assessment

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VIPAC

CERTIFIED QUALITY MANAGEMENT SYSTEM ISO9001

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Noise Impact Assessment

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EXECUTIVE SUMMARY

VIPAC Engineers and Scientists Ltd (VIPAC) was commissioned by Sinclair Knight Merz to assess the noise impact of the proposed Utah Point Berth Project.

The Utah Point Berth Project is being developed to cater for an increased demand for bulk export facilities at the Port of Port Hedland. The Berth will also relocate some of the existing bulk commodity export operations from the eastern side of the harbour to Finucane Island.

This report outlines the methodology employed and results obtained from noise modelling of the Utah Point Berth Project.

The potential noise impacts of the proposed Utah Point Berth Project can be divided into three categories, as follows:

- Traffic noise from vehicles associated with the Utah Point Berth Project travelling on public roads.
- Operational (Industrial) noise from the Utah Point Berth Project.
- Construction noise during the construction stage of the Utah Point Berth Project.

To assess the potential for noise impacts, the following three scenarios were modelled:

- Existing port operations (year 2006)
- Future PHPA port operations (year 2009) **without** the proposed Utah Point Berth Project
- Future PHPA port operations (year 2009) **with** the proposed Utah Point Berth Project

With the implementation of the proposed Utah Point Berth Project the following outcomes with respect to noise can be expected:

Traffic noise. Predicted traffic noise levels at residences in Port Hedland will satisfy the applicable traffic noise criteria, as detailed in *EPA Statements for EIA No. 14 (Version 3) Road and Rail Transportation Noise, (Draft 10/5/00).*

Predicted traffic noise levels at residences in South Hedland will satisfy the applicable traffic noise criteria, as detailed in *EPA Statements for EIA No. 14 (Version 3) Road and Rail Transportation Noise, (Draft 10/5/00).*

In Wedgefield the traffic noise criteria may be exceeded at certain noise sensitive sites. Residences could counter any increase in noise levels by implementing simple architectural treatments. As such the objectives of the *EPA Statements for EIA No. 14 (Version 3) Road and Rail Transportation Noise, (Draft 10/5/00)* can be achieved.

Operational noise. The applicable noise criteria, as detailed in the Environmental Protection (Noise) Regulations 1997 (EP(N)R), will be exceeded in most areas west of the Port Hedland Hospital. However, since the operation of the proposed Utah Point Berth Project and the **future** PHPA port operation at Port Hedland are intrinsically linked, noise emissions from the two plants are best considered together. The outcome is that with the implementation of the Utah Point Berth Project, **future noise levels will be lower** than if the facility is not implemented. As such, the noise environment in Port Hedland is predicted to improve.

Discussions are also provided in the report on construction noise, Noise Management, and the relative noise impact of quad and triple road trains.

It is recommended that a suitably qualified acoustic consultant be contracted to participate in the detailed design stage of the proposed project.

TABLE OF CONTENTS

1. INTRODUCTION

VIPAC Engineers and Scientists Ltd (VIPAC) was commissioned by Sinclair Knight Merz (SKM) to assess the noise impact of the proposed Utah Point Berth Project.

The Utah Point Berth Project is being developed to cater for an increased demand for bulk export facilities at the Port of Port Hedland. The Berth will also relocate some of the existing bulk commodity export operations from the eastern side of the harbour to Finucane Island.

This report outlines the methodology employed and the results obtained from noise modelling of the proposed development.

Port Hedland is the major export port of bulk commodities from north Western Australia. Almost all commercial and industrial interests within Port Hedland Region are directly or indirectly related to servicing the ore handling facilities. Significant expansion of port facilities is planned in the region to cater for the increased export demand for bulk commodities. The Utah Point Berth Project is a proposal to increase the ore handling capability of the Port Hedland Port Authority.

Figure 1.1 shows an overview of the Port Hedland region showing the location of Port Hedland, Wedgefield and South Hedland, as well as the major traffic routes from the Great Northern Hwy to Nelson Point and Finucane Island. The location of the proposed facility is indicated, as are the built up areas where noise impacts are considered.

Figure 1.2 shows the Finucane Island and Nelson Point areas. Of note are the Finucane Island and Nelson Point BHP Billiton iron ore facilities. These facilities are the dominant source of noise in Port Hedland, and typically control the existing background noise level.

Figure 1.1: Port Hedland Region showing traffic routes and built up areas.

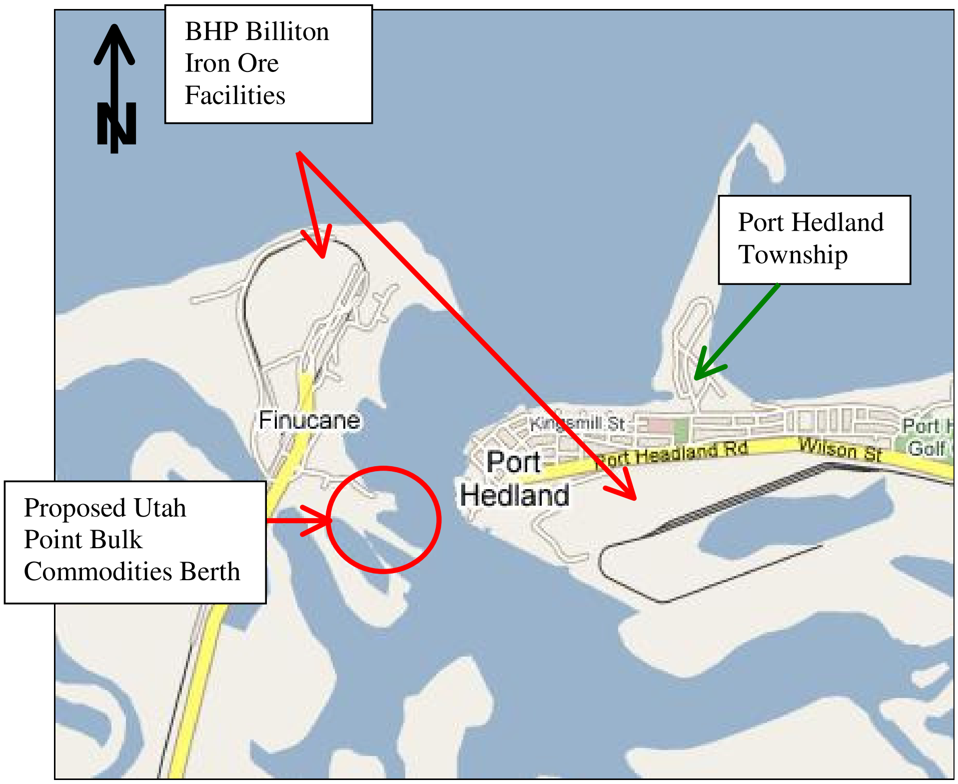

Figure 1.2: Location of Proposed Utah Point Berth Project and Surrounding Land Uses

1.1 Existing noise environment

The existing noise environment in Port Hedland, particularly at the west end of Port Hedland, is significantly affected by industrial noise. A large amount of industrial infrastructure is located immediately to the south of the Port Hedland township. This infrastructure includes iron ore ship loading and stockpiling operations, and iron ore transportation in the form of rail and road traffic. This infrastructure operates continuously (24hr / 7 day operation).

VIPAC has conducted a series of background noise measurements in Port Hedland for other noise studies. Background (L_{A90}) noise levels are generally greater than 50 dB(A) during the quietest night time period (1 – 2 am) at the Western part of Port Hedland. Closer to the Port, particularly in the Commercial District, existing background noise levels can be up to 60 dB(A) during this period.

1.2 Potential noise impacts

The potential noise impacts of the proposed Utah Point Berth Project can be divided into three categories, as follows:

1) Traffic noise from vehicles associated with the Utah Point Berth Project travelling on public roads.
2) Operational (Industrial) noise from the Utah Point Berth Project facility.
3) Construction noise during the construction stage of the Utah Point Berth Project.

2. NOISE MODELLING

Traffic noise and Industrial noise were modelled using SoundPLAN noise modelling software. SoundPLAN Version 6.3 was used to predict noise levels using single point calculations and noise contour maps. SoundPLAN is a leading software package used for modelling road, rail and industrial noise in over thirty countries. The noise prediction methods used for predicting traffic noise and operational noise are as follows:

- Traffic Noise: The CoRTN (Calculation of Road Traffic Noise) method was used. CoRTN is a traffic noise prediction algorithm developed in the UK, and is generally accepted as the standard prediction algorithm for road traffic noise in Australia.
- Operational noise was modelled using the CONCAWE noise prediction method. CONCAWE was developed as an algorithm to predict noise from petrochemical plants. It allows consideration of the effect of meteorological conditions on noise propagation. CONCAWE has been used successfully to model other industrial plants at Port Hedland, including the BHP Billiton Iron Ore plant.

3. TRAFFIC NOISE

Traffic noise impacts from the proposed Utah Point Berth Project may occur due to the additional traffic associated with the project travelling on public roads.

Modelled Scenarios

To assess the potential for traffic noise impacts, traffic noise was predicted for the following three scenarios:

1. Existing traffic scenario (year 2006)
2. Future traffic (year 2009) **without** the proposed Utah Point Berth Project
3. Future traffic (year 2009) **with** the proposed Utah Point Berth Project

3.1 Traffic Noise Criteria

The traffic noise assessment is based on *EPA Statements for EIA No. 14 (Version 3) Road and Rail Transportation Noise, (Draft 10/5/00)*, which states:

> *5.3 Criteria for proposed increase in road or rail traffic*
>
> *5.3.1 Environmental objective*
>
> *This section applies where an increase in traffic flow is proposed such that the total flow along the corridor exceeds that on which planning decisions were made under Section 5.1 above, and where a significant traffic flow, either temporary or permanent, would result from a specific industrial or transportation proposal. This section would not apply to incremental increases which were associated with the normal traffic growth along the corridor and were within the bounds of planning decisions under Section 5.1 above.*
>
> *The objectives are -*
>
> *(i) that the noise levels inside noise-sensitive premises associated with the proposed traffic should meet acceptable levels, or that the degree of increase in noise levels should be of low significance; and*
>
> *(ii) that the noise emissions of the vehicles associated with a specific proposal should comply with 'best practice'.*

For this project the 'degree of increase in noise levels' is assessed by comparing the predicted traffic noise levels for the scenarios of 'with' and 'without' the Utah Point Berth Project, for the year 2009. Traffic volumes for each scenario have been provided by SKM.

EPA Statements for EIA No. 14 refers to 'Noise Amenity Ratings' (NAR) that classify the pre-existing noise environment at noise sensitive receivers. Acceptable increases in noise at noise sensitive receivers due to increase of traffic flow caused by a specific industrial or transportation proposal are also presented in Statement 14. These acceptable increases are based on the NAR for that receiver. The NAR for each receiver is determined by the noise level prior to the introduction of the proposed development. Noise Amenity Ratings and acceptable increases are presented in Table 3.1.

Table 3.1: Noise Amenity Ratings and Acceptable Increases in $L_{Aeq,T}$ Noise Level

Rating	$L_{Aeq,0700\text{-}2200}$ (Day), dB(A)	$L_{Aeq,2200\text{-}0700}$ (Night), dB(A)	Acceptable increase in $L_{Aeq,T}$ noise level, dB(A)
N0	< 50	< 40	4, or to top of N0, whichever is greater
N1	51 – 55	41 – 45	3
N2	56 – 60	46 – 50	1.5
N3	61 – 65	51 – 55	0.5
N4	66 – 70	56 – 60	0
N5	> 70	> 70	0

Notes (taken from the EPA Statements for EIA No. 14):

1. *The NAR for a location is the higher of the day and night ratings.*
2. *Noise levels refer to external locations at 1 m from a building façade*
3. *"Day" means 7am – 10pm and "Night" means 10pm – 7am.*

The proposed development at Utah Point will satisfy the guidelines if the increase in noise at noise sensitive receivers are less than or equal to the acceptable increases in Table 3.1 for the applicable Noise Amenity Ratings.

3.2 Traffic Noise Modelling Methodology

The Utah Point Berth Project will serve as a connection between heavy vehicles transporting bulk commodities from mines in the region, and ships which will transport bulk commodities from Utah Point to other ports. The heavy vehicles will use public roads to access Utah Point, and potentially could increase the noise levels in areas adjacent to these public roads. As such traffic noise modelling is focused on these roads.

Predicted traffic noise levels are shown as the $L_{Aeq,0700\text{-}2200}$ (Day), and the $L_{Aeq,2200\text{-}0700}$ (Night) noise descriptors, so that a comparison can be made between with the traffic noise criteria, as indicated in Table 3.1.

The CoRTN method of traffic noise prediction was used in SoundPLAN noise modelling software to predict the $L_{A10,0600\text{-}2400}$ noise descriptor, which was then converted to $L_{Aeq,0700\text{-}2200}$ (Day), and the $L_{Aeq,2200\text{-}0700}$ (Night) noise descriptors using accepted adjustment factors (See Appendix A for details)

Traffic Noise Sources in the Noise Model

Due to the high volumes of heavy vehicles and road trains modelled in this study, separate traffic noise source strings were used in the noise model to define light vehicles, heavy vehicles and road trains.

Five noise source lines were used to collectively define the traffic noise from each road section, as follows:

- Light vehicles
- Heavy vehicles – engine noise
- Heavy vehicles – exhaust noise
- Road Trains – engine noise
- Road Trains – exhaust noise

The roads modelled are shown in Figure 3.1. Full details are shown in Appendix A.

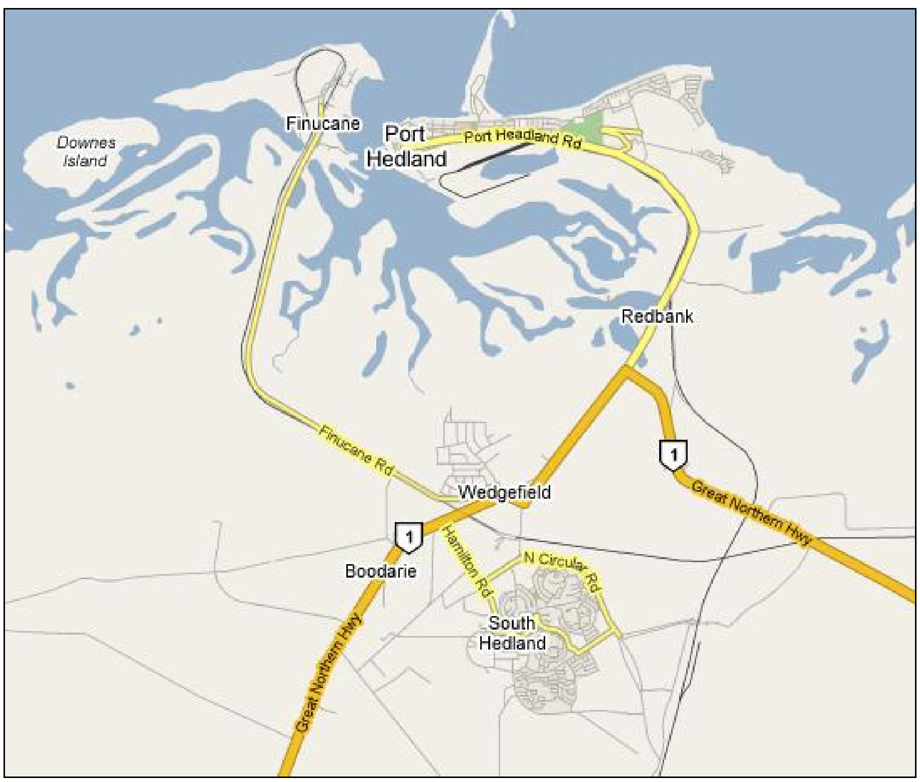

Figure 3.1 Roads Modelled for traffic noise impacts from the Utah Point Berth Project

3.3 Traffic Noise Modelling Results

Predicted traffic noise levels are presented as noise contour maps in Appendices D, E and F, for the following scenarios:

- Existing traffic scenario (year 2006)
- Future traffic (year 2009) **without** the proposed Utah Point Berth Project
- Future traffic (year 2009) **with** the proposed Utah Point Berth Project

Noise increase maps are presented in Figure 3.2 and Figure 3.3, and in Appendices D, E, & F to show the difference in traffic noise levels between the cases of 'with' and 'without' the Utah Point Berth Project, for the future year 2009.

The results are summarised by location below.

Port Hedland and Nelson Point – Noise Contour Maps D1 – D8

For day time traffic noise, the noise increase map indicates there will be an increase in traffic noise in Port Hedland of between 0 and 0.5dB(A) due to traffic associated with the proposed Utah Point Berth Project – See Figure 3.2. According to the noise amenity ratings (Table 3.1), existing noise levels adjacent to Port Hedland Road allow for an increase of 0.5dB(A). Therefore, the change in road traffic noise in the day time due to the proposed development is deemed to comply with the applicable noise criteria, as outlined in Section 3.1.

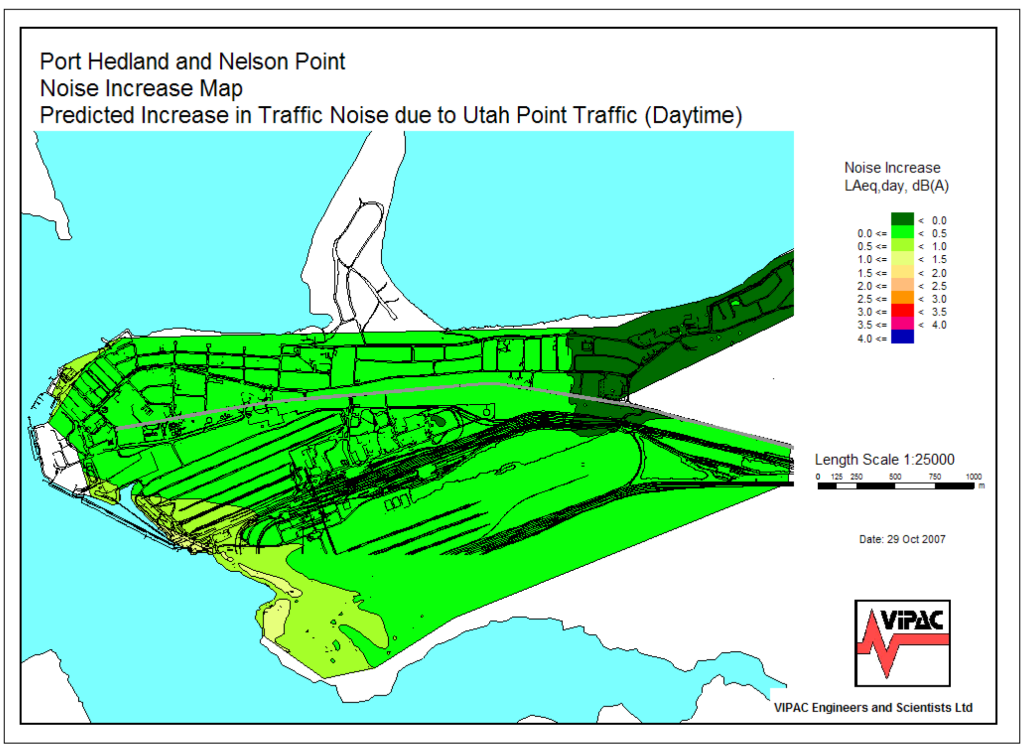

Figure 3.2 Predicted increase in traffic noise in Port Hedland due to additional traffic associated with the Utah Point Berth Project in the day time.

For night time traffic noise, the noise increase map indicates there will be an increase in traffic noise in Port Hedland of between 0 and 0.5dB(A) due to traffic associated with the proposed Utah Point Berth Project – See Figure 3.3. According to the noise amenity ratings (Table 3.1), existing noise levels adjacent to Port Hedland Road allow for an increase of 0.5dB(A). Therefore, the change in road traffic noise at night due to the proposed development is deemed to comply with the applicable noise criteria, as outlined in Section 3.1.

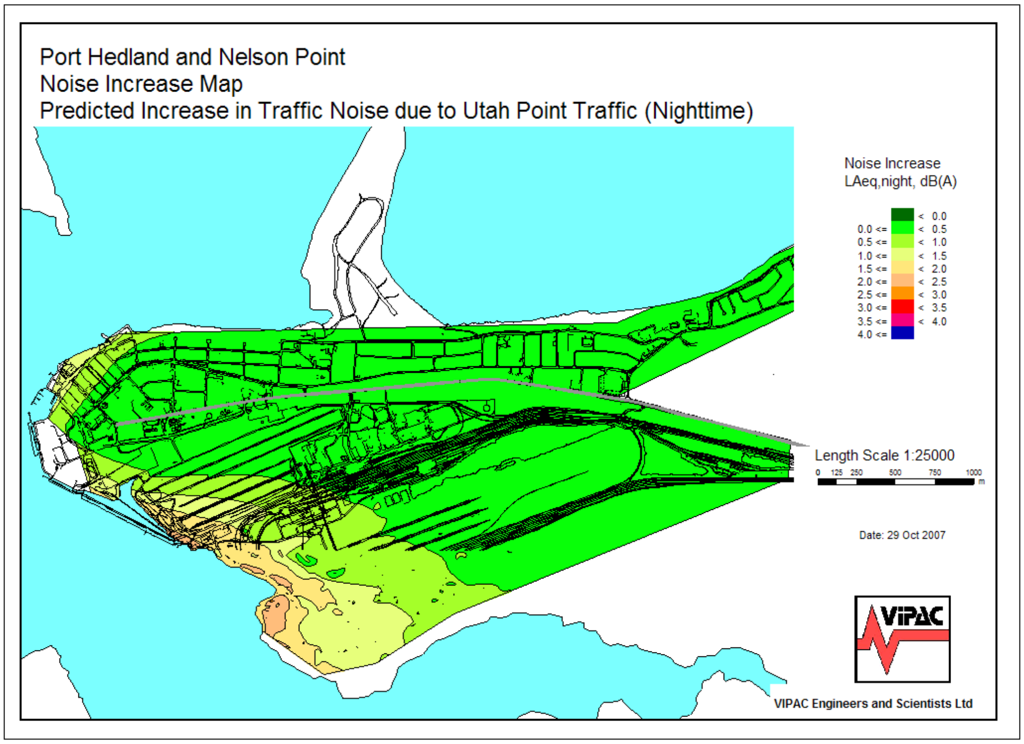

Figure 3.3 Predicted increase in traffic noise in Port Hedland due to additional traffic associated with the Utah Point Berth Project in the night time.

South Hedland – Noise Contour Maps E1 – E8

For day time traffic noise, the noise increase map indicates there will be an increase in traffic noise from the Great Northern Hwy of up to 1.5 dB(A), due to traffic associated with the proposed Utah Point Berth Project – see Figure 3.4. The traffic noise increase is due to an increase in road train traffic on the Great Northern Hwy.

Predicted noise levels from the Great Northern Hwy are generally lower than 36dB(A), as The Great Northern Hwy is some distance to the north of South Hedland. As such other transportation noise sources will contribute to the noise levels used to determine the NAR.

Since South Hedland is primarily a residential area, existing daytime noise levels are likely to be dominated by local traffic noise. As such existing noise levels are likely to be below 55dB(A) in most areas of South Hedland, except in close proximity to major local roads, where levels are likely to be below 60dB(A), except those residences immediately adjacent to major roads. In any case, with such a high contribution from local transportation, the increase in noise at residences in South Hedland will be close to 0 dB(A). As such, based on the amenity rating, the increase in noise is acceptable.

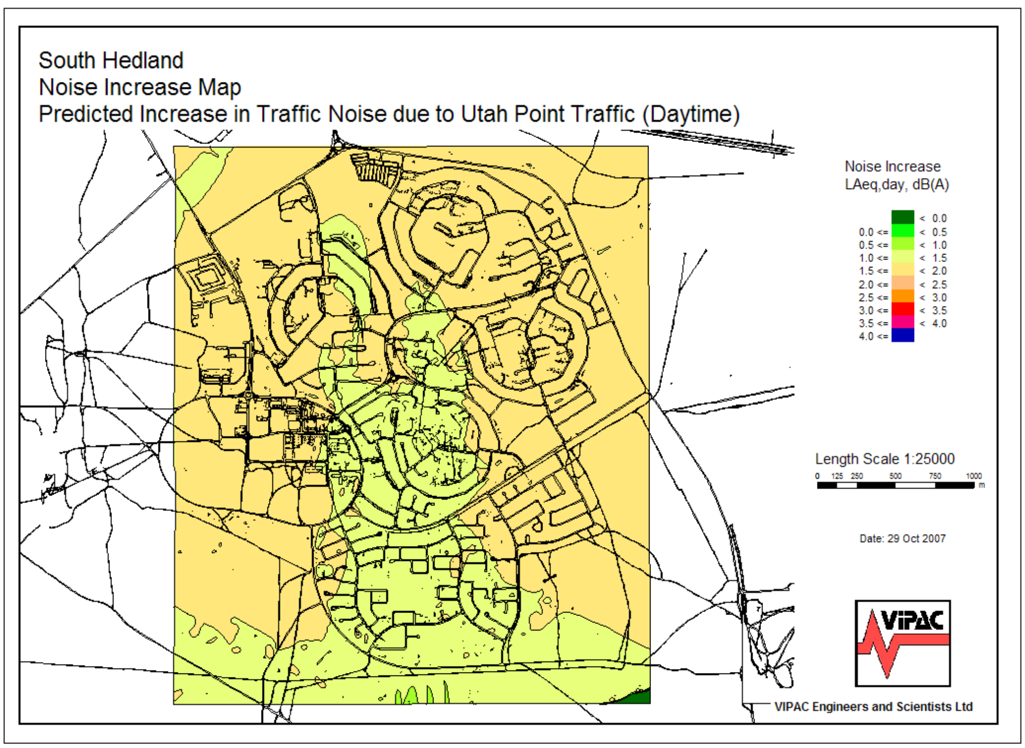

Figure 3.4 Predicted increase in traffic noise in South Hedland due to additional traffic associated with the Utah Point Berth Project in the day time.

For night time traffic noise, the noise increase map indicates there will be an increase in traffic noise from the Great Northern Hwy of up to 3.0 – 3.5dB(A) due to traffic associated with the proposed Utah Point Berth Project – see Figure 3.5. The noise is seen to increase more to the east of South Hedland because of the proportionately higher increase in traffic on the section of the Great Northern Hwy to the east of Port Hedland Road.

Existing night time noise levels in South Hedland from transportation will consist of noise from the Great Northern Hwy, and noise from local South Hedland traffic. Noise from the Great Northern Hwy over most of South Hedland is predicted to be lower than 36dB(A). With normal background noise levels in residential areas generally being 35- 40dB(A), noise from the Great Northern Hwy will be lower than noise from the local traffic noise.

Noise levels of less than 40B(A) give an amenity rating of N0, which allows for an increase of either 4 dBA or up to the upper limit of N0, whichever is the greater. However the amenity rating for an area is taken as the higher of the day and night time ratings. The day amenity rating is likely to be either N1 or N2 (ambient noise levels of 55dB(A) and 60dB(A) respectively), giving allowable increases in noise of 3dB(A) and 1.5dB(A) respectively. Since noise from the Great Northern Hwy is lower than noise from local traffic, the increase in transportation noise at residences is likely to be less than 1.5dB(A). As such, noise increases at residences in South Hedland would satisfy the noise criteria.

In any case, if noise from the local traffic is higher than estimated, then the contribution from the Great Northern Hwy is lower and there is less noise increase due to traffic associated with the Utah Point Berth Project. If noise from the local traffic is lower than estimated, the noise at a residence would remain in the N0 Noise Amenity Rating. The EPA Statement for EIA No. 14 states that noise levels in the N0 Noise Amenity Rating are considered as “acceptable’. As such, in any case, there is no significant traffic noise impact on South Hedland from the Utah Point Berth Project.

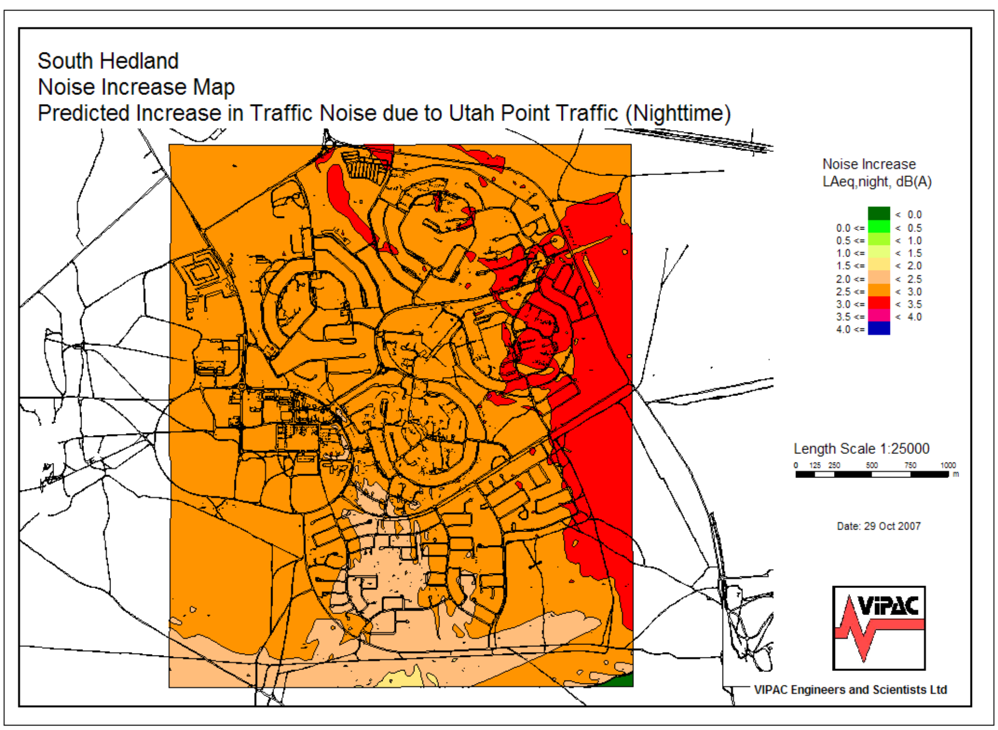

Figure 3.5 Predicted increase in traffic noise in South Hedland due to additional traffic associated with the Utah Point Berth Project in the night time.

Wedgefield – Noise Contour Maps F1 – F8

Wedgefield is essentially an industrial area and is zoned 'light industrial' over most of the built up areas. It has small isolated areas where residences may be present. These residences are generally for caretakers of the town's industry.

For day time traffic noise, the noise increase map indicates there will be an increase in traffic noise of up to 3.0 dB(A) – see Figure 3.6. This traffic noise increase is due to an increase in road train traffic on the Great Northern Hwy, to the south of Wedgefield.

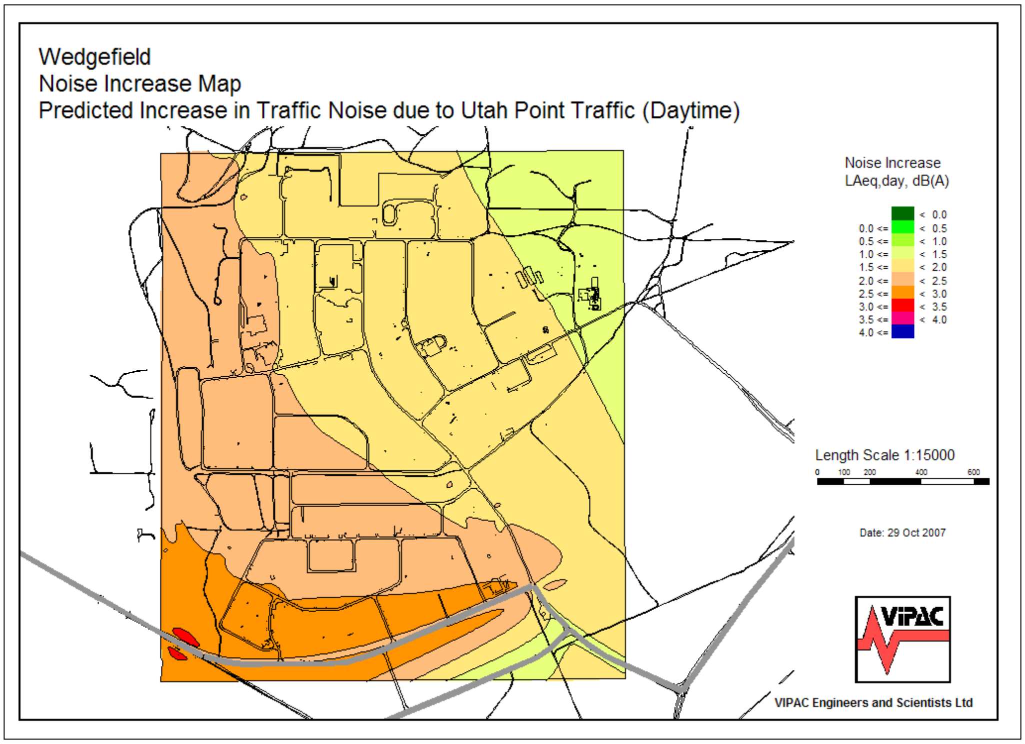

Figure 3.6 Predicted increase in traffic noise in Wedgefield due to additional traffic associated with the Utah Point Berth Project in the day time

For night time traffic noise, the noise increase map indicates there will be an increase in traffic noise of over 4.0 dB(A) – see Figure 3.7 . This traffic noise increase is due to an increase in road train traffic on the Great Northern Hwy, to the south of Wedgefield. Existing night time noise levels are likely to be dominated by traffic noise from the Great Northern Highway. Current predicted traffic noise levels from the Great Northern Highway at night are at least 41 dB(A). As such the noise amenity rating would not allow for an increase in traffic noise of 4dB(A).

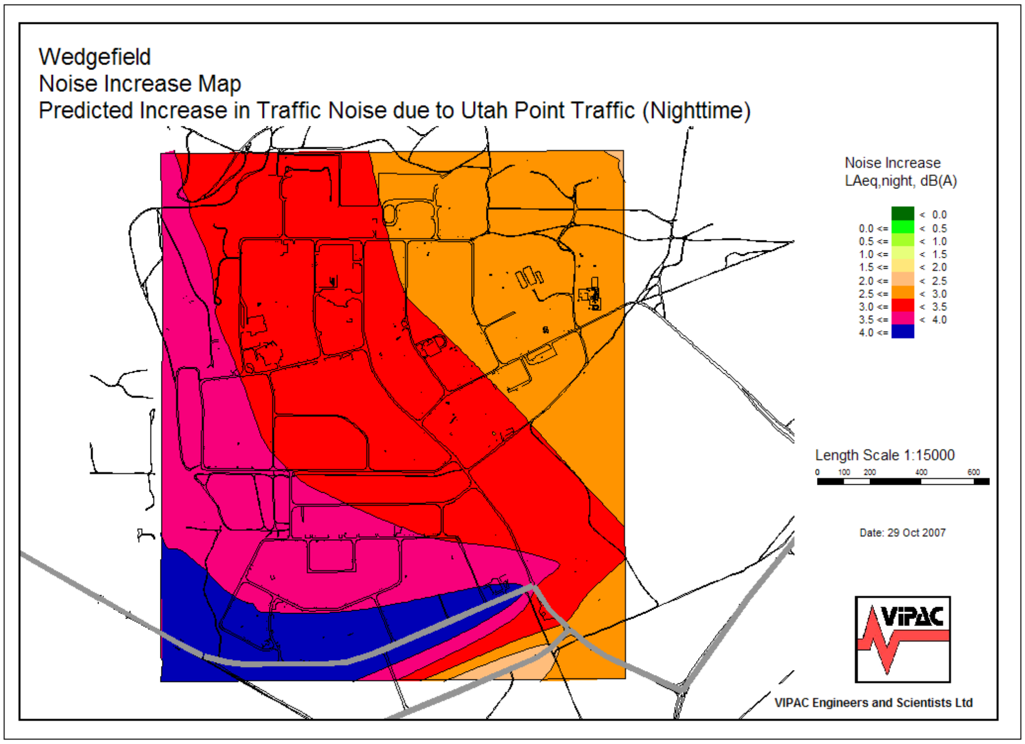

Figure 3.7 Predicted increase in traffic noise in Wedgefield due to additional traffic associated with the Utah Point Berth Project in the night time

To address the issue of traffic noise impact in Wedgefield, the objectives of the *EPA Statements for EIA No. 14 (Version 3) Road and Rail Transportation Noise, (Draft 10/5/00)* should be directly addressed. The objectives are -

> *(i) that the noise levels inside noise-sensitive premises associated with the proposed traffic should meet acceptable levels, or that the degree of increase in noise levels should be of low significance; and*
>
> *(ii) that the noise emissions of the vehicles associated with a specific proposal should comply with 'best practice'*

Since there are relatively few residences in Wedgefield, the objectives of the Guideline can be achieved by the following initiatives:

- Assessing the indoor noise levels at any affected noise sensitive receiver and treating if required by simple and appropriate architectural treatment. Acceptable noise levels inside noise sensitive receivers can be determined from Australian Standards AS2107—2000 for more distant traffic noise and AS 2120-2000 for close truck pass-by.
- Ensuring all trucks associated with the Utah Point facility comply with best practice.

Redbank

A detailed assessment of traffic noise has not been conducted for Redbank, as the roads affected by the proposed development are located approximately 1.3 km from Redbank. At this distance, the proposed development would not result in a significant increase in noise levels at Redbank.

3.4 Discussion of Traffic Noise

3.4.1 Noise from triple road trains and quad road trains

Bulk Commodities can be delivered to Utah Point with either triple road trains or quad road trains. The noise impact from a fleet of triple road trains will be different to the noise impact from a fleet of quad road trains, when considering delivery of the same amount of bulk commodity to Utah Point. The following points highlight the important points in this discussion:

- Since a quad road train has more axles and hence more tyres to generate noise than a triple road train, a quad road train would produce more noise than a triple road train, and potentially produce a higher L_{max}. Assuming vehicle noise is proportional to the number of axles, a single quad road train would be 1.2dB(A) louder than a single triple road train.
- To deliver the same amount of bulk commodity to Utah Point, 50% more triple road trains would be needed than quad road trains (quad road train = 105 tonne capacity, triple road train = 70 tonne capacity). For the same vehicle type, an increase in traffic volume of 50 % produces a noise increase of 1.8 dB L_{Aeq}.
- The effect of the previous two points is that the L_{Aeq} measure of traffic noise is likely to be slightly higher with the use of quad road trains by an amount of less than 1 dB(A). Individual vehicle passby levels as described with an L_{max} noise descriptor are likely to be 1.2dB(A) higher for quad trains than for triple road trains. This difference would not be noticeable.

3.4.2 Confidence in results

No noise measurements were taken to calibrate the traffic noise predictions. However, VIPAC has conducted many traffic noise modelling studies involving roads with a high percentage of heavy vehicles, particularly articulated vehicles. For many of these studies noise measurements were taken. In these studies, when the traffic noise source is broken down into components of car, heavy vehicle tyre noise, and heavy vehicle engine/exhaust noise (as has been done for this study), predicted noise level are usually within 2dB(A) of the measured noise levels. As such we expect that the predicted traffic noise levels in this study will be within 2dB(A) of the actual noise levels.

4. OPERATIONAL NOISE

Operation of the proposed Utah Point Berth Project has the potential to impact on noise sensitive residences in the Port Hedland Region.

To assess the potential for operational noise impacts, industrial noise was predicted for the following three scenarios:

1. Existing wharf operations at Port Hedland managed by the Port Hedland Port Authority (year 2006).
2. Future wharf operations at Port Hedland managed by the Port Hedland Port Authority **without** the proposed Utah Point Berth Project (year 2009).
3. Future wharf operations at Port Hedland managed by the Port Hedland Port Authority **with** the proposed Utah Point Berth Project (year 2009).

Predicted noise levels for the above scenarios were compared to each other and to the applicable criteria to determine the noise impacts of the proposed Utah Point Berth Project.

4.1 Industrial Noise Criteria

Criteria for the assessment of the impact of noise from industrial plants are presented in the Environmental Protection (Noise) Regulations 1997 (EP(N)R). The Regulations prescribe the calculation of an Assigned Noise Level as a means of determining acceptable noise levels at a receiver location. Table 4.1 summarises the calculation of assigned levels as presented in the regulations.

Table 4.1: EP(N)R Assigned Noise Levels

Type of premises receiving noise	Time of day	Assigned level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises at locations within 15 metres of a building directly associated with a noise sensitive use	0700 to 1900 hours Monday to Saturday	45 + IF	55 +IF	65 + IF
	0900 to 1900 hours Sunday and public holidays	40 + IF	50 + IF	65 + IF
	1900 to 2200 hours all days	40 + IF	50 + IF	55 + IF
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35 + IF	45 + IF	55 + IF
Noise sensitive premises at locations further than 15 metres from a building		60	75	80
Commercial premises		60	75	80
Industrial and utility premises		65	80	90

Note: 'IF' represents an influencing factor which increases along with the number of busy roads, and commercial and industrial areas that surround the noise sensitive premises.

4.1.1 Closest noise sensitive receivers

Figure 4.1 and Figure 4.2 show the representative noise sensitive receivers that are most affected by noise from the Utah Point Berth Project. In addition, the Port Hedland Hospital was considered. All other noise sensitive receivers in the Port Hedland region will have acceptable noise levels if noise levels at the closest noise sensitive receivers are acceptable.

Since the proposed plant will operate for 24 hours a day, noise emissions from the plant will be constant. As such, the night time assigned levels are the most strict requirement, as the assigned level is the lowest at this time. Table 4.2 gives the calculated assigned noise levels for the closest noise sensitive locations.

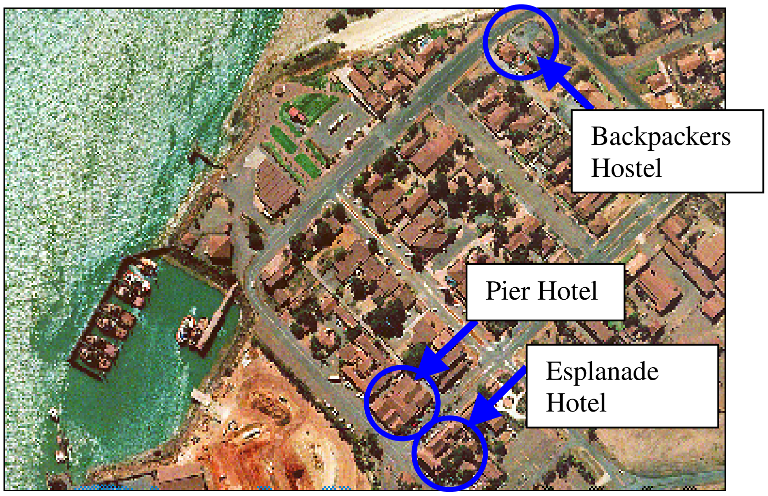

Figure 4.1: Western Port Hedland, Showing Noise Sensitive Receivers in Commercial District

Figure 4.2: Location of the Port Hedland Hospital

Table 4.2: Night Time (2200 – 0700) Assigned Noise levels for the Closest Noise Sensitive Receivers in Port Hedland

	Influencing Factor, dB(A)	L_{A10}, dB(A)	L_{A1}, dB(A)	L_{AMax}, dB(A)
Pier Hotel	11	46	56	66
Esplanade Hotel	11	46	56	66
Backpackers' Hostel	7	42	52	62
Hospital	2	37	47	57

Previous noise measurements by VIPAC at the closest noise sensitive receivers indicate that the assigned noise levels shown in Table 4.2 are currently exceeded. This is due to the close proximity of BHP's existing processing facilities at Nelson Point and Finucane Island.

The regulations state that where assigned noise levels are already exceeded, an additional noise source must not 'significantly contribute to' the exceedence. Section 7 of the regulations further stipulate that 'a noise emission is taken to significantly contribute to a level of noise if the noise emission exceeds a value which is 5 dB below the assigned level at the point of reception. Therefore to comply with the applicable noise policy, predicted noise levels from the proposed Utah Point Berth Project need to be 5 dB(A) below the assigned levels shown in Table 4.2.

As such the noise criteria for the closest noise sensitive receivers for the proposed Utah Point Berth Project are as presented in Table 4.3.

Table 4.3: Design Noise Criteria for the Closest Noise Sensitive Receivers in Port Hedland

	L_{A10}, dB(A)	L_{A1}, dB(A)	L_{AMax}, dB(A)
Pier Hotel	41	51	61
Esplanade Hotel	41	51	61
Backpackers' Hostel	37	47	57
Hospital	32	42	52

Note that the noise criteria presented in Table 4.3 are Design Noise Criteria, i.e. these are the maximum noise levels that the proposed plant can produce alone. They do not include background noise.

The L_{A10} noise descriptor is the strictest of the design criteria. As such all sources are defined as L_{A10} sound powers and noise levels are predicted as L_{A10} sound pressure levels.

4.1.2 Tonality, impulsiveness and modulation

Regulation 7(1)(a) prescribes that noise emissions, 'must be free of tonality, impulsiveness; and modulation, when assessed under regulation 9.' Regulation 9(3) states:

> *Noise is taken to be free of the characteristics of tonality, impulsiveness, and modulation if –*
>
> *(a) the characteristics cannot be reasonably and practicably removed by techniques other than attenuating the overall level of the noise emission; and*
>
> *(b) the noise emission complies with the standard prescribed under regulation 7(1)(a) after the adjustments in the table to this subregulation are made to the noise emission as measured at the point of reception.*

Table 2 (extracted from Reg 9(3) of EP(N)R 1997)

Adjustment where noise emission is not music. These adjustments are cumulative to a maximum of 15 dB.		
Where tonality is present	*Where modulation is present*	*Where impulsiveness is present*
+ 5 dB	*+ 5 dB*	*+ 10 dB*

These adjustments are to be applied to noise showing tonal, modulating or impulsive characteristics.

4.1.3 Meteorological conditions

In accordance with the EPA Guidance Statement No 8, noise was predicted for the 'worst case' meteorological conditions for both day time and night time, as shown in Table 4.4.

Table 4.4: 'Worst Case' Meteorological Conditions for Use In Noise Predictions of Operational Noise

Parameter	Worst Case Day	Worst Case Night
Wind speed	4 m/s	3 m/s
Temperature inversion lapse rate	Nil	2 °C / 100 m
Pasquill Stability Class	E	F
Temperature	20 °C	15 °C
Relative humidity	50 %	50 %

4.2 Industrial Noise Modelling Methodology

Operational noise was predicted by simulating plant noise in a noise model. In the noise model each plant item that emits a significant amount of noise was defined as a noise source. The collective noise from all sources was predicted at the closest noise sensitive receivers for various scenarios and compared with the applicable industrial noise criteria.

4.2.1 Noise sensitive receivers

Noise sensitive receivers are considered as buildings with the following uses:

- Houses, townhouses, apartments, etc (residential dwellings)
- Hotels, Motels, and other short-term accommodation
- Hospitals, schools, places of worship, and other noise sensitive utilities.

The noise sensitive receivers selected for consideration in this report are the most affected noise sensitive receivers. It is expected that if the noise criteria is satisfied at these receivers, the noise criteria will be met at all other noise sensitive receivers (see Section 4.1.1).

4.2.2 Predicted noise levels from the Utah Point Berth Project

As per the requirements of the EPA presented in Section 4.1, noise from the Utah Point Berth Project was predicted for the worst case day and worst case night meteorological conditions. Results were compared to the applicable noise criteria.

4.2.3 Change in noise environment with the Utah Point Berth Project

As part of the Utah Point development proposal, some existing plant at the Port Hedland port operations are to be moved from Port Hedland to Utah Point. As such the noise impact assessment of the Utah Point development involves the consideration of the reduction in noise from the Port Hedland port, as well as the new noise emissions from the proposed Point Utah facilities.

The groups of industrial noise sources considered in each modelling scenario are presented in Table 4.5. Implementation of the proposed Utah Point Berth Project will involve the decommissioning of some plant at the existing Wharf, the addition of some plant at the existing Wharf, and the construction of plant at Utah Point. A detailed list of sources considered in each of these areas is provided in Appendix B.

Table 4.5: Industrial Noise Source Groups Included in Each Modelling Scenario

	Existing PHPA Operations without Utah Point	Future PHPA Operations without Utah Point	Future PHPA Operations with Utah Point	Future PHPA Operations without Utah Point With Noise Controls	Future PHPA Operations with Utah Point With Noise Controls
Plant which will be Decommissioned at the existing Wharf if the Utah Point Berth Project is implemented	Included	Included		Included	
Plant which will remain at the existing Wharf – untreated	Included	Included	Included		
Plant which will remain at the existing Wharf – treated				Included	Included
New plant at the existing Wharf – untreated			Included		
New plant at the existing Wharf – treated					Included
New Plant at Utah Point – untreated			Included		
New Plant at Utah Point – treated					Included

When considering which plant items were operating in each plant, the following assumptions were made:

- The maximum number of plant items that can run simultaneously were considered to be operating.
- A sea wall with the minimum height of 2.5m is located on the north western side of the facility. This may afford a degree of shielding to sources located in the stockyard.
- Stockpiles were modelled at half of the maximum stockpile height. Stockpiles will afford a degree of shielding of noise sources.
- Shielding is provided by 1 fully loaded ship anchored at the berth.

4.3 Industrial Noise Source Data

This section describes the data used to model the existing and future PHPA wharf operations, including the proposed Utah Point operations. All details and assumptions of noise sources used in the noise model are shown in Appendix B.

4.3.1 Proposed Utah Point Berth Project

Figure 4.3 shows the layout of the proposed Utah Point Berth Project, as provided by the PHPA. The facility will act as a transfer station for bulk commodities from road transport to shipping. As such, most of the machinery at the facility is materials handling equipment, and mobile plant. Noise sources including; conveyors, drives, shiploaders, trucks, dozers, front end loaders and a hopper were modelled. Sound powers, spectra, and assumptions about noise sources are included in Appendix B.

4.3.2 Port Hedland Wharf Operations

Existing Port Hedland operations at the wharf and the Chromite / Manganese stockpiles were modelled to determine the change in noise levels from all PHPA operations with the implementation of the proposed development. Some of the stockpiling operations currently conducted at Port Hedland are to be moved to the proposed Utah Point Berth facility. The construction of a new shed at the existing PHPA port facility is also proposed. Following the construction of Utah Point Berth Berth facility, it is planned that future stockpiling works at the wharf will be enclosed. The existing Port Hedland wharf operations, as modelled in SoundPLAN noise modelling software, are shown in Figure 4.4.

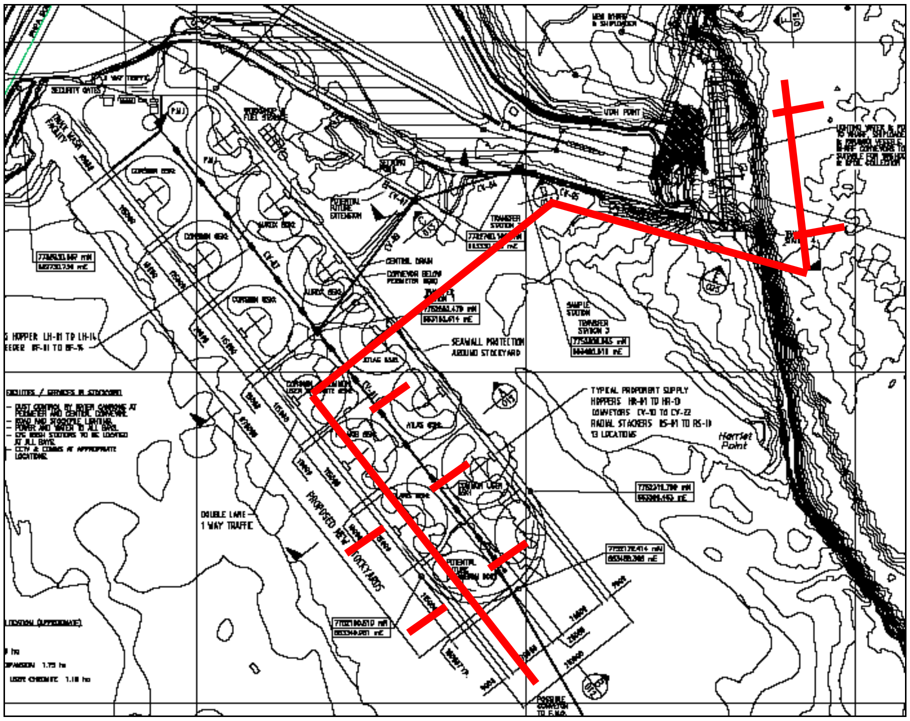

Figure 4.3 Proposed Layout of Utah Point Berth Project

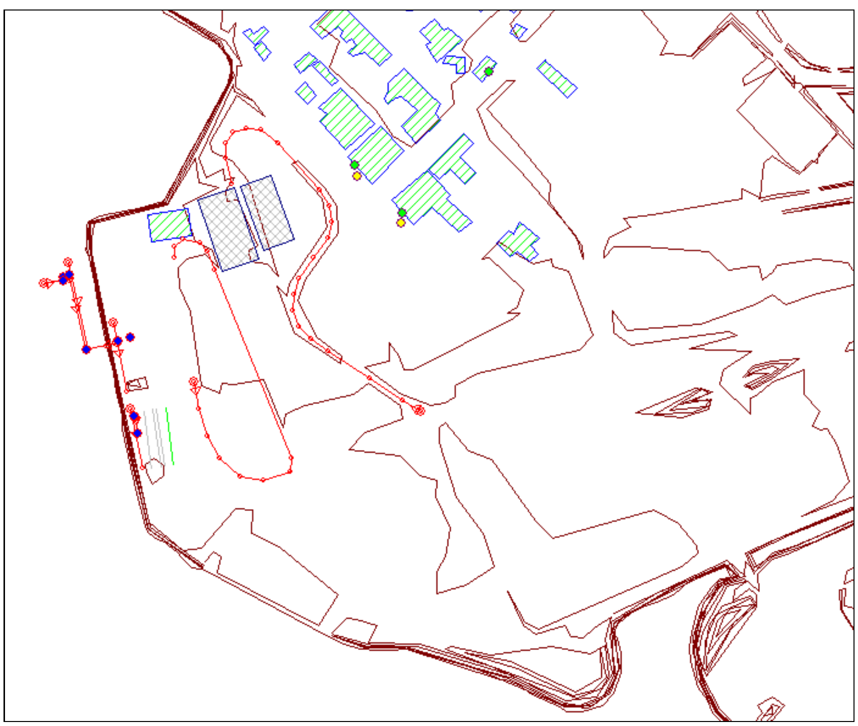

Figure 4.4 Port Hedland – Existing Wharf Infrastructure – SoundPLAN Model

4.4 Operational Noise Modelling Results

4.4.1 Noise from Utah Point Berth Project

Predicted noise levels at the closest noise sensitive receivers in Port Hedland due to the proposed Utah Point Berth Project are shown in Table 4.6. Predicted noise levels for the worst case day and worst case night time meteorological conditions are shown. It is predicted that operational noise will exceed the noise criteria at all of the specified noise sensitive receivers in Port Hedland.

Table 4.6: Predicted Industrial Noise at the Closest Noise Sensitive Receivers – Utah Point Berth Project Only - Year 2009 - L_{A10} dB(A) – No noise controls

	Backpackers Hostel	Esplanade Hotel	Pier Hotel	Hospital
Criteria – Design Noise Levels (as per Table 4.3)	37	41	41	32
Predicted Noise Levels due to Utah Point Berth Project – Worst Case Day Meteorological Conditions	**46**	**48**	**49**	**33**
Predicted Noise Levels due to Utah Point Berth Project – Worst Case Night Meteorological Conditions	**46**	**48**	**49**	**34**
Background noise levels	51	50	50	52

Figure G 1 in Appendix G shows the 2009 predicted noise levels in Port Hedland due to the Utah Point Berth Project for the worst case night time weather. Predicted noise levels in Port Hedland range from below 36dB(A) up to 50dB(A). Areas in western Port Hedland with noise sensitive receivers are likely to exceed their respective design criteria.

It can be seen from Table 4.6 that the difference in predicted noise levels between worst case day meteorological conditions and worst case night meteorological conditions is negligible. This is because SoundPLAN categorises both sets of meteorological conditions as Category 6 for calculation of the effects of weather on noise propagation (See Appendix B for a detailed explanation).

It is important to note that the current background noise levels are 2-8dB(A) higher than the predicted noise levels for the Utah Point Berth Project.

For the Utah Point Berth Project to comply with the noise criteria engineering noise controls should be considered.

4.4.2 Noise from Utah Point Berth Project and PHPA Wharf Operations

In order to demonstrate the overall impact of the proposed Utah Point Berth Project, noise was modelled for two future scenarios – with and without the Utah Point Berth Project. Results for the closest noise sensitive receivers are presented in Table 4.7.

Table 4.7 shows that noise from the existing PHPA Port operations is generally higher than the predicted noise from the combined future operations of the proposed Utah Point Berth Project and the Future PHPA Port Hedland Port Operations.

This is best illustrated with noise contour maps. Figures G 2 and G 3 in Appendix G show the predicted noise levels for the scenarios indicated in Table 4.7. It is assumed that if the Utah Point Berth Project does not go ahead then the Future PHPA port operations in Port Hedland will be the same as the current operations.

The dominant noise source indicated in Figure G2 is the Front End Loader associated with the existing chromite operations. With the construction of the Utah Point Berth Project, the existing Port will undergo some changes, which will involve the removal of the Front End Loader from the chromite operations near the port, and the construction of some very large sheds at the Port to house some operations. As such, a significant noise source will be removed and the new sheds will provide considerable shielding to nearby areas of Port Hedland.

Table 4.7: Predicted Industrial Noise Levels from the proposed Utah Point operations and the PHPA Port Hedland Port Operations at the Closest Noise Sensitive Receivers – Worst Case Night Time Meteorological Conditions - L_{A10} dB(A) – No noise controls

	Backpackers Hostel	Esplanade Hotel	Pier Hotel	Hospital
Future scenario of proposed Utah Point Berth Project and Future PHPA Port Hedland Port Operations	**51**	**58**	**56**	**36**
Future PHPA Port Hedland Port Operations only (no Utah Point operations)	**49**	**61**	**56**	**43**
Difference in noise with implementation of the proposed development	+2	-3	0	-7
Equal or better noise environment with Utah Point Berth Project?	No	Yes	Yes	Yes

The change in predicted noise levels at each of the noise sensitive receivers with the implementation of the Utah Point Berth Project is not the same. This is due to the different exposure of each noise sensitive receiver to the many noise sources and the variation in the shielding of noise sources, particularly those that are added or removed in the 'with Utah' scenario.

Noise sources can be grouped into one of two groups – those at Utah Point, and those at the existing wharf. The Backpackers is directly exposed to Utah Point with minimal shielding. As such the additional equipment at Utah Point produce a increase in noise at the Backpackers. The Backpackers is partially shielded from noise sources at the existing wharf. The increase in noise due to sources at Utah Point is more significant than the reduction in noise from changes in plant at the existing wharf. As a result noise levels at the Backpackers increase by 2dB(A) with the implementation of the Utah Point Berth Project.

For the Esplanade Hotel the situation is reversed. The Esplanade Hotel is shielded to some degree from Utah Point and some noises at the existing wharf. The increase in noise due to sources at Utah Point is less than the reduction in noise from changes in plant at the existing wharf. As a result noise levels at the Esplanade Hotel reduce by 3 dB(A) with the implementation of the Utah Point Berth Project.

For the Pier Hotel the increase in noise due to sources at Utah Point is comparable to the reduction in noise from changes in plant at the existing wharf, and the noise levels do not change (though the source contributions do).

Figure G 4 in Appendix G shows a noise difference map which shows the change in noise levels with the implementation of the Utah Point Berth Project. The decrease in noise from the removal of the front end loader is clearly seen, and indicates a significant improvement in the noise environment in the vicinity of the front end loader. Noise levels decrease by 3 – 15 dB(A) over most of the Port Hedland township. However, there are some areas in the western part of Port Hedland that will experience a noise increase of up to 2 dB(A). The increase occurs because the western part of Port Hedland is further from the position of the front end loader and closer to the new sources introduced at Utah Point.

4.4.3 Significant noise sources

Table 4.8 shows 20 noise sources from the Utah Point Berth Project with the highest noise contribution at the Backpackers Hostel. The Backpackers Hostel is chosen to illustrate the typical noise contributions over most of Port Hedland, as it is close to Utah Point but is not shielded by the proposed large sheds at the PHPA wharf operations. The noise sources are ranked from highest noise contribution to lowest noise contribution.

Similarly, Table 4.9 shows 20 noise sources from the combined operations of the Utah Point Berth Project and Future PHPA Port Hedland Port Operations with the highest noise contribution at the Backpackers Hostel

Table 4.8: Most significant noise sources from the proposed Utah Point Berth Project at the Backpackers Hostel – Worst Case Night Time Meteorological Conditions - L_{A10} dB(A) – No noise controls

Noise source	Noise Contribution at the Backpackers Hostel dB(A)
Dozer - Engine	39.4
Front End Loader 1 - Eng	39.2
Shiploader Motor A1	36.7
Shiploader Motor A2	36.5
Shiploader Conveyor Drive B1	35.9
Shiploader Conveyor Drive B2	35.8
CV -05 Drive	35.6
CV -06 Drive	35.6
Hopper	34.7
Utah Truck 1 Driving	34.4
CV-06	34
CV-05	33.6
Utah Truck 3 Driving	33.4
Front End Loader at Hopper - Eng	32.5
CV -03 Drive	32.3
Dozer - Exhaust	32.2
Front End Loader 1 - Exh	32
Utah Truck 5 Driving	32
Utah Truck 4 Driving	31.9
Shiploader Conveyor A	31.3
Total noise of all sources in model (total of 62)	**46**

Table 4.9: Most significant noise sources from the combined operations of Utah Point Berth Project and Future PHPA Port Hedland Port Operations at the Backpackers Hostel – Worst Case Night Time Meteorological Conditions - L_{A10} dB(A) – No noise controls

Noise source	Noise Contribution at the Backpackers Hostel dB(A)
Transfer Tower 5 - (exist)	44.9
PHPA Truck 1 Driving	41.3
Newcrest Roof	40.1
Shiploader Motor 1 (exist)	40.1
Shiploader Motor 2 (exist)	39.9
Dozer - Engine	39.4
Front End Loader 1 - Eng	39.2
CV-05 (exist)	38
BNCS Roof	37.5
CV-04 (existing)	37
Shiploader Motor A1	36.7
Shiploader Motor A2	36.5
BNCS Fac 3	36.4
Newcrest Fac1	36.4
Newcrest Fac4	36.1
Shiploader Conveyor Drive B1	35.9
NewBldg Roof	35.8
Proposed New Conveyor - Wharf	35.8
Shiploader Conveyor Drive B2	35.8
CV -06 Drive	35.6
Total noise of all sources in model (total of 62)	**51**

It can be seen from Table 4.8 and Table 4.9 that the highest noise contributions are considerably lower than the total noise level. This is typical of industrial noise plants where a lot of noise sources are present.

To reduce noise levels from plant operations by a significant amount, a significant number of noise sources will have to be treated.

4.5 Engineering Noise Controls

Section 4.4 indicates that the noise emissions from the Utah Point Berth Project do not comply with the applicable noise criteria. However, in support of the development, it can be shown that if the Utah Point Berth Project is implemented, noise levels will actually decrease in Port Hedland. For noise levels to decrease at all locations in Port Hedland, Engineering noise controls will need to be considered. Noise levels can be reduced with a variety of solutions. The preferred solution would depend on the noise contribution from each piece of equipment and the viability of treating each piece of equipment.

An example set of engineering noise controls has been drafted which when implemented will produce a lower noise environment in all areas of Port Hedland with the implementation of Utah Point Berth Project. Note that other engineering noise control options can be considered, and will depend on the circumstances at the time. The example noise controls will produce a reduction of 3-4 dB(A) from the Utah Point Berth Project, and a reduction of 2dB(A) from the combined noise of the proposed Utah Point operations and the PHPA Port Hedland Port Operations. Details of the example noise controls are shown in Appendix B.

4.6 Operational Noise with Noise Controls

4.6.1 Noise from Utah Point Berth Project

Predicted noise levels at the closest representative noise sensitive receivers in Port Hedland due to the proposed Utah Point Berth Project with the example noise controls are shown in Table 4.10. Predicted noise for worst case day and worst case night time meteorological conditions are shown. It is predicted that operational noise will exceed the criteria at all the specified noise sensitive receivers in Port Hedland, except the Hospital, which is 1dB(A) below the criteria. This indicates that the area of Port Hedland west of the Hospital would exceed the criteria.

Table 4.10: Predicted Industrial Noise at the Closest Noise Sensitive Receivers – Utah Point Berth Project Only - Year 2009 - L_{A10} dB(A) – with noise controls

	Backpackers Hostel	Esplanade Hotel	Pier Hotel	Hospital
Criteria – Design Noise Levels (as per Table 4.3)	37	41	41	32
Predicted Noise Levels due to Utah Point Berth Project –Worst Case Day Time Meteorological Conditions	**43**	**44**	**45**	**30**
Predicted Noise Levels due to Utah Point Berth Project – Worst Case Night Time Meteorological Conditions	**43**	**45**	**45**	**31**
Background noise levels	51	50	50	52

Figure G 5 in Appendix G shows predicted noise levels for 2009 due to Utah Point alone over the broader Port Hedland township. Figure 4.5 shows a close up of the western areas of Port Hedland. Predicted noise levels in Port Hedland range up to 46dB(A). With engineering noise controls, areas to the west of the Port Hedland Hospital still exceed the noise criteria.

The example noise controls applied to equipment at Utah Point are significant in terms of the reductions they achieve on individual noise sources (up to 10dB(A)). See Appendix B for details of noise controls. The effect of the example noise controls is to reduce the total noise from the Utah Point operations by 3-4 dB(A).

With predicted noise levels still 4-6dB(A) above the criteria, it is unlikely that further noise controls would reduce noise levels to meet the criteria, unless severe restrictions are placed on the movements of mobile plant, or extreme noise treatments are applied to mobile plant

It is important to note that the current background noise levels are at least 4 dB(A) higher than the predicted noise levels for the Utah Point Berth Project.

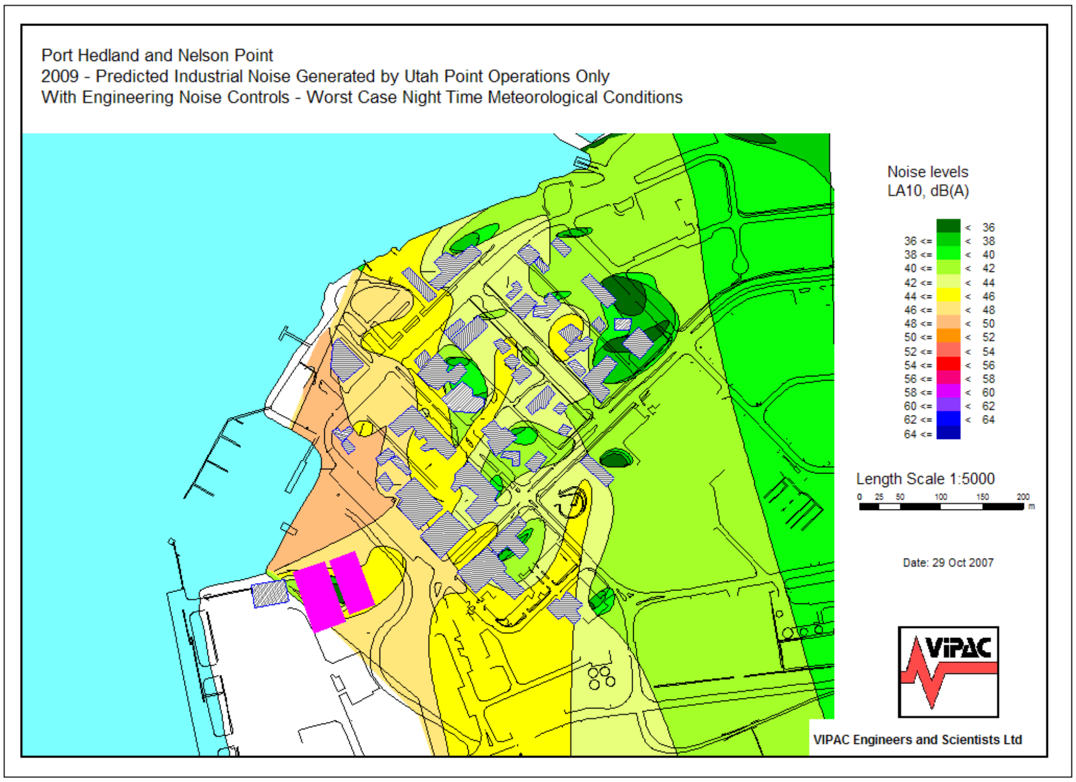

Figure 4.5 Predicted Noise Levels in western Port Hedland due to the Utah Point Berth Facility – Worst Case Night Time Weather with noise controls.

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4.6.2 Utah Point Berth Project and PHPA Wharf Operations

Predicted noise levels for the combined operations of the Utah Point Berth Project and PHPA Wharf Operations with engineering noise controls, are shown in Table 4.11. It can be seen that with the implementation of the Utah Point Berth Project and engineering noise controls, future noise levels are predicted to be the same or lower than if the project was not implemented. As such the project has a positive effect on noise levels in Port Hedland.

Table 4.11: Predicted Industrial Noise Levels from the proposed Utah Point operations and the PHPA Port Hedland Port Operations at the Closest Noise Sensitive Receivers – Worst Case Night Time Meteorological Conditions - L_{A10} dB(A) – with noise controls

	Backpackers Hostel	Esplanade Hotel	Pier Hotel	Hospital
Future scenario of proposed Utah Point Berth Project and Future PHPA Port Hedland Port Operations	**49**	**58**	**56**	**34**
Future PHPA Port Hedland Port Operations only (no Utah Point operations)	**49**	**61**	**56**	**43**
Difference in noise with implementation of the proposed development	0	-3	0	-9
Equal or better noise environment with Utah Point Berth Project?	Yes	Yes	Yes	Yes

Figure G 6 in Appendix G shows the predicted noise levels for the proposed Utah Point Berth Project and Future PHPA Port Hedland Port Operations with noise controls.

Figure 4.6 shows a noise difference map of the Port Hedland area, which shows that almost all areas of Port Hedland area will experience a reduction in noise levels with the implementation of the Utah Point Berth Project if noise controls are implemented. Figure 4.7 shows a close up of the western part of the Port Hedland township.

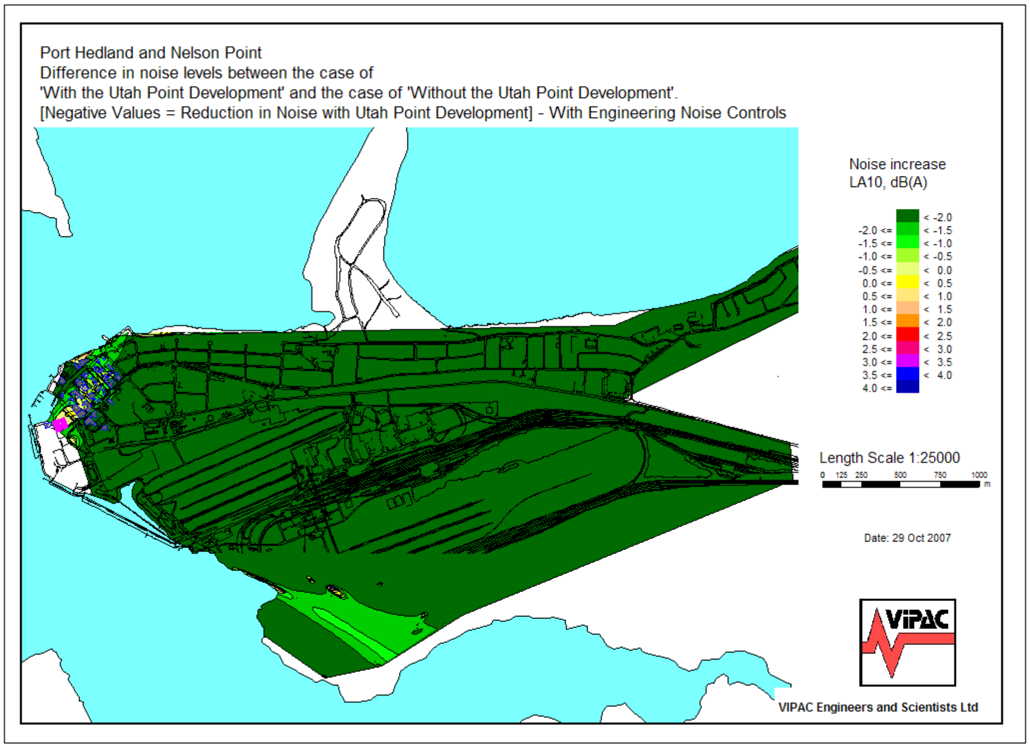


Figure 4.6 Noise difference map showing a decrease in noise with the implementation of the Utah Point Berth Project

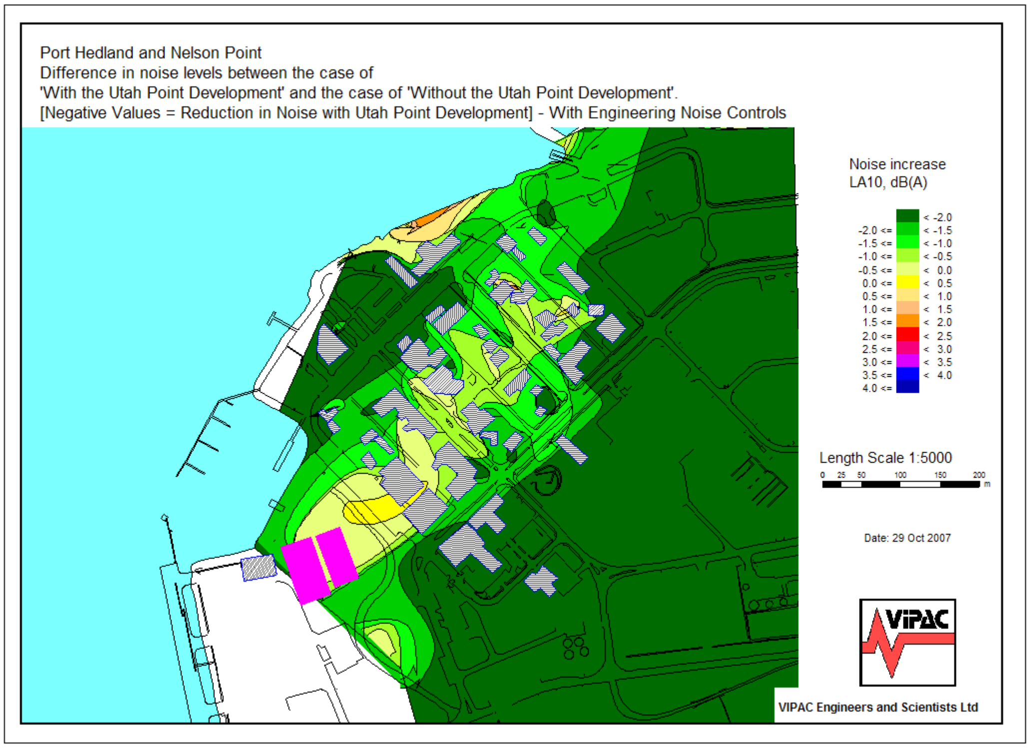


Figure 4.7 Noise difference map of western part of Port Hedland showing the decrease in noise with the implementation of the Utah Point Berth Project

4.7 Discussion on Operational Noise

The operational noise impact on South Hedland, Wedgefield and Redbank is insignificant due to the relatively large distances between them and the proposed development. The noise criteria in these areas will be satisfied.

This report does not consider noise contributions from facilities other than the Utah Point Berth Project and the port operations in Port Hedland managed by Port Hedland Port Authority. The noise regulations only require consideration of noise from the proposed development.

4.7.1 Cumulative noise impacts

Since the operation of the proposed Utah Point Berth Project and the **future** PHPA port operation at Port Hedland are intrinsically linked, noise emissions from the two plants are best considered together. The outcome is that with the implementation of the Utah Point Berth Project, **future noise levels will be lower** than if the facility is not implemented. As such, the noise environment in Port Hedland is predicted to improve as a result of the proposed development, and there will be no cumulative noise impact from the development.

4.7.2 Noise impact of the proposed Utah Point Berth facility

If the proposed Utah Point Berth facility is considered by itself, noise predictions show that locations to the west of the hospital in Port Hedland will exceed the noise criteria. However, the operations conducted at the proposed Utah Point Berth facility are intrinsically associated with the port operations in Port Hedland managed by Port Hedland Port Authority. If the operations of these two plants are considered together, noise predictions show that implementation of the Utah Point Berth facility will cause noise levels to remain either the same or decrease in Port Hedland. There will be no increase in noise levels due to implementation of the Utah Point Berth facility.

4.7.3 Noise model accuracy

The noise model can be considered accurate and suitable for predicting noise to comply with the noise criteria on the following basis.

- The sound power levels and spectra used in the noise model have been determined from measurements of equipment which are the same, or similar to the equipment considered in this study.
- The sound power levels and spectra used in the noise model have been used in other industrial noise models where the predicted noise levels are in line with measured noise levels. As such, it can be said the input data to the noise model has been previously validated.

4.7.4 Variation in noise emissions from the future plant

The focus of this report is on the worst case scenario. This includes worst case weather, worst case equipment operations (ie the operation mode of equipment that produces the most noise), and worst case equipment position (most exposure to receivers - if equipment is mobile). The actual scenario of all these individual worst case situations occurring together is unlikely. As such, future noise levels from the plant are expected to be lower than those used for comparison with the noise criteria.

5. CONSTRUCTION NOISE

5.1 Construction Noise Criteria

Regulation 13(2) of the Environmental Protection (Noise) Regulations considers noise emission from construction sites between the hours of 0700 – 1900 on any day which is not a Sunday or public holiday. Regulation 7 does not apply to noise emitted from a construction site as a result of construction work carried out between 0700 hours and 1900 hours on any day which is not a Sunday or public holiday if the occupier of the premises or public place, shows that -

> *(a) the construction work was carried out in accordance with control of environmental noise practices set out in section 6 of AS 2436-1981 Guide to Noise Control on Construction, M aintenance and Demolition Sites;*
>
> *(b) the equipment used on the premises was the quietest reasonably available; and*
>
> *(c) if the occupier was required to prepare a noise management plan under subregulation (4) in respect of the construction site —*
>
> > *(i) the noise management plan was prepared and given in accordance with the requirement, and approved by the Chief Executive Officer; and*

(ii) the construction work was carried out in accordance with the management plan.

5.2 Construction Noise Management

Detailed information on the construction schedule is not available at this stage. As per the Regulations, construction noise should be *carried out in accordance with good noise control practice as defined in Section 6 of AS 2436—1981.* Section 6 of this Standard addresses *Control of noise* and identifies four ways of controlling noise at the source. A brief overview is presented below.

Substitution

Where reasonably practicable, noisy plant or processes should be replaced by less noisy alternatives.

Modification of Existing Equipment

A variety of engineering controls may be applied to excessively noisy equipment to reduce their noise impact. This may be achieved by enclosing equipment, inserting silencers, damping of noise radiating panels, etc.

Use and Siting of Equipment

Care should be taken to site noisy equipment away from noise-sensitive areas.

In the case of the Utah Point construction, this will involve the minimising of noisy activities on the wharf, which is the closest construction location to the township of Port Hedland. Where possible, pre-fabrication should be conducted away from the wharf.

Maintenance

Regular and effective maintenance of stationary and mobile equipment including off-site vehicles is essential and will do much to keep noise levels near to that of new machinery.

Regulation 13(2) of the EP(N)R also states that the equipment used should be *the quietest reasonably available*.

These management strategies for minimising noise impact should be taken into account when planning construction works.

5.3 Operational Noise Management

5.3.1 Noise Management Strategies – Required for Criteria Compliance

The implementation of engineering noise controls is the primary method of ensuring compliance with the noise criteria. The implementation and management of these engineering noise controls will be required to ensure these controls are effective.

- **Involvement of a suitably qualified acoustic consultant in the design and construction process.** This will ensure that specifications for enclosures and shielding are correct, and that the controls are implemented correctly.
- **A maintenance program to ensure that engineering noise controls are maintained for the life of the plant.** Acoustic treatments can degrade over time, thereby reducing their performance. For example, fibre based absorptive material can erode from enclosures and silencers. There is potential that this could cause criteria exceedance several years after commissioning. Maintenance and replacement of damaged or worn acoustic treatments should be conducted on a regular basis.
- **A buy quiet policy for all drives.** Any equipment that need to be replaced (particularly motors and gearboxes) should be replaced with the quietest available. This will ensure that noise levels are kept to a minimum.
- **Maintain all equipment to minimise noise.** Poorly maintained equipment, (such as noisy conveyor idlers or worn motor bearings), all contribute to the total noise emission of a plant. Such items should be maintained to minimise noise emission.

5.3.2 Noise Management Strategies – For Best Practice

- **Education of all staff.** Staff should be aware of how their work impacts on the noise environment. This is particularly pertinent for mobile plant operators and maintenance personnel.
- **Ongoing community liaison.**
- **Noise Measurement.** If complaints are received from Port Hedland residents, these should be investigated and documented, including noise measurements by a suitably qualified acoustic consultant.
- **Establishment and continual updating of a Noise Management Plan for operation of the proposed site.** This will identify other potential noise control measures and how they should be implemented on site.

6. CONCLUSIONS

With the implementation of the proposed Utah Point Berth Project the following outcomes with respect to noise can be expected:

Traffic noise. Predicted traffic noise levels at residences in Port Hedland will satisfy the applicable traffic noise criteria, as detailed in *EPA Statements for EIA No. 14 (Version 3) Road and Rail Transportation Noise, (Draft 10/5/00).*

Predicted traffic noise levels at residences in South Hedland will satisfy the applicable traffic noise criteria, as detailed in *EPA Statements for EIA No. 14 (Version 3) Road and Rail Transportation Noise, (Draft 10/5/00).*

In Wedgefield the traffic noise criteria may be exceeded at certain noise sensitive sites. Residences could counter any increase in noise levels by implementing simple architectural treatments. As such the objectives of the *EPA Statements for EIA No. 14 (Version 3) Road and Rail Transportation Noise, (Draft 10/5/00)* can be achieved.

Operational noise. The applicable noise criteria, as detailed in the Environmental Protection (Noise) Regulations 1997 (EP(N)R), will be exceeded in most areas west of the Port Hedland Hospital. However, since the operation of the proposed Utah Point Berth Project and the **future** PHPA port operation at Port Hedland are intrinsically linked, noise emissions from the two plants are best considered together. The outcome is that with the implementation of the Utah Point Berth Project, **future noise levels will be lower** than if the facility is not implemented. As such, the noise environment in Port Hedland is predicted to improve.

Construction noise. With the implementation of suitable administrative and engineering control measures, as outlined in this report, construction activities will be carried out in accordance with good noise control practice, and thereby satisfy the construction noise requirements of the EP(N)R.

7. RECOMMENDATIONS

It is recommended that a suitably qualified acoustic consultant be contracted to participate in the detailed design stage of the project. The acoustic consultant can give advice on equipment selection, and provide details of the engineering controls required to achieve the noise levels used in the model.

APPENDIX A - Traffic noise modelling - data and assumptions

Traffic volumes used in the noise model

Traffic volumes for traffic associated with Utah Point Berth Project and other traffic were calculated for the 15hr day time period and the 9hr night time period. These numbers were then adjusted to a equivalent 18hr period (6am – 12 midnight) so they could be used in the CoRTN algorithms (CoRTN predicts a L10 18 hour 6am – 12 midnight value). A conversion from L10 to LAeq was made by subtracting 3 dB(A). 3 dB(A) is the normal difference seen between the L10 to LAeq noise descriptors in traffic noise data.

Traffic Noise Sources in the Noise Model

The noise from traffic was simulated in the noise model as noise emitting source lines on each road section. A separate line source was used to represent each type of vehicle - light vehicles, heavy vehicles and road trains. Two line sources were used to represent the noise from heavy vehicles. This is because heavy vehicle produce noise at two different heights, i.e. tyre/engine noise (close to road) and exhaust noise (high above road).

Five noise source lines were used to collectively define the traffic noise from each road section, as follows:

- Light vehicles
- Heavy vehicles – engine/tyre noise
- Heavy vehicles – exhaust noise
- Road Trains – engine/tyre noise
- Road Trains – exhaust noise

Each noise source line was modelled at the height above the road of the noise source it represents. For example, truck exhaust noise was modelled at 3.5m above the road, as this is the average height of a heavy vehicle exhaust outlet.

Noise source string heights were modelled as shown in Table A-1.

Table A-1: Traffic Noise Source String Parameters Used in Traffic Modelling

	% Heavy Vehicles	Noise Source Line Height (m)	*Road Train Correction
Light vehicles	0	0.5	--
Heavy vehicles – engine / tyre noise	100	1.5	--
Heavy vehicles – exhaust noise	100	3.5	--
Road Trains – engine / tyre noise	100	1.5	+ 3
Road Trains –exhaust noise	100	3.5	+ 3

*3 dB(A) was added to the road train noise source to allow for the increased tyre and engine noise produced by these vehicles. 3dB(A) equates to double the noise level, which would occur with double the number of axles on a road train compared with a regular heavy vehicle.

In the absence of any available data on road surface type, it has been assumed that dense graded asphalt (DGA) is used on all roads. CRTN uses a 0 dB road surface correction for this road surface type.

Table A 2: AADT Traffic Volumes Used in Traffic Noise Study

	2006 ESTIMATED EXISTING VOLUMES			2009 PREDICTED TRAFFIC VOLUMES – WITH UTAH POINT					
				*TRIPLE ROAD TRAIN SCENARIO			QUAD ROAD TRAIN SCENARIO		
	Light Vehicles	Heavy Vehicles	Road Trains	Light Vehicles	Heavy Vehicles	Road Trains	Light Vehicles	Heavy Vehicles	Road Trains
1	7400	745	408	8584	745	408	8584	745	404
2	4050	565	366	4698	570	1188	4698	570	978
3	7215	335	0	8369	335	0	8369	335	0
4	7130	768	384	8271	768	1008	8271	768	900
7	1500	160	180	1740	170	372	1740	170	339
8	4475	573	378	5191	573	1002	5191	573	896
9	1695	185	276	1966	185	900	1966	185	794
11	7303	1180	408	8471	1180	408	8471	1180	404
12	5739	831	408	6657	831	408	6657	831	404
13	4643	496	408	5386	496	408	5386	496	404
14	2265	305	216	2627	305	1044	2627	305	762
15	2265	305	216	2627	305	1044	2627	305	762

* The triple road train traffic volumes were used to calculated model all traffic noise levels the year 2009 with Utah Point.

Table A 3: AADT Traffic Volumes Used in Traffic Noise Study (continued)

Road numbers*	2009 PREDICTED TRAFFIC VOLUMES – NOT CONSIDERING UTAH POINT		
	Light Vehicles	Heavy Vehicles	Road Trains
1	8584	745	408
2	4698	570	484
3	8369	335	0
4	8271	768	460
7	1740	170	216
8	5191	573	454
9	1966	185	352
11	8471	1180	408
12	6657	831	408
13	5386	496	408
14	2627	305	340
15	2627	305	340

Table A 4: Road References Used in Tables A 1 and A 2

Road Number*	Road Name	Posted Speed km/hr
1	Port Hedland Rd	90
2	Pinga St, between Cajarina Rd and Great Northern Hwy	70
4	Great Northern Hwy, between Wallwork Rd and Port Hedland Rd	90
7	Great Northern Hwy, South	80
8	Great Northern Hwy, between Cajarina Rd and Wallwork Rd	80
9	Great Northern Hwy, east of Port Hedland Rd	90
11	Port Hedland Rd	90
12	Port Hedland Rd	90
13	Port Hedland Rd	80
14	Pinga St, north-west of Cajarina Rd	80
15	Cajarina Rd and Finucane Rd	90

*Road numbers are the labels of road sections used in the traffic flow study by SKM. The traffic flow study was used to generate traffic volumes for noise predictions.

Figure A 1: Port Hedland Region Showing Modelled Roads

Figure A 2: Port Hedland Region Showing Modelled Roads

Traffic Noise Source Data

Traffic volumes were obtained from SKM. The data provided was the input data to the intersection assessment conducted for the traffic impact assessment. The data considered AM and PM peak hour turning volumes at four intersections, namely:

- Cnr Pinga and Cajarina Sts, Wedgefield
- Cnr Great Northern Hwy and Pinga St, Wedgefield
- Cnr Great Northern Hwy and Wallwork Rd, Wedgefield
- Cnr Great Northern Hwy and Port Hedland Rd, Redbank

Three traffic scenarios are considered in the traffic data provided. These have been used as the basis for traffic scenarios considered in the noise study presented in this report, namely:

- Existing traffic scenario (year 2006)
- Future traffic (year 2009) without the proposed Utah Point Berth Project
- Future traffic (year 2009) with the proposed Utah Point Berth Project

In addition, the January 2007 traffic count for Port Hedland was provided.

VIPAC has processed the data provided by SKM to determine Annual Average Daily Traffic (AADT) and 18 hour traffic volumes for input into the SoundPLAN traffic model. The following assumptions have been used to process the traffic data:

Light and Heavy Vehicles (Austroads 94 Classes 1 – 2 and 3 – 9)

- The average peak hour traffic volume is 10 % of the AADT, as advised by SKM traffic engineers.
- 95 % of the AADT travels between 6 am and 12 am (the 18 hour period for traffic calculation).
- No data was provided for predicted (2009) traffic volumes on Port Hedland Rd and Wilson St, apart from AM and PM intersection volumes at the cnr of Great Northern Hwy and Port Hedland Rd. The ratio of vehicles on various sections of these roads was taken from the 2007 traffic count and scaled according to the volumes in the peak hour traffic predictions to generate 2009 data.
- All vehicles travelling on Cajarina Rd continue along Finucane Rd to the proposed development at Utah Point for all scenarios.
- Posted traffic speeds are as per the 2007 traffic count.

Road Trains (Austroads 94 Classes 10 – 12)

- Road train traffic is evenly distributed across a 22 hour period. A two hour curfew is imposed on road trains during the evening peak hours.
- All road trains heading north from the cnr of Great Northern Hwy and Port Hedland Rd travel to the existing public berth.
- All vehicles travelling on Cajarina Rd continue along Finucane Rd to the proposed development at Utah Point for all scenarios.
- Posted traffic speeds are as per the 2007 traffic count.

APPENDIX B - Industrial noise modelling

PROPOSED UTAH POINT BERTH PROJECT – NOISE DATA

Noise Descriptors

All noise sources used in the prediction of operational noise are defined as L_{A10} sound powers, and noise levels are predicted as L_{A10} sound pressure levels. Previous noise measurements of machine noise which were used in this model recorded the L_{Aeq}, L_{A10}, L_{Amax}, and L_{A90} noise descriptors, measured over a period of 15s to 1 minute. Since the L_{A10} is the noise descriptor with the strictest criteria, the L_{A10} for each machine was used to define the sound power in the model. As such all predicted noise levels are L_{A10} values (L_{A10} in, L_{A10} out).

Conveyors and Drives

Conveyors and drives for five conveyors were considered, as noted below. Locations of these sources were taken from Ewing VDM drawing 7452-C-05-SK1, Rev D. Typical sound powers and spectra were used for conveyors and drives, taken from VIPAC's database. A sound power of 78 dB(A) per metre was used for the conveyors and 106 dB(A) for drives. A conservative source height of 9.5 m AHD (approximately 1.5 m above ground) was assumed.

- CV-01 – Stockpile Conveyor
- CV-02 – Stockpile Conveyor – not modelled, as this is not running if CV-01 is operational.
- CV-03 – Route to Shiploader
- CV-05 – Route to Shiploader
- CV-06 – Wharf Conveyor

Shiploaders

The shiploader was modelled as shown on Ewing VDM drawing 7452-C-05-SK1, Rev D. The sound powers and spectra of these sources are based on measured data at similar shiploading facilities. Two drives of sound power 106 dB(A) (untreated) are used for each loading conveyor. A conservative source height of 10 m AHD (approximately 4.5 m above ground) was assumed for the drives. The conveyors were modelled with a sound power of 85 dB(A) per metre (untreated), with a source height of 10 m rising to 18 m AHD.

Stackers

Five stackers were assumed to be operating. A sound power of 85 dB(A) per metre was used for the stacker conveyors. The conveyor motors were modelled as a sound power of 106 dB(A). The source spectra were based on VIPAC's database. A source height of 10 m AHD was used. The stackers were located at the stockpiles located closest to Port Hedland in order to model a 'worst-case' scenario.

Truck Movements on site

Noise was modelled using the LA10 noise descriptor, as this is the critical noise descriptor in the criteria.

The following assumptions have been made regarding the movement of trucks within the site:

- There are five road trains within the facility at any time.
- The time a road train will spend at the facility is divided such that approximately one third is spent unloading, and the remainder is spent driving at low speed.

Sound power for each truck at idle is expected to be 95 dB(A). Sound power for each truck while travelling around the site is expected to be 108 dB(A). The source spectra were based on VIPAC's database.

Front End Loaders

Two front end loaders were assumed to be operating. An overall sound power of 115 dB(A) for each loader (untreated) was used, based on rated sound power of a CAT 994 from the CAT website. The source spectra were based on VIPAC's database. A source height of 3 m above ground was assumed for the engine, and 7 m above ground for the exhaust. The two front end loaders were located at stockpiles located closest to Port Hedland in order to model a 'worst-case' scenario.

Dozers

One Dozer was assumed to be operating. A sound power of 115 dB(A) (untreated) was used, based on rated sound power of a CAT 834H from the CAT website. The source spectra were based on VIPAC's database. A source height of 2 m above ground was assumed for the engine, and 4 m above ground for the exhaust. The two front end loaders were located at stockpiles located closest to Port Hedland in order to model a 'worst-case' operational scenario.

Loading Hopper

A series of apron feeders will be installed to feed product onto CV-01 and CV-02. Product will be introduced to the hoppers by Front End Loaders (discussed above). The main source of noise from the hoppers will be the impacting of product on the walls of the hopper when the loader is dumping. As the apron feeders are typically low speed, and the drives are typically small, these have not been considered as a significant noise source.

The sound power of the hopper is dependent on detailed design elements, such as plate thickness, structural steel specifications, wear plate properties and product consistency. A sound power of 110 dB(A) has been assumed. As there are two front end loaders, two hoppers running concurrently are modelled as worst case. It has also been assumed that product will be dumped into the hopper for approximately 10 % of the loader's cycle.

SOURCE SPECTRA - L_{A10}

Source	SrcType	l or S	Lw	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
BNCS Fac 1	Area	496.9	94.4	88.8	88.9	88.4	85.8	81	75.2	64	45.9
BNCS Roof	Area	2323	101.1	95.5	95.6	95.1	92.5	87.7	81.9	70.7	52.6
BNCS Fac 2	Area	1049	64.1	58	58.1	57.6	55	50.2	54.4	33.2	29.1
BNCS Fac 3	Area	496.9	94.4	88.8	88.9	88.4	85.8	81	75.2	64	45.9
BNCS Fac 4	Area	1049	97.6	92	92.1	91.6	89	84.2	78.4	67.2	49.1
Newcrest Fac1	Area	595.2	96.9	91.5	91.6	90.1	88.5	83.7	77.9	65.7	48.6
Newcrest Roof	Area	3082	104.1	98.7	98.8	97.3	95.7	90.9	85.1	72.9	55.8
Newcrest Fac2	Area	1162	99.8	94.5	94.6	93.1	91.5	86.7	80.9	68.7	51.6
Newcrest Fac3	Area	595.2	96.9	91.5	91.6	90.1	88.5	83.7	77.9	65.7	48.6
Newcrest Fac4	Area	1162	99.8	94.5	94.6	93.1	91.5	86.7	80.9	68.7	51.6
Shiploader Conveyor (exist)	Line	22.27	98.5	47.5	67.5	78.5	91.5	94.5	93.5	86.5	72.5
CV-05 (exist)	Line	90.53	104.6	53.6	73.6	84.6	97.6	100	99.6	92.6	78.6
CV-06 (existing)	Line	30.59	99.9	48.9	68.9	79.9	92.9	95.9	94.9	87.9	73.9
CV-04 (existing)	Line	73.54	103.7	52.7	72.7	83.7	96.7	99.7	98.7	91.7	77.7
MC-01 (exist)	Line	14.13	96.5	45.5	65.5	76.5	89.5	92.5	91.5	84.5	70.5
Shiploader Motor 1 (exist)	Point		106	68.8	80.3	85.8	94.9	101	103	92.7	81.2
Shiploader Motor 2 (exist)	Point		106	68.8	80.3	85.8	94.9	101	103	92.7	81.2
Transfer Tower 3 - (exist)	Point		110	84.8	91.8	98.8	103	105	103	96.8	85.8
Transfer Tower 5 - (exist)	Point		110	84.8	91.8	98.8	103	105	103	96.8	85.8
PHPA Truck 1 Driving	Point		108	83.2	93.3	97.8	101	102	102	97.4	87.3
NewBldg Fac1	Area	2414	99	93.6	93.7	92.2	90.6	85.8	80	67.8	50.7
NewBldg Roof	Area	6075	103	97.6	97.7	96.2	94.6	89.8	84	71.8	54.7
NewBldg Fac2	Area	1004	95.2	89.8	89.9	88.4	86.8	82	76.2	64	46.9
NewBldg Fac3	Area	2414	99	93.6	93.7	92.2	90.6	85.8	80	67.8	50.7
NewBldg Fac4	Area	1004	95.2	89.8	89.9	88.4	86.8	82	76.2	64	46.9
Proposed New Conveyor -	Line	64.8	103.1	52.2	72.2	83.2	96.2	99.2	98.2	91.2	77.2
Utah Truck 2 Dumping	Point		95	70.2	80.3	84.8	88.2	89.4	89.6	84.4	74.3
Utah Truck 3 Driving	Point		108	83.2	93.3	97.8	101	102	102	97.4	87.3
Utah Truck 4 Driving	Point		108	83.2	93.3	97.8	101	102	102	97.4	87.3
Utah Truck 5 Driving	Point		108	83.2	93.3	97.8	101	102	102	97.4	87.3
Utah Truck 1 Driving	Point		108	83.2	93.3	97.8	101	102	102	97.4	87.3
CV-06	Line	225.8	101.5	50.6	70.6	81.6	94.6	97.6	96.6	89.6	75.6
CV-05	Line	323.2	103.1	52.1	72.1	83.1	96.1	99.1	98.1	91.1	77.1
CV-01	Line	467.5	104.7	53.7	73.7	84.7	97.7	100	99.7	92.7	78.7
Shiploader Conveyor A	Line	22.28	98.5	47.5	67.5	78.5	91.5	94.5	93.5	86.5	72.5
Shiploader Conveyor B	Line	18.71	97.7	46.8	66.8	77.8	90.8	93.8	92.8	85.8	71.8
Stacker 4	Line	52.53	102.2	51.2	71.2	82.2	95.2	98.2	97.2	90.2	76.2
Stacker 4	Line	57.63	102.6	51.6	71.6	82.6	95.6	98.6	97.6	90.6	76.6
Stacker 1	Line	51.75	102.1	51.2	71.2	82.2	95.2	98.2	97.2	90.2	76.2
Stacker 2	Line	57.31	102.6	51.6	71.6	82.6	95.6	98.6	97.6	90.6	76.6
Stacker 3	Line	56.95	102.6	51.6	71.6	82.6	95.6	98.6	97.6	90.6	76.6
CV-03 New	Line	393.7	104	53	73	84	97	100	99	92	78
CV -01 Drive	Point		106	68.8	80.3	85.8	94.9	101	103	92.7	81.2
CV -06 Drive	Point		106	68.8	80.3	85.8	94.9	101	103	92.7	81.2
CV -05 Drive	Point		106	68.8	80.3	85.8	94.9	101	103	92.7	81.2
CV -03 Drive	Point		106	68.8	80.3	85.8	94.9	101	103	92.7	81.2
Shiploader Motor A1	Point		106	68.8	80.3	85.8	94.9	101	103	92.7	81.2

Shiploader Motor A2	Point	106	68.8	80.3	85.8	94.9	101	103	92.7	81.2
Shiploader Conveyor Drive B1	Point	106	68.8	80.3	85.8	94.9	101	103	92.7	81.2
Shiploader Conveyor Drive B2	Point	106	68.8	80.3	85.8	94.9	101	103	92.7	81.2
Stacker 1 Drive	Point	106	68.8	80.3	85.8	94.9	101	103	92.7	81.2
Stacker 3 Drive	Point	106	68.8	80.3	85.8	94.9	101	103	92.7	81.2
Stacker 2 Drive	Point	106	68.8	80.3	85.8	94.9	101	103	92.7	81.2
Stacker 5 Drive	Point	106	68.8	80.3	85.8	94.9	101	103	92.7	81.2
Stacker 4 Drive	Point	106	68.8	80.3	85.8	94.9	101	103	92.7	81.2
Hopper	Point	110	82.4	90.6	95.7	102	105	104	100	97.6
Dozer - Engine	Point	114.2	89.4	99.5	104	107	108	108	103	93.5
Dozer - Exhaust	Point	107	82.2	92.3	96.8	100	101	101	96.4	86.3
Front End Loader at Hopper -	Point	107.2	82.4	92.5	97	100	101	101	96.6	86.5
Front End Loader at Hopper -	Point	100	75.2	85.3	89.8	93.2	94.4	94.6	89.4	79.3
Front End Loader 1 - Eng	Point	114.2	89.4	99.5	104	107	108	108	103	93.5
Front End Loader 1 - Exh	Point	107	82.2	92.3	96.8	100	101	101	96.4	86.3

EXISTING PORT HEDLAND WHARF OPERATIONS – NOISE DATA

Plant to be Decommissioned

The following items will be decommissioned as part of the proposed Utah Point expansion:

- Consolidated Minerals equipment
- The use of un-enclosed Front End Loaders at the Wharf and stockpile area.
- CV-08
- Transfer Towers associated with decommissioned conveyors

Plant to be Retained

- Shiploader, with associated conveyors and drives
- Birla Nifty stockpile shed (containing 1 Front end Loader, excavator and bobcat)
- Newcrest stockpile shed (containing 2 x Front End Loaders, excavator and bobcat)

Proposed Plant

- Multi-User Concentrate Shed, approx 115 m long and 20 m high
- Conveyor from proposed shed to existing shiploading conveyors

Low Speed Truck Movements

VIPAC is advised that vehicle movements at the existing facility, every 2.5-3 hours (24 hours per day, 7 days per week) – Based on 2006-07 tonnage.

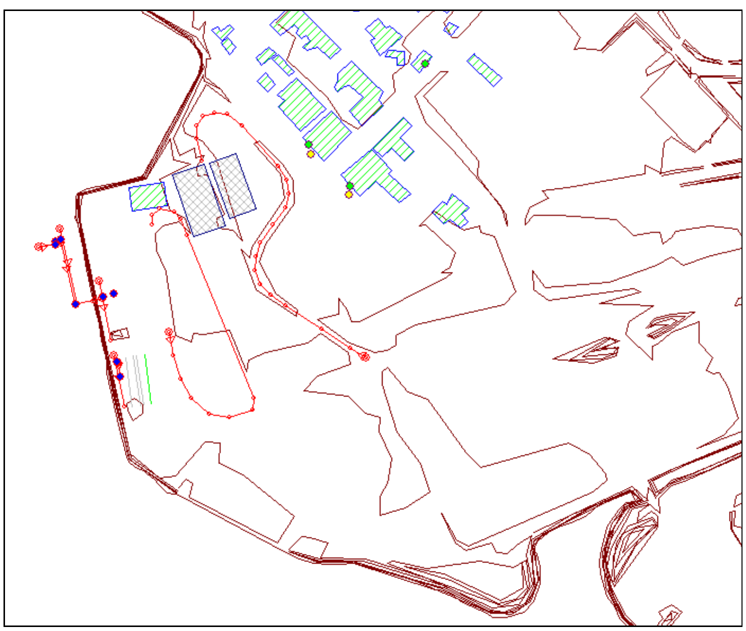


Figure B-1: Port Hedland – Existing Wharf Infrastructure – SoundPLAN Model

SOURCE OF NOISE MODEL INPUT DATA

A summary of the sources of model input data is presented in Table B-5

Table B-5: Model Input Data

Item	Description
Cadastre	Landgate data, provided by SKM
Terrain	WV03265_De_Grey_Mosaic.dwg, provided by SKM
Existing Traffic Count and traffic speeds	Copy of Port Hedland Traffic Count Summary – Jan 07.xls, provided by SKM
Traffic Predictions	TrafficVols_PointUtah_Ver1.xls, provided by SKM
Industrial Noise Source Layout	7452-C-05-SK1, Rev D, Utah Point Panamax Berth Project, Drawing by Ewing VDM Engineers
Industrial Noise Source Spectra and Sound Powers	Provided by SKM, else sourced from VIPAC's database
Noise Sensitive Receiver Height	1.8 m above natural terrain

EFFECT OF METEOROLOGY ON NOISE PROPOGATION

Meteorology has a significant influence on the propagation of noise from industrial noise sources. The EPA document *Guidance for the Assessment of Environmental Factors – Environmental Noise No. 8 Draft June 1998* recommends the parameters shown in Table 4.3 as the worst case weather scenarios for industrial noise modelling.

Table 0.3 EPA's Default 'Worst Case' Weather Conditions

Parameter	Day (0700 – 1900)	Night (1900 – 0700
Wind Speed	4 m/s	3 m/s
Temperature inversion lapse rate	Nil	2 °C /100m
Temperature	20 °C	15 °C
Relative Humidity	50 %	50 %

SoundPLAN noise modelling software uses the Pasquill Stability Class (PSC) system to account for the influence of temperature inversions. Depending on the PSC and wind speed, the atmospheric conditions fall in to one of 6 Meterological Categories, with Category 6 producing the greatest increase in noise levels due to atmospheric conditions. Each meterological category comprises a set of algorithms for each octave band.

EXAMPLE SET OF ENGINEERING NOISE CONTROLS TO REDUCE NOISE FROM THE UTAH POINT BERTH PROJECT

This example set of engineering controls has been drafted to produce a noise reduction of 3-4 dB(A) from the Utah Point Berth Project, and a noise reduction of 2dB(A) when considering the combined noise of the proposed Utah Point operations and the PHPA Port Hedland Port Operations.

The likely maximum reduction for each engineering noise control is indicated in parentheses.

Utah Point

- Enclosure, or selection of low noise drives for drives on the shiploaders and conveyors CV-05 to CV-06. (10 dB)
- Shielding around conveyor CV-06, CV-03 and shiploading conveyors. (10 dB)

Existing PHPA Wharf

- Eastern wall in Multi-User Concentrate shed to be filled concrete block. (15 dB)
- Roof and sides of Multi-User Concentrate shed to be lined. (5 dB)
- Shielding of noisy transfer towers that will remain in use. (10 dB)
- Northern wall and roof of the Newcrest shed to be lined. (5 dB)

Roof of the Birla Nifty Copper Shed to be lined. (5 dB)

APPENDIX C - Noise terminology

Common Acoustic Terms

Sound Pressure Level (L_p) – Sound or noise is the sensation produced at the ear by very small fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range (from 20 microPascals to 60 Pascals). A scale that compresses this range to a more manageable size and that is best matched to subjective response is the logarithmic scale, rather than a linear scale.

Sound Pressure Level (L_p) is defined as:

$$L_P = 10\log_{10}\left(\frac{p^2}{p_{ref}^2}\right)dB$$

In the above equation, p is the sound pressure fluctuation (above or below atmospheric pressure), and p_{ref} is 20 microPascals (2×10^{-5} Pa), the approximate threshold of hearing. To avoid a scale which is too compressed, a factor of 10 is included, giving rise to the decibel, or dB for short.

A-Weighted Decibel (dB(A)) & Loudness – The overall level of a sound is usually expressed as dB(A), instead of dB. The sound is measured using an A-weighted filter, which is incorporated into the sound level meter. The filter is used to approximate the response of the human ear. It reduces the significance of lower frequencies and very high frequencies, thereby increasing the importance of mid-frequencies (500 Hz to 4 kHz).

A change of 1 to 2 dB(A) is difficult to detect, whilst a change of 3 to 5 dB(A) corresponds to a small but noticeable change. A 10 dB(A) change corresponds to a doubling or halving in apparent loudness. Refer to the section below on *Human Perception of Loudness.*

C-Weighted Decibel (dB(C)) – In some circumstances, the sound pressure level is expressed as C-Weighted decibels, instead of the more common A-Weighted. The C-Weighting filter is designed to replicate the response of the human ear above 85 dB, and places a greater weighting on low frequency noise.

L_{Aeq} is the time averaged A-weighted sound pressure level for the interval, as defined in AS1055.1. It is generally described as the equivalent continuous A-weighted sound pressure level that has the same mean square pressure level as a sound that varies over time. It can be considered as the average sound pressure level over the measurement period.

Octave frequency bands allow a representation of the spectrum associated with a particular noise. They are an octave wide, meaning that the highest frequency in the band is just twice the lowest frequency, with all intermediate frequencies included and all other frequencies excluded. Each octave band is described by its centre frequency.

Third (1/3) octave frequency bands provide a little more information. Third octave bands are bands of frequency approximately one third of the width of an octave band.

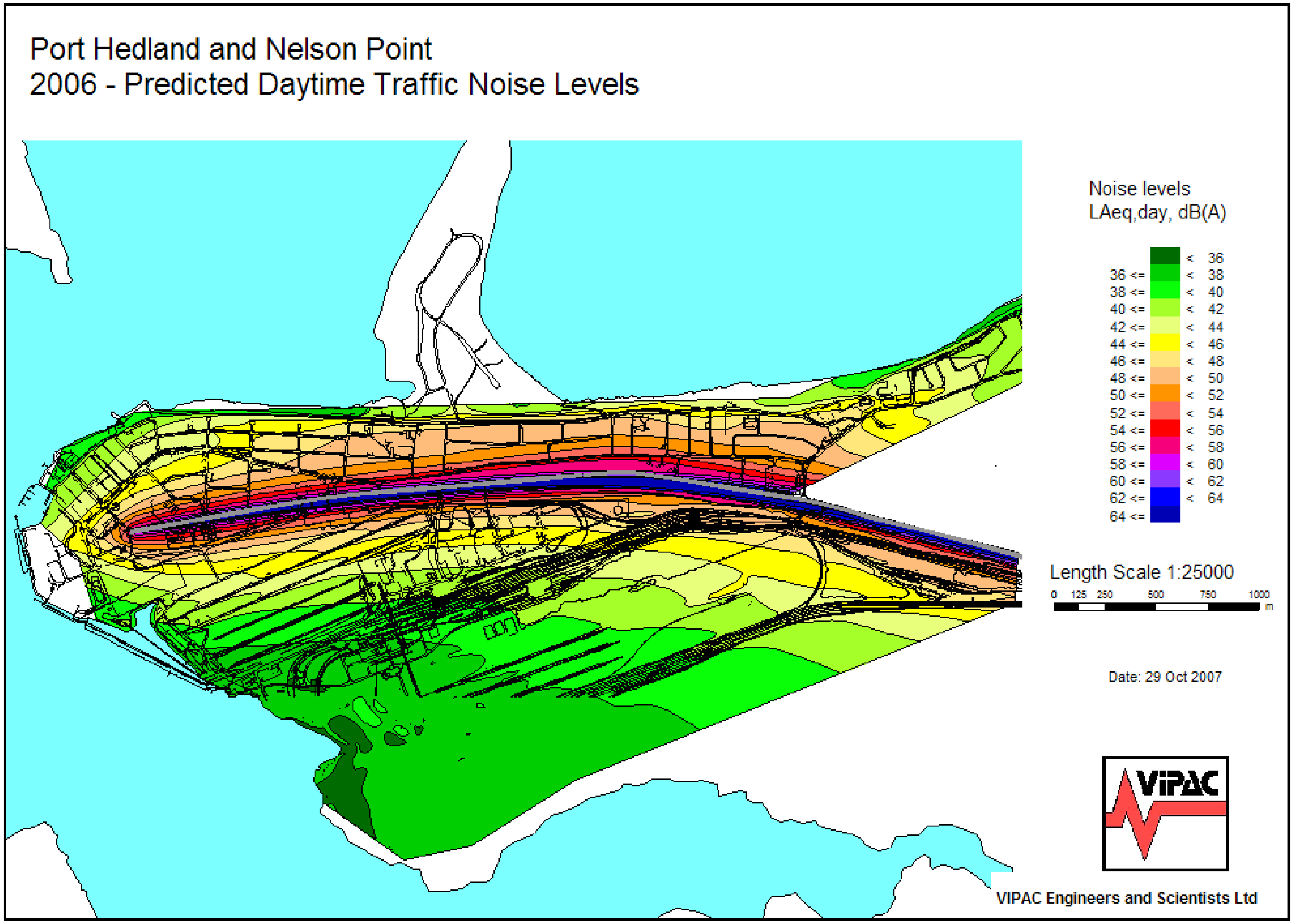
Human Perception of Loudness

The following table is extracted from Bies, DA and Hansen, CH, *Engineering Noise Control, 3rd Ed.* It presents the apparent, perceived change in loudness due to changes in sound pressure level.

Subjective Effect of Changes in Sound Pressure Level

Change in sound level (dB)	Change in sound power		Change in Apparent Loudness
	Decrease	Increase	
3	1/2	2	Just perceptible
5	1/3	3	Clearly noticeable
10	1/10	10	Half or twice as loud
20	1/100	100	Much quieter or louder

APPENDIX D - NOISE CONTOUR MAPS - TRAFFIC NOISE – PORT HEDLAND


Port Hedland and Nelson Point
2006 - Predicted Daytime Traffic Noise Levels
Noise levels
LAeq,day, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
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0 125 250 500 750 1000
m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure D 1

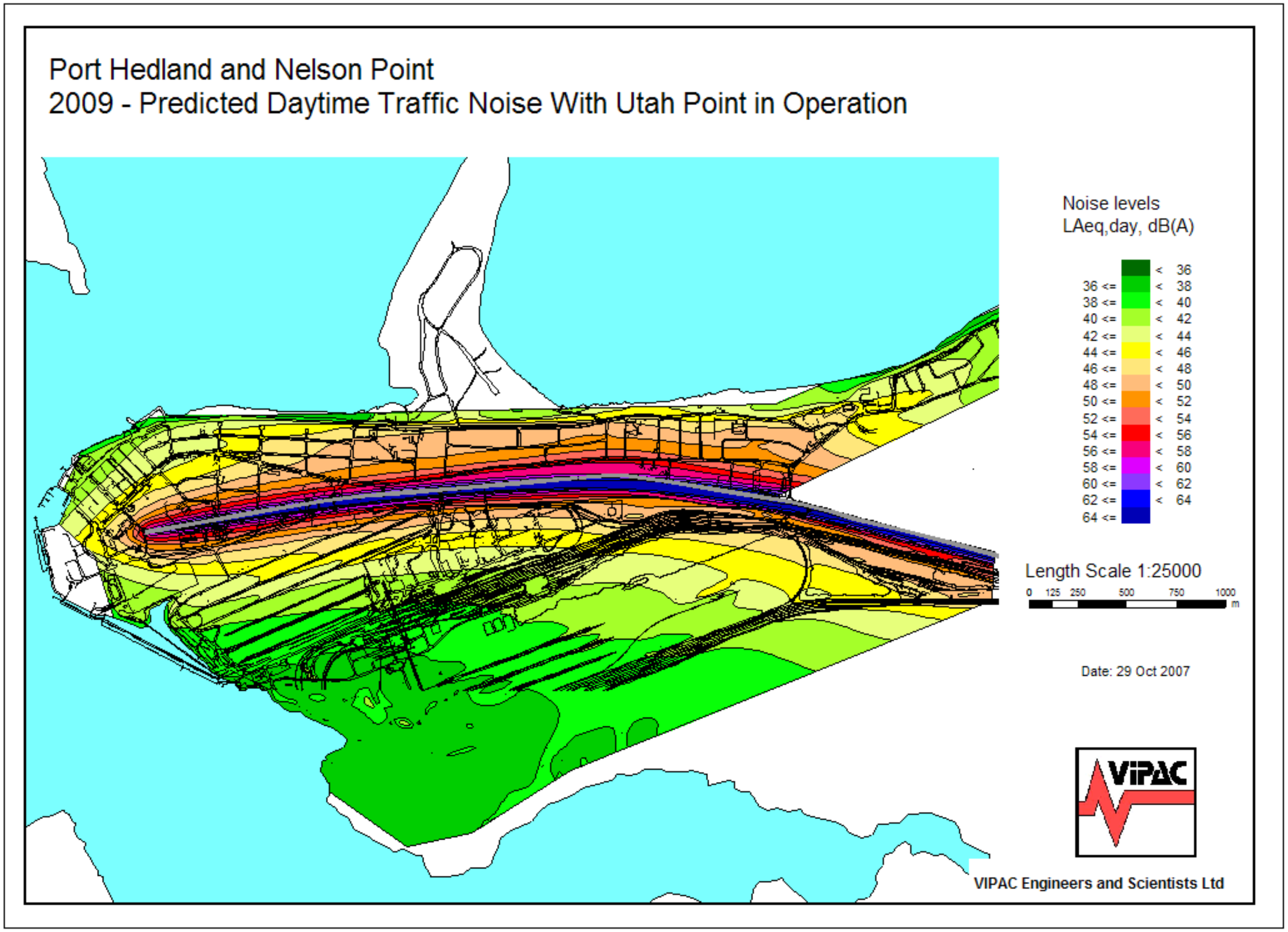
Port Hedland and Nelson Point
2009 - Predicted Daytime Traffic Noise With Utah Point in Operation
Noise levels
LAeq,day, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:25000
0 125 250 500 750 1000 m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure D 2

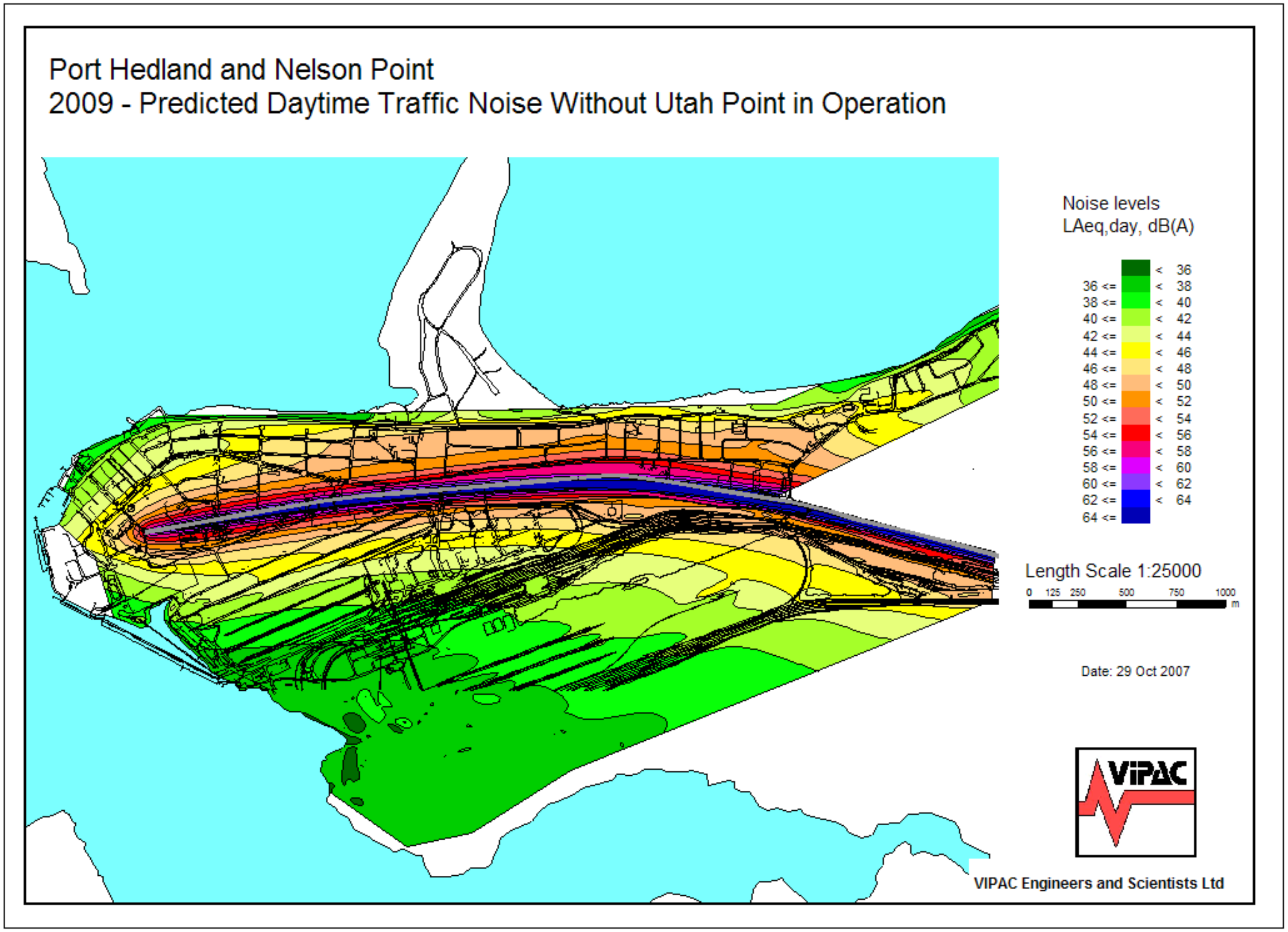
Port Hedland and Nelson Point
2009 - Predicted Daytime Traffic Noise Without Utah Point in Operation
Noise levels
LAeq,day, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:25000
0 125 250 500 750 1000
m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure D 3

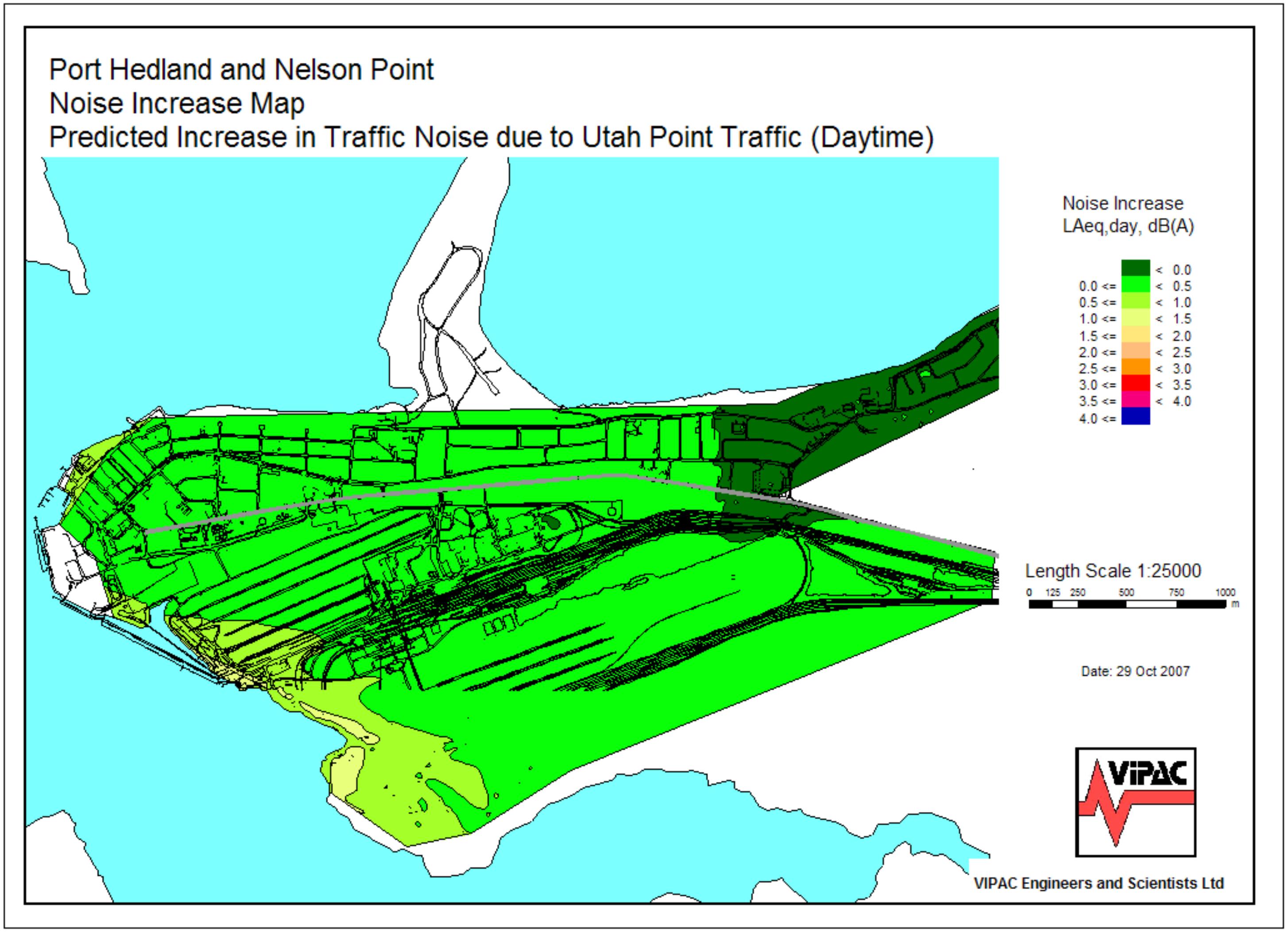
Port Hedland and Nelson Point
Noise Increase Map
Predicted Increase in Traffic Noise due to Utah Point Traffic (Daytime)
Noise Increase
LAeq,day, dB(A)
< 0.0
0.0 <= < 0.5
0.5 <= < 1.0
1.0 <= < 1.5
1.5 <= < 2.0
2.0 <= < 2.5
2.5 <= < 3.0
3.0 <= < 3.5
3.5 <= < 4.0
4.0 <=
Length Scale 1:25000
0 125 250 500 750 1000 m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure D 4

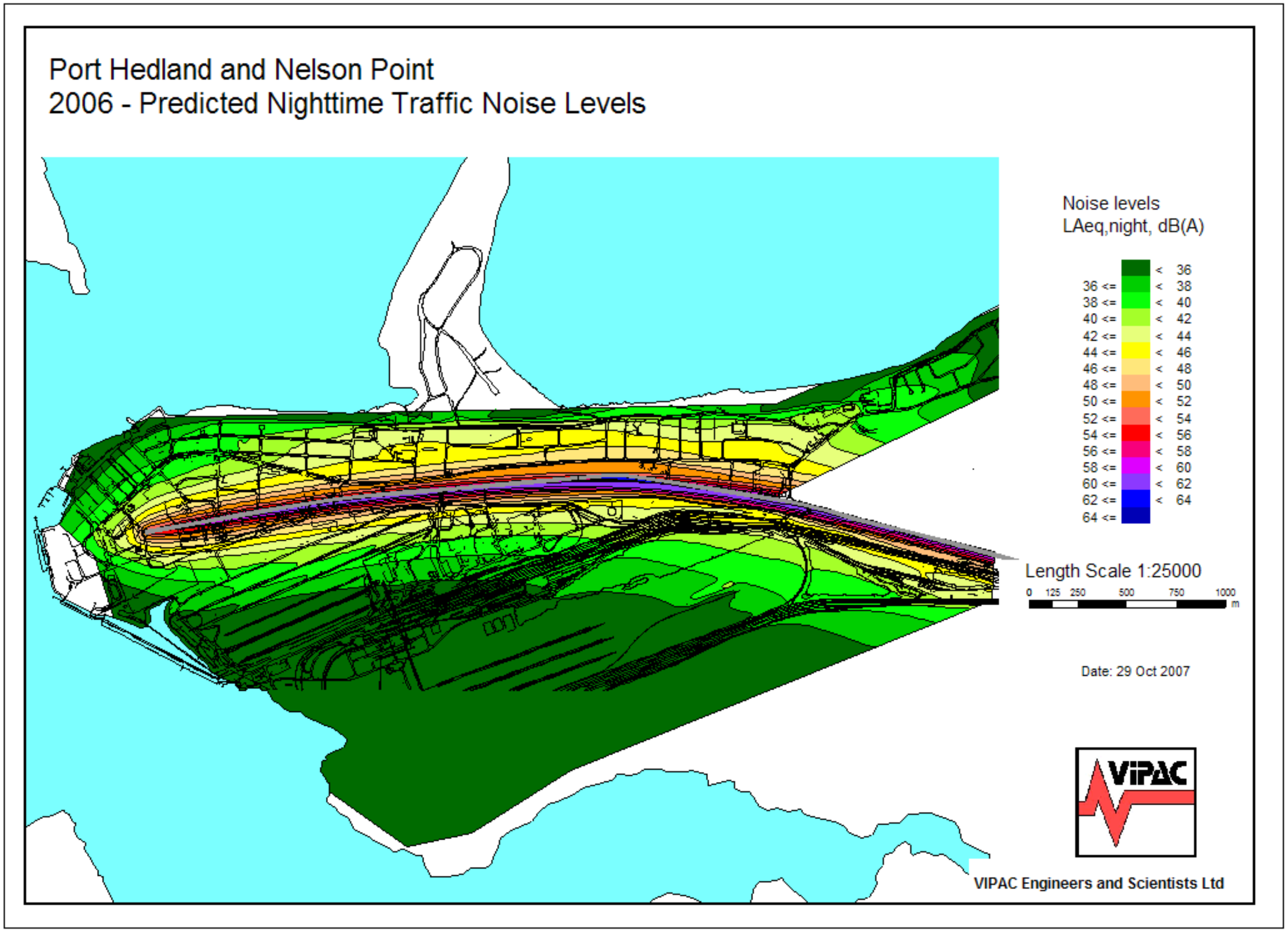
Port Hedland and Nelson Point
2006 - Predicted Nighttime Traffic Noise Levels
Noise levels
LAeq,night, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:25000
0 125 250 500 750 1000 m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure D 5

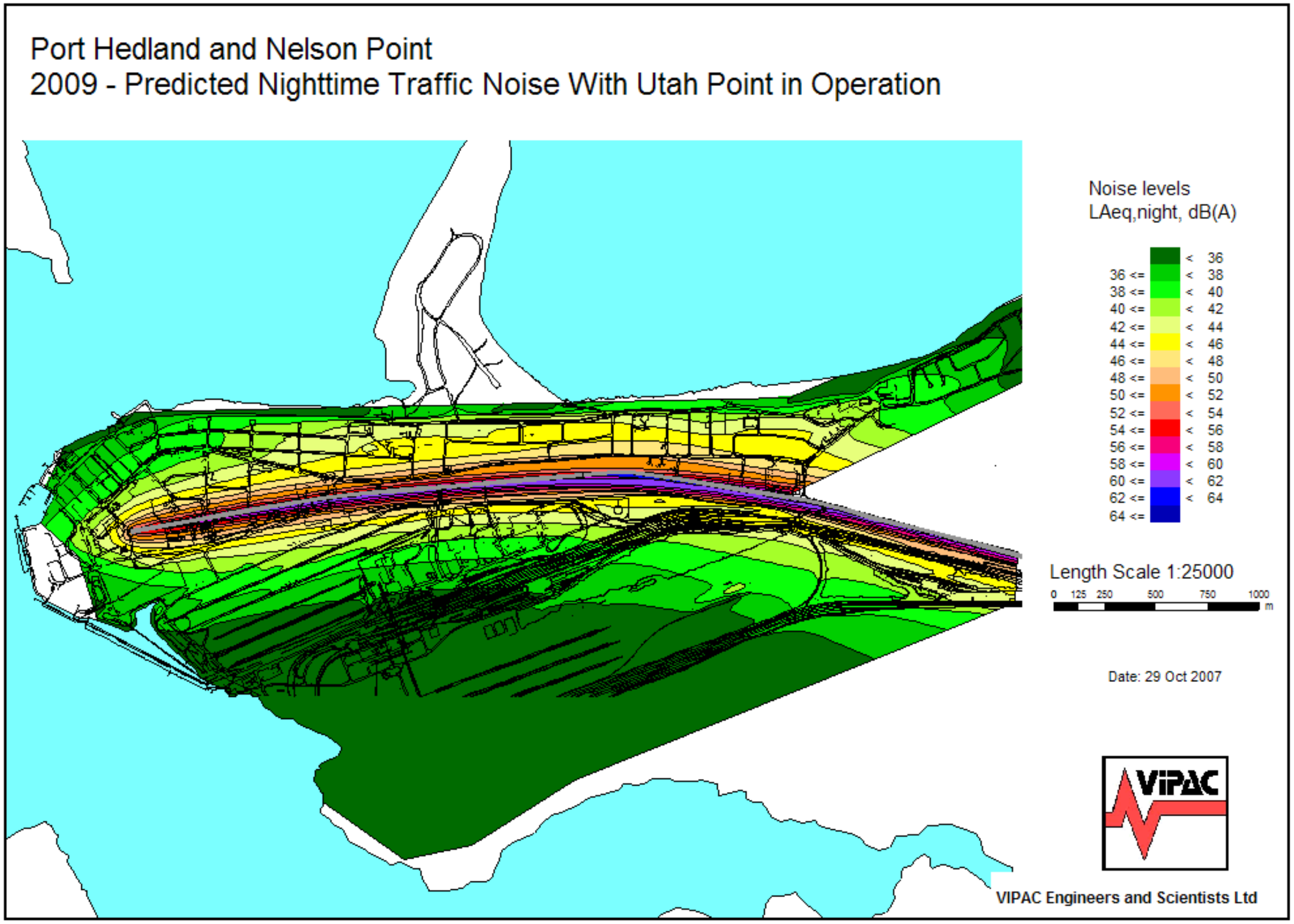
Port Hedland and Nelson Point
2009 - Predicted Nighttime Traffic Noise With Utah Point in Operation
Noise levels
LAeq,night, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:25000
0 125 250 500 750 1000
m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure D 6

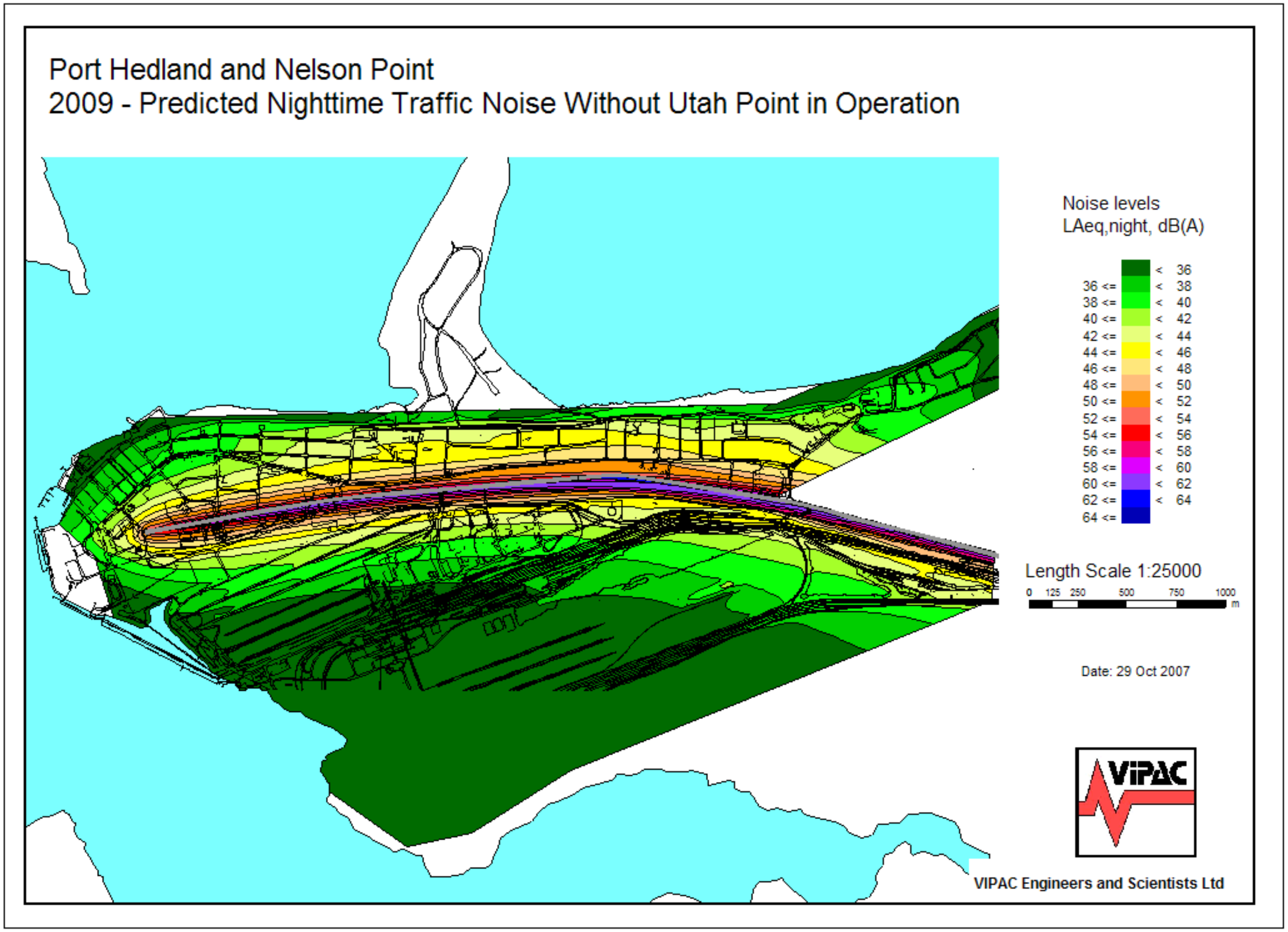
Port Hedland and Nelson Point
2009 - Predicted Nighttime Traffic Noise Without Utah Point in Operation
Noise levels
LAeq,night, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:25000
0 125 250 500 750 1000
m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure D 7

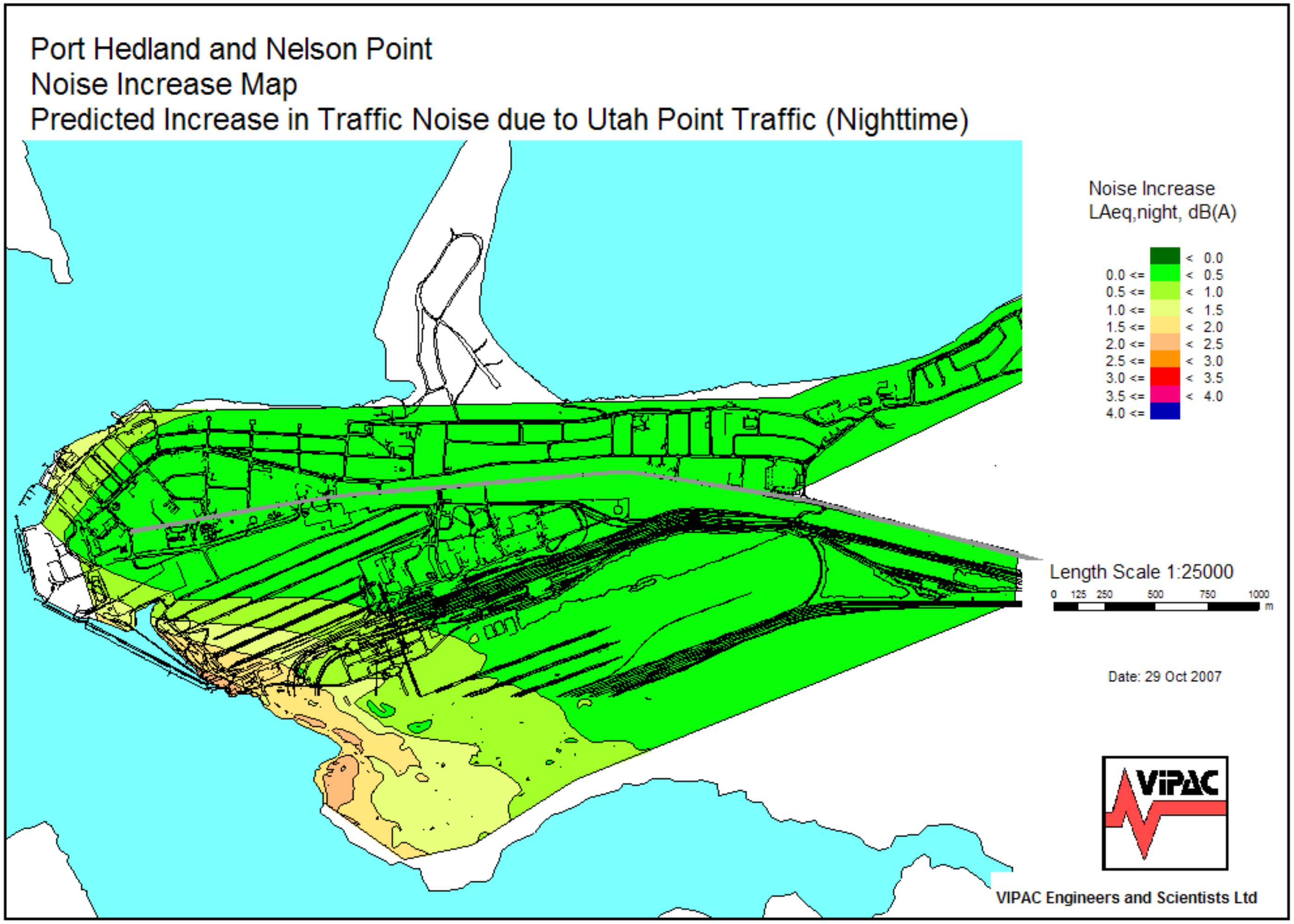
Port Hedland and Nelson Point
Noise Increase Map
Predicted Increase in Traffic Noise due to Utah Point Traffic (Nighttime)
Noise Increase
LAeq,night, dB(A)
< 0.0
0.0 <= < 0.5
0.5 <= < 1.0
1.0 <= < 1.5
1.5 <= < 2.0
2.0 <= < 2.5
2.5 <= < 3.0
3.0 <= < 3.5
3.5 <= < 4.0
4.0 <=
Length Scale 1:25000
0 125 250 500 750 1000 m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure D 8

APPENDIX E - NOISE CONTOUR MAPS - TRAFFIC NOISE SOUTH HEDLAND

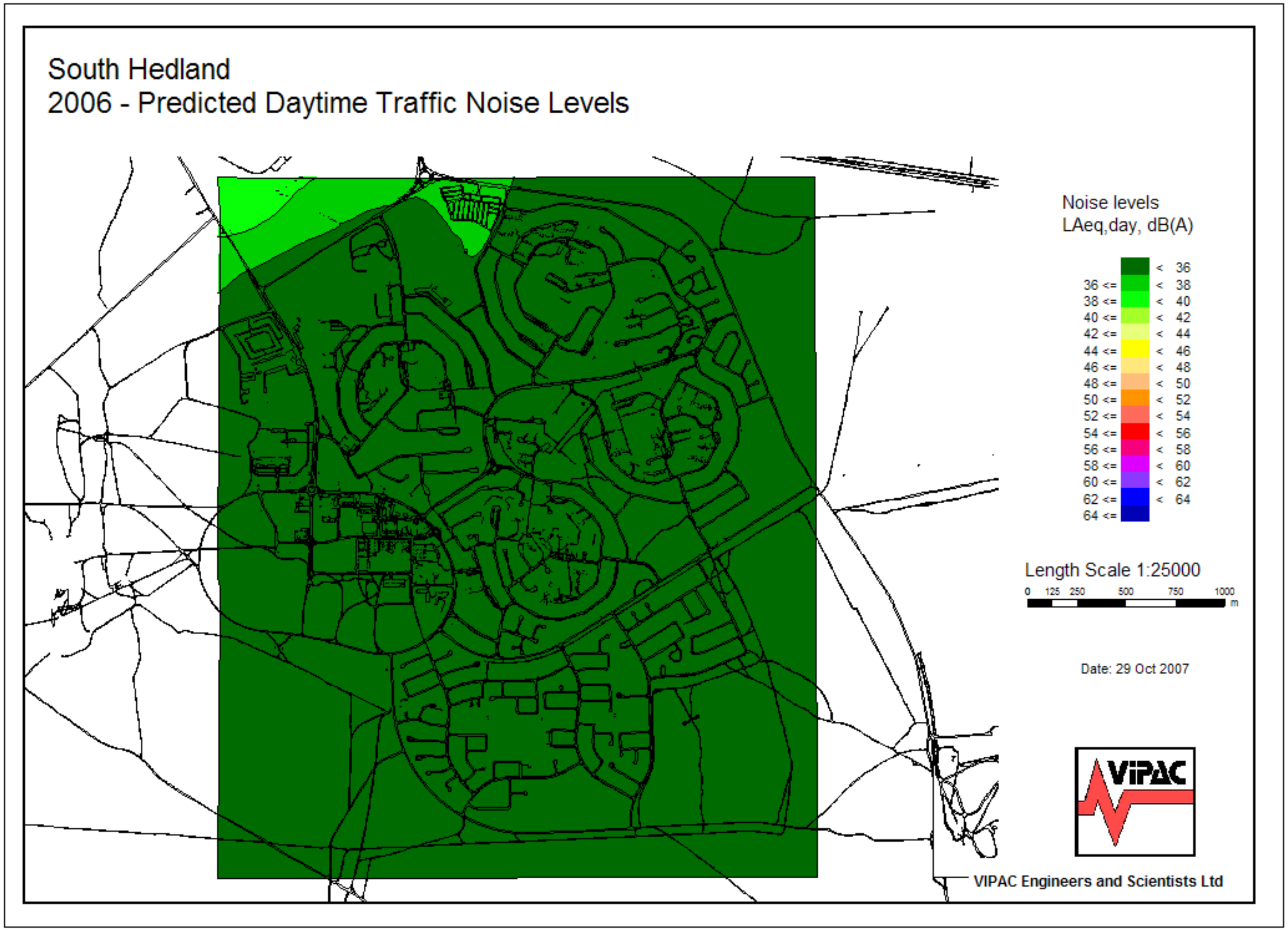
South Hedland
2006 - Predicted Daytime Traffic Noise Levels
Noise levels
LAeq,day, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:25000
0 125 250 500 750 1000
m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure E 1

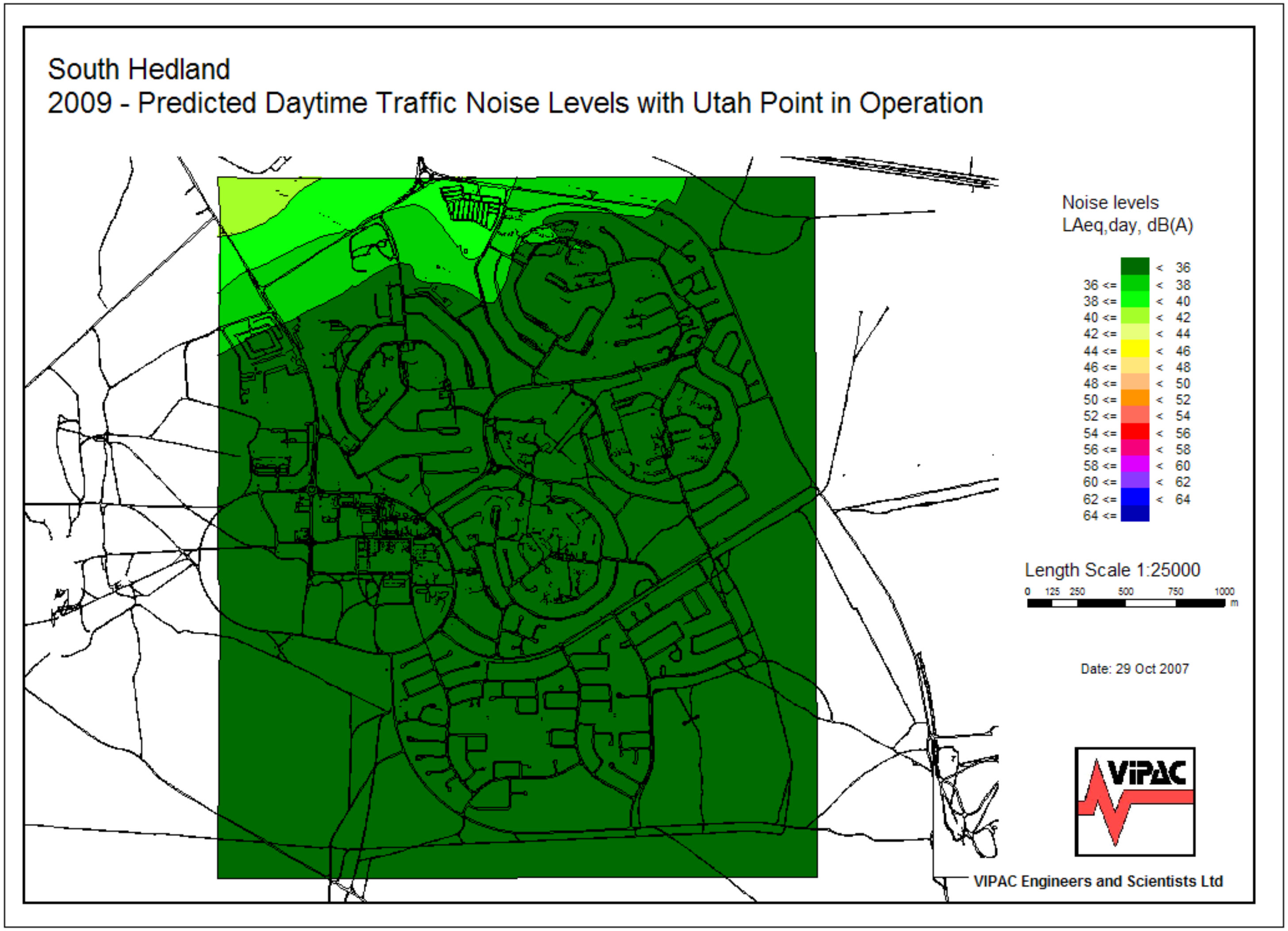
South Hedland
2009 - Predicted Daytime Traffic Noise Levels with Utah Point in Operation
Noise levels
LAeq,day, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:25000
0 125 250 500 750 1000 m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure E 2

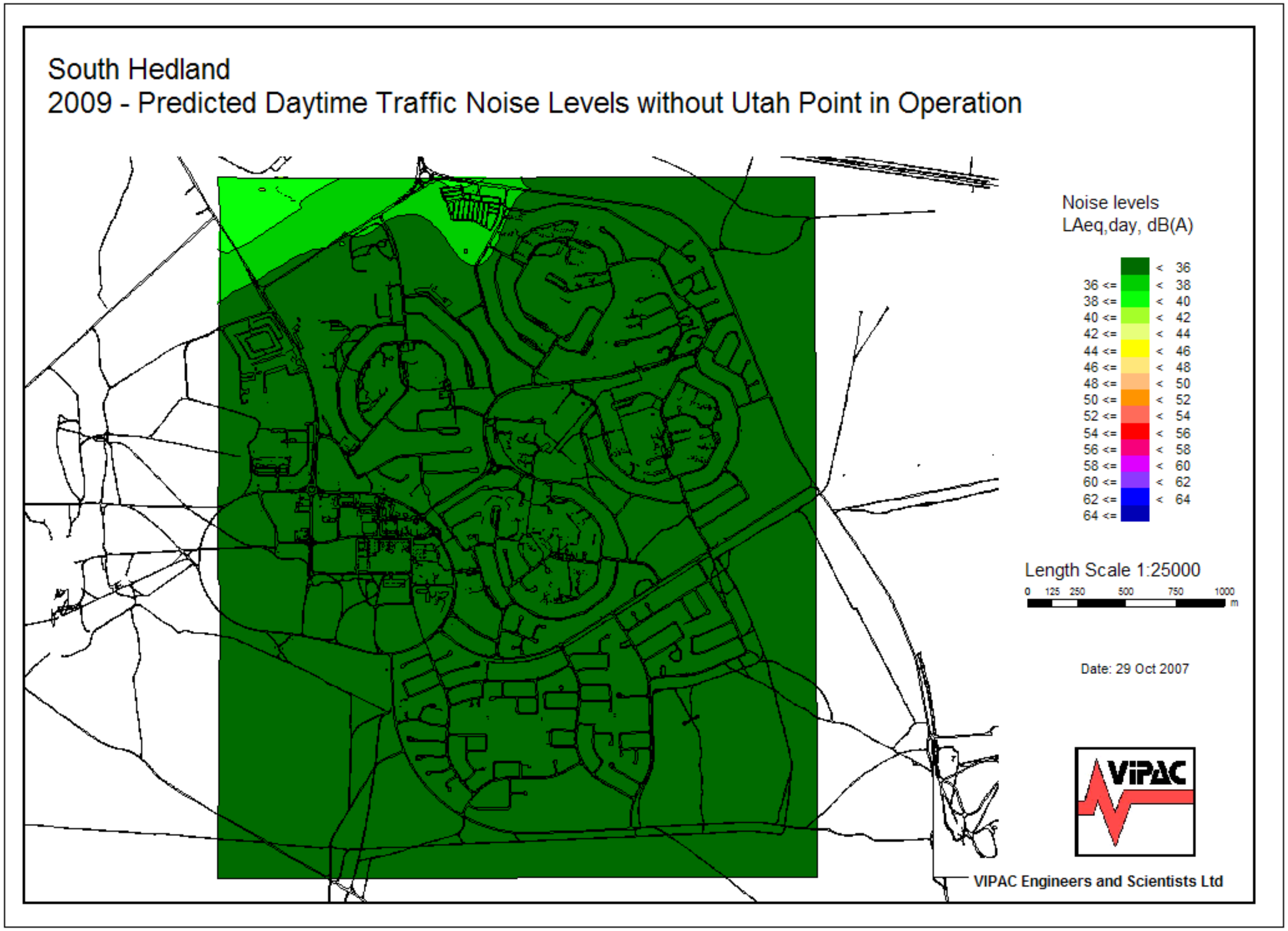
South Hedland
2009 - Predicted Daytime Traffic Noise Levels without Utah Point in Operation
Noise levels
LAeq,day, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:25000
0 125 250 500 750 1000
m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure E 3

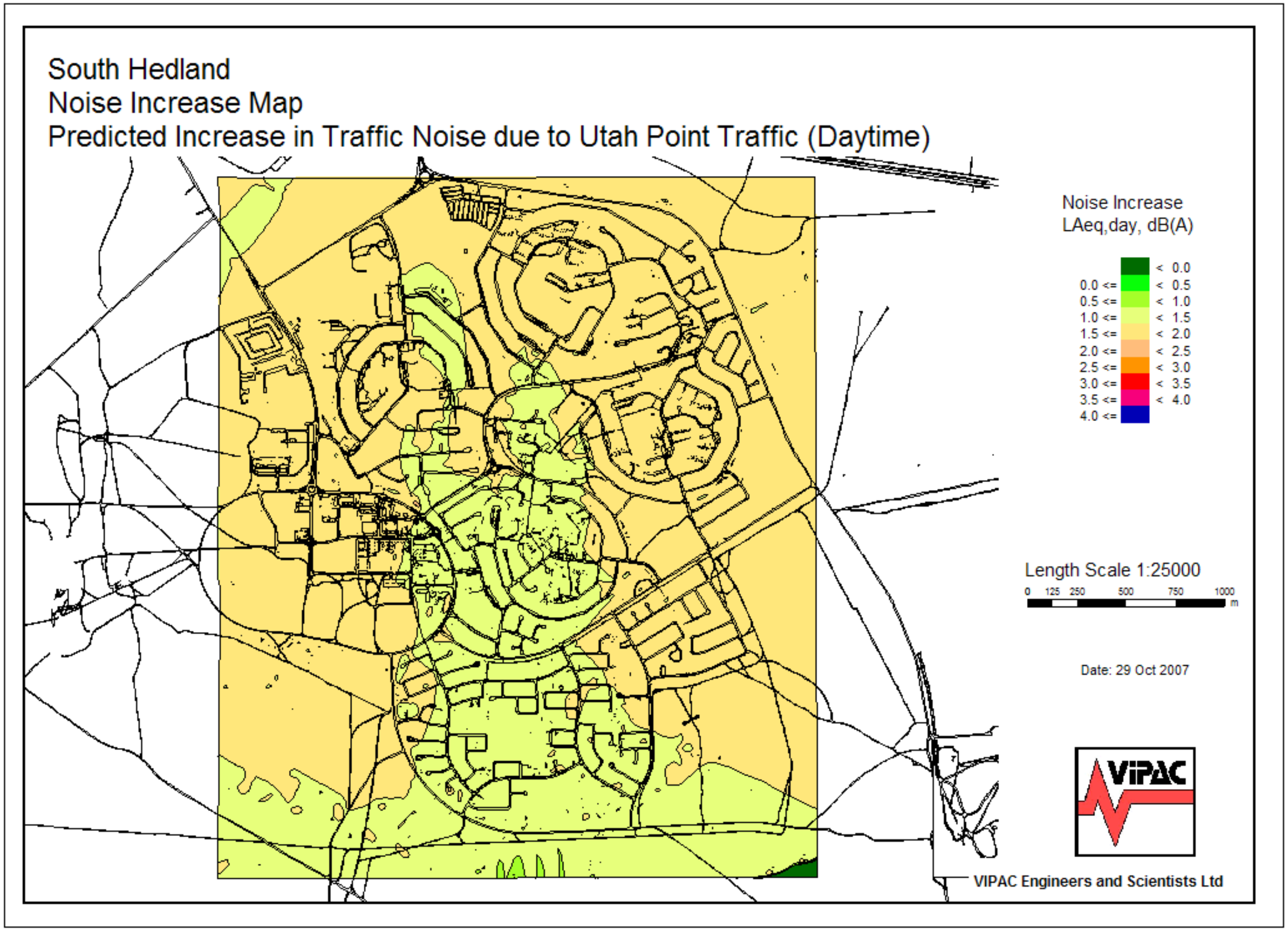
South Hedland
Noise Increase Map
Predicted Increase in Traffic Noise due to Utah Point Traffic (Daytime)
Noise Increase
LAeq,day, dB(A)
< 0.0
0.0 <= < 0.5
0.5 <= < 1.0
1.0 <= < 1.5
1.5 <= < 2.0
2.0 <= < 2.5
2.5 <= < 3.0
3.0 <= < 3.5
3.5 <= < 4.0
4.0 <=
Length Scale 1:25000
0 125 250 500 750 1000
m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure E 4

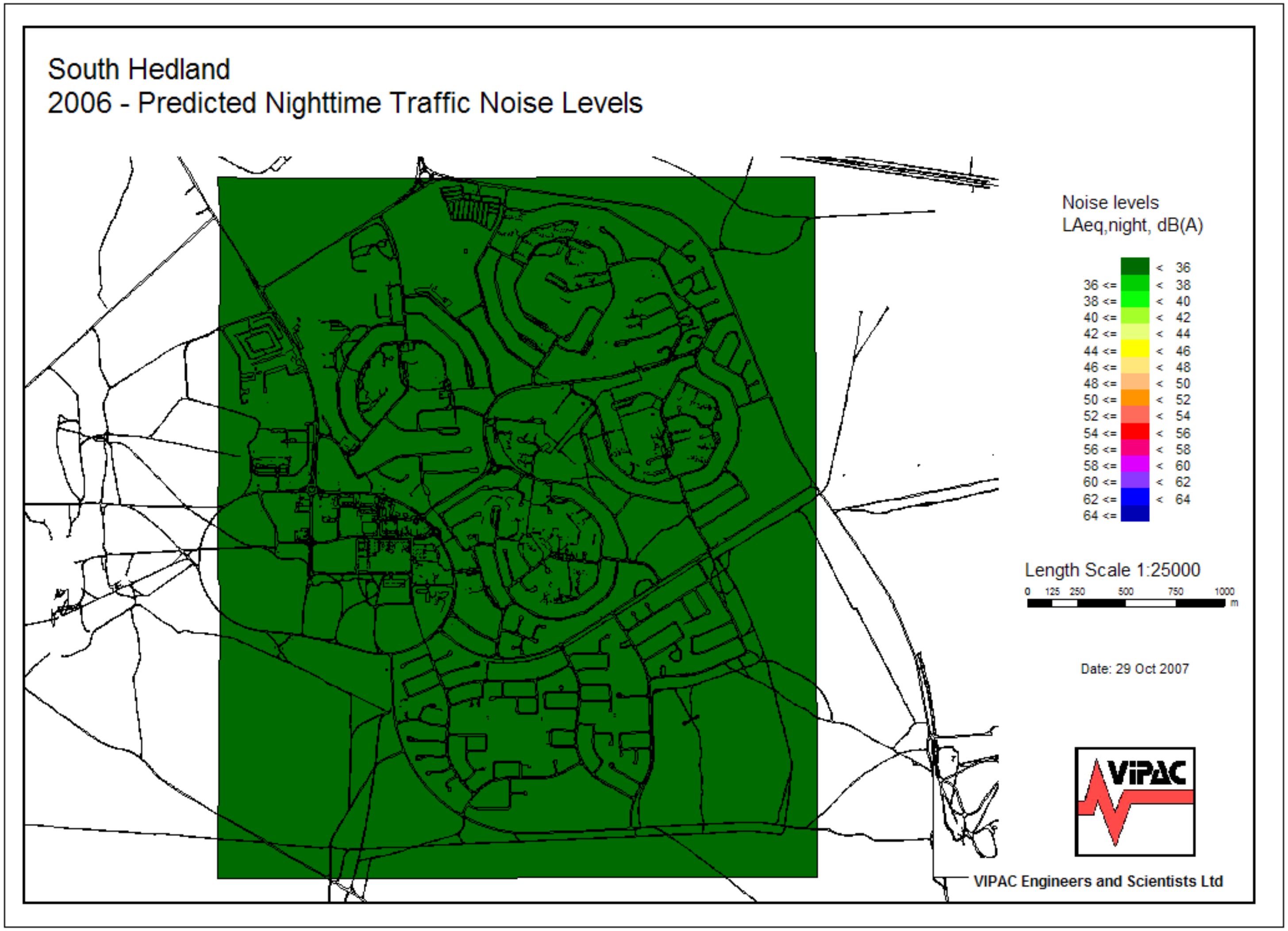
South Hedland
2006 - Predicted Nighttime Traffic Noise Levels
Noise levels
LAeq,night, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:25000
0 125 250 500 750 1000
m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure E 5

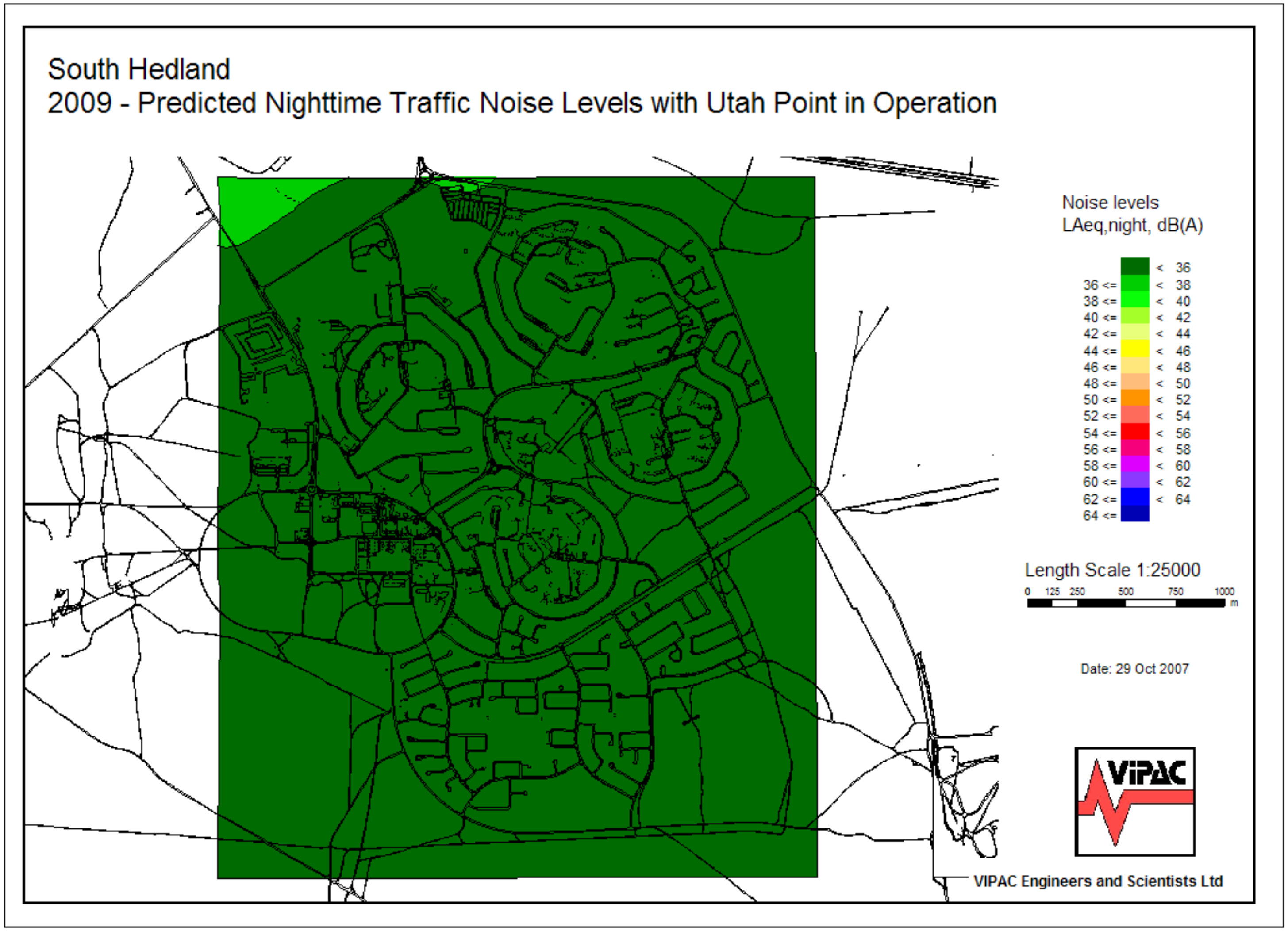
South Hedland
2009 - Predicted Nighttime Traffic Noise Levels with Utah Point in Operation
Noise levels
LAeq,night, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:25000
0 125 250 500 750 1000 m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure E 6

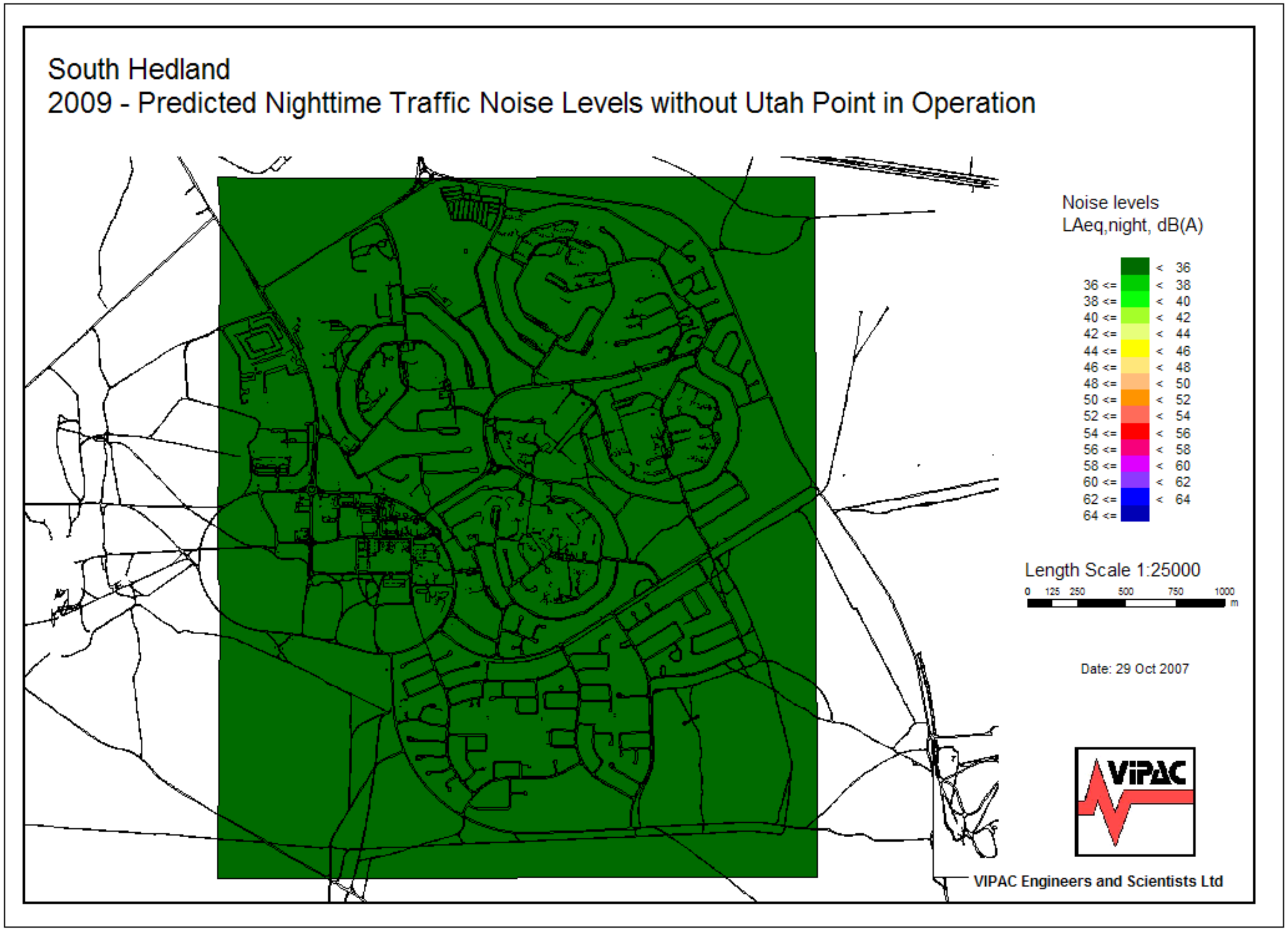
South Hedland
2009 - Predicted Nighttime Traffic Noise Levels without Utah Point in Operation
Noise levels
LAeq,night, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:25000
0 125 250 500 750 1000 m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure E 7

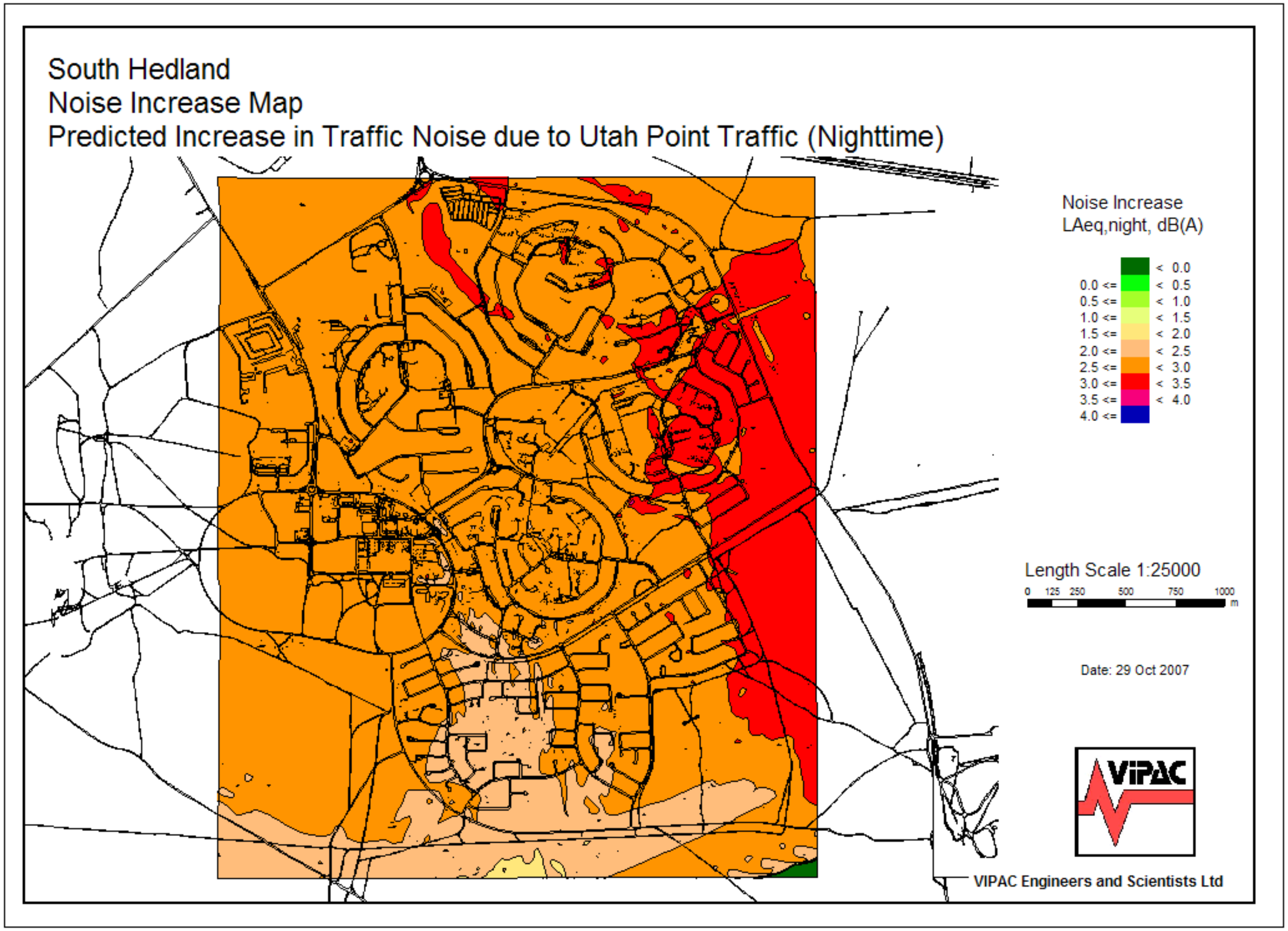
South Hedland
Noise Increase Map
Predicted Increase in Traffic Noise due to Utah Point Traffic (Nighttime)
Noise Increase
LAeq,night, dB(A)
< 0.0
0.0 <= < 0.5
0.5 <= < 1.0
1.0 <= < 1.5
1.5 <= < 2.0
2.0 <= < 2.5
2.5 <= < 3.0
3.0 <= < 3.5
3.5 <= < 4.0
4.0 <=
Length Scale 1:25000
0 125 250 500 750 1000
m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure E 8

APPENDIX F - NOISE CONTOUR MAPS - TRAFFIC NOISE - WEDGEFIELD

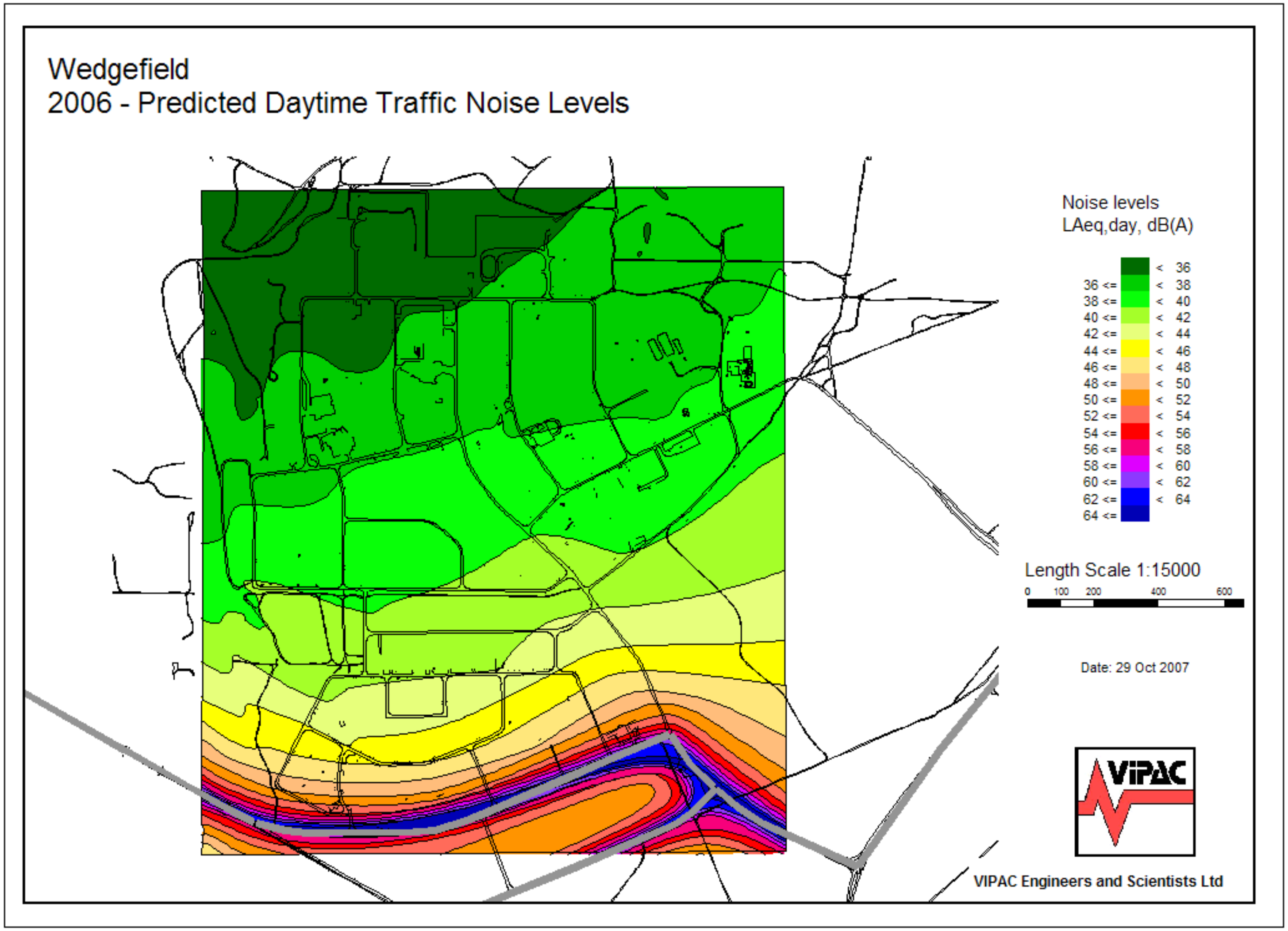
Wedgefield
2006 - Predicted Daytime Traffic Noise Levels
Noise levels
LAeq,day, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:15000
0 100 200 400 600
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure F 1

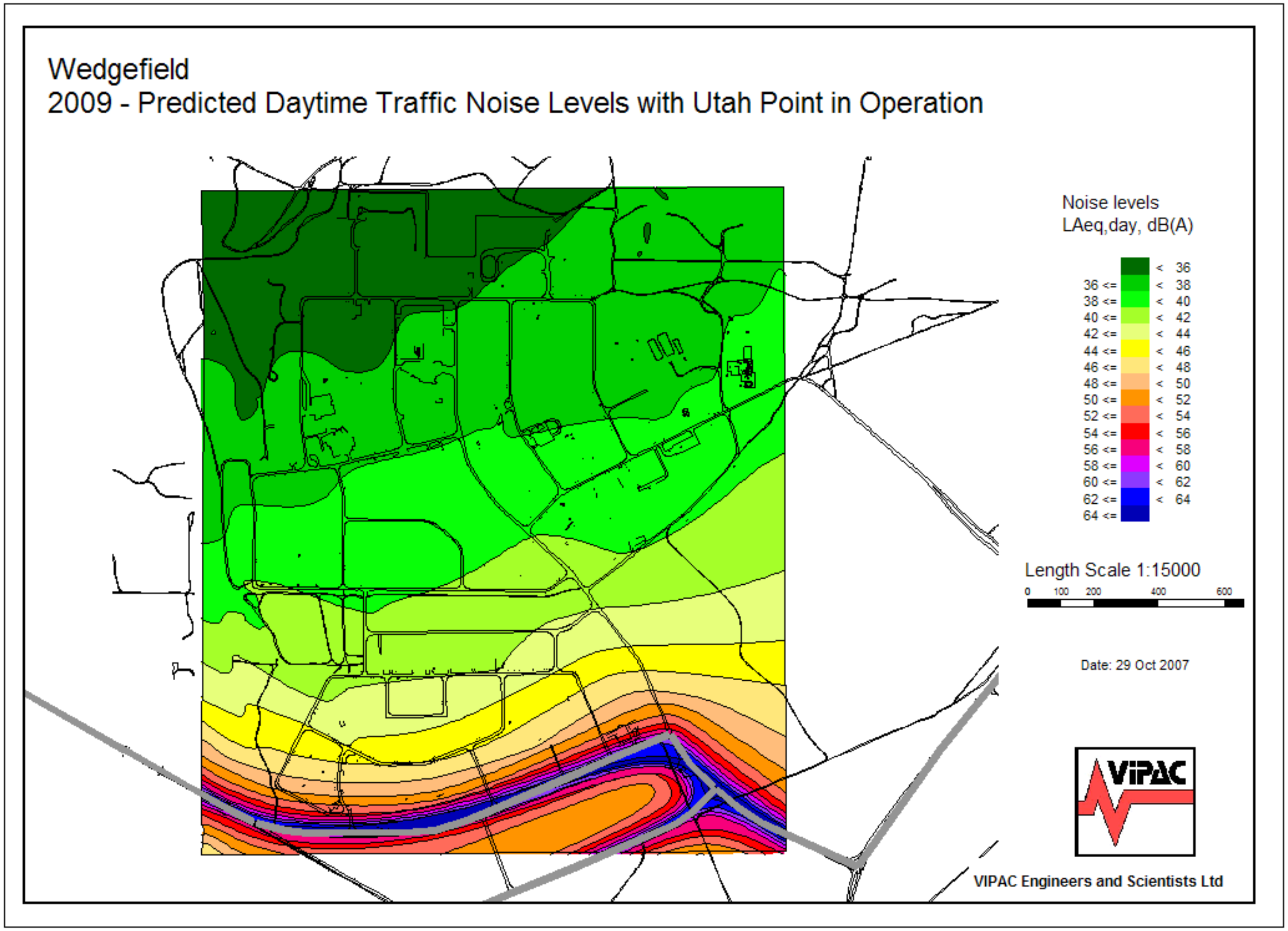
Wedgefield
2009 - Predicted Daytime Traffic Noise Levels with Utah Point in Operation
Noise levels
LAeq,day, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:15000
0 100 200 400 600
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure F 2

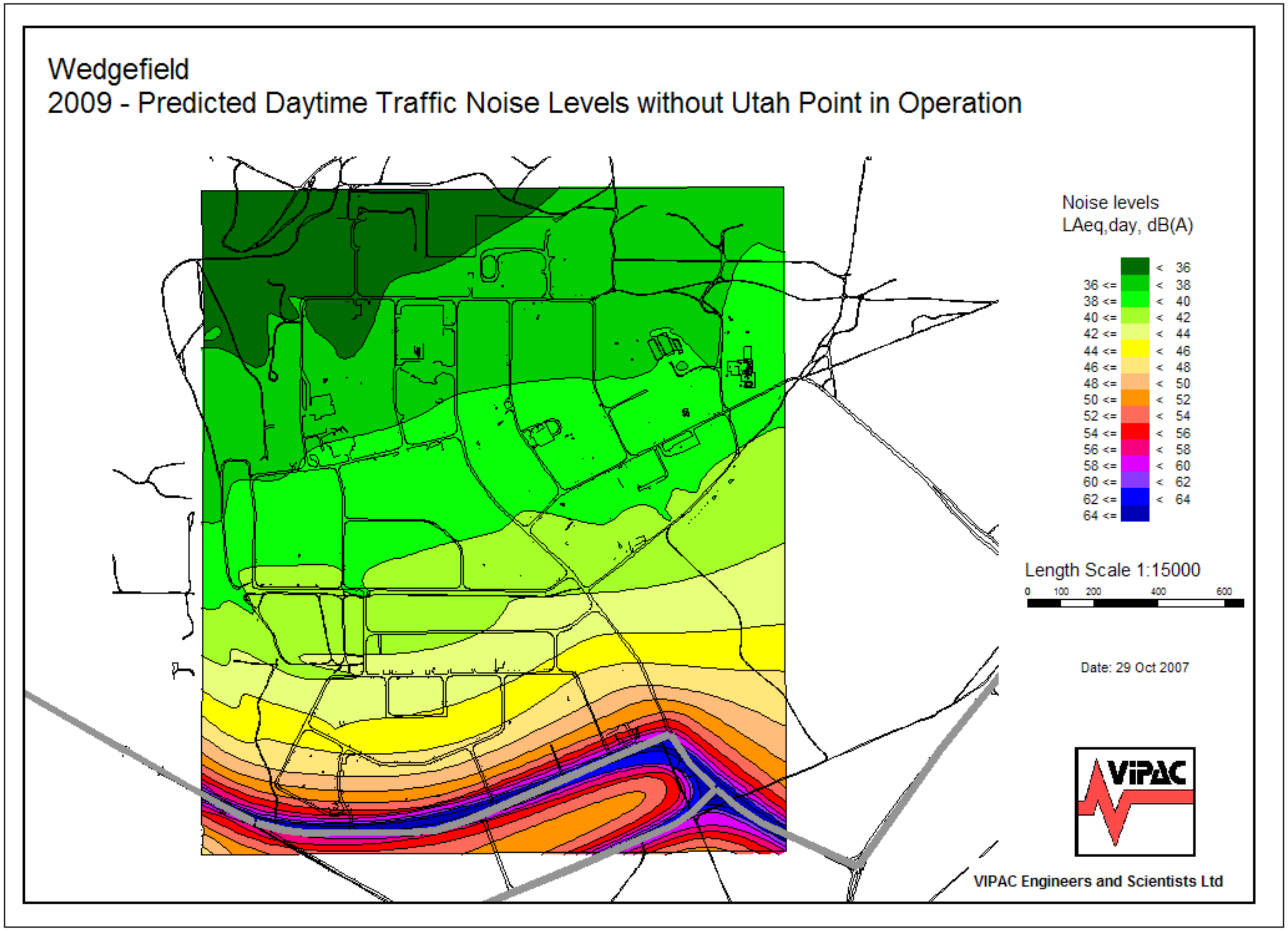
Wedgefield
2009 - Predicted Daytime Traffic Noise Levels without Utah Point in Operation
Noise levels
LAeq,day, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:15000
0 100 200 400 600
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure F 3

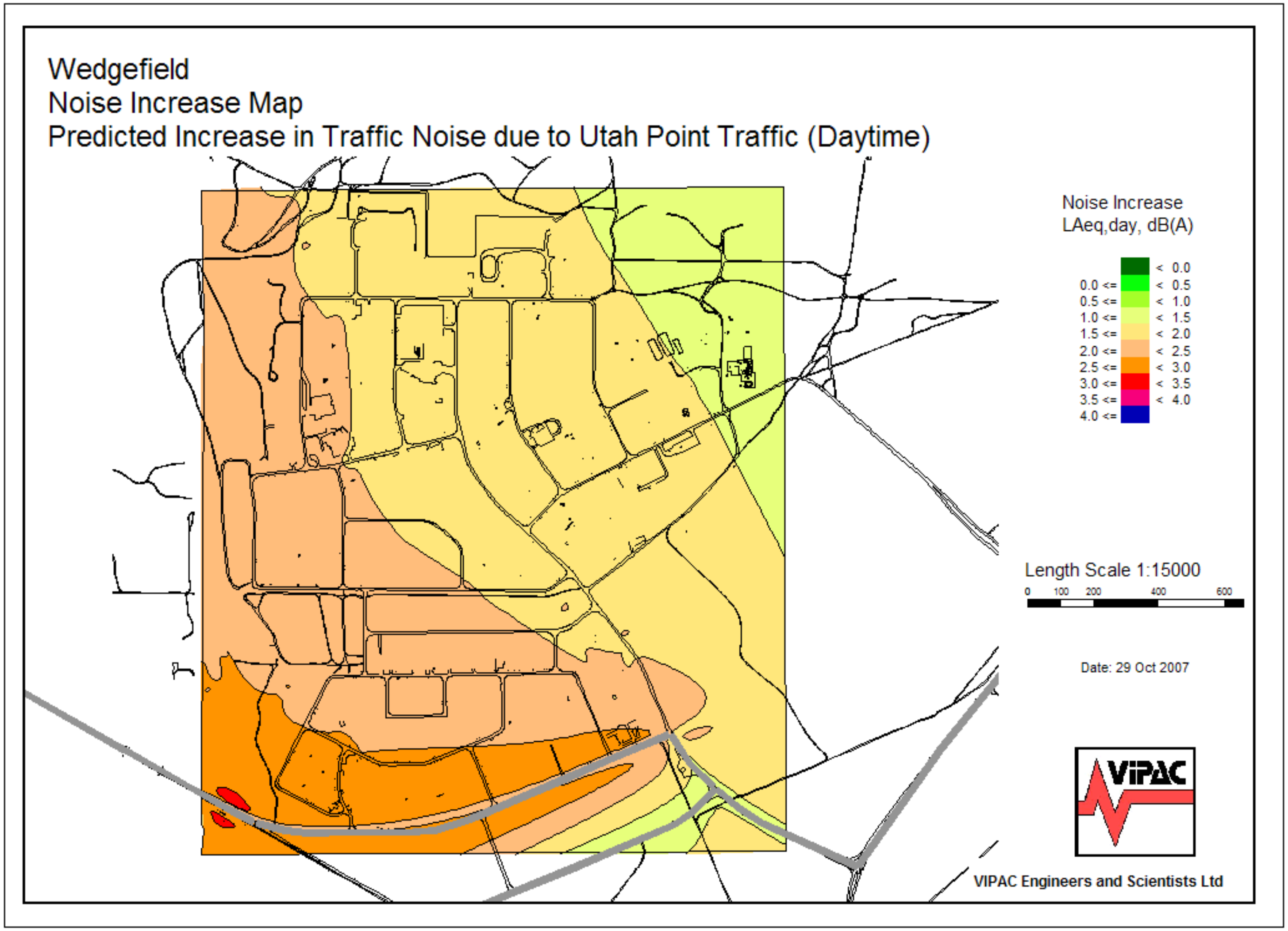
Wedgefield
Noise Increase Map
Predicted Increase in Traffic Noise due to Utah Point Traffic (Daytime)
Noise Increase
LAeq,day, dB(A)
< 0.0
0.0 <= < 0.5
0.5 <= < 1.0
1.0 <= < 1.5
1.5 <= < 2.0
2.0 <= < 2.5
2.5 <= < 3.0
3.0 <= < 3.5
3.5 <= < 4.0
4.0 <=
Length Scale 1:15000
0 100 200 400 600
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure F 4

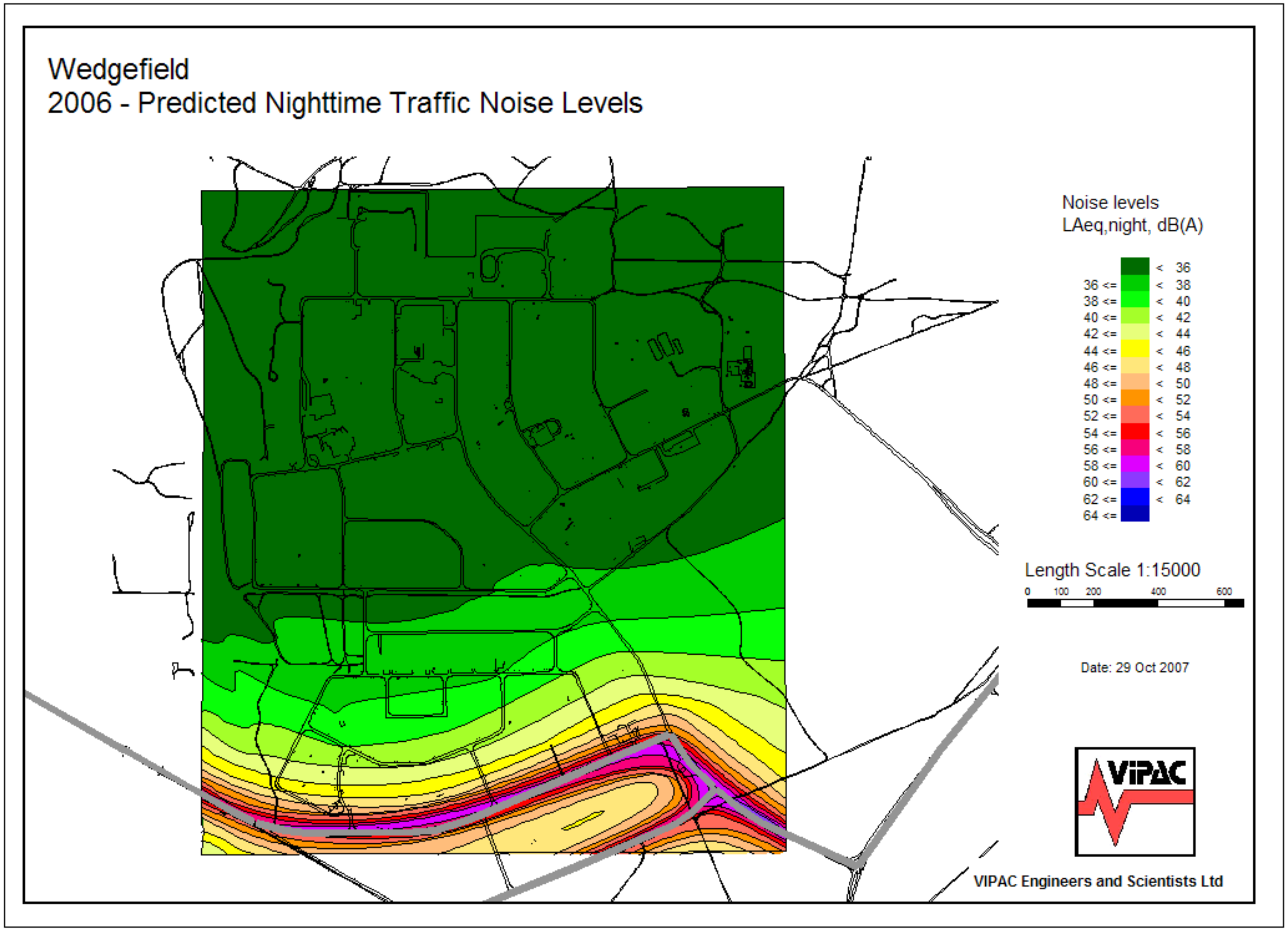
Wedgefield
2006 - Predicted Nighttime Traffic Noise Levels
Noise levels
LAeq,night, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:15000
0 100 200 400 600
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure F 5

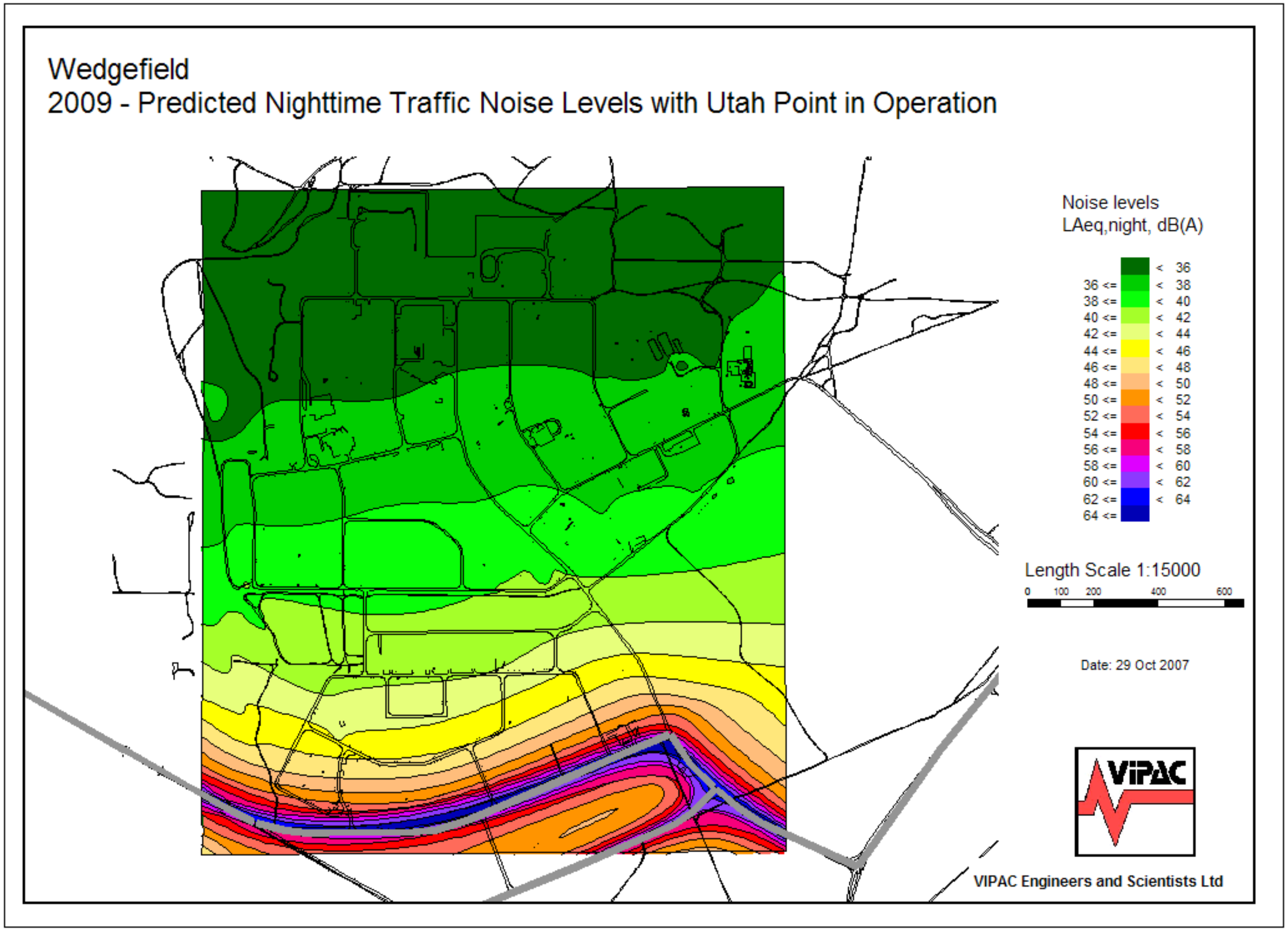
Wedgefield
2009 - Predicted Nighttime Traffic Noise Levels with Utah Point in Operation
Noise levels
LAeq,night, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:15000
0 100 200 400 600
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure F 6

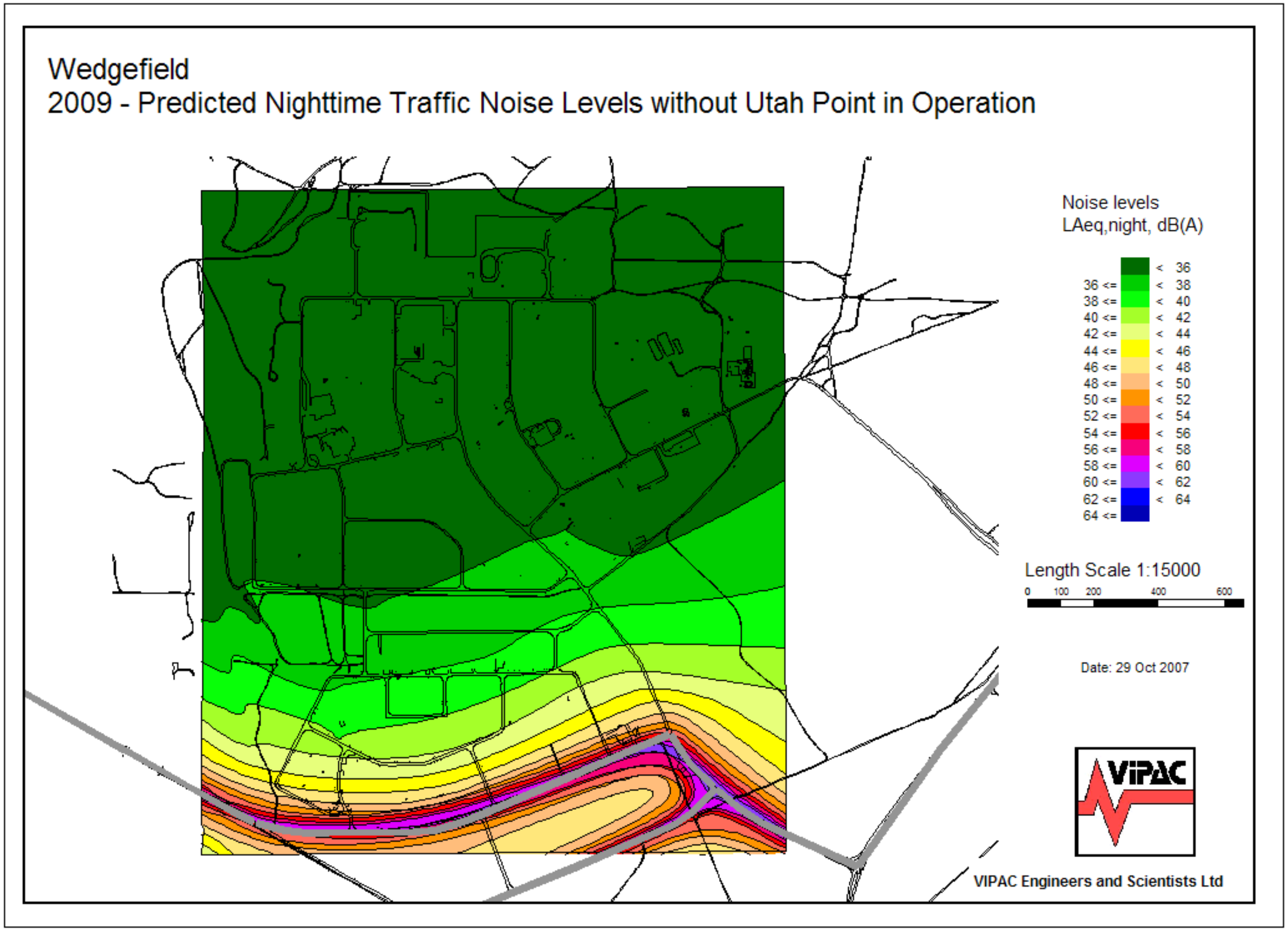
Wedgefield
2009 - Predicted Nighttime Traffic Noise Levels without Utah Point in Operation
Noise levels
LAeq,night, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:15000
0 100 200 400 600
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure F 7

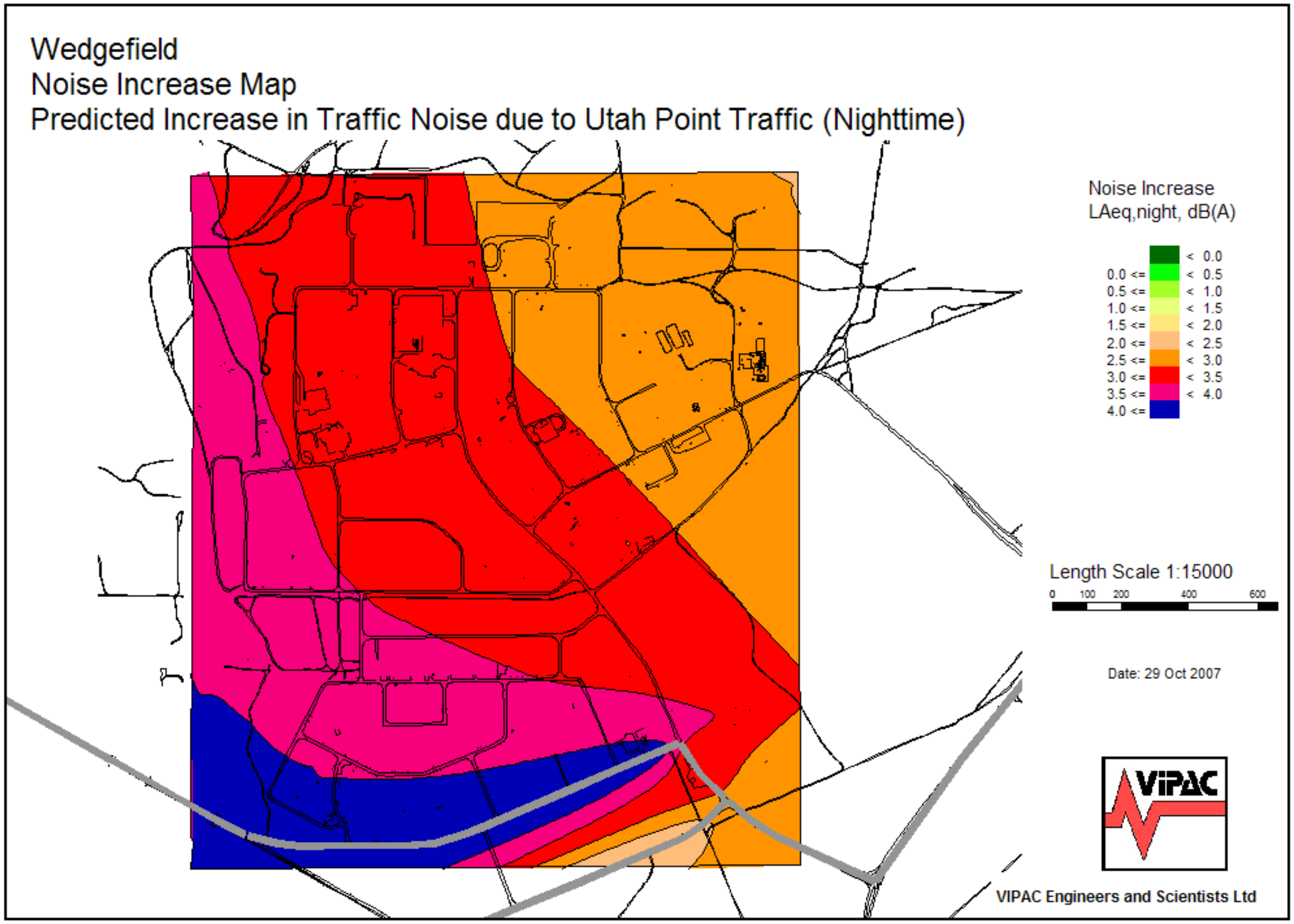
Wedgefield
Noise Increase Map
Predicted Increase in Traffic Noise due to Utah Point Traffic (Nighttime)
Noise Increase
LAeq,night, dB(A)
< 0.0
0.0 <= < 0.5
0.5 <= < 1.0
1.0 <= < 1.5
1.5 <= < 2.0
2.0 <= < 2.5
2.5 <= < 3.0
3.0 <= < 3.5
3.5 <= < 4.0
4.0 <=
Length Scale 1:15000
0 100 200 400 600
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure F 8

APPENDIX G - NOISE CONTOUR MAPS - OPERATIONAL NOISE

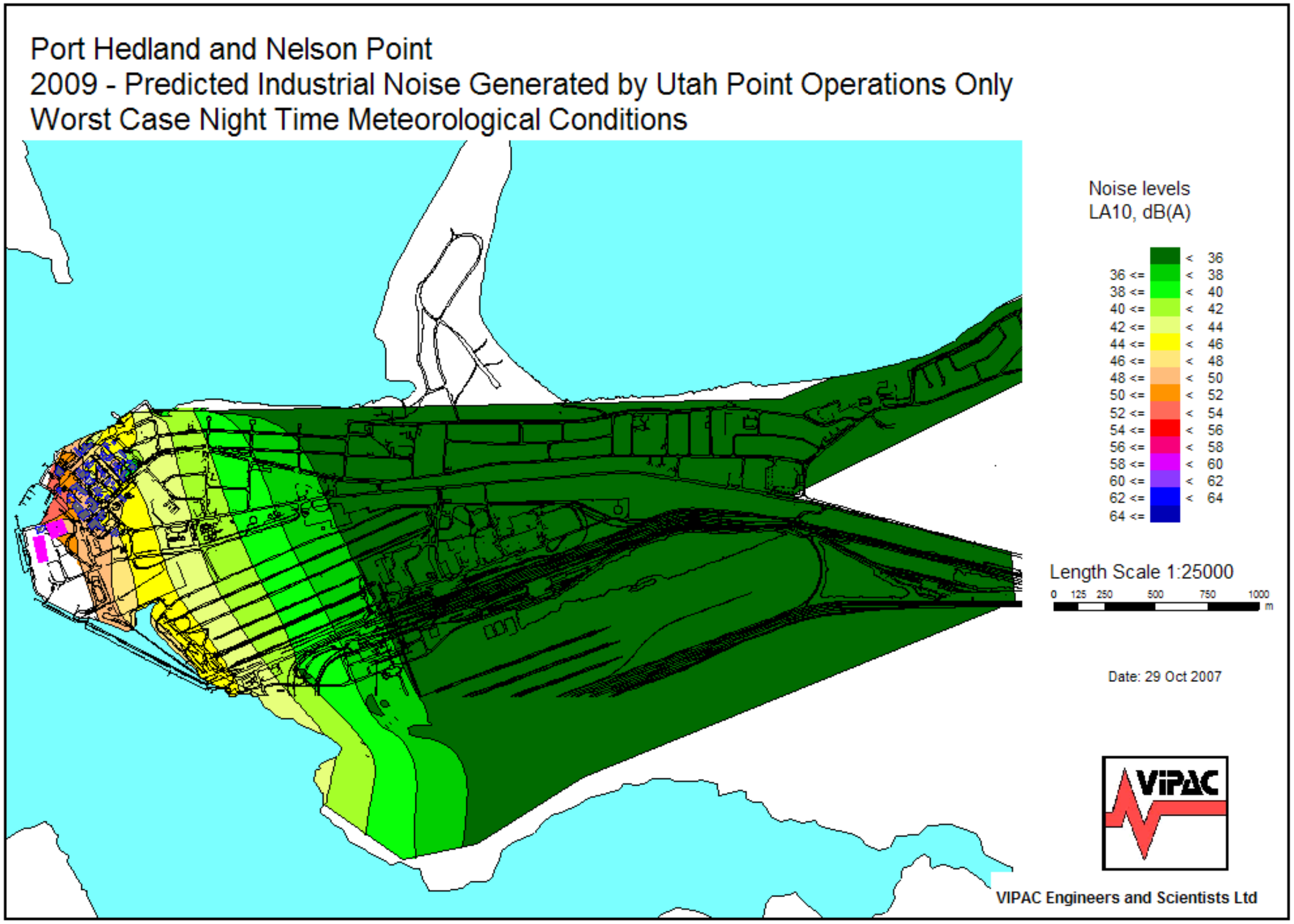
Port Hedland and Nelson Point
2009 - Predicted Industrial Noise Generated by Utah Point Operations Only
Worst Case Night Time Meteorological Conditions
Noise levels
LA10, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:25000
0 125 250 500 750 1000 m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure G 1

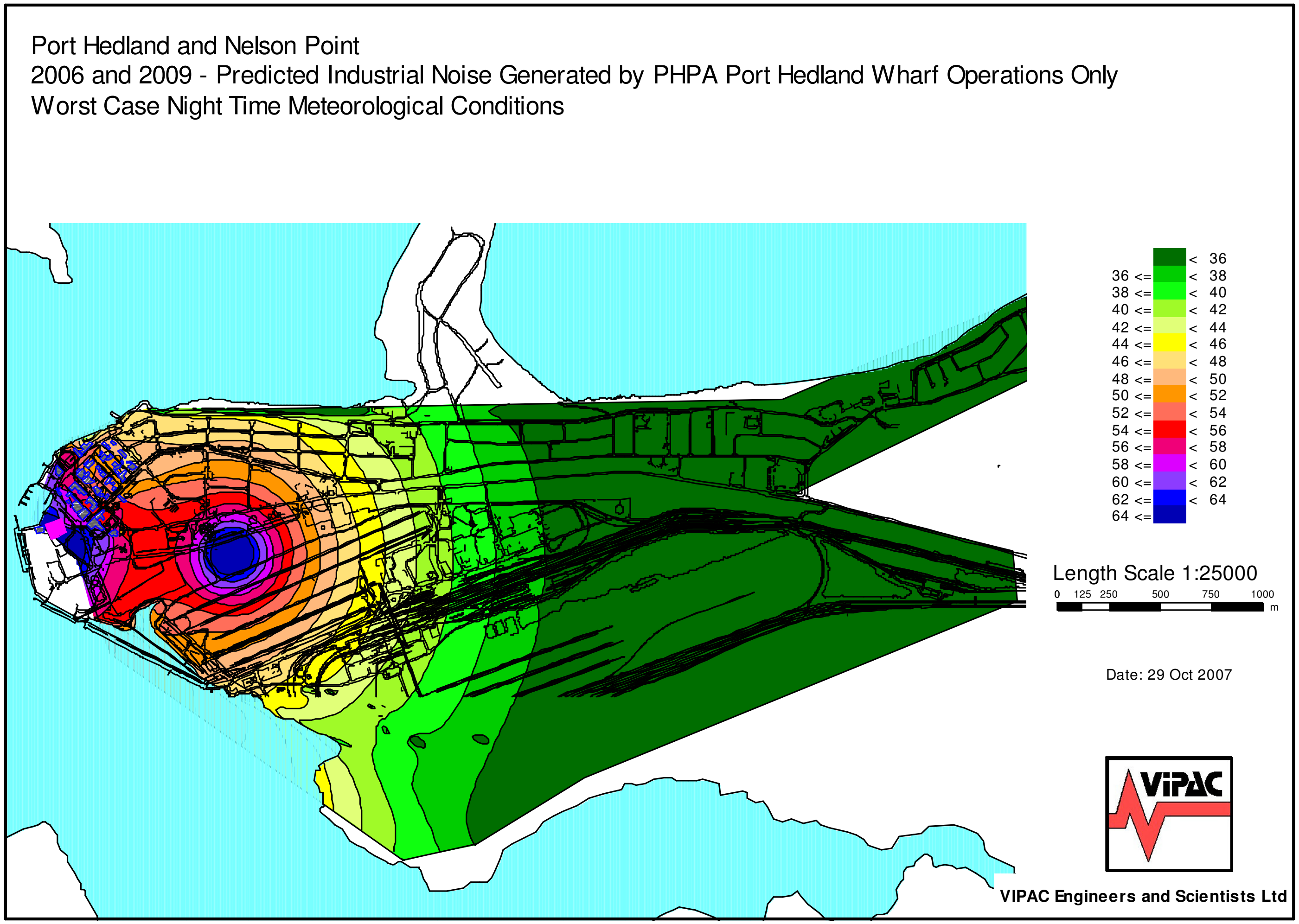
Port Hedland and Nelson Point
2006 and 2009 - Predicted Industrial Noise Generated by PHPA Port Hedland Wharf Operations Only
Worst Case Night Time Meteorological Conditions
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:25000
0 125 250 500 750 1000
m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure G 2

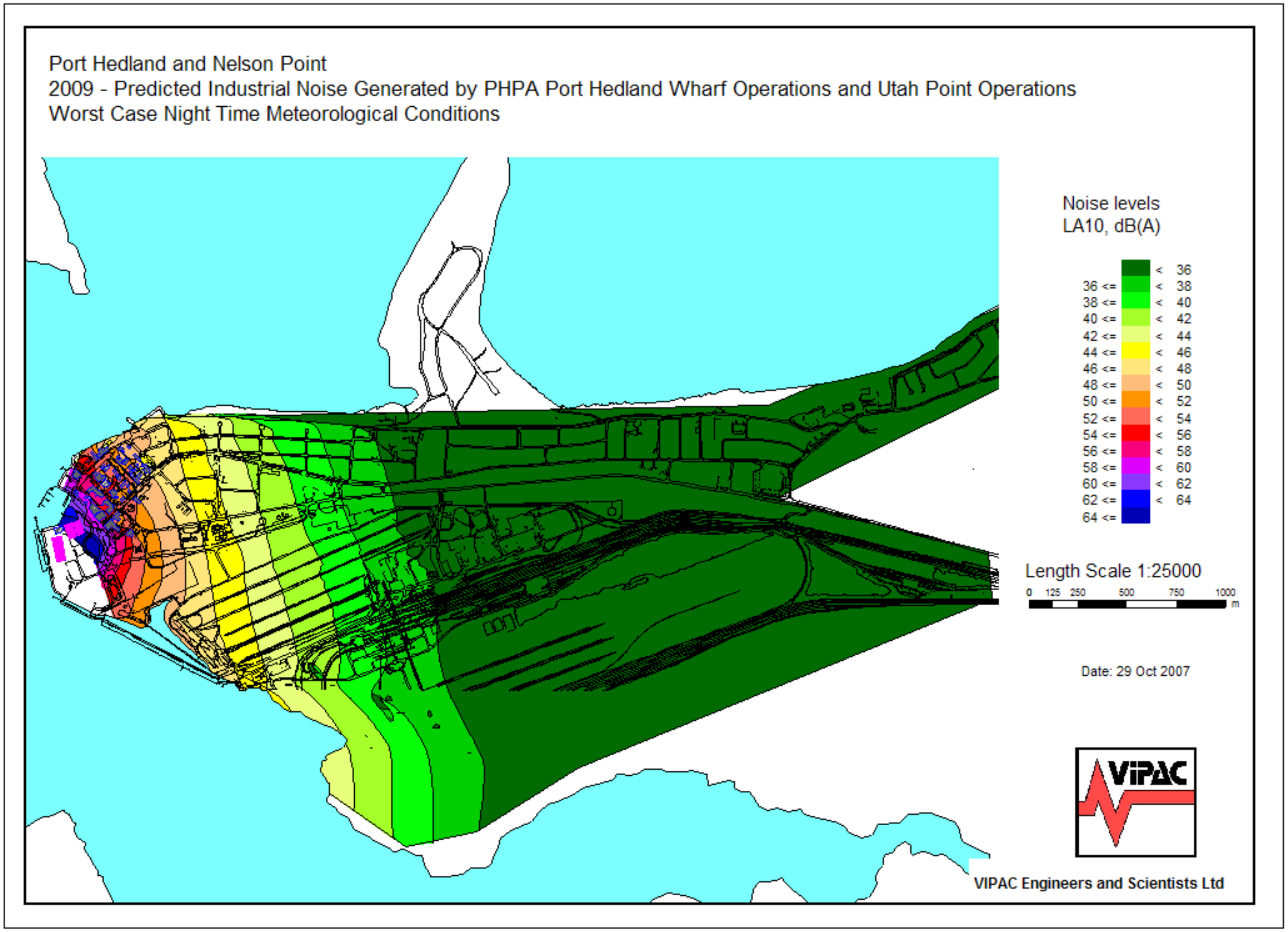
Port Hedland and Nelson Point
2009 - Predicted Industrial Noise Generated by PHPA Port Hedland Wharf Operations and Utah Point Operations
Worst Case Night Time Meteorological Conditions
Noise levels
LA10, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:25000
0 125 250 500 750 1000 m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure G 3

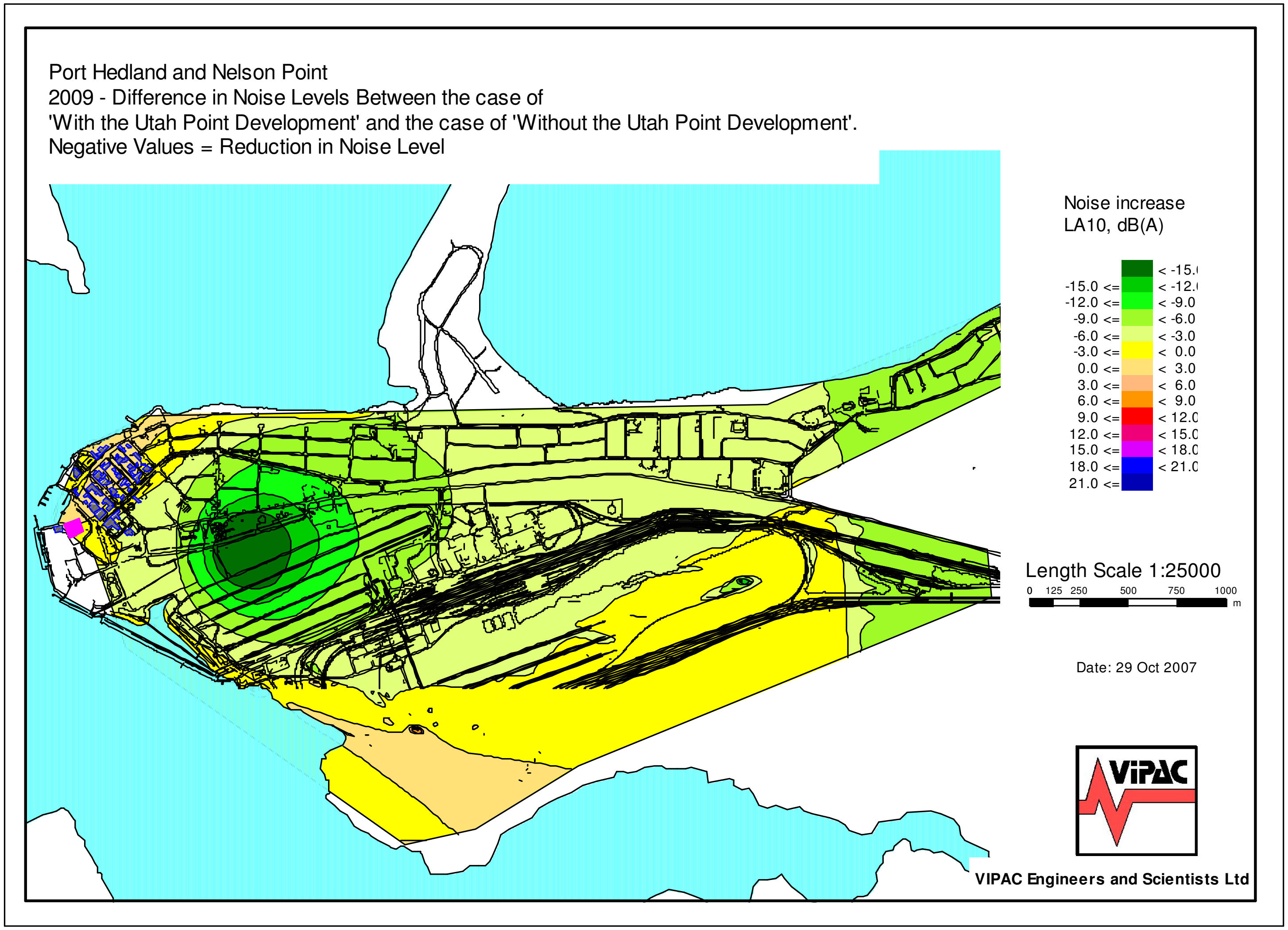
Port Hedland and Nelson Point
2009 - Difference in Noise Levels Between the case of
'With the Utah Point Development' and the case of 'Without the Utah Point Development'.
Negative Values = Reduction in Noise Level
Noise increase
LA10, dB(A)
< -15.
-15.0 <= < -12.
-12.0 <= < -9.0
-9.0 <= < -6.0
-6.0 <= < -3.0
-3.0 <= < 0.0
0.0 <= < 3.0
3.0 <= < 6.0
6.0 <= < 9.0
9.0 <= < 12.
12.0 <= < 15.
15.0 <= < 18.
18.0 <= < 21.
21.0 <=
Length Scale 1:25000
0 125 250 500 750 1000
m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure G 4

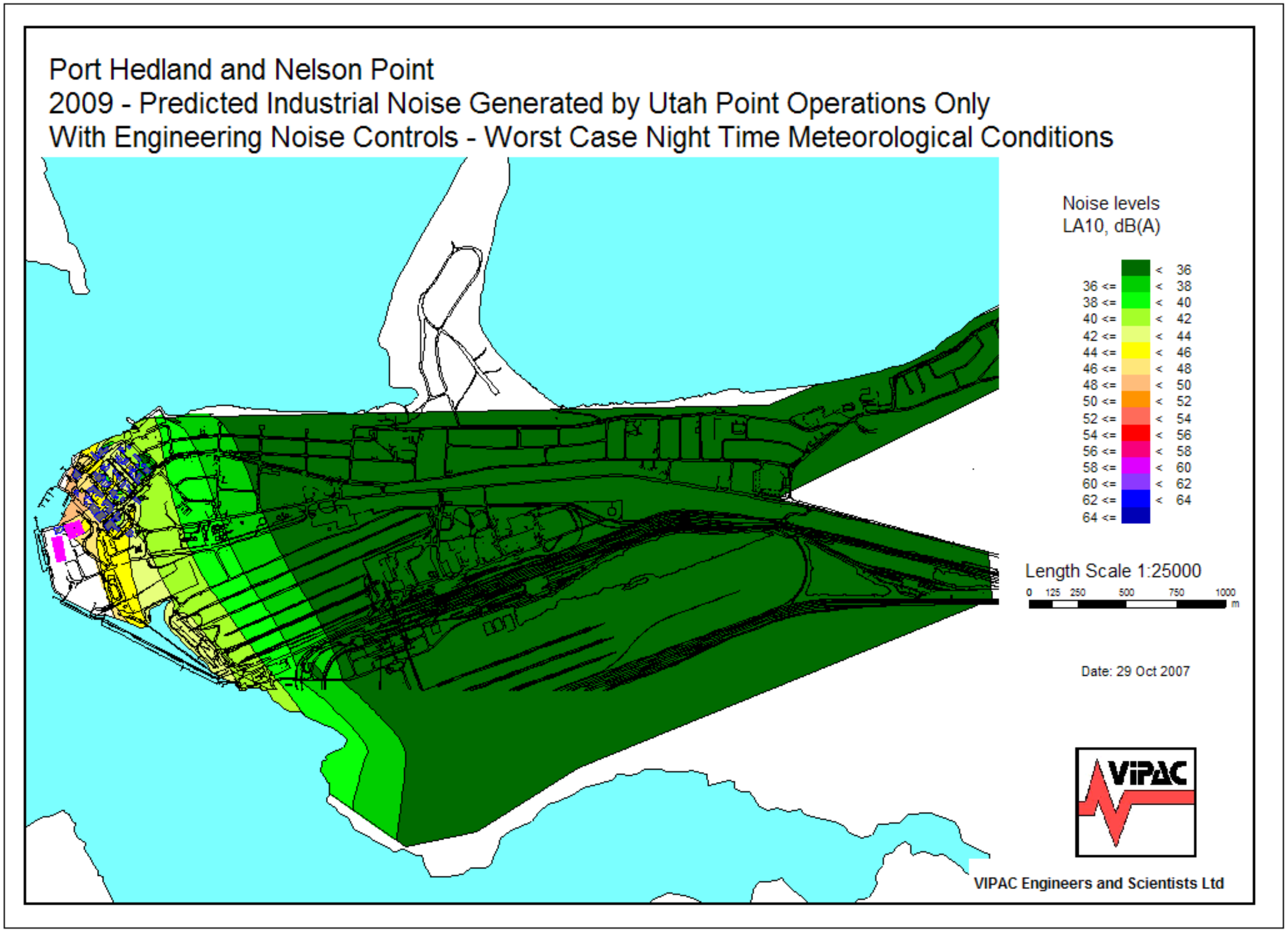
Port Hedland and Nelson Point
2009 - Predicted Industrial Noise Generated by Utah Point Operations Only
With Engineering Noise Controls - Worst Case Night Time Meteorological Conditions
Noise levels
LA10, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:25000
0 125 250 500 750 1000
m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure G 5

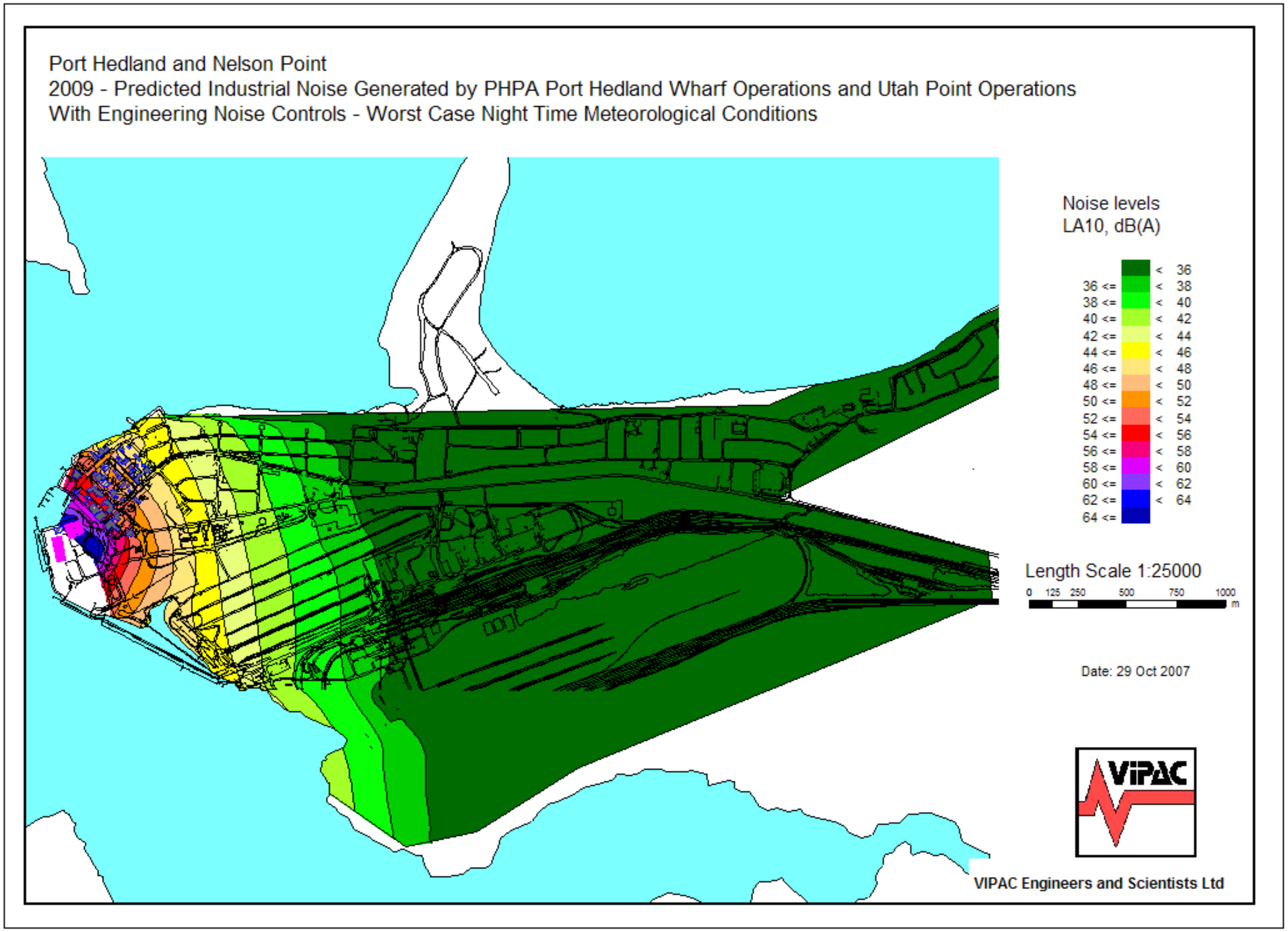
Port Hedland and Nelson Point
2009 - Predicted Industrial Noise Generated by PHPA Port Hedland Wharf Operations and Utah Point Operations
With Engineering Noise Controls - Worst Case Night Time Meteorological Conditions
Noise levels
LA10, dB(A)
< 36
36 <= < 38
38 <= < 40
40 <= < 42
42 <= < 44
44 <= < 46
46 <= < 48
48 <= < 50
50 <= < 52
52 <= < 54
54 <= < 56
56 <= < 58
58 <= < 60
60 <= < 62
62 <= < 64
64 <=
Length Scale 1:25000
0 125 250 500 750 1000
m
Date: 29 Oct 2007
VIPAC Engineers and Scientists Ltd

Figure G 6

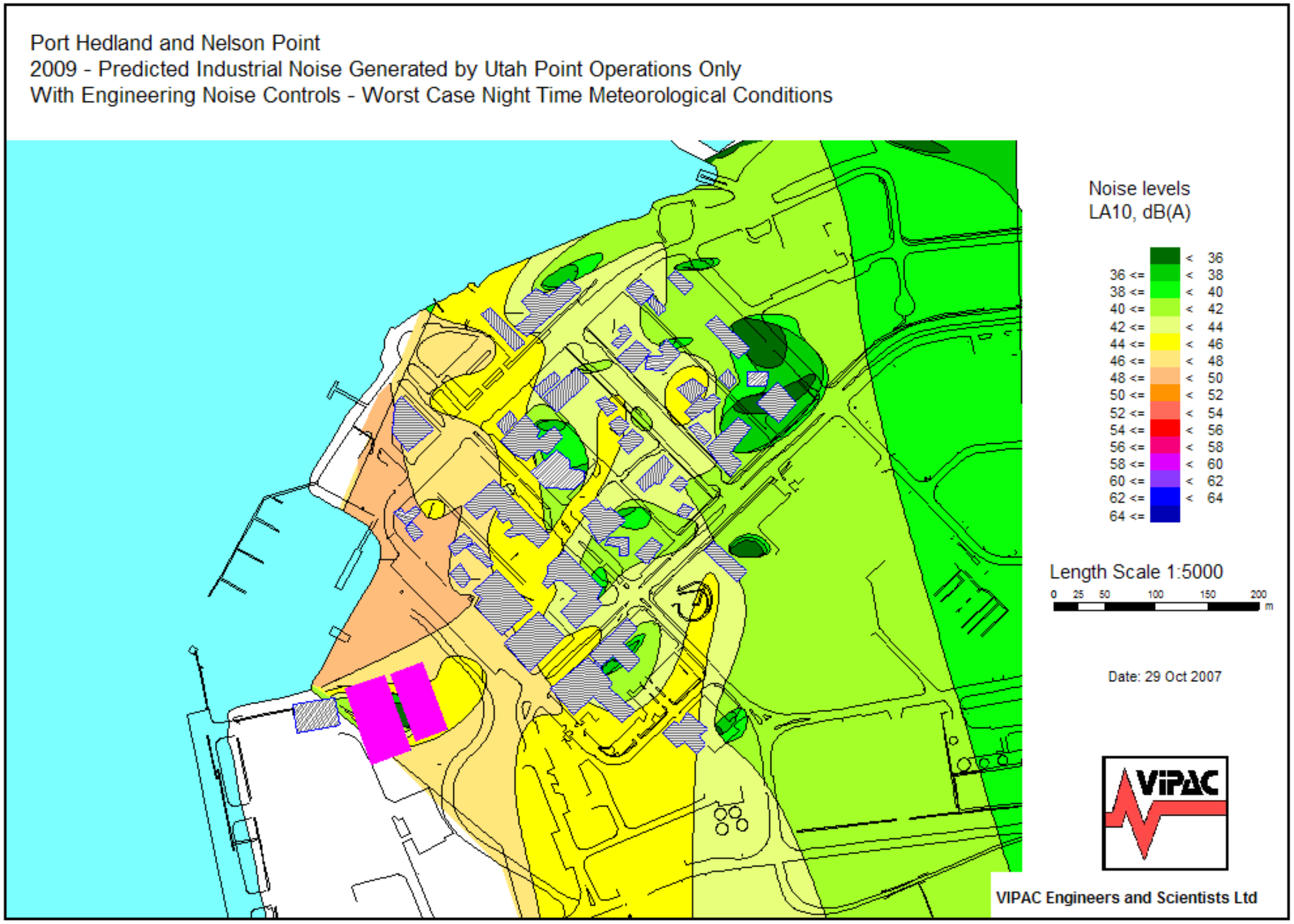

Figure G 7 (shown in report as Figure 4.5)

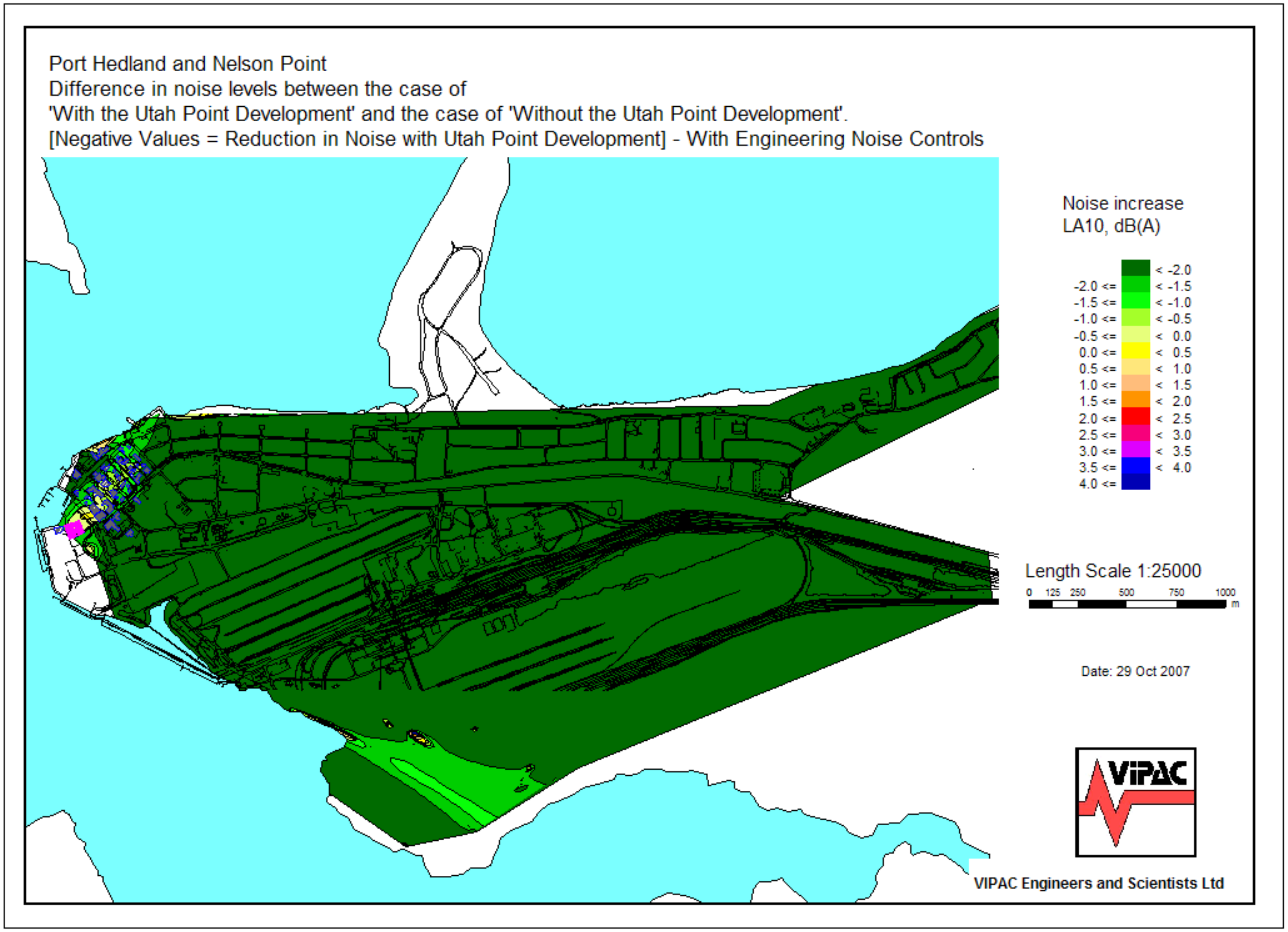

Figure G 8 (shown in report as Figure 4.6)

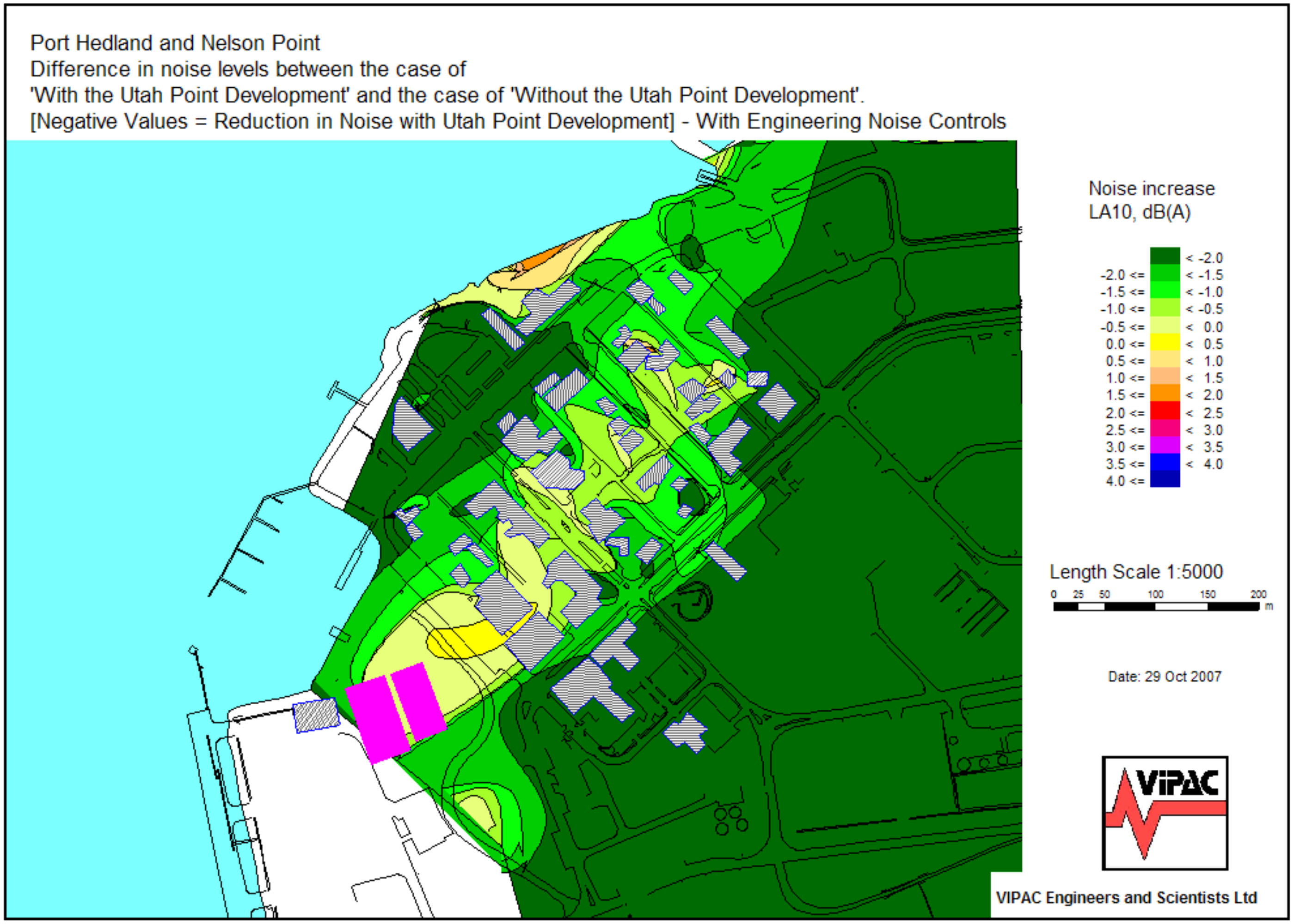

Figure G 9 (shown in report as Figure 4.7)