Appendix F

Noise & Vibration Impact Assessment

ACOUSTICS AND AIR

APPENDIX F

KURNELL REFINERY CONVERSION INTO A FINISHED PRODUCT TERMINAL NOISE & VIBRATION ASSESSMENT

REPORT NO. 12315
VERSION F

MAY 2013

PREPARED FOR

URS AUSTRALIA PTY LTD
407 PACIFIC HIGHWAY
ARTARMON NSW 2064

ON BEHALF OF

CALTEX REFINERIES (NSW) PTY LTD
KURNELL REFINERY
2 SOLANDER STREET
KURNELL NSW 2231

WILKINSON MURRAY

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TABLE OF CONTENTS

GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

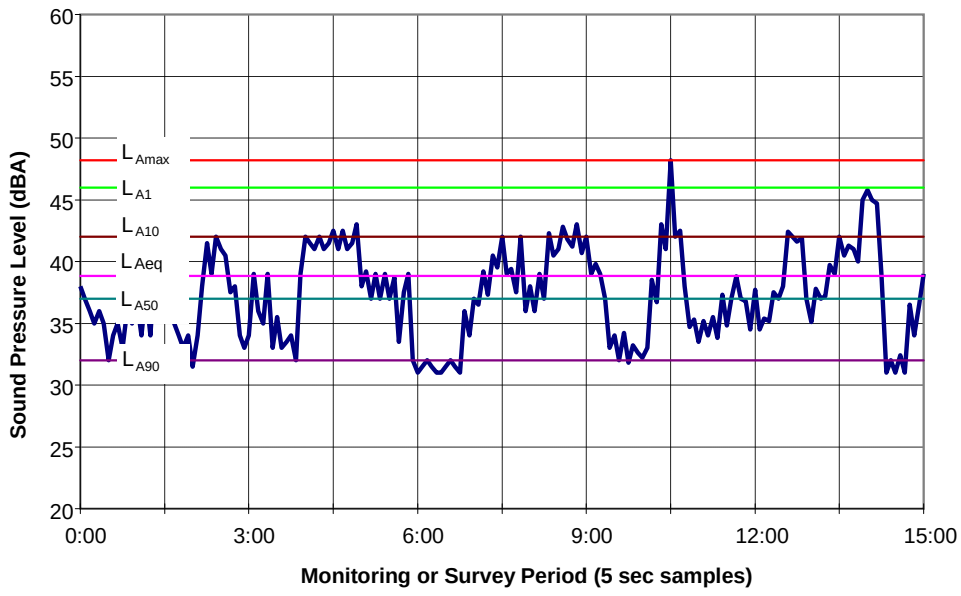
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

Typical Graph of Sound Pressure Level vs Time



1 INTRODUCTION

Wilkinson Murray Pty Limited (WMPL) was engaged to undertake a desktop environmental noise and vibration assessment associated with the conversion the existing Kurnell Refinery into a Finished Product Terminal (the 'Project').

The Project includes cessation of refinery operations and modifications to the existing Kurnell Refinery (the 'Site') to convert it to a working finished product terminal. The proposed terminal would manage the following products:

- Gasoline – Unleaded Petrol (ULP), Premium Unleaded Petrol (PULP) and Super Premium Unleaded Petrol (SPULP);
- Diesel;
- Jet Fuel; and
- Fuel Oil.

The terminal would also manage the following by-products:

- Slop; and
- Wastewater.

The Project involves the conversion of tanks and installation of pumps and associated pipelines within the Project Area to allow for the expansion of terminal operations. These works would all occur within the Project Area outlined on **Figure 1-1.**

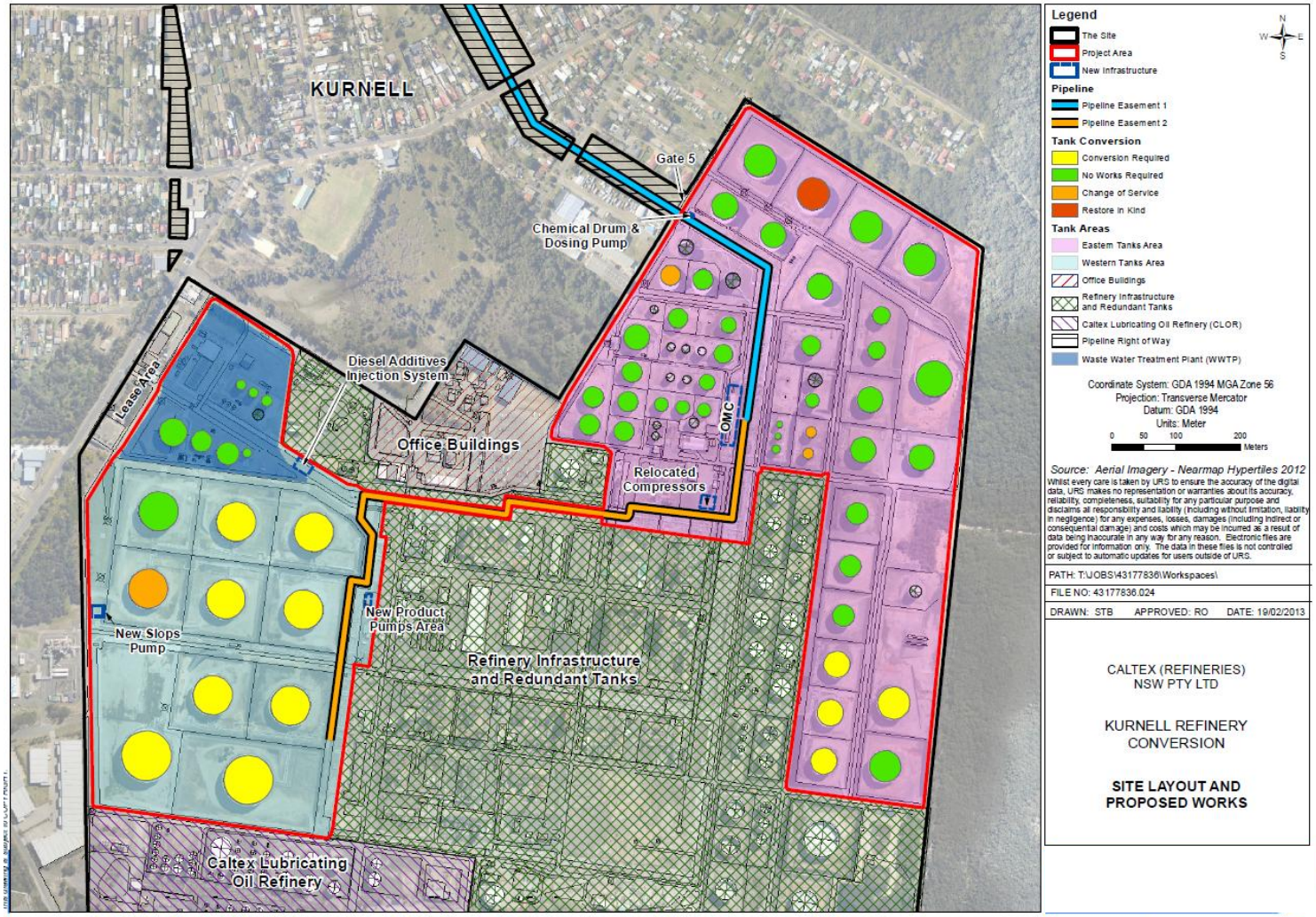
During the initial conversion activities, the Site would still operate in its current mode as both a refinery and a terminal. Cessation of refinery operations would occur in the second half of 2014 and would be followed by the continued conversion of some tanks within the Project Area to hold finished products. Eventually the Site would operate wholly as a terminal.

This noise and vibration assessment considered the following steps:

- review of the applicable noise criteria, legislation and Director General's Requirements;
- reviews of previous noise assessments conducted for the Site;
- understanding of the existing acoustic environment of the study area;
- identification of noise sensitive receptors;
- setting of Project specific noise criteria;
- prediction of operation and construction noise and comparison with the nominated noise criteria; and
- recommendation of necessary mitigation measures to achieve satisfactory noise criteria performance if required.

Due to the distances between the potential sensitive receptors and the proposed works it is unlikely that there is any vibration associated with the Project and, as such, no further evaluation is conducted in this assessment.

Figure 1-1 Project Area within the Site and Proposed Works



2 PROJECT DESCRIPTION

An overview of the modifications required for the Project are summarised below. This information has been provided by URS Australia Pty Ltd (URS).

2.1 Gasoline

Gasoline Products, including ULP, PULP and SPULP, would be stored within tanks in the Eastern Tank Area. Two existing dedicated gasoline pipelines extend from the Kurnell Wharf to the Eastern Tank Area along Pipeline Easement 1 (refer to **Figure 1-1**). Gasoline products would be distributed along these pipelines to a total sixteen existing finished product tanks within the Eastern Tank Area. Twelve of these tanks are currently in gasoline or similar service. Four tanks would be converted from other services to ULP / PULP / SPULP service.

2.2 Diesel

Two existing dedicated diesel pipelines extend from the wharf to the Eastern Tank Area within Pipeline Easement 1 (refer to **Figure 1-1**). Diesel product would be distributed along these lines to twelve finished product tanks within the Eastern Tank Area. At present all of these tanks already store diesel, excluding one which is currently used for fuel oil.

The two existing diesel pipelines would be extended from the Oil Movements Centre (OMC) (refer to **Figure 1-1**) along Pipeline Easement 2 to supply four large tanks within the Western Tank Area that would be converted from crude oil storage to the storage of diesel products. These pipelines would be installed low to the ground, along pipe racks in line with the existing pipework on the Site.

The existing diesel additives injection system at the OMC manifold would be duplicated at a new location within the Western Tank Area (refer to **Figure 1-1**). This system would be used to dose diesel as it is received into the terminal from the wharf to ensure that the finished product meets the required specification.

2.3 Jet Fuel

Two existing dedicated jet fuel pipelines extend from the wharf to the Eastern Tank Area within Pipeline Easement 1. Jet fuel would be distributed to six existing finished product tanks within the Eastern Tanks Area.

The two existing jet fuel pipelines would be extended from the OMC along Pipeline Easement 2 to supply four large tanks within the Western Tank Area that would be converted from crude oil to jet fuel service. These pipelines would be installed low to the ground, along pipe racks as per the existing pipework on the Site.

A small chemical drum and dosing pump would be installed at Gate 5 (refer to **Figure 4-1**). This system would be attached to the jet fuel pipeline and used for dosing an additive into the jet fuel as it is received into the Site from the wharf.

2.4 Fuel Oil

Two existing dedicated fuel oil pipelines extend from the wharf to the Project Area within Pipeline Easement 1. Fuel Oil product would be distributed to four existing finished product tanks within the Eastern Tank Area. No proposed conversion works would be associated with these tanks as they are already used for Fuel Oil storage.

2.5 Slop Oil

An existing pipeline within Pipeline Easement 1 would be transferred from its current usage to transfer Slop oil. This would involve flushing the existing pipeline. No intrusive works would occur within Pipeline Easement 1. Slop produced from normal terminal transfers would be stored within five existing tanks within the Eastern Tank Area. Two of these tanks require minor piping and tank nozzle modifications to change their service to storage of slop.

It is proposed that a tank within the Western Tank Area would be changed from crude oil into slop service. No changes are required to this tank to facilitate this change of service. The existing pipelines that connect this tank to the existing slop tanks would be replaced in kind.

2.6 Wastewater

The existing Oily Water Management System (OWMS) at the Site collects process effluent and stormwater from areas of the Site where there is potential for interaction of water flows with petroleum products. Oily water from a range of sources is collected in the Site's oily water sewer system and is transferred to the wastewater treatment plant (WWTP) (refer to **Figure 1-1**).

Oily water is treated in the WWTP. The treatment process utilises physical, chemical and biological treatment to treat the oily water. Treated effluent is discharged to the Tasman Sea via the Yena Gap outfall under conditions of the Site EPL.

The WWTP would remain in service as part of the Project, operating in line with the EPL for the Site.

2.7 Utilities

The existing air, potable water, firewater, natural gas and nitrogen utilities would remain in place on the Site. Demand for these utilities would significantly decrease as a result of the Project. Some minor relocation and consolidation of utilities equipment would be required. These relocation works would include moving certain compressors and pipework within the Project Area (refer to **Figure 1-1**).

2.8 Tanks

2.8.1 Overview

The existing Site has over 100 tanks used for storing crude oil, refined or finished product, other petroleum intermediate products and effluent water. Some of these tanks would remain in current service, some would change service with no modifications required and some would be modified to contain finished product when the refinery is converted to a terminal.

Tanks that do not require modification in order to change service would have the tank levels drawn down to minimum and, in cases where product specifications would not be compromised, the new product would be added to the tanks. In cases where product specifications could be compromised, the tank heel would be safely emptied using a vacuum truck. The removed material would be relocated to an appropriate product tank and the tank would be filled with new material.

For tanks which require modification in order to change service or have reached their statutory inspection date (Turnaound and Inspection (T&I)) the works may involve some or all the following activities:

- shutdown of the tanks and associated infrastructure;
- removal of the existing product from the tanks;
- draining the excess product from the pipes connecting to the tanks;
- isolating and making safe any infrastructure and instrumentation that is no longer required;
- upgrading control systems to improve efficiency; and
- modifications to the tanks including upgrades to the tank internals, roofs, floors, nozzles, manifolds and finished product distribution pipework where required.

Other works associated with the tank modifications (where required) include:

- installation of additional product quality controls; and
- upgrading safeguard systems.

The specific works required for those tanks that would be converted to contain Gasoline, Diesel and Jet Fuel are outlined below.

2.8.2 Gasoline

The changes required for the conversion of heavy oil tanks to gasoline tanks involve the following works:

- The water draw-off system for the tank would be evaluated and where required replaced.
- Installation of an internal floating roof (with air scoops, hinged covers and stainless mesh screens) and an external cone roof. These would be installed where required. This arrangement protects Gasoline from external contaminants, e.g. water, and ensures safer operation.
- Internal painting would be undertaken for entire floor and shell up to the first strake only unless additional protection is required. The external side of the tank would be painted where required.
- Vent systems would be designed and installed on the gasoline tanks in line with API 2000, API1650 and API1653.
- A Sleeve on the slotted guide pole would be installed on all EFRTs

- Fire systems would be modified as required to meet fire foam and water volume requirements.
- New power and signal cables, cable ladders, switchgear, instrumentation and electrical motors would be installed where required.

No new mixers would be installed in these tanks. Tank mixers would be modified or replaced to meet requirements.

2.8.3 Diesel

The changes required for the conversion of crude oil tanks to diesel tanks involve the following works:

- The water draw-off system for the tank would be evaluated and where required replaced.
- The tank floor would be evaluated and where required repaired or replaced.
- Vent systems would be designed and installed on the diesel tanks in line with API 2000.
- Internal painting would be undertaken for the entire floor up to 600mm. The external side of the tank would be painted where required.
- New power and signal cables, cable ladders, switchgear, instrumentation and electrical motors would be installed where required.
- No new mixers would be installed in these tanks. The existing mixers would be retained. The roofs of all the tanks would remain as an external floating roof.

2.8.4 Jet Fuel

The changes required for the conversion of crude oil tanks to jet fuel tanks involve the following works:

- The tank floor would be replaced with a cone floor.
- A fast flush system would be installed to remove free water from the Jet Fuel.
- The tanks would be fully painted internally to minimise the possibility of product contaminations due to shell / floor corrosion.
- New power and signal cables, cable ladders, switchgear, instrumentation and electrical motors would be installed where required.
- Fire systems would be modified as required to meet foam and water volume requirements.

No new mixers would be installed in these tanks. The existing mixers would be retained. The fixed roof would be retained on all of the tanks.

Tank Replacement

A tank in the Eastern Tank Area (refer to Figure 4-1) is due for routine inspection and would be restored in kind for service. This tank currently sits at ground level on a concrete ring beam pad. The restoration would involve:

- dismantling the existing tank; and

- preparing a foundation for the new tank (which would be the same size and shape as the existing tank) in the same location as the current base. This would be prepared for a cone up tank floor. This type of tank floor does not require major excavation works. Excavation depth would not extend past half a metre below ground level.

2.8.5 Tank Conversion Summary

The tank conversion works described above would commence in advance of recommissioning the tanks to receive imported finished product. These works would be conducted throughout the construction phase. At the end of the conversion works there would be a reduction in the total number of tanks required for the storage of finished product imports and terminal operations when compared to the number currently required for refinery operations. The tanks that are not required for terminal operations are shown on **Figure 1-1**. These tanks would be emptied, isolated, cleaned and left with all manhole covers removed. The dismantling and remediation of the redundant tanks would be subject to a separate approval process in consultation with Sutherland Shire Council and the NSW Environmental Protection Authority.

Table 2-2-1 provides a summary of the final tankage use within the Project Area.

Table 2-2-1 Terminal Tank Changes Summary

Proposed Tank Service	No. of Tanks Requiring Conversion	No. of Tanks Requiring Change of Service
Gasoline	5*	-
Diesel	4	1
Jet Fuel	4	-
Fuel Oil	0	0
Waste Water and SLOP	0	3
Total	13	4

Note: One tank in the Eastern Tank Area would be restored in kind

Where it has been identified that either a change of service or no works are required for a tank, a T&I would be carried out for remaining tanks at a date which complies with statutory requirements. This is a normal operating procedure at the Site. A T&I involves the following high level activities:

- removing the tank out of service and moving the product to another location;
- internally cleaning the tank to allow accurate inspection of the tank walls, floor and roof;
- preparing a scope of works based on the results of the inspection and taking into account the service period since the last tank T&I;
- undertaking repair works as required which may include tank repair, painting or further testing; and
- returning the tank to service with the proposed finished product.

2.9 Bunding

2.9.1 Bund Capacity

Caltex has committed that the bunding capacity for tanks retained in service would comply with requirements of AS1940.

The current inspection programs at the Site monitor external bund walls and identify if repairs are required. The routine tank T&I program would continue through the conversion phase and into the operational phase of the Project. This program includes inspections of and repairs to tank internal bund walls. The current tank T&I program results in the inspection and required repairs of approximately 8-10 tanks per year.

2.9.2 Tank and Bund Floors

Of the tanks which would remain in hydrocarbon service, there are some bund areas which are of natural ground construction.

Any tank floors that are rebuilt during the Project and during the ongoing operation of the terminal would incorporate an underfloor liner. Five tanks are currently scheduled as part of the Project to include new installation of underfloor liners.

2.9.3 Protection Measures

Caltex's focus during the construction and operation of the Project would be on inspections, maintenance and spill prevention within the tank and tank bund areas. Extensive spill prevention measures would continue to be incorporated into the operation of the Project. These include:

- an automated high level shut off system for each tank;
- explosive vapour (LEL) detectors within the bunds of tanks containing low flash materials;
- triple infrared scanners on all low flash tank roofs;
- CCTV on low flash tanks, in conjunction with infrared cameras as a confirmation for alarms; and
- continuance of a comprehensive inspection / repair program.

In addition, in the unlikely event of a spill, the Site has significant contingency arrangements, including tertiary containment capacity available within the oily wastewater system.

2.10 Pumps

Five new product transfer pumps would be installed in the Western Tank Area. These pumps would service the newly converted large diesel and jet fuel product tanks (refer to **Figure 1-1**). The product transfer pumps would consist of three jet fuel product pumps and two diesel pumps. They would be located on the eastern side of the Western Tank Area (refer to **Figure 1-1**).

One new product transfer pump would be located within the Western Tank Area to transfer Slop Oil. This pump would be located on the western side of the Western Tank Area (refer to **Figure 1-1**).

Two new product transfer pumps would be installed at the OMC to transfer Slop oil and Jet Fuel respectively across the Site.

For each set of pumps new concrete foundations would be installed.

2.11 Electrical / Instrumental Facilities

The instrumentation within the Project Area would be upgraded as part of the Project. This work would include upgrades to the:

- wharf and tank instrumentation and control systems to enable remote and automated control;
- electrical tracing would be implemented to maintain fuel oil temperatures;
- oil movements manifold systems and remote valves with segregated product distribution piping to respective tanks;
- power supplies to new pumps; and
- consolidated site electrical systems.

These works would all occur within the existing Site footprint.

2.12 Workforce

Table 2-2 provides the workforce profile for the Project, including current and projected numbers during the construction and operation of the Project.

The current workforce, including Caltex employees and contractors is approximately 885. This increases by up to 500 people during maintenance shutdown periods. These periods range from 8-12 weeks in duration.

During the peak construction year of the Project (2014), the workforce would include up to an additional 140 people on Site.

Following all construction works, and when the Project is fully operational, there would be approximately 100 people on Site, with an addition 90 people during maintenance shutdown periods.

Table 2-2 Workforce Numbers (Current and Projected)

Workforce Numbers (Current and Projected)						
	2012[2]	**2013**	**2014[3]**	**2015**	**2016**	**2017**
Caltex Employees	410	400	450[4]	40	45	45
Contractors	475	475	475	40	55	55
Project Construction	-	140	140	100	90	-
Total	**885**	**1,015**	**1,065**	**180[5]**	**190**	**100**
Maintenance Shutdown Periods[1]	500	0[6]	0[6]	0[6]	90	90
Total including Maintenance Activities	**1,385**	**1,015**	**1,065**	**180**	**280**	**190**

Notes: *[1] Maintenance shutdown periods are periodic and for short time frames (8-12 weeks).*
[2] Current employee numbers at the Site.
[3] 2014 would be the peak construction period. Additional personnel brought to the Site for the Project construction would be a maximum of 140 personnel.
[4] Additional Caltex Employees in 2014 would be staff hired for terminal operations.
[5] The large reduction in numbers between 2014 and 2015 follows the cessation of refining at the Site. The increase in workforce numbers between 2015 and 2016 represents a gradual stabilisation of the terminal operational workforce.
[6] No maintenance shutdown periods will occur during 2013 and 2015.

2.13 Operation

2.13.1 Operation as a Terminal

Once the conversion is complete, Caltex would import finished products (gasoline, jet fuel, diesel and fuel oil) through the two fixed berths at the existing wharf and the additional sub berth located in Botany Bay. These products would be stored in existing and converted tanks.

The major product distribution systems would continue to operate in line with current practice, i.e. product would be pumped under Botany Bay to the Banksmeadow Terminal, the Sydney / Newcastle pipeline or the Joint User Hydrant Installation (JUHI) at Sydney Airport for further distribution. Road transport of products from the Site would cease. Under typical operation, road transport of products from the Site would cease. However, in exceptional circumstances, some road transport of product may be required.

With the cessation of the refining operation at the Site and the high levels of automation of the terminal, the number of employees on Site would reduce (See **Section 2-12**). These employees would operate in a shift arrangement 24 hours a day, 7 days a week.

Ongoing operational activities would be undertaken on the Site.

2.14 Ancillary Facilities and Infrastructure

2.14.1 Electricity

The existing electricity infrastructure on Site would be used to service the new terminal. Electricity usage would reduce significantly following the shutdown of the refinery operations;

however some power would still be required for operation of the terminal assets and general amenities.

2.14.2 Water and Stormwater / Wastewater Management

The current Site operations consume approximately 6 ML of potable water per day. Approximately 90% of this consumption would cease following shutdown of the refinery operations at the Site.

A further 1 ML of potable water per day is consumed for amenities. This volume would reduce over time as the work force declines. The long term demand at the Site following the completion of the Project is expected to reduce the overall potable water consumption by approximately 90%.

The drainage arrangements for the existing process plants would be kept in service during the Project. Storm water runoff from paved areas would continue to be routed to the Waste Water Treatment Plant (WWTP) on Site. No changes are proposed to this system. Tank bunded areas and tank water draws would remain unchanged and flow from these sources would continue to be processed through the WWTP.

2.14.3 Sewers

Existing sewerage infrastructure would continue to be used. It is expected that the amount of sewerage generated would decrease significantly.

2.14.4 Road Access

Road access to the Site would remain unchanged. Vehicle (car and truck) usage may increase marginally during initial conversion activities (2013-2014), but would decrease following the termination of refining. Vehicle movements to and from the Site would continue to decrease until full terminal operation is established due to reduced employees, service groups, deliveries and tanker loading activities on Site.

2.14.5 Shipping Movements

The upgrade to the Port and Berthing Facility would allow flexibility in the size of the ships able to berth at the Kurnell Wharf. This flexibility would see an anticipated reduction in ships arriving at the facility by approximately 40% in 2020 (compared to 2011 figures). This reduction would occur progressively over the life of the Project.

2.15 Construction Program

Construction works are proposed to begin in Q3 2013. During the construction phase, the Site would still operate as both a refinery and a terminal. Cessation of refinery operations would occur in the second half of 2014. This would be followed by continued conversion of some tanks and associated piping within the Project Area to hold finished products.

A high level schedule for conversion activities is shown in **Table 2-3**.

Table 2-3 Proposed Construction Schedule

Task	Date
Detailed Engineering & Design Start	Mid 2012
Engineering & Design Completed	Q2 2013
Tank Conversions Start	Second half 2013
Installation of Piping, Pumps and Associated Infrastructure	Second half 2013
Construction on Piping Completed	Q2 2014
Kurnell Refinery Shutdown	Second half 2014
Continued Tank Conversions	End 2014 – end 2016
CONVERSION TO TERMINAL COMPLETED	December 2016

2.16 Working Hours

The majority of the conversion works would be typically completed between 7.00 am to 10.00 pm seven days a week. However some works consistent with Caltex's existing maintenance procedures would need to occur over a 24 hour period.

The nature of the proposed works are the same as the activites that Caltex carries out as part of their ongoing maintenance and Turnaround and Inspection work. For the latter, the Site's existing Environmental Protection Licence (No. 837) (EPL) asks that Caltex ensure that any operational or maintenance activities on Site do not exceed 70 dB (A) between 7.00am and 10.00pm, and do not exceed 65 dB (A) between 10.00 pm and 7.00 am. The working hours for any construction works that are the the same as ongoing maintenance activities would be governed by the noise limits presented in the relevant EPL for the Site.

2.17 Construction Traffic

The traffic generated by the Project would incorporate a mix of construction plant vehicles, delivery vehicles and construction personnel movements. A summary of the construction vehicles and associated staff numbers that would be required during the construction of the Project is summarised in **Table 2-4.**

Table 2-4 Staff and Plant Requirements for Construction

	Description	Daily Movements (Return Trips)	Peak Hour Trips1
Heavy Vehicles	Construction Vehicles (Cranes/semi-trailers etc)	10	2
	Equipment/Material Delivery Vehicles	10	2
Private Vehicles	Construction Personnel*	140	140
	TOTAL	**160**	**144**
	Heavy Vehicle Proportion	13%	3%

Notes: 1. *Assumptions*

- *All personnel would arrive to Site during the AM Peak Hour and depart during the PM Peak Hour;*
- *Personnel would utilise their own private vehicle with no use of car-pooling or public transport;*
- *Heavy vehicle movements would be evenly distributed throughout the hours of operation (10 hour workdays); and*
- *All plant delivery vehicles are assumed to occur on the same day in order to produce a 'worst-case' scenario.*

Max number of construction staff (refer to Table **2-2).*

3 DIRECTOR GENERAL'S REQUIREMENTS (DGR)

The DGRs stipulated that the EIS considers:

- an assessment of all construction, operational and transportation noise impacts on surrounding residential receivers;
- any vibration impacts from construction and operation;
- cumulative impacts of other developments both on the Site and in the vicinity of the Site; and
- details of the proposed noise management and monitoring measures.

Due to the distances between the potential sensitive receptors and the proposed works it is unlikely that there is any vibration associated with the Project and as such no further evaluation is conducted in this assessment.

The NSW Environment Protection Agency (EPA) has also outlined their agency comments for the Noise Assessment. These comments, and the sections they are addressed in, are outlined in **Table 3-1**.

Table 3-1 EPA Comments

Comment	Section
Identification and assessment of all potential noise sources associated with the conversion works. This may include any demolition, construction and operational noises from the Project and associated shipping movements.	Section 7
Identify the locations of all sensitive receptors.	Section 4
The proposed hours of construction and operation of the conversion works.	Section 2
An assessment of compliance with the project specific noise levels as determined using the above guidelines (Industrial Noise Policy).	Section 8
Any proposed noise mitigation, monitoring and management measures which are necessary to achieve the above outcome.	Section 11

4 NOISE SENSITIVE RECEPTORS

The surrounding potentially noise sensitive receptors have been identified considering the relative location of the Project Area to the surrounding area. The following groups of receptors were identified:

- Receiver R1 – 44-64 Cook Street (Industrial Premises) Industrial premises adjacent to the refinery to the west and sharing a common boundary.
- Receiver R2 – 30D Cook Street (Residential) Residential property adjacent to the refinery to the west and sharing a common boundary.
- Receiver R3 – Reserve Road (Residential) Residential properties north of the refinery.
- Receiver R4 – Rangers' House (Residential) located towards the northern end of the National Park.
- Receiver R5 – Prince Charles Parade (Residential) Residential properties south of the refinery wharf.
- Receiver R6 – Corner of Captain Cook Drive and Silver Beach Road (Residential) Residential properties north of the refinery.
- Receiver R7 – Tasman Street (Residential) Residential property west of the refinery.
- Receiver R8 – 35 Cook Street (Residential) Residential property west of the refinery.

Figure 4-1 shows the locations of the above receptors.

Figure 4-1 Noise Sensitive Receptors

5 EXISTING NOISE ENVIRONMENT

The noise environment on the Kurnell Peninsula is characterised by a number of industrial noise sources, particularly the operations of the Kurnell Refinery. However, other marine activities across the Botany Bay harbour and aircraft noise from the Sydney (Kingsford Smith) Airport flight paths contribute to the existing noise environment. Other noise sources include local vehicle movements and sounds such as wave action and fauna.

A number of noise studies have been performed on the Kurnell Peninsula and Botany Bay in recent years, and therefore WMPL has used existing noise data to determine representative ambient and background noise levels (refer to **Figure 5-1**). The following references have been reviewed:

- Environmental Assessment, Botany Bay Cable Project. (Wilkinson Murray, 2006).
- Caltex Jet Fuel Pipeline, Construction Noise and Vibration Assessment. (Renzo Tonin Associates, 2011).
- The Kurnell Port and Berthing Project Noise and Vibration Assessment (URS, 2012).
- 2011 Computer Noise Update Project Caltex Refineries (NSW) Pty Ltd (HFP Acoustic Consultants Corp, 2011).

Table 5-1 summarises the relevant information extracted from the referenced reports. The ambient noise levels are presented in the form of a Rating Background Level (RBL) and L_{Aeq} period noise levels, which are defined in the *Industrial Noise Policy (INP)*.

Table 5-1 Measured Existing Noise Levels at Kurnell

#	Reference	Monitoring Type	Location	Rating Background Noise Levels, L_{A90}			Ambient Noise Levels, L_{Aeq}		
				Day 0700-1800h	Evening 1800-2200h	Night 2200-0700h	Day 0700-1800h	Evening 1800-2200h	Night 2200-0700h
M1	Botany Bay Cable Project (Jul 2006)	Long-term noise logging	10 Prince Charles Parade	41	42	40	57*	54*	49*
M2	Noise update Project Caltex Refineries (2011)	Long-term noise logging	48 Prince Charles Parade	40	43	41	50	51	50
M3	Noise update Project Caltex Refineries (2011)	Long-term noise logging	39 Polo Street	40	40	41	54	52	51
M4	Jet Fuel Pipeline (April 2011)	Long-term noise logging	15 Cook Street	41	43	39	Not provided	Not provided	Not provided
M5	Noise update Project Caltex Refineries (2011)	Long-term noise logging	35 Cook Street	40	40	38	55	53	53
M6	Kurnell Port and Berthing (Dec 2012)	Long-term noise logging	Ranger's House	41	43	41	55*	57*	51*
M7	Noise update Project Caltex Refineries (2011)	Long-term noise logging	11 Tasman Street	40	39	36	53	52	51
M8	Noise update Project Caltex Refineries (2011)	Long-term noise logging	1 Silver Beach Road	44	40	40	52	50	50
M9	Noise update Project Caltex Refineries (2011)	Long-term noise logging	31 Silver Beach Road	47	49	38	55	54	51
M10	Noise update Project Caltex Refineries (2011)	Long-term noise logging	30D Cook Street	36	35	30	44	39	36

Notes ** Dominated by surf noise.*

Figure 5-1 Noise Monitoring Locations

The measurements typically show that highest background noise levels occur during the evening; principally due to insects rather than industrial activities.

The RBLs and ambient noise levels assumed as representative at residential noise sensitive receptors for the proposed Project are set out in **Table 5-2**.

Table 5-2 Summary of representative Noise Levels at Kurnell

#	Sensitive Receptors	Rating Background Noise Levels, L_{A90}			Ambient Noise Levels, L_{Aeq}			Comments
		Day 0700-1800h	Evening 1800-2200h	Night 2200-0700h	Day 0700-1800h	Evening 1800-2200h	Night 2200-0700h	
R1 & R2	30D Cook Street	36	35	30	44	39	36	Based on M10.
R3	Reserve Road	40	40	41	54	52	51	Based on M3.
R4	Ranger's House	41	43	41	55**	57**	51**	Based on M6.
R5	Prince Charles Parade	40	40	40	50	51	50	Based on the lowest measured levels from M1, M2 and M8.
R6	Corner of Captain Cook Drive and Silver Beach Rd	47	49	38	52	50	50	Based on M9.
R7	Tasman Street	40	39	36	53	52	51	Based on M7.
R8	Cook Street	40	40	38	55	53	53	Based on the lowest measured level from M4 and M5.

*Note: * For Prince Charles Parade the daytime RBLs are based on the attended measurements undertaken in 2012. ** Dominated by surf noise.*

6 NOISE CRITERIA

The current operation at the Site is subject to approved noise limits as presented in the EPA's Environment Protection Licence (#837).

The Industrial Noise Policy (INP) is used to assess the operational noise activities while construction activities are assessed against *Interim Construction Noise Guideline (ICNG)*. Both operational noise and construction noise activities are also assessed against and the approved noise limits.

6.1 Operational Noise Limits

The EPL states the following noise limits:

L6.1 Noise from the premises must not exceed:

a) an $L_{A10(15\ minute)}$ noise emission criterion of 70 dB(A) (7:00 to 2200) seven days a week; and

b) an $L_{A10(15\ minute)}$ noise emission criterion of 65 dB(A) at all other times;

except as expressly provided by this licence."

L6.2 Noise from the premises is to be measured or computed at any point within one metre of any affected residence to determine compliance with condition L6.1. 5dB(A) must be added if the noise is tonal or impulsive in character.

Note: For the purposes of condition L6.1 and L6.2, noise limits for the premises must be set using information provided as part of the post commissioning noise impact assessment monitoring as required by PRP U11 of this licence. Noise limits will be determined using data collected that is in accordance with the EPA's NSW Industrial Noise Policy 2000 and account for the contribution of the Clean Fuels plant and equipment and the Flare Replacement plant and equipment.

(L6.3, L6.4 and L6.5 are on the subject of flaring which is not subject to change as a result of this proposal.)

L6.6 Where it can be demonstrated that direct measurement of noise from the premises is impractical, the EPA may accept alternative means of determining compliance. See Chapter 11 of the NSW Industrial Noise Policy January 2000 for general guidance on determining compliance.

L6.7 For the purposes of determining the noise generated at the premises the modification factors in Section 4 of the NSW Industrial Noise Policy must be applied, as appropriate, to the noise levels measured by the noise monitoring equipment.

L6.8 The noise emission limits identified in Condition L6.3 of this licence, apply under meteorological conditions of:

a) Wind speed up to 3 m/s at 10 metres above ground level; and

b) Temperature inversion conditions up to 3 degrees Celsius/100 metres and wind speed up to 2 m/s at 10 metres above the ground.

Before the introduction of the INP (EPA 2000) in 2000, the L_{A10} descriptor was used and currently still remains in the EPL. For the purpose of this assessment, it is conservatively assumed that the $L_{A10,15min}$ criteria is a $L_{Aeq,15min}$ criteria. Typically a $L_{Aeq,15min}$ noise level from an industial site is up to 3dB lower than the $L_{A10,15min}$ noise level.

6.2 Construction Noise Criteria

The *ICNG* presents the process to assess construction in NSW. The *ICNG* was developed by the EPA taking into consideration that construction is temporary, noisy and difficult to ameliorate. As such, the *ICNG* was developed to focus on applying a range of work practices most suited to minimising construction noise impacts, rather than focusing only on achieving a specific noise level.

The *ICNG* recommends that standard construction work hours should typically be as follows:

- Monday to Friday 7.00am to 6.00pm;
- Saturday 8.00am to 1.00pm; and
- No work on Sundays or public holiday.

Additionally, it recommends quantitative management noise criteria at residences as presented in **Table 6-1**.

Table 6-1 Construction Noise at Residences using Quantitative Assessment

Time of Day	Management Level $L_{Aeq\ (15\ min)}$	How to Apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays	Noise affected RBL + 10dBA	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.

Time of Day	Management Level $L_{Aeq\ (15\ min)}$	How to Apply
Outside recommended standard hours	Noise affected RBL + 5dBA	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dBA above the noise affected level, the proponent should negotiate with the community.

For commercial or industrial land the *ICNG* the following noise management levels:

- industrial premises: external $L_{Aeq\ (15\ min)}$ 75 dBA; and
- offices, retail outlets: external $L_{Aeq\ (15\ min)}$ 70 dBA.

Table 6-2 presents the Project-specific construction noise criteria for the Project.

Table 6-2 Project-Specific Criteria for Construction Noise Criteria

#	Sensitive Receptors	Day 0700-1800h $L_{Aeq,15min}$ (dBA)	Out of hours 18:00h 22:00h $L_{Aeq,15min}$ (dBA)	Out of hours 22:00h 7:00h $L_{Aeq,15min}$ (dBA)
R1	Cook Street (Industrial Premises)	75		
R2	30D Cook Street (Residential Premises)	46	40	35
R3	Reserve Road (Residential Premises)	50	45	45
R4	Ranger's House (Residential Premises)	51	46	46
R5	Prince Charles Parade (Residential Premises)	50	45	45
R6	Corner of Captain Cook Drive and Silver Beach Rd (Residential Premises)	57	52	43
R7	Tasman Street (Residential Premises)	50	44	41

#	Sensitive Receptors	Day 0700-1800h $L_{Aeq,15min}$ (dBA)	Out of hours 18:00h 22:00h $L_{Aeq,15min}$ (dBA)	Out of hours 22:00h 7:00h $L_{Aeq,15min}$ (dBA)
R8	Cook Street (Residential Premises)	50	45	43

6.3 *Industrial Noise Policy* Noise Criteria

The *INP* recommends two criteria, "Intrusiveness" and "Amenity", both of which are relevant for the assessment of noise. In most situations, one of these is more stringent than the other and becomes the dominating noise criteria. The criteria are based on the equivalent continuous noise level (L_{Aeq}) noise descriptor, which is explained in the Glossary of Acoustic Terms. While the intrusiveness criterion is based on a typical worst-case 15 minute period, the amenity criterion is expressed as an $L_{Aeq,period}$ noise level over the whole assessment period considered (day, evening or night).

6.3.1 Intrusiveness Criterion

The intrusiveness criterion is established by adding 5 dBA to the background noise levels. Monitoring of the ambient noise level surrounding the Site was identified in **Section 3**. In accordance with the EPA, where the RBL in the evening was found to be higher than the daytime, the project-specific noise level was determined so that the intrusive noise level for evening was set at no greater than the intrusive noise level for daytime.

6.3.2 Amenity Criterion

The amenity criterion considers noise levels from all industrial sources (excluding traffic noise) including existing industrial noise sources and the Project. It is designed to protect amenity levels for different types of residential receiver areas (i.e. urban, rural, etc.).

Where noise levels from existing industrial sources are close to or above the acceptable levels, the amenity criterion would incorporate a sliding scale to set limits which prevents overall noise levels exceeding the acceptable level due to the addition of a new noise source.

The potentially affected residences near the Site are in an area which would be classified as "urban industrial interface" or urban. To be conservative the urban "acceptable" amenity criteria has been used in this assessment. The recommended acceptable "urban" noise levels are 60 dBA, 50 dBA and 45 dBA $L_{Aeq,period}$ for daytime, evening and night time periods, respectively.

Table 6-3 presents a summary of the relevant intrusive and amenity operational noise criteria.

The *INP* states that the lowest of the two intrusive and amenity noise criteria be used as the Project Specific Noise Levels for the Project. The Project Specific Noise Levels are highlighted in "bold" in **Table 6-3**.

Table 6-3 Project Criteria Summary

#	Receiver Area	Time Period	Intrusiveness Criterion $L_{Aeq,15min}$ (dBA)	Amenity Criterion $L_{Aeq,period}$ (dBA)*
R1	Cook Street (Industrial Premises)	When in use	-	**70**
R2	30D Cook Street (Residential Premises)	Daytime (7.00am–6.00pm)	**41**	60
		Evening (6.00pm–10.00pm)	**40**	50
		Night Time (10.00pm–7.00am)	**35**	45
R3	Reserve Road (Residential Premises)	Daytime (7.00am–6.00pm)	**45**	59
		Evening (6.00pm–10.00pm)	45	**42**
		Night Time (10.00pm–7.00am)	45	**41**
R4	Ranger's House (Residential Premises)	Daytime (7.00am–6.00pm)	**46**	60
		Evening (6.00pm–10.00pm)	**46**	50
		Night Time (10.00pm–7.00am)	46	**45**
R5	Prince Charles Parade (Residential Premises)	Daytime (7.00am–6.00pm)	**45**	60
		Evening (6.00pm–10.00pm)	**45**	50
		Night Time (10.00pm–7.00am)	**45**	45
R6	Corner of Captain Cook Drive and Silver Beach Rd (Residential Premises)	Daytime (7.00am–6.00pm)	**52**	58
		Evening (6.00pm–10.00pm)	52	**44**
		Night Time (10.00pm–7.00am)	43	**41**
R7	Tasman Street (Residential Premises)	Daytime (7.00am–6.00pm)	**45**	60
		Evening (6.00pm–10.00pm)	44	**42**
		Night Time (10.00pm–7.00am)	**41**	41
R8	Cook Street (Residential Premises)	Daytime (7.00am–6.00pm)	**45**	59
		Evening (6.00pm–10.00pm)	45	**43**
		Night Time (10.00pm–7.00am)	43	**43**

*Notes: * As the operational noise levels are relatively constant from the facility it is assumed that the $L_{Aeq,\ period}$ and $L_{Aeq,15minute}$ noise levels are the same.*

7 METEOROLOGY

At relatively large distances from a source the resultant noise levels from a noise source will be influenced by meteorological conditions, specifically:

- wind; and
- temperature gradients.

Wind can increase noise at a receiver when it blows from the direction of the noise source at relatively low wind speeds (below 3 metres per second [m/s]). An increase in wind strength greater than 3 m/s generally results in a corresponding increase in wind noise at the receiver which masks noise from the source under investigation.

Temperature inversions (positive temperature gradients) can increase noise levels at surrounding receivers by the reflection of sound waves from warmer upper layers of air. Temperature inversions occur predominantly at night.

In assessing noise impacts, the criteria are expected to apply under weather conditions that would be expected to occur at a particular site for a significant period of time.

The INP describes two approaches for assessing these effects; the simple and the more detailed approach.

The simple approach forgoes a detailed analysis of meteorological data and simply applies given default meteorological parameters to predict noise levels. This approach assumes that meteorological effects are present for a significant amount of time, avoiding the need to quantify these effects in detail. It is conservative, in that it is likely to predict the upper range of increases in noise levels due to meteorological conditions.

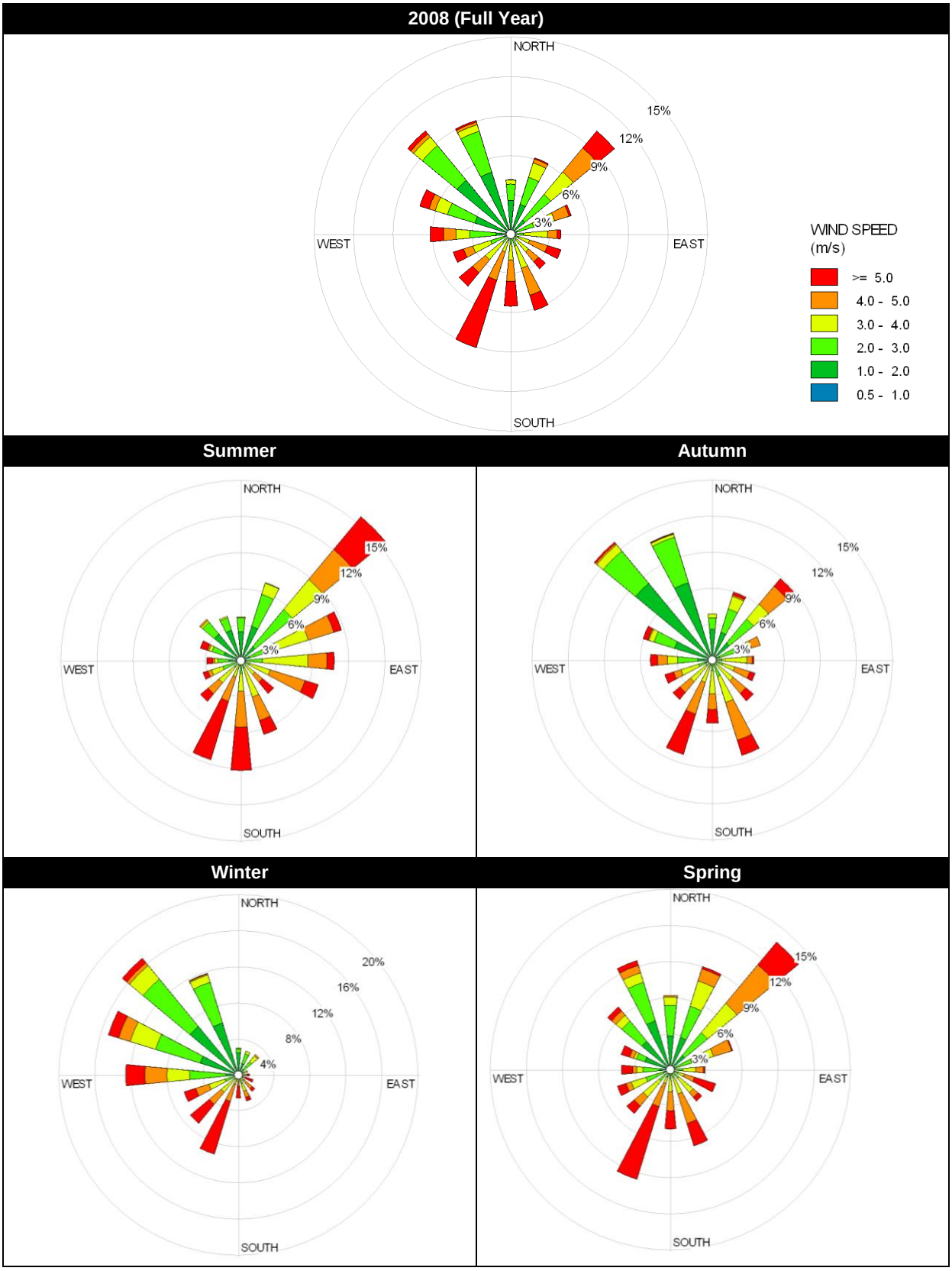
The more detailed approach involves an analysis of meteorological data to determine whether inversions and/or wind effects are significant features warranting assessment. Where assessment is warranted, default parameters are available for use in predicting noise or where preferred, measured values maybe used instead.

A thorough review of the meteorological conditions for the Kurnell area was conducted in the Air Quality Assessment for this project presented in Appendix G. The meteorological data file used for the air quality assessment used the TAPM model to developed a synthetic data set which was assimilated to Caltex's two on site automatic meteorological stations. The following sections provide a summary of the predominating meteorological data.

7.1 Wind

Figures 5-1 show seasonal windroses for the Kurnell area. Winds are shown to be well distributed in all directions, with the slight accentuation of north easterly sea breezes, south-south westerly and north-westerly winds, as common to the coastal areas of Sydney. Also shown is a low proportion of calm winds, constituting only 0.2% of hourly wind records for the year, as is expected given the location on the Kurnell Peninsula.

Figure 5-1 Seasonal Wind Roses for the Kurnell Area based on 2008 (URS, 2013)



7.2 Temperature Inversion

Pasquill-Gifford stability conditions indicate the potential for temperature inversions. There are seven stability classes referred to as A to F. The predicted frequencies of occurrence of stability class are shown in **Tables 5-1** for the Kurnell area.

Pasquill-Gifford stability conditions A to D indicate lapse conditions (negative temperature gradient). Pasquill-Gifford stability conditions E to G indicate temperature inversion conditions, E indicating a temperature gradient of between -0.5 and 1.5 degrees Celsius (^{o}C)/100 m, F indicating a temperature gradient of between 1.5 and 4^{o}C/100 m and G indicating a temperature gradient greater than 4^{o}C/100 m.

Table 5-1 Distribution of Atmospheric Stability Categories for the Kurnell Area

Stability	Percentage Occurrence
A (Extremely Unstable)	1.0%
B (Moderately Unstable)	8.7%
C (Slightly Unstable)	14.2%
D (neutral)	41.4%
E (Slightly Stable)	11.9%
F (Moderately Stable)	22.9%

Stability Classes F apply normally at night when winds are light and the sky is clear. Class E describe intermediate conditions between those described above.

There is a high percentage of D, E and F class conditions for the area (**Tables 5-1**), reflecting a prevalence of unstable meteorological conditions.

7.3 Meteorological Conditions Used for Noise Assessment Purposes

Noise levels experienced by a receiver at relatively large distances from a source can vary considerably under different meteorological conditions, particularly at night. Prevailing wind and air temperature gradients will change over the course of the night time period; hence noise levels at receivers will change even when the source noise level is constant.

The Project area is located in a non-arid area, as prescribed by the INP. For such areas, the INP recommends the following default meteorological conditions that enhance noise levels:

- Moderate (F-class stability category) inversions:

  $3^{o}C$/100 m inversion strength and source-to-receiver drainage flow wind of 2 m/s.

- Gradient wind:

  Source-to-receiver gradient wind of 3 m/s.

Comparison of the synthesised wind and temperature inversion conditions with the INP default conditions indicates that the INP default meteorological conditions provide a worst case scenario in terms of enhancement of operational noise due to meteorological factors.

Therefore INP default meteorological parameters have been used to predict noise levels at each receiver. It is a conservative approach, in that it is likely to predict the upper range of increases in noise levels due to meteorological conditions.

8 NOISE MODELLING

8.1 Noise Modelling Methodology

Noise levels at surrounding residential receivers have been predicted based on indicative types and locations of plant throughout the development. Predictions assume 24 hour operation of the equipment.

Site related noise emissions were modelled with the "CadnaA" acoustic noise prediction software using ISO 9613 noise prediction algorithm. Factors that are addressed in the noise modelling are:

- equipment sound level emissions and location;
- receiver locations;
- ground topography;
- noise attenuation due to geometric spreading;
- ground absorption; and
- atmospheric absorption.

The CadnaA modelling software is accepted by the EPA for use in environmental noise assessments.

8.2 Noise Source Levels

Table 8-1 outlines the proposed construction and operational plant and equipment relevant to this noise assessment (i.e. the plant with potential to contribute to noise levels at the receiver locations) and associated sound power level (SWL).

Table 8-1 Summary of Sound Power Levels Used for Plant and Mobile Equipment

Item	Overall $L_{Aeq(15\ minutes)}$ Sound Power Level (dBA)	Usage Factor (%)
Construction Plant		
Miscellaneous hand tools x3	100	40
Compressor for Pneumatic tools	93	40
Small Generator	93	50
Concrete Pump	106	20
Concrete Truck	105	40
Mobile Crane	104	16
Vacuum Truck	106	20
Excavator	108	20
Reversing Alarm for large trucks	106	5

Item	Overall $L_{Aeq(15\ minutes)}$ Sound Power Level (dBA)	Usage Factor (%)
Operational Plant		
Ship	105	100
Product Pump	93	30
Slop Pump	81	30
Diesel additives injection system	90	5
Chemical drum and dosing pump	80	5
Compressors	90	40

Note: All plant and equipment acquired by Caltex would meet its purchasing policy of "85dBA at the source".

8.3 Noise Scenarios Modelled

The Project has been modelled for two scenarios, namely:

- The initial construction phase which would involve the installation of new plant and the refurbishment of the tanks; and
- The typical worst-case scenario when new operational plant is working concurrently.

The Site has been modelled for typical worst-case operational and construction scenarios for when all plant is working concurrently. The construction scenario is assumed to only take place during daytime while the operational scenario is assumed to take place 24 hour a day, i.e. similar operations during daytime, evening and night time.

8.4 Construction Noise Scenario

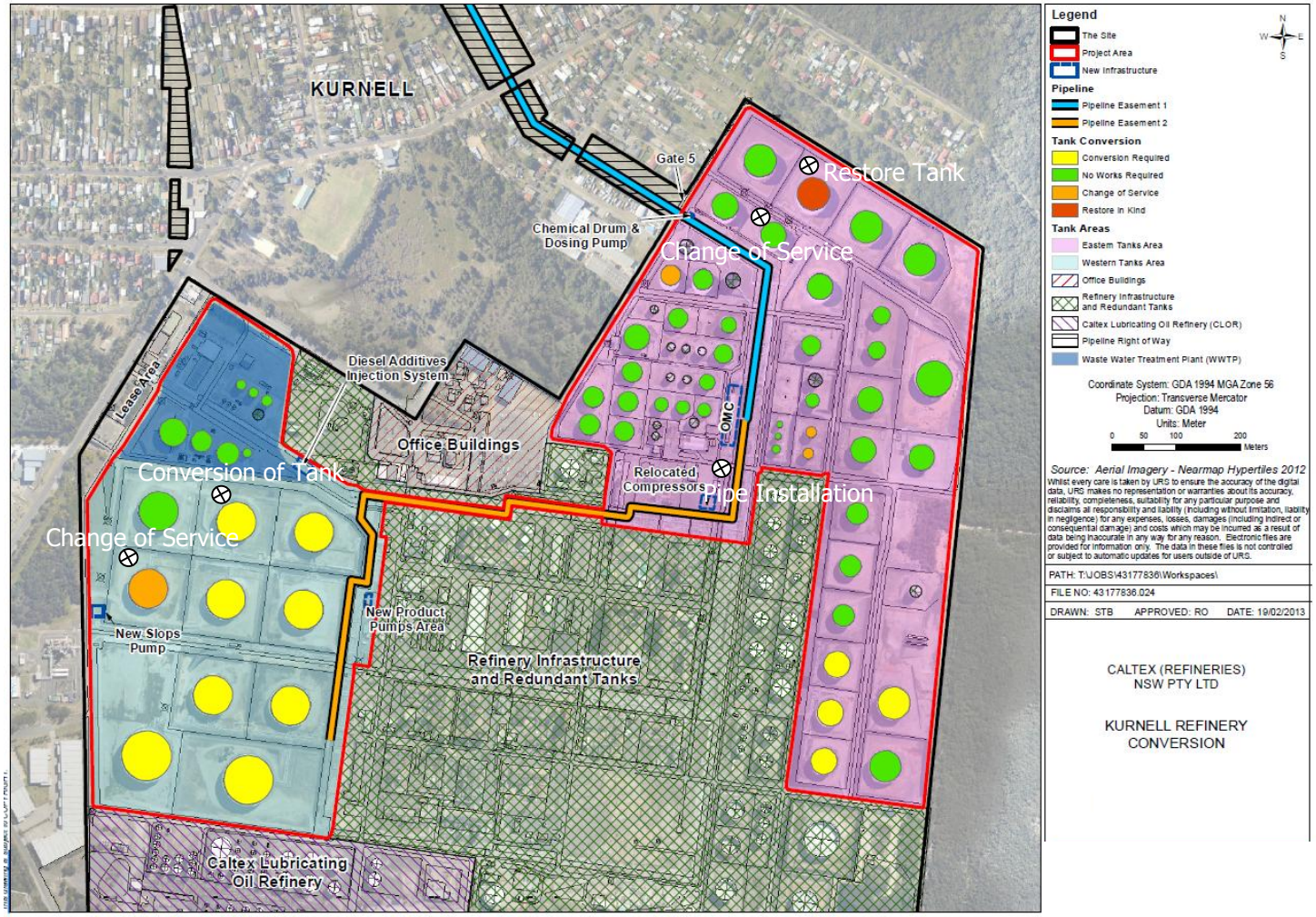
Table 8-2 presents the likely construction equipment need for each construction activity. This equipment has been assumed from the construction description in **Section 2**.

The construction scenario modelled is presented in **Figure 8-1**. The scenario assumes a reasonable 'worst-case' construction scenario with 4 tanks being converted, pipe line being constructed and the new pumps being installed. That is, the modelling assumes that the construction works potentially overlap.

Table 8-2 Summary of Assumed Plant and Mobile Equipment for Construction

Activity	Noise Source	Qty
Tank Conversions	Miscellaneous hand tools x3	1
	Compressor for Pneumatic tools	1
	Small Generator	1
	Vacuum Truck	1
Restore Tank	Excavator	1
	Miscellaneous hand tools x3	1
	Compressor for Pneumatic tools	1
	Small Generator	1
Change of Tank Service	Miscellaneous hand tools x3	1
	Compressor for Pneumatic tools	1
	Small Generator	1
	Vacuum Truck	1
Installation of Piping, Pumps and Associated Infrastructure	Miscellaneous hand tools x3	1
	Truck	1
	Crane	1
	Small Generator	1

Figure 8-1 Construction Scenario



8.5 Operational Noise Scenario

The operational scenario has been modelled assuming that all the new plant and equipment proposed for the Project is working concurrently following the shutdown of the refinery plant, mid year 2014 (See **Figure 8-2**). The following plant is modelled:

- Ship at berth;
- New Slops Pump Shed (1x pump);
- New Product Pumps Area (5x pumps);
- 1x Diesel Additives Injection System;
- Compressor Area (2x Compressors); and
- 1x Chemical Drum & Dosing Pump.

It should be noted that the cessation of refining operations would reduce noise levels substantially at the Site. An appreciation of the existing noise levels around the Site can be gauged from noise assessments conducted for the plants pollution reduction program (HFP, 2011) which is summarised in **Section 10** of this report discussing cumulative noise impacts from the Site.

Figure 8-2 Operational Scenario

9 NOISE PREDICTIONS

This section presents the predicted construction and operational noise levels at the surrounding identified receivers for the Project.

9.1 Construction Noise

Table 9-1 presents the predicted construction noise levels at the receiver locations surrounding the Site.

Table 9-1 Predicted Noise Levels – Construction – dB(A)

#	Sensitive Receptors	Predicted L_{Aeq} Noise Level	Day 0700-1800h $L_{Aeq,15min}$ (dBA)	Out of hours 18:00h 22:00h $L_{Aeq,15min}$ (dBA)	Out of hours 22:00h 7:00h $L_{Aeq,15min}$ (dBA)	Complies (Yes/No)
R1	Cook Street (Industrial Premises)	44	75	-	-	Yes
R2	30D Cook Street (Residential Premises)	40	46	40	35	Yes/Yes/No
R3	Reserve Road (Residential Premises)	49	50	45	45	Yes/No/No
R4	Ranger's House (Residential Premises)	28	51	46	46	Yes/Yes/Yes
R5	Prince Charles Parade (Residential Premises)	34	50	45	45	Yes/Yes/Yes
R6	Corner of Captain Cook Drive and Silver Beach Rd (Residential Premises)	36	57	52	43	Yes/Yes/Yes
R7	Tasman Street (Residential Premises)	38	50	44	41	Yes/Yes/Yes

#	Sensitive Receptors	Predicted L_{Aeq} Noise Level	Day 0700-1800h $L_{Aeq,15min}$ (dBA)	Out of hours 18:00h 22:00h $L_{Aeq,15min}$ (dBA)	Out of hours 22:00h 7:00h $L_{Aeq,15min}$ (dBA)	Complies (Yes/No)
R8	Cook Street (Residential Premises)	39	50	45	43	Yes/Yes/Yes

Table 9-1 illustrates the predicted construction noise levels at surrounding residences.

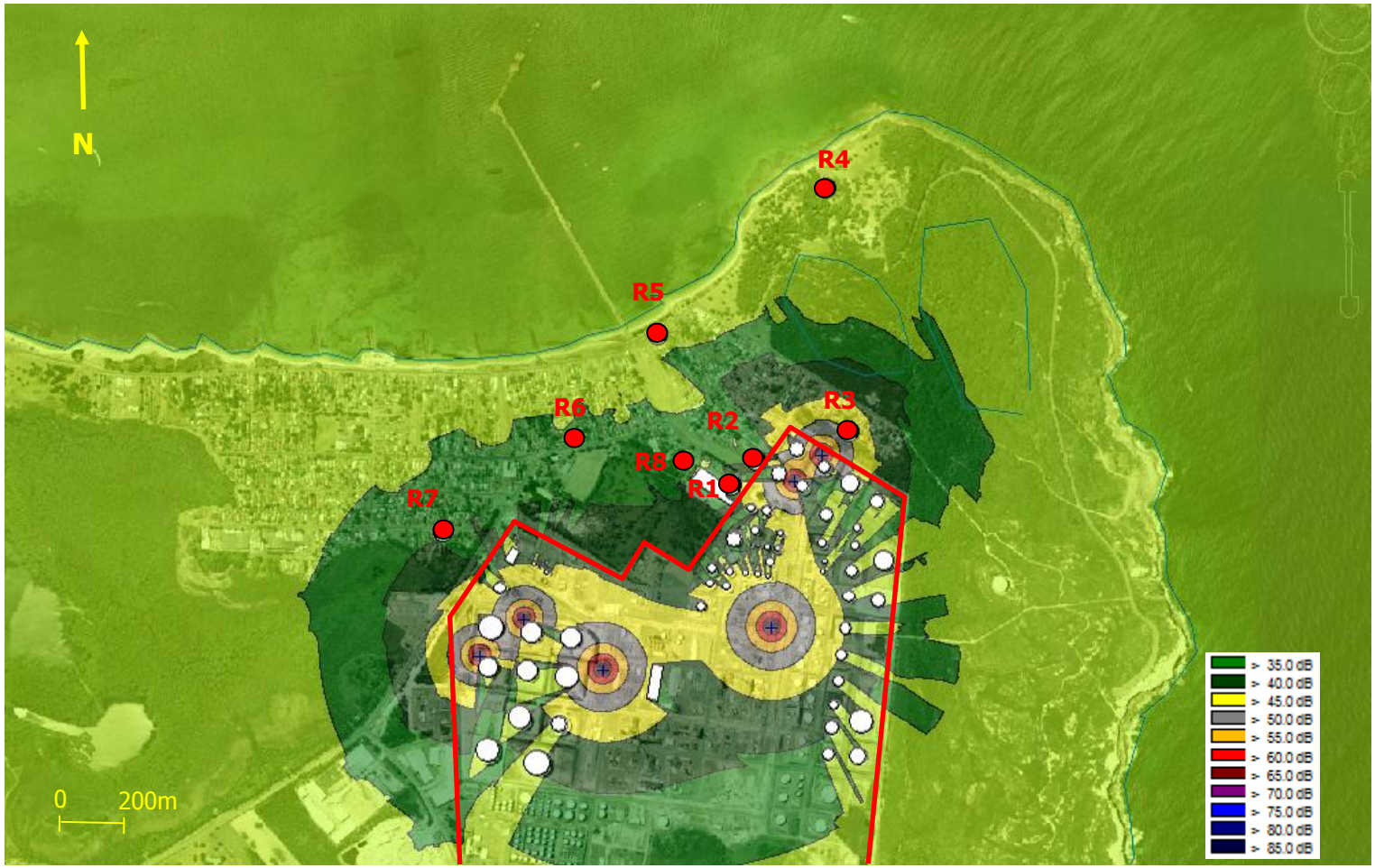
The construction noise levels as a result of the Project are predicted to be below the daytime construction noise criteria at all receivers. For out of hours construction work noise levels as a result of the Project are predicted to be below evening and night construction noise criteria at all receivers except R2 and R3 where minor exceedances of up to 5 dB have been calculated. However, as the construction activities are going be taking place while the refinery is still in operation the existing noise environment in addition to the construction noise levels need to be considered. The current noise levels for the Site with all plant operating are summarised in **Table 11-1.** The predicted construction noise levels presented in **Table 9-1** are at least 10dB below the current noise levels. Therefore, the noise contribution from the proposed construction activities have an acoustically insignificant contribution to the existing noise levels. Cumulatively, the additional construction noise levels and the current noise levels for the Site would also meet the Site's current EPL noise limits.

The nature of the proposed works are the same as the activites that Caltex carries out as part of their ongoing maintenance and Turnaround and Inspection work. For the latter, the Site's existing Environmental Protection Licence (No. 837) (EPL) asks that Caltex ensure that any operational or maintenance activities on Site do not exceed 70 dB (A) between 7.00am and 10.00pm, and do not exceed 65 dB (A) between 10.00 pm and 7.00 am. The working hours for any construction works that are the the same as ongoing maintenance activities would be governed by the noise limits presented in the relevant EPL for the Site.

As can be seen from the Projects construction noise contours, the predicted levels at the boundary of the Site are well below the EPL daytime and night time noise limits and as such the limits would comply at all the closest residential receivers.

It should be noted that the majority of the conversion works would typically be completed between 7.00am to 10.00pm seven days a week, with some works consistent with Caltex's existing maintenance procedures occurring over a 24 hour period.

Figure 9-1 Predicted $L_{Aeq(15\ min)}$ Construction Daytime Noise levels at Surrounding Residences



9.2 Operational Noise

Table 9-2 presents the predicted Project's operational noise levels at the receiver locations surrounding the Site during day and evening under calm meteorological conditions, day and evening under windy meteorological conditions and night time under temperature inversion meteorological conditions, respectively..

Table 9-2 Predicted L_{Aeq} Noise Levels – Operation – dB(A)

Receiver	Description	Predicted L_{Aeq} Noise Level			*INP* Project Specific Noise Levels (Day/Evening/Night)	Complies (Yes/No)
		Calm	3 m/s down wind	3°C/100 m inversion strength		
R1	Cook Street (Industrial Premises)	29	31	31	70	Yes
R2	30D Cook Street (Residential Premises)	31	33	33	41/40/35	Yes/Yes/Yes
R3	Reserve Road (Residential Premises)	25	29	29	45/45/45	Yes/Yes/Yes
R4	Ranger's House (Residential Premises)	33	38	38	46/46/45	Yes/Yes/Yes
R5	Prince Charles Parade (Residential Premises)	34	39	39	45/45/45	Yes/Yes/Yes
R6	Corner of Captain Cook Drive and Silver Beach Rd (Residential Premises)	31	36	36	52/44/41	Yes/Yes/Yes
R7	Tasman Street (Residential Premises)	34	39	39	45/42/41	Yes/Yes/Yes
R8	Cook Street (Residential Premises)	35	39	39	45/43/43	Yes/Yes/Yes

Note: If R1 was a residential receptor it would also comply with residential criteria.

The operational noise levels as a result of the Project are predicted to comply with the daytime, evening and night time operational Project Specific Noise Levels at all the receivers.

Figure 9-2, Figure 9-3 and **Figure 9-4** illustrate the predicted noise levels at surrounding resident receiver locations during day and evening under calm meteorological conditions, day and evening under windy meteorological conditions and night time under temperature inversion meteorological conditions, respectively.

Figure 9-2 Predicted $L_{Aeq(15min)}$ Operational Day / Evening Noise at Surrounding Resident Receivers (Calm)

Figure 9-3 Predicted $L_{Aeq(15min)}$ Operational Day / Evening Noise at Surrounding Resident Receivers (3m/s down wind)

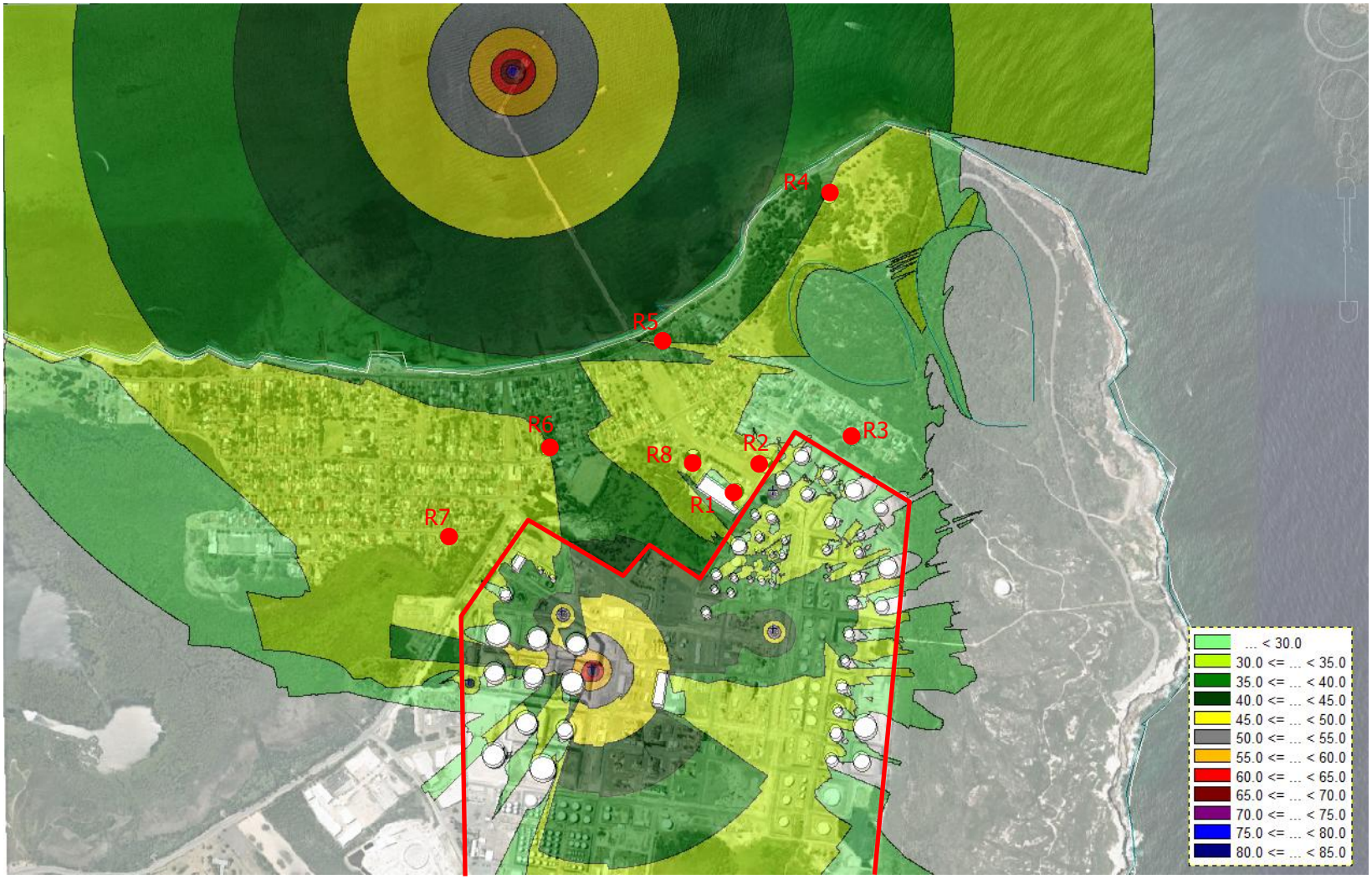
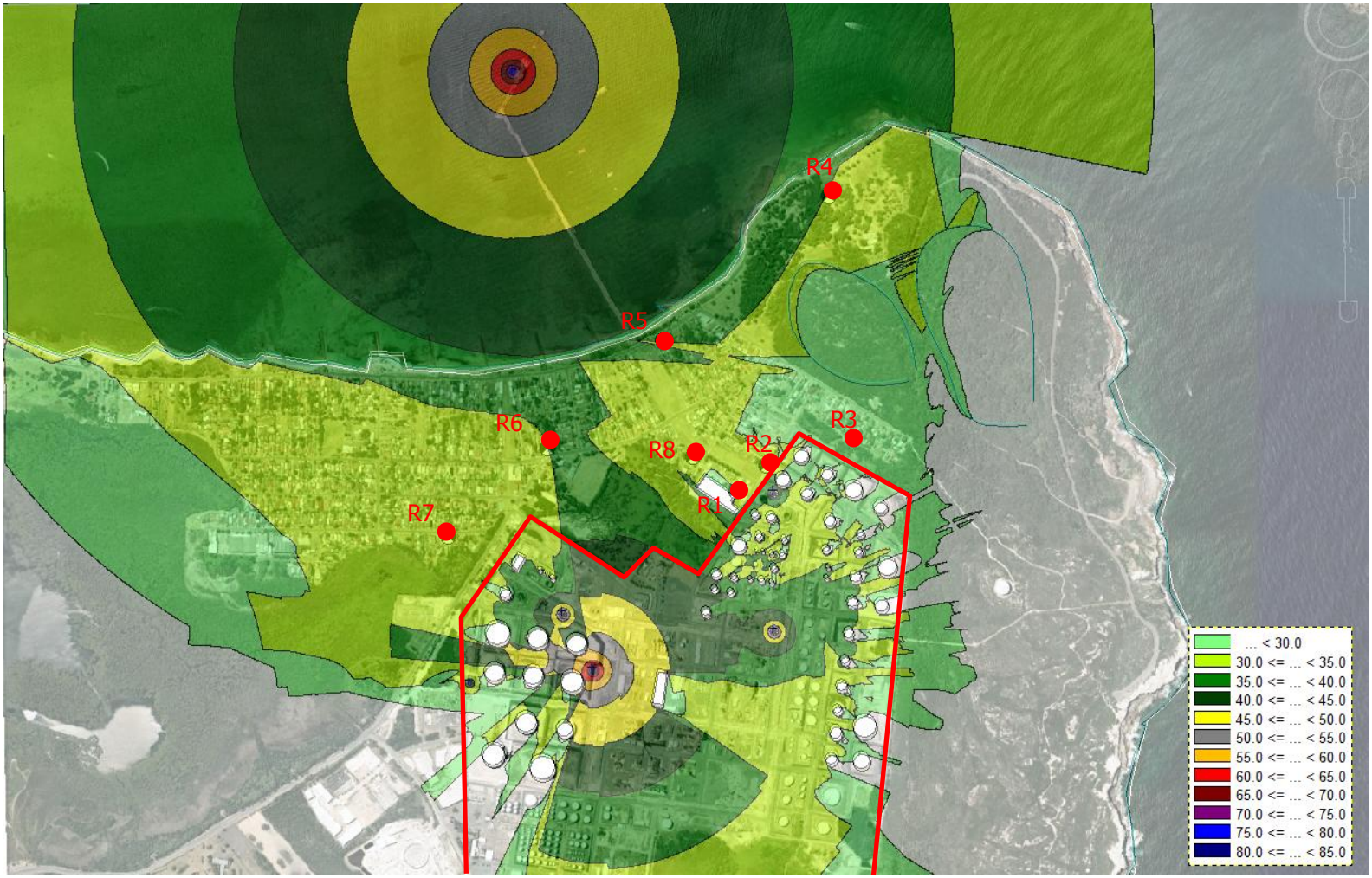


Figure 9-4 Predicted $L_{Aeq(15min)}$ Operational Night Time Noise at Surrounding Resident Receivers (3°C/100 m temperature inversion strength)



10 TRAFFIC NOISE

10.1 Traffic Noise Criteria

Noise Criteria for assessment of road traffic noise are set out in the NSW Government's *NSW Road Noise Policy (RNP)*. **Table 10-1** presents the assessment criteria for residences to be applied to particular types of project, road category and land use.

In summary the noise level goals at the residential receivers, for this Project, based on the *RNP* are:

- $L_{Aeq,15hr}$ day 60 dBA
- $L_{Aeq,9hr}$ night 55 dBA

Table 10-1 Traffic Noise Criteria Extracted from the *NSW RNP*

Road category	Type of project/land use	Assessment criteria – dB(A)	
		Day (7 a.m.–10 p.m.)	Night (10 p.m.–7 a.m.)
Freeway/ arterial/ sub-arterial roads	1. Existing residences affected by noise from **new** freeway/arterial/sub-arterial road corridors	$L_{Aeq,\ (15\ hour)}$ 55 (external)	$L_{Aeq,\ (9\ hour)}$ 50 (external)
	2. Existing residences affected by noise from **redevelopment** of existing freeway/arterial/sub-arterial roads 3. Existing residences affected by **additional traffic** on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,\ (15\ hour)}$ 60 (external)	$L_{Aeq,\ (9\ hour)}$ 55 (external)
Local roads	4. Existing residences affected by noise from **new** local road corridors 5. Existing residences affected by noise from **redevelopment** of existing local roads 6. Existing residences affected by **additional traffic** on existing local roads generated by land use developments	$L_{Aeq,\ (1\ hour)}$ 55 (external)	$L_{Aeq,\ (1\ hour)}$ 50 (external)

In addition, where the above criteria are already exceeded as a result of existing traffic the policy notes:

> *For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.*

10.2 Traffic Noise Assessment

Vehicles from the Project would access the Project Area from the Captain Cook Drive. Captain Cook Drive is the major access road to the Kurnell Peninsula on the southern shore of Botany Bay from the wider Sydney road network. It connects Taren Point Road to the west (and further to the Princes Highway via The Boulevard) with Prince Charles Parade to the east and the suburb of Kurnell. It has three lanes in each direction west of Gannons Road with a median strip separating each carriageway, reducing to two lanes in each direction and divided carriageways between Gannons Road and Woolooware Road, and further decreasing to an undivided carriageway with one lane in each direction east of Woolooware Road to Kurnell.

10.2.1 Construction Traffic Noise

The traffic generated by the Project would incorporate a mix of construction plant vehicles, delivery vehicles and construction personnel movements. A summary of the construction vehicle mix includes:

- construction vehicles, 10 trucks (10 daily return trips) maximum would be required at the Site during the construction phase. These vehicles would typically include cranes and semi-trailers etc;
- equipment and material delivery vehicles, 10 trucks (10 daily return trips) maximum would be required to deliver the construction equipment and materials to the Site; and
- construction personnel, 140 additional personnel (140 daily return trips) on average would be required at the Site during the construction phase.

The existing traffic noise levels along the Captain Cook Drive already exceed the noise criteria of 60 and 55 dB(A) for the day and night, respectively. Captain Cook Drive east of Gannons Road has an average annual daily traffic flow of 38,810 (two-way) vehicles per day in 2012. Given these volumes the noise contribution from traffic generated by the Project construction would be negligible at residences on Captain Cook Drive (that is, less than a 2dB increase).

10.2.2 Operational Traffic Noise

Once the Project is complete, Caltex would import finished products (gasoline, jet fuel, diesel and fuel oil) through the two fixed berths at the existing wharf and the sub berth located in Botany Bay. This product would be stored in existing and converted tanks.

The major product distribution systems would continue to operate in line with current practice, i.e. product would be pumped under Botany Bay to the Banksmeadow Terminal, the Sydney / Newcastle pipeline or the Joint User Hydrant Installation (JUHI) at Sydney Airport for further distribution. Road transport of products from the Site would cease.

With the cessation of the refining operation at the Site and the introduced high levels of automation of the terminal, the number of employees on Site would reduce. It is anticipated approximately 100 employees would provide routine operational or supporting services to the terminal. These employees would operate in a shift arrangement 24 hours a day, 7 days a week. Up to an additional 90 people would be required at the Site during maintenance shutdown periods during the operation of the terminal, which are periodic and for short time frames (8-12 weeks).

With the reduction in employees and cessation of routine road haulage at the Site the number of vehicles generated by the Project during its operational phase would be significantly fewer than the number of vehicles generated by the existing refinery operations, resulting in a net reduction in traffic volumes along Captain Cook Drive and therefore traffic noise. The impact produced by operational traffic noise associated with the Project would therefore be less than the existing impact from traffic travelling to / from the Site.

11 CUMULATIVE NOISE ASSESSMENTS

11.1 Construction

Caltex are proposing dredging work and upgrades to the Kurnell Port and Berthing Facility. These upgrades have been described in the Caltex Kurnell Port and Berthing Facility Environmental Impact Statement (URS, 2012) (Kurnell Port and Berthing Project). There is potential for cumulative construction noise impacts between the Port and Berthing Facility Project and the Kurnell Refinery Conversion Project as both projects are likely to occur between the 3rd quarter of 2013 and the second half of 2014.

11.1.1 Construction Noise

A construction noise assessment was conducted for the Kurnell Port and Berthing Project (URS, 2012). The construction impacts from the Kurnell Port and Berthing Project have identified potential impacts at residences on Prince Charles Parade and the Rangers' House as these are the closest residential receivers. Maximum construction noise levels including piling and impulsive noise sources where predicted to be between 56 and 49 dBA for day time construction works (URS, 2012).

Construction noise level for the proposed Project are identified in Section 8.1 and show predicted construction noise levels of 34 dBA at Prince Charles Parade and 28 dBA at the Rangers' House. The predicted noise contribution from the proposed Project would have an acoustically insignificant contribution to the construction noise levels from the Kurnell Port and Berthing Project.

11.1.2 Construction Traffic Noise

The Caltex Kurnell Port and Berthing Facility Environmental Impact Statement (URS, 2012) would include the following construction vehicle generation:

- 60-100 construction truck movements would be required infrequently and intermittently over the duration of the project;
- 100 concrete trucks would be required to make deliveries to site over a 6-8 week period; and
- Up to 30 construction personnel (30 daily return trips).

Construction traffic noise levels for the proposed Project are discussed in **Section 9.1**. Due to the anticipated small volume of vehicle movements from both the Kurnell Port and Berthing Project and the proposed Project along Captain Cook Drive, the cumulative road traffic noise impacts would be less than 2dB and as such are considered a negligible impact.

11.2 Operational Noise

The most accurate current noise levels for the Site with all plant operating were conducted for the Site's pollution reduction program (HFP, 2011) which is presented in the noise contour figure in **Appendix A** and summarised in **Table 11-1.** It can be concluded from the noise contours in **Appendix A** that the Site meets its EPL noise limits.

Table 11-1 Estimated Site Noise Levels with all Plant Operating (HFP, 2011)

#	Receiver	Predicted L_{Aeq} Noise Level* 3 m/s Southerly wind
R1	Cook Street (Industrial Premises)	57
R2	30D Cook Street (Residential Premises)	57
R3	Reserve Road (Residential Premises)	57-53
R4	Ranger's House (Residential Premises)	<45
R5	Prince Charles Parade (Residential Premises)	50
R6	Corner of Captain Cook Drive and Silver Beach Rd (Residential Premises)	55
R7	Tasman Street (Residential Premises)	55
R8	Cook Street (Residential Premises)	52

*Note: * Levels interpolated from the noise contour figure in **Appendix A**.*

The predicted operational noise levels presented in **Section 8** are at least 10dB below the current noise levels. Therefore, the predicted noise contribution from the proposed Project would have an acoustically insignificant contribution to the existing noise levels. As such, in the short-term when the refinery is still operating, the cumulative noise levels from the Site including the Project would not change from those levels presented in **Table 11-1**.

Cumulatively, the additional Project noise levels and the current noise levels for the Site with all plant operating including the refinery would also meet the Site's current EPL noise limits.

Due to the cessation of the refining at the Site, operational noise associated with the Site would reduce substantially and operational noise levels as a result of the Project would remain. These are predicted to be below the *INP* daytime, evening and night time noise criteria at the closest receivers.

12 CONCLUSION

This noise study has assessed the potential construction and operational noise impacts associated with the proposed conversion of the existing Kurnell Refinery into a Finished Product Terminal.

The nature of the proposed works are the same as the activites that Caltex carries out as part of their ongoing maintenance and Turnaround and Inspection work. For the latter, the Site's existing Environmental Protection Licence (No. 837) (EPL) asks that Caltex ensure that any operational or maintenance activities on Site do not exceed 70 dB (A) between 7.00am and 10.00pm, and do not exceed 65 dB (A) between 10.00 pm and 7.00 am. The working hours for any construction works that are the the same as ongoing maintenance activities would be governed by the noise limits presented in the relevant EPL for the Site.

The predicted Project's operational noise levels comply with the daytime, evening and night time *INP* noise criteria at all the closest receivers.

The predicted operational noise levels from the Project presented are at least 10dB below the current noise levels. Therefore, the predicted noise contribution from the proposed Project would have an acoustically insignificant contribution to the existing noise levels. As such, in the short-term when the refinery is still operating, the cumulative noise levels from the Site including the Project would not change.

Cumulatively, the additional Project noise levels and the current noise levels for the Site would meet the Site's EPL noise limits.

Due to the cessation of refining, operational noise associated with the Site would reduce substantially and only operational noise levels as a result of the Project would remain. These noise levels are predicted to be below the *INP* daytime, evening and night time noise criteria at the closest receivers.

The contribution from traffic generated by the Project construction would be negligible at residences on Captain Cook Drive (less than 2 dB increase). As a result of the cessation of the refinery operation and the associated traffic reduction, the traffic noise associated with the Project would be less than the existing impact from vehicles travelling to / from the Site.

In conclusion, the proposed conversion of the refinery into a finished product terminal would not adversely impact on the acoustic amenity of surrounding receivers.

13 REFERENCES

- Department of Environment and Conservation (2006) *Assessing Vibration: a technical guideline.*
- Environment Protection Authority (2000) *NSW Industrial Noise Policy*.
- Environment Protection Authority (2011) *NSW Road Traffic Noise Policy*.
- Office of Environment and Heritage (2011) *Application Notes – NSW Industrial Noise Policy*. Website: http://www.environment.nsw.gov.au/noise/applicnotesindustnoise.htm. Accessed 5 October 2011.
- Department of Environment, Food and Rural Affairs (2005) Update of Noise Database for Prediction of Noise on Construction and Pen Sites.
- Federal Highway Administration (2006) Construction Noise Handbook.
- HFP Acoustic Consultants Corp (2011) 2011 Computer Noise Update Project Caltex Refineries (NSW) Pty Ltd.
- URS Australia Pty Ltd (2011) Kurnell B Line Upgrade Project Environmental Assessment.
- URS Australia Pty Ltd (2012) The Kurnell Port and Berthing Project Environmental Assessment.
- URS Australia Pty Ltd (2013) Kurnell Refinery into a Finished Product Terminal – Air quality Assessment – Appendix G

APPENDIX A

KURNELL REFINERY OFF-SITE NOISE PREDICTIONS (HFP ACOUSTIC CONSULTANTS CORP, 2011)

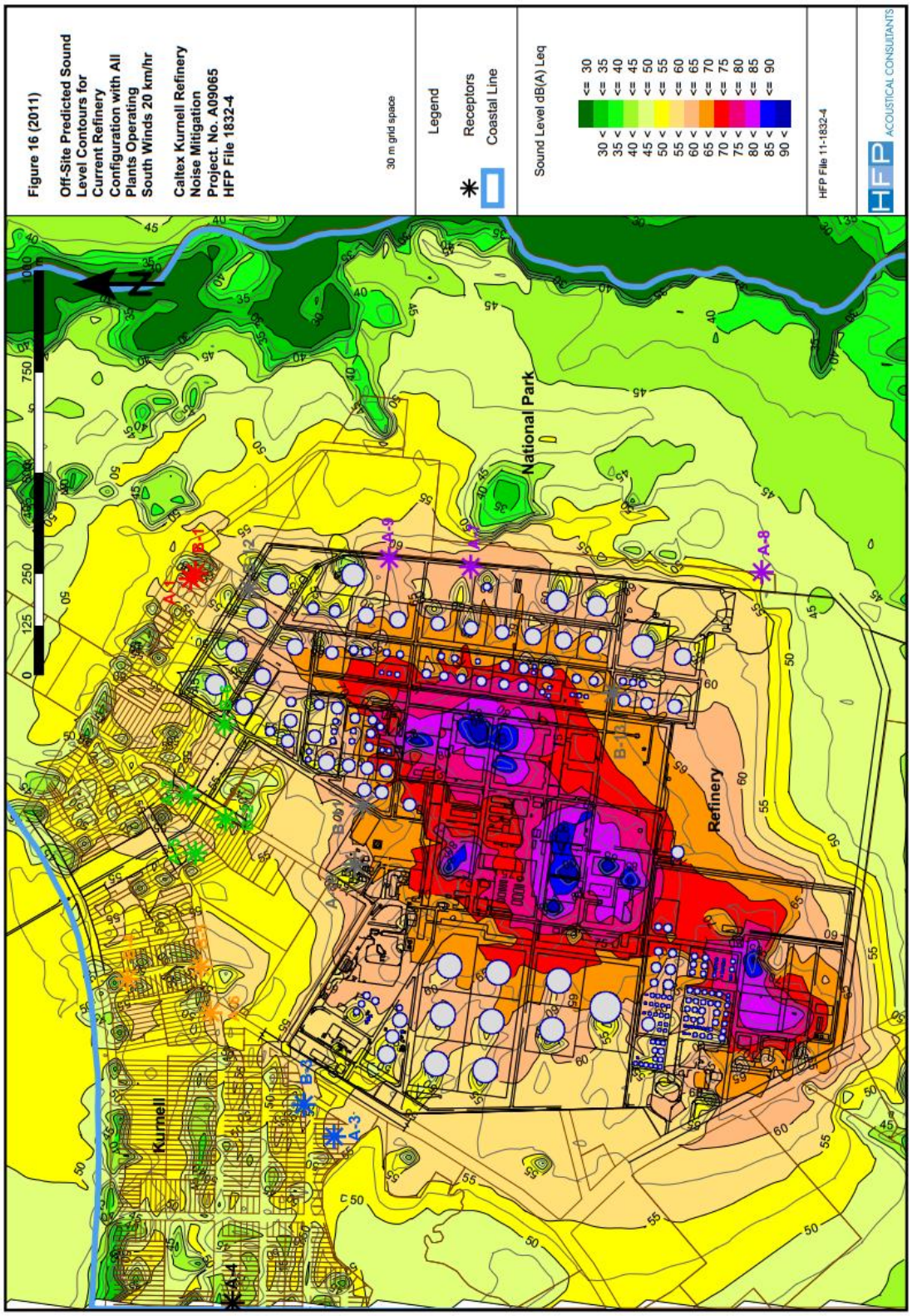


Figure 16 (2011)
Off-Site Predicted Sound Level Contours for Current Refinery Configuration with All Plants Operating South Winds 20 km/hr
Caltex Kurnell Refinery Noise Mitigation
Project. No. A09065
HFP File 1832-4
30 m grid space
Legend
Receptors
Coastal Line
Sound Level dB(A) Leq
HFP File 11-1832-4
ACOUSTICAL CONSULTANTS
National Park
Refinery
Kurnell
A-1
A-2
A-3
A-4
A-5
A-6
A-7
A-8
A-9
B-1
B-2
B-3
B-13