Appendix E

Noise & Vibration Impact Assessment

ACOUSTICS AND AIR

APPENDIX E

KURNELL REFINERY CONVERSION
PROPOSED DEMOLITION WORKS
DEMOLITION NOISE AND VIBRATION ASSESSMENT

REPORT NO. 14074
VERSION C

NOVEMBER 2014

PREPARED FOR

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ON BEHALF OF

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AAAC

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Celebrating 50 Years in 2012

Wilkinson Murray is an independent firm established in 1962, originally as Carr & Wilkinson. In 1976 Barry Murray joined founding partner Roger Wilkinson and the firm adopted the name which remains today. From a successful operation in Australia, Wilkinson Murray expanded its reach into Asia by opening a Hong Kong office early in 2006. 2010 saw the introduction of our Queensland office and 2011 the introduction of our Orange office to service a growing client base in these regions. From these offices, Wilkinson Murray services the entire Asia-Pacific region.

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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.

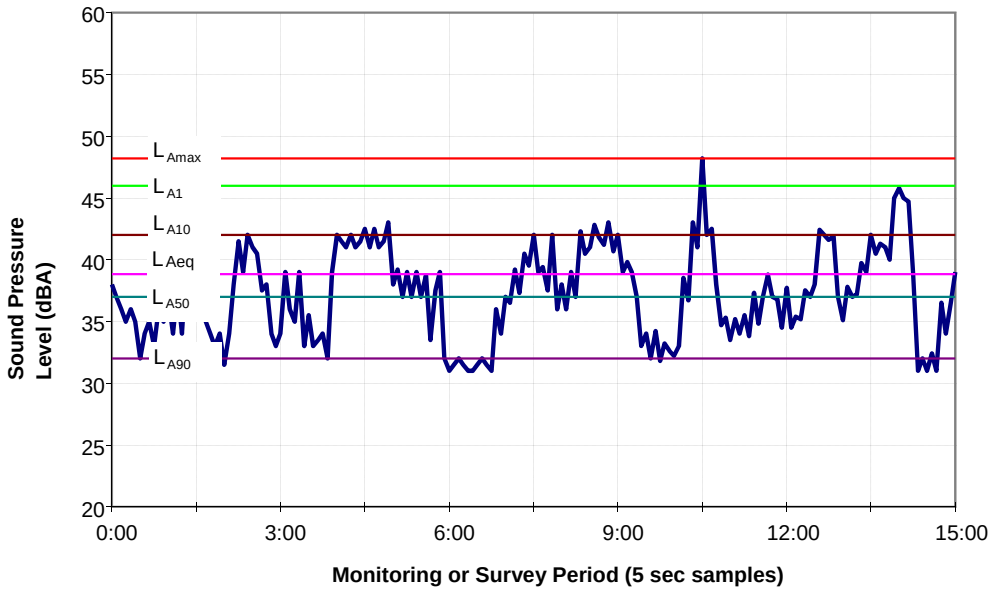
L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

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.



1 INTRODUCTION

Caltex Refineries (NSW) Pty Ltd (hereafter referred to as Caltex) announced in July 2012 that it would progress with converting Kurnell Refinery (the Site) to a finished product terminal (the Project).

This Project has been divided into two initial phases:

1. Converting infrastructure to allow the Site to operate as a terminal and shutdown of the refinery; and

2. Demolition and removal of redundant infrastructure.

Caltex has received development consent to convert the Kurnell Refinery into a Finished Product Terminal (application number: SSD 5544) (referred to as 'the conversion works'). Caltex is now seeking a modification to development consent SSD 5544 for works related to the demolition, dismantling or removal of refinery process units, redundant tanks, redundant pipelines, redundant services and redundant buildings as well as associated minor civil works and waste management activities. These are referred to as 'the demolition works'.

Caltex is seeking approval for the demolition works as a modification to development consent SSD 5544 under S.96 (2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) as the works are a continuation of the conversion process, but may result in certain impacts that were not considered under the initial consent. Completion of the demolition works would ensure that the conversion process at the Site can be successfully completed in line with the Project objective. The demolition works would introduce certain impacts that would be temporary in nature and can be appropriately managed; ensuring that end result of these works would be substantially the same development as approved under SSD 5544.

Wilkinson Murray Pty Limited (WMPL) was engaged to undertake a desktop environmental noise and vibration assessment associated with proposed demolition works for the Project.

2 PROJECT DESCRIPTION

The demolition and removal of redundant infrastructure at the Site would broadly involve the following works:

- Demolition, dismantling or removal of:
  - refinery process units;
  - redundant tanks;
  - redundant pipelines;
  - redundant services; and
  - redundant buildings.
- Associated minor civil works with the removal of foundations and underground services;
- Waste management activities; and
- Returning the works area to grade.

Following the demolition works the Site will operate as finished product terminal. The modification does not change the operation of the terminal, as approved by SSD 5544.

The majority of the demolition works would be completed within the boundary of the Site (as defined by the EIS for SSD 5544). The exceptions to this include:

- the removal of the Continental Carbon Pipeline which is located on land owned by Caltex to the south of the Site;
- sections of the redundant pipelines that run through the Western and Eastern ROWs that are located outside of the Site (i.e. under the roads that cross the ROWs and under Silver Beach); and
- the removal of the cooling water intake pipelines and associated infrastructure from the Kurnell Wharf.

Figure 2-1 shows the location of the proposed demolition works.

2.1 Demolition

For the purpose of the modification application, it has been assumed that the majority of the redundant components highlighted in **Figure 2-1** would be demolished. The demolition would be mainly to ground level, however, the below ground removal of associated foundations, slabs, pipelines and some redundant services would also be required. The works would also involve the removal of insulation, corrosion protection materials and other building materials prior to demolition taking place.

The demolition works would follow the general order of:

- Demolition of the refinery process units and associated pipelines by:
  - Disconnection and removal of pipelines from process units;

  - Demolition of the refinery process units by lowering to the levels where they can be more easily be cut up using heavy machinery;
  - Intermediate storage on Site as required prior to disposal, recycling or divestment.

- Removal of the foundations of the process units and redundant slabs. Removal of the foundations would require excavation work.
- Removal of the redundant cabling and certain underground services including the Oily Water Sewer from the area beneath the refinery process units. Removal of the underground services would require excavation work.
- Removal of a number of tanks and vessels from both the eastern and western tank areas. These structures will be demolished using heavy machinery. Once the tanks are cut up they would be stored in an appropriate location on Site prior to disposal.
- Removal of seven underground pipelines. This work will include removing the soil from above the pipeline and stockpiling it close to the trench, removing the pipeline and backfilling the trench. The seven redundant pipelines are:
  - The cooling water outlet line running through the western right of way;
  - Two cooling water intake lines running through the eastern right of way;
  - Three redundant product lines running through the eastern right of way; and
  - The Continental Carbon pipeline running south from the main refinery site.
- Demolition and removal of a number of buildings on Site related to the operation of the refinery using heavy machinery such as bulldozers and excavators. Building foundations and services would also be removed. Some minor excavation may be required.

As the works progress, the soil removed during the excavation work would be stockpiled and where appropriate, reused as backfill. Additional backfill material may be brought to Site as required.

The concrete from the demolition works would be crushed on the southern part of the Site and used as an aggregate to cover the parts of the Site where structures and buildings have been removed.

2.1.1 Pipeline Removal

One redundant pipeline would be removed from the Western ROW (refer to **Figure 2-1**). The works to remove this pipeline would include the following:

- Within the Western ROW, the cooling water outlet would be excavated, removed and the surface returned to grade.
- Where the pipeline crosses Captain Cook Drive, Bridges Street, Torres Street and Prince Charles Parade, the roads would be excavated to remove the pipeline before repairing the road in kind.

- From Prince Charles Parade, through Silver Beach and 20m below the low tide mark into Botany Bay the pipeline would be excavated where it is covered with sediment/sand. The pipeline may need to be cut but ideally be dismantled at the original construction joints prior to lifting and removal. The area would be backfilled with suitable material to restore the beach and sea bed profile and the beach rehabilitated.

Five redundant pipelines would be removed from the Eastern ROW (refer to **Figure 2-1**). Two of these pipes are the redundant cooling water inlet pipes, and the other three are redundant product pipelines. These pipelines run from Gate 5 to Kurnell Wharf and are of varying diameters.

- Within the Eastern ROW, these redundant pipelines would be excavated, removed and the surface returned to grade.
- Where the pipelines crosses Cook St, Captain Cook Drive and Prince Charles Parade the roads would be excavated to remove the pipelines before being backfilled and the roads repaired in kind.
- To the north of Prince Charles Parade the two cooling water inlet pipelines move from underground to aboveground and are mounted on Kurnell Wharf. On the wharf these pipelines would be removed and transferred onto a truck on the wharf by a barge crane. This work would not result in disturbance of the sea bed as the pipeline supports are part of the wharf structure and would remain in situ. Some pump infrastructure from the wharf pump house would also be removed.
- The four redundant product pipelines would remain on the wharf.

2.2 Staging and Program

Caltex is planning to commence the demolition from the second quarter of 2015. The precise timing would be dependent on the timing of the development consent. The work is likely to be staged as follows:

- Demolition of the refinery process units and associated pipework, foundations and services;
- Demolition of redundant tanks;
- Removal of redundant pipes from various pipeways and right of ways;
- Demolition of redundant buildings and associated foundations and services; and
- Concrete crushing.

The demolition works are likely to be completed by the end of 2017. An indicative staging plan is provided in **Table 2-1**.

Table 2-1 Indicative Demolition Works Staging

Task	Date
The Conversion Works	
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	Q4 2014
Continued Tank Conversions	End 2014 – end 2016
CONVERSION TO TERMINAL COMPLETED	December 2016
The Demolition Works	
Demolition of Refinery Process Units	Mid 2015 – Mid 2017
Demolition of Tanks	Mid 2015 – End 2017
Pipeline Removal	Start 2016 – End 2017
Demolition of Buildings	Mid 2016 – End 2017
Concrete Crushing	End 2017

2.3 Traffic

In addition to private vehicles movements, the demolition works are likely to result in approximately 2,675 additional heavy vehicle movements to and from the Site between the second quarter of 2015 and 2017. This equates to approximately 6 heavy vehicle movements a day on average with a peak of 60 additional movements on any one day.

2.4 Demolition Hours

The working hours would be in line with the conditions of consent for SSD 5544, in particular Conditions C18, C19 and C20.

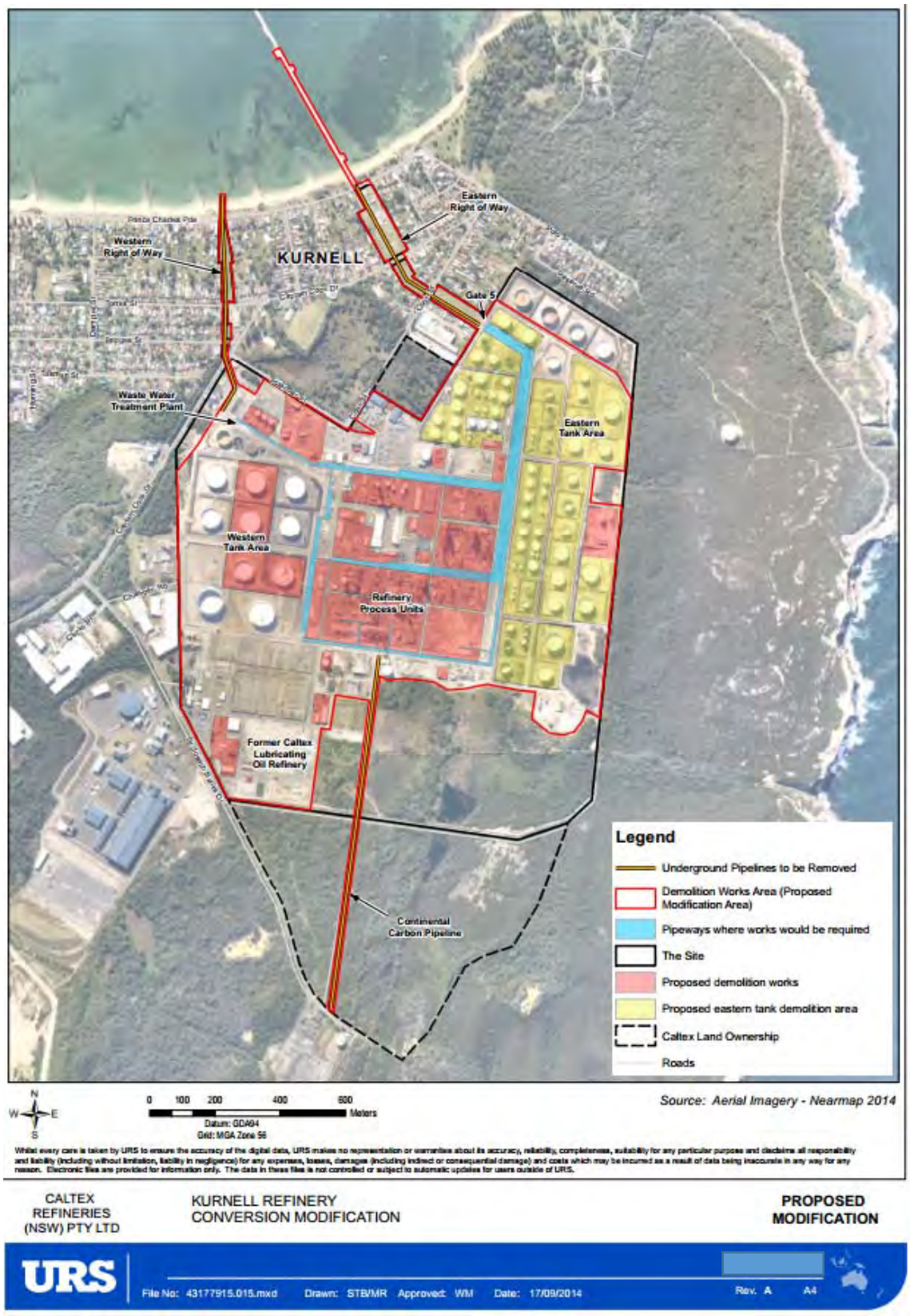
In summary:

- Construction to be completed between 7.00 am and 10.00 pm seven days a week (Condition C18);
- High noise generating construction works would be confined to less sensitive times of the day and not outside the hours of 7.00 am to 6.00 pm Monday to Saturday (Condition C19); and
- Construction outside those hours would only be undertaken in certain circumstances as defined in Condition C20, namely:
    - Works that are inaudible at the nearest sensitive land receivers;
    - Works that are consistent with Caltex's existing maintenance procedures and are in accordance with the existing EPL;
    - Works agreed to in writing by the EPA or the Department;

- For the delivery of materials required outside these hours by NSW Police Force or other authorities for safety reasons; or
- Where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.

As the pipeline removal works within the ROWs would occur close to residential receivers it is proposed that these works are confined to 7.00 am to 6.00 pm Monday to Saturday as per Condition C19.

Figure 2-1 Proposed Demolition Works



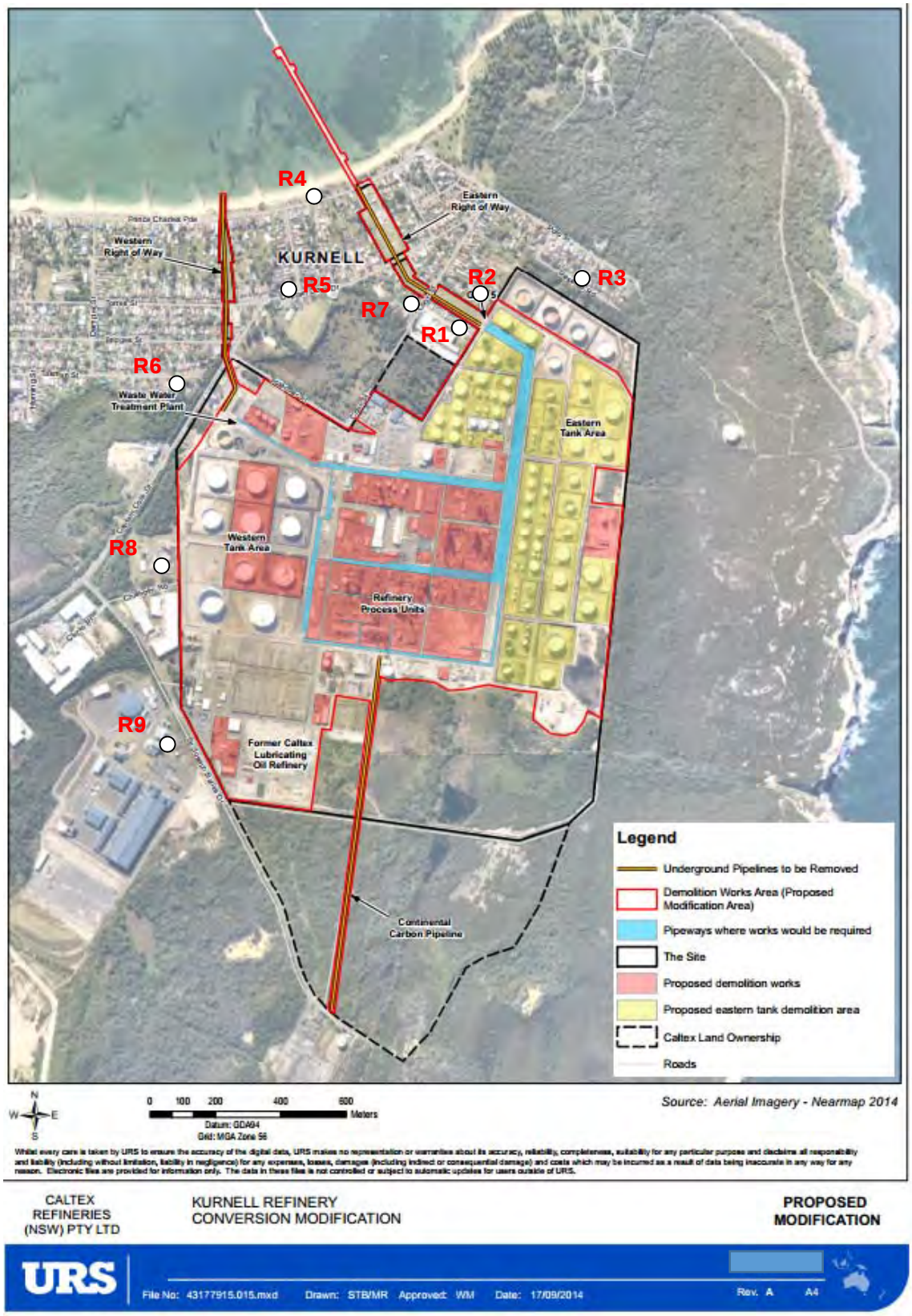
3 NOISE SENSITIVE RECEPTORS

The potentially noise sensitive receptors have been identified by considering the relative location of the demolition works to the surrounding area and to be consistent with the noise assessment for SSD 5544. The following groups of receptors were identified:

- Receiver R1 – 44-64 Cook Street (Industrial Premises) Industrial premises adjacent to the Site to the west and sharing a common boundary.
- Receiver R2 – 30D Cook Street (Residential) Residential property adjacent to the Site to the west and sharing a common boundary.
- Receiver R3 – Reserve Road (Residential) Residential properties north of the Site.
- Receiver R4 – Prince Charles Parade (Residential) Residential properties close to the eastern right of way.
- Receiver R5 – Corner of Captain Cook Drive and Silver Beach Road (Residential) Residential properties north of the Site.
- Receiver R6 – Tasman Street (Residential) Residential property west of the Site.
- Receiver R7 – 35 Cook Street (Residential) Residential property west of the Site.
- Receiver R8 – End of Chisholm Road (Industrial Premises) Industrial premises adjacent to the Site to the west and sharing a common boundary.
- Receiver R9 – Sir Joseph Banks Drive (Industrial Premises) Industrial premises on the other side of Sir Joseph Banks Drive to the west of the Site.

Figure 3-1 shows the locations of the above receptors. It should be noted there are no residential receivers to the south of the Site that could be affected by the noise from the demolition works.

Figure 3-1 Noise Sensitive Receptors



4 NOISE CRITERIA

The NSW Environment Protection Agency (EPA) recommends the use of *the Interim Construction Noise Guideline (ICNG)* for assessing and managing construction/ demolition. Relevant elements of the *ICNG* are summarised and discussed in this chapter.

4.1 Construction (Demolition) Noise Criteria

The ICNG provides the process to assess construction noise 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. In the same way that the *ICNG* documents the process to assess construction in NSW, it can be used to guide demolition noise assessment.

The *ICNG* recommends that standard construction (demolition) 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 4-1**.

Table 4-1 Construction (Demolition) Noise Criteria at Residences for Quantitative Assessments

Time of Day	Management Level $L_{Aeq,(15min)}$	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 $L_{Aeq,(15min)}$ 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.

Time of Day	Management Level $L_{Aeq,(15min)}$	How to Apply
	Highly noise affected 75 dBA	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.
Outside recommended standard hours	Noise affected RBL + 5 dBA	• 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 5 dB(A) above the noise affected level, the proponent should negotiate with the community.

For commercial or industrial land the *ICNG* provides 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.

The *noise affected level* represents the point above which there could be some community reaction to noise. Where the *noise affected level* is exceeded all feasible and reasonable work practices to minimise noise should be applied and all potentially impacted residents should be informed of the nature of the works, expected noise levels, duration of works and provided with a method of contacting the proponent.

The *highly noise affected level* represents the point above which there could be strong community reaction to noise and is set at 75dBA. Where noise is above this level, the relevant authority could require respite periods by restricting the hours when the subject noisy activities can occur, taking into account:

- Times identified by the community when they are less sensitive to noise (such as mid-morning or mid-afternoon for works near residences).
- If the community is prepared to accept a longer period of noise in exchange for restrictions on construction (demolition) times.

The noise management levels are assessed at the most-affected point on or within the residential/commercial property boundary or, if that is more than 30 m from the residence/ commercial premises, at the most-affected point within 30 m of the residence/ commercial premises.

4.2 Construction / Demolition Noise Management Levels

The background noise level surrounding the Site is currently changing as the conversion works are completed (refer to **Section 2.2**). The noise assessment for SSD 5544 identified that the construction noise limits were consistent with the ICNG based on previous background noise monitoring (Wilkinson Murray, 2013).

As the background noise level is current subject to change, it is proposed that demolition works assessment is consistent with the conversion works Construction Nose limits presented in Condition 16 of SSD 5544. This is deemed appropriate as the construction noise limits were established using the typical minimum background levels.

Conditions C16 of SSD 5544 requires that the construction noise generated by the development does not exceed the criteria **Table 4-2.**

Table 4-2 Construction Noise Limits in SSD 5544.

Location	Day, $L_{Aeq,15min}$	Evening , $L_{Aeq,15min}$
R2 – 30D Cook Street	45[1]	40
At any other residence or other noise sensitive receivers	50	45

[1]-SSD 5544 incorrectly identified the construction noise criterion for R2 as 45dBA. This should be corrected to 46dBA if the modification is approved.

Table 4-2 presents the construction/demolition noise management levels for the sensitive noise receptors identified for the Project (i.e. the conversion works and the demolition works).

The sensitive receptors below have been identified as the most relevant for the assessment of noise and vibration from the demolition works.

Table 4-2 Construction/demolition noise management levels

#	Sensitive Receptors	Day 07:00-18:00h $L_{Aeq,15min}$ (dBA)	Out of hours 18:00h 22:00h $L_{Aeq,15min}$ (dBA)
R1	Cook Street (Industrial Premises)	75	-
R2	30D Cook Street (Residential Premises)	46	40
R3	Reserve Road (Residential Premises)	50	45

#	Sensitive Receptors	Day 07:00-18:00h $L_{Aeq,15min}$ (dBA)	Out of hours 18:00h 22:00h $L_{Aeq,15min}$ (dBA)
R4	Prince Charles Parade (Residential Premises)	50	45
R5	Corner of Captain Cook Drive and Silver Beach Rd (Residential Premises)	50	45
R6	Tasman Street (Residential Premises)	50	45
R7	Cook Street (Residential Premises)	50	45
R8	End of Chisholm Road (Industrial Premises)	75	-
R9	Sir Joseph Banks Drive (Industrial Premises)	75	-

5 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS (SEAR)

The SEARs stipulate that the SEE considers Noise and Vibration, including an assessment of all potential noise and vibration impacts on surrounding receivers.

The EPA has also outlined their comments for the Noise Assessment. It was stated that the noise assessment should be conducted in accordance with EPA's *Interim Construction Noise Guideline* and *Industrial Noise Policy*. These comments, and the sections they are addressed in, are outlined in **Table 5-1**.

Table 5-1 EPA Comments

Comment	Section
Identification and assessment of all potential noise sources associated with the demolition and removal of the redundant infrastructure. This may include any use of heavy machinery (bulldozers and excavators), crushing, grinding or separating activities and any proposed blasting.	Section 6
If there is likely to be any vibration impacts associated with the demolition works, the SEE should also include an assessment of the predicted vibration impacts associated with the project.	Section 7
Identify the locations of all sensitive receptors.	Section 3
The proposed hours of demolition works.	Section 2
An assessment of compliance with existing licence conditions and appropriate construction noise criteria as determined using the above guidelines.	Section 6[1]
Any proposed noise mitigation, monitoring (continuous and/or attended) and management measures which are necessary to achieve the above outcome.	Section 9

Note: 1. Additionally EPA stated specifically that the existing licence contains noise limits but these apply to an operational refinery and should not be used for the demolition works. As such, these licence limits have not been considered in this assessment.

6 DEMOLITION NOISE ASSESSMENT

A range of plant and equipment would be required to undertake activities associated with the demolition works. A summary of anticipated demolition scenarios and predicted noise levels are provided below. This information has been used to determine potential impacts of the demolition works on the receiving community. An adaptive management approach has also been identified for the implementation of mitigation measures to minimise impacts on the community.

Noise levels at surrounding residential receivers have been predicted based on indicative types and locations of plant throughout the demolition works.

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.

6.1 Demolition Plant Source Noise Source

Table 6-1 outlines the proposed demolition 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) and appropriate usage factor.

Table 6-1 Typical Demolition Plant Sound Levels

Plant	Sound Power Level (dBA)	Usage Factor[2] (%)
Plant and Equipment used on Site		
Large Shearer	105	10
Oxycutter	101	50
Mobile 130T Crane	104	16
Vacuum Truck or Trucks	93	20
Concrete Crusher	110	50
Concrete Saw	105	10
Large Excavator	105	20
Jackhammer	110	5
Pipeline Removal Plant and Equipment[1]		
80T mobile cranes	93	20
Excavator 13 T- / Backhoe	88	20
Vacuum Truck or Truck	93	20
Oxycutter	101	50
Road Repair Plant and Equipment[1]		
Small Vibratory Roller	104	20
Trucks	93	20
Excavator 13 T- / Backhoe	88	20
Kurnell Wharf Pipe Removal[1]		
Boat and Barge	105	20
Barge Crane	104	16
Oxycutter	101	50
Vacuum Truck or Trucks	93	20
Pipe Removal from Silver Beach[1]		
Excavator 13 T- / Backhoe	88	20
Oxycutter	101	50
Trucks	93	20
80T mobile cranes	93	20

Note:

1. Low noise equipment consistent with the Eastern Right of Way Kurnell B Line Upgrade Project.
2. The usage factor represents the percent of time that equipment is assumed to be running at full power while working on site.

6.2 Demolition Noise Scenarios

The demolition works have been assessed in two separate stages as they would typically impact different receivers:

- the removal of the redundant pipelines from the two Rights of Way, the road reserves, Silver Beach and Kurnell Wharf (the works would not occur in both Rights of Way at once); and
- works within the main Site and the removal of the Continental Carbon Pipeline.

6.2.1 Predicted Noise Levels at Residences from Pipeline Removal

For the removal of the cooling water outlet (within the Western ROW) and the fuel pipelines and cooling water intakes (within the Eastern ROW) the noise level experienced at any residence would depend upon the distance to the activity and shielding between the activity and the residence (i.e. fences).

The removal of the pipelines is regarded as linear works, that is, works that pass through the right of way and would not be stationary for an extended period of time. Therefore the noise exposure to the nearest residences would be limited. Any noise impact on individual receivers during these works would not be continuous and would be expected to occur for no more than approximately two weeks.

The equipment proposed to be used for the pipeline removal is presented in **Table 6-2**.

Table 6-2 Summary of Assumed Plant for the Pipeline Removal Works

Activity	Noise Source	Qty
Removal of redundant pipe from Western ROW	80T mobile cranes	1
	Oxycutter	1
	Excavator 13 T- / Backhoe	1
	Vacuum Truck or Truck	1
Removal of redundant pipes from Eastern ROW	80T mobile cranes	1
	Oxycutter	1
	Excavator 13 T- / Backhoe	1
	Vacuum Truck or Truck	1
Kurnell Wharf Pipe Removal	Boat and Barge	1
	Barge Crane	1
	Oxycutter	1
	Vacuum Truck or Truck	1
Pipe removal from Silver beach Western ROW	Oxycutter	1
	Excavator 13 T- / Backhoe	1
	80T mobile cranes	1
	Truck	1
Road repair	Small Vibratory Roller	1
	Trucks	1
	Excavator 13 T- / Backhoe	1

As identified in **Section 4** the construction/demolition noise management level for the pipeline removal works during day time operations is 45 $L_{Aeq,15minutes}$ for 30D Cook Street and 50 $L_{Aeq,15minutes}$ for all other residential receivers.

Figure 6-1 and **Figure 6-2** show the worst case noise levels that may be expected from the pipeline removal works in the eastern and western right of ways.

Figure 6-1 and **Figure 6-2** also show that the pipeline removal works are likely to exceed the construction/demolition noise management levels at the closest residential receiver neighbouring the right of ways. However, the predicted noise levels do not exceed the highly noise affected 75dBA noise criterion from the ICNG.

It is important to note that the demolition works move along the corridor reasonably quickly therefore the noise impact is not continuous for the duration of the works. However, as noise management levels are likely to be exceeded it is recommended that a Demolition Noise and Vibration Management Plan (DNVMP) is developed that considers all reasonable and feasible mitigation measures to manage potential community concerns. **Section 9** of this report recommends reasonable and feasible noise mitigation methods to be considered in the DNVMP.

Figure 6-3 shows the worst case noise levels that may be expected from the pipeline removal works on Kurnell Wharf. **Figure 6-4** shows the worst case noise levels that may be expected from the pipeline removal works on Silver Beach.

The pipeline removal works at Kurnell Wharf and Silver Beach are likely to exceed the construction/demolition noise management levels at the closest residential receivers. However, the predicted noise levels do not exceed the highly noise affected 75dBA noise criterion from the ICNG.

As above, potential noise impacts would need to be managed by implementing a number of reasonable and feasible mitigation measures. These measures would be detailed within a DNVMP for the demolition works. **Section 9** of this report outlines reasonable and feasible noise mitigation methods recommended to be considered in the DNVMP.

Figure 6-1 Eastern Right of Way Worst Case Demolition Noise Contours, L_{Aeq}

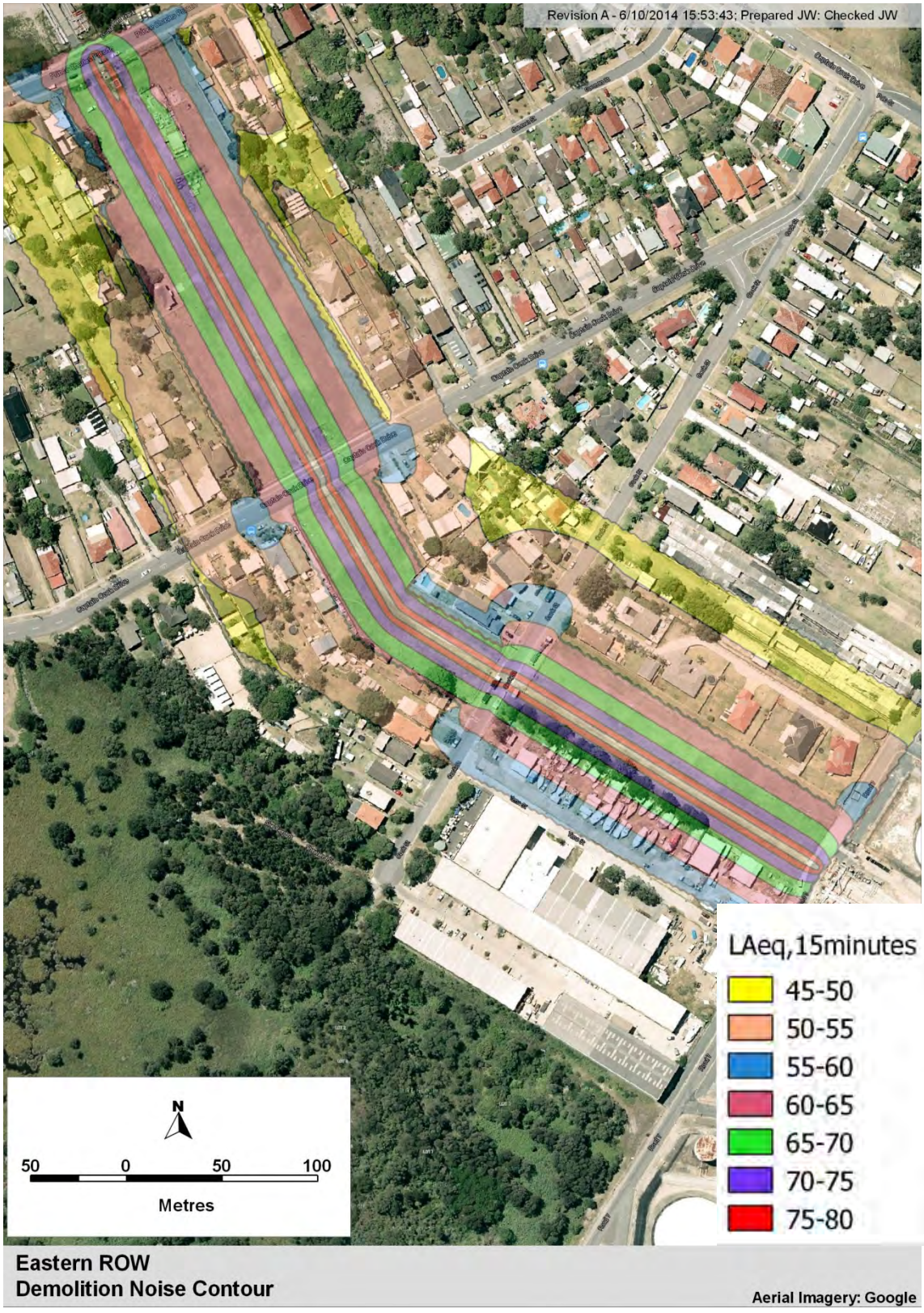


Figure 6-2 Western Right of Way Worst Case Demolition Noise Contours, L_{Aeq}

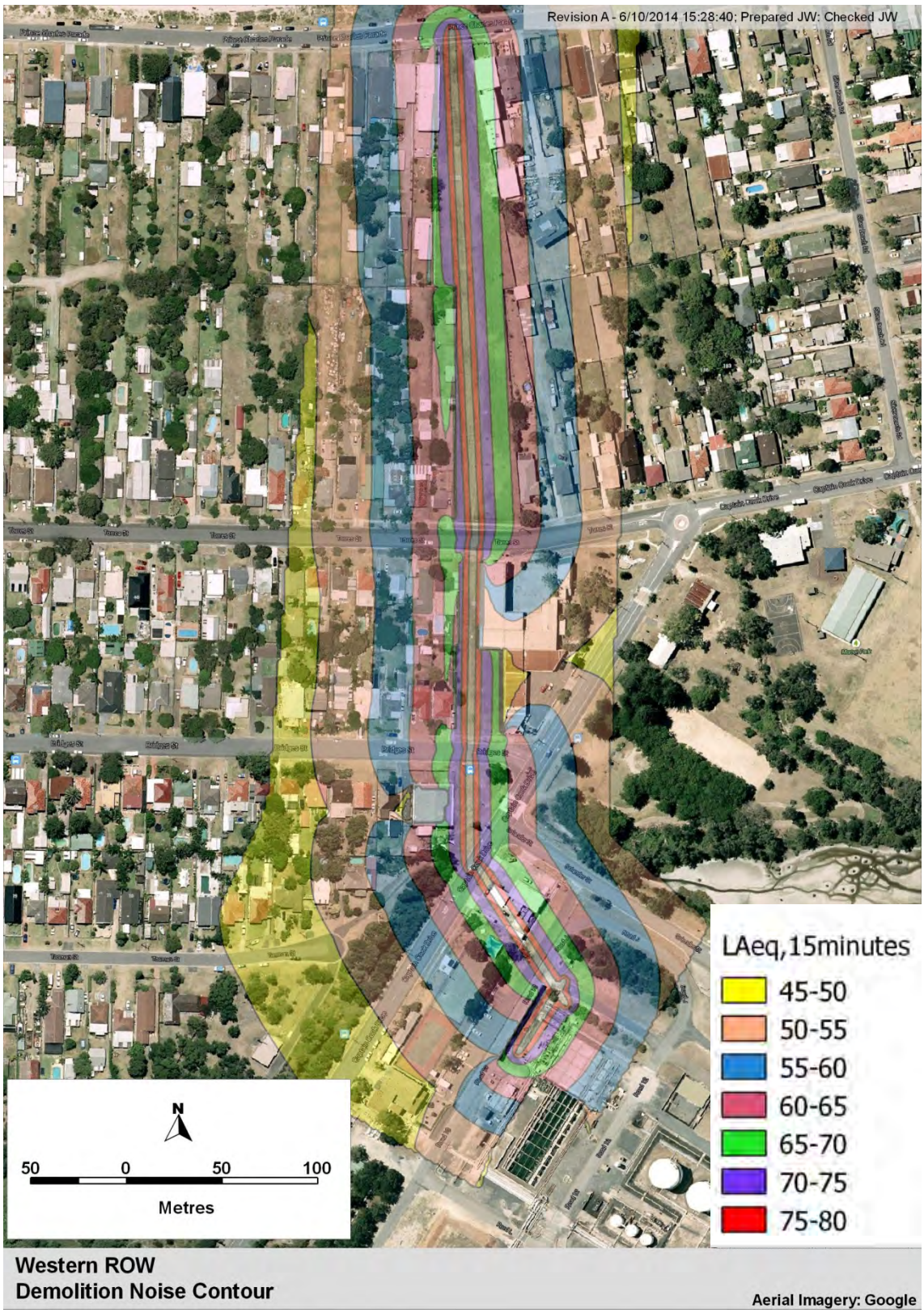


Figure 6-3 Kurnell Wharf Pipeline Removal Worst Case Demolition Noise Contours, L_{Aeq}

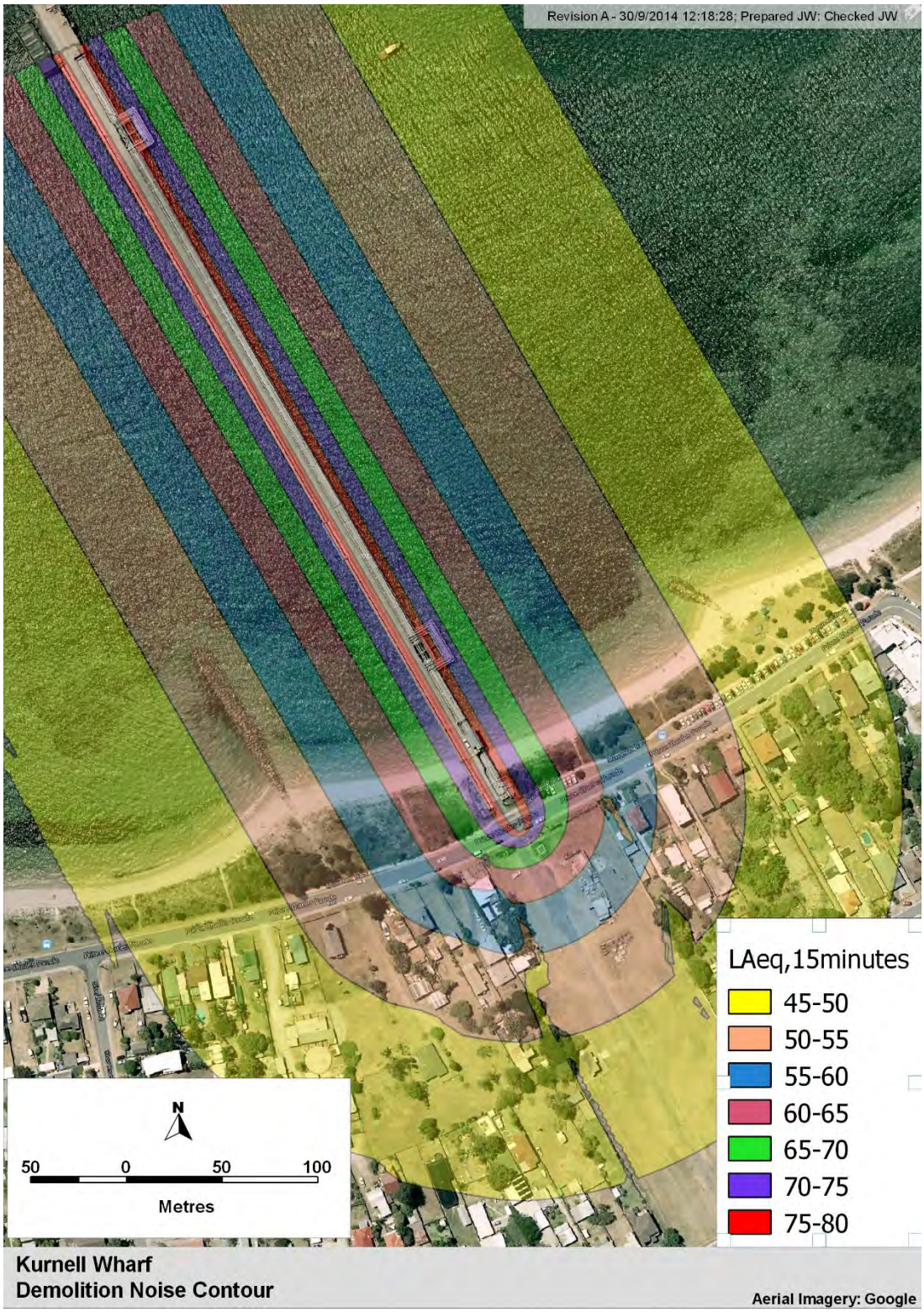
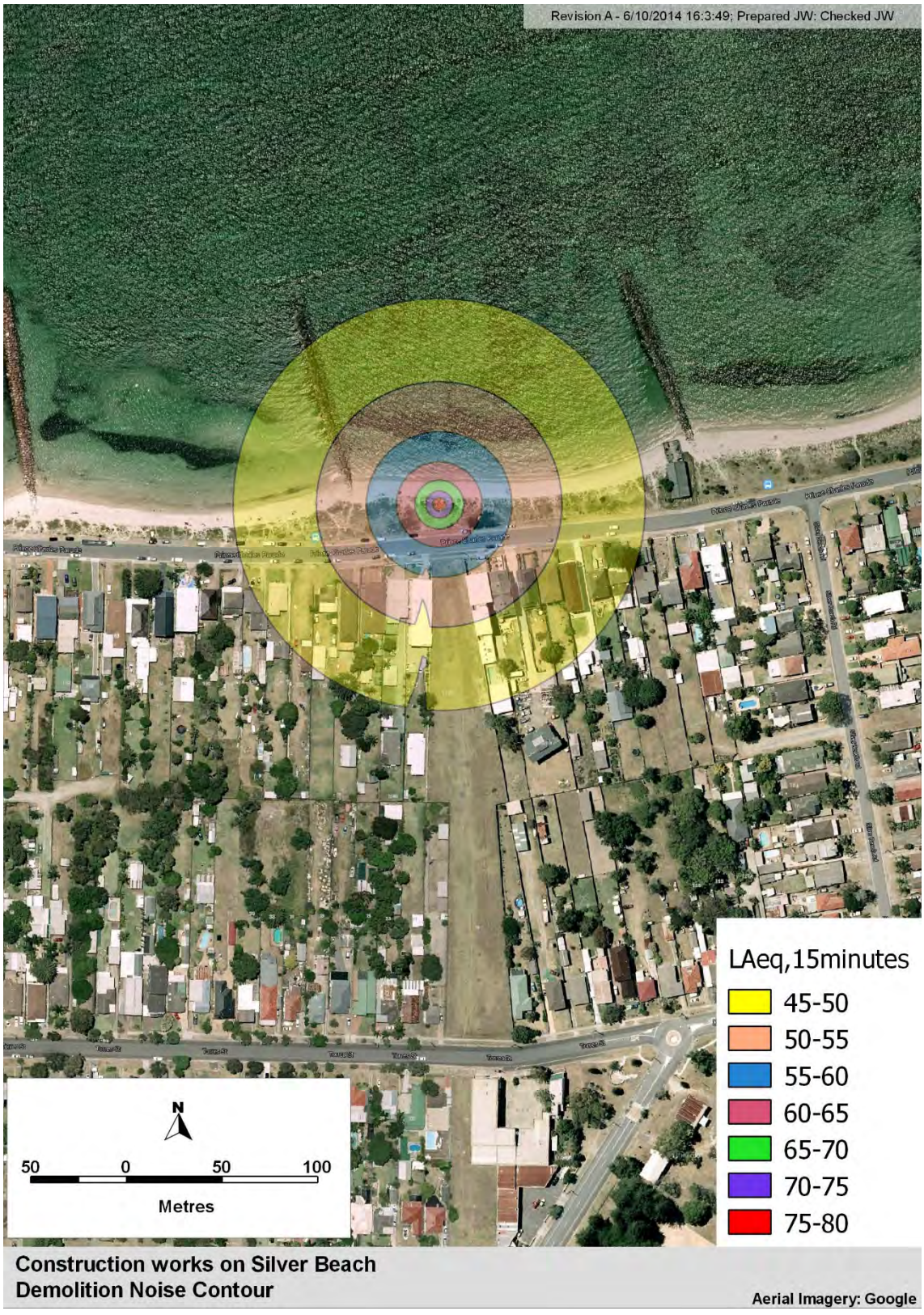


Figure 6-4 Silver Beach Pipeline Removal Worst Case Demolition Noise Contours, L_{Aeq}



6.2.2 Predicted Noise Levels from Site Demolition Works

Noise emissions from the Site have been modelled for a typical worst-case demolition scenario assuming all plant identified in **Table 6-3** would operate concurrently, based the demolition description in **Section 2**.

The scenario assumes the following concurrent activities:

- the refinery process units and associated pipework, foundations and services being demolished and removed;
- redundant tanks within the Eastern and Western Tank Areas being demolished;
- removal of the Continental Carbon pipeline;
- redundant buildings being demolished; and
- concrete crushing.

The modelled locations of demolition works are shown in **Figure 6-5**.

Table 6-3 Summary of Assumed Plant and Mobile Equipment for Demolition

Activity	Noise Source	Qty
Demolition of the refinery process units and associated pipework, foundations and services	Shearing / Concrete Sawing	4
	Oxycutter	4
	Excavators	8
	Vacuum Truck or Truck	1
	Jackhammer	1
	130 T Crane	1
Demolition of redundant tanks	Shearer / Concrete Sawing	2
	Oxycutter	2
	Excavators	2
	Vacuum Truck or Truck	2
Removal of the Continental Carbon pipeline	80T mobile cranes	1
	Oxycutter	1
	Excavator 13 T-/ Backhoe	1
	Vacuum Truck or Truck	1
Demolition of redundant buildings and associated foundations and service	Concrete sawing	1
	Oxycutter	2
	Excavators	1
	Vacuum Truck or Truck	1
Concrete Crushing	Excavator	2
	Trucks	1
	Concrete Crusher	1

Table 6-4 presents the predicted demolition noise levels at the receiver locations surrounding the Site.

Figure 6-5 Demolition Scenario

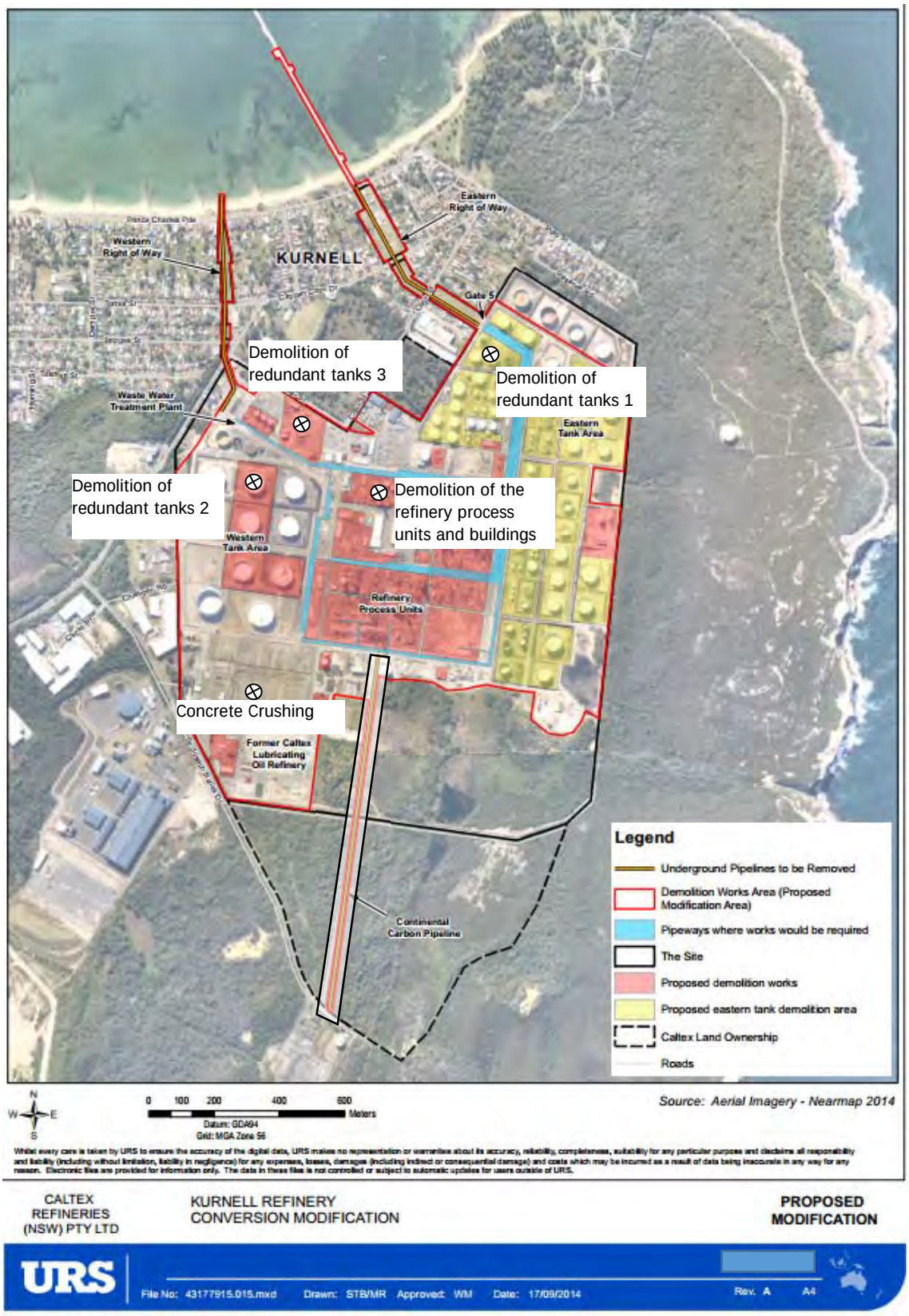


Table 6-4 Predicted Noise Levels – Site Demolition Works – $L_{Aeq,15minutes}$

#	Sensitive Receptors	Predicted L_{Aeq} Noise Level	Day Criteria 07:00-18:00h $L_{Aeq,15min}$ (dBA)	Out of hours Criteria 18:00h 22:00h $L_{Aeq,15min}$ (dBA)	Complies With Criteria (Yes/No)
R1	Cook Street (Industrial Premises)	50	75	-	Yes/-
R2	30D Cook Street (Residential Premises)	50	46	40	No/No
R3	Reserve Road (Residential Premises)	40	50	45	Yes/Yes
R4	Prince Charles Parade (Residential Premises)	38	50	45	Yes/Yes
R5	Corner of Captain Cook Drive and Silver Beach Rd (Residential Premises)	40	50	45	Yes/Yes
R6	Tasman Street (Residential Premises)	42	50	45	Yes/Yes
R7	Cook Street (Residential Premises)	43	50	45	Yes/Yes
R8	End of Chisholm Road (Industrial Premises)	43	75	-	Yes/-
R9	Sir Joseph Banks Drive (Industrial Premises)	45	75	-	Yes/-

As shown in **Table 6-4** the Site demolition works noise levels are predicted to be below the daytime construction/demolition noise criteria at all receivers except R2 where a minor exceedance of 4dB is predicted. For out of hours demolition work (which, as outlined in **Section 2.4**, would be restricted to the conditions of consent for SSD 5544), noise levels are predicted to be below evening and night construction/demolition noise criteria at all receivers except R2 where an exceedances of up to 10 dB have been calculated in the evening.

It should be noted that it was assumed that all activities are occurring concurrently and that this may not be the case and therefore the noise predictions are conservative.

As there is potential for the noise management levels to be exceeded it is recommended that a DNVMP is developed that considers reasonable and feasible mitigation measures. **Section 9** recommends reasonable and feasible noise mitigation methods to be considered in the DNVMP.

7 VIBRATION

7.1 Vibration Criteria

Effects of ground vibration on buildings resulting from demolition may be split into the following two categories:

- Human comfort – disturbance to building occupants: vibration in which the occupants or users of the building are inconvenienced or possibly disturbed.
- Effects on building structures – vibration in which the integrity of the building or structure itself may be prejudiced.

Assessing Vibration: A Technical Guideline (DEC 2006) considers impacts from vibration in terms of effects on building occupants (human comfort) and the effects on the building structure (building damage). The guideline gives "preferred" and "maximum" vibration levels at buildings exposed to continuous and impulsive vibration. For construction vibration the guideline recommends initially applying the criteria for preferred continuous vibration.

Acceptable values of human exposure to continuous vibration are dependent on the time of day and the activity taking place in the occupied space (e.g. workshop, office, residence or a vibration-critical area). Guidance on preferred values for continuous vibration is set out in **Table 7-1**.

Table 7-1 Criteria for Exposure to Continuous and Impulsive Vibration

Place	Time	Peak velocity (mm/s)	
		Preferred	Maximum
Critical working areas (e.g. hospital operating theatres, precision laboratories)	Day or night time	0.14	0.28
Residences	Daytime	0.28	0.56
	Night time	0.20	0.40
Offices	Day or night time	0.56	1.1
Workshops	Day or night time	1.1	2.2

In relation to building damage from vibration, suitable levels are determined from German Standard *DIN 4150-3: 1999 Structural Vibration – Part 3: Effects of vibration on structures*.

For the purpose of this assessment, the limits interpreted from this standard have been simplified and are included in **Table 7-2**.

Table 7-2 Structural Damage Criteria

Type of Structure	Peak Component Particle Velocity, mm/s			
	Vibration at the foundation at a frequency of			Vibration of horizontal plane of highest floor at all frequencies
	1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz*	
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and / or use	5	5 to 15	15 to 20	15
Structures that, because of their sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

Note: * For frequencies above 100Hz, at least the values specified in this column shall be applied.

7.2 Demolition Vibration

Table 7-3 lists vibration intensive plant likely to be used during demolition and provides predicted ground vibration levels at various distances from the plant. The vibration levels are indicative only and would vary depending on the particular item of plant and geotechnical conditions.

Table 7-3 Typical Plant Vibration Levels

Activity	Peak Particle Velocity Vibration Level (mm/s) at Distance		
	10 m	20 m	30 m
Truck over smooth road surface	0.05	<0.01	-
Jackhammer	0.2	<0.1	-
Excavator (Earthmoving)	0.5-0.2	0.1	<0.1
Heavy Hydraulic Hammer	2.5	0.5	0.2

The nearest receivers to the Site are residences in Cook Street approximately 50 m from the closest point where demolition would occur. As such, given the predicted vibration levels in **Table 7-3**, and the criteria in **Table 7-1**, vibration levels are unlikely to exceed the criteria for human comfort at all the nearest receivers.

Equally the typical vibration levels for the demolition works are unlikely to result in levels that cause damage to buildings as structural damage criteria are substantially higher than human exposure criteria. There would be potential for demolition material to be dropped and cause

vibration, however every effort would be made to avoid this occurrence.

The vibration levels in **Table 7-3** are indicative levels only. As outlined in **Appendix H Heritage Impact Assessment,** there are buildings which would be retained on Site with medium or high heritage significance which require consideration and management. As such it is recommended that Caltex prepare a Vibration Management Plan for these buildings. This would form part of the DNVMP and would outline the requirement to:

- Utilise **Appendix H Heritage Impact Assessment** to identify the medium to high heritage significance buildings to be retained;
- Identify where works to demolish redundant structures are occurring within 20m of a medium to high significance heritage building and the requirement to undertake vibration monitoring and management for these buildings to protect their integrity; and
- General monitoring and management measures during the demolition works to monitor vibration and take measures necessary to manage buildings if they are being affected.

It should be noted that Caltex are retaining the buildings identified in **Appendix H Heritage Impact Assessment** as they are required for the ongoing operation of the terminal.

8 CUMULATIVE NOISE ASSESSMENT

As shown in **Section 2.2** there would be an overlap between the start of the demolition works and end of the conversion works (i.e. tank conversions). As such there is potential for cumulative construction noise impacts between the demolition works and the conversion works as both elements of the Project are likely to occur between mid-2015 and December 2016.

A construction noise assessment was conducted for the Kurnell Refinery Conversion Project (URS, 2013). The construction noise levels from the conversion works and the demolition works are presented in **Table 8-1** with the total construction noise levels.

Table 8-1 Cumulative Construction Noise Levels for Conversion and Demolition Works – $L_{Aeq,15minutes}$

#	Sensitive Receptors	Conversion works Predicted L_{Aeq} Noise Level	Demolition works Predicted L_{Aeq} Noise Level	Total L_{Aeq} Noise Level	Day Criteria 07:00-18:00h $L_{Aeq,15min}$ (dBA)	Out of hours Criteria 18:00h 22:00h $L_{Aeq,15min}$ (dBA)	Complies with Criteria (Yes/No)
R1	Cook Street (Industrial Premises)	44	50	**51**	75	-	Yes/-
R2	30D Cook Street (Residential Premises)	40	50	**50**	46	40	No/No
R3	Reserve Road (Residential Premises)	49	40	**50**	50	45	Yes/No
R4	Prince Charles Parade (Residential Premises)	34	38	**40**	50	45	Yes/Yes
R5	Corner of Captain Cook Drive and Silver Beach Rd (Residential Premises)	36	40	**42**	50	45	Yes/Yes
R6	Tasman Street (Residential Premises)	38	42	**44**	50	45	Yes/Yes
R7	Cook Street (Residential Premises)	39	43	**45**	50	45	Yes/Yes

#	Sensitive Receptors	Conversion works Predicted L_{Aeq} Noise Level	Demolition works Predicted L_{Aeq} Noise Level	Total L_{Aeq} Noise Level	Day Criteria 07:00-18:00h $L_{Aeq,15min}$ (dBA)	Out of hours Criteria 18:00h 22:00h $L_{Aeq,15min}$ (dBA)	Complies with Criteria (Yes/No)
R8	End of Chisholm Road (Industrial Premises)	40*	43	**45**	75	-	Yes/-
R9	Sir Joseph Banks Drive (Industrial Premises)	40*	45	**47**	75	-	Yes/-

* Estimated

As shown in **Table 8-1** cumulative conversion and demolition works noise levels are predicted to be below the daytime construction noise criteria at all receivers except R2 where a minor exceedance of 4dBA is predicted. For out of hours demolition work, noise levels are predicted to be below evening noise criteria at all receivers except R2 and R3. Working hours would be restricted to the conditions of consent for SSD 5544.

As there is potential for the noise management levels to be exceeded it is recommended that a DNVMP is developed that considers reasonable and feasible mitigation measures. **Section 9** recommends reasonable and feasible noise mitigation methods to be considered in the DNVMP.

9 MITIGATION MEASURES

The demolition works noise assessment has identified potential noise exceedances for:

- the pipeline removal works at sensitive receivers neighbouring those works; and
- for some site demolition works close to 30D Cook Street.

Therefore it is recommended that a Demolition Noise and Vibration Management Plan (DNVMP) be developed as part of the Demolition Environmental Management Plan (DEMP) for the works. This DNVMP should be updated once more detailed design is available for the demolition methods and programme.

It is recommended that the following noise management strategies are implemented and detailed within the DNVMP. These measures would help reduce the potential for noise and vibration issues during demolition:

- Pipeline removal works are confined to 7.00 am to 6.00 pm Monday to Saturday as per Condition C19 for SSD 5544;
- Demolition works on the main refinery site that are occurring within 500m of 30D Cook Street would be confined to 7.00 am to 6.00 pm Monday to Saturday as per Condition C19. Demolition works taking place beyond 500 m on the main refinery site are likely to comply the evening Construction (demolition) Noise Limits. This would not apply to short term events such as truck movements along internal roads;
- Plant and equipment with low noise emission levels would be used where practicable;
- Community consultation with local residents and building owners to assist in the alleviation of community concerns. Previous experience on similar projects has demonstrated that affected noise sensitive receptors may be willing to endure higher construction noise levels for a shorter duration if they have been provided with sufficient warning in the place of intermittent but extended periods of construction noise at lower levels. These existing 24 hour Community Concerns Hotline would continue to be operated for the Project;
- Maintaining a suitable complaint register. Should noise complaints be received, noise monitoring can be considered at the locations concerned. Reasonable and feasible measures would be implemented to reduce noise impacts. All complaints would be managed through the existing feedback process at the Site;
- Conduct demolition noise monitoring to ensure compliance with construction/demolition noise criteria;
- Educate and train demolition staff to be noise aware. Strategies should focus on:
    - Ensuring work occurs within approved hours;
    - Locating noisy equipment away from sensitive receivers;
    - Ensuring plant and equipment is well maintained and not making excessive noise; and
    - Turning off machinery when not in use.

- Caltex would ensure that the demolition noise generated by the Development does not exceed the criteria defined in Table 2 below (from Condition of Consent C16 of SSD 5544) unless the reasonable and feasible noise mitigation strategies outlined within the DNVMP have been implemented.

- Table 2: Construction Noise Criteria (dB(A)).

Location	Day $L_{Aeq,15minutes}$	Evening $L_{Aeq,15minutes}$
R2 – 30D Cook Street	46[1]	40
At any other residence or other noise sensitive receivers	50	45

1-SSD 5544 identity 45dBA incorrectly as the construction noise criterion for R2. This should be corrected to 46dBA if the modification is approved.

- The DNVMP would describe where demolition noise limits from Table 2 (from Condition of Consent C16 of SSD 5544) are likely to be exceeded and what reasonable and feasible noise mitigation would be employed to minimise noise.
- Vibration Management Plan would be developed as part of the DNVMP and would outline the requirement to:
  - Utilise **Appendix H Heritage Impact Assessment** to identify the medium to high heritage significance buildings to be retained;
  - Identify where works to demolish redundant structures are occurring within 20m of a medium to high significance heritage building and the requirement to undertake vibration monitoring and management for these buildings to protect their integrity; and
  - General monitoring and management measures during the demolition works to monitor vibration and take measures necessary to manage buildings if they are being affected

With regards to community consultation, it is understood that Caltex's current approach to managing complaints (from noise or otherwise) would continue. As discussed above, this approach includes a 24-hour hotline number for the local community. This number forms part of an established community complaints process where the community complaint or enquiry is emailed and texted to an Operations representative, the Shift Manager, the Environment Protection Superintendent, the Community Relations and Communication Advisor, amongst other Caltex personnel. The complaint is responded to and investigated to determine the source of the noise and then, if required, operational adjustments are made to mitigate the noise. The resident is generally updated on the action(s) taken and asked about whether they consider that the operational adjustments have been effective. This consultation procedure has been effectively implements for a number of previous projects.

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 the demolition works, 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 – dBA	
		Day (7am-10pm)	Night (10pm-7am)
Freeway / arterial / sub-arterial roads	1. Existing residences affected by noise from **new** freeway / arterial / sub-arterial road corridors	$L_{Aeq,15hr}$ 55 (external)	$L_{Aeq,9hr}$ 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	$L_{Aeq,15hr}$ 60 (external)	$L_{Aeq,9hr}$ 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	$L_{Aeq,1hr}$ 55 (external)	$L_{Aeq,1hr}$ 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 related to the demolition works would access the Site from 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.

The demolition works are likely to result in approximately 2,675 additional heavy vehicle movements to and from the Site between mid-2015 and 2017. This equates to approximately 6 heavy vehicle movements a day on average with a peak of 60 additional movements on any one day.

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 demolition works would be negligible at residences on Captain Cook Drive (that is, less than a 2 dB increase).

11 CONCLUSION

A desktop assessment of the potential demolition noise and vibration emissions that could arise from the proposed demolition works has been completed.

Specifically, this report has identified that there is potential for demolition noise impacts. As such, it is recommended that all reasonable and feasible noise mitigation be considered and documented within a Demolition Noise and Vibration Management Plan (DNVMP). Implementation of the DNVMP and the measures within it would help minimise and manage the potential noise and vibration impacts from the demolition works.

In-principle noise and vibration mitigation measures are provided in **Section 9** to aid in reducing construction noise and vibration levels at nearby receivers.

Noise from construction traffic travelling along public roads has also been assessed. The contribution from traffic generated by the demolition works would be negligible at residences on Captain Cook Drive (less than 2 dB increase).