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Stolthaven Australia Pty Ltd
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Stolthaven Bulk Liquids Fuel Storage Facility, Mayfield

Operational Noise Compliance Assessment (2017)

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Operational Noise Compliance Assessment (2017)

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1.0 Introduction

AECOM Australia Pty Ltd (AECOM) has been engaged by Stolthaven Australia Pty Ltd (Stolthaven) to carry out noise compliance measurements for operations at the Stolthaven Bulk Liquids Fuel Storage Facility (the Facility) operated by Stolthaven at the Port of Newcastle, Mayfield, NSW.

The Facility has three approval/license documents that control its operations, these documents are:

- State Significant Development (SSD) 6664 – 16 April 2015; and
  - Modification – 28 September 2015.
- The NSW Environment Protection Authority (EPA) issued Environment Protection Licence No. 20193 (EPL 20193), License version date 28 August 2017; and
- Mayfield Concept Approval (MCP) (Application 09_0096) dated 16 July 2012 (latest modification 12 December 2014).

This acoustic assessment was conducted to determine compliance with the requirement in EPL 20193 and SSD 6664 MOD 1.

As the Facility lies within the MCP approval area, it requires noise emissions from the site to be consistent with the environmental assessment requirements of the MCP Approval. Consistency with the MCP Approval requirements has also been addressed in this report.

Section L5.6, L5.7 and M9 of the EPL 20193 outline the methods to determine compliance with the noise limits within the EPL 20193. Attended noise measurements were undertaken on 28 November 2017 at the closest nearby residential receiver locations in accordance with EPL 20193, Section L5.6. During the attended measurements, it was not possible to directly measure the noise arising from operations at the Facility due to the influence from extraneous noise sources, i.e. existing industrial noise from other industrial areas unrelated to the Facility and traffic noise on Industrial Drive. In accordance with the EPA NSW Industrial Noise Policy (INP), an alternative method was employed to demonstrate the compliance noise levels. The compliance assessment was carried out using SoundPLAN noise modelling software.

This method of noise compliance assessment is in accordance of the Chapter 11 of the INP. In order to determine compliance of the Facility operational noise emissions with the required noise limits 'reasonable' worst case operational scenarios where determined from 2017 historical data provided by Stolthaven, and noise levels based upon the attended noise measurements undertaken over the period of 27 to 28 November 2017 .

AECOM has been advised by Stolthaven that no noise complaints have been received to date in relation to noise from the operation of the Facility.

1.1 EPA Noise Policy for Industry

The *NSW Industrial Noise Policy* (EPA 2000) was withdrawn in November 2017 and replaced by the *Noise Policy for Industry* (EPA 2017) except as describe in the EPA document *Implementation and transitional arrangements for the Noise Policy for Industry (2017),* point 8, as presented below:

> *8. The NSW Industrial Noise Policy (2000) will continue to apply where it is referenced in existing statutory instruments (such as consents and licences), except for the NSW Industrial Noise Policy Section 4 modifying factors, which will be transitioned to the Noise Policy for Industry (2017) Fact Sheet C through a NSW Industrial Noise Policy application note. This approach has been taken because the Noise Policy for Industry (2017) modification factor approach reflects more recent understanding of the impact of tonal and low-frequency noise on the community.*

1.2 Stolthaven Bulk Liquid Storage Terminal Description

1.2.1 Location

The Facility is located on the former BHP steelworks site in Mayfield North, adjacent to the Hunter River, approximately 5 km north-west of Newcastle CBD. The site location falls within the MCP area, which is currently being redeveloped as an industrial precinct.

During operations, haulage ships will dock at the Mayfield No. 4 Berth and pump fuel into storage tanks to be blended and held on site. Haulage trucks receive the blended fuels and transport it through an access road leading to the intersection of Industrial Drive and Ingall Street.

The nearest residential areas to the site are located to the south-west of the Facility at Mayfield, with the closest receivers in Crebert Street, approximately 900 m away. To the south east there are residential receivers located in Carrington, approximately 2 km away. To the south east there are the residential receivers located in Stockton, approximately 3 km away.

The Facility location and key sensitive receivers are shown in **Figure 1**.

1.2.2 Operational Activities and Facilities

Stolthaven has approval to operate the Facility to receive, store and dispatch diesel and biodiesel fuel. The Facility has been approved for an annual throughput of 1,300 ML of diesel and biodiesel.

The Facility makes use of an existing ship berthing facility to receive diesel fuel, which are transferred to site using an above-ground, dedicated pipeline approximately 1 km in length. Transportation of the fuel to customers is undertaken by B-Double road tankers. Transportation occurs 24 hours per day, seven days per week.

1.2.3 Operational Noise Sources

Operations at the site consist of the following activities:

Internal private access Roads	• Moving trucks, idling trucks.
Industrial noise sources	• Fuel pumps; • Haulage tanker trucks filling; and • Ships in berth filling/depositing (currently at Mayfield No. 4 Berth, as such these operations fall under Condition 5.11 of the Consent Condition DA-293-08-00 MOD 9, dated 29 August 2013)

Sound power levels of the different operations at the Facility were determined through on-site measurements conducted on 28 November 2017.

1.2.4 Hours of Operation

The operational hours for the Facility are Monday to Sunday, 24 hours per day.

1.2.5 Nearby Sensitive Receiver Locations

The locations of the Facility and nearby assessment receivers are shown in **Figure 1**. Provided in **Table 1** are the assessment receiver locations including the land use classification in accordance with the INP.

Table 1 Assessment Receiver Locations

EPL Receiver Number / Mayfield Concept Plan Receiver Location[1]	Address	Land use Classification	Associated Receiver Area
R1/A	1 Arthur St, Mayfield	Residence - Urban	Mayfield
R2	52 Arthur St, Mayfield	Residence - Urban	Mayfield
R3/B	2 Crebert St, Mayfield	Residence - Urban	Mayfield
R4	21 Crebert St, Mayfield	Residence - Urban	Mayfield
R5	24 Crebert St, Mayfield	Residence - Urban	Mayfield
R6	30 Crebert St, Mayfield	Residence - Urban	Mayfield
R7	50 Crebert St, Mayfield	Residence - Urban	Mayfield
R8	2 McNeil Cl, Mayfield	Residence - Urban	Mayfield
C	32 Elizabeth St, Carrington	Residence - Suburban	Carrington
D	186 Fullerton Rd, Stockton	Residence - Suburban	Stockton

Notes:

1. Letters designate the Mayfield Concept Plan assessment receiver locations.

Figure 1 Site Location, Assessment Receiver Locations and Measurement Locations

1.3 Compliance Assessment Criteria

1.3.1 Summary of Monitoring Requirements

1.3.1.1 Environment Protection Licence 20193

Section L5.1 of the EPL 20193, License version date 28 August 2017, presents the noise limits that apply to the site, and are reproduced in **Table 2**.

Table 2 Summary of Site Operational Noise Limits ($L_{Aeq(15minute)}$)

Receiver	Day	Evening	Night	
	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{A1(1min)}$
R1 - 1 Arthur St, Mayfield	35	35	35	45
R2 - 52 Arthur St, Mayfield	35	35	35	48
R3 - 2 Crebert St, Mayfield	41	41	41	49
R4 - 21 Crebert St, Mayfield	40	40	40	47
R5 - 24 Crebert St, Mayfield	42	42	42	51
R6 - 30 Crebert St, Mayfield	41	41	41	50
R7 - 50 Crebert St, Mayfield	35	35	35	50
R8 - 2 McNeil Cl, Mayfield	35	35	35	48

In addressing the requirement that "*Noise generated by the Project is to be measured in accordance with the procedures and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy*." these noise limits apply under all meteorological conditions except for any of the following:

a. Wind speeds greater than 3 metres/second at 10 metres above ground level; or

b. Stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level; or

c. Stability category G temperature inversion conditions.

1.3.1.2 Sleep Disturbance Requirements

Section L5.1 of the EPL 20193 presented sleep disturbance criteria which are provided in **Table 2**.

1.3.2 Conditions of Consent - State Significant Development (SSD) 6664 – 16 April 2015 (Modification dated 28 September 2015)

Amenity Noise Requirements – Mayfield Concept Plan (MCP)

A methodology to deal with cumulative noise from the entire MCP is currently in development and is yet to be finalised. As part of the most recent update, Minister for Planning's Project Approval (Application SSD 6664, dated 16 April 2015), two key sections are relevant to this noise compliance assessment, these include condition 22 and 27. These state:

22.

The Applicant shall, in consultation with the PON ensure that noise from operation of the Development:

a. Fits within the Site Noise Model developed for the Mayfield Concept Plan;

b. Does not exceed any noise quota provided by PON for the Development, in accordance with the Site Noise model for the Mayfield Concept Plan.

27.

The Applicant shall monitor noise from operation of the Development, to the satisfaction of the Secretary. The monitoring shall:

a. Be undertaken annually, or to address genuine noise complaints that are related to the Development as determined by the Department or the EPA.;

b. Be undertaken in accordance with the NSW Industrial Noise Policy; and

c. Demonstrate compliance with the relevant noise goals constrained in the Mayfield Concept Plan, or any noise quota established by the PON for the Development.

Note: The monitoring requirements could be satisfied by the monitoring network require for the Mayfield Concept Plan once it is established.

It is understood that a key part of the development of this cumulative noise management strategy is a focused upon the amenity (whole of period) noise levels. It is understood that, for any proposed development within the MCP area, the available noise criteria for the entire MCP area will be proportionally distributed amongst all future developments. When lodgement or notification of a new development is received by Port of Newcastle (PON), a noise allocation will be provided to the proposed development site that will become the cumulative amenity noise quota that they should meet. The overall MCP noise goals are presented in **Table 3.**

Table 3 MCP overall noise goals

Receiver	Project Specific Noise Goals, $L_{Aeq, period}$ dB(A)		
	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 7am)
A – 1 Arthur St, Mayfield	60	49	43
B – 2 Crebert St, Mayfield	60	50	43
C – 32 Elizabeth St, Carrington	57	44	45
D - 186 Fullerton Rd, Stockton	55	37	37

1.3.2.1 Stolthaven Stage 3 (SSD 7065) - Specific MCP Requirements

PON is using a Cumulative Environmental Noise Management Tool (CENMT) that has been developed for the MCP to manage individual site noise requirements for projects within the MCP. It is noted that site specific noise quota was not issued as part of the Stolthaven SSD 6664 MOD 1 submission. However, as part of Stolthaven Stage 3 (SSD 7056) Environmental Impact Statement noise quotas were allocated to the Stolthaven Stage 3 development. In the absence of other quotas for the MCP those quotas from the development consent for SSD_7065 have been referenced in this compliance assessment.

Stolthaven Stage 3 (SSD 7065) specific cumulative amenity noise quota derived using the Mayfield Concept Plan CENMT is presented in **Table 4.** The quotas are based upon the Project area presented in **Figure 2.** As such for the purposes of assessing the sites noise emission (i.e. SSD 6664 MOD 1) against the requirements of the MCP; they have been assessed against the noise quotas allocated for Stolthaven Stage (SSD 7065).

For clarity, Stolthaven have been issued development consent SSD_7065 for the expansion of the existing terminal. When acted upon, SSD_7065 will supersed SSD_6664. To date however Stolthaven have not surrendered SSD_6664. Therefore SSD_6664 conditions of consent remain the applicable conditions under which the facility currently operates.

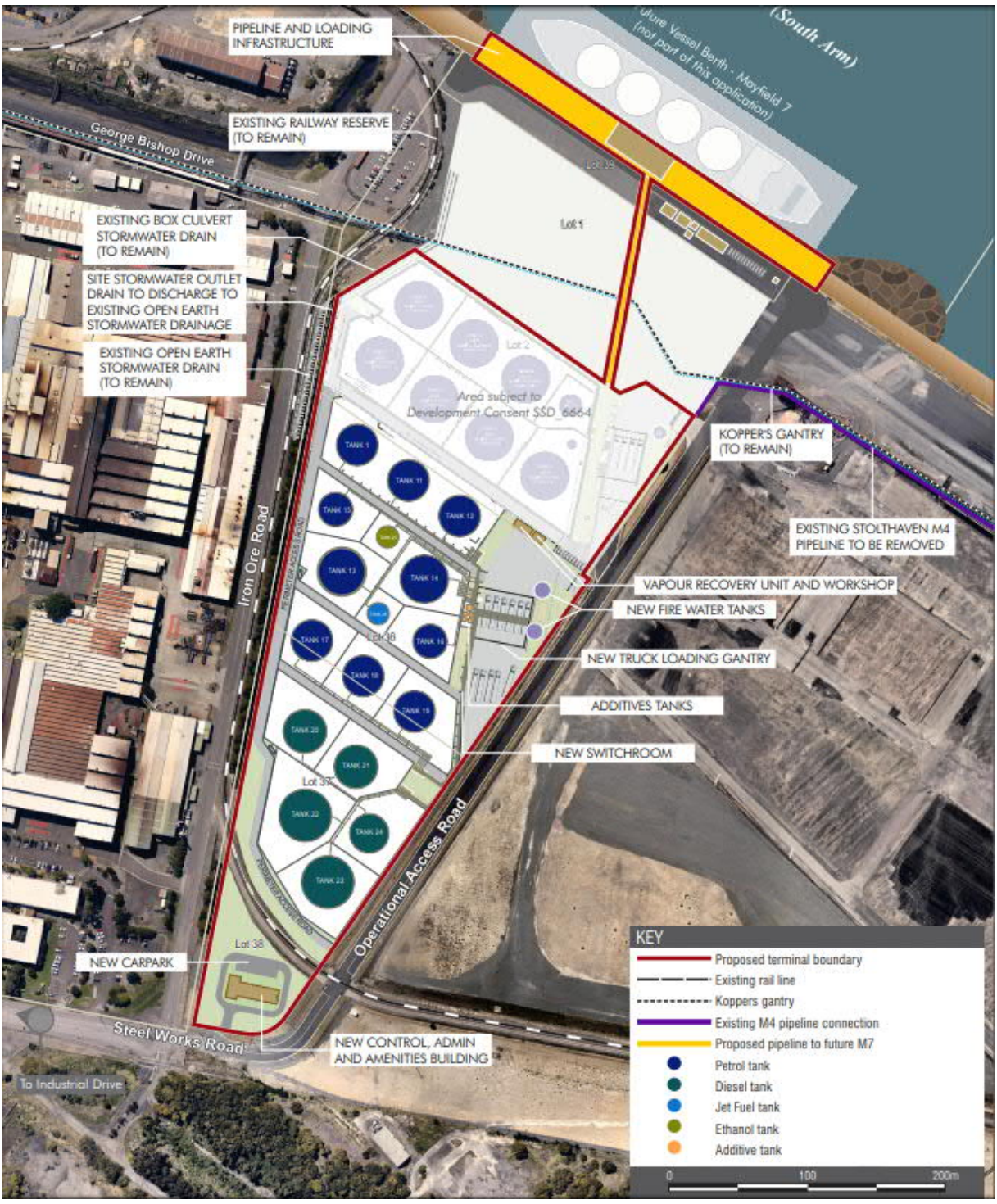

Figure 2 Site Operational Area for Derivation of MCP Noise Quota – Stolthaven Stage 3 (Not yet Constructed)

Table 4 Summary of MCP Noise Quotas for Noise Assessment for Stolthaven Stage 3 (SSD 7065)

Receiver	Applicable Amenity Noise Quota, $L_{Aeq, period}$ dB(A)		
	Day (7.00 am to 6.00 pm)	Evening (6.00 pm to 10.00 pm)	Night (10.00 pm to 7.00 am)
A – 1 Arthur St, Mayfield	47	36	30
B – 2 Crebert St, Mayfield	51	40	34
C – 32 Elizabeth St, Carrington	42	30	25
D – 186 Fullerton Rd, Stockton	39	28	22

Notes:

1. These cumulative amenity noise quota levels are subject to approval by PON and DP&E and have been included for assessment purposes

These noise quotas apply under winds of up to 3 metres/second (measured at 10 metres above the ground level) and Pasquill stability class from A to F.

Predicted amenity noise emission levels for assessment against the MCP requirements are provided in **Section 2.4.**

2.0 Measurement Methodology and Results

2.1 Compliance Measurements

2.1.1 Meteorological Conditions

Meteorological results have been taken from the Stolthaven Terminal Automatic Weather Station (AWS) as required by EPL 20193 Condition M5.1.

Meteorological conditions during the representative assessment receiver attended measurement period have been reviewed for the noise monitoring period to determine the prevailing wind and temperature inversion conditions. The meteorological conditions experienced during noise compliance investigations is summarised as:

- During the night-time receiver measurement period at the Facility the equivalent average wind speed was a 1-4 m/s and generally from the NE, varying from NNE to E. The measurements were not impacted by the prevailing wind during the measurement periods;
- During the night-time period measurements, the temperature inversion conditions were generally Class D inversion, based upon calculations using he sigma-theta method referred to in Part E4 of Appendix E to the NSW INP;
- No rain occurred during any of the measurement periods; and
- The temperature during the night-time measurements ranged between 20˚C - 21˚C, and the cloud conditions were generally clear skies with a few scattered clouds during all periods.

2.1.2 Instrumentation

Attended noise measurements were conducted using the equipment presented in **Table 5.**

Table 5 Measurement Instruments

Equipment	Serial Number
Attended Noise Measurements	
Brüel and Kjaer Type 2250	3009330

All instruments presented in **Table 5** are designated as Class 1 instruments. Each sound level meter was calibrated before and after the measurements using a calibrator (Rion NC-74 Serial Number 34283660) with a drift in calibration not exceeding ±0.5 dB.

All the acoustic instrumentation employed during the noise measurements comply with the requirements of "*AS IEC 61672.1-2004 Electroacoustics - Sound level meters - Specifications*".

All equipment used for this report has valid calibration certificates.

2.1.3 Attended Measurement Results and Discussion

Attended noise measurements of typical operations were undertaken at the Facility in order to develop the noise model used for this noise compliance assessment.

The results of the attended measurements and site observations are presented in **Table 6**.

The receiver locations were selected as they are either EPL 20193 and MCP receiver locations or all other receiver locations are further away. As such, by achieving compliance at these locations, compliance will be achieved at all other receiver locations.

At all the measurement locations, except R3 and C (2 Creber Street, Mayfield and 32 Elizabeth Street, Carrington), exceeded the noise limits.

However, it should be noted that noise from the Stolhaven Facility was not clearly distinguishable or quantifiable at any of the attended measurement receiver locations.

We have been informed that during the night-time attended measurements at nearby residential receivers the Facility was operating under normal conditions (i.e. including truck movements).

During the attended measurements it was not possible to quantify the noise contribution from the Facility from the other industrial sources in the surrounding area at all receiver locations. Thus it was not possible to determine the noise contribution through direct measurement. The INP provides guidance in Chapter 11 as to how to review the noise emissions of a site where the existing noise levels are already high.

Table 6 Attended Measurements at Assessment Receiver Locations on 27 to 28 November 2017

Location		Time of Measurement	Monitored Noise Levels			Comments
			L_{A1}, dB(A)	L_{Aeq}, dB(A)	L_{A90}, dB(A)	
R1/A	1 Arthur St, Mayfield	27/11/17 10:11 PM	63	52	48	INDUSTRIAL CONTRIBUTION**:** Background constant broadband industrial hum from north (controls background). Occasional banging of metal at to north. Faint but audible warning alarms to north. No distinguishable noise sources in the direction of the Stolthaven Facility TRAFFIC CONTRIBUTION: Industrial hum was the main noise source other than the Intermittent traffic on Industrial Drive OTHER: Cicadas. Average Wind – Calm to slight NNE ~0.5 m/s, Clear sky
R2	52 Arthur St, Mayfield	27/11/17 11:06 PM	77	63	49	INDUSTRIAL CONTRIBUTION: Background constant broadband industrial hum from north (controls background). Occasional banging of metal at to north. Faint but audible warning alarms to north. No distinguishable noise sources in the direction of the Stolthaven Facility TRAFFIC CONTRIBUTION: Industrial hum was the main noise source other than the Intermittent traffic on Industrial Drive OTHER: Cicadas. Average Wind – Calm, Clear Sky
R3/B	2 Crebert St, Mayfield	27/11/17 11:18 PM	65	54	48	INDUSTRIAL CONTRIBUTION: Background constant broadband industrial hum with occasional sizzling noise from industry across Industrial Drive. Intermittent traffic on Industrial Drive. Occasional banging of metal to north. Faint but audible warning alarms to the north. No distinguishable noise sources in the direction of the Stolthaven Facility (~25ºdeg). TRAFFIC CONTRIBUTION: Intermittent traffic on Industrial Drive was the main noise source other than the background industrial hum. OTHER: Cicadas. Average Wind – Calm, Clear Sky

Location		Time of Measurement	Monitored Noise Levels			Comments
			L_{A1}, dB(A)	L_{Aeq}, dB(A)	L_{A90}, dB(A)	
R4/R5[1]	21 Crebert St, Mayfield	27/11/17 11:06 PM	77	63	49	INDUSTRIAL CONTRIBUTION: Background constant broadband industrial hum from the north east. A few events which sound like banging of metal from the north. No distinguishable noise sources in the direction of the Stolthaven Facility. TRAFFIC CONTRIBUTION: Intermittent traffic on Industrial Drive was the main noise source other than the background industrial hum, with car passby's ~75 dB(A), truck passby's 79 dB(A). OTHER: Cicadas. Average Wind – Calm, Clear Sky
R6/R7[2]	30 Crebert St, Mayfield	27/11/17 11:30 PM	74	61	44	INDUSTRIAL CONTRIBUTION: Background constant broadband industrial hum from north east. Occasional banging of metal to north. No distinguishable noise sources in the direction of the Stolthaven Facility TRAFFIC CONTRIBUTION: Intermittent traffic on Industrial Drive was the main noise source other than the background industrial hum, with truck passby's ~85 dB(A). OTHER: Cicadas. Average Wind – Calm, Clear Sky
R8	2 McNeil Cl, Mayfield	27/11/17 10:51 PM	54	46	42	INDUSTRIAL CONTRIBUTION: Background constant broadband industrial hum from the north. A few events which sound like banging of metal from the north. No distinguishable noise sources in the direction of the Stolthaven Facility. TRAFFIC CONTRIBUTION: Intermittent traffic on Industrial Drive was the main noise source other than the background industrial hum, truck passby's 56 dB(A). OTHER: Cicadas. Average Wind – Calm, Clear Sky
C	32 Elizabeth St,	27/11/17 11:54 PM	48	42	41	INDUSTRIAL CONTRIBUTION: Strong constant broadband industrial hum from Kooragang Island (controls background). No distinguishable sources in the

Location		Time of Measurement	Monitored Noise Levels			Comments
			L_{A1}, dB(A)	L_{Aeq}, dB(A)	L_{A90}, dB(A)	
	Carrington					direction of the Stolthaven Facility. TRAFFIC CONTRIBUTION: Local traffic on Fullerton Road excluded from measurement. OTHER: Cicadas. Average Wind – Calm, Clear Sky
D	186 Fullerton Rd, Stockton	28/11/17 12:39 AM	62	48	32	INDUSTRIAL CONTRIBUTION: Strong constant broadband industrial hum from Kooragang Island (controls background). No distinguishable sources in the direction of the Stolthaven Facility. TRAFFIC CONTRIBUTION: Local traffic on Fullerton Road excluded from measurement. OTHER: Cicadas. Average Wind – Calm, Clear Sky
-	Mayfield East Public School	28/11/17 9:42 AM	69	60	47	INDUSTRIAL CONTRIBUTION: Industrial noise was not audible. No distinguishable sources in the direction of the Stolthaven Facility. TRAFFIC CONTRIBUTION: Dominant noise from traffic movements on Industrial Drive. OTHER: None audible above traffic on Industrial Drive Average Wind – Calm, Clear Sky

Notes:

1. Attended noise measurements at Location R4 (21 Crebert St, Mayfield), are representative of ambient noise conditions at locations R4 (21 Crebert St, Mayfield) and R5 (24 Crebert St, Mayfield).
2. Attended noise measurements at Location R6 (30 Crebert St, Mayfield), are representative of ambient noise conditions at locations R6 (30 Crebert St, Mayfield) and R7 (50 Crebert St, Mayfield).

Section 11.1.2 Notes on Noise Monitoring of the INP states:

Where existing noise levels are high

"When compliance is being measured it may be found that, in many cases, existing noise levels are higher than noise level from the source, making it difficult to separate out the source noise level. When this happens, it may not be feasible to measure compliance at the specified location, and other methods will be needed. In these cases, measurements may be taken closer to the source and then calculated back to the specified location."

Accordingly, on-site measurements of individual plant items and typical operations were undertaken on 28 November 2017 at the Facility.

It was noted during all measurements that the specific noise source being measured was the dominant noise source throughout the measurement period. Observations were made of the onsite operations, which have then been reviewed in conjunction with the Facility operational data to model 'reasonable' worst case operational scenarios over the assessment periods. These scenarios are described in **Section 2.2**.

The noise model was validated using the attended noise measurements, refer to **Section 2.3.2** for noise model calibration.

Key on-site attended measurement results are summarised in **Table 7**.

Table 7 On-site Attended Measurements at the Facility on 27 and 28 November 2017

Operation	Time of Measurement	Monitored Noise Levels				Comments
		$L_{A1(t)}$, dB(A)	$L_{A10(t)}$, dB(A)	$L_{Aeq(t)}$, dB(A)	$L_{A90(t)}$, dB(A)	
Trucks pumping in Bays 1,2 & 4	1:40 PM	85	82	81	80	Trucks pumping in Bays 1, 2 & 3 measured at approximately 50 metres.
Truck pass-by	2:03 PM	80	79	75	66	Truck pass-by (accelerating down access road departing site) at 18 m from closest point of truck pass-by.
Truck idling	2:16 PM	62	62	60	59	Truck idling while waiting at entry gate
Truck arriving at site	2:16 PM	79	76	72	59	Truck pass-by (truck arriving at entry gate with air brake discharge) at 10 m from closest point of truck pass-by.
Truck leaving site	1:48 PM	81	80	80	79	Truck pass-by (accelerating down access road departing site) at 10 m from closest point of truck pass-by.
Pump operations	1:32 PM	62	61	61	60	Measurement of pump/motor in operation at 1.2 m
Compressor	1:23 PM	66	65	66	64	Compressor at 10 m.

2.2 Modelled Operational Scenarios

2.2.1 Observed Operations for Modelling

Based upon the attended measurements presented in **Table 7,** the movement logs for the Facility over the measurement period, and discussions with Stolthaven personnel, 'reasonable' worst case operational scenarios were established and modelled for the operations during the day, evening and night assessment periods, as required to satisfy the assessment periods under the following documents:

1. EPL 20193; and
2. The Minister for Planning's Project Approval (State Significant Development (SSD) 6664 – dated 16 April 2015) (Modification dated 28 September 2015).

2.2.2 Truck Operations

The following data on truck operations was obtained from a combination of site observations during the attended noise measurements, and from data provided by Stolthaven for the movements.

- Truck operations were typically B-Double trucks, and that a typical 'in-and-out' cycle time in the Facility was on median 30 minutes, with each tank filling cycle taking approximately 5-8 minutes;
- The average idling time for a truck from when it arrived to when it entered the Facility was approximately 1.5 minutes;
- There was typically a 5 to 6 minute gap between the pumping operations when switching between tanks;
- A maximum of trucks four trucks used the fuelling loading bays simultaneously;
- The pump source levels were based upon attended noise measurements. These have been included in the sound power levels presented in **Table 8**;
- Air-brake releases would occur when the trucks came to a complete stop at the truck gates and within the bays;
- Reversing beepers were not used on site;
- When the truck entered or exited the Facility a warning alarm at the gate would sound as the gate opened or closed;
- When a truck was loading typically a single pump/motor set would be serving the truck during the loading operations, and motors would operate based upon the load required in the linked bays; and
- Based on discussions with personnel onsite, it was noted that a maximum of four pumps and full load would operate at the same time typically with all four bays in operations.

2.2.3 Compressor Shed and Office Area Operations

- The main compressor would run for durations of around 5 minutes;
- An air-release valve that protruded from the southern façade of the compressor shed would operate rarely which is consistent with the previous year; and
- At the time the office plant was not in operation. The sound power level of some of the ventilation units was noted on the side of the units, and that unit types were also noted. As such, these were included in the modelling to take into account for periods where these are required for use.

2.2.4 Assessment Noise Source Levels

The sound power level inputs presented in **Table 8** were used in the noise compliance modelling, and adjusted for duration and frequency of operations in accordance with the operations described in **Section 2.2.5** and **2.2.6**. The plant item sound power levels were determined from the attended noise measurements of typical operations made on site (**Table 7**). In order to determine compliance with the

recommended noise limits, the predicted noise levels for each operational scenario were determined at each of the assessment locations. The results are presented in **Section 2.3**.

Modelling was undertaken using SoundPLAN noise modelling software. In total two intrusive (reasonable 'worst' 15-minute period) operational scenarios were modelled, in addition to day, evening and night-time amenity (whole of period) scenarios. The assessment of each scenario considers a 'reasonable' worst case operational period. The assumptions made for modelling purposes with regards to the equipment operating and the duration and frequency of operation are described in **Section 2.2.5** and **2.2.6**.

The predicted noise levels for both worst case wind or from worst case temperature inversion scenarios as required by the project approval conditions, in addition to the neutral scenarios are presented **Section 2.3**.

Table 8 The Facility Plant Items Sound Power Levels

Plant Item/Operation	Sound Power Level, dB(A)
Trucks approaching/leaving site - Accelerating	88 dB(A)/m[1]
Trucks approaching/leaving site – Using main access road	81 dB(A)/m[1]
Trucks idling at site	91
Truck airbrake event	104
Fuel Pump/Motor (Bay 1/2)	97[1]
Fuel Pump/Motor (Bay 3/4)	105[1]
Entrance gate/ exit gate alarm	96[1]
Office plant (individual item) – 5 items	68[2]
Office plant (individual item) – 2 items	75[2]
Compressor	89
Compressor shed air release valve	101[1]

Note1: Based on previous year

Note2: Based on manufacturer data

Table 9 The Facility Plant Items Sound Power Levels for Peak Events

Plant Item/Operation	$L_{A1\ 1\ minute}$ Sound Power Level, dB(A)
Trucks approaching/leaving site - Accelerating	108
Truck airbrake event	115[1]
Entrance gate/ exit gate alarm	101[1]
Compressor shed air release valve	101[1]

Note1: Based upon previous year

2.2.5 Reasonable Worst Case Intrusiveness Scenarios (15 minute period)

The following are the modelled reasonable worst case intrusiveness scenarios (15 minute period). Two key sets of operations which generate noise emissions represent the sites worst case noise emissions, which are the worst case pumping operations, and then the worst case truck movements approaching or leaving the site. The make-up of these scenarios has been determined from an analysis of the movement data over the measurement period.

Both worst case periods occurred during the night-time measurement period, and so this has been used to assess against the day, evening and night periods. Noting the only difference will be the office noise contribution from the office based mechanical services, which generate negligible contribution to the overall noise impacts from the site operations.

Table 10 Worst Case 15 Minute Intrusive Assessment Scenarios

Activity	Worst case on-site activities 15 minute assessment period (10:22 pm - 10:37 pm 22 November 2016)	Worst case truck movements 15 minute assessment period (4:11 am - 4:26 am 23 November 2016)
Leaving	Two trucks move down the approach road at approximately 40 km/h departing site. (Bays 1 & 4)	Two trucks move down the approach road at approximately 40 km/h departing site. (Bays 2 & 3).
Arriving	Two trucks move down the approach road at approximately 40 km/h and arrive at the site, stop with airbrake release, and idle for 1 minute at the entrance gate of the Facility (Bays 1 & 4).	Two trucks move down the approach road at approximately 40 km/h and arrive at the site, stop with airbrake release, and idle for 1 minute at the entrance gate of the Facility (Bays 1 & 4).
Pumping	Four B-Double trucks pumping in the facility. a. Bay 1 – One truck pumping for 9 minutes, then 2nd truck pumping for 2 minutes during period with 4 minute change over. b. Bay 2 – Pumping for 10 minutes c. Bay 3 – Pumping for 10 minutes each during period (Bay 3) with 3 minute tank switch break. d. Bay 4 – Pumping for 9 minutes with break.	Four B-Double trucks pumping in the facility. a. Bay 1 – Pumping for 10 minutes b. Bay 2 – Pumping for 6 minutes c. Bay 3 – Pumping for 6 minutes d. Bay 4 – Pumping for 6 minutes
	Consideration for the onsite speed and the usage of airbrakes at the Facility has been included in the modelling.	
	The operation of the entrance gate is associated with each truck movement through the Facility.	
Other	Compressor shed operating with gas discharge during period.	
Office Plant	Office plant is not operating as the office building is not operating during the night period.	

2.2.6 Reasonable Worst Case Amenity Scenarios

The following are the modelled whole of period scenarios based upon on-site observations. All noise sources in the model were assumed to operate as per the points below.

1. Each truck using the Facility is a B-Double.
2. One motor/pumps combination is used to fill each tank.
3. Each B-Double tank takes 6 minutes to fill (i.e. 12 minutes per B-Double truck).
4. Each truck idles for a total of 1 minute on site at gate.
5. Air-break releases occur when the trucks arrived on-site and stopped prior to swiping in at the gate, and also when they stopped after moving into the bays.
6. Trucks move down the approach road at approximately 40 km/h and arrive at the site.
7. The operation of the entrance and exit gate is associated with each truck movement through the Facility.
8. Consideration for the onsite speed and the usage of airbrakes at the Facility has been included in the modelling.
9. Usage of the pump/motors is distributed throughout available pumps as per the operational usage.

10. Compressor shed operating with gas discharge operating throughout period.
11. Office plant are operating throughout the day and evening periods, 5 condenser units were noted on the south-western façade of the office building and are assumed the operation during the day and evening periods when the office could be occupied.
12. In consultation with Stolthaven, reasonable worst-case truck movements have been determined for 2017. These movements are consistent with movements in 2016. The approach has been based upon the top 10% of movements through the facility during each of the day, evening or night assessment periods. The source noise levels have been based upon the on-site measured noise levels.

    Presented in **Table 11** are the truck numbers modelled to represent the reasonable worst case truck throughput during 2017.

Table 11 Reasonable Worst Case Trucks through the Facility - 2017

Reasonable Worst Case Trucks through the Facility	Day (7am - 6pm)	Evening (6pm - 10pm)	Night (10pm - 7am)
Truck movements (either to or from the facility)	83	28	55
Trucks in each period	41	14	28

2.3 Modelling Methodology

2.3.1 General Modelling Assumptions

Noise levels due to the operational activities shown in **Section 2.2** have been predicted to nearby noise sensitive receivers using SoundPLAN 7.3 noise modelling software. The base model has been based upon the current version of the *MCP Master SoundPlan model*.

The CONCAWE method was originally developed for predicting the long-distance propagation of noise from petrochemical complexes. It is especially suited to predicting noise propagation over large distances because it accounts for a range of atmospheric conditions that can significantly influence the propagation of noise over large distances.

Noting that the closest receptors in the vicinity of the proposed Facility are at least 500 m from the site, the CONCAWE environmental noise prediction method is an appropriate method for predicting the noise propagation. Whilst the General Prediction Method algorithm more accurately predicts at closer receiver locations, and was used for modelled receiver locations less than 100 m, as part of the model validation.

The modelling includes:

- Ground topography;
- Buildings and structures;
- All sources behave as point, or moving point sources;
- Ground Absorption; and
- Representative operational noise sources as required.

It can be expected that there may be differences between predicted and measured noise levels due to variations in instantaneous operating conditions, plant in operation during the measurement and also the location of the plant equipment.

2.3.2 Model Validation

The noise model outputs were compared with attended measurement results. Measurements at locations further than this were not possible, as the existing industrial noise levels were in the region of 50 dB(A) during the night period and in the region of 55 dB(A) during the day from sources to the north, and at locations further away it was not possible to quantify noise directly from the Facility.

Validation of the worst case on-site pumping activities was undertaken, and is presented below in **Table 12.** Comparisons have been made against noise measurements for known operational activities (e.g. operational pumps (including duration), occupied bays, and pumping was the dominate activity taking place).

Table 12 Comparison Between Measured and Modelled Noise Levels

Activity	Measured Noise Levels (L_{Aeq}, dB(A))	Predicted Noise Levels (L_{Aeq}, dB(A))	Difference, dB
Trucks idling at entry gate	75	74	1
Compressor operation	66	66	0

The differences identified in **Table 12** are within the accuracy of the modelling algorithm and considered suitable for this assessment. The results from the validation of the model show that the model is suitable for determining the compliance noise levels for this assessment.

2.4 Noise Compliance Assessment

Provided in **Table 13** to **Table 15** are the predicted noise levels present at each of the assessment locations during each of the reasonable worst case operational scenarios. The predicted noise levels identify that each operational scenario is compliant with the applicable noise criteria.

Observed meteorological conditions on the day of the measurements are presented in **Section 2.1.1**, however, as required by the EPL 20193 and the MCP noise verification requirements adverse meteorological conditions to be assessed for each period. Previous assessments have identified that the 3m/s source to receiver wind meteorological condition predictions to be consistently between 0 dB(A) to 1 dB(A) higher than temperature inversion predictions. As such this report has limited the assessment of adverse conditions to the more conservative 3m/s source to receiver wind meteorological condition.

2.4.1 Intrusiveness Noise Assessment (15 minute period)

The following are the modelled results for the reasonable worst case intrusiveness scenario (15 minute period). The modelling scenarios are presented in **Section 2.2.5.**

Table 13 Predicted Intrusive Noise Levels

Receiver	EPL Noise Limits $L_{Aeq,15min}$ dB(A)[1]	Predicted Noise Level, $L_{Aeq,15min}$ dB(A)		Compliance
		Neutral Weather	Adverse Weather[2]	
Worst Case – Truck Movements				
R1	35	27	32	Yes
R2	35	28	32	Yes
R3	41	34	39	Yes
R4	40	34	39	Yes
R5	42	35	39	Yes
R6	41	33	37	Yes
R7	35	29	33	Yes
R8	35	29	33	Yes
Worst Case – Site Operations				
R1	35	28	32	Yes
R2	35	29	33	Yes

Receiver	EPL Noise Limits $L_{Aeq,15min}$ dB(A)[1]	Predicted Noise Level, $L_{Aeq,15min}$ dB(A)		Compliance
		Neutral Weather	Adverse Weather[2]	
R3	41	36	41	Yes
R4	40	35	40	Yes
R5	42	35	40	Yes
R6	41	34	37	Yes
R7	35	29	34	Yes
R8	35	29	34	Yes

Notes:

1. Operational noise limits are based on the most stringent operational noise limits (i.e. night-time period).
2. Adverse weather considers the worst case of 3m/s source to receiver wind and temperature inversions.

The worst-case site operations indicate that predicted noise levels comply at all receiver locations for all site operation scenarios and weather conditions.

2.4.2 Amenity Noise Assessment

Table 14 presents the modelled results for whole of period amenity operating scenarios. The modelling scenarios are presented in **Section 2.2.6**.

Table 14 Predicted Amenity Noise Levels

Receiver	MCP Noise Quota $L_{Aeq,period}$ dB(A)[1]	Predicted Noise Level, $L_{Aeq,period}$ dB(A)		Compliance
		Neutral Weather	Adverse Weather[2]	
Daytime				
A	47	22	27	Yes
B	51	30	35	Yes
C	42	13	18	Yes
D	39	12	18	Yes
Evening				
A	36	24	29	Yes
B	40	32	37	Yes
C	30	18	23	Yes
D	28	18	24	Yes
Night-time				
A	30	22	27	Yes
B	34	30	34	Yes
C	25	12	18	Yes
D	22	11	17	Yes

Notes:

1. Operational noise limits are based on the most stringent operational noise limits (i.e. night-time period).
2. Adverse weather considers the worst case of 3m/s source to receiver wind and temperature inversions.

2.4.3 Sleep Disturbance Noise Assessment

The following are the modelled results to determine noise impacts with the potential to cause sleep disturbance against the required approval criteria. The sound power levels for the maximum noise events at the Facility are included in **Table 9.**

Table 15 Predicted Noise Levels - Sleep Disturbance Assessment, Night-time Period

Receiver	Criteria dB(A)	Predicted Noise Level, $L_{A1,}$ dB(A)		Compliance
		Neutral Weather	Adverse Weather[1]	
R1	45	40	44	Yes
R2	48	45	48	Yes
R3	49	45	49	Yes
R4	47	43	47	Yes
R5	51	48	51	Yes
R6	50	48[1]	50	Yes
R7	50	43	47	Yes
R8	48	45	48	Yes

Notes:

1. Operational noise limits are based on the most stringent operational noise limits (i.e. night-time period).

The L_{A1} night-time site operation assessment indicates that the predicted noise levels at all receiver locations comply with sleep disturbance criteria during both neutral and adverse weather conditions.

3.0 Conclusion

AECOM Australia Pty Ltd (AECOM) was commissioned by Stolthaven Australia Pty Ltd (Stolthaven) to undertake a compliance noise assessment of operations at the Stolthaven Bulk Liquids Fuel Storage Facility (the Facility) operated by Stolthaven at the Port of Newcastle, Mayfield, NSW.

This acoustic assessment was conducted to determine compliance with the following site operational approvals and requirements -

- State Significant Development (SSD) 6664 – 16 April 2015;
  - Modification – 28 September 2015.
- The NSW Environment Protection Authority (EPA) issued Environment Protection Licence No. 20193 (EPL 20193), License version date 28 August 2017; and
- Mayfield Concept Approval (MCP) (Application 09_0096) dated 16 July 2012 (latest modification 12 December 2014).

As the Facility lies within the Mayfield Concept Plan approval area, it requires noise emissions from the site to be consistent with the environmental assessment requirements of the Mayfield Concept Plan Approval, as stated in the approval SSD 6664 MOD 1, which have been demonstrated in this report.

Attended noise measurements were undertaken on 28 November 2017 at the closest nearby residential receiver locations. During the attended measurements, it was not possible to directly quantify the impacts of noise arising from operations at the Facility due to the influence from extraneous noise sources, i.e. existing industrial noise from other industrial areas unrelated to the Facility and traffic noise on Industrial Drive, or the noise impacts are significantly below the measured existing noise levels. As such, an alternative method was required in order to demonstrate compliance with the project approval requirements.

The compliance assessment was carried out using SoundPLAN noise modelling software, calibrated based upon attended noise measurements.

This method of noise compliance assessment is in accordance of the Chapter 11 of the EPA NSW Industrial Noise Policy (INP). In order to determine compliance of the Facility operational noise emissions with the required noise limits, ‘reasonable’ worst case operational scenarios where determined from 2017 historical data provided by Stolthaven, and noise levels based upon the site attended noise measurements undertaken over the measurement period.

Daytime, evening and night-time noise emissions were predicted to each of the required assessment locations and compared against the site noise limits for all scenarios. The Project approval requires that the noise emissions be assessed under worst case prevailing wind and temperature inversion conditions.

Noise impacts were found to be consistent with operations in previous years with small 1 dB to 2 dB increases due to different equipment measured on site.

Results of the noise compliance modelling showed that the operation of the facility complies with the noise limits stated in EPL 20193 in addition to the project specific noise goals in the MCP for all outlined receivers.

Appendix A

Acoustic Terminology

Appendix A Acoustic Terminology

The following is a brief description of acoustic terminology that may have been used in this report.

Sound power level	The total sound emitted by a source
Sound pressure level	The amount of sound at a specified point
Decibel [dB]	The measurement unit of sound
A Weighted decibels [dB(A])	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:

0dB(A)	Threshold of human hearing
30dB(A)	A quiet country park
40dB(A)	Whisper in a library
50dB(A)	Open office space
70dB(A)	Inside a car on a freeway
80dB(A)	Outboard motor
90dB(A)	Heavy truck pass-by
100dB(A)	Jackhammer/Subway train
110 dB(A)	Rock Concert
115dB(A)	Limit of sound permitted in industry
120dB(A)	747 take off at 250 metres

Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
L_{max}	The maximum sound pressure level measured over the measurement period
L_{min}	The minimum sound pressure level measured over the measurement period
L_{10}	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L_{10}.

L_{90}	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L_{90}.
Ambient noise	The all-encompassing noise at a point composed of sound from all sources near and far.
Background noise	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L_{90} sound pressure level is used to quantify background noise.
Traffic noise	The total noise resulting from road traffic. The L_{eq} sound pressure level is used to quantify traffic noise.
Day	The period from 0700 to 1800 h Monday to Saturday and 0800 to 1800 h Sundays and Public Holidays.
Evening	The period from 1800 to 2200 h Monday to Sunday and Public Holidays.
Night	The period from 2200 to 0700 h Monday to Saturday and 2200 to 0800 h Sundays and Public Holidays.
Assessment background level [ABL]	The overall background level for each day, evening and night period for **each day** of the noise monitoring.
Rating background level [RBL]	The overall background level for each day, evening and night period for the **entire length** of noise monitoring.
Weighted sound reduction index [R_w]	A single figure representation of the air-borne sound insulation of a partition based upon the R values for each frequency measured in a laboratory environment.

*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 *"Acoustics – Glossary of terms and related symbols"*, the EPA's NSW Industrial Noise Policy, Noise Policy for Industry and the EPA's NSW Road Noise Policy.