Mackas Sand Pty Ltd

Mackas Sand
Annual Environmental Management Report 2010-2011

November 2011

Umwelt
Environmental Consultants

Mackas Sand Annual Environmental Management Report 2010-2011

Prepared by

Umwelt (Australia) Pty Limited

on behalf of

Mackas Sand Pty Ltd

Project Director:	Peter Jamieson		
Project Manager:	Andy Goodwin		
Report No.	1646/R26/V2	Date:	November 2011

2/20 The Boulevarde
PO Box 838
Toronto NSW 2283

Ph: 02 4950 5322
Fax: 02 4950 5737
Email: mail@umwelt.com.au
Website: www.umwelt.com.au

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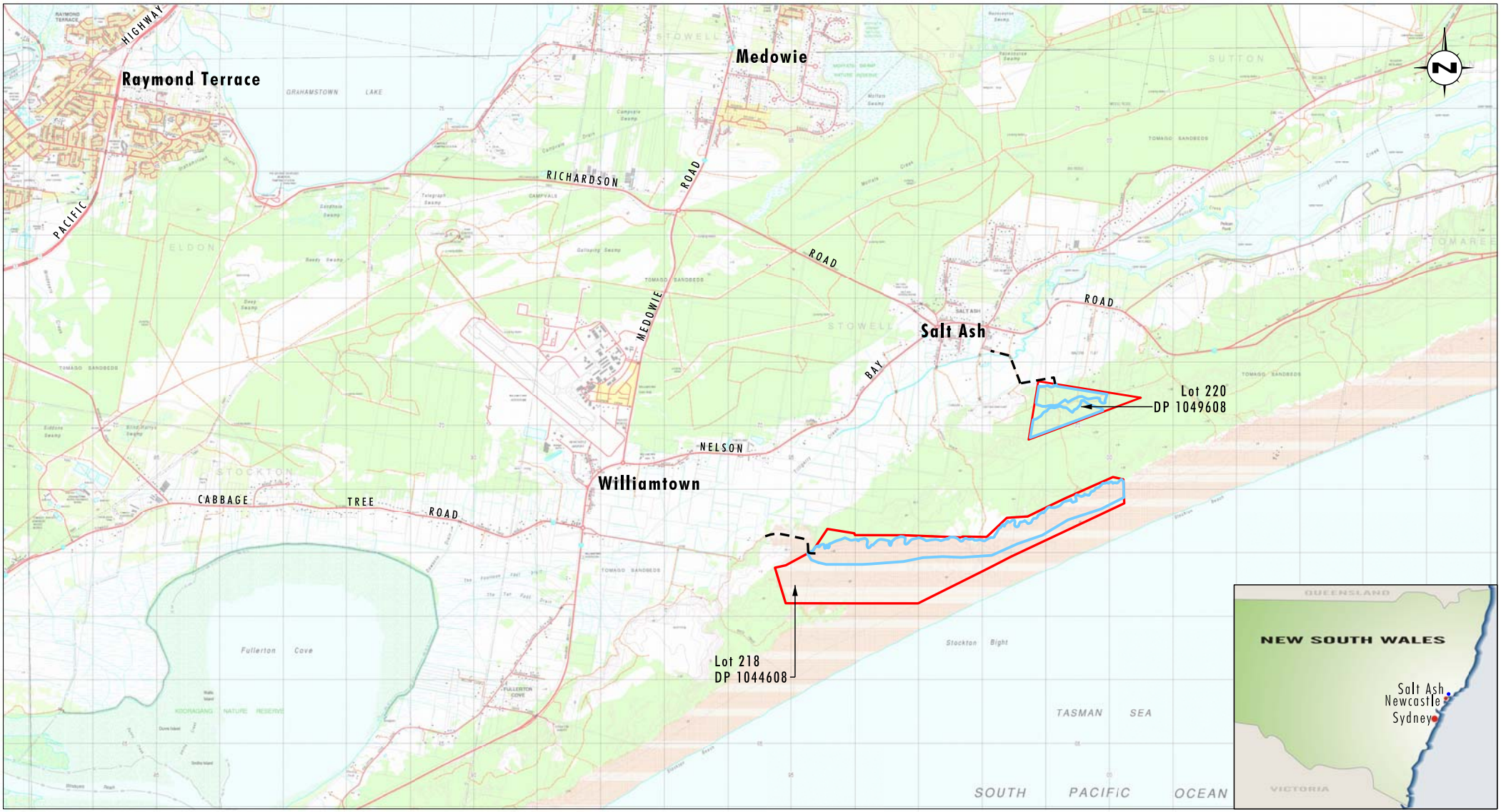
1.0 Introduction

On 20 September 2009, Mackas Sand Pty Ltd (Mackas Sand) was granted Project Approval 08_0142 under Part 3A of the *Environmental Planning and Assessment Act 1979* to extract up to 2 million tonnes of sand per year from Lot 218 in DP 1044608 (Lot 218) and Lot 220 in DP 1049608 (Lot 220), Salt Ash (see **Figure 1.1**). These land parcels are owned by the Worimi Local Aboriginal Council and contain approximately 21 million tonnes of sand resource. Extractive operations on Lot 220 commenced at the start of December 2009. No extractive activities were undertaken on Lot 218 as of September 2011.

The present report has been prepared in accordance with Project Approval 08_0142, Schedule 5, Condition 4, which states that:

> Within 12 months of the date of this approval and annually thereafter, the Proponent shall submit an AEMR to the Director-General and relevant agencies. This report must:
> (a) identify the standards and performance measures that apply to the project;
> (b) describe the works carried out in the last 12 months, and the works that will be carried out in the next 12 months;
> (c) include a summary of the complaints received during the past year, and compare this to the complaints received in previous years;
> (d) include a summary of the monitoring results for the project during the past year;
> (e) include an analysis of these monitoring results against the relevant:
> - impact assessment criteria/limits;
> - monitoring results from previous years; and
> - predictions in the EA.
>
> (f) identify any trends in the monitoring results over the life of the project;
> (g) indentify any non-compliance during the previous year; and
> (h) describe what actions were, or are being, taken to ensure compliance.



Source: Department of Lands, 2006

Legend

- Lot Boundaries
- Approval Areas
- Approved Access Roads

FIGURE 1.1

Location of Approval Areas

2.0 Standards and Performance Measures

The operations at Mackas Sand are subject to a range of standards and performance measures, consisting of Major Project Approval 08_0142 which includes:

- permit under *Hunter Water (Special Areas) Regulation 2003* Clause 13(1);
- Environmental Protection Licence (EPL) 13218; and
- a range of plans of management, including
  - Noise Management Plan;
  - Air Quality Monitoring Program;
  - Soil & Water Management Plan;
  - Unexploded Ordinance Management Plan (for operations in Lot 218);
  - Landscape management Plan;
  - Aboriginal Cultural Heritage Management Plan;
  - Non-Indigenous Heritage Management Plan;
  - Environmental Management Strategy.

The permit under the *Hunter Water (Special Areas) Regulation 2003* was granted on 18 November 2009 and was valid for 12 months. An application for renewal of this permit was sought on 19 November 2010. Mackas Sand is waiting for confirmation regarding the renewal to the licence.

Notice of variation of EPL 13218 was provided to Mackas Sand by the Office of Environment and Heritage (OEH) on 1 June 2011.

3.0 Works Programme

3.1 Since Commencement

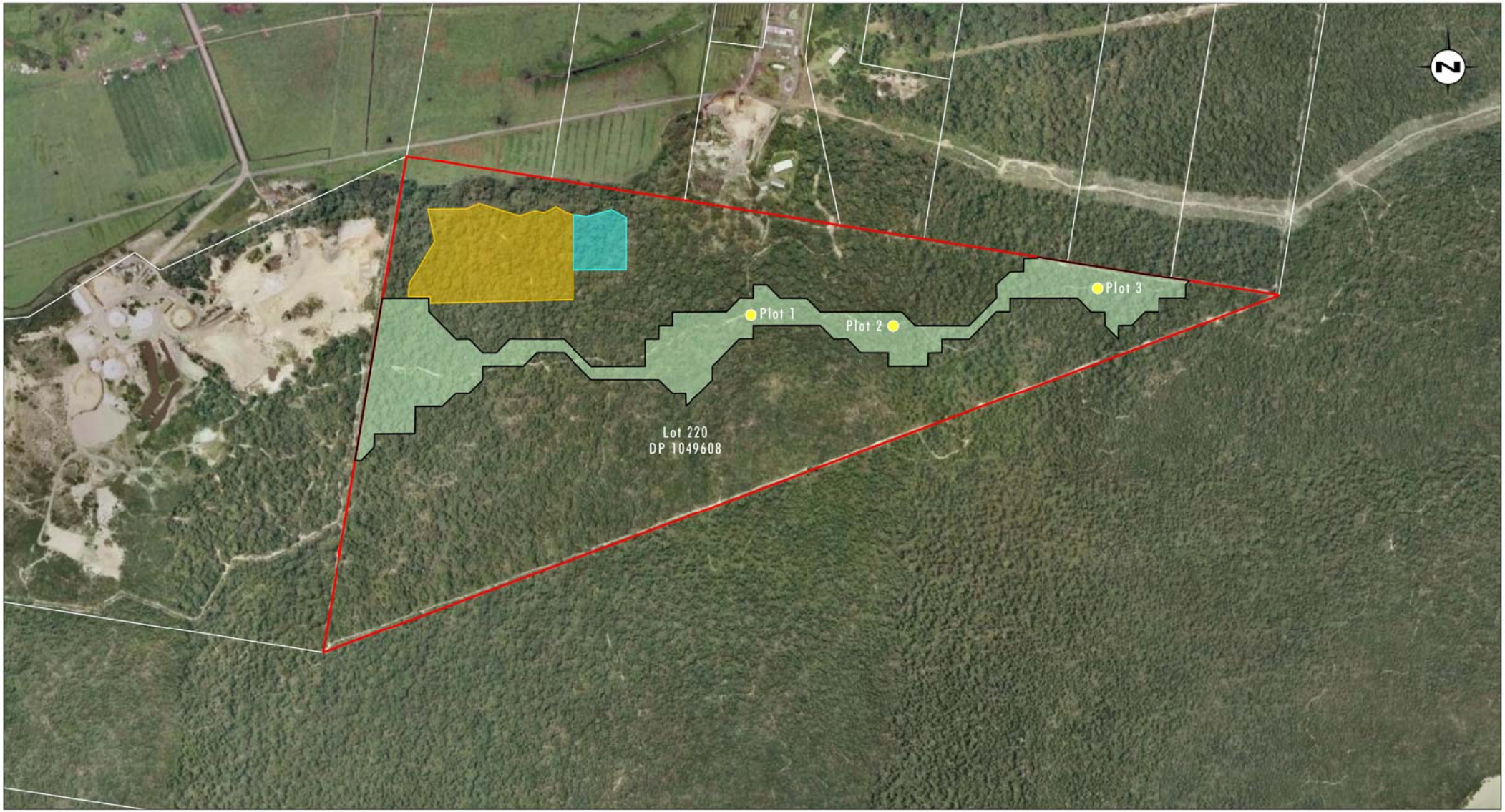
Extraction operations commenced at Lot 220 on 23 November 2009. Initial operations included clearing vegetation in accordance with the Vegetation Clearance Management Plan and Aboriginal Cultural Heritage Management Plan. This involved:

- pre-clearance ecological survey;
- clearing understorey vegetation;
- inspection by Aboriginal stakeholders;
- clearing of larger trees in accordance with Vegetation Clearance Management Plan;
- further inspection by Aboriginal stakeholders;
- relocation of tank traps in accordance with the Non-Indigenous Management Plan; and
- clearing and stockpiling of topsoil around perimeter of extraction area.

In areas where extraction has occurred hardstand has been put down to provide a trafficable surface and a reference level from which extraction depth can be regulated. Sand production from Lot 220 by month since the commencement of extraction operations is shown in **Table 3.1**. A mobile coarse screen was brought on to Lot 220 during November 2010 to enable the screening of tree roots and other debris as required. Operations had not commenced at Lot 218 as of September 2011. Approximate area of impact including cleared and extracted areas is depicted in **Figure 3.1**.

Table 3.1 – Sand Production at Lot 220 by Month since commencement of Extractive Operations

Month	Sand Extracted (tonnes)
Nov-09	9200.00
Dec-09	14460.00
Jan-10	19425.00
Feb-10	16480.00
Mar-10	18810.00
Apr-10	25920.00
May-10	19830.00
Jun-10	90623.30
Jul-10	49650.97
Aug-10	22770.20
Total to August 2010	**287169.47**



Source: Aerial: Google Earth 2008

0 100 250 500m
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Legend

- Lot 220 Approval Area
- Archaeological Area
- Monitoring Plots
- Existing Area of Impact 2011
- Anticipated Area of Impact 2012

FIGURE 3.1

Existing and Anticipated Areas of Impact

File Name (A4): R26_V1/1646_287.dgn

Table 3.1 – Sand Production at Lot 220 by Month since commencement of Extractive Operations (cont)

Month	Sand Extracted (tonnes)
Sep-10	25832.9
Oct-10	26156.67
Nov-10	27665.97
Dec-10	24526.01
Jan-11	13517.72
Feb-11	27589.38
Mar-11	34033.53
Apr-11	22464.54
May-11	33104.22
Jun-11	36115.08
Jul-11	32825.38
Aug-11	37572.09
Total Sep 2010 to August 2011	**341403.49**
Grand Total	**628572.96**

3.2 Next 12 Months

Operations at Lot 220 are anticipated to continue with production levels to increase over the coming 12 months. The mobile screen is anticipated to stay on site at Lot 220 to screen material as needed. There are no planned changes to mobile plant or infrastructure at this stage. Prior to sand production at Lot 220 exceeding 500,000 tonnes, or sand production at Lot 218 commencing, a variation to EPL 13218 will be sought.

It is anticipated that access to Lot 218 will be gained during the final quarter of 2011 or the first quarter of 2012, pending the approval and construction of a proposed access road. This will require a modification of Project Approval 08_0142. If approved, construction of the access road will commence in accordance with Project Approval 08_0142 and other regulatory and statutory guidelines as appropriate. Extraction of sands from Lot 218 will commence as soon as practicable. Extraction will be regulated by the suite of approval conditions and management plans described in **Section 2**. It is anticipated that further extraction outside of the existing impacted area as depicted in **Figure 3.1** will occur in the next 12 months. This is also shown in **Figure 3.1**. This is due to local landform characteristics and will increase the effectiveness of barrier bund stabilisation and revegetation along the northern boundary of the extraction site, and allow for the safe and orderly extraction of sand. The extended extraction area has been surveyed in accordance with the Aboriginal Heritage Management Plan (AHMP), and when clearing occurs it will be undertaken in accordance with the AHMP, Landscape Management Plan and other relevant plans and programs. It is estimated that these two areas hold sufficient sand resources for extraction for more than 12 months of extraction.

4.0 Complaints Log

No complaints have been received to date.

5.0 Monitoring Results & Analysis

5.1 Groundwater

5.1.1 Groundwater Monitoring Results

Groundwater height monitoring has been undertaken on a monthly basis at Mackas Sand since 1 March 2010 except for May 2010 and August 2010. Baseline groundwater monitoring was undertaken during 2008. Bore locations are shown on **Figure 5.1**. Groundwater height measurements are shown in **Tables 5.1** and **5.2** and graphed with relevant Hunter Water Corporation (HWC) data in **Chart 5.1**. Note that groundwater bore SP6 was covered with a significant depth of windblown sand between 1 February 2011 and 15 March 2011 as a result of the transgressive dunes moving northwards. Measurements from HWC bore BL158 which is located nearby have been taken since that time. Analysis of groundwater depth monitoring is included within **Section 5.1.2**.

Groundwater quality samples have been taken since 19 November 2010. Samples were collected every second month for seven months, and have been taken quarterly since that time. Sample results are provided in **Tables 5.3** to **5.8** and graphed in **Charts 5.2** to **5.7**. Analysis of these results against relevant standards as described in **Section 2** is provided in **Section 5.1.2**.

Table 5.1 – Mackas Sand Groundwater Depth Measurements (mAHD)

Bore	SP1	SP2	SP3	SP4	SP5	SP6	BL158*
11/07/2008	1.72	1.05	1.86	0.62	2.20	1.77	-
13/09/2008	2.20	1.65	2.36	0.62	3.15	2.77	-
11/10/2008	2.00	1.42	2.26	0.62	3.10	2.74	-
01/03/2010	1.82	1.97	2.18	0.26	3.10	2.32	-
22/04/2010	1.32	1.20	1.18	0.42	2.90	1.81	-
21/06/2010	1.72	1.60	2.18	0.66	2.60	2.45	-
30/07/2010	1.62	1.80	2.28	0.66	2.60	2.35	-
09/09/2010	1.62	1.90	2.28	0.66	2.70	2.40	-
01/10/2010	1.62	1.55	1.98	0.66	2.50	2.25	-
01/11/2010	1.78	1.87	2.19	0.94	2.87	2.42	-
30/11/2010	1.72	1.72	2.13	0.64	2.77	2.42	-
01/01/2011	1.63	1.57	2.00	0.49	2.65	2.32	-
01/02/2011	1.51	1.44	1.87	0.30	2.53	2.19	-
15/03/2011	1.34	1.44	1.71	0.35	2.38	-	-
10/04/2011	1.33	1.64	1.65	0.66	2.49	-	2.58
05/05/2011	1.39	1.71	1.69	0.70	2.70	-	2.7
19/06/2011	1.64	2.29	2.24	0.97	2.93	-	3.13
25/07/2011	2.02	2.77	2.64	0.98	3.33	-	3.55
23/08/2011	2.14	2.89	2.52	1.03	3.42	-	3.51

*Groundwater depth unverified

Source: Aerial: Google Earth 2008, Cadastral: Department of Lands, 2003
Note: Contour Interval 2m

Legend

- Lot Boundaries (218 & 220)
- Approved Extraction Areas
- HWC Emergency Borefield Easement
- Groundwater Monitoring Bore Location
- Dust Monitoring Bore Location

FIGURE 5.1

Monitoring Locations

Table 5.2 – Hunter Water Corporation Groundwater Depth Measurements (mAHD)

Bore	BL135	BL152	BL153	BL158	BL159
04/02/2010	2.21	2.27	2.93	2.71	1.74
18/02/2010	2.21	2.25	2.93	2.72	1.64
05/03/2010	2.18	2.23	2.90	2.69	1.62
19/03/2010	2.38	2.38	3.04	2.88	1.76
08/04/2010	1.98	2.36	2.69	2.53	1.29
28/04/2010	1.87	2.23	2.57	2.41	1.15
07/05/2010	1.89	2.22	2.59	2.42	1.12
09/06/2010	2.28	2.21	3.04	2.80	1.87
18/06/2010	2.40	2.35	3.12	2.89	1.96
02/07/2010	2.29	2.21		2.81	1.88
16/07/2010	2.44	2.40	3.05	2.93	1.99
20/07/2010	2.55	2.51	3.16	3.04	2.10
13/08/2010	2.54	2.53	3.26	3.18	2.07
26/08/2010	2.49	2.46	3.23	3.12	2.00
10/09/2010	2.50	2.45	3.16	3.14	1.99
24/09/2010	2.36	2.47	3.19	3.02	1.89
07/10/2010	2.32	2.43	3.04	2.98	1.86
22/10/2010	2.26	2.40	3.01	2.90	1.81
07/11/2010	2.35	2.50	2.94	2.99	1.90
17/12/2010	2.28	2.41		2.94	1.84
14/01/2011	-1.83	2.23	2.71	3.04	1.65
29/01/2011	2.02	2.16	2.84	2.71	1.57
10/02/2011	1.96	2.09	3.43	3.44	1.50
25/02/2011	1.96	2.14	3.34	2.62	1.46
11/03/2011	1.91	2.08	3.10	2.56	1.41
24/03/2011	1.94	2.11		2.59	1.45
20/04/2011	1.95	2.14	3.11	2.59	1.69
05/05/2011	1.98	2.16	3.08	2.60	1.70
02/06/2011	2.20	2.36	3.08	2.86	1.88
17/06/2011	2.28	2.47	2.82	2.99	2.08
01/07/2011	2.93	2.59	2.95	3.10	2.13
29/07/2011	2.89	2.86	3.05	3.52	2.36
12/08/2011	2.91	2.88	3.56	3.54	2.37

Table 5.3 – Groundwater pH Levels (pH Unit)

Bore	SP1	SP2	SP3	SP4	SP5	SP6	BL158
11/07/2008	-	5.5	4.8	5.6	5.4	-	-
13/09/2008	5.9	5.4	5.4	5	5.2	4.8	-
19/11/2010	5.57	5.08	5.72	5.77	5.36	5.04	-
05/01/2011	5.83	5.27	4.78	5.55	5.37	5.13	-
18/03/2011*	6.04	5.46	5.05	5.55	5.06	-	-
23/05/2011*	5.41	5.46	4.67	5.05	6.94	-	5.1
23/08/2011*	5.67	5.73	5.18	5.8	5.64	-	5.33

*bores purged using electric pump

Table 5.4 – Groundwater Conductivity Levels (µS/cm)

Bore	SP1	SP2	SP3	SP4	SP5	SP6	BL158
11/07/2008	-	218	162	178	133	-	-
13/09/2008	145	567	104	174	134	570	-
19/11/2010	154	334	158	224	131	334	-
05/01/2011	409	160	173	210	118	255	-
18/03/2011*	226	98	84	118	139	-	-
23/05/2011*	177	181	172	378	541	-	363
23/08/2011*	127	170	123	254	122	-	390

*bores purged using electric pump

Table 5.5 – Groundwater Turbidity Levels (NTU)

Bore	SP1	SP2	SP3	SP4	SP5	SP6	BL158
11/07/2008	-	-	-	-	-	-	-
13/09/2008	-	-	-	-	-	-	-
19/11/2010	72.9	44.1	76.2	123	496	69.3	-
05/01/2011	277	57.8	60.2	111	381	25.2	-
18/03/2011*	5.1	8.6	1.1	2.5	6.2	-	-
23/05/2011*	15	14.6	1	16.2	0.8	-	0.8
23/08/2011*	13.3	16.9	1.1	1.7	32.2	-	2.2

*bores purged using electric pump

Table 5.6 – Groundwater Arsenic Levels (mg/L)

Bore	SP1	SP2	SP3	SP4	SP5	SP6	BL158
11/07/2008	-	0.006	0.0012	0.0011	0.0023	-	-
13/09/2008	0.0005	0.0057	0.0005	0.0034	0.0022	0.0064	-
19/11/2010	0.003	0.002	0.004	0.008	0.003	0.003	-
05/01/2011	0.03	0.008	0.002	0.016	0.003	0.002	-
18/03/2011*	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
23/05/2011*	<0.001	0.001	<0.001	0.003	<0.001	-	0.001
23/08/2011*	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001

*bores purged using electric pump

Table 5.7 – Groundwater Manganese Levels (mg/L)

Bore	SP1	SP2	SP3	SP4	SP5	SP6	BL158
11/07/2008	-	-	-	-	-	-	-
13/09/2008	-	-	-	-	-	-	-
19/11/2010	0.034	0.016	0.038	0.048	0.04	0.014	-
05/01/2011	0.09	0.026	0.016	0.084	0.023	0.021	-
18/03/2011*	0.011	0.034	0.017	0.014	0.04	-	-
23/05/2011*	0.035	0.045	0.005	0.046	0.048	-	0.009
23/08/2011*	0.028	0.027	<0.001	0.032	0.02	-	0.01

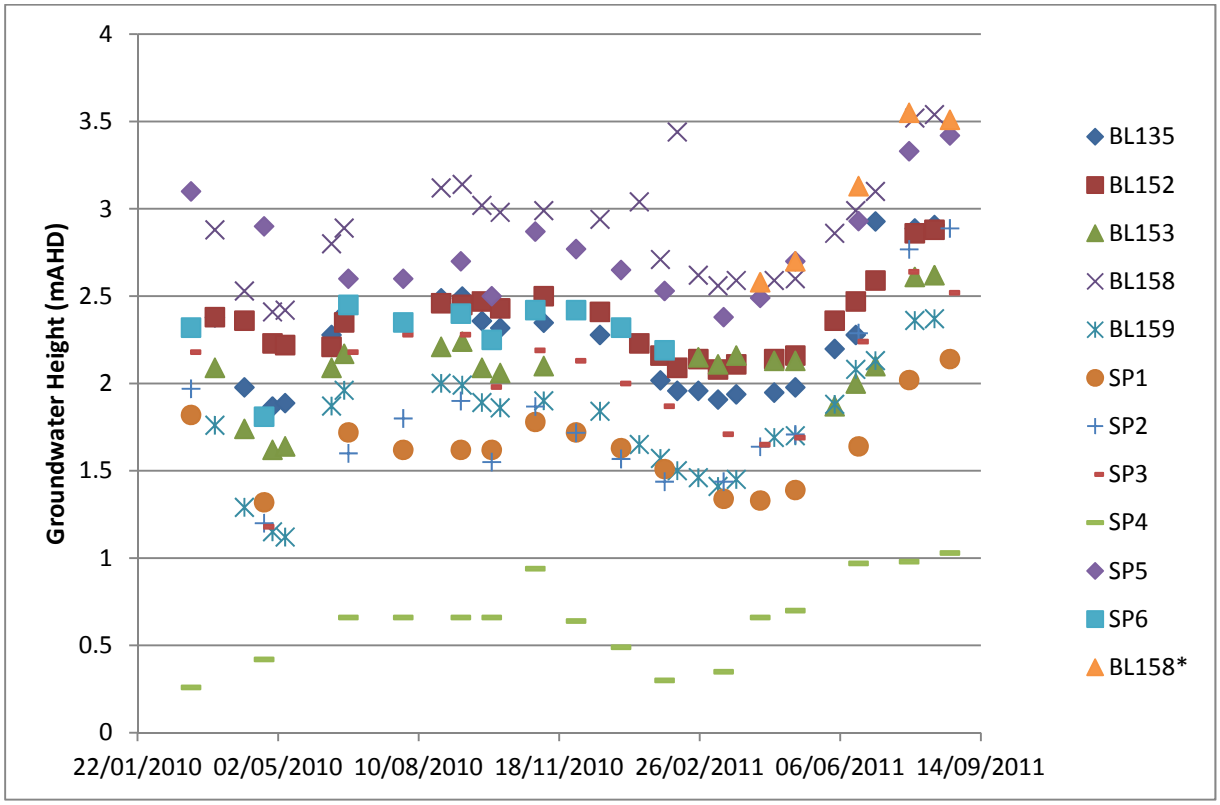
*bores purged using electric pump

Table 5.8 – Groundwater Iron Levels (mg/L)

Bore	SP1	SP2	SP3	SP4	SP5	SP6	BL158
11/07/2008	-	8.7	0.24	2.5	0.77	-	-
13/09/2008	0.47	3.7	0.22	3.9	0.91	2.8	-
19/11/2010	4.91	1.74	5.5	3.26	1.46	1.14	-
05/01/2011	9.55	9.38	2.39	13.1	1.28	1.6	-
18/03/2011*	0.2	2.12	0.18	0.51	1.12	-	-
23/05/2011*	2.3	2.38	0.29	5.7	1.02	-	0.89
23/08/2011*	2.13	2.1	0.11	2.02	0.64	-	1.01

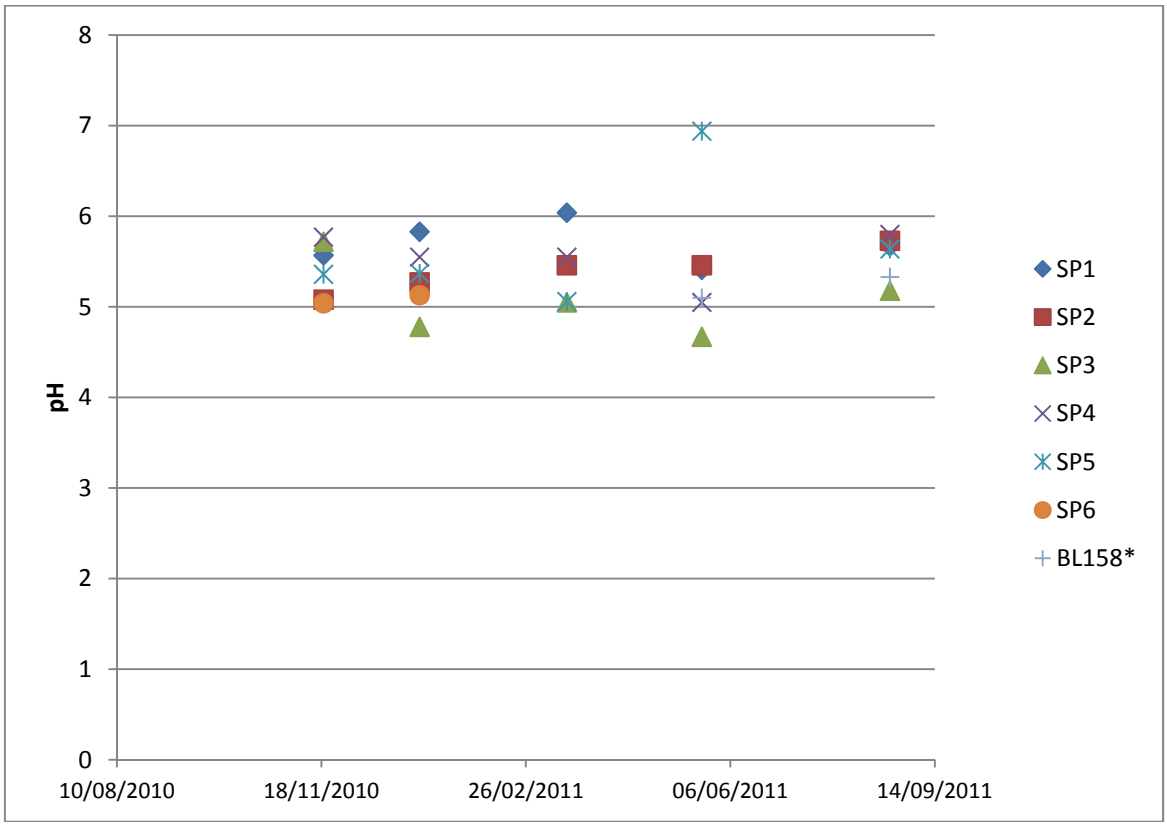
*bores purged using electric pump

Chart 5.1 – Comparison between Mackas Sand and HWC Groundwater Level Data



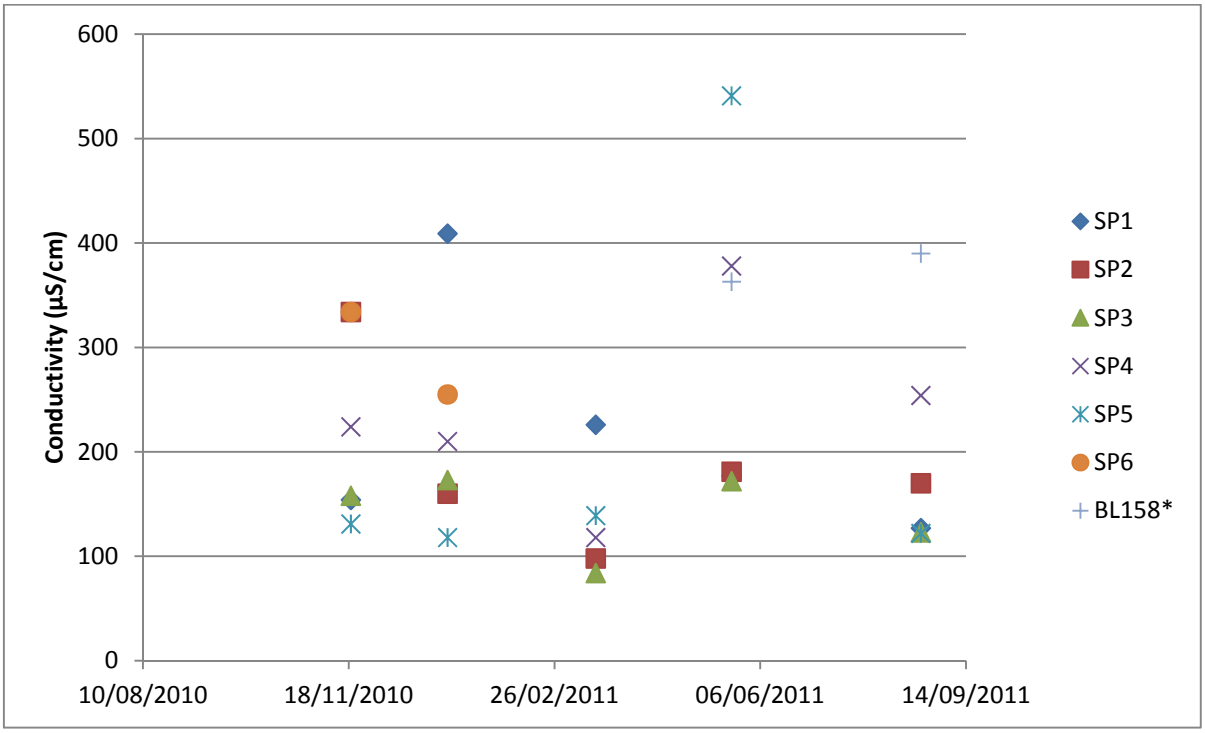
*BL158 data as taken by Mackas Sand
Note following HWC bore BL153 measurements excluded; -3.24m on 17/12/2010, -1.11m on 14/01/2011, -3.52m on 29/01/2011, -3.61m on 10/02/2011 and bore BL135 measurement -1.832m on 14/01/2011.

Chart 5.2 – Groundwater pH Levels (pH Unit)



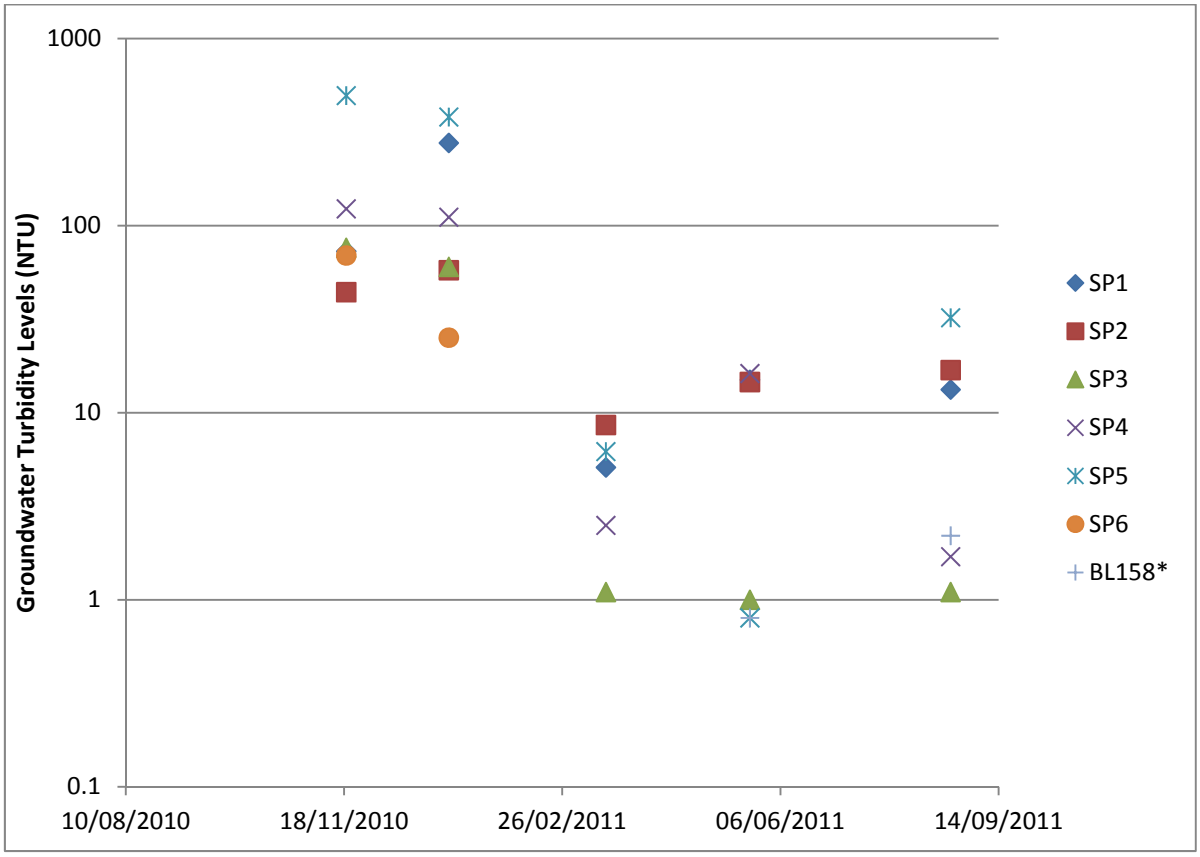
*BL158 data as taken by Mackas Sand

Chart 5.3 – Groundwater Conductivity Levels (µS/cm)



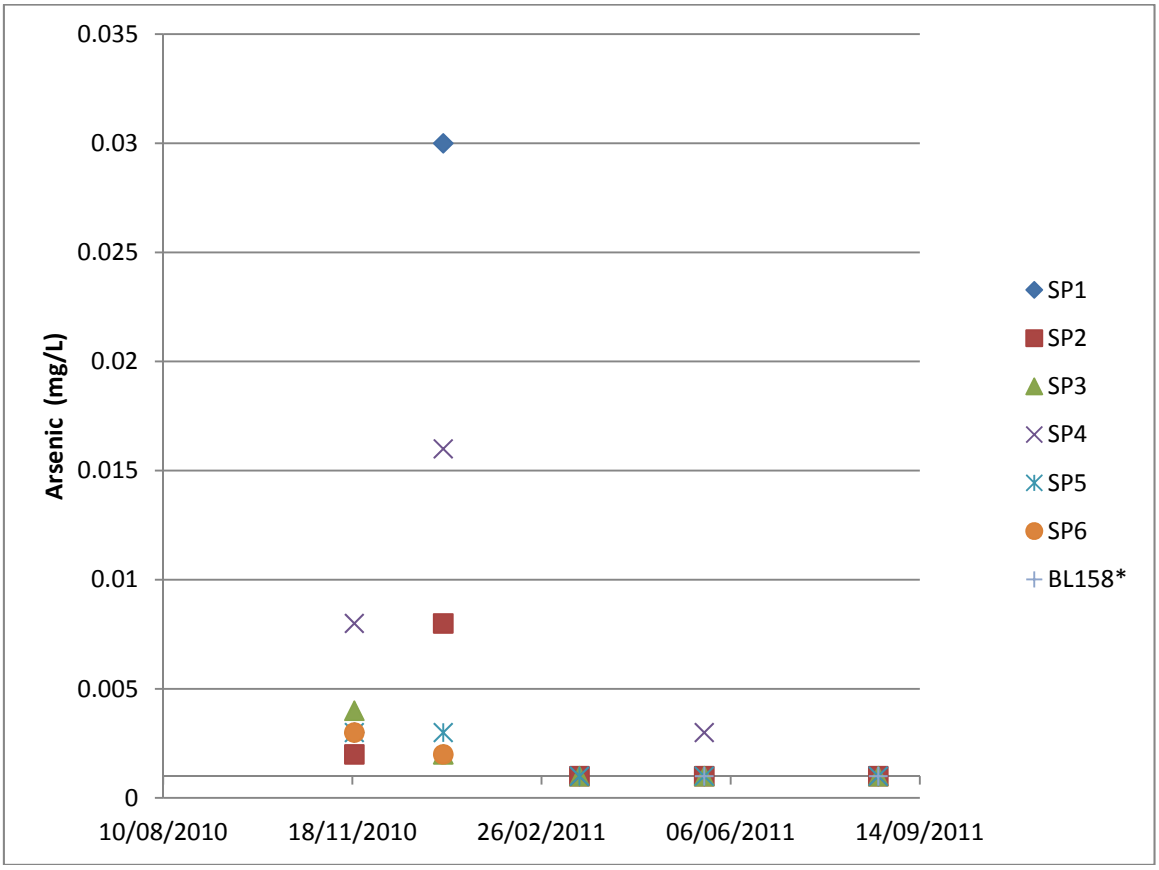
*BL158 data as taken by Mackas Sand

Chart 5.4 – Groundwater Turbidity Levels (NTU)



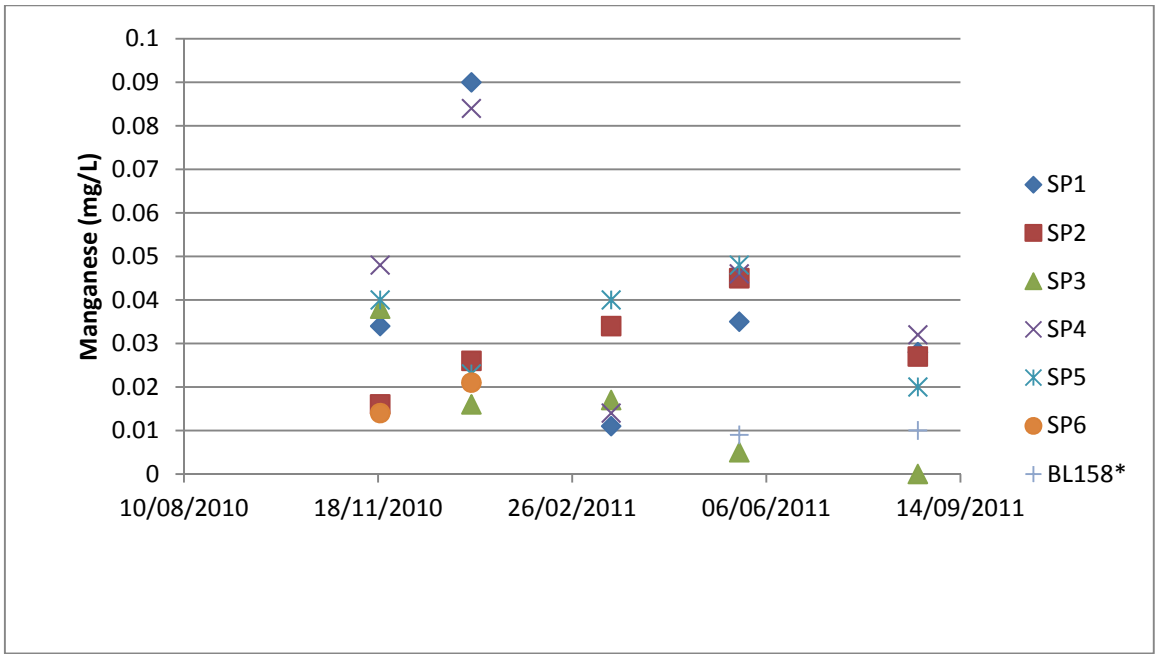
*BL158 data as taken by Mackas Sand
Note scale of Chart 5.4 is logarithmic (base 10) in order to meaningfully show differences in lower turbidity measurements across samples. Raw data is available in **Table 5.5** and discussion of measurements in **Section 5.1.2**. Bores purged using electric pump for all samples collected from 18/03/2011 onwards

Chart 5.5 – Groundwater Arsenic Levels (mg/L)



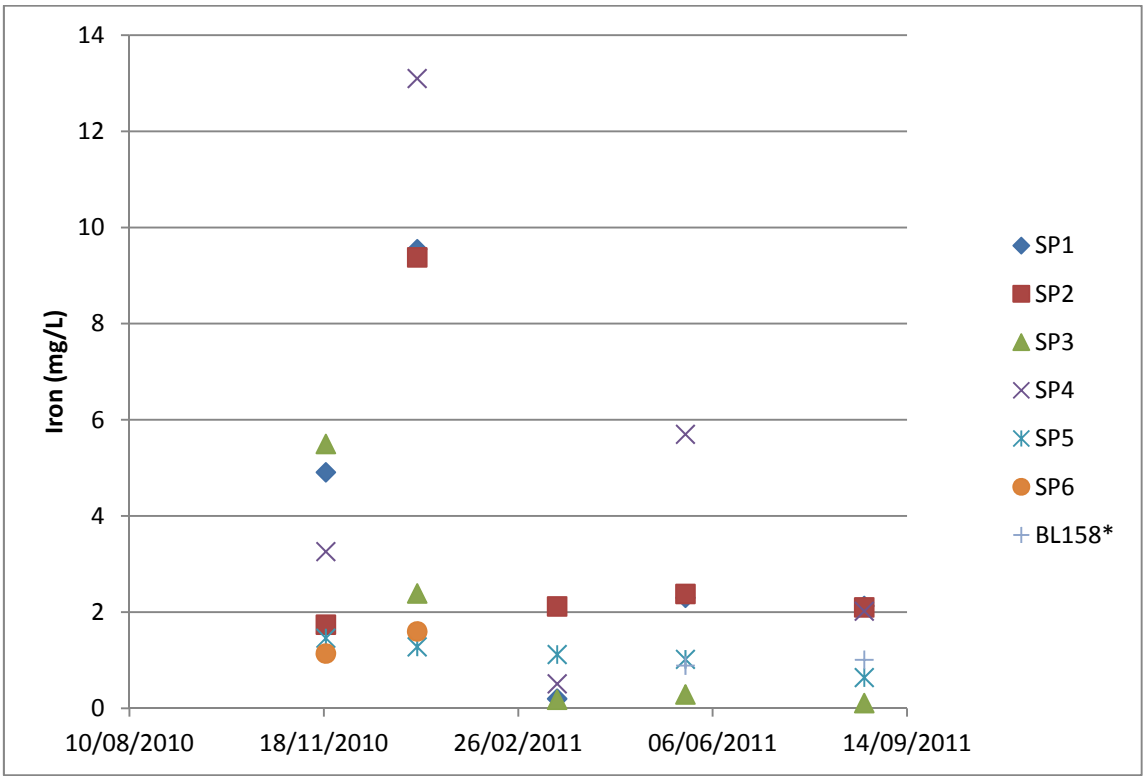
*BL158 data as taken by Mackas Sand

Chart 5.6 – Groundwater Manganese Levels (mg/L)



*BL158 data as taken by Mackas Sand

Chart 5.7 – Groundwater Iron Levels (mg/L)



*BL158 data as taken by Mackas Sand

5.1.2 Groundwater Analysis

In accordance with Project Approval 08_0142, Schedule 5, Condition 4 (e), the impact assessment criteria and predictions made within the environmental assessment (EA) were incorporated into the Mackas Sand Soil and Water Management Plan (SWMP) (Umwelt 2009a revised 2011) which states:

> Groundwater quality will be monitored quarterly at selected bores for the life of the operation for the following groundwater quality parameters:
>
> - pH (Lab);
> - Conductivity (µS/cm);
> - Arsenic;
> - Iron;
> - Manganese; and
> - Turbidity.
>
> Quarterly results will be compiled and analysed to check for unforeseen impacts or unacceptable trends in groundwater quality. A short report will be prepared quarterly and provided to the Quarry Manager who will implement any necessary changes or controls that may be required.

The SWMP further states:

> The main criteria to be used for comparing groundwater quality will be baseline measurements recorded in **Table 5.9**.

Table 5.9 – Groundwater Quality (September 2008 to October 2008)

Parameter	Monitoring Point SP1	Monitoring Point SP2	Monitoring Point SP3	Monitoring Point SP4	Monitoring Point SP5	Monitoring Point SP6	Drinking Water Guidelines
pH	5.9	5.4-5.5	4.8-5.4	5.0-5.6	5.2-5.4	4.8	6.5 – 8.5
EC (µS/cm)	145	218-567	104-162	174-178	133-134	570	1000
Fe (mg/L)	0.47	3.7-8.7	0.22-0.24	2.5-3.9	0.77-0.91	2.8	0.3
As (mg/L)	<0.0005	0.0057-0.0060	0.0005-0.0012	0.0011-0.0034	0.0022-0.0023	0.0064	0.007

* Aesthetic value given as no health guideline applies

Note: Drinking Water Guidelines are from National Health and Medical Research Council (2004)

These limits were determined based on site specific groundwater quality information that was available at the time. This site specific data from bores SP1 to SP6 during 2008 is reported within **Section 5.1.1** and provides baseline comparison levels for analysis. Note that further analysis is available within *Mackas Sand Annual Groundwater Monitoring Report* (Umwelt 2011a), prepared in accordance with EPL 13218.

In order to provide further background levels, groundwater quality data collected 1995 and 2006 as part Mineral Deposits Limited's (MDL) operations within the North Stockton Sandbeds to the south-west of Lot 218 are provided in **Table 5.10**.

Table 5.10 summarises the pre-mining monitoring results for MDL monitoring points on the landward side of the mobile dunes within similar locations on North Stockton Sandbeds to that on Lots 218 and 220. These monitoring points measured groundwater between 7 and -2 metres AHD. These data have been included to provide broader background water quality monitoring data within North Stockton Sandbeds.

Table 5.10 – Range of Pre-mining Monitoring Results in Monitoring Points (MP) on the Landward Side of MDL Operations

Parameter	MP 130	MP132	MP139a	MP139b	MP140a	MP140b
Monitoring Dates	Jun 95 – Sep 06	Jul 95 – Sep 06	Nov 97 – Sep 06	Nov 97 – Sep 06	Nov 97 – Jan 04	Nov 97 – Jan 04
pH	4.8 – 6.0	3.8 – 5.9	3.9 – 6.2	4.4 – 5.3	4.1 – 5.2	4.4 – 5.2
EC (µS/cm)	110 – 331	101 – 480	80 – 414	088 – 374	117 – 463	117 – 426
Fe (mg/L)	0.58 – 2.20	0.20 – 1.80	<0.10 – 1.10	0.28 – 4.30	0.40 – 2.20	0.32 – 2.60
Cl (mg/L)	23 – 89	22 – 110	3 – 105	2 – 100	18 – 110	31 – 105
As (mg/L)	<0.001 – 0.01	<0.001 – 0.01	<0.001 – 0.007	<0.001 – 0.01	<0.001 – 0.003	<0.001 – 0.006

Groundwater Height Analysis

As shown in **Chart 5.1**, the recorded groundwater depths from the monitoring bores at Mackas Sand are generally consistent with the recorded groundwater depths from the HWC bores for the duration of operations.

Maximum groundwater heights recorded by HWC are listed within **Table 5.11**. Maximum groundwater heights occurred following significant rain events during June 2007.

Table 5.11 – Maximum Groundwater Heights after June 2007

HWC Bore	Date of Max reading	Groundwater Height (mAHD)
BL135	17/08/2007	3.40
BL152	22/06/2007	3.73
BL153	12/10/2007	2.95
BL158	31/08/2007	3.55
BL159	03/08/2007	2.77

Monitoring at groundwater monitoring bores SP1 to SP6 commenced after the June 2007 rainfall events. Groundwater monitoring bore SP4 is located adjacent to an artificial drain that has been constructed along the northern boundary of Lot 220 at the interface between the interbarrier depression and the vegetated dunes. Groundwater levels exhibited at this bore range from approximately 0.25 mAHD to 1.0 mAHD.

Groundwater bores SP5, SP6, BL152 and BL 158 are all located near the landward edge of the mobile dune system on Lot 218. Groundwater Bores SP5 and BL152 are located within 50 metres of one another with the ground level at SP5 being approximately 0.25 metres higher than at BL152. Recorded groundwater levels at both sites vary by approximately 1 metre with the recorded groundwater level at SP5 being typically 0.5 metres higher than at BL152.

Groundwater Bores SP6 and BL158 are located within approximately 100 metres of one another. Recorded groundwater levels at SP6 varied by approximately 1 metre while at BL158 the groundwater level fluctuated by approximately 1.4 metres. Recorded groundwater level at BL158 is typically 0.2 to 0.5 metres higher than at SP6. A significant depth of windblown sand was blown over bore SP6 between 1 February 2011 and 15 March 2011 making it no longer accessible. As a result, groundwater monitoring has been transferred to nearby HWC bore BL158 which has been subsequently monitored as part of Mackas Sand monitoring program since that time. As shown on **Chart 5.1**, measurements taken by HWC and Mackas Sand at BL158 have been consistent since Mackas Sand monitoring of BL158 commenced.

Monitoring bores BL 135, BL 153, SP1 and SP3 are all located within the vegetated dunes between the mobile dunes and the interbarrier depression. These bores exhibit groundwater levels fluctuating between approximately 1.18 mAHD and 2.7 mAHD with recorded groundwater levels fluctuating over the period of record by approximately 1 to 1.4 metres.

Monitoring bores SP2 and BL159 are both located on the footslopes of the vegetated dune system approximately 200 to 400 metres from the interbarrier depression. Recorded groundwater levels at SP2 and BL159 ranged by approximately 1.5 metres.

Except for occasional outliers in HWC data which are considered to be a result of recording error, groundwater levels at the HWC and Mackas Sand bores are consistent in elevation and respond consistently to changes in climatic conditions. As a result an extensive and consistent groundwater level data set has been established for North Stockton Sandbeds in the vicinity of extractive operations on Lot 218 and Lot 220.

Groundwater pH

As shown in **Chart 5.2**, the pH values from the groundwater monitoring at Mackas Sand groundwater monitoring bores range from 4.67 to 6.94, and are slightly acidic. pH values fluctuate both over time and between bores and are generally consistent with those recorded during 2008 as baseline measurements and those recorded as part of MDL's North Stockton Sandbed operations (see **Table 5.10**).

Groundwater from SP5 on 23 May 2011 indicated a pH of 6.94 which is higher than the range of pH levels recorded for Mackas Sand and for the landward MDL bores recorded in **Table 5.10** but is within an acceptable range for drinking water. Previous MDL monitoring within the mobile dune field has recorded pH values of 7 to 7.5.

During the monitoring period, extractive operations on Lot 218 had not commenced and bore SP5 is too distant to be potentially affected by operations on Lot 220 and as a result it is considered that the neutral pH recording is due to natural variability.

Groundwater Conductivity

As shown in **Chart 5.3**, the conductivity values from groundwater monitoring at Mackas Sand ranged from 118 µS/cm to 570 µS/cm and are consistent with those recorded during 2008 as baseline measurements and at MDL within North Stockton Sandbeds.

Groundwater Turbidity

As shown in **Chart 5.4**, the Turbidity values from groundwater monitoring at Mackas Sand when recorded on 19 November 2010 and 5 January 2011 were higher than expected in a sand environment generally, with monitoring bore SP5 recording turbidity of 496 NTU. High turbidity has the potential to impact on the measurement of a range of water quality parameters. Field investigation of the Mackas Sand monitoring bores undertaken in January 2011 found that the bores required significant purging which was not being achieved by the previous hand bailing that had been undertaken. As a result, a suitable electric bore pump was identified and purchased by Mackas Sand for use during groundwater monitoring and field instructions given in regard to use of the bore and sampling techniques.

Since 18 March 2011 the electric bore pump has been utilised to purge bores properly before samples are taken. With the use of the electric bore pump turbidity readings have reduced significantly and range from 0.8 NTU to 32.2 NTU. No baseline measurements for turbidity were undertaken during 2008 or as part of the MDL monitoring program. Note that the scale on **Chart 5.4** is logarithmic. Data has been presented in this way to preferentially illustrate meaningful differences in turbidity readings since the utilisation of the electric bore pump rather than differences between readings previous to this time.

Previous analysis undertaken as part of the MDL monitoring program has indicated that high turbidity levels can also influence recorded arsenic and iron concentrations in particular and as a result arsenic and iron concentrations recorded prior to 18 March 2011 are potentially affected by the high levels of sediment that was present in the groundwater bores before they were thoroughly purged.

Groundwater Arsenic

In samples taken from 18 March 2011 onwards, arsenic concentrations at all Mackas Sand monitoring sites have been in the range of <0.001 to 0.003 mg/L and samples from all bores remain within drinking water guidelines and generally similar to or lower than concentrations recorded for North Stockton Sandbeds as part of the MDL operations.

Groundwater Manganese

No baseline measurements for manganese were undertaken during 2008. Manganese levels have remained consistent, ranging from <0.001 mg/L at SP3 to 0.9 mg/L at SP1. The use of the electric bore pump did not substantially alter the groundwater manganese levels within water samples.

Groundwater Iron

Groundwater iron concentrations from samples taken before 18 March 2011 varied from 0.22 mg/L to 13.1 mg/L. The subsequent use of the electric bore pump to appropriately purge monitoring bores resulted in lower concentrations of iron being recorded than prior to March 2011 with iron concentrations varying from 0.11 mg/L and 5.7 mg/L. Groundwater iron concentrations are consistently above drinking water guidelines and this is considered typical of groundwater in the North Stockton Sandbeds.

5.2 Air Quality

Condition 11 of Schedule 3 of Project Approval 08_0142 states:

> The Proponent shall ensure that the dust emissions generated by the project do not cause additional exceedances of the air quality impact assessment criteria listed in Tables 5, 6 and 7 at any residence on privately owned land, or on more than 25 percent of any privately owned land.

Table 5: Long term impact assessment criteria for particulate matter

Pollutant	Averaging period	Criterion
Total suspended particulate (TSP) matter	Annual	90 µg/m^3
Particulate matter < 10 µm (PM_{10})	Annual	30 µg/m^3

Table 6: Short term impact assessment criterion for particulate matter

Pollutant	***Averaging period***	***Criterion***
Particulate matter < 10 µm (PM_{10})	24 hour	50 µg/m^3

Table 7: Long term impact assessment criteria for deposited dust

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

Note: Deposited dust is assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method.

Air quality modelling undertaken as part of the EA (Umwelt 2009b) indicated that the predominant potential source of dust generation was from haul roads. No sand has been extracted or transported from Lot 218 in the reporting period and therefore there is no potential for dust generation as result of operations on Lot 218.

Sand extraction has been undertaken on Lot 220 with product being transported via private haul road over land owned by Mackas Sand or associated entities. Air quality modelling (Umwelt 2009b) indicates that dust deposition from sand extraction operations could result at the nearest non-related residence (Hufnagls) in additional:

- Dust deposition of 0.013 g/m^2/month annual average.
- 24 hour Average PM_{10} concentrations of 50 µg/m^3.
- Annual Average PM_{10} of 3 µg/m^3 (25 µg/m^3 including background).
- Annual Average TSP of 8.5 µg/m^3 (61 µg/m^3 including background).

The nearest residences to the haul route are all adjacent to the sealed section of the haul route which has minimal dust generation potential. As a result it was considered that dust monitoring for operations at Lot 220 would be initially limited to dust deposition monitoring unless dust emissions were noted as potentially being an issue at which time monitoring of PM_{10} and TSP concentrations would be undertaken. To date dust emissions have not been an issue and no complaints have been received in regard to dust from operations at Lot 220.

To provide a measure of dust emissions from Lot 220 sand extraction operations and background for future operations on Lot 218, two dust deposition gauges (DDG1 and DDG2) were installed on 1 December 2010. Recording of dust deposition levels commenced on 4 January 2011. Monitoring locations are shown on **Figure 5.1**. Recorded dust deposition levels are provided in **Tables 5.12** and **5.13**. DDG 3 as indicated on **Figure 5.1** is currently being installed prior to extraction commencing on Lot 218. Mackas Sand agreed to install the third dust deposition gauge in consultation with the Community Consultative Committee. The location was chosen by the Committee to monitor levels of dust associated with the transport of sand from Lot 218.

Table 5.12 – Total Dust Deposition Levels at DDG 1 – Lot 220

	Ash Content (g/m².month)	Total Insoluble Matter (g/m².month)
04/01/2011	0.7	6.2
13/04/2011	0.7	1.6
20/05/2011	0.6	0.7
20/06/2011	0.5	0.5
25/07/2011	0.4	0.6
23/08/2011	0.7	0.7

Table 5.13 – Dust Deposition Levels at DDG 2 – Lot 218

	Ash Content (g/m².month)	Total Insoluble Matter (g/m².month)
04/01/2011	0.4	0.9
13/04/2011	0.8	2.9
20/05/2011	7.4	7.5
20/06/2011	23.1	23.1
25/07/2011	0.8	0.8
23/08/2011	3.9	4

Dust Deposition at DDG1 (Lot 220) recorded Total Dust Deposition levels varying between 0.5 g/m²/month and 1.6 g/m²/month, with one recorded value of 6.2 g/m²/month on 4 January 2011. While 6.2 g/m²/month is higher than the total dust deposition of 4 g/m²/month, analysis of the ash content (0.7 g/m^2/month) within the sample taken indicates that approximately 5.5 g/m²/month is due to organic matter. It is considered that this anomalous reading of Total Insoluble Matter was due to the intrusion of combustible material (plant or animal) unrelated to dust generated by extractive operations. The remainder of samples received indicate that operations on Lot 220 are complying with an increase of less than 2 g/m²/month annual average and total dust deposition of less than 4 g/m²/month.

Results from dust deposition samples at DDG2 (Lot 218) vary significantly, with readings of Total Insoluble Matter from 0.9 g/m².month to 23.1 g/m².month. As operations have not yet commenced at Lot 218 it is considered that elevated dust deposition levels could have resulted from:

- dust from other nearby sand extraction operations; or
- sand blowing in off the transgressive dune system to the south.

Previous observations of sand movement on the mobile dune system have demonstrated that during high wind conditions significant volumes of sand can be transported over large distances confirming that this area can on occasions be a high dust (sand) deposition environment where deposition levels exceed the criteria set out in Condition 11 of Schedule 3 of Major Project Approval 08_0142 of total dust deposition of 4 g/m^2/month.

Dust deposition monitoring will continue on a monthly basis at all monitoring points to detect any impacts due to sand extraction operations at Lot 220 and Lot 218 over the coming year.

5.3 Noise

Two attended noise surveys were undertaken in the year preceding 20 September 2011. Noise monitoring occurred during January 2011 as articulated within **Appendix 1**; *Environmental Noise Monitoring Summer 2010/2011* (Umwelt 2011b). This monitoring indicated that sound power levels emitted from the quarry site are 115 dB(A), which is 2 dB(A) less than the 117 dB(A) predicted within the Noise Impact Assessment (Umwelt 2009b). Sound power levels emitted from the six truck movements associated with Mackas Sand recorded during the monitoring were 44 dB(A). If 11 laden vehicles, being the maximum number of heavy vehicle movements as assessed within the EA were to occur it is predicted to raise the impact by 3 dB(A) to 47 dB(A). This remains significantly less than the allowable limits as shown in **Table 5.14**.

Table 5.14 – Traffic Noise Impact Assessment Criteria, dB(A)

Road	Day/Evening $L_{Aeq, 1\ hour}$	Night $L_{Aeq, 1\ hour}$
Lavis Lane, Oakvale Road, Nelson Bay Road	60	55

Results of the attended noise monitoring program conducted on 18 January 2011 indicated that Mackas Sand was complying with the noise assessment criteria as outlined in Project Approval 08_0142 and EPL 13218 for the meteorological conditions experienced at the time of monitoring.

Further monitoring was undertaken on 8 September 2011. Attended noise monitoring was conducted at four locations in the region surrounding the Mackas Sand site during the night period between 6.00 am to 7.00 am and the day period between 7.00 am to 9.50 am. Analysis of monitoring results indicates that Mackas Sand extraction operations were generating noise levels of 3 dB(A) to 11 dB(A) below night time noise criteria, and 2 dB(A) to 10 dB(A) below day time noise criteria as shown in **Table 5.15** and **Table 5.16**. Further information regarding this monitoring is available in *Environmental Noise Monitoring September 2011* (Umwelt 2011c) (see **Appendix 2**).

Table 5.15 – Predicted Night Time Noise Levels versus Noise Criteria, dB(A)

Location	$L_{Aeq, 15\ minute}$		$L_{A1, 1\ minute}$	
	Noise Criteria	Noise Level Contribution	Noise Criteria	Noise Level Contribution
Site 1	35	26	45	42
Site 3	35	32	45	38

Note: No measurements were conducted at Sites 3 and 4 in the night period.

Table 5.16 – Predicted Day Time Noise Levels versus Noise Criteria, dB(A)

Location	$L_{Aeq, 15\ minute}$	
	Noise Criteria	Noise Level Contribution
Site 2	36	34
Site 3	35	29
Site 4	36	26 to 27

Note: No measurements were conducted at Sites 3 and 4 in the night period.

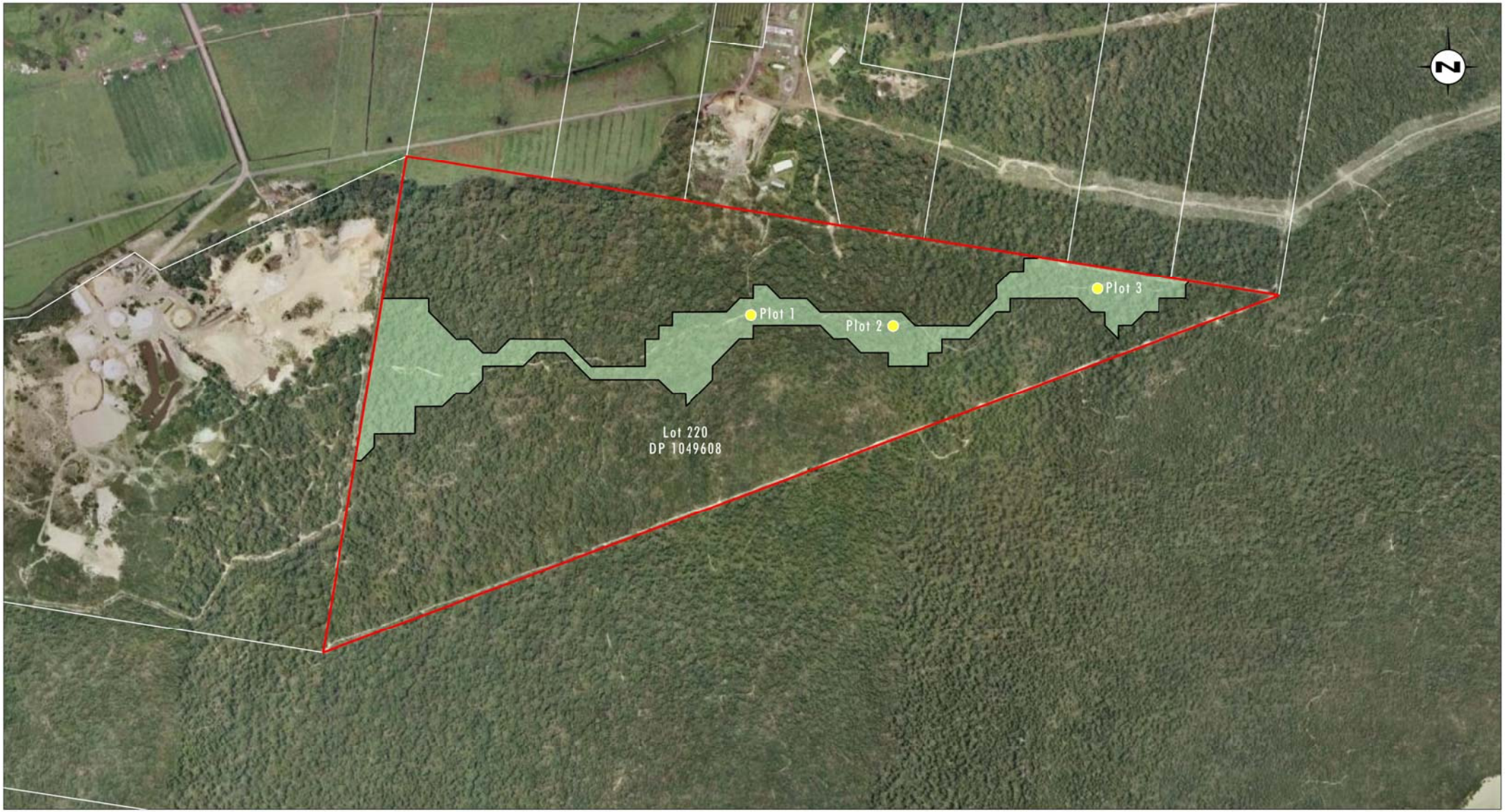
5.4 Ecological Monitoring

The Mackas Sand Landscape Management Plan (Umwelt 2009c) in regard to rehabilitation of Lot 220 states that:

> As the objective of the rehabilitation is to return the site to a native ecosystem, reference/analogue sites are required based on the following criteria:
>
> - analogue sites should occur in natural ecosystems, representative of the goal/target for rehabilitation; and
>
> - where possible, analogue sites should occur in areas that have experienced minimal disturbance.

Three permanent flora monitoring plots were established in strategic locations throughout the study area as remnant analogue sites against which to monitor rehabilitated vegetation on 1 February 2011. Flora monitoring plots were established within Apple – Blackbutt Coastal woodland vegetation communities in areas that will not be impacted by sand extraction operations. The locations of these flora sites are shown on **Figure 5.2**.

Details regarding the establishment of baseline ecological values against which rehabilitated areas can be assessed is available within *Mackas Sand Ecological Monitoring Program for Lot 220 DP 1049608* (Umwelt 2011d) (see **Appendix 3**).



Source: Aerial: Google Earth 2008

0 100 250 500m
1:10 000

Legend

- Lot 220 Approval Area
- Archaeological Area
- Monitoring Plots

FIGURE 5.2

Location of Monitoring Plots

Further ecological monitoring of rehabilitated areas and remnant sites will be undertaken in accordance with the Landscape Management Plan as required.

6.0 Non-Compliances

Compliance with the consent conditions within Project Approval 08_0142 is assessed below. It is noted that increased regularity of data collection during 2011 has provided results which indicate that no significant harm to the environment has occurred due to Mackas Sand operations.

SCHEDULE 2
ADMINISTRATIVE CONDITIONS

Obligation to Minimise Harm to the Environment

1. The Proponent shall implement all reasonable and feasible measures to prevent or minimise any harm to the environment that may result from the construction, operation, or rehabilitation of the project.

Mackas Sand has undertaken sand extraction operations on Lot 220 in a manner that prevents or minimises harm to the environment.

Terms of Approval

2. The Proponent shall carry out the project generally in accordance with the:
   (a) EA;
   (b) statement of commitments; and
   (c) conditions of this approval.

The project has generally been carried out in accordance with the EA, statement of commitments and conditions of Project Approval 08_0142. Areas where there are deviations from consent requirements are discussed in regard to the relevant condition.

3. If there is any inconsistency between the above, the conditions of this approval shall prevail to the extent of the inconsistency.

Noted.

4. The Proponent shall comply with any reasonable requirement/s of the Director-General arising from the Department's assessment of:
   (a) any reports, plans, programs or correspondence that are submitted in accordance with this approval; and
   (b) the implementation of any actions or measures contained in these reports, plans, programs or correspondence.

Noted and requirements have been complied with.

Limits on Approval

5. Quarrying operations may take place on site until 31 December 2029.

Noted.

6. The Proponent shall not transport more than:
   (a) 1,000,000 tonnes of product in a calendar year from Lot 218; and
   (b) 1,000,000 tonnes of product in a calendar year from Lot 220.

The quantity of product transported from Lot 220 is shown in **Table 3.1**. Extraction has yet to commence in Lot 218, and consequently no product has been transported from Lot 218.

7. The Proponent shall not undertake any extraction within:
   (a) 2 metres of the average year groundwater level; and
   (b) 1 metre of the highest predicted groundwater level.

Modelling indicates that average groundwater level in the northern approval area of Lot 220 (see **Figure 1.1**) ranges from 1.0 mAHD to approximately 1.75 mAHD. The maximum predicted groundwater level in the same area ranges from 2.25 mAHD to 3 mAHD. The highest point of the maximum predicted groundwater level within quarried areas is under 2.75 mAHD, with an average groundwater height of under 1.75 mAHD. Extraction has occurred to a level of 4 mAHD at the entrance to the quarry site, and to a minimum extraction level of 3.8 mAHD within the extracted area. This is 2.05 metres above the average groundwater height and 1.05 metres above the maximum predicted groundwater height within the quarried area. Extraction at Lot 220 has not occurred within two metres of the average year groundwater level and has been maintained at least one metre above the highest predicted groundwater level.

Management Plans/Monitoring Programs

8. With the approval of the Director-General, the Proponent may submit any management plan or monitoring program required by this approval on a progressive basis.

Management plans have been submitted on an ongoing basis with several of the submission dates as required within Schedule 3 of Project Approval 08_0142 not met. Several of these plans have recently been revised and resubmitted to the Department of Planning & Infrastructure (DP&I) for approval. Any further modifications to these plans such as those that may be required before extraction at Lot 218 commences will be submitted to the DP&I for approval prior to extractive operations. Approval of specific management plans are addressed individually below.

Structural Adequacy

9. The Proponent shall ensure that all new buildings and structures, and any alterations or additions to existing buildings and structures, are constructed in accordance with the relevant requirements of the BCA.

No new buildings have been constructed and no alterations have occurred as of September 2011.

Demolition

10. The Proponent shall ensure that all demolition work is carried out in accordance with *AS 2601-2001:The Demolition of Structures,* or its latest version.

No demolition work has occurred.

Protection of Public Infrastructure

11. The Proponent shall:
   (a) repair, or pay the full costs associated with repairing, any public infrastructure that is damaged by the project; and
   (b) relocate, or pay the full costs associated with relocating, any public infrastructure that needs to be relocated as a result of the project.

No public infrastructure has been reported as being damaged by the project as of September 2011.

Operation of Plant and Equipment

12. The Proponent shall ensure that all plant and equipment used at the site is:
    (a) maintained in a proper and efficient condition; and
    (b) operated in a proper and efficient condition.

All plant and equipment used at the site is maintained and operated in a proper and efficient condition.

Section 94 Contributions

13. The Proponent shall pay Council contributions for roadworks in accordance with the *Port Stephens Section 94 Development Contributions Plan 2007*, as may be updated from time to time, to the satisfaction of the Director-General.

Section 94 contributions have been paid at a rate of $0.04 per tonne.kilometre as shown in **Table 6.1** in accordance with the *Port Stephens Section 94 Development Contributions Plan 2007* as discussed and agreed with Port Stephens Council. The second payment that occurred on 31 May 2010 as shown in **Table 6.1** was back payment for tonnes of sand extracted during the period between the commencement of extraction and when an agreement with Port Stephens Council regarding Section 94 Contributions was reached.

Table 6.1 – Section 94 Contributions Paid to 28 July 2011

Date	Amount Paid
31/05/2010	$1,036.80
31/05/2010	$3,135.00
07/06/2010	$793.20
27/07/2010	$3,464.10
01/09/2010	$2,143.24
24/09/2010	$910.81
28/10/2010	$1,033.32
01/12/2010	$1,046.27
01/12/2010	$1,106.64
01/03/2011	$1,521.75
01/04/2011	$969.30
28/04/2011	$1,276.95
28/07/2011	$3,667.36
Total	**$22,104.74**

SCHEDULE 3
ENVIRONMENTAL PERFORMANCE CONDITIONS

GENERAL EXTRACTION AND PROCESSING PROVISIONS

Identification of Boundaries

1. Prior to carrying out any development on site, or as otherwise agreed by the Director-General, the Proponent shall:
    (a) engage an independent registered surveyor to survey the boundaries of the approved limit of extraction;
    (b) submit a survey plan of these boundaries to the Director-General; and

(c) ensure that these boundaries are:
- clearly marked at all times in a permanent manner that allows operating staff and inspecting officers to clearly identify those limits, for all boundaries other than the seaward edge of Lot 218; or
- identifiable using an accurate Global Positioning System in a manner that allows operating staff and inspecting officers to readily identify those limits, for the seaward edge of Lot 218.

The approved limits of extraction have been surveyed and a survey plan of these boundaries was submitted to the Director-General as part of the Environmental Management Strategy (Umwelt 2009d) that was submitted to DP&I (then the Department of Planning) on 23 December 2009.

Maximum Extraction Depth Map

2. The Proponent shall:
   (a) establish the average year and highest predicted groundwater levels for the site based on all available (and at least 12 months) site specific and HWC groundwater monitoring data;
   (b) engage a suitably qualified and experienced expert to establish the maximum extraction depths to which extraction can be undertaken on site, to comply with condition 7 of schedule 2;
   (c) submit a Maximum Extraction Depth Map (contour map or similar) for the project to the Director-General within 6 months of the date of this approval; and
   (d) comply with the extraction depths specified in the map,
   to the satisfaction of the Director-General.

A report detailing the determination of groundwater levels and maximum extraction depth for Lot 220 was submitted to DP&I on 28 October 2010. The report has subsequently been reviewed and revised and resubmitted to DP&I in September 2011. Sand extraction on Lot 220 has complied with the extraction depths as required on the Maximum Extraction Depth Map that was submitted in October 2010 as well as with the levels predicted within the EA. Once approved, sand extraction will be undertaken in accordance with the revised Maximum Extraction Depth Map which is generally allows extraction to slightly lower levels than those depicted on the October 2010 Maximum Extraction Depth Map.

3. Within 3 months of the completion of the Independent Environmental Audit (see condition 5 of schedule 5), the Proponent shall review and update as required the Maximum Extraction Depth Map for the project to the satisfaction of the Director-General.

The Independent Environmental Audit is due on 23 November 2011 and will be commissioned in the near future. At this time the Maximum Extraction Depth Map shall be reviewed as necessary.

NOISE

Impact Assessment Criteria

4. The Proponent shall ensure that the noise generated by the project does not exceed the noise impact assessment criteria in Table 1.

Attended noise monitoring undertaken on 18 January 2011 and 8 September 2011 indicate that noise generated by Mackas Sand operations has not exceeded the noise impact assessment criteria for the project.

Land Acquisition Criteria

5. If the noise generated by the project exceeds the criteria in Table 2, the Proponent shall, upon receiving a written request for acquisition from the landowner, acquire the land in accordance with the procedures in conditions 6-8 of schedule 4.

Noise generated by the project has not exceeded the project specific criteria and therefore no land acquisition has been requested or triggered.

Cumulative Noise Criteria

6. The Proponent shall take all reasonable and feasible measures to ensure that the noise generated by the quarrying operations combined with the noise generated by other extractive industries does not exceed the following amenity criteria on any privately owned land, to the satisfaction of the Director-General:

Noise generated by Mackas Sand combined with noise generated by other extractive industries in the vicinity does not exceed the listed amenity criteria.

Traffic Noise Impact Assessment Criteria

7. The Proponent shall take all reasonable and feasible measures to ensure that the traffic noise generated by the project does not exceed the traffic noise impact assessment criteria in Table 3.

Attended noise monitoring undertaken on 18 January 2011 and 8 September 2011 indicate that traffic noise generated by Mackas Sand operations has not exceeded the traffic noise impact assessment criteria for the project.

Additional Noise Mitigation Measures

8. Upon receiving a written request from:
   - the owner of residence R1, if the residence is habitable in the opinion of the Director-General; or
   - the owner of any residence where operational noise monitoring shows the noise generated by the project at night is greater than or equal to:
     - 40 dB(A) LAeq(15 minute) for residences R1 to R4;
     - 39 dB(A) LAeq(15 minute) for residences R20 to R23; and
     - 38 dB(A) LAeq(15 minute) for all other privately-owned residences;

   the Proponent shall implement additional noise mitigation measures such as double glazing, insulation, and/or air conditioning at the residence in consultation with the landowner. These additional mitigation measures must be reasonable and feasible. If within 3 months of receiving this request from the landowner, the Proponent and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Director-General for resolution.

No written requests have been received from the owners of any of the identified residences.

Operating Hours

9. The Proponent shall comply with the operating hours in Table 4.
   However, the Proponent may undertake:
   (a) quarrying operations within 250 metres of residence R27 if the Proponent has an agreement with the owner of the residence to extend the hours of operation; and/or
   (b) transportation outside the hours in Table 4, to a maximum of 5.00am to 10.00pm Monday to Saturday, and 8.00am to 12.00pm on Sundays and public holidays, if the Proponent has agreements to extend the hours of transportation with all owners of privately-owned land with frontage to:

- Lavis Lane (between the site and Nelson Bay Road), for operations on Lot 218; and/or
- Oakvale Road (between the site and Nelson Bay Road), for operations on Lot 220,

and the Proponent has advised the Department in writing of the terms of these agreements.

Mackas Sand complies with the operating hours listed.

Noise Monitoring

10. The Proponent shall prepare and implement a Noise Management Plan for the project to the satisfaction of the Director-General. This plan must:
    (a) be prepared in consultation with DECCW, and be submitted to the Director-General for approval within 3 months of the date of this approval;
    (b) include:
    - a description of the measures that would be implemented to minimise noise emissions from the project, with particular focus on:
        - quarrying operations within 250 metres of residences on privately-owned land;
        - transportation activities; and
        - continual improvement of noise performance;
    - a noise monitoring protocol for evaluating compliance with the relevant noise limits in this approval (including traffic noise);
    - a protocol for the investigation, notification and mitigation of identified exceedances of the relevant noise limits; and
    - a continual improvement program for investigating, implementing and reporting on reasonable and feasible measures to reduce noise generated by the project.

A Noise Management Plan was prepared by Umwelt (2009e) and submitted to DP&I on 22 December 2009. Discussion of noise monitoring results in provided in **Section 5.3**.

AIR QUALITY

Impact Assessment Criteria

11. The Proponent shall ensure that the dust emissions generated by the project do not cause additional exceedances of the air quality impact assessment criteria listed in Tables 5, 6 and 7 at any residence on privately owned land, or on more than 25 percent of any privately owned land.

Dust monitoring undertaken in accordance with the Air Quality Monitoring Program (Umwelt, September 2011) indicates that dust emissions from the project do not cause additional exceedances of the air quality impact assessment criteria for the project as discussed in **Section 5.2**.

Operating Conditions

12. The Proponent shall ensure any visible air pollution generated by the project is assessed regularly, and that quarrying operations are relocated, modified, and/or stopped as required to minimise air quality impacts on privately-owned land, to the satisfaction of the Director-General.

No visible air pollution generated by the project has been reported. Visible air pollution is assessed regularly. If it is ascertained that quarry operations result in air pollution that impacts on privately owned land, modification to the quarrying operations will be undertaken as required.

Air Quality Monitoring

13. The Proponent shall prepare and implement an Air Quality Monitoring Program for the project to the satisfaction of the Director-General. This program must:
    (a) be prepared in consultation with DECCW, and be submitted to the Director-General for approval within 3 months of the date of this approval; and
    (b) include details of how the air quality performance of the project will be monitored, and include a protocol for evaluating compliance with the relevant air quality criteria in this approval.

An Air Quality Monitoring Program was prepared by Umwelt (Umwelt 2009f) and submitted to the Director-General of DP&I on 23 December 2009. The Air Quality Monitoring Program has been reviewed, revised and resubmitted to DP&I in September 2011.

METEOROLOGICAL MONITORING

14. During the life of the project, the Proponent shall ensure that there is a suitable meteorological station in the vicinity of the site that complies with the requirements in the *Approved Methods for Sampling of Air Pollutants in New South Wales* guideline.

The approved meteorological station used by Mackas Sand is Bureau of Meteorology Station 61078, Williamtown RAAF, which is located approximately 3.23 kilometres from Lot 218 and approximately 6.67 kilometres from Lot 220. This meteorological station complies with the requirements in the *Approved Methods of Sampling Air Pollutants in New South Wales* guideline.

SOIL AND WATER

Water Supply

15. The Proponent shall ensure that it has sufficient water for all stages of the project, and if necessary, adjust the scale of operations to match its water supply.

Mackas Sand has access to sufficient water for its current operations including the watering of unsealed access roads, as well as for projected operations as described in the Soil and Water Management Plan. Dust suppression on the unsealed haul road to Lot 220 has been undertaken by a contractor.

Pollution of Waters

16. Except as may be expressly provided for by an EPL, the Proponent shall comply with section 120 of the *Protection of the Environment Operations Act 1997* during the carrying out of the project.

Mackas Sand complies with section 120 of the *Protection of the Environment Operations Act 1997*, as detailed in **Section 5.1**.

Wastewater Treatment

17. The Proponent shall manage on-site sewage to the satisfaction of Council and DECCW. The facility must comply with the requirements of the *Environment and Health Protection Guidelines – On-site Sewage Management for Single Households (1998)*.

Mackas Sand has not constructed offices or amenities on Lot 220 and as of September 2011 no on-site sewerage system has been constructed.

Soil and Water Management

18. The Proponent shall prepare and implement a Soil and Water Management Plan for the project to the satisfaction of the Director-General. This plan must:
    (a) be prepared in consultation with DECCW, OOW and HWC, and be submitted to the Director-General for approval within 3 months of the date of this approval; and
    (b) include a:
        - Site Water Balance;
        - Erosion and Sediment Control Plan;
        - Surface Water Monitoring Program; and
        - Ground Water Monitoring Program.

A Soil & Water Management Plan (SWMP) was prepared by Umwelt (2009a) in accordance with the above condition and submitted to the Director-General of DP&I on 23 December 2009. Comment on the plan was received from the NSW Office of Water on 13 December 2010. The SWMP has been revised and resubmitted to DP&I.

19. The Site Water Balance must:
    (a) include details of:
        - sources and security of water supply;
        - water use on site;
        - water management on site;
        - any off-site water transfers;
        - reporting procedures; and
    (b) investigate and describe measures to minimise water use by the project.

A Site Water Balance for operations at Lot 220 and Lot 218 that complies with the above requirements is included within the SWMP.

20. The Erosion and Sediment Control Plan must:
    (a) be consistent with the requirements of *Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Edition, 2004* (Landcom);
    (b) identify activities that could cause soil erosion and generate sediment;
    (c) describe measures to minimise soil erosion and the potential for the transport of sediment off site;
    (d) describe the location, function, and capacity of erosion and sediment control structures; and
    (e) describe what measures would be implemented to maintain the structures over time.

An Erosion and Sediment Control Plan that complies with the above requirements is included within the SWMP.

21. The Surface Water Monitoring Program must include:
    (a) baseline data on surface water quality, where available;
    (b) surface water impact assessment criteria;
    (c) a program to monitor surface water quality (particularly in project sediment basins); and
    (d) a protocol for the investigation, notification and mitigation of identified exceedances of the surface water impact assessment criteria.

A Surface Water Monitoring Program that complies with the above requirements is included within the SWMP.

22. The Ground Water Monitoring Program must include:
    (a) detailed baseline data on ground water levels and quality, based on statistical analysis (including available HWC data);
    (b) groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts;

(c) a program to monitor groundwater levels and quality;
(d) a protocol for further groundwater modelling to confirm the limits to excavation depth across the site permitted in accordance with condition 7 of schedule 2; and
(e) a protocol for the investigation, notification and mitigation of identified exceedances of the ground water impact assessment criteria.

A Ground Water Monitoring Program that complies with the above requirements is included within the SWMP.

Unexploded Ordnance

23. The Proponent shall prepare and implement an Unexploded Ordnance Management Plan for the project to the satisfaction of the Director-General. This plan must:
    (a) be prepared by a suitable qualified ordnance expert whose appointment has been approved by the Director-General, and be submitted to the Director-General for approval prior to the commencement of quarrying operations on Lot 218; and
    (b) include:
        - a protocol for managing unexploded ordnance risk on Lot 218 during quarrying operations; and
        - a description of the measures that would be undertaken if any unexploded ordnance is discovered during the project.

An Unexploded Ordnance Management Plan for operations on Lot 218 has been prepared by David Thomas of Gibson Nominees and has been submitted to the Director-General for approval prior to the commencement of quarrying operations on Lot 218.

REHABILITATION AND LANDSCAPE MANAGEMENT

Rehabilitation

24. The Proponent shall progressively rehabilitate the site in a manner that is generally consistent with the final landform in the EA (as reproduced in Appendix 4), to the satisfaction of the Director-General.

Mackas Sand will progressively rehabilitate the site in a manner that is generally consistent with the final landform in the EA as required by the Landscape Management Plan.

Landscape Management Plan

25. The Proponent shall prepare and implement a Landscape Management Plan for the project to the satisfaction of the Director-General. This plan must:
    (a) be prepared in consultation with DECCW, OOW and Council, and be submitted to the Director-General within 6 months of the date of this approval, or prior to any vegetation clearing on Lot 220, whichever is sooner;
    (b) include a:
        - Rehabilitation Management Plan; and
        - Long Term Management Strategy.

A Landscape Management Plan was prepared by Umwelt (2009c) and submitted to the Director-General of DP&I on 3 November 2009. The Landscape Management Plan was approved by DP&I on 5 November 2009

26. The Rehabilitation Management Plan must include:
    (a) the objectives for the site rehabilitation and site landscaping;
    (b) a description of the short, medium, and long term measures that would be implemented to rehabilitate and landscape the site;
    (c) detailed performance and completion criteria for the site rehabilitation and site landscaping;

(d) a detailed description of the measures that would be implemented over the next 3 years, including the procedures to be implemented for:
- progressively rehabilitating disturbed areas;
- landscaping the site to minimise visual impacts;
- protecting vegetation and soil outside the disturbance areas;
- preventing and/or minimising the accretion of sand dunes outside the project disturbance areas;
- undertaking pre-clearance surveys;
- salvaging and reusing material from the site for habitat enhancement;
- managing impacts on fauna;
- maintaining koala habitat linkages;
- conserving and reusing topsoil;
- collecting and propagating seed for rehabilitation works;
- salvaging and reusing material from the site for habitat enhancement;
- controlling weeds and feral pests;
- controlling access; and
- bushfire management;

(e) a program to monitor the effectiveness of these measures, and progress against the performance and completion criteria;

(f) a description of the potential risks to successful rehabilitation, and a description of the contingency measures that would be implemented to mitigate these risks; and

(g) details of who would be responsible for monitoring, reviewing, and implementing the plan.

A Rehabilitation Management Plan that complies with the above requirements was prepared as part of the Landscape Management Plan.

27. The Long Term Management Strategy must:
- define the objectives and criteria for quarry closure and post-extraction management;
- investigate and/or describe options for the future use of the site;
- describe the measures that would be implemented to minimise or manage the ongoing environmental effects of the project; and
- describe how the performance of these measures would be monitored over time.

A Long Term Management Strategy that complies with the above requirements was prepared as part of the Landscape Management Plan.

Rehabilitation Bond

28. Within 3 months of the approval of the Landscape Management Plan, the Proponent shall lodge a rehabilitation bond for the project with the Director-General to ensure that the site rehabilitation is implemented in accordance with the performance and completion criteria of the Landscape Management Plan. The sum of the bond shall be determined by:
    (a) calculating the full cost of rehabilitating the site in each 3 year review period (see condition 7 of schedule 5); and
    (b) employing a suitably qualified expert to verify the calculated costs, to the satisfaction of the Director-General.

Costing of the rehabilitation bond was initially provided in the Environmental Management Strategy and subsequently reworked to include ongoing monitoring maintenance and personal costs and costs for rehabilitation of Lot 218. The final bond of $270,237 was lodged with DP&I on 7 February 2011.

HERITAGE

Aboriginal Cultural Heritage Management Plan

29. The Proponent shall prepare and implement an Aboriginal Cultural Heritage Management Plan for the project to the satisfaction of the Director-General. This plan must:
    (a) be prepared in consultation with DECCW and the Aboriginal community, and be submitted to the Director-General for approval prior to the disturbance of any Aboriginal object or site; and
    (b) include a:
        - detailed salvage program and management plan for all identified Aboriginal sites within the project disturbance area;
        - detailed description of the measures that would be implemented to protect Aboriginal sites and PAD outside the project disturbance area;
        - protocol for monitoring operations and vegetation removal on the site;
        - protocol for undertaking additional archaeological investigation, and where warranted excavation and/or salvage, on:
            - any identified stabilised soil surfaces on Lot 218 that are proposed to be disturbed; or
            - any area of the identified PAD on Lot 220 that is proposed to be disturbed;
        - protocol for monitoring of reject material;
        - description of the measures that would be implemented if any new Aboriginal objects or skeletal remains are discovered during the project; and
        - protocol for the ongoing consultation and involvement of the Aboriginal community in the conservation and management of Aboriginal cultural heritage on the site, including the establishment of a management group comprising Aboriginal stakeholders and a suitably qualified archaeologist.

An Aboriginal Cultural Heritage Management Plan was prepared by Umwelt (2009g) and submitted to the Director-General of DP&I on 30 October 2009. The Aboriginal Cultural Heritage Management Plan was approved on 9 November 2009.

Non-Indigenous Heritage Management Plan

30. The Proponent shall prepare and implement a non-indigenous Heritage Management Plan for the project to the satisfaction of the Director-General. This plan must:
    (a) be prepared in consultation with the Heritage Branch and Council, and be submitted to the Director-General for approval prior to the disturbance of any heritage item, including the identified tank traps;
    (b) include:
        - archival recording of the tank traps, in accordance with the requirements and guidelines of the Heritage Branch;
        - a protocol for the investigation, removal and storage of the tank traps, and for their reinstallation following quarrying operations; and
        - a description of the measures that would be implemented if any new heritage objects or items are discovered during the project.

A Non-Indigenous Heritage Management Plan including protocols for the proper management of the tank traps was prepared by Umwelt (2009h) and submitted to the Director-General in stages with the final stage being photographic recording being submitted to DP&I on 11 August 2010. The Non-Indigenous Heritage Management Plan was approved on 7 January 2011.

TRAFFIC AND TRANSPORT

Road Upgrades

31. The Proponent shall upgrade Lavis Lane (including the eastern section leading to the private haul road) to provide a minimum 6 metre sealed carriageway, to the satisfaction of Council, within 6 months of the commencement of quarrying operations on Lot 218, unless otherwise agreed by the Director-General.

Quarrying operations had not commenced on Lot 218 as of September 2011.

Traffic Restrictions

32. The Proponent shall restrict truck movements (in plus out) on Lavis Lane and Oakvale Road to a maximum of 10 per hour during the night time period and on Sundays and public holidays, unless otherwise approved by the Director-General.

Truck movements to and from Lot 220 are restricted to a maximum of 10 per hour if they occur during night time and on Sundays and public holidays.

Road Haulage

33. The Proponent shall ensure that:
    (a) all loaded vehicles entering or leaving the site are covered; and
    (b) all loaded vehicles leaving the site are cleaned of materials that may fall on the road, before they leave the site.

All loaded road registered product trucks leaving the site are covered and cleaned of materials that may fall on the public road system before they leave the site with product trucks travelling over two separate shaker grids before they leave the site.

Product is also transported from Lot 220 in Volvo A35D Articulated Dump Trucks to Mackas Sand & Soil via a private haul road that is wholly contained on land owned by related entities to Mackas Sand. The dump trucks are not covered and are restricted to travelling at 20 kilometres per hour or less. The private haul road is watered. Road registered trucks carting product to the public road system from Mackas Sand & Soil are covered.

Parking

34. The Proponent shall provide sufficient parking on-site for all project-related traffic, in accordance with Council's parking codes, and to the satisfaction of the Director-General.

No offices or amenity buildings have been constructed as part of the project as of September 2011. Sufficient parking is provided on site for all project-related traffic.

VISUAL

Visual Amenity

35. The Proponent shall minimise the visual impacts of the project to the satisfaction of the Director- General.

Visual impacts of the project are minimised through the vegetation of bordering bunds at Lot 220. Extraction is yet to commence at Lot 218.

Lighting Emissions

36. The Proponent shall:
    (a) take all practicable measures to mitigate off-site lighting impacts from the project; and
    (b) ensure that all external lighting associated with the project complies with *Australian Standard AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting,* to the satisfaction of the Director-General.

No on-site lighting is used at Lot 220 as operations are currently occurring during daylight hours only.

Advertising

37. The Proponent shall not erect or display any advertising structure(s) or signs on the site without the written approval of the Director-General.

No advertising structures or signs are erected on site.

WASTE MANAGEMENT

Waste Minimisation

38. The Proponent shall minimise the amount of waste generated by the project to the satisfaction of the Director-General.

There is no waste generated by operations on Lot 220. Any plant material or debris that is screened from product sand is retained on site for future incorporation into the rehabilitated landform.

EMERGENCY AND HAZARDS MANAGEMENT

Dangerous Goods

39. The Proponent shall ensure that the storage, handling, and transport of fuels and dangerous goods are conducted in accordance with the relevant *Australian Standards*, particularly AS1940 and AS1596, and the *Dangerous Goods Code*.

Fuels are transported to the site by licensed contractors. No dangerous goods are stored on Lot 220 or Lot 218.

Safety

40. The Proponent shall secure the project to ensure public safety to the satisfaction of the Director- General.

Lot 220 is located on a private road and extractive operations are monitored to ensure public safety. Attempts were made to block access tracks other than the haulage route into Lot 220. However given the proximity of the site to adjoining access tracks and conservation lands it has not been possible to prevent unauthorised access to the site without having a significant impact on the landform and ecological values of the site.

Bushfire Management

41. The Proponent shall:
    (a) ensure that the project is suitably equipped to respond to any fires on-site; and
    (b) assist the rural fire service and emergency services as much as possible if there is a fire on-site.

The project site is suitably equipped to respond to any fires on site in accordance with Section 5.4.3 of the Environmental Management Strategy. If there is a fire on site all emergency services will be assisted as much as possible.

PRODUCTION DATA

42. The Proponent shall:
    (a) provide annual production data to the DII using the standard form for that purpose; and
    (b) include a copy of this data in the AEMR.

The Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS – formerly DII) 2010-2011 Return of Non Royalty and Statistics (NRNS) Forms for both Lot 220 and Lot 218 are included as **Appendix 4**. No RNRS Forms were provided to Mackas Sand for the year 2009-2010. Production data is also included within **Section 3.1**.

SCHEDULE 4
ADDITIONAL PROCEDURES

NOTIFICATION OF LANDOWNERS

1. Within 1 month of the date of this approval, the Proponent shall notify the landowner of residence R1 in writing that they have the right to require the Proponent to undertake additional noise mitigation measures on their residence in accordance with condition 8 of schedule 3 at any stage during the project, if the residence is habitable in the opinion of the Director-General.

The landowner of residence R1 has been notified.

2. If the results of the monitoring required in schedule 3 identify that impacts generated by the project are greater than the relevant impact assessment criteria, except where a negotiated agreement has been entered into in relation to that impact, then the Proponent shall, within 2 weeks of obtaining the monitoring results, notify the Director-General, the affected landowners and tenants (including tenants of quarry-owned properties) accordingly, and provide quarterly monitoring results to each of these parties until the results show that the project is complying with the criteria in schedule 3.

Monitoring has not identified that impacts generated by the project are greater than the relevant impact assessment criteria.

INDEPENDENT REVIEW & LAND ACQUISITION

Conditions 3 to 8 of schedule 4 under the titles ‘independent review’ and ‘land acquisition’ detail the processes through which land impacted by operations may be valued and acquired by Mackas Sand. As monitoring has not identified any exceedances of the listed criteria and no landowners have requested a review of impacts, conditions 3 to 8 have not been triggered in regard to the project. If monitoring identifies exceedances, or a review is requested Mackas Sand will comply with conditions 3 to 8 of schedule 4.

SCHEDULE 5
ENVIRONMENTAL MANAGEMENT AND MONITORING CONDITIONS

ENVIRONMENTAL MANAGEMENT STRATEGY

1. The Proponent shall prepare and implement an Environmental Management Strategy for the project to the satisfaction of the Director-General. This strategy must:
    (a) be submitted to the Director-General for approval within 3 months of the date of this approval;

(b) provide the strategic framework for environmental management of the project;
(c) identify the statutory approvals that apply to the project;
(d) describe the role, responsibility, authority and accountability of all key personnel involved in the environmental management of the project;
(e) describe the procedures that would be implemented to:
- keep the local community and relevant agencies informed about the operation and environmental performance of the project;
- receive, handle, respond to, and record complaints;
- resolve any disputes that may arise during the course of the project;
- respond to any non-compliance; and
- respond to emergencies; and

(f) include:
- copies of the various strategies, plans and programs that are required under the conditions of this approval once they have been approved; and
- a clear plan depicting all the monitoring currently being carried out within the project area.

An Environmental Management Strategy was prepared by Umwelt (2009d) and submitted to the Director-General on 23 December 2009. The Strategy has been reviewed, revised and subsequently resubmitted.

INCIDENT REPORTING

2. Within 24 hours of detecting an exceedance of the limits/performance criteria in this approval or the occurrence of an incident that causes (or may cause) material harm to the environment, the Proponent shall notify the Department and other relevant agencies of the exceedance/incident.

There have been no detected exceedances of limits or performance criteria as a result of sand extraction operations on Lot 220.

Depositional dust monitoring undertaken adjacent to Lot 218 has indicated naturally occurring high levels of deposited dust which exceed the 4 g/m^2/month Total Dust Deposition criteria for the project. As extractive operations have yet to commence at Lot 218 it is considered that these results are indicative of baseline levels and will be used as such once operations commence at Lot 218.

On 21 April 2011 it was ascertained that vegetation between the extraction zones on Lot 220 had been partially cleared by an unknown third party in what appeared to be an attempt to prevent unauthorised vehicle access to the area. This was not a part of sand extraction operations on Lot 220, however was raised at the following Community Consultative Committee meeting on 8 June 2011 where it was resolved to not require further reporting.

3. Within 6 days of notifying the Department and other relevant agencies of an exceedance/incident, the Proponent shall provide the Department and these agencies with a written report that must:
(a) describe the date, time, and nature of the exceedance/incident;
(b) identify the cause (or likely cause) of the exceedance/incident;
(c) describe what action has been taken to date; and
(d) describe the proposed measures to address the exceedance/incident.

Noted.

ANNUAL REPORTING

4. Within 12 months of the date of this approval, and annually thereafter, the Proponent shall submit an AEMR to the Director-General and relevant agencies. This report must:
   (a) identify the standards and performance measures that apply to the project;
   (b) describe the works carried out in the last 12 months, and the works that will be carried out in the next 12 months;
   (c) include a summary of the complaints received during the past year, and compare this to the complaints received in previous years;
   (d) include a summary of the monitoring results for the project during the past year;
   (e) include an analysis of these monitoring results against the relevant:
      - impact assessment criteria/limits;
      - monitoring results from previous years; and
      - predictions in the EA;
   (f) identify any trends in the monitoring results over the life of the project;
   (g) identify any non-compliance during the previous year; and
   (h) describe what actions were, or are being, taken to ensure compliance.

The current document is the Annual Environmental Management Report (AEMR) for extractive operations since commencement of extractive operations and is inclusive of the year to 20 September 2011. No AEMR was previously submitted for the period up to 20 September 2010 with monitoring and reporting for that period included in this AEMR.

INDEPENDENT ENVIRONMENTAL AUDIT

5. Within 2 years of the date of the commencement of quarrying operations, and every 3 years thereafter, unless the Director-General directs otherwise, the Proponent shall commission and pay the full cost of an Independent Environmental Audit of the project. This audit must:
   (a) be conducted by a suitably qualified, experienced, and independent team of experts whose appointment has been approved by the Director-General;
   (b) assess the environmental performance of the project, and its effects on the surrounding environment;
   (c) assess whether the project is complying with the relevant standards, performance measures and statutory requirements;
   (d) review the adequacy of any strategy/plan/program required under this approval; and, if necessary,
   (e) recommend measures or actions to improve the environmental performance of the project, and/or any strategy/plan/program required under this approval.

The Independent Environmental Audit is scheduled to be completed by 23 November 2011 and will be commissioned in the near future.

6. Within 1 month of completion of each Independent Environmental Audit, the Proponent shall submit a copy of the audit report to the Director-General and relevant agencies, with a response to any of the recommendations in the audit report.
7. Within 3 months of submitting a copy of the audit report to the Director-General, the Proponent shall review and if necessary revise the:
   (a) strategies/plans/programs required under this approval; and
   (b) rehabilitation bond, to consider the:
      - effects of inflation;
      - changes to the total area of disturbance; and
      - performance of the rehabilitation against the completion criteria of the Landscape Management Plan, to the satisfaction of the Director-General.

No Independent Environmental Audit has been undertaken as at September 2011.

COMMUNITY CONSULTATIVE COMMITTEE

8. Within 3 months of the commencement of quarrying operations, the Proponent shall establish a Community Consultative Committee (CCC) for the project to the satisfaction of the Director-General, in accordance with the Department's *Guideline for Establishing and Operating Community Consultative Committees for Mining Projects*.

A CCC was formed and approved and held its first meeting on 15 September 2010. It has met quarterly in line with the *Guideline for Establishing and Operating Community Consultative Committees for Mining Projects* on 8 December 2010, 9 March 2011, 8 June 2011 and 7 September 2011.

ACCESS TO INFORMATION

9. Within 1 month of the approval of any strategies/plans/programs required under this approval (or any subsequent revision of these strategies/plans/programs), or the completion of the audits or AEMR required under this approval, the Proponent shall:
   (a) provide a copy of the relevant document/s to the relevant agencies and to members of the general public upon request; and
   (b) ensure that a copy of the relevant document/s is made publicly available on its website and at the site.

Copies of all relevant documents are available on request, and up to date copies are available on the website (www.mackassand.com.au).

10. During the project, the Proponent shall:
   (a) make a summary of monitoring results required under this approval publicly available on its website and at the site; and
   (b) update these results on a regular basis (at least every 3 months).

Summaries of monitoring results are publicly available on the Mackas Sand website and are updated as required.

APPENDIX 2
STATEMENT OF COMMITMENTS

The Statement of Commitments has been largely incorporated into the consent conditions within Project Approval 08_0142 and as a result has not been addressed separately within this AEMR.

7.0 Environmental Management Actions

In order to assist in ensuring compliance with monitoring actions, a yearly compliance monitoring and schedule was developed and is displayed within Mackas Sand offices.

Other actions undertaken to improve environmental outcomes and ensure compliance include:

- quarry manager undertook groundwater depth measurement and sampling training to ensure accurate measurements and sample quality;
- purchase of groundwater monitoring equipment including electronic depth measurement equipment and an electric bore pump to ensure the collection of valid data;
- installation of depositional dust gauges DDG1 at Lot 220 and DDG2 Lot 218, with the installation of DDG3 near Lavis Lane underway;
- installation of road signs to slow heavy vehicles travelling to and from Lot 220, ensuring safety of nearby residents and the quieter passage of vehicles;
- movement of Tank Traps in accordance with Non-Indigenous Heritage Management Plan;
- vegetation of perimeter bunds at Lot 220 in accordance with Landscape Management Plan;
- establishing flora monitoring plots as remnant analogue sites for assessment of post extraction ecological values on Lot 220;
- undertaking two noise monitoring assessments within the last year; and
- as part of Mackas Sand's continuous improvement program, the emission volume of the broadband reverse alarms on site mobile plant items operating within the quarrying operations at Lot 220 will be lowered as recommended within Umwelt (2011c) (see **Appendix 2**).

8.0 References

Umwelt (Australia Pty Limited, 2009a. *Soil and Water Management Plan Extractive Industry Lot 218 and Lot 220 Salt Ash*

Umwelt (Australia) Pty Limited, 2009b. *Environmental Assessment for Sand Extraction Operations from Lot 218 DP 1044608 and Lot 220 DP 1049608, Salt Ash*

Umwelt (Australia) Pty Limited, 2009c. *Mackas Sand Pty Limited Landscape Management Plan (Including Rehabilitation Management Plan and Long Term Management Strategy)*

Umwelt (Australia) Pty Limited, 2009d. *Environmental Management Strategy for Sand Extraction at Lot 218 and Lot 220, Salt Ash, NSW*

Umwelt (Australia) Pty Limited, 2009e. *Noise Management Plan for Sand Extraction Operations from Lot 218 DP 1044608 and Lot 220 DP 1049608, Salt Ash*

Umwelt (Australia) Pty Limited, 2009f. *Air Quality Monitoring Program for Sand Extractive Industry from Lot 220, Salt Ash*

Umwelt (Australia) Pty Limited, 2009g. *Aboriginal Cultural Heritage Management Plan for Sand Extraction Operations from Lot 218 DP 1044608 and Lot 220 DP 1049608, Salt Ash*

Umwelt (Australia) Pty Limited, 2009h. *Non-Indigenous Heritage Management Plan for Sand Extraction Operations from Lot 218 DP 1044608 and Lot 220 DP 1049608, Salt Ash*

Umwelt (Australia) Pty Limited, 2011a. *Mackas Sand Annual Groundwater Monitoring Report*

Umwelt (Australia) Pty Limited, 2011b*. Environmental Noise Monitoring Summer 2010/2011*

Umwelt (Australia) Pty Limited, 2011c. *Environmental Noise Monitoring September 2011*

Umwelt (Australia) Pty Limited, 2011d. *Mackas Sand Ecological Monitoring Program for Lot 220 DP 1049608*

APPENDIX 1

Environmental Noise Monitoring Summer 2010/2011

Mackas Sand

Environmental Noise Monitoring
Summer 2010/2011

January 2011

Umwelt
Environmental Consultants

Environmental Noise Monitoring
Summer 2010/2011

Prepared by

Umwelt (Australia) Pty Limited

on behalf of

Mackas Sand

Project Director:	Peter Jamieson		
Project Manager:	Tim Procter		
Report No.	1646/R28/V1	Date:	January 2011

Umwelt
Environmental Consultants

2/20 The Boulevarde
PO Box 838
Toronto NSW 2283

Ph: 02 4950 5322
Fax: 02 4950 5737
Email: mail@umwelt.com.au
Website: www.umwelt.com.au

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FIGURES

APPENDICES

1.0 Introduction

Mackas Sand was granted development consent in September 2009 by the Minister for Planning under Part 3A of the *Environmental Planning and Assessment Act 1979* to operate sand extraction operations at Salt Ash, approximately 25 kilometres north-east of Newcastle, in the Port Stephens local government area of New South Wales (refer to **Figure 1**).

Mackas Sand has approval to extract sand from Lot 218 and Lot 220 shown on **Figure 1**. It has been estimated that approximately 21 million tonnes of sand resource will be extracted from Lot 220, with Lot 218 having an indefinite extraction life due to the ongoing movement of sand from the mobile dunes into the approved extraction area.

At the time of preparing this report sand extraction was only being undertaken on Lot 220. No extraction activities have occurred on Lot 218.

1.1 Scope

This Noise Monitoring Report has been prepared by Umwelt (Australia) Pty Limited (Umwelt) on behalf of Mackas Sand. The noise monitoring and reporting requirements for Mackas Sand are outlined in the Mackas Sand Development Consent (DA No. 08_0142 20-09-2009), Environmental Protection Licence (EPL) 13218 and the Mackas Sand Noise Management Plan (Umwelt 2009).

This report presents the results of noise monitoring undertaken in January 2011 as part of the ongoing noise monitoring program for Mackas Sand.

A glossary of terms and abbreviations used in this report is provided in **Appendix 1**.

2.0 Assessment Criteria

The consent conditions for the project, outlined in the Mackas Sand Development Consent (DA No. 08_0142 20-09-2009) and EPL 13218, set the noise limits for all stages of the operations. The assessment criteria are presented in **Table 2.1**.

Table 2.1 – Noise Impact Assessment Criteria, dB(A)

Location	Day $L_{Aeq,\ 15\ min}$	Evening $L_{Aeq,\ 15\ min}$	Night $L_{Aeq,\ 15\ min}$	Night $L_{A1,\ 1\ min}$
R18 – 300 Nelson Bay Road	39	39	40	45
R1 – Lavis Lane residence	39	39	39	45
R19 – 316 Nelson Bay Road	36	36	37	45
R26 – Residence opp. Oakdale Farm	36	36	35	45
R27 – Hufnagl residence	36	35	35	45
R17 – 287 Nelson Bay Road	35	35	36	45
All other residences	35	35	35	45

Day time is 7 am to 6 pm Monday to Saturday and 8 am to 6 pm Sundays and Public Holidays, evening is 6 pm to 10 pm and night time is 10 pm to 7 am Monday to Saturday and 10 pm to 8 am Sundays and Public Holidays.

Source: Department of Lands (2003)

0 0.5 1 2km

1:45 000

Legend

- Lot Boundaries (218 & 220)
- Proposed Operational Area
- Residential Receivers
- Site Access
- Proposed Site Access

FIGURE 1

Location

File Name (A4): R28_V1/1646_248.dgn

Condition 7 of Schedule 3 of the development consent requires that road traffic noise generated by quarry operations does not exceed the criteria stipulated in **Table 2.2**.

Table 2.2 – Traffic Noise Impact Assessment Criteria, dB(A)

Road	Day/Evening $L_{Aeq, 1\ hour}$	Night $L_{Aeq, 1\ hour}$
Lavis Lane, Oakvale Road, Nelson Bay Road	60	55

Compulsory Land Acquisition criteria, as required by Condition 5 of Schedule 3 of the development consent are outlined in **Table 2.3** for night time noise levels.

Table 2.3 – Land Acquisition Criteria, dB(A)

Property Location	Night $L_{Aeq, 15\ min}$
R1 to R4	42
R20 to R23	41
All other privately owned residences	40

Additional noise mitigation measures as required by Condition 8 of Schedule 3 of the development consent must be undertaken if noise levels exceed the criteria in **Table 2.4**.

Table 2.4 – Additional Noise Mitigation Criteria, dB(A)

Property Location	Night $L_{Aeq, 15\ min}$
Residences R2 to R4 (and R1)	40
Residences R20 to R23	39
All other privately owned residences	38

Additionally, EPL 13218 for sand extraction operations on Lot 218 and Lot 220 Salt Ash, issued on 30 November 2009 requires that noise from the premises must not exceed the limits specified in **Table 2.5**.

Table 2.5 – EPL 13218 Condition L6.1 Noise Limits, dB(A)

Location	Day $L_{Aeq, 15\ min}$	Evening $L_{Aeq, 15\ min}$	Night $L_{Aeq, 15\ min}$	Night $L_{A1, 1\ min}$
Residences North of private haul road servicing Lot 220	-	40	40	45
Residence R27	36	36	35	45
All other residences	-	36	35	45

3.0 Assessment Methodology

The approved quarrying operations were designed to be undertaken in three phases of development. Mackas Sand Noise Management Plan (Umwelt, 2009) outlines the potential noise impacts from each of the phases and presents control measures, monitoring programs and assessment methodologies to minimise the risk of noise impacts on residences adjacent to the quarry operations. **Section 3.1** of this report outlines the planned phases of the quarry operations while **Section 3.2** outlines the corresponding noise monitoring and assessment methodologies. **Section 3.3** discusses the status of quarrying operations as at January 2011 and the methodology used to assess any potential noise impacts from the quarry.

3.1 Approved Quarry Operational Phases

3.1.1 Phase 1 Extraction – Lot 220

Phase 1 operations on Lot 220 will consist of extraction and transport off site of material only (no screening). Limited machinery will be used during this phase of the operations, this will include:

- 1 x Volvo 180F Wheel Loader (2009 model) or similar;
- 1 x Komatsu D65PX-15 Bull Dozer (2007 model) or similar; and
- 2 x Volvo A35D Articulated Dump Truck (2003 model) or similar

All operations during Phase 1 will be in excess of 250 metres from nearest potentially effected residence (R27).

3.1.2 Phase 2 Extraction – Lot 220

During Phase 2 on Lot 220, operations will be increased by including screening of sand initially using mobile screens and the use of mobile plant in addition to that used during Phase 1. Once sufficient space is established on the quarry floor, the sand processing plant will be constructed. At this time operations will be consistent with Normal Operations described in the environmental assessment (EA) (Umwelt, 2009). Normal Operations on Lot 220 will involve the processing of sand and extraction of sand from areas greater than 250 metres from receiver R27. Equipment used on Lot 220 during Normal Operations will include the simultaneous use of the sand processing plant, up to four front-end loaders, a vibrating screen and a haul truck. Equipment will operate up to seven days per week during daytime, evening and night time periods. In addition to this a product truck and water cart will operate at Lot 220 between the hours of 5.00 am and 10.00 pm Monday to Saturday and 8.00 am and 12.00 pm Sundays and Public Holidays.

Approximately 10 to 20 percent of sand from Lot 220 will be transported from the operation or blended with other products without processing. Approximately 40 to 90 percent of extracted sand will pass through 14 millimetre vibrating screens prior to being loaded onto trucks. The vibrating screens will be portable and will follow the extraction operations, where feasible. Waste material from the screens will consist of sand aggregates, fallen vegetation and leaf litter, and will be incorporated into the final landform of the site.

3.1.3 Phase 3 Extraction

Phase 3 will consist of Normal Operations for Lot 220 with the following modifications to operations during daytime extraction operations when within 250 metres of receiver R27:

- there will only be two front-end loaders, a vibrating screen and haul truck operating within 250 metres of receiver R27. These will be located within 25 metres of the extraction face and either a localised barrier will be placed around the vibrating screen or it being placed within 5 metres of the extraction face; or

- extraction will be undertaken with only one front-end loader, vibrating screen and haul truck operating within 250 metres of receiver R27.

There will be no extraction equipment operating within 250 metres of receiver R27 during evening and night time periods unless agreement is reached with the landholder.

3.2 Compliance Assessment

3.2.1 Phase 1 Extraction

There will be no noise monitoring undertaken during Phase 1 of operations unless complaints from neighbouring land owners warrant noise monitoring being undertaken. Up until November 2010, there was no screening undertaken on Lot 220.

3.2.2 Phase 2 Extraction

Monitoring of Phase 2 operations on Lot 220 and traffic noise from Lot 218 and Lot 220 product haulage on Lavis Lane and Oakvale Drive respectively, will be undertaken as part of compliance monitoring required by EPL 13218 Licence Condition M7. Phase 2 extraction commenced in early November 2010 when a Chieftain 1400 mobile screen was brought to Lot 220.

3.2.3 Phase 3 Extraction

Prior to commencing Phase 3 of operations, detailed monitoring of noise emissions will build on noise monitoring carried out for Phase 2. Noise emissions from both mobile and fixed equipment will be measured and a revised Noise Management Plan addressing extraction operations within 250 metres of receiver R27 will be developed. Phase 3 extraction had not commenced at the time of undertaking this noise compliance assessment.

3.3 Quarry Operations as at January 2011

3.3.1 Outline of Operations as at January 2011

The quarrying operations at Lot 220 on 18 January 2011 were equivalent to the transition from phase one to phase two operations. The extraction operations were generally consistent with phase one operations; however a mobile power screen (a Turbo Chieftain 1400) was also located within the quarry. The power screen was not being used at the time of monitoring as it only operated intermittently (approximately once per week) when handling the top layer of sand to remove roots, fallen vegetation and leaf litter. The quarrying operations consisted of a single Sumitomo SH450HD 45 tonne excavator that was used to quarry and load sand into two Volvo A35D articulated dump trucks. Quarried sand was

transported by the articulated dump trucks to the nearby Mackas Sand and Soil Supplies site for processing and delivery to customers.

The Turbo Chieftain 1400 mobile power screen located at the quarry site was operated for a short period of time on 18 January 2011 for the purposes of noise monitoring. No other sand processing plant was present or in use at the quarry face.

Quarrying operations as at January 2011 were limited to daytime hours (from 7 am to 6 pm) only Monday to Friday. No quarrying operations were being undertaken within 250 metres of residence R27.

3.3.2 Assessment Methodology

As quarrying operations were found to be generally in accordance with the planned phase one operations and no noise complaints had been received from neighbouring land owners, the approved Mackas Sand Noise Management Plan (Umwelt, 2009) sets out that minimal noise monitoring of the quarrying operations is required.

However, EPL 13218 requires:

- validation of sound power levels of equipment modelled as part of the noise impact assessment for the quarry development consent; and
- monitoring of increased traffic noise along Oakvale Drive due to increased truck movements picking up quarried sand.

To address these requirements, noise measurements were made within the quarry of the excavator loading sand onto articulated dump trucks and of the mobile power screen. Sound power levels (SWLs) were calculated from these measurements for comparison with the sound power levels presented in the Mackas Sand Noise Management Plan (Umwelt, 2009).

Noise measurements of product trucks servicing the quarry were made beside the access road to the Mackas Sand and Soil Supplies site.

4.0 Results of the Attended Noise Monitoring Program

Operator-attended noise monitoring was conducted at two locations at the Mackas Sand site during the day period on 18 January 2011. The purpose of the attended noise survey was to quantify the contribution of quarrying-related activities to the noise environment. During the attended noise monitoring program the noise sources contributing to the ambient noise environment were recorded.

Attended monitoring was conducted in accordance with the Department of Environment and Climate Change (DECC) *Industrial Noise Policy (INP) (2000) guidelines* and the *Australian Standard AS1055-1989, 'Acoustics – Description and Measurement of Environmental Noise, Part 1 General Procedures'*.

4.1 Monitoring Results

Operator-attended noise monitoring was undertaken at two monitoring locations:

- the quarry site (Lot 220); and
- the access road to the Mackas Sand and Soil Supplies site.

Operator-attended noise measurements were undertaken with a Svantek 959 noise and vibration analyser, Serial Number 12918. During the attended surveys the noise meter was calibrated using a Svantek Model SV 30A Noise Meter Calibrator, Serial Number 14162. The noise monitor was run using three measurement profiles (Linear, C Weighting and A Weighting) and recorded A-weighted 1/3 octave noise levels at 1 second intervals.

The attended noise monitoring was undertaken between 8.00 am and 9.30 am 18 January 2011.

Noise measurements conducted at the quarry site (Lot 220) are presented in **Appendix 2**. Noise measurements were made of the following equipment:

- Volvo A35D 6X6 articulated dump truck pulling away after being loaded;
- Sumitomo SH40HDexcavator quarrying and loading sand; and
- Turbo Chieftain 1400 mobile power screen.

Noise measurements of product trucks travelling to pick up and transport sand also were conducted along the access to the Mackas Sand and Soil Supplies site and are presented in **Appendix 2**.

4.2 Assessment of Attended Monitoring Results

The results of the attended noise monitoring program summarised in **Tables 4.1** to **4.3** indicate that, under the meteorological conditions at the time of monitoring, Mackas Sand was complying with the noise assessment criteria outlined in the Mackas Sand Development Consent (DA No. 08_0142 20-09-2009) and EPL 13218, summarised in **Section 2.0**.

4.2.1 Operational Noise Monitoring Results

As set out by the Mackas Sand Noise Management Plan (Umwelt, 2009), the sound power levels used in the Noise Impact Assessment (Umwelt, 2009) for the development consent (**Table 4.1**) were compared to measured noise levels of equipment in use at the quarrying site during the attended monitoring on 18 January 2011 (**Table 4.2**).

The results show that, while different equipment than that modelled was in use on 18 January 2011, the total sound power levels emitted from the quarry site are less (115 dB(A) compared to 117 dB(A)) than those modelled in the Noise Impact Assessment (Umwelt, 2009). As the results from the Noise Impact Assessment formulated the basis of the noise assessment criteria stipulated by the NSW Department of Planning and the Department of Conservation, Climate Change and Water, the results of the attended monitoring indicate that Mackas Sand with the mobile power screen operating was complying with the noise assessment criteria at the time of monitoring. On this basis it is considered that the quarry operations would have also complied with noise assessment criteria in the

period up until November 2010 when the mobile power screen was commissioned at Lot 220.

Table 4.1 – Noise Impact Assessment Modelled Sound Power Levels of Quarrying Operations at Lot 220

Equipment Description	Number of Machines modelled	Modelled SWL dB(A)	Total SWL dB(A)
Volvo 180F front-end loader (FEL)	4	108	114
Vibrating screen	1	113	113
Volvo A40 six-wheel articulated hauler	1	92	92
33-tonne road truck	1	102	102
Water cart	1	100	100
Sand processing plant/processing area	1	102	102
Total Modelled Sound Power Level (SWL) of equipment at Lot 220			**117**

Table 4.2 – Measured Sound Power Levels of Quarrying Operations at Lot 220 on 18 January 2011

Equipment Description	Number of Machines	Measured SWL dB(A)	Total SWL dB(A)
Volvo A35D six-wheel articulated hauler	2	110	113
Excavator, 3000kg SWL	1	95	95
Turbo Chieftain Mobile Power Screen	1	111	111
Total Measured Sound Power Level (SWL) of equipment at Lot 220			**115**

4.2.2 Road Traffic Noise Monitoring Results

Noise measurements of product trucks travelling to pick up and transport sand were conducted along the access road to the Mackas Sand and Soil Supplies site. A total of six truck movements associated with Mackas Sand were observed over the space of one hour. At the time of the attended noise monitoring program Mackas Sand was complying with the road traffic noise assessment criteria outlined in **Table 2.2** with the $L_{Aeq,\ 1\ hour}$ from truck movements calculated to be 44 dB(A).

The EA indicated that during normal operations six laden trucks would typically leave the site per hour. Based on the monitoring of actual truck movements, 12 truck movements per hour (in plus out), **Table 4.3** indicates this would equate to an $L_{Aeq,\ 1\ hour}$ of 47 dB(A), well below the day and night time criteria road traffic noise assessment criteria outlined in **Table 2.2**.

Table 4.3 – Calculated $L_{Aeq, 1\ hour}$ Traffic Noise Impacts, dB(A)

	Measured Noise Level		Predicted Noise Level		
	$L_{Aeq, per\ event}$ at 18m	Event Duration, seconds	Trucks per Hour	$L_{Aeq, 1\ hour}$ at 18m	$L_{Aeq, 1\ hour}$ at 20m
Loaded Truck	62	30	6	46	45
Unloaded Truck	66	23	6	42	41
Total	-	-	-	**47**	**47**

The EA indicated that up to eight laden trucks could leave the site per hour. Based on the monitoring of actual truck movements, 16 truck movements per hour (in plus out) would equate to an $L_{Aeq, 1\ hour}$ of 48 dB(A), well below the day and night time criteria road traffic noise assessment criteria outlined in **Table 2.2**.

Condition 32 of Schedule 3 of the Mackas Sand Development Consent (DA No. 08_0142 20-09-2009), requires Mackas Sand to restrict truck movements (in plus out) on Lavis Lane and Oakvale Road to a maximum of 10 per hour during the night time period and on Sundays and Public Holidays, unless otherwise approved by the Director-General. Based on the monitoring of actual truck movements, 10 truck movements per hour (in plus out) would equate to an $L_{Aeq, 1\ hour}$ of 46 dB(A), well below the night time limit of 55 dB(A).

5.0 Statement of Compliance

Results of the attended noise monitoring program conducted on 18 January 2011 indicated that Mackas Sand was complying with the noise assessment criteria as outlined in the Mackas Sand Development Consent (DA No. 08_0142 20-09-2009) and EPL 13218 for the meteorological conditions experienced at the time of monitoring.

6.0 References

Australian Standard AS1055-1989. 'Acoustics – Description and Measurement of Environmental Noise, Part 1 General Procedures'.

NSW Environment Protection Authority 1999. *Environmental Criteria for Road Traffic Noise*.

NSW Environment Protection Authority 1994. *Environmental Noise Control Manual*.

NSW Environment Protection Authority 2000, *New South Wales Industrial Noise Policy.*

Umwelt (Australia) Pty Limited, 2009. *Mackas Sand Noise Management Plan*.

Umwelt (Australia) Pty Limited, 2009. *Noise Impact Assessment of Sand Extraction Operations from Lot 218 DP 1044608 and Lot 220 DP 1049608, Salt Ash.*

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APPENDIX 1

Glossary and Abbreviations

Appendix 1 – Glossary and Abbreviations

1/3 Octave	Single octave bands divided into three parts.
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment background level – A single-figure background level representing each assessment period – day, evening and night (that is, three assessment background levels are determined for each 24-h period of the monitoring period). It is determined by taking the lowest 10th percentile of the L_{90} level for each assessment period.
Airblast	Sound wave from blasting (overpressure).
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dB(A), dBA	Decibels A-weighted.
dB(L), dB(Lin)	Decibels Linear or decibels Z-weighted.
Decibel (dB)	The units of sound level and noise exposure measurement where a step of 10 dB is a ten-fold increase in intensity or sound energy and actually sounds a little more than twice as loud.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second – 1 oscillation per second equals 1 hertz.
L_{A10}	The percentile sound pressure level exceeded for 10% of the measurement period with 'A' frequency weighting calculated by statistical analysis. Typically used to assess the impact of an existing operation on a receiver area and is referred to as the cumulative noise levels at the receiver attributable to the noise source.
L_{A90}	Background Noise Level. The percentile sound pressure level exceeded for 90% of the measurement period with 'A' frequency weighting calculated by statistical analysis.
L_{Amax}	The maximum of the sound pressure levels recorded over an interval of 1 second.
$L_{A1,1minute}$	The measure of the short duration high-level noises that cause sleep arousal. The noise level is measured as the percentile sound pressure level that is exceeded 1 per cent of measurement period with 'A' frequency weighting calculated by statistical analysis during a measurement time interval of 1 minute.

Attachment 1 – Glossary and Abbreviations (cont)

$L_{Aeq,t}$	Equivalent continuous sound pressure level – The value of the sound pressure level of a continuous steady noise that, a measurement interval of time (t), has the same mean square sound pressure as the sound under consideration whose level varies with time. Usually measured in dB with 'A' weighting.
L_{An}	Percentile level – A measure of the fluctuation of the sound pressure level which is exceeded 'n' per cent of the observation time.
MIC	Maximum explosive charge mass (kg) detonated per delay (any 8 ms interval).
PVS (mm/s)	Peak Vector Sum.
PVV (mm/s)	Peak Particle Velocity.
RBL	Rating background level – The overall single figure background level representing each assessment period over the whole monitoring period determined by taking the median of the ABLs found for each assessment period.
SD (m)	The scaled distance for airblast and ground vibration from the charge to the receiver.
SPL (dBL)	Blasting: peak airblast level measured in dB Linear.
SPL (dBA)	Noise: Sound pressure level – The basic measure of noise loudness. The level of the root-mean-square sound pressure in decibels given by: $SPL = 10.\log10\ (p/po)^2$ where p is the rms sound pressure in pascals and po is the sound reference pressure at 20 μPa.
SWL	Sound power level – A measure of the energy emitted from a source as sound and is given by: $SWL = 10.\log10\ (W/W_o)$ where W is the sound power in watts and W_o is the sound reference power at 10^{12} watts.

APPENDIX 2

Measured Sound Power Levels

Appendix 2 – Measured Sound Power Levels

Chart A2.1 – Measured Sound Power Level – Articulated Dump Truck

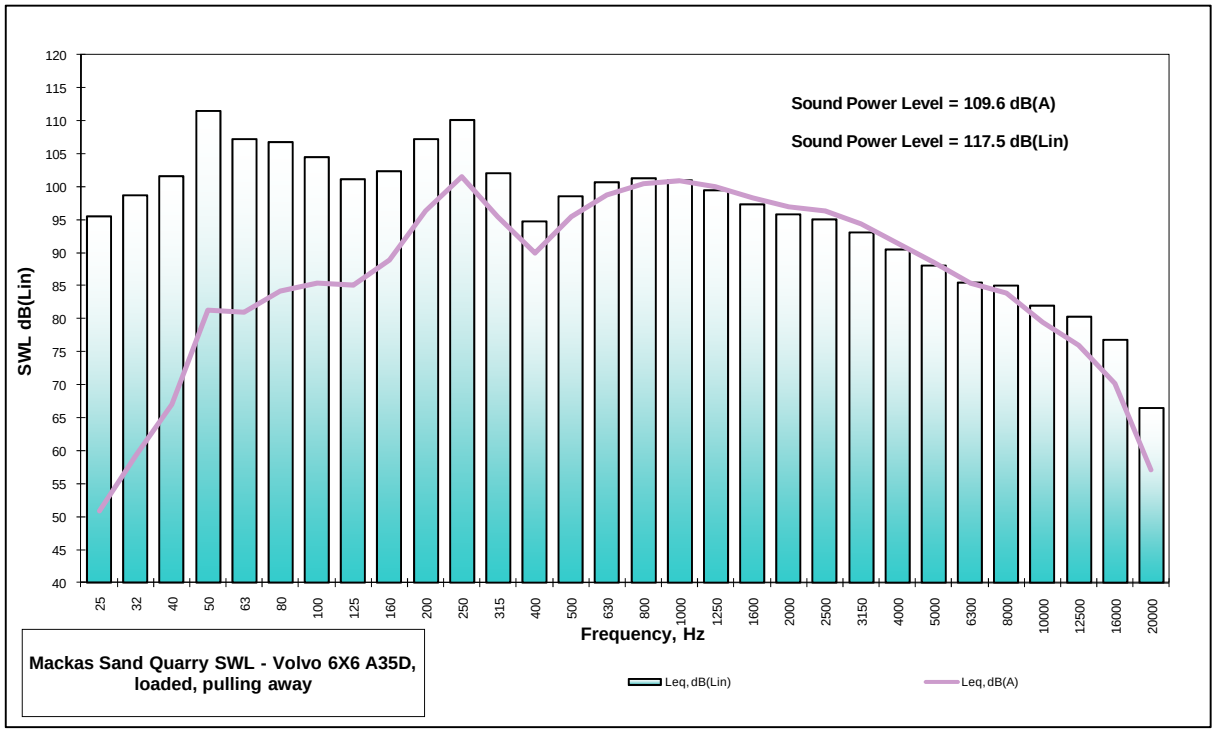


Chart A2.2 – Measured Sound Power Level – Excavator

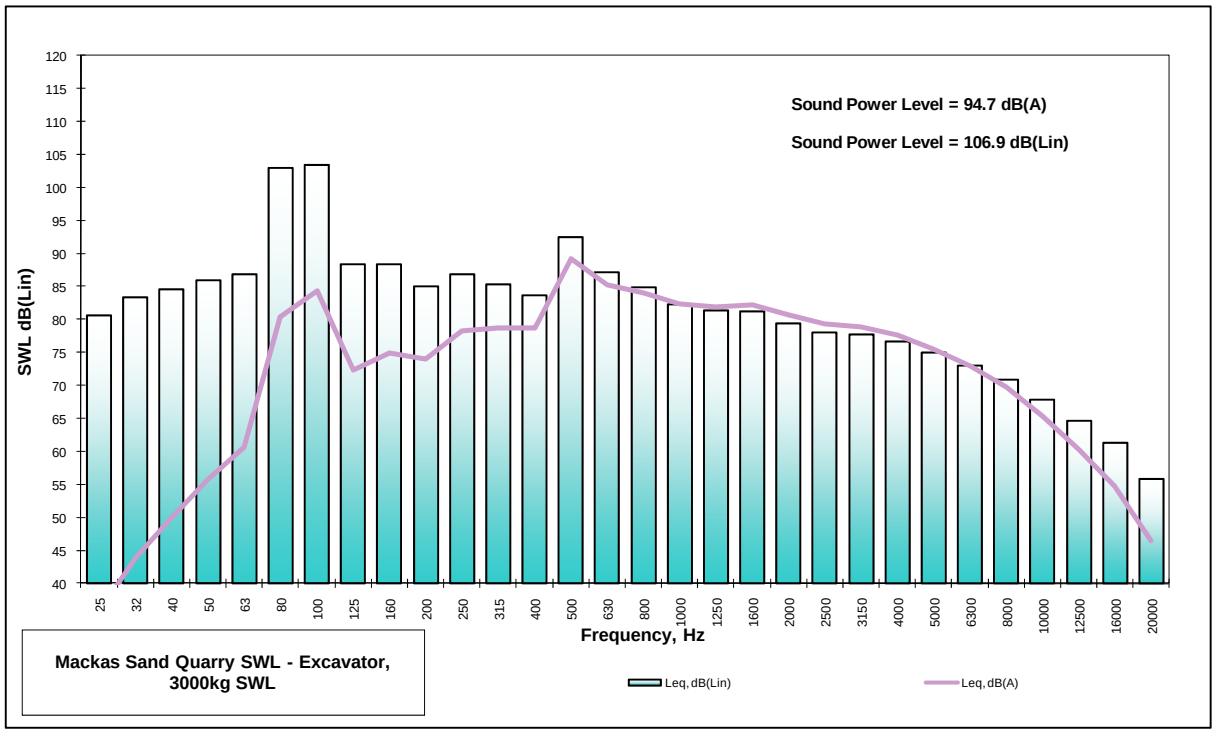


Chart A2.3 – Measured Sound Power Level – Power Screen

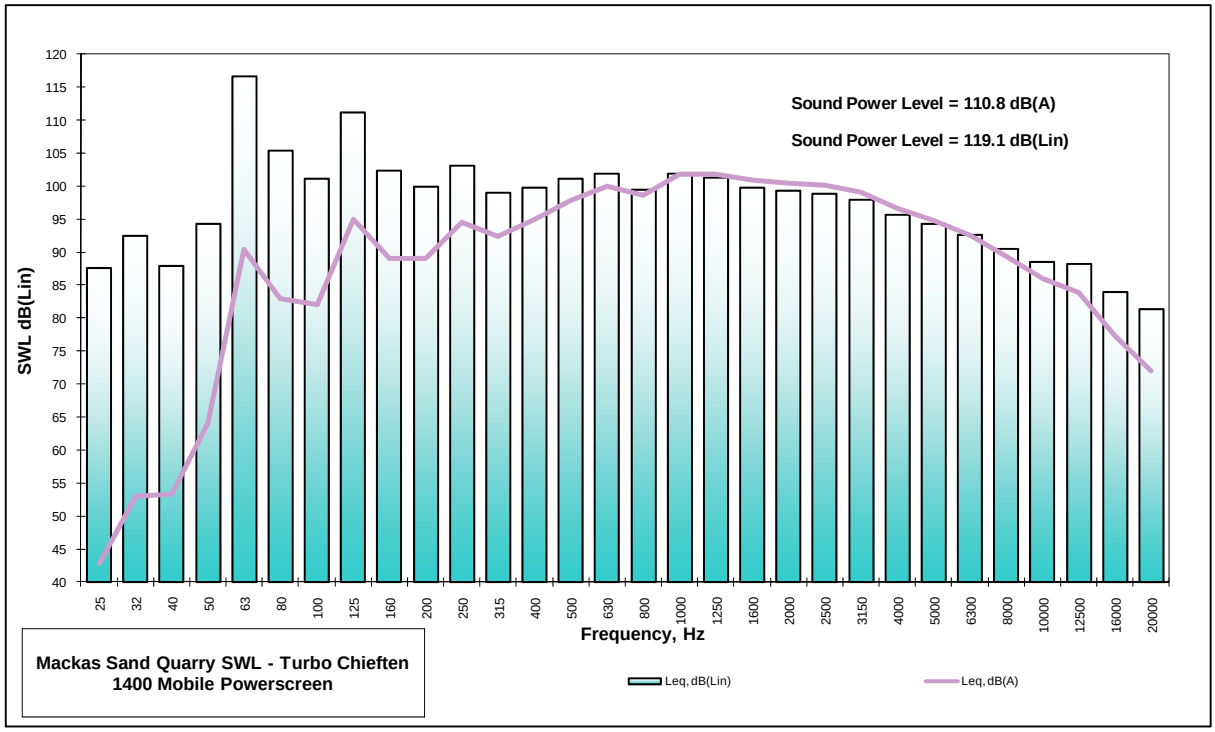


Chart A2.4 – Measured Sound Power Level – Truck and Dog, Loaded

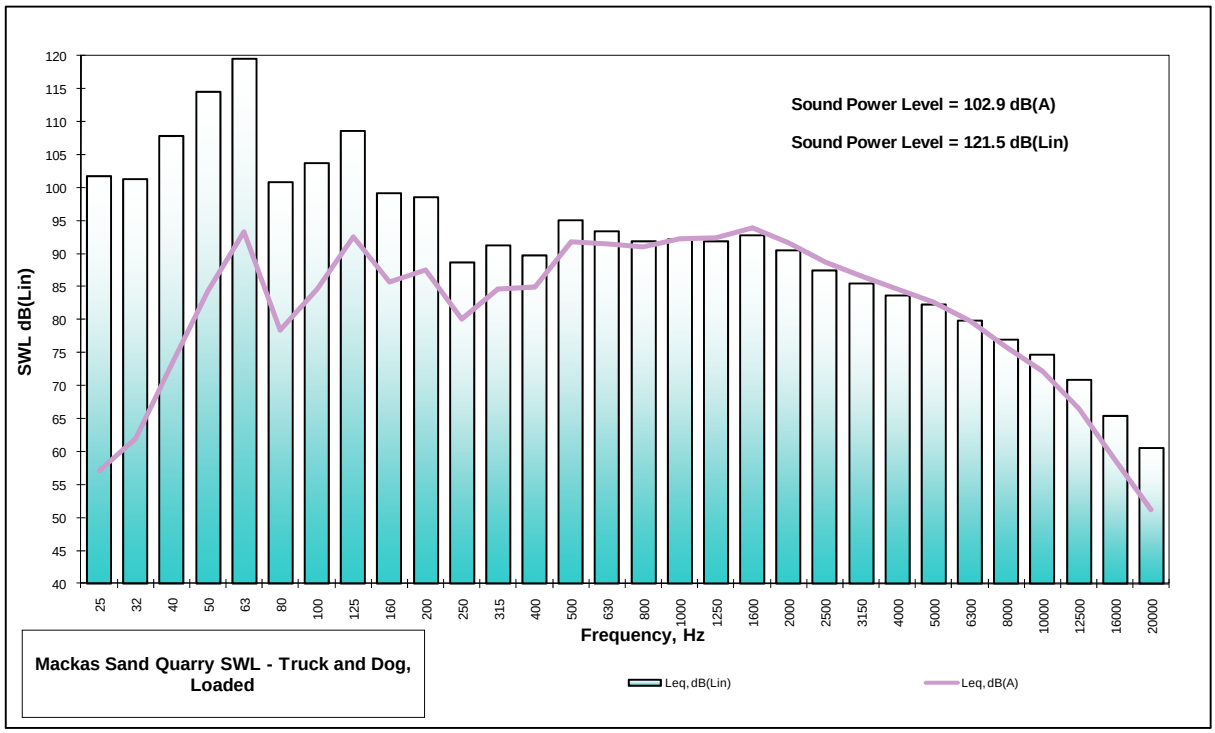
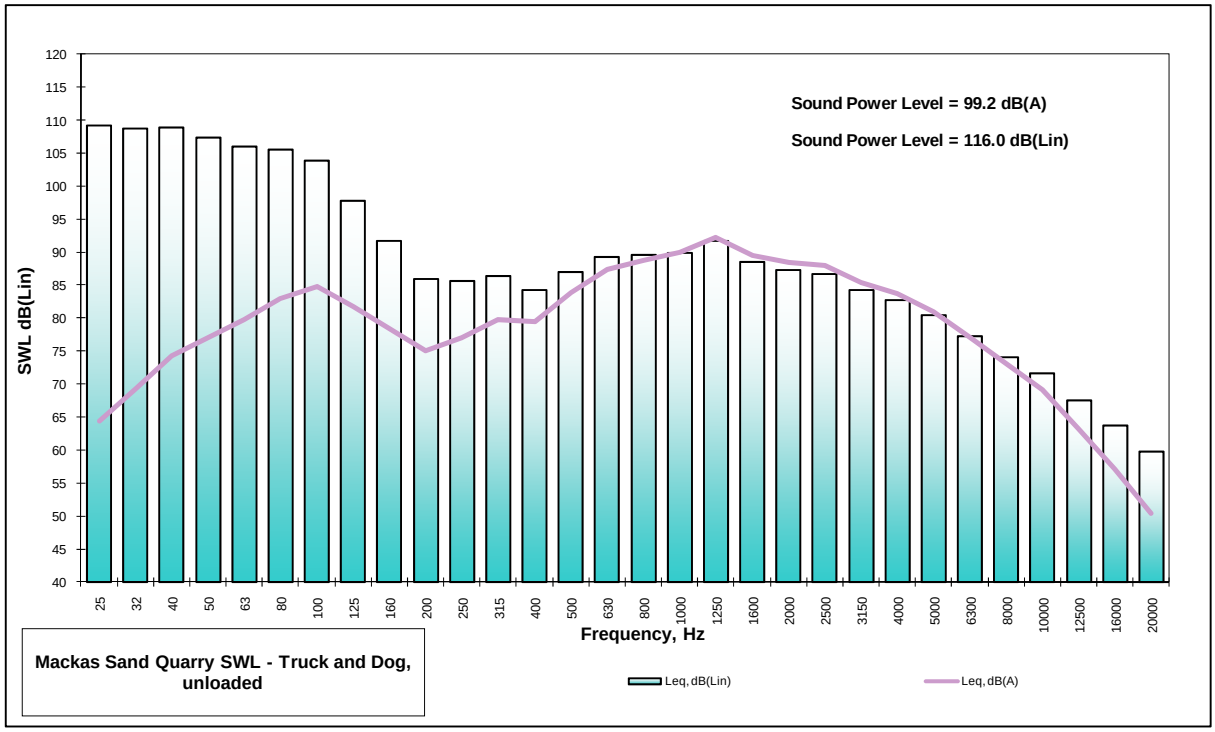


Chart A2.5 – Measured Sound Power Level – Truck and Dog, Unloaded



APPENDIX 2

Environmental Noise Monitoring
September 2011

Mackas Sand Pty Ltd

Environmental Noise Monitoring
September 2011

September 2011

Umwelt
Environmental Consultants

Environmental Noise Monitoring
September 2011

Prepared by

Umwelt (Australia) Pty Limited

on behalf of

Mackas Sand Pty Ltd

Project Director:	Peter Jamieson		
Project Manager:	Andy Goodwin		
Report No.	1646/R34/V1	Date:	September 2011

2/20 The Boulevarde
PO Box 838
Toronto NSW 2283

Ph: 02 4950 5322
Fax: 02 4950 5737
Email: mail@umwelt.com.au
Website: www.umwelt.com.au

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1.0 Introduction

1.1 Project Background

Mackas Sand was granted Major Project Approval 08_142 in September 2009 by the Minister for Planning under Part 3A of the *Environmental Planning and Assessment Act 1979* to operate sand extraction operations at Salt Ash, approximately 25 kilometres north-east of Newcastle, in the Port Stephens local government area of New South Wales (refer to **Figure 1.1**).

Mackas Sand Pty Ltd (Mackas Sand) has approval to extract and process sand from Lot 218 and Lot 220 shown on **Figure 1.1**. It has been estimated that approximately 11.4 million tonnes of sand resource will be extracted from Lot 220, with Lot 218 having an identified resource of 9.6 million tonnes however an indefinite extraction life due to the ongoing movement of sand from the mobile dunes into the approved extraction area.

At the time of preparing this report sand extraction was only being undertaken on Lot 220. No extraction activities have occurred on Lot 218. As of September 2011, no sand product had been transported along Lavis Lane from Lot 218.

1.2 Scope

This Noise Monitoring Report has been prepared by Umwelt (Australia) Pty Limited (Umwelt) on behalf of Mackas Sand. The noise monitoring and reporting requirements for Mackas Sand are outlined in the Major Project Approval 08_0142, Environmental Protection Licence (EPL) 13218 and the Mackas Sand Noise Management Plan (Umwelt 2009).

This report presents the results of attended noise monitoring undertaken in September 2011 as part of the ongoing noise monitoring program for Mackas Sand.

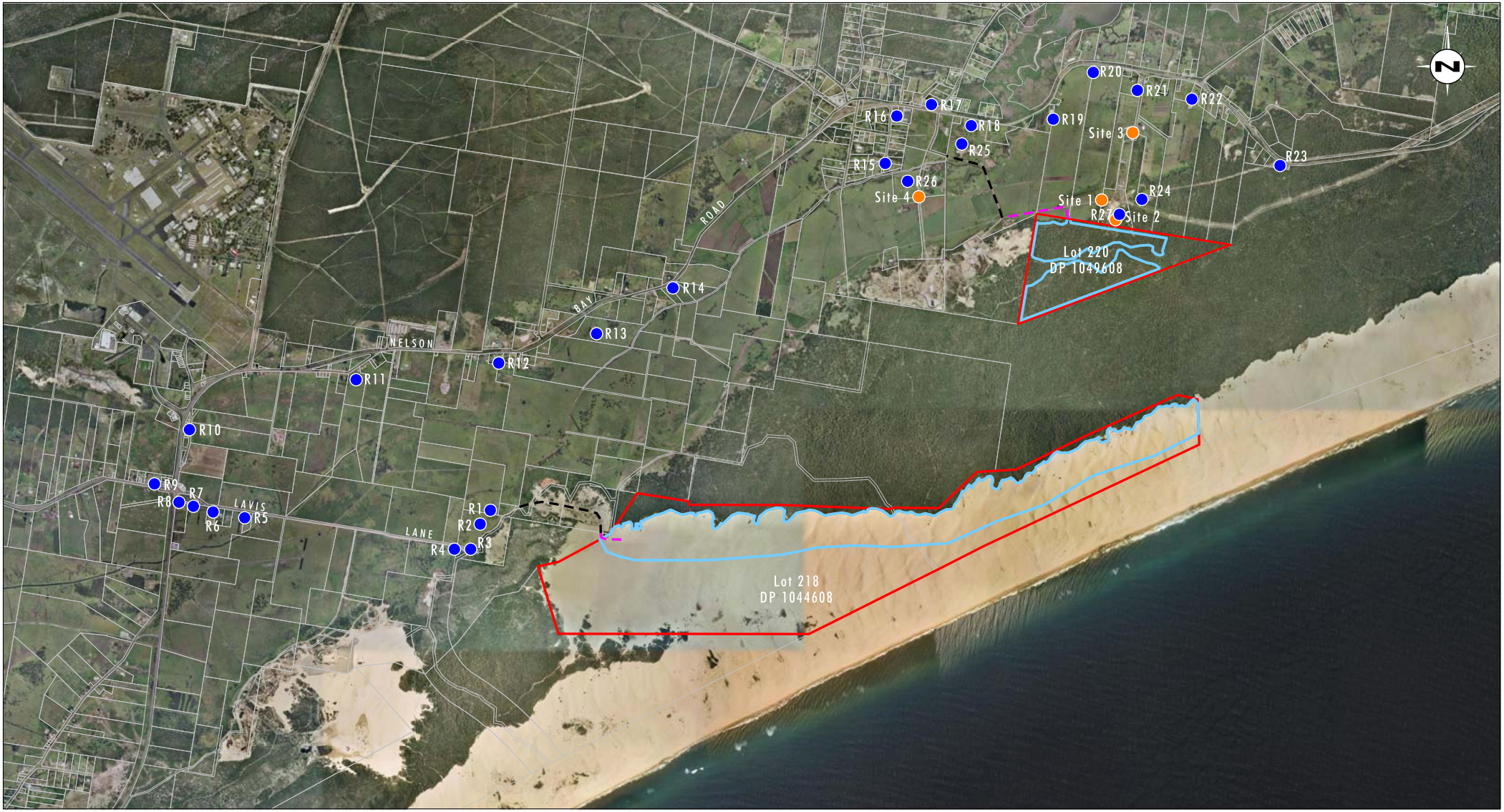
A glossary of terms and abbreviations used in this report is provided in **Appendix 1**.

2.0 Assessment Criteria

The consent conditions for the project, outlined in the Mackas Sand Major Project Approval 08_0142 and EPL 13218, set the noise limits for all stages of the operations. The assessment criteria are presented in **Table 2.1**. The receiver locations are shown in **Figure 1.1**.

Table 2.1 – Noise Impact Assessment Criteria, dB(A)

Location	Day $L_{Aeq,\ 15\ min}$	Evening $L_{Aeq,\ 15\ min}$	Night $L_{Aeq,\ 15\ min}$	Night $L_{A1,\ 1\ min}$
R18 – 300 Nelson Bay Road	39	39	40	45
R1 – Lavis Lane residence	39	39	39	45
R19 – 316 Nelson Bay Road	36	36	37	45
R26 – Residence opp. Oakvale Farm	36	36	35	45
R27 – Hufnagl residence	36	35	35	45
R17 – 287 Nelson Bay Road	35	35	36	45
All other residences	35	35	35	45



Source: Department of Lands (2003)

0 0.5 1 2km

1:45 000

Legend

- Lot Boundaries (218 & 220)
- Proposed Operational Area
- Residential Receivers
- Noise Monitoring Location
- Site Access
- Proposed Site Access

FIGURE 1.1

Noise Monitoring Sites

File Name (A4): R34_V1/1646_269.dgn

Day time is 7.00 am to 6.00 pm Monday to Saturday and 8.00 am to 6.00 pm Sundays and Public Holidays, evening is 6.00 pm to 10.00 pm and night time is 10.00 pm to 7.00 am Monday to Saturday and 10.00 pm to 8.00 am Sundays and Public Holidays.

Condition 7 of Schedule 3 of Major Project Approval 08_142 requires that road traffic noise generated by quarry operations does not exceed the criteria stipulated in **Table 2.2**.

Table 2.2 – Traffic Noise Impact Assessment Criteria, dB(A)

Road	Day/Evening $L_{Aeq, 1\ hour}$	Night $L_{Aeq, 1\ hour}$
Lavis Lane, Oakvale Drive, Nelson Bay Road	60	55

Compulsory Land Acquisition criteria, as set out in Condition 5 of Schedule 3 of Major Project Approval 08_142 are outlined in **Table 2.3** for night time noise levels.

Table 2.3 – Land Acquisition Criteria, dB(A)

Property Location	Night $L_{Aeq, 15\ min}$
R1 to R4	42
R20 to R23	41
All other privately owned residences	40

Additional noise mitigation measures as required in Condition 8 of Schedule 3 of Major Project Approval 08_142 must be undertaken if noise levels exceed the criteria in **Table 2.4**.

Table 2.4 – Additional Noise Mitigation Criteria, dB(A)

Property Location	Night $L_{Aeq, 15\ min}$
Residences R2 to R4 (and R1)	40
Residences R20 to R23	39
All other privately owned residences	38

Additionally, the Notice of Variation of EPL 13218 for sand extraction operations on Lot 218 and Lot 220 Salt Ash, issued on 1 June 2011, requires that noise from the premises must not exceed the limits specified in **Table 2.5**.

Table 2.5 – EPL 13218 Condition L6.1 Noise Limits, dB(A)

Location	Day $L_{Aeq, 15\ min}$	Evening $L_{Aeq, 15\ min}$	Night $L_{Aeq, 15\ min}$	Night $L_{A1, 1\ min}$
Residences North of private haul road servicing Lot 220	-	40	40	45
Residence R27	36	36	35	45
Residences R1, R2, R3, R4, R5, R6, R7 and R8.	39	39	39	45
All other residences	-	36	35	45

3.0 Assessment Methodology

3.1 Approved Quarry Operational Phases

The approved quarrying operations on Lot 220 were, from a noise perspective, designed to be undertaken in three phases of development. Mackas Sand Noise Management Plan (Umwelt, 2009) outlines the potential noise impacts from each of the phases and presents control measures, monitoring programs and assessment methodologies to minimise the risk of noise impacts on residences adjacent to the quarry operations. **Section 3.1** of this report outlines the planned phases of the quarry operations while **Section 3.2** outlines the corresponding noise monitoring and assessment methodologies. **Section 3.3** discusses the status of quarrying operations as at September 2011 and the methodology used to assess any potential noise impacts from the quarry.

3.1.1 Phase 1 Extraction – Lot 220

Phase 1 operations on Lot 220 consists of extraction and transport off site of material only (no screening). Limited machinery will be used during this phase of the operations, this will include:

- 1 x Volvo 180F Wheel Loader (2009 model) or similar;
- 1 x Komatsu D65PX-15 Bull Dozer (2007 model) or similar; and
- 2 x Volvo A35D Articulated Dump Truck (2003 model) or similar.

All operations during Phase 1 will be in excess of 250 metres from nearest potentially effected residence (R27).

3.1.2 Phase 2 Extraction – Lot 220

During Phase 2 on Lot 220, operations include screening of sand initially using mobile screens and the use of mobile plant in addition to that used during Phase 1. Once sufficient space is established on the quarry floor, the sand processing plant will be constructed. At this time operations will be consistent with Normal Operations described in the environmental assessment (EA) (Umwelt, 2009). Equipment will operate up to seven days per week during daytime, evening and night time periods. In addition to this a product truck and water cart will operate at Lot 220 between the hours of 5.00 am and 10.00 pm Monday to Saturday and 8.00 am and 12.00 pm Sundays and Public Holidays.

Approximately 10 to 20 percent of sand from Lot 220 will be transported from the operation or blended with other products without processing. Approximately 40 to 90 percent of extracted sand will pass through 14 millimetre vibrating screens prior to being loaded onto trucks. The vibrating screens will be portable and will follow the extraction operations, where feasible. Waste material from the screens will consist of sand aggregates, fallen vegetation and leaf litter, and will be incorporated into the final landform of the site.

3.1.3 Phase 3 Extraction – Lot 220

Normal Operations on Lot 220 will involve the processing of sand and extraction of sand from areas greater than 250 metres from receiver R27. Equipment used on Lot 220 during Normal Operations will include the simultaneous use of the sand processing plant, up to four front-end loaders, a vibrating screen and a haul truck.

Phase 3 will consist of Normal Operations for Lot 220 with the following modifications to operations during daytime extraction operations when within 250 metres of receiver R27:

- there will only be two front-end loaders, a vibrating screen and haul truck operating within 250 metres of receiver R27. These will be located within 25 metres of the extraction face and either a localised barrier will be placed around the vibrating screen or it being placed within 5 metres of the extraction face; or

- extraction will be undertaken with only one front-end loader, vibrating screen and haul truck operating within 250 metres of receiver R27.

There will be no extraction equipment operating within 250 metres of receiver R27 during evening and night time periods unless agreement is reached with the landholder.

3.2 Compliance Assessment Methodology per Phase

3.2.1 Phase 1 Extraction – Lot 220

There will be no noise monitoring undertaken during Phase 1 of operations unless complaints from neighbouring land owners warrant noise monitoring being undertaken. Up until November 2010, there was no screening undertaken on Lot 220.

3.2.2 Phase 2 Extraction – Lot 220

Monitoring of Phase 2 operations on Lot 220 and traffic noise from Lot 218 and Lot 220 product haulage on Lavis Lane and Oakvale Drive respectively, will be undertaken as part of compliance monitoring required by EPL 13218 Licence Condition M7. Technically Phase 2 extractions commenced in early November 2010 when a Chieftain 1400 mobile screen was brought to Lot 220, however the screen is only used on an intermittent basis to screen the top layer of sand to remove roots, fallen vegetation and leaf litter.

3.2.3 Phase 3 Extraction – Lot 220

Prior to commencing Phase 3 of operations on Lot 220, detailed monitoring of noise emissions will build on noise monitoring carried out for Phase 2. Noise emissions from both mobile and fixed equipment will be measured and a revised Noise Management Plan addressing extraction operations within 250 metres of receiver R27 will be developed. Phase 3 extractions had not commenced at the time of undertaking this noise compliance assessment.

3.3 Quarry Operations as at September 2011

3.3.1 Outline of Operations as at September 2011

The quarrying operations at Lot 220 on 8 September 2011 were equivalent to Phase 2 extraction operations. The extraction operations were generally consistent with Phase 1 operations, however, a mobile power screen (a Turbo Chieftain 1400) was also located within the quarry.

The power screen was not being used continuously throughout the time of attended monitoring however was in use between approximately 8.27 am to 9.27 am coinciding with attended monitoring being conducted at monitoring locations R24 (9A Janet Parade, Salt

Ash) and R27 (Hufnagl residence, 10 Janet Parade, Salt Ash), the nearest potentially affected residential receiver.

The quarrying operations at the time of monitoring also consisted of a single Sumitomo SH450HD 45 tonne excavator and a Volvo 180F Wheel Loader that were used to quarry and load sand into two Volvo A35D and A40E articulated dump trucks and product trucks. Quarried sand was delivered by the articulated dump trucks via a private haul road to the nearby Mackas Sand and Soil Supplies. Product trucks servicing the quarry arrived and departed the site via the site access road and Oakvale Drive.

No other sand processing plant was present or in use at the quarry face.

3.4 Compliance Assessment

Attended noise surveys are used to quantify and describe the acoustic environment around a site. Typically the results are compared with the noise criteria defined in the relevant project approvals to assess compliance. Attended monitoring is often considered the preferred method for determining compliance with prescribed limits because it allows for an accurate assessment of the contribution, if any, from an industrial noise source to measured ambient noise levels.

The methodology involved the following activities:

- attended noise monitoring surveys to measure the ambient noise levels in the surrounding region and to assess the sand extraction operation's contribution to measured noise levels; and

- comparison of the attended noise monitoring results with the relevant noise impact assessment criteria to assess compliance of the sand extraction operations with the relevant project approval and EPL criteria.

Compliance with the sleep arousal criteria is determined by comparing the $L_{A1,\ 1\ minute}$ noise levels measured during the night period attended noise surveys with the sleep arousal criteria outlined in the development consents and EPLs under which the site operates.

Compliance monitoring of the site generated $L_{Aeq,\ 1\ hour}$ road traffic noise contribution was undertaken during the site visit at the closest offset house to Oakvale Drive, at 2642 Nelson Bay Road. However, during the attended traffic noise monitoring program there was no heavy vehicle activity along Oakvale Drive carrying product directly from Lot 220. Road truck movements past the monitoring location during the monitoring period were associated with vehicles servicing the adjoining businesses of Mackas Sand and Soil and Sibelco Australia. Results of the attended traffic noise monitoring program were utilised to correlate the accuracy of the site traffic noise model to existing conditions. The predicted noise levels at the façade of 2642 Nelson Bay Road resulting from peak and average hourly traffic movements associated with the Project were then predicted and assessed against $L_{Aeq,\ 1\ hour}$ road traffic criteria.

4.0 Attended Noise Monitoring

4.1 Attended Noise Monitoring – Industrial Noise

Attended industrial noise monitoring was conducted at four locations in the region surrounding the Lot 220 sand extraction site during the night period on 8 September 2011 between 6.00 am to 7.00 am and the day period between 7.00 am to 9.50 am on 8 September 2011.

The purpose of the attended noise survey was to quantify and describe the ambient noise environment in the region surrounding the Lot 220 extraction site and to interpret the results to account for the contribution of sand extraction related activities to the surrounding noise environment. During the attended industrial noise monitoring survey the noise sources contributing to the ambient noise environment were recorded with particular attention focussed on the contribution from the Lot 220 operations site. The weather conditions over the monitoring period were also recorded.

Attended noise monitoring was conducted in accordance with the NSW Government Office of Environment and Heritage (OEH) *Industrial Noise Policy* (INP) (2000) guidelines and the *Australian Standard AS1055-1989, 'Acoustics – Description and Measurement of Environmental Noise, Part 1 General Procedures'*.

4.2 Attended Noise Monitoring – Traffic Noise

Attended noise monitoring was conducted at one location situated along Oakvale Drive for one hour during the day period on 8 September 2011 between 10.58 am to 11.59 pm.

The purpose of the attended road traffic noise survey was to quantify and describe the ambient noise environment in the region surrounding the Mackas Sand site and to interpret the results to account for the road traffic noise contribution of sand extraction related haulage operations to the surrounding noise environment. During the attended noise monitoring survey the noise sources contributing to the ambient noise environment were recorded with particular attention focussed on the contribution from the road truck movements along Oakvale Drive. The weather conditions over the monitoring period were also recorded.

Attended noise monitoring was conducted in accordance with the NSW Government Office of Environment and Heritage (OEH) *Environmental Criteria for Road Traffic Noise* (ECRTN) (EPA, 1999) guidelines.

4.3 Monitoring Locations

4.3.1 Monitoring Locations – Industrial Noise Impact

The monitoring locations used during the attended industrial noise monitoring program are described in **Table 4.1** and shown on **Figure 1.1**.

Table 4.1 – Monitoring Locations for Industrial Noise Monitoring Program

Monitoring Location	Description
Site 1	Private residence, site boundary (R27 – Hufnagl residence, 10 Janet Parade, Salt Ash) MGA N = 6370803, MGA E = 399426
Site 2	Private residence (R27 – Hufnagl residence, 10 Janet Parade, Salt Ash) MGA N = 6370639, MGA E = 399542
Site 3	Private residence (R24 – 9A Janet Parade, Salt Ash) MGA N = 6371363, MGA E = 399685
Site 4	Private residence (R26 – 6 Oakvale Drive, Salt Ash) MGA N = 6370830, MGA E = 397906

Note: R24 to R27 descriptors are from *Noise Management Plan for Sand Extraction Operations* (Umwelt 2009)

The September 2011 attended industrial noise monitoring survey included monitoring at Sites 1, 2, 3 and 4. Noise monitoring data from the reference sites has been used to assist in identifying and assessing the contribution of the Mackas Sand site sand extraction operations to industrial noise levels at the receiver locations (Sites 1 to 4).

4.3.2 Monitoring Location – Traffic Noise Impact

The monitoring location used during the attended road traffic noise monitoring program is described in **Table 4.2**.

Table 4.2 – Monitoring Location for Traffic Noise Impact Monitoring Program

Monitoring Location	Description
Site 5	Private residence, Lot 2, DP 818198, 2642 Nelson Bay Road, Salt Ash (situated on the corner of Oakvale Drive and Nelson Bay Road) MGA N = 6371455, MGA E = 398102

The September 2011 attended traffic noise monitoring survey includes monitoring at Site 5. Noise monitoring data from this reference site has been used to assist in identifying and assessing the contribution of the Mackas Sand site sand extraction operations to traffic noise levels at the assessed receiver location (Site 5).

The relevant road traffic noise criteria for roads associated with the proposed operations are provided in **Section 2** of this report.

4.4 Monitoring Results

4.4.1 Monitoring Locations – Industrial Noise Impact

Attended noise monitoring was undertaken at four monitoring locations during the night time and day time periods (refer to **Table 4.1**).

Attended noise measurements were undertaken with a Type 1, Svantek 959 noise and vibration analyser, Serial Number 12918. During the attended noise surveys the noise meter was calibrated using a Svantek Model SV 30A Noise Meter Calibrator, Serial Number 14162. The noise monitor was run using three measurement profiles [Z- (Linear), C- and

A- Weighting] and recorded A-weighted 1/3 octave noise levels at 1 second intervals over a 15 minute measurement period.

Meteorological data was collected for the attended monitoring period from the weather station located at the Williamtown RAAF Base situated approximately 6 kilometres west of the site.

The night time attended noise monitoring was undertaken between 6.15 am to 7.00 am on 8 September 2011. The day time attended noise monitoring was undertaken between 7.00 am to 9.50 am on 8 September 2011.

The night and day time monitoring results shown in **Figures 4.1** to **4.6** and **Tables 4.3** and **4.4** include:

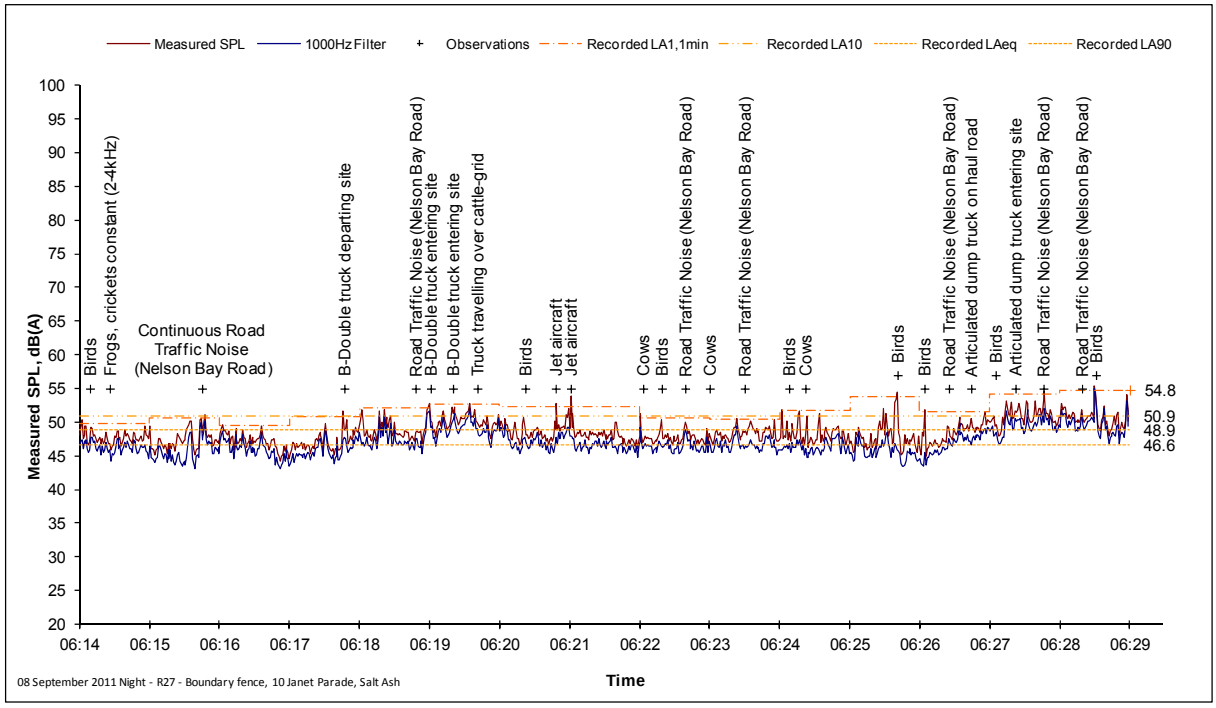
- the recorded overall A-weighted noise levels at 1 second intervals over a 15 minute measurement period;
- the results of a 1000 Hz low pass filter at 1 second intervals over the 15 minute measurement period;
- an assessment of the maximum $L_{A1,\ 1\ minute}$ noise level recorded over the 15 minute measurement period for night period measurements; and,
- the $L_{Aeq,\ 15\ minute}$ and $L_{A90,\ 15\ minute}$ noise levels for the 15 minute measurement period.

Comments regarding the noise sources contributing to the ambient noise levels are also presented on **Figures 4.1** to **4.6**.

An assessment of the results from the attended noise monitoring program and the corresponding meteorological conditions are provided in **Section 4.3**.

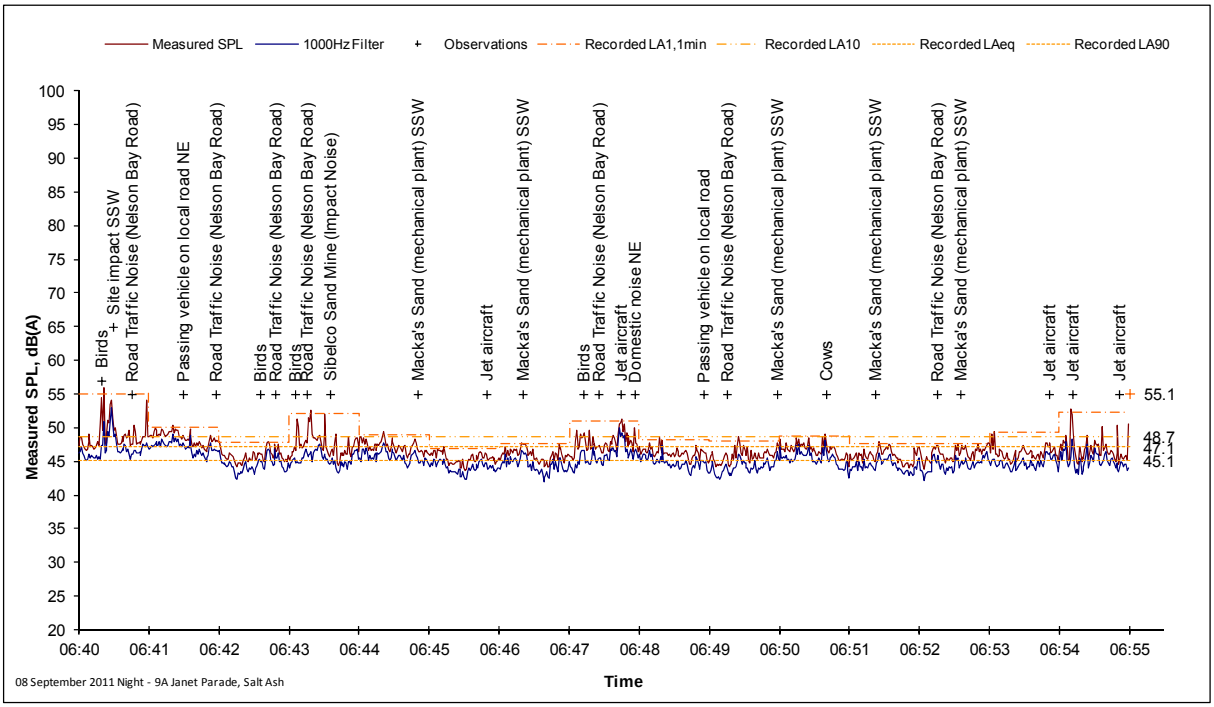
4.4.2 Night Time Period Attended Monitoring on 8 September 2011

Figure 4.1 – Site 1 (Hufnagl site boundary), 8 September 2011



The results in **Figure 4.1** indicate that the ambient noise levels at monitoring location Site 1 (R27 – Hufnagl) were dominated by continuous road traffic noise from Nelson Bay Road, local fauna (bird calls, insects and farm animals) and jet aircraft noise sources. The $L_{Aeq,\ 15\ minute}$ noise contribution from the Mackas Sand site discernible from the ambient noise environment at the monitoring location resulted from site articulated haul trucks and B-double road truck activity when travelling along the private haul road that services operations on Lot 220, Mackas Sand and Soil and Sibelco Australia and when entering and departing these premises across the entrance cattle grid. The site $L_{A1,\ 1\ minute}$ noise contribution resulted from a truck travelling across the site entrance cattle grid.

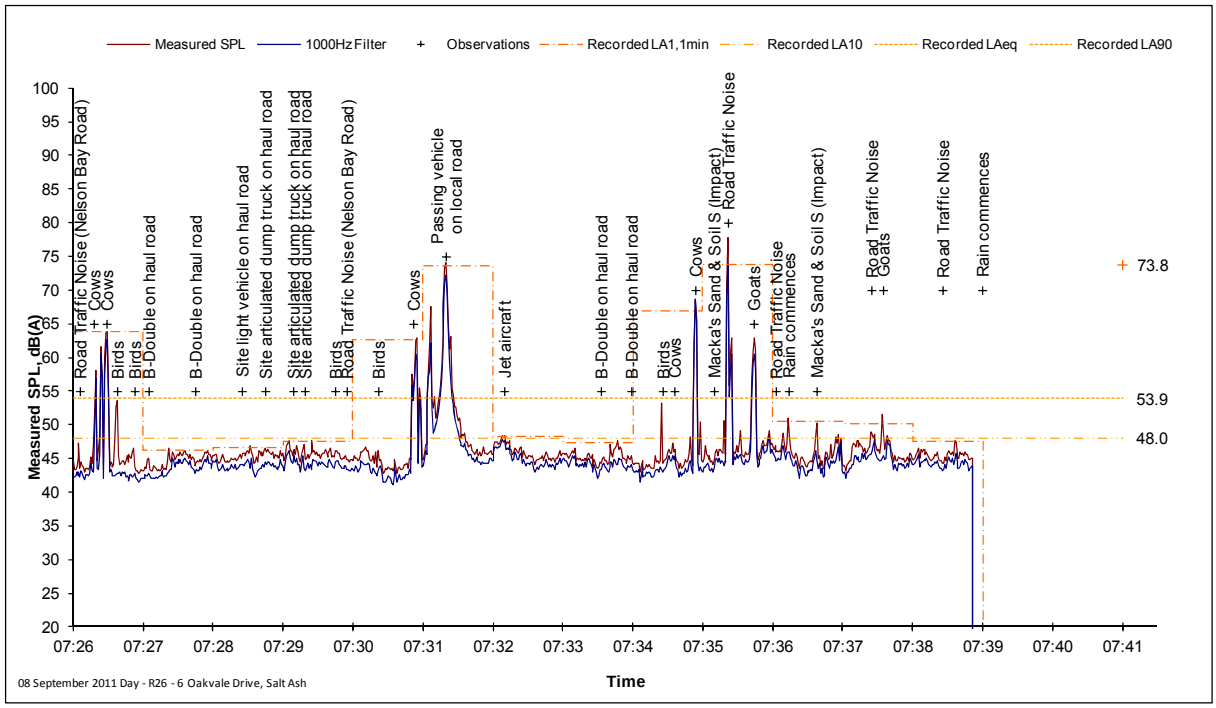
Figure 4.2 – Site 3 (R24 – 9A Janet Parade, Salt Ash), 8 September 2011



The results in **Figure 4.2** indicate that the ambient noise levels at monitoring location Site 3 (R24 – 9A Janet Parade) were dominated by continuous road traffic noise from Nelson Bay Road, local fauna (bird calls, insects and farm animals) and jet aircraft noise sources. The $L_{Aeq,\ 15\ minute}$ noise contribution from the Mackas Sand site discernible from the ambient noise environment at the monitoring location likely resulted from audible but not visible wheel loader and excavator operations observed intermittently throughout the monitoring period. The site $L_{A1,\ 1\ minute}$ noise contribution resulted from an impact occurring within the site likely associated with loading activity.

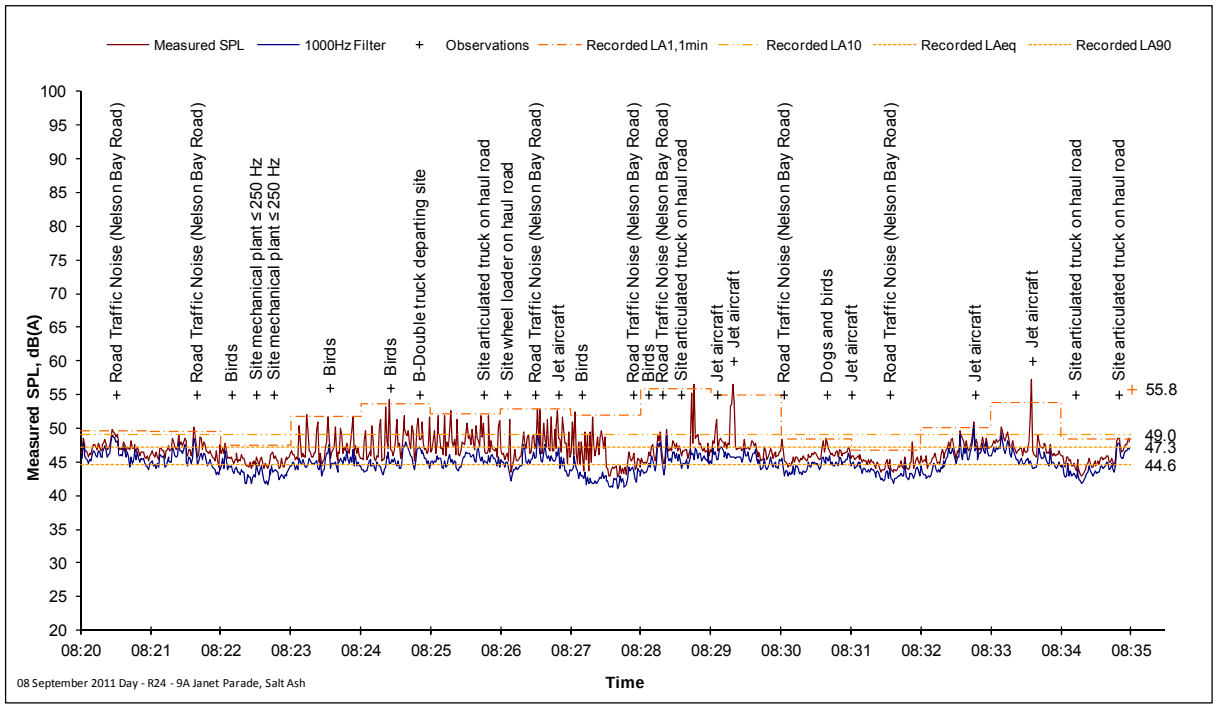
4.4.3 Day Period Attended Monitoring on 8 September 2011

Figure 4.3 – Site 4, 7.25 am (R26 – 6 Oakvale Drive, Salt Ash), 8 September 2011



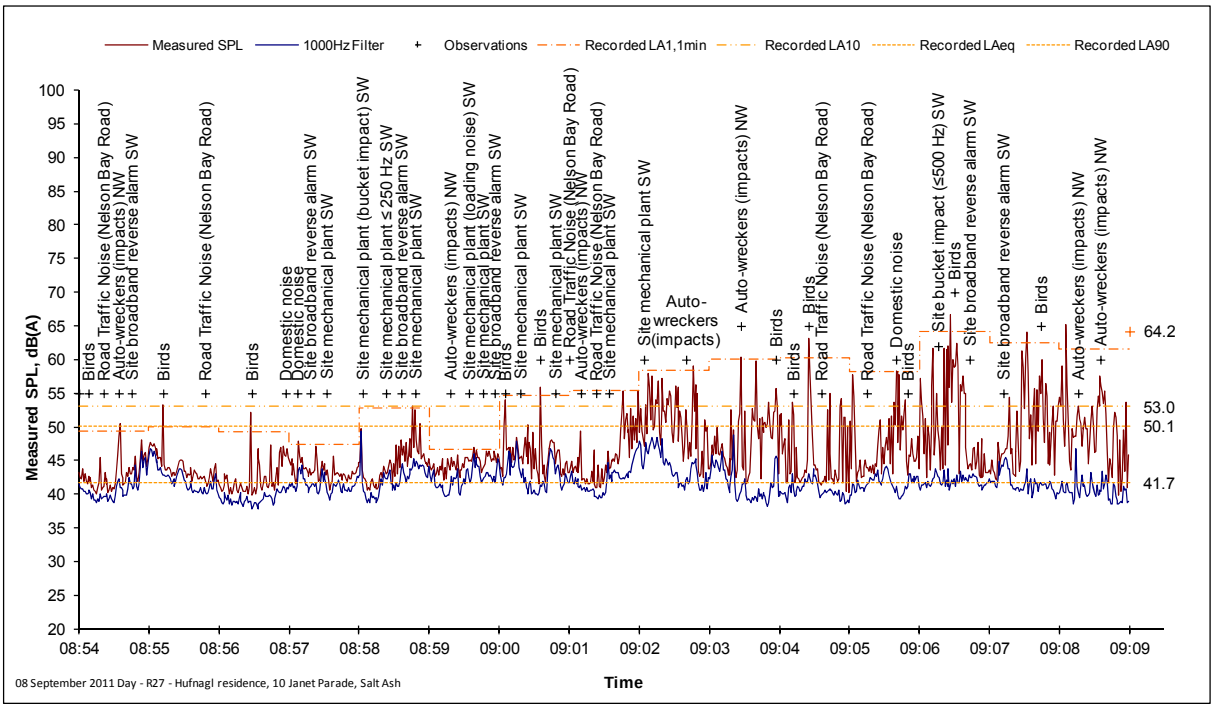
The results in **Figure 4.3** indicate that the ambient noise levels at monitoring location Site 1 (R26 – 6 Oakvale Drive) were dominated by continuous road traffic noise from Nelson Bay Road, local fauna (bird calls, insects and farm animals) and jet aircraft noise sources. The $L_{Aeq,\ 15\ minute}$ noise contribution associated with the Mackas Sand site activity discernible from the ambient noise environment at the monitoring location resulted from site articulated haul truck activity when travelling along the private haul road servicing the premises. The measurement was ceased at 7.39 am due to the commencement of rain.

Figure 4.4 – Site 3 (R24 – 9A Janet Parade, Salt Ash), 8 September 2011



The results in **Figure 4.4** indicate that the ambient noise levels at monitoring location Site 3 (R24 – 9A Janet Parade) were dominated by continuous road traffic noise from Nelson Bay Road, local fauna and jet aircraft noise sources. The $L_{Aeq,\ 15\ minute}$ noise contribution from the Mackas Sand site discernible from the ambient noise environment at the monitoring location likely resulted from mobile plant items and a Turbo Chieftain 1400 mobile power screen operating within the site, from site articulated haul trucks and B-double road truck activity when travelling along the private haul road servicing Lot 220 operations, Mackas Sand and Soil and Sibelco Australia premises and when entering and departing these sites across the entrance cattle grid.

Figure 4.5 – Site 1 Hufnagl residence (R27 – 10 Janet Parade, Salt Ash), 8 September 2011



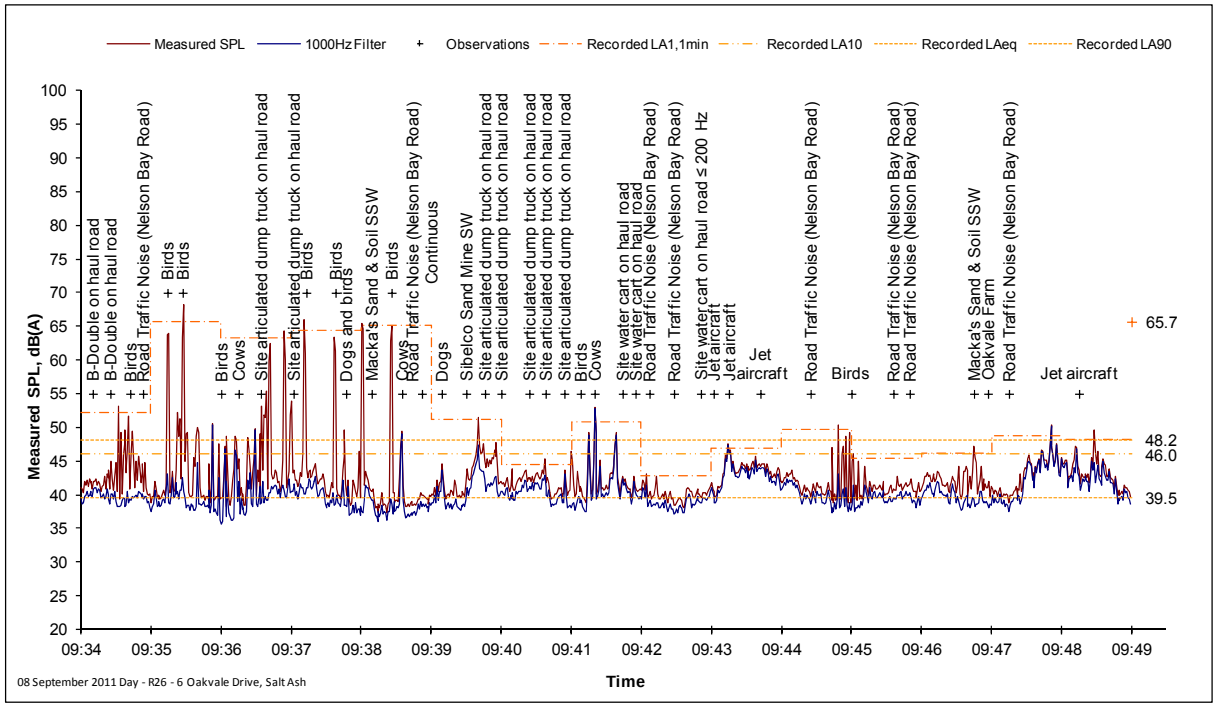
The results in **Figure 4.5** indicate that the ambient noise levels at monitoring location Site 3 (R27 – 10 Janet Parade) were dominated by continuous road traffic noise from Nelson Bay Road, bird calls and noise from an auto-wreckers to the north-west of the site and site noise sources.

The $L_{Aeq,\ 15\ minute}$ noise contribution from the Mackas Sand site discernible from the ambient noise environment at the monitoring location likely resulted from audible but not visible wheel loader, excavator and a Turbo Chieftain 1400 mobile power screen operations observed intermittently throughout the monitoring period. Broadband (white sound) reverse alarms were audible at this location and also contributed to the site noise contribution at this monitoring location.

The site $L_{A1,\ 1\ minute}$ noise contribution resulted from an impact occurring within the site likely associated with loading activity.

It is considered that the meteorological conditions of cool morning temperatures and relatively high humidity, along with the monitoring location being downwind of site operations resulted in noise propagation from the premises to this nearest potentially affected residential receiver monitoring location being representative of likely worst-case noise enhancing meteorological conditions.

Figure 4.6 – Site 4, 9.35 am (R26 – 6 Oakvale Drive, Salt Ash), 8 September 2011



The results in **Figure 4.6** indicate that the ambient noise levels at monitoring location Site 1 (R26 – 6 Oakvale Drive) were dominated by continuous road traffic noise from Nelson Bay Road, local fauna (bird calls and farm animals) and jet aircraft noise sources. The $L_{Aeq,\ 15\ minute}$ noise contribution associated with the Mackas Sand site activity discernible from the ambient noise environment at the monitoring location resulted from site articulated haul truck and water cart activity when travelling along the private haul road servicing the premises.

4.4.4 Monitoring Locations – Traffic Noise Impact

Attended traffic noise monitoring was undertaken at one monitoring location during the day time period (refer to **Table 4.2**).

Attended traffic noise measurement was undertaken with a Type 1, Svantek 959 noise and vibration analyser, Serial Number 12918. During the attended noise survey the noise meter was calibrated using a Svantek Model SV 30A Noise Meter Calibrator, Serial Number 14162. The noise monitor was run using three measurement profiles [Z- (Linear), C- and A- Weighting] and recorded A-weighted 1/3 octave noise levels at 1 second intervals over four consecutive 15 minute measurement periods resulting in a cumulative 1 hour measurement period. As recommended in Section C *Noise Monitoring Procedures* of the ECRTN, the L_{Aeq} for the adopted assessment period was measured 'on a 15-minute basis.'

Meteorological data was collected for the attended monitoring period from the weather station located at the Williamtown RAAF Base situated approximately 6 kilometres west of the site.

The day time attended traffic noise monitoring was undertaken between 10.58 am to 11.59 am on 8 September 2011.

The night and day time monitoring results shown in **Figures 4.7** to **4.10** and **Table 4.5** include:

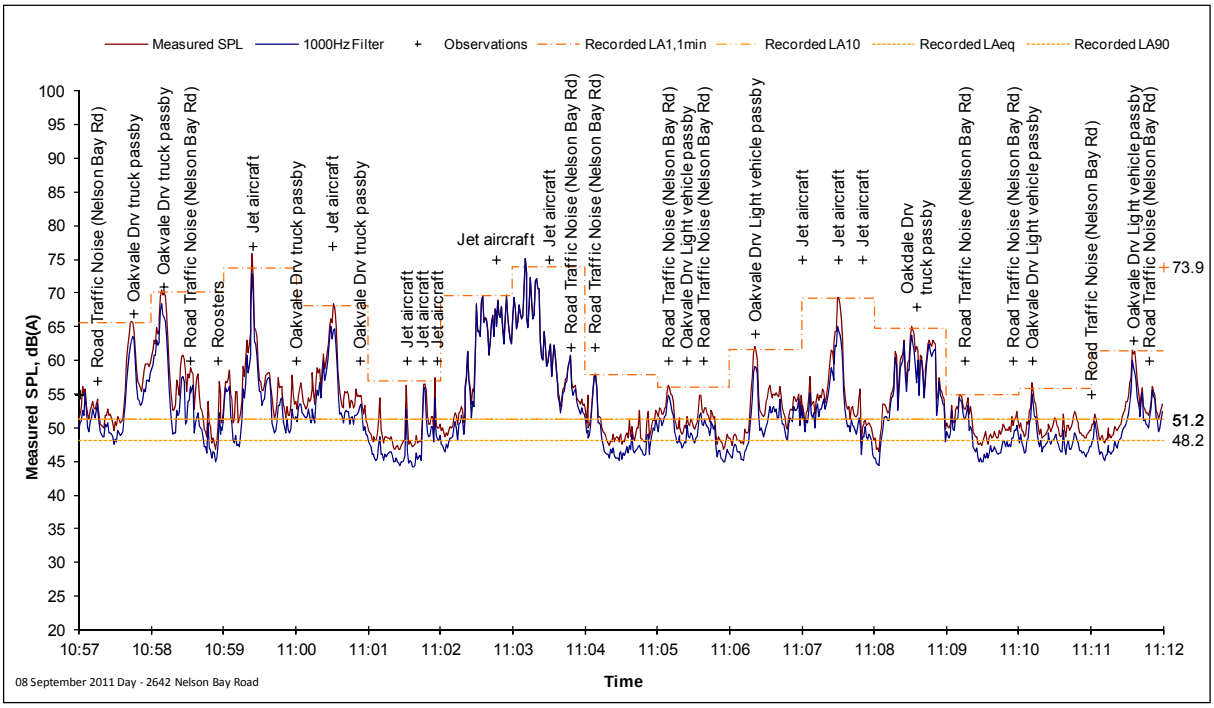
- the recorded overall A-weighted noise levels at 1 second intervals over a 15 minute measurement period;
- the results of a 1000 Hz low pass filter at 1 second intervals over the 15 minute measurement period;
- an assessment of the maximum $L_{A1,\ 1\ minute}$ noise level recorded over the 15 minute measurement period for night period measurements; and,
- the $L_{Aeq,\ 15\ minute}$ and $L_{A90,\ 15\ minute}$ noise levels for the 15 minute measurement period.

Comments regarding the noise sources contributing to the ambient noise levels are also presented on **Figures 4.7** to **4.10**.

An assessment of the results from the attended noise monitoring program and the corresponding meteorological conditions are provided in **Section 4.5.2**.

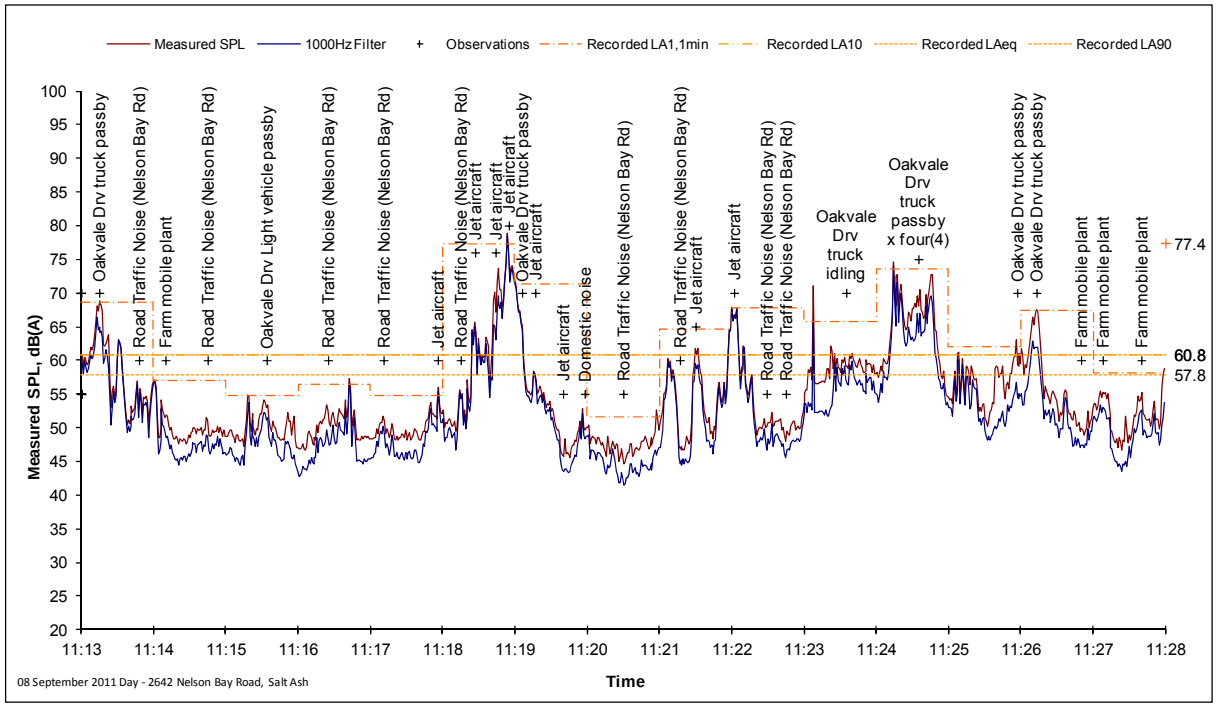
4.4.5 Attended Traffic Noise Monitoring on 8 September 2011

Figure 4.7 – Site 5, 10.58 am (2642 Nelson Bay Road, Salt Ash), 8 September 2011



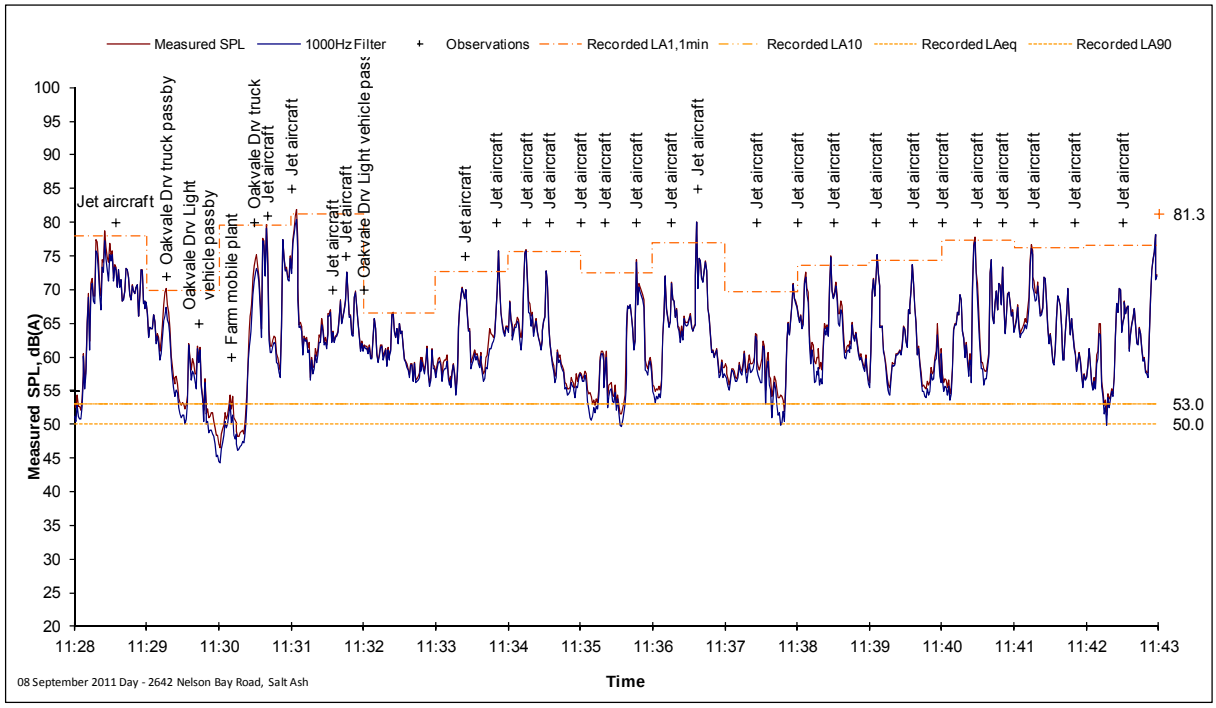
The results in **Figure 4.7** indicate that the ambient noise levels at monitoring location Site 5 (2642 Nelson Bay Road, Salt Ash) were dominated by jet aircraft noise sources, continuous road traffic noise from Nelson Bay Road and intermittent road traffic noise from Oakvale Drive. The $L_{Aeq,\ 15\ minute}$ noise contribution resulting from road truck activity along Oakvale Drive was calculated and utilised to derive the $L_{Aeq,\ 1\ hour}$ road traffic noise contribution at this monitoring location.

Figure 4.8 – Site 5, 11.13 am (2642 Nelson Bay Road, Salt Ash), 8 September 2011



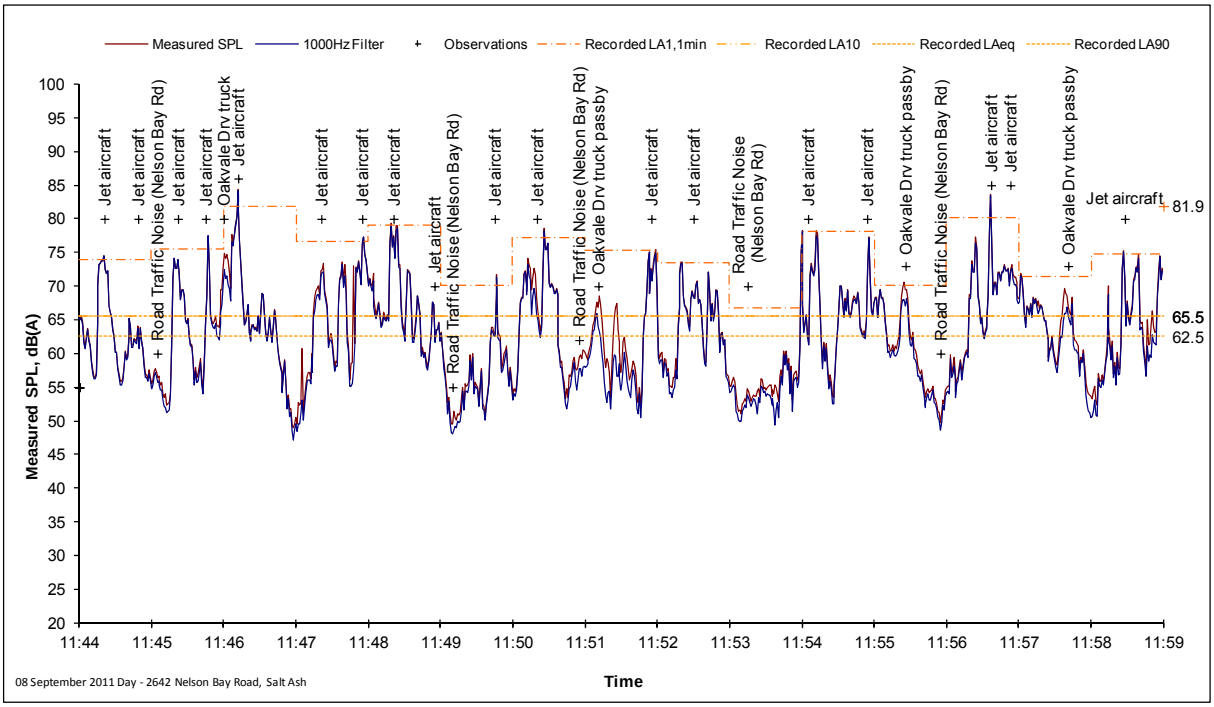
The results in **Figure 4.8** indicate that the ambient noise levels at monitoring location Site 5 were dominated by jet aircraft noise sources, continuous road traffic noise from Nelson Bay Road, intermittent road traffic noise from Oakvale Drive and mobile farming equipment being operated in the vicinity. The $L_{Aeq,\ 15\ minute}$ noise contribution resulting from road truck activity along Oakvale Drive was calculated and utilised to derive the $L_{Aeq,\ 1\ hour}$ road traffic noise contribution at this monitoring location.

Figure 4.9 – Site 5, 11.29 am (2642 Nelson Bay Road, Salt Ash), 8 September 2011



The results in **Figure 4.9** indicate that the ambient noise levels at monitoring location Site 5 were dominated by jet aircraft noise sources, continuous road traffic noise from Nelson Bay Road, intermittent road traffic noise from Oakvale Drive and mobile farming equipment being operated in the vicinity. The $L_{Aeq,\ 15\ minute}$ noise contribution resulting from road truck activity along Oakvale Drive was calculated and utilised to derive the $L_{Aeq,\ 1\ hour}$ road traffic noise contribution at this monitoring location.

Figure 4.10 – Site 5, 11.44 am (2642 Nelson Bay Road, Salt Ash), 8 September 2011



The results in **Figure 4.10** indicate that the ambient noise levels at monitoring location Site 3 (R24 – 9A Janet Parade) were dominated by continuous road traffic noise from Nelson Bay Road, local fauna and jet aircraft noise sources. The $L_{Aeq,\ 15\ minute}$ noise contribution resulting from road truck activity along Oakvale Drive was calculated and utilised to derive the $L_{Aeq,\ 1\ hour}$ road traffic noise contribution at this monitoring location.

4.5 Assessment of Attended Monitoring Results

4.5.1 Assessment of Attended Monitoring Results – Industrial Noise

During the attended monitoring program, the ambient noise levels surrounding the Mackas Sand site were recorded with particular attention paid to the contribution of the Mackas Sand site operations.

The results of the attended noise monitoring program summarised in **Tables 4.3** and **4.4** indicate that, under the meteorological conditions at the time of monitoring, the Mackas Sand site was complying with the $L_{Aeq,\ 15\ minute}$ and $L_{A1,\ 1\ minute}$ industrial noise assessment criteria outlined in the development consents and EPLs under which the Mackas Sand operates. Site related assessment criteria for industrial noise are summarised in **Section 2** of this report.

Table 4.3 – Summary of Attended Industrial Noise Monitoring – September 2011, dB(A)
Night time Period: 6.15 to 7.00 am on 8 September 2011

Location	Monitoring Period (15 min starting)	Measured Noise Level			Estimated Mackas Sand Contribution		Meteorological Conditions [Wind speed (m/sec), Direction, Temperature (°C), Humidity (%)]
		LA90, 15 min	LAeq, 15 min	LA1, 1min	Measure	Contribution	
Site 1	6.14 am	47	49	49	LAeq, 15 min LA1, 1 min	26 42	4.5 m/s, WSW, 13°C, 77%
Site 2	6.40 am	45	47	55	LAeq, 15 min LA1, 1 min	32 38	4.2 m/s, WSW, 14°C, 73%

Note: No measurements were conducted at Sites 3 and 4 in the night period.

Table 4.4 – Summary of Attended Industrial Noise Monitoring – September 2011, dB(A)
Day time Period: 7.00 to 9.50 am on 8 September 2011

Location	Monitoring Period (15 min starting)	Measured Noise Level			Estimated Mackas Sand Contribution		Meteorological Conditions [Wind speed (m/sec), Direction, Temperature (°C), Humidity (%)]
		LA90, 15 min	LAeq, 15 min	LA1, 1min	Measure	Contribution	
Site 2	8.54 am	42	50	64	LAeq, 15 min	34	4.2 m/s, W, 16°C, 65%
Site 3	8.20 am	45	47	56	LAeq, 15 min	29	3.6 m/s, W, 16°C, 70%
Site 4	7.26 am	15	54	74	LAeq, 15 min	26	4.0 m/s, WSW, 14°C, 72%
Site 4	9.34 am	40	48	66	LAeq, 15 min	27	3.1 m/s, WNW, 18°C, 63%

Note: No measurements were conducted at Site 1 in the night period.

4.5.2 Assessment of Attended Monitoring Results – Traffic Noise

During the attended monitoring program, the ambient noise levels at Site 5 (2642 Nelson Bay Road, Salt Ash) were recorded with particular attention paid to the contribution of the product haulage road truck activity on Oakvale Drive.

The results of the attended traffic noise monitoring program are summarised in **Table 4.5**. The $L_{Aeq,\ 1\ hour}$ traffic noise level resulting from the contribution of 19 truck movements past the monitoring location was 56 dB(A). None of these trucks were from Mackas Sand operations on Lot 220, however would be representative of a similar number of trucks hauling product from Lot 220.

Table 4.5 – Summary of Attended Traffic Noise Monitoring – September 2011, dB(A)
Day time Period: 10.58 to 11.59 am on 8 September 2011

Location	Monitoring Period (1 hour starting)	Measured Noise Level	Estimated road truck contribution		Meteorological Conditions [Wind speed (m/sec), Direction, Temperature (°C), Humidity (%)]
		LAeq	Measure	Contribution	
Site 5	10.58 am	64	LAeq, 1 hour	56	4 m/s, SSW, 19°C, 67%

Note: Monitoring results are noise levels those at 1 m from the worst affected facade.

5.0 Assessment of Compliance

5.1 Compliance Results – Industrial Noise

The measured industrial noise level contribution of the Mackas Sand site resulting from the attended noise surveys and the relevant noise assessment criteria are presented in **Tables 5.1** and **5.2** for the night period and day period respectively.

Table 5.1 – Predicted Night Time Industrial Noise Levels versus Noise Criteria, dB(A)

Location	$L_{Aeq,\ 15\ minute}$		$L_{A1,\ 1\ minute}$	
	Noise Criteria	Noise Level Contribution	Noise Criteria	Noise Level Contribution
Site 1	35	26	45	42
Site 3	35	32	45	38

Note: No measurements were conducted at Sites 3 and 4 in the night period.

Table 5.2 – Predicted Day Time Industrial Noise Levels versus Noise Criteria, dB(A)

Location	$L_{Aeq,\ 15\ minute}$	
	Noise Criteria	Noise Level Contribution
Site 2	36	34
Site 3	35	29
Site 4	36	26 to 27

Note: No measurements were conducted at Sites 3 and 4 in the night period.

The results from the Mackas Sand compliance noise monitoring presented in **Table 5.1** and **Table 5.2** indicate that the Mackas Sand sand extraction operations were generating noise levels during the periods of attended monitoring below relevant industrial noise criteria outlined in the development consents and EPLs under which the Mackas Sand operates and summarised in **Table 2.1**.

5.2 Compliance Results – Traffic Noise

During the attended road traffic noise monitoring period, between 10.58 am to 11.59 pm, there was no site associated road trucks activity using Oakvale Drive. Road truck movements past the monitoring location during the monitoring period were associated with vehicles servicing Mackas Sand and Soil and Sibelco Australia.

Nonetheless the road truck noise contribution over the hour monitoring period has been used as the basis for assessment of site traffic noise as it is understood that the vehicle fleet that services Mackas Sand and Soil and Sibelco Australia is representative of that servicing Mackas Sand operations on Lot 220.

As presented in Section 6 of the *Noise Management Plan for Sand Extraction Operations* (Umwelt 2009), traffic predictions for the proposed operations were previously made based on the traffic assessment undertaken by B J Bradley & Associates (October 2008). Traffic noise predictions were undertaken based on a maximum of 16 truck movements per hour (two ways) with an average of twelve 12 truck movements (two ways) per hour along Oakvale Drive.

In this case, the traffic noise level resulting from 19 heavy vehicle movements had an acoustic contribution over the hour long monitoring period of $L_{Aeq,\ 1\ hour}$ 56 dB(A) as shown in **Table 5.3**.

The results of the attended traffic noise monitoring conducted on the 8 September 2011 have been utilised to correlate the accuracy of the site traffic noise model to existing conditions.

A road traffic noise assessment was undertaken using the United States Federal Highway Administration (USFHWA) L_{Aeq} calculation method (reference) (US EPA Report 550/9-74-004, (March 1974) as modified. Based on equations in Appendix A-13 & CoRTN amendments).

The road traffic noise predictions were made using the following assumptions:

- 19 truck movements over the 1 hour period; and
- vehicle speed of 50 km/hr.

Predictions of road traffic noise resulting from the heavy vehicle traffic movements along Oakvale Drive, received at Site 5 (2642 Nelson Bay Road) situated along Oakvale Drive are presented in **Table 5.3**.

Table 5.3 – Comparative Analysis between Predicted and Measured Oakvale Drive Heavy Vehicle Road Traffic Noise, Site 5 (2642 Nelson Bay Road, Salt Ash)

Receiver Location	Heavy vehicle movements (two ways) per hour along Oakvale Drive	Measured heavy vehicle noise contribution $L_{Aeq,\ 1\ hour}$	Predicted heavy vehicle noise contribution $L_{Aeq,\ 1\ hour}$
Site 5	19	56 dB(A)	56 dB(A)

Results presented in **Table 5.3** indicate the site traffic noise model is accurate within ± 0.5 dB(A).

As previously presented in Section 7.4.2 of the *Noise Management Plan for Sand Extraction Operations* (Umwelt 2009), results of traffic noise predictions undertaken based on a maximum of 16 truck movements per hour (two ways) with an average of 12 truck movements (two ways) per hour along Oakvale Drive are presented in **Table 5.34**.

Table 5.4 – Predicted Road Traffic Noise Contribution at Site 5 based on Peak and Average Site Hourly Heavy Vehicle Movements

Receiver Location	Project Related Road Traffic – Peak $L_{Aeq,\ 1\ hour}$	Project Related Road Traffic – Average $L_{Aeq,\ 1\ hour}$	Criteria
Site 5	55 dB(A)	54 dB(A)	55 dB(A) $L_{Aeq,\ 1\ hour}$

Heavy vehicle road traffic noise levels from the site related peak and average heavy vehicle movements are predicted to meet the relevant day time and night time criteria of 60 dB(A)

$L_{Aeq,\ 1\ hour\ day}$ and 55 dB(A) $L_{Aeq,\ 1\ hour\ night}$ at Site 5 (2642 Nelson Bay Road), the assessed residential receiver location along Oakvale Drive.

6.0 Recommendations

6.1.1 Continuous Improvement

During attended monitoring at R27 (Hufnagl), the broadband reverse alarms were audible and even though in compliance with consent requirements, could be quietened to reduce noise levels at this residence. Following discussions with Mackas Sand, it was agreed that Mackas Sand would implement the following noise control measure as a self-applied continuous improvement to minimise project-related noise emissions:

- As broadband reverse alarms were audible at the R27 monitoring location during attended monitoring, the emission volume of the broadband reverse alarms on site mobile plant items operating within the quarrying operations at Lot 220 will be lowered. The broadband reverse alarms only need to be effectively heard within the 'danger zone' or potential zone of impact.

It is noted that future noise-compliance monitoring will aim to be conducted during periods where there is minimal noise contribution from military aircraft bombing range operations. Air Force jet aircraft undertake bombing run sorties at the Williamtown RAAF Base bombing range situated north of the site.

7.0 Statement of Compliance

7.1.1 Statement of Compliance – Industrial Noise

Results of the attended industrial noise monitoring program conducted on 8 September 2011 indicated that Mackas Sand was complying with the $L_{Aeq,\ 15\ minute}$ and $L_{A1,\ 1\ minute}$ industrial noise assessment criteria as outlined in the Mackas Sand Major Project Approval 08_0142 and EPL 13218 for the meteorological conditions experienced at the time of monitoring.

7.1.2 Statement of Compliance – Traffic Noise

During the attended traffic noise monitoring program conducted on 8 September 2011 there was no heavy vehicle activity along Oakvale Drive associated with Mackas Sand. Road truck movements past the monitoring location during the monitoring period were solely associated with vehicles servicing Mackas Sand and Soil and Sibelco Australia.

Results of the attended traffic noise monitoring program were utilised to correlate the accuracy of the site traffic noise model to existing conditions for the 19 heavy vehicle movements (two ways) an hour observed on 8 September 2011. Results of the model correlation presented in **Table 5.3** indicate the site traffic noise model is accurate within ± 0.5 dB(A).

Results of traffic noise predictions undertaken based on a maximum of 16 truck movements per hour (two ways) with an average of 12 truck movements (two ways) per hour along Oakvale Drive were presented in **Table 5.4**. The predicted noise levels at the façade of Site 5 (2642 Nelson Bay Road) resulting from peak and average hourly traffic movements associated with the Project would be 55 dB(A) $L_{Aeq,\ 1\ hour}$ and 54 dB(A) $L_{Aeq,\ 1\ hour}$ respectively.

The predicted road traffic noise results correlated against existing site conditions at Site 5 (2642 Nelson Bay Road) indicate compliance against the traffic noise assessment criteria as outlined in Major Project Approval 08_0142) and EPL 13218 for the meteorological conditions experienced at the time of monitoring.

8.0 References

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Umwelt (Australia) Pty Limited, 2009. *Noise Management Plan for Sand Extraction Operations*.

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APPENDIX 1

Glossary and Abbreviations

Appendix 1 – Glossary and Definitions – Acoustics

1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit
ABL	Assessment background level - A single-figure background level representing each assessment period – day, evening and night (that is, three assessment background levels are determined for each 24-h period of the monitoring period). It is determined by taking the lowest 10th percentile of the L90 level for each assessment period
Airblast	Sound wave from blasting (overpressure)
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise
dB(A)	Decibels A-weighted
dB(L), dB(Lin)	Decibels Linear or decibels Z-weighted
Decibel (dB)	The units of sound level and noise exposure measurement where a step of 10 dB is a ten-fold increase in intensity or sound energy and actually sounds a little more than twice as loud
Hertz (Hz)	The measure of frequency of sound wave oscillations per second – 1 oscillation per second equals 1 hertz
L_{A10}	The percentile sound pressure level exceeded for 10 per cent of the measurement period with 'A' frequency weighting calculated by statistical analysis. Typically used to assess the impact of an existing operation on a receiver area and is referred to as the cumulative noise levels at the receiver attributable to the noise source
L_{A90}	Background Noise Level. The percentile sound pressure level exceeded for 90 per cent of the measurement period with 'A' frequency weighting calculated by statistical analysis
L_{Amax}	The maximum of the sound pressure levels recorded over an interval of 1 second
$L_{A1,\ 1\ minute}$	The measure of the short duration high-level noises that cause sleep arousal. The noise level is measured as the percentile sound pressure level that is exceeded 1 per cent of measurement period with 'A' frequency weighting calculated by statistical analysis during a measurement time interval of 1 minute

$L_{Aeq,t}$	Equivalent continuous sound pressure level - The value of the sound pressure level of a continuous steady noise that, a measurement interval of time (t), has the same mean square sound pressure as the sound under consideration whose level varies with time. Usually measured in dB with 'A' weighting
L_{An}	Percentile level – A measure of the fluctuation of the sound pressure level which is exceeded 'n' per cent of the observation time
MIC	Maximum explosive charge mass (kg) detonated per delay (any 8ms interval)
PVS (mm/s)	Peak Vector Sum
PVV (mm/s)	Peak Particle Velocity
RBL	Rating background level - The overall single figure background level representing each assessment period over the whole monitoring period determined by taking the median of the ABLs found for each assessment period
SD (m)	The scaled distance for airblast and ground vibration from the charge to the receiver
SPL (dBL)	Blasting: peak airblast level measured in dB Linear
SPL (dBA)	Noise: Sound pressure level - The basic measure of noise loudness. The level of the root-mean-square sound pressure in decibels given by: $SPL = 10.\log10\ (p/po)^2$ where p is the rms sound pressure in pascals and po is the sound reference pressure at 20 μPa. decibels
SWL	Sound power level - A measure of the energy emitted from a source as sound and is given by: $SWL = 10.\log10\ (W/W_o)$ where W is the sound power in watts and W_o is the sound reference power at 10^{-12} watts

APPENDIX 3

Mackas Sand Ecological Monitoring Program for Lot 220 DP 1049608

Mackas Sand Pty Limited

Mackas Sand Pty Limited
2011 Baseline Ecological Monitoring Program for Lot 220 DP 1049608

September 2011

Umwelt
Environmental Consultants

Mackas Sand Pty Limited
2011 Baseline Ecological Monitoring Program for Lot 220 DP 1049608

Prepared by

Umwelt (Australia) Pty Limited

on behalf of

Mackas Sand Pty Limited

Project Director:	Peter Jamieson	
Project Manager:	Andy Goodwin	
Report No.	1646/R29/V1	Date: September 2011

Umwelt
Environmental Consultants

2/20 The Boulevarde
PO Box 838
Toronto NSW 2283

Ph: 02 4950 5322
Fax: 02 4950 5737
Email: mail@umwelt.com.au
Website: www.umwelt.com.au

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APPENDICES

1.0 Introduction

Mackas Sand Pty Limited (Mackas Sand) is a sand mining operation located approximately 20 kilometres north-east of Newcastle, at Salt Ash, NSW. Mackas Sand contracted Umwelt (Australia) Pty Limited (Umwelt) to establish a rehabilitation monitoring program as outlined in the Mackas Sand Landscape Management Plan (Umwelt 2009). This report documents the methods and results of the baseline ecological monitoring survey of three reference sites located within remnant vegetation that will be retained within Lot 220 (**Figure 1.1**). It is intended that rehabilitation sites will be added to the monitoring program when rehabilitation commences.

2.0 Methods

Three monitoring sites have been established in remnant vegetation within the Archaeological Area (**Figure 1.1**). The three permanent analogue sites were established in remnant vegetation on 1 February 2011 to monitor the floristic characteristics and vegetation structure of remnant vegetation. The sites were selected in areas considered to be appropriate targets for the final vegetation communities in the rehabilitation areas. The Mackas Sand Landscape Management Plan (Umwelt 2009) states that 'as the objective of the rehabilitation is to return the site to a native ecosystem, reference/analogue sites are required based on the following criteria:

- analogue sites should occur in natural ecosystems, representative of the goal/target for rehabilitation; and
- where possible, analogue sites should occur in areas that have experienced minimal disturbance.'

As the rehabilitation is established and then matures, the composition and condition of rehabilitated areas will be compared with the remnant vegetation sites, using the remnant vegetation sites as a benchmark for its success.

The following sections detail the methods employed to establish the remnant monitoring sites in 2011.

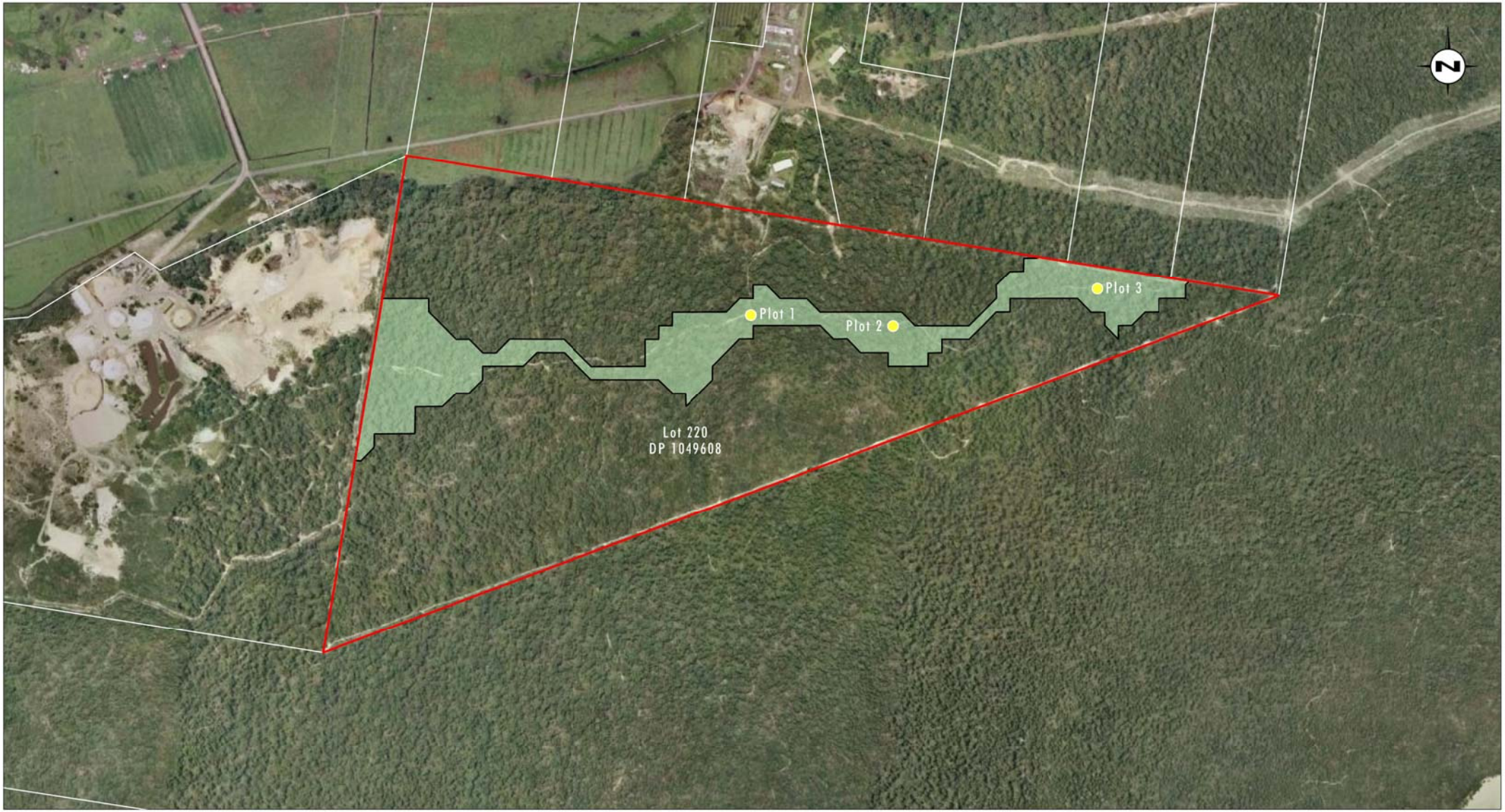
2.1 Flora Monitoring Methods

Three permanent flora monitoring plots were established in remnant vegetation within the Archaeological Area (**Figure 1.1**). This area will not be disturbed by quarrying activities on Lot 220. The vegetation community throughout Lot 220 is uniform and therefore the sites were selected based on spatial distribution and vegetation assemblages that identified the sites as suitable reference sites for comparison with rehabilitation areas. The centre point coordinates of the monitoring locations are listed in **Table 2.1**.

Table 2.1 – Centre Point Coordinates of the Three Permanent Flora Monitoring Plots

Plot Number	Vegetation Type	Easting	Northing
Plot 1	Remnant	399521	6370394
Plot 2	Remnant	399784	6370374
Plot 3	Remnant	400162	6370443

Note: Eastings and northings are recorded in MGA94



Source: Aerial: Google Earth 2008

0 100 250 500m
1:10 000

Legend
- Lot 220 Approval Area
- Archaeological Area
- Monitoring Plots

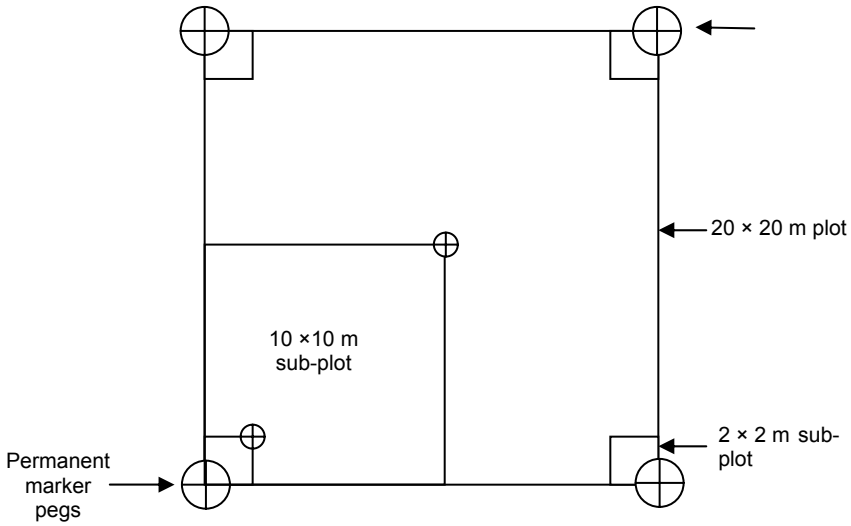
FIGURE 1

Location of Monitoring Plots

2.1.1 Flora Plot Methods

Each vegetation monitoring site consisted of a 20 × 20 metre (400 m²) plot; this size is widely used and recommended by the Royal Botanic Gardens Sydney (RBGS) and the Office of Environment and Heritage (OEH), allowing for comparative analyses where required. The four corners of each plot were marked with metal stakes and labelled with metal tags to show the plot number and corner location.

Within each of the 20 × 20 metre plots, five sub-plots were established as indicated in **Schematic 1.1**. The sub-plots comprised one 10 × 10 metre sub-plot and four 2 × 2 metre sub-plots. To mark the sub-plots existing marker pegs from the 20 × 20 metre plots were used along with additional marker pegs were required.



Schematic 1.1 – Vegetation Monitoring Plot Design

Approximately 60 minutes was spent surveying flora within each 20 × 20 metre plot. The following methods were used for the plot and sub-plots:

- **20 × 20 metre plot:** all vascular flora species present were recorded. Flora species were either identified on-site or samples were taken for identification at a later date. A modified Braun-Blanquet 6-point scale (Braun-Blanquet 1927, with selected modifications sourced from Poore 1955 and Austin et al. 2000) was used to estimate cover-abundances of the plant species identified within each plot. **Table 2.2** shows the cover-abundance categories used. Additionally, the number of individual plants of each species over 5 metres in height occurring within the plot were recorded.

- **10 × 10 metre sub-plot:** the number of individual plants of each species between 1 and 5 metres in height occurring within the plot were recorded.

- **2 × 2 metre sub-plots:** the number of individual plants of each species less than 1 metre in height occurring within the plot were recorded, or estimated where they were numerous.

Table 2.2 - Modified Braun-Blanquet Crown Cover-Abundance Scale

Class	Cover-abundance Scale*	Growth Form Dependent
1	Few individuals (less than` 5% cover)	Herbs, sedges and grasses: <5 individuals
		Shrubs and small trees: <5 individuals
2	Many individuals (less than 5% cover)	Herbs, sedges and grasses: ≥ 5 individuals
		Shrubs and small trees: ≥ 5 individuals
		Medium-large overhanging tree
3	5% – less than 20% cover	
4	20% – less than 50% cover	
5	50% – less than 75% cover	
6	75% – 100% cover	

Note: * Modified Braun-Blanquet scale (Poore 1955; Austin et al. 2000)

The vegetation within each 20 **×** 20 metre plot was assessed for general health, evidence of natural regeneration, the occurrence and abundance of weeds, evidence of feral animals and other disturbances such as erosion or grazing.

2.1.2 Plant Identification and Taxonomic Review

All vascular plants recorded or collected were identified using keys and nomenclature from Harden (1992, 1993, 2000 & 2002) and Wheeler et al. (2002). Recent changes to nomenclature and classification have been incorporated into the results, as derived from *PlantNET* (Botanic Gardens Trust 2011), the on-line plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 & 2002) where available, and draw on other sources such as local names where these references do not provide common names. Where the identity of a specimen was unknown or uncertain, it was lodged with the National Herbarium of New South Wales at the RBGS.

2.1.3 Photo Monitoring

Photo monitoring points were established at each of the three flora monitoring sites. Photos were taken from each corner star-picket of the survey plot facing towards the centre of the plot, comprising a total of four photos per **20 × 20 metre** plot.

3.0 Results

A complete list of flora species recorded at each site, along with the cover abundance of each, is provided in **Appendix 1**. The results of the stem counts in the sub-plots are presented in **Appendix 2**. The following sections provide the specific detail of the results of each of the three monitoring plots.

Baseline photos from the permanent photo monitoring of all three sites are provided in **Appendix 3**.

3.1 Plot 1

3.1.1 Vegetation

Plot 1 occurred in an Apple – Blackbutt Coastal woodland community, following nomenclature of the Lower Hunter and Central Coast Regional Environmental Management Strategy regional vegetation mapping (NPWS 2000). Plot 1 was characterised by a moderately dense canopy (30 per cent) to 20 metres in height, dominated by blackbutt (*Eucalyptus pilularis*) and smooth-barked apple (*Angophora costata*) (see **Appendix 3**). The sub-canopy was open (10 per cent) to 8 metres in height, and is dominated by smooth-barked apple (*Angophora costata*) and old-man banksia (*Banksia serrata*). The shrub stratum consisted of coastal beard-heath (*Leucopogon parviflora*), *Dillwynia retorta*, and old-man banksia (*Banksia serrata*), to 2 metres in height with a 20 per cent canopy cover. The ground cover was dense (to 60 per cent cover), and dominated by common bracken (*Pteridium esculentum*), *Tetratheca ericifolia* and raspwort (*Gonocarpus teucrioides*).

3.1.2 Floristics

A total of 20 flora species were recorded in Plot 1 in the 2011 monitoring surveys. All were native species. Species were recorded from 14 plant families, the most speciose being Fabaceae (Faboiddeae) with four species and Myrtaceae and Proteaceae with two species each.

Table 3.1 shows the results of the sub-plot size class monitoring that was undertaken for Plot 1 (complete results Plot 1 are shown in **Appendix 3**). Plot 1 contained only native species.

Table 3.1 – Results of Plot 1 Size Class Monitoring

	Vegetation < 1 m **2 m** × 2 m sub-plot		**Vegetation 1-5 m** **10 m** × 10 m sub-plot		**Vegetation >5 m** **20 m** × 20 m plot	
	Stem Count	**No. of Species**	**Stem Count**	**No. of Species**	**Stem Count**	**No. of Species**
Counts	65	12	50	5	22	3
Native Composition	100% native		100% native		100% native	

3.2 Plot 2

3.2.1 Vegetation

Plot 2 vegetation comprised an Apple - Blackbutt Coastal woodland, following nomenclature of the Lower Hunter and Central Coast Regional Environmental Management Strategy regional vegetation mapping (NPWS 2000). Plot 2 was characterised by a moderately dense canopy of 30 per cent to 22 metres in height, and was dominated by blackbutt (*Eucalyptus pilularis*) and smooth-barked apple (*Angophora costata*) (see **Appendix 3**). The sub-canopy is moderately dense (25 per cent cover) to 12 metres in height, and dominated by smooth-barked apple (*Angophora costata*), old-man banksia (*Banksia serrata*) and blackbutt (*Eucalyptus pilularis*). An open shrub-stratum (10 per cent cover) occurred to a height of three metres was characterised by Sydney golden wattle (*Acacia longifolia* subsp. *longifolia*), coastal beard-heath (*Leucopogon parviflora*) and *Dillwynia retorta*. The ground cover was dense (60 per cent cover), less than one metre in height, with dominant species including

common bracken fern (*Pteridium esculatum*), blady grass (*Imperata cylindrica* var. *major*) and blue flax lily (*Dianella caerulea* var. *producta*).

3.2.2 Floristics

A total of 25 native flora species were recorded in Plot 2. No introduced species were recorded. Species were recorded from 16 plant families, the most speciose being Fabaceae (Faboideae) with five species and Myrtaceae and Proteaceae both with two species.

Table 3.2 shows the results of the size class monitoring for Plot 2 (complete results for this plot are shown in **Appendix 3**). Plot 2 contained only native species.

Table 3.2 – Results of Plot 2 Size Class Monitoring

	Vegetation < 1 m		Vegetation 1-5 m		Vegetation >5 m	
	Stem Count	**No. of Species**	**Stem Count**	**No. of Species**	**Stem Count**	**No. of Species**
Counts	103	7	56	4	30	4
Native Composition	100% native		100% native		100% native	

3.3 Plot 3

3.3.1 Vegetation

Plot 3 occurred in an Apple – Blackbutt Coastal woodland community, following nomenclature of the Lower Hunter and Central Coast Regional Environmental Management Strategy regional vegetation mapping (NPWS 2000). Plot 3 was characterised by a moderately dense (30% cover) canopy stratum to 20 metres, dominated by blackbutt (*Eucalyptus pilularis*) and smooth-barked apple (*Angophora costata*) (see **Appendix 3**). The moderately dense (20 per cent cover) sub-canopy of up to 10 metres was dominated by smooth-barked apple (*Angophora costata*) and old-man banksia (*Banksia serrata*). An open (10 per cent cover) understory of two metres in height consisted of coastal beard-heath (*Leucopogon parviflora*), old-man banksia (*Banksia serrata*), broad-leaved geebung (*Persoonia levis)* and slender tea-tree (*Leptospermum trinervium*). The ground cover was dense (60 per cent cover), less than one metre in height, with dominant species including common bracken fern (*Pteridium esculatum*), blue flax lily (*Dianella caerulea* var. *producta*) and raspwort (*Gonocarpus teucrioides*).

3.3.2 Floristics

A total of 19 native flora species were recorded in Plot 3. No introduced species were recorded. Species were recorded from 12 plant families, the most speciose being Fabaceae (Faboideae) with four species and Myrtaceae and Proteaceae both with two species.

Table 3.3 shows the results of the size class monitoring for Plot 3 (complete results for this plot are shown in **Appendix 3**). Plot 3 contained only native species.

Table 3.3 – Results of Size Class Monitoring for Plot 3

	Vegetation < 1 m		Vegetation 1-5 m		Vegetation >5 m	
	Stem Count	No. of Species	Stem Count	No. of Species	Stem Count	No. of Species
Counts	63	12	57	5	27	3
Native Composition	100% native		100% native		100% native	

4.0 Conclusions and Recommendations

The 2011 Baseline Ecological Monitoring Program established three permanent monitoring sites in an area of remnant vegetation that will not be impacted as part of the approved disturbance of Lot 220. The three monitoring sites have been established in remnant vegetation to provide benchmark scores to which future rehabilitation sites can be compared. Additionally the remnant vegetation monitoring sites will facilitate the monitoring of remnant woodland areas within Lot 220.

As additional areas become available for rehabilitation, additional permanent rehabilitation monitoring sites will be incorporated into the monitoring schedule. This will allow a range of sites, of varying stages of rehabilitation to be monitored and compared to the preliminary rehabilitation criteria and rehabilitation objectives outlined in the Landscape Management Plan (Umwelt 2009).

Monitoring of the remnant sites will be undertaken every three years. Once established, rehabilitation sites will also be monitored every three years.

5.0 References

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APPENDIX 1

Flora Species List

Appendix 1

Flora Species List

The following list was developed from the baseline survey of ecological monitoring sites detailed in **Section 2.0** of the main report. It includes all species of vascular plants observed during fieldwork. Not all species are readily detected at any one time of the year, therefore the list will not necessarily include all plant species likely to occur in the Salt Ash region of Mackas Sand. Many species flower only during restricted periods of the year, and some flower only once in several years. In the absence of flowering material, many of these species cannot be identified, or even detected.

Names of classes and families follow a modified Cronquist (1981) System.

The following abbreviations or symbols are used in the list:

sp.	specimens that are identified to genus level only;
asterisk (*)	denotes species not indigenous to the study area;
subsp.	subspecies; and
var.	variety.

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 & 2002) and Wheeler et al. (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from *PlantNET* (Botanic Gardens Trust 2011), the on-line plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 & 2002) where available, and draw on other sources such as local names where these references do not provide a common name. The cover-abundance scores in the table below refer to the modified Braun-Blanquet crown cover-abundance scale identified in **Table 2.2** of the main report.

Family	Scientific Name	Common Name	Cover-abundance		
			Plot 1	Plot 2	Plot 3
Cycadopsida (Cycads)					
Zamiaceae	*Macrozamia communis*	burrawang		2	
Filicopsida (Ferns)					
Dennstaedtiaceae	*Pteridium esculentum*	bracken fern	4	4	4
Magnoliopsida (flowering plants) – Liliidae (Monocots)					
Hypoxidaceae	**Hypoxis* sp.		2	2	
Lomandraceae	*Lomandra longifolia*	spiny-headed mat-rush	1	1	2
Phormiaceae	*Dianella caerulea* var. *producta*	blue flax lily	2	2	2
Poaceae	*Imperata cylindrica*	blady grass	2	3	2
Poaceae	*Themeda australis*	kangaroo grass		2	
Magnoliopsida (flowering plants) – Magnoliidae (Dicots)					
Dilleniaceae	*Hibbertia aspera*	rough guinea flower	2	2	2
Epacridaceae	*Leucopogon parviflorus*	coastal beard-heath	3	3	2
Epacridaceae	*Leucopogon lanceolata*		2		
Euphorbiaceae	*Ricinocarpos pinifolius*	wedding bush	2	2	2
Fabaceae (Faboideae)	*Bossiaea rhombifolia*		2	2	
Fabaceae (Faboideae)	*Dillwynia retorta*		3	2	2
Fabaceae (Faboideae)	*Glycine tabacina*	love creeper		2	
Fabaceae (Faboideae)	*Hardenbergia violacea*	false sarsaparilla	2	2	2
Fabaceae (Faboideae)	*Kennedia rubicunda*	red kennedy pea			2
Fabaceae (Faboideae)	*Pultenaea rosmarinifolia*		2	2	2
Fabaceae (Mimosoideae)	*Acacia longifolia* subsp. *longifolia*	Sydney golden wattle		2	
Fabaceae (Mimosoideae)	*Acacia stricta*	straight wattle			2
Fabaceae (Mimosoideae)	*Acacia ulicifolia*	prickly Moses		1	
Haloragaceae	*Gonocarpus teucrioides*	raspwort	3	2	2
Myrtaceae	*Angophora costata*	smooth-barked apple	3	3	3
Myrtaceae	*Eucalyptus pilularis*	blackbutt	3	3	3
Myrtaceae	*Leptospermum trinervium*	paperbark tea tree			2
Pittosporaceae	*Billardiera scandens*	appleberry		2	
Proteaceae	*Banksia serrata*	old-man banksia	3	3	3
Proteaceae	*Persoonia levis*	broad-leaved geebung	1	2	2
Rubiaceae	*Pomax umbellata*		2		
Santalaceae	*Exocarpos cupressiformis*	native cherry		1	
Tremandraceae	*Tetratheca ericifolia*		3	2	2

APPENDIX 2

Flora Monitoring Sub-plot Results

Appendix 2

Flora Monitoring Sub-plot Results

The following species were recorded during the 2011 monitoring surveys in the sub-plots as described in **Section 2.0** of the main text.

The following symbol is used in the below tables:

var. variety.

Plot 1

Table 1 – Stem counts for all species recorded in 20 metre x 20 metre plot growing over 5 metres in height at Plot 1

No.	Species	Total Stem Count	Notes
1	*Angophora costata*	10	
2	*Eucalyptus pilularis*	2	
3	*Banksia serrata*	10	

Table 2 – Stem counts for all species recorded in 10 metre x 10 metre sub-plot growing between 1 and 5 metres in height at Plot 1

No.	Species	Total Stem Count	Notes
1	*Angophora costata*	4	
2	*Banksia serrata*	3	
3	*Leucopogon parviflorus*	4	
4	*Dillwynia retorta*	14	
5	*Pteridium esculentum*	25	

Table 3 – Stem counts for all species recorded in 2 metre x 2 metre sub-plots growing less than one metre in height at Plot 1

No.	Species	Total Stem Count				Notes
		Sub-plot 1 (NE)	Sub-plot 2 (SE)	Sub-plot 3 (SW)	Sub-plot 4 (NW)	
1	*Dillwynia retorta*	1				
2	*Angophora costata*	1				
3	*Pultenaea rosemarinifolia*	1	2			
4	*Ricinocarpos pinifolius*	1				
5	*Pteridium esculatum*	1	3		3	
6	*Diannela caerulea* var. *producta*		15	12		

Table 3 – Stem counts for all species recorded in 2 metre x 2 metre sub-plots growing less than one metre in height at Plot 1 (cont)

No.	Species	Total Stem Count				Notes
		Sub-plot 1 (NE)	Sub-plot 2 (SE)	Sub-plot 3 (SW)	Sub-plot 4 (NW)	
7	*Gonocarpus teucrioides*		5			
8	*Bossiaea rhombifolia*			2		
9	*Hibbertia aspera*			2	3	
10	*Lomandra longifolia*				1	
11	*Tetratheca ericifolia*				10	
12	*Hardenbergia violacea*				2	

Plot 2

Table 4 – Stem counts for all species recorded in 20 metre x 20 metre plot growing over 5 metres in height at Plot 2

No.	Species	Total Stem Count	Notes
1	*Angophora costata*	17	
2	*Eucalyptus pilularis*	4	
3	*Corymbia gummifera*	1	
4	*Banksia serrata*	8	

Table 5 – Stem counts for all species recorded in 10 metre x 10 metre sub-plot growing between 1 and 5 metres in height at Plot 2

No.	Species	Total Stem Count	Notes
1	*Banksia serrata*	2	
2	*Leucopogon parviflorus*	14	
3	*Dillwynia retorta*	10	
4	*Pteridium esculentum*	30	

Table 6 – Stem counts for all species recorded in 2 metre x 2 metre sub-plots growing less than one metre in height at Plot 2

No.	Species	Total Stem Count				Notes
		Sub-plot 1 (NE)	Sub-plot 2 (SE)	Sub-plot 3 (SW)	Sub-plot 4 (NW)	
1	*Imperata cylindrica* var. *major*	10	40	10	8	
2	*Tetratheca ericifolia*	3			5	
3	*Hardenbergia violacea*	1				
4	*Gonocarpus teucrioides*		8			
5	*Dianella caerulea* var. *producta*			8		
6	*Angophora costata*			8		
7	*Dillwynia retorta*				2	

Plot 3

Table 7 – Stem counts for all species recorded in 20 metre x 20 metre plot growing over 5 metres in height at Plot 3

No.	Species	Total Stem Count	Notes
1	*Angophora costata*	15	
2	*Eucalyptus pilularis*	3	
3	*Banksia serrata*	9	

Table 8 – Stem counts for all species recorded in 10 metre x 10 metre sub-plot growing between 1 and 5 metres in height at Plot 3

No.	Species	Total Stem Count	Notes
1	*Persoonia levis*	1	
2	*Acacia stricta*	3	
3	*Leucopogon parviflora*	11	
4	*Dillwynia retorta*	2	
5	*Pteridium esculentum*	40	

Table 9 – Stem counts for all species recorded in 2 metre x 2 metre sub-plots growing less than one metre in height at Plot 3

No.	Species	Total Stem Count				Notes
		Sub-plot 1 (S)	Sub-plot 2 (W)	Sub-plot 3 (E)	Sub-plot 4 (N)	
1	*Angophora costata*	1				
2	*Gonocarpus teucrioides*	10	4	5	3	
3	*Dillwynia retorta*	5		2		
4	*Leucopogon parviflora*	1				
5	*Bossiaea rhombifolia*		5	6		
6	*Dianella caerulea*		4			
7	*Ricinocarpos pinifolius*		2			
8	*Pteridium esculatum*		4			
9	*Tetratheca ericifolia*			6		
10	*Hardenbergia violacea*				2	
11	*Lomandra longifolia*				1	
12	*Themeda australis*				5	

APPENDIX 3

Photo Monitoring Results

PLATE 1
Plot 1 North-east Corner (2011)

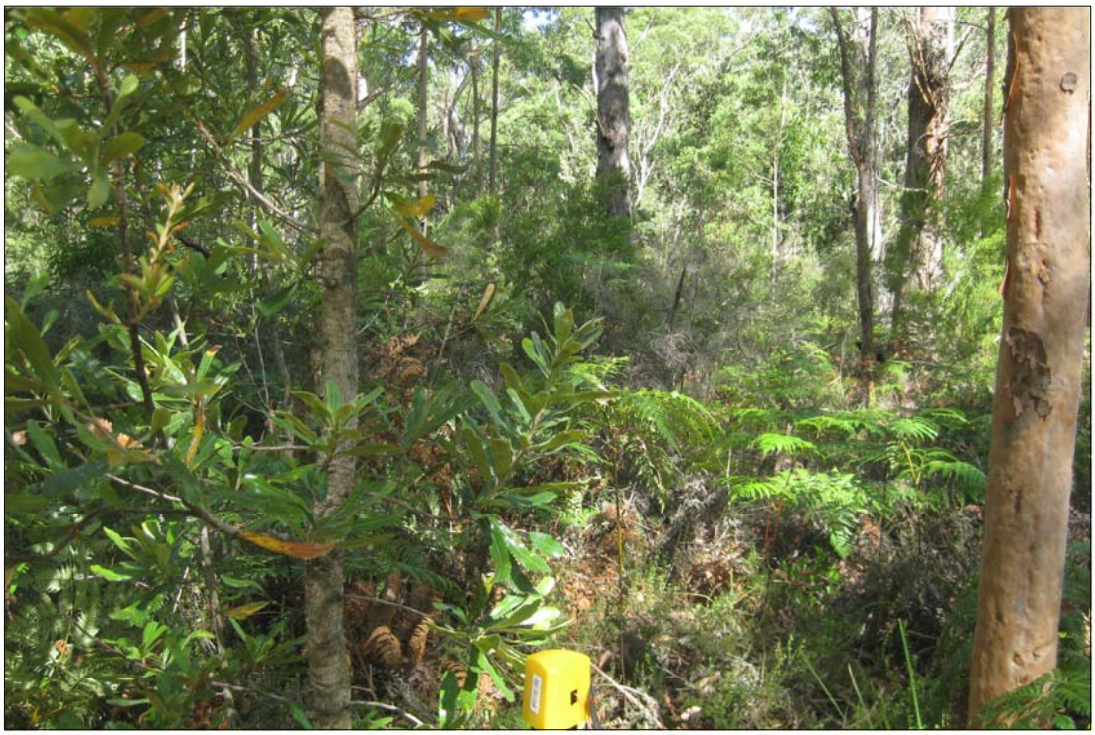

PLATE 2
Plot 1 North-west Corner (2011)

PLATE 3
Plot 1 South-east Corner (2011)

PLATE 4
Plot 1 South-west Corner (2011)

PLATE 5
Plot 2 North-east Corner (2011)

PLATE 6
Plot 2 North-west Corner (2011)

PLATE 7
Plot 2 South-east Corner (2011)

PLATE 8
Plot 2 South-west Corner (2011)

PLATE 9
Plot 3 West Corner (2011)

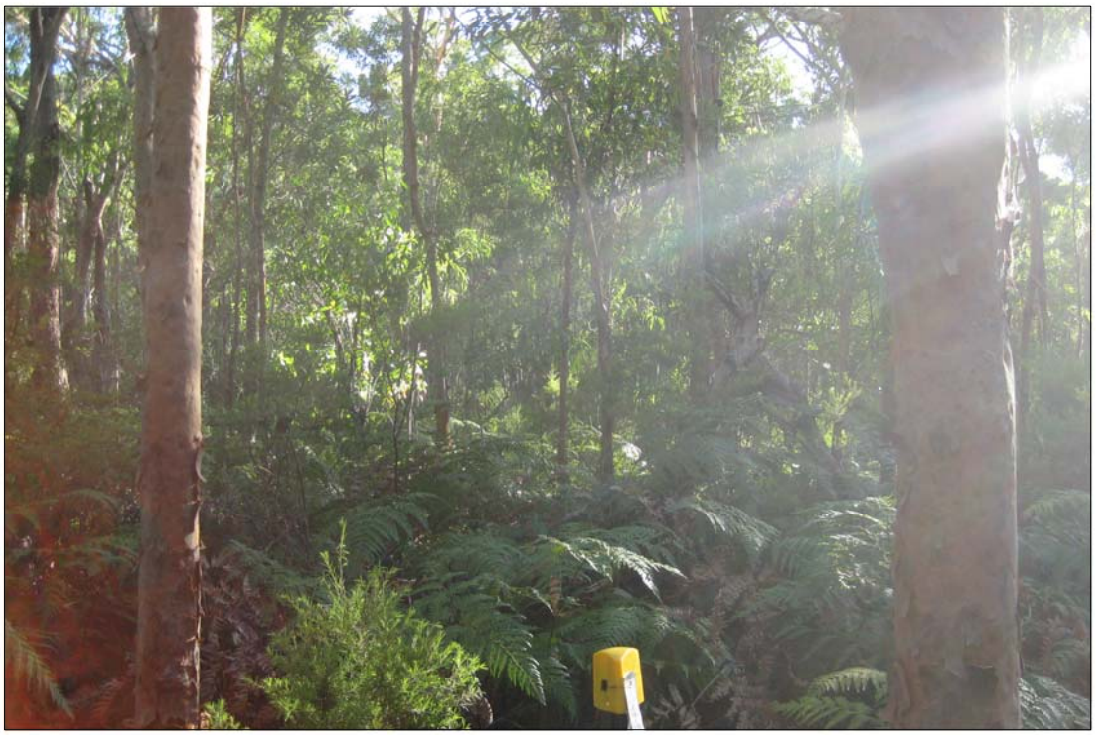

PLATE 10
Plot 3 North Corner (2011)

PLATE 11
Plot 3 East Corner (2011)

PLATE 12
Plot 3 South Corner (2011)

APPENDIX 4

DI&I/DTIRIS Form

Form S 1

NSW GOVERNMENT Industry & Investment

RETURN FOR EXTRACTIVE MATERIALS: YEAR ENDED 30 JUNE 2011

Quote Reference No. in all correspondence

Quarry Id: Rims ID:

Operators Name: MACKAS SAND
Address

Email:

Quarry Name: Mackas Sand Mine
Quarry Address: ~~Oakville Drive~~ ~~Stockton Bight~~
Oakvale Drive ~~Tank Hillsmantown~~

Inquiries please telephone:
(02) 4931 6435
Completed or Nil Returns
Fax - (02) 4931 6796
Email -
mineral.royalty@industry.nsw.gov.au
Postal Address (see address below)

Please amend name, postal address and location of mine or quarry if incorrect or incomplete

2010-2011

The return should be completed and forwarded to the **STATISTICAL OFFICER, MINERALS & ENERGY DIVISION, INDUSTRY & INVESTMENT NSW, PO BOX 344 HUNTER REGION MAIL CENTRE NSW 2310 on or before 16 December, 2011**. If completion of the return is unavoidably delayed, an application for extension of time should be requested **before** the due date. If no work was done during the year, a **NIL** return must be forwarded.

The return should relate to the **above quarrying establishment**, and should cover the operations of quarrying and treatment (such as crushing, screening, washing etc.) carried out at or near the quarry. A return is required even if the operations are solely of a developmental nature, and whether the area being worked is held under a mining title or otherwise.

Brad Mullard, Executive Director Mineral Resources

Please complete the following information to assist in identifying the location of the Quarry

Typical Geology Sand

Nearest Town to Quarry SALT ASH

Local Council Name Port stephens

Deposited Plan and Lot Number/s of Quarry Lot 220

Email Address of Operator oakfields@big pond.com

Name of Owner or Licensee Mackas Sand

Postal Address of Licensee 2684 Nelson Bay Rd Salt Ash 2318

Licence/Lease Number/s (if any)
From Mineral Resources NSW (Industry & Investment NSW) EPA No 13218

From Department of Lands or other Department

If any output was obtained from land NOT held under licence from the above Departments, state the Name/s and Address/es of the Owners of the land

- To the best of my knowledge, the particulars which have been entered in this return are correct and no blank spaces have been left where figures should have been inserted.
- **SIGNATURE of PROPRIETOR or MANAGER** RMackenzie **DATE** 29-9-11
- **PERSON to be contacted if queries arise regarding this return** Robert Mackenzie
- **NAME** (Block letters) Robert Mackenzie **Telephone** 0408 490911

SALES During 2010-2011

Production information may be published in aggregated form for statistical reporting. However, production data for individual operations is kept strictly confidential.

Product	Description	Quantity Tonnes
Virgin Materials		
• **Crushed Coarse Aggregates**		
Over 75mm		
Over 30mm to 75mm		
5mm to 30mm		
Under 5mm		
Natural Sand		
Manufactured Sand		
Prepared Road Base & Sub Base		
Other Unprocessed Materials		
Recycled Materials		
• **Crushed Coarse Aggregates**		
Over 75mm		
Over 30mm to 75mm		
5mm to 30mm		
Under 5mm		
Natural Sand		
Manufactured Sand		
Prepared Road Base & Sub Base		
Other Unprocessed Materials		
• **River Gravel**		
Over 30mm		
5mm to 30mm		
Under 5mm		
• **Construction Sand**	Excluding Industrial	
• **Industrial Sand**		
Foundry, Moulding		
Glass		
Other (Specify)	BEACH SAND	343427-19
• **Dimension Stone**	Building, Ornamental, Monumental	
Quarried in Blocks		
Quarried in Slabs		
• **Decorative Aggregate**	Including Terrazzo	
• **Loam**	Soil for Topdressing, Garden soil, Horticultural purposes)	
• **TOTAL SITE PRODUCTION**		
• **Gross Value ($) of all Sales**		$ 3434271-90
• **Type of Material**	BEACH SAND Ton	343427-19
• **Number of Full-Time Equivalent (FTE) Employees**	Employees: 3	Contractors NIL

Please Note: A return for clay based products can be obtained by contacting the inquiry number.

Form S 1

NSW GOVERNMENT | Industry & Investment

RETURN FOR EXTRACTIVE MATERIALS: YEAR ENDED 30 JUNE 2011

Quote Reference No. in all correspondence

Quarry Id: Rims ID:

Operators Name: MACKAS SAND
Address

Email:

Quarry Name: Mackas Sand Mine
Quarry Address: ~~Oakville Drive~~ Stockton Bight Track

Inquiries please telephone:
(02) 4931 6435
Completed or Nil Returns
Fax - (02) 4931 6796
Email -
mineral.royalty@industry.nsw.gov.au
Postal Address (see address below)

Please amend name, postal address and location of mine or quarry if incorrect or incomplete

2010-2011

The return should be completed and forwarded to the **STATISTICAL OFFICER, MINERALS & ENERGY DIVISION, INDUSTRY & INVESTMENT NSW, PO BOX 344 HUNTER REGION MAIL CENTRE NSW 2310 on or before 16 December, 2011**. If completion of the return is unavoidably delayed, an application for extension of time should be requested **before** the due date. If no work was done during the year, a **NIL** return must be forwarded.

The return should relate to the **above quarrying establishment**, and should cover the operations of quarrying and treatment (such as crushing, screening, washing etc.) carried out at or near the quarry. A return is required even if the operations are solely of a developmental nature, and whether the area being worked is held under a mining title or otherwise.

Brad Mullard, Executive Director Mineral Resources

Please complete the following information to assist in identifying the location of the Quarry

Typical Geology Sand

Nearest Town to Quarry Williamtown

Local Council Name Port Stephens

Deposited Plan and Lot Number/s of Quarry Lot 218

Email Address of Operator oakfields@bigpond.com

Name of Owner or Licensee Mackas Sand

Postal Address of Licensee 2684 Nelson Bay Rd Salt Ash 2318

Licence/Lease Number/s (if any)
From Mineral Resources NSW (Industry & Investment NSW) EPA No 13218

From Department of Lands or other Department

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- To the best of my knowledge, the particulars which have been entered in this return are correct and no blank spaces have been left where figures should have been inserted.
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- **PERSON to be contacted if queries arise regarding this return** Robert Mackenzie
- **NAME** (Block letters) Robert Mackenzie **Telephone** 0408 490911

SALES During 2010-2011

Production information may be published in aggregated form for statistical reporting. However, production data for individual operations is kept strictly confidential.

Product	Description	Quantity Tonnes
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Over 75mm		
Over 30mm to 75mm		
5mm to 30mm		
Under 5mm		
Natural Sand		
Manufactured Sand		
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Other Unprocessed Materials		
Recycled Materials		
• **Crushed Coarse Aggregates**		
Over 75mm		
Over 30mm to 75mm		
5mm to 30mm		
Under 5mm		
Natural Sand		
Manufactured Sand		
Prepared Road Base & Sub Base		
Other Unprocessed Materials		
• **River Gravel**		
Over 30mm		
5mm to 30mm		
Under 5mm		
• **Construction Sand**	Excluding Industrial	
• **Industrial Sand**		
Foundry, Moulding		
Glass		
Other (Specify)		
• **Dimension Stone**	Building, Ornamental, Monumental	
Quarried in Blocks		
Quarried in Slabs		
• **Decorative Aggregate**	Including Terrazzo	
• **Loam**	Soil for Topdressing, Garden soil, Horticultural purposes)	
• **TOTAL SITE PRODUCTION**		NIL
• **Gross Value ($) of all Sales**		
• **Type of Material**		
• **Number of Full-Time Equivalent (FTE) Employees**	Employees: NIL	Contractors NIL

Please Note: A return for clay based products can be obtained by contacting the inquiry number.

1

Umwelt (Australia) Pty Limited
2/20 The Boulevarde
PO Box 838
Toronto NSW 2283

Ph. 02 4950 5322
Fax 02 4950 5737