Centennial Coal

CENTENNIAL MANDALONG PTY LTD

Mandalong Mine

ANNUAL REVIEW

March 2020

Annual Review Title Block

Name of Operation	Mandalong Mine
Name of Operator	Centennial Mandalong Pty Ltd
Development Consent/ Project Approval #	SSD-5144, SSD-5145, DA97/800, DA 35-2-2004.
Mining Lease #	Mining Lease 1443 Mining Lease 1543 Mining Lease 1553 Mining Lease 1722 Mining Lease 1744
Name of Holder of Mining Lease	Centennial Mandalong Pty Ltd
Water License #	WAL39767
Name of Holder of Water License	Centennial Mandalong Pty Ltd
MOP/RMP Start Date	1 December 2016
MOP/RMP End Date	30 November 2023
Annual Review Start Date	1 January 2019
Annual Review End Date	31 December 2019

I, Gregory Shields **certify that this audit report is a true and accurate record of the compliance status of Centennial Mandalong for the period 1 January to 31 December 2019 and that I am authorized to make this statement on behalf of Centennial Mandalong Pty Ltd.**

Note:

a) *The Annual Review is an 'environmental audit' for the purposes of s122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion) in an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000.*

b) *The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (intention to defraud by false or misleading statement – maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents –maximum penalty 2 years imprisonment or $22,000,or both).*

Name of Authorised Reporting Officer	GREGORY SHIELDS
Title of Authorised Reporting Officer	DIRECTOR
Signature of Authorised Reporting Officer	
Date	18 MARCH 2020

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Plan 2-3	Delta Entry Site Domains at Commencement of MOP
Plan 2-4	Cooranbong Entry Site Domains at Commencement of MOP
MG10815	Mandalong Mine Monthly Production 2019
MG10722d	Mandalong Mine Location of Environmental Monitoring Points
MG10722c	Delta Entry Site Locations of Environmental Monitoring Points
MG10722b	Cooranbong Service Site Location of Environmental Monitoring Points
MG10722f	Mandalong South Surface Site Location of Environmental Monitoring Points
MG10502	Mandalong Surface Water and Groundwater Monitoring Locations

Appendices

Appendix No.	Appendix Name
1	Bank Guarantee – DA97/800 CC24
2	Floodpath Condition Report – 2019
3	2019 Independent Environmental Audit Action Plan
4	Centennial Mandalong Rehabilitation Security Estimate (DRG only)
5	2019 Noise Monitoring Reports (GHD)

1 STATEMENT OF COMPLIANCE

Table 1-1: Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
DA97/800 (MOD10)	Yes
DA97/800 MOD 4 Statement of Commitments	Yes
DA97/800 MOD 7 Statement of Commitments	Yes
SSD-5144 (MOD7)	Yes
SSD-5144 Mandalong Southern Extension Project Statement of Commitments	Yes
SSD-5144 MOD 1 Statement of Commitments	Yes
SSD-5144 MOD 6 Statement of Commitments	Yes
SSD-5144 MOD 7 Statement of Commitments	Yes
SSD-5145 (MOD 1)	No
DA35-2-2004 (MOD 1)	Yes
EPL 365	No
Mining Lease 1443	Yes
Mining Lease 1543	Yes
Mining Lease 1553	Yes
Mining Lease 1722	Yes
Mining Lease 1744	Yes
WAL39767	Yes
EPBC Approval 2013/6906	Yes

Table 1-2: 2019 Non-Compliances

Relevant Approval	Condition #	Condition summary	Compliance Status	Comment	Table # Addressed in Annual Review
EPL365	L2.4 Concentration Limits	Water and or land concentration limits	Low	Exceedance of LDP003 water quality limit criteria.	Table 11-1
EPL365	L2.4 Concentration Limits	Water and or land concentration limits	Low	Exceedance of LDP003 water quality limit criteria.	Table 11-2
EPL365	L5 Noise Limits	Operational noise limit	Low	Exceedance of noise limit criteria	Table 11-3
SSD-5145	Sch 3 Condition 3	Operational noise limit			

Note: Compliance Status Key for Table 1-2

Risk Level	Colour Code	Description
High		Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium		Non-compliance with: • Potential for serious environmental consequences, but is unlikely to occur; or • Potential for moderate environmental consequences, but is likely to occur
Low		Non-compliance with: • Potential for moderate environmental consequences, but is unlikely to occur; or • Potential for low environmental consequences, but is likely to occur
Administrative		Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval conditions)

2 INTRODUCTION

Mandalong Mine is owned and operated by Centennial Mandalong Pty Ltd (Centennial Mandalong), a subsidiary of Centennial Coal Company Limited ('Centennial'). Centennial completed the purchase of the Mandalong Mine in August 2002. Centennial was subsequently purchased by Banpu Public Company Limited ("Banpu") in October 2010.

Mandalong Mine is a modern underground longwall operation located on the western side of Lake Macquarie near Morisset and west of the M1 Motorway. The Mine is situated approximately 130 km north of Sydney and 50 km from the Port of Newcastle, supplying up to 6.5 million tonnes of coal to the domestic power and export markets (**Figure 2-1**).

Figure 2-1: Regional Context

2.1 OVERVIEW

Mandalong Mine comprises the underground workings and surface infrastructure of:

- The Mandalong Mine underground workings including longwall panels, development units and surface infrastructure located near Morisset;
- The Cooranbong Entry Site, consisting of the Cooranbong Colliery underground workings and surface infrastructure located near Dora Creek;
- The Mandalong South Surface Site located off Mandalong Road; and
- The Delta Entry Site, which encompasses an entry and coal delivery system, located near Wyee at the Vales Point Rail Unloader Facility.

An Environmental Impact Statement (EIS) was submitted in 1997 and a Commission of Inquiry held in 1998. The Mine was granted development consent DA 97/800, in October 1998. After obtaining development consent, Centennial constructed the Mandalong Mine site and decline tunnel to access the Mandalong mining area. Longwall mining operations at Mandalong commenced in January 2005. The Mine has approval to extract up to 6.5 million tonnes per annum of coal from the West Wallarah Seam and Wallarah-Great Northern Seam using the longwall mining method.

Development consent DA 35/2/2004 granted in July 2004 by the then NSW Department of Planning & Infrastructure approved the construction and operation of the coal handling and clearance system at the Delta Entry Site. Construction of the Delta Coal Clearance System was completed in 2006. The Cooranbong Entry Site and the Delta Entry Site contain coal handling infrastructure, enabling the Mandalong Mine to process and convey as permitted by their respective development consents up to 10 million tonnes of coal per annum. These sites are maintained under current mine leases as detailed in **Table 3-1**.

Development consent SSD-5144 was granted by the Planning & Assessment Commission (PAC) on 12 October 2015. As per Condition 13 of Schedule 2 of SSD-5144 and agreed with the Secretary of the Department of Planning & Environment on 16 September 2016 in accordance with Section 104A of the Environmental Planning and Assessment Act 1979 (EP&A Act) Centennial Mandalong shall surrender DA97/800 by 30 April 2020.

2.2 SCOPE

This Annual Review details the progress of environmental management covering Mandalong Mine, Mandalong South Surface Site, Cooranbong Entry Site and the Delta Entry Site collectively, for the period 1 January 2019 to 31 December 2019.

The Annual Review has been prepared in accordance with the Mandalong Mine conditions of consent as detailed in SSD-5144 and DA 97/800. The Annual Review has also been prepared in accordance with the requirements of Schedule 3, Condition 4 of DA35-2-2004 (Mandalong Coal Delivery System – Delta Link Project).

Development Consent SSD-5145 (Northern Coal Logistic Project) was approved by the DPE on 29 September 2015. The approval consolidates the receipt, handling, processing and transport of run-of-mine coal from Centennial Coal's underground operations at Mandalong Mine, Newstan Colliery and Awaba Colliery.

This Annual Review document also addresses the requirements of Schedule 5, Condition 11 of SSD-5145 for the Cooranbong Entry Site (CES). The others operations covered by SSD-5145 are described in the Newstan Annual Review required by SSD-5145.

Table 2-1: Centennial Mandalong Environmental Contact Details

Name	Position	Email	Phone
Richard Gelson	Mine Manager	richard.gelson@centennialcoal.com.au	02 49730911
Jeffrey Dunwoodie	Environment & Community Coordinator	jeffrey.dunwoodie@centennialcoal.com.au	02 49730947
Phil Enright	Mining Approvals Coordinator	phil.enright@centennialcoal.com.au	02 49730948

3 APPROVALS

Table 3-1: Environmental Approvals held by Centennial Mandalong.

Name	Description	Issued By	Expiry Date	Renewal Procedure
Consolidated Coal Lease 762	Title to Cooranbong Workings includes some surface land, some environmental conditions	Dept. Primary Industry (Mineral Resources)	13/10/2022	Group Manager Property, Titles and Survey
Consolidated Coal Lease 746 (sublease)	Title for Cooranbong Workings includes some surface land – some environmental conditions	Dept. Primary Industry (Mineral Resources)	31/12/2028	Group Manager Property, Titles and Survey This lease is managed by Centennial Newstan
Mining Purposes Lease 191	Title to surface land for water tanks at Cooranbong – requires annual environmental management report on anniversary	Dept. Primary Industry (Mineral Resources)	24/2/2023	Group Manager Property, Titles and Survey
Mining Lease 1431	Title to surface land for proposed shaft at the back of Morisset	Dept. Primary Industry (Mineral Resources)	Expired - 27/5/2019	Group Manager Property, Titles and Survey
Mining Lease 1443	Mandalong Project Mining Lease – includes some surface land	Dept. Primary Industry (Minerals Resources)	01/03/2020[#]	Group Manager Property, Titles and Survey
Mining Lease 1543	Mining Lease – Mandalong Mine Project	Dept. Primary Industry (Mineral Resources)	25/11/2024	Group Manager Property, Titles and Survey
Mining Lease 1553	Mining Lease Delta Link Project – includes surface land	Dept. Primary Industry (Mineral Resources)	07/09/2025	Group Manager Property, Titles and Survey
Mining Lease 1722	Mining Lease – Southern Extension Area	Dept. Industry Resources & Energy	17/12/2036	Group Manager Property, Titles and Survey

Name	Description	Issued By	Expiry Date	Renewal Procedure
Mining Lease 1744	Mining lease associated with proposed mining operations in the Olney State Forest areas within the Southern Extension Area	Dept. Industry Resources & Energy	6/10/2037	Group Manager Property, Titles and Survey
Exploration Licence 4443	Exploration Licence	Dept. Primary Industry (Mineral Resources)	23/10/2017#	Group Manager Property, Titles and Survey
Exploration Licence 4969	Exploration Licence	Dept. Primary Industry (Mineral Resources)	31/07/2017#	Group Manager Property, Titles and Survey
Exploration Licence 5892	Exploration Licence	Dept. Primary Industry (Mineral Resources)	31/07/2017#	Group Manager Property, Titles and Survey
Exploration Licence 6317	Exploration Licence	Dept. Primary Industry (Mineral Resources)	08/08/2019#	Group Manager Property, Titles and Survey
Authorisation 404	Exploration Licence	Dept. Primary Industry (Mineral Resources)	31/07/2017#	Group Manager Property, Titles and Survey
Mine Operations Plan (MOP) – Amendment B	Summary of Mining Activities – Mandalong	Department of Planning & Environment – Division of Resources & Geoscience.	30/11/2023	MOP approved for the period 1 December 2016 to 30 November 2023.
Environmental Protection Licence 365	Permits scheduled activity “coal mining” and discharge of water from licensed discharge points.	Environment Protection Authority	Perpetual	Requires payment and Annual Return February each year

Name	Description	Issued By	Expiry Date	Renewal Procedure
Mandalong Mine Development Consent No.97/800	Permits development and works to occur as described in the EIS.	NSW Department of Planning, Infrastructure & Environment	October 2020	To be surrendered by 30 April 2020.
Mandalong Mine Development Consent No. DA 35-2-2004	Permits construction and operation of the Delta Coal Handling Facility	NSW Department of Planning, Infrastructure & Environment	31/12/2040	Requires new development consent after expiry date.
Mandalong Mine Development Consent SSD-5144	Extension of underground operations into the Mandalong Southern Extension Area.	NSW Department of Planning, Infrastructure & Environment	31/12/2040	Requires new development consent after expiry date.
Centennial Northern Coal Services Development Consent SSD-5145	Receipt, handling, processing and transport of run-of-mine coal from Centennial Coal's underground operations at Mandalong Mine, Newstan Colliery and Awaba Colliery.	NSW Department of Planning, Infrastructure & Environment	31/12/2045	Requires new development consent after expiry date.
Northern Coal Logistics EPBC Approval 2013/6906	To upgrade coal preparation, handling infrastructure, transport and water management activities at the existing Northern Coal Services Site	Department of the Environment & Energy	31/12/2055	Requires new EPBC approval after expiry date.
Cooranbong Borehole WAL39767	Dewatering of Mine Workings	Department of Industry – Crown Lands & Water	This water access licence continues to be in force until it is cancelled.	Not applicable.
Radiation Licence 5064217	Radiation management	Environment Protection Authority	26/6/2020	Submit renewal application.

Note # Renewal applications have been lodged and acknowledged for these titles however, no renewal offers have been received at the time of writing of this Annual Review.

3.1 DEVELOPMENT CONSENTS

The Mandalong Mine, which is an extension of the old Cooranbong Colliery, was originally granted Development Consent DA 97/800 by the then Minister for Urban Affairs and Planning on 14 October 1998 under Part 4 of the EP&A Act following the submission of the *Cooranbong Colliery Life Extension Project Environmental Impact Statement* (Umwelt, 1997) and a Commission of Inquiry. In 2015 Development Consent SSD-5144 was granted by the Planning & Assessment Commission (PAC) for the Mandalong Southern Extension Project.

The currently approved Mandalong Mine comprises the underground workings and surface infrastructure of the:

- Mandalong Mine, including the Mandalong Mine Access Site, encompassing underground workings and associated surface infrastructure near Morisset;
- Cooranbong Entry Site encompassing a coal delivery system and surface infrastructure (coal handling and processing) near Dora Creek; and
- The new surface facilities site currently under construction, referred to as the Mandalong South Surface Site located off Mandalong Road.

The other operations directly related to the currently approved Mandalong Mine are the two components which comprise the Delta Link Project, namely:

- The construction and use of the Mandalong Coal Delivery System for the underground transportation of coal from the Mandalong Mine to the Delta Entry Site; and
- The receipt and handling of coal at the Wyee Coal Handling Plant at the Delta Entry Site.

The approved Mandalong Mine, and the other operations which directly relate to it, are currently regulated by four planning approvals.

3.1.1 Development Consent SSD-5144 for the Mandalong Southern Extension Project

Development Consent SSD-5144 was granted by the Planning & Assessment Commission (PAC) on 12 October 2015 for the Mandalong Southern Extension Project.

The primary components of the Project are:

- Continue the currently approved operations at the Mandalong Mine, with the exception of the surface infrastructure and operations at the Cooranbong Entry Site (i.e. the continued use of the coal delivery system, the ventilation shaft and the extent of workings at Cooranbong Entry Site for water management.) Note: The surface infrastructure and operations at the Cooranbong Entry Site are part of the Northern Coal Logistics Project SSD-5145, however continue to be managed by Centennial Mandalong;
- Extend the Mandalong Mine's underground mining operations into the Southern Extension Area using a combination of continuous miner and longwall mining methods;
- Extract up to 6.5 Mtpa of ROM coal from the West Wallarah and Wallarah-Great Northern Seams within the current mining lease areas;
- Deliver ROM coal from the underground workings to the Cooranbong Entry Site at a rate of up to 6 Mtpa and to the Delta Entry Site at a rate of up to 6 Mtpa;

- Continue to utilise, and upgrade where required, the existing surface infrastructure of the Mandalong Mine Access Site and Delta Entry Site;
- Install and operate surface infrastructure at the proposed Mandalong South Surface Site to service the extended underground mining operation;
- Increase manning to 420 full-time employees and up to 50 contractors during longwall relocations;
- Undertake on-going exploration drilling activities within the bounds of Centennial Mandalong's mining leases and exploration licences;
- Increase the life of mine to 25 years from the granting of a mining lease(s); and
- Continue to operate 24 hours per day, seven days per week.

Approval to modify SSD-5144 (**MOD 1**) to allow for the relocation of Transgrid's 330 kV Transmission Line TL24 was granted by the DPE on 14 June 2016.

In August 2016, Centennial Mandalong submitted a second application to modify Development Consent SSD-5144 (**MOD 2**) to the DPE. The modification sought to extend development of first workings associated with maingates for longwall panels 22 and 23. This modification was approved on 22 September 2016.

A further modification (**MOD 3**) to increase the annual production limit for the Mandalong Mine from 6 million tonnes per annum to 6.5 million tonnes per annum of ROM coal was approved by DPE on 16 November 2016. This increase is required due to the mine optimising the production process, both in terms of mechanical improvements and through the continuing development and training of underground operators.

An igneous sill exists to the north of approved Longwall panels 22 to 24. Due to historic uncertainty associated with the extent of the igneous sill, Longwall panels 22 to 24 were shortened as a conservative measure to mitigate the sill's impact on production. Through ongoing geological exploration and the successful extraction of adjacent Longwall panels 19, 20 and 21 below the igneous sill, its extent and condition had become better understood. This resulted in the proposed extension of Longwall panels 22 to 24 and the addition of Longwall panel 24A within the existing development consent boundary.

This extension of Longwall mining however existed beyond the development layout. To address this, a Statement of Environmental Effects was prepared titled the Mandalong Longwall Panel 22-23 Extension Modification (**MOD 4**) which was approved by the Department of Planning & Environment on 24 March 2017.

The Mandalong Longwall 24-24A modification (**MOD 5**) was approved by the Department of Planning and Environment on 1 August 2017 following public exhibition of the Statement of Environmental Effects. This modification approves the extension of Longwall 24 and the addition of Longwall 24A.

A modification (**MOD 6**) to Development Consent SSD-5144 to allow for the controlled release of stored water from the Mandalong South Surface Site Sediment Dam following significant rainfall events into the unnamed creek that flows into the upper reaches of Morans Creek was approved by DPIE on 15 April 2019. This is to be a short-term arrangement until the ability to redirect water from the MSSS Sediment Dam to the underground mine workings can be implemented. Additionally, Centennial Mandalong sought the ability to transport the sediment and material collected at the Mandalong South Surface Site to the Cooranbong Entry Site. Once at the Cooranbong Entry Site, the material will be stockpiled on the 1,500 tonne coal stockpile and managed in accordance with the coal handling system approved by the Northern Coal Logistics Project (SSD-5145).

A modification (**MOD 7**) to allow for construction of a new 7.7 km, 33 kV power line from Mandalong Road to the MSSS was approved by the DPIE 25 July 2019. The Project Area comprises the proposed power line easement, access tracks, and a temporary site office at the MMAS, and covers an area of approximately 10.49 ha.

3.1.2 Development Consent DA 97/800 for the Mandalong Mine

Development application DA 97/800 was lodged with LMCC on 27 November 1997 and described in the *Cooranbong Colliery Life Extension Project Environmental Impact Assessment* (Umwelt, 1997), including the Applicants submissions to the Commission of Inquiry, and as modified on nine occasions as follows:

- **MOD 1 (August 2001) -** minor changes to the conditions of consent relating to the preparation of subsidence management plans and notification of landholder requirements, as described in the modification application dated 29 March 2001.
- **MOD 2 (February 2005) -** installation of methane drainage plant and the transport of 1,000 tonnes of mined coal by road, as described in *Mandalong Mine Methane Drainage Plant and Coal Haulage, Statement of Environmental Effects*, dated 28 October 2004 and prepared by Sinclair Knight Merz.
- **MOD 3 (March 2006) -** installation and operation of enclosed methane gas flare units for high purity methane drainage gas. This was undertaken in response to condition 60a(iii) imposed as part of MOD 2, which required Centennial Mandalong to submit a report on the progress towards implementing greenhouse gas abatement measures. This modification is as described in the *Statement of Environmental Effects for the Installation and Operation of Enclosed Methane Gas Flare Units*, dated February 2006 and prepared by Umwelt.
- **MOD 4 (July 2009) -** installation and operation of gas engines (yet to be constructed) to produce up to 12 megawatts of electricity using high purity methane drainage gas, increase the coal production rate from 4 Mtpa to 6 Mtpa, relocate a ballast borehole and update subsidence conditions. This modification is as described in the Environmental Assessment entitled *Mandalong Mine Modification to Development Consent Environmental Assessment*, dated September 2008.
- **MOD 5 (November 2009) -** coal from Mandalong Mine (Cooranbong Entry Site) permitted to be washed at Newstan Colliery and a temporary increase in the volume of coal transported by conveyor from the Cooranbong Entry Site to the Eraring Power Station stockpiles for subsequent road haulage to Newstan Colliery (until construction of the Cooranbong Private Haul Road was complete). This modification is as described in the Statement of Environmental Effects entitled *Washing of Mandalong Coal at Newstan Section 96(A) Application Statement of Environmental Effects*, dated October 2009.
- **MOD 6 (November 2009) -** changes to the locations and heights of approved (but not previously constructed) coal handling infrastructure at the Cooranbong Entry Site. This modification is as described in the Statement of Environmental Effects entitled *Relocation of Infrastructure within the Mandalong Services Site Section 96(1A) Application Statement of Environmental Effects*, dated November 2009.
- **MOD 7 (October 2011) -** installation and operation of a new technology known as a ventilation air methane regenerative after burner (VAM-RAB) as a trial unit to demonstrate the ability of the technology to capture and abate ventilation air methane from the underground mine. This modification is as described in the *Environmental Assessment: Ventilation Air Methane Abatement Demonstration Project, Mandalong Mine – Section 75W Modification*, dated June 2011 and additional information provided in the document entitled *Mandalong Mine Ventilation Air Methane Abatement Demonstration Project – Response to Submissions* dated September 2011.
- **MOD 8 (August 2012) -** increase in the volume of coal permitted to be transported from the Cooranbong Entry Site to both Newstan Colliery and the Eraring Power Station from 2 Mtpa to up to 4 Mtpa and back haulage of middlings (middle quality coal product) from Newstan Colliery to the Cooranbong Entry Site for subsequent supply to the Eraring Power Station. This modification is as described in the *Environmental Assessment: Mandalong Mine – Cooranbong Entry Site – Cooranbong Distribution Project – Section 75W Modification to Development*

Consent DA 97/800, (GSS Environmental, 2012) and additional *Noise Mitigation Assessment*, dated 31 May 2012.

- **MOD 9 (February 2013) -** administrative amendment to conditions 1A(c) and (d) to allow the coal delivery limits approved as part of MOD 8 (i.e. up to 4 Mtpa from Cooranbong Entry Site to both Newstan Colliery and the Eraring Power Station).
- **MOD 10 (November 2014) -** a minor modification to conditions 1A(b) and 1A (c) for a small increase in the amount of coal allowed to be delivered from the underground workings to the Cooranbong Entry Site from 4 Mtpa to 4.1 Mtpa in 2014 only.

3.1.3 Development Consent DA 35-2-2004 for the Delta Entry Site

Development Consent for the transportation of coal to the Delta Entry Site via the underground Mandalong Coal Delivery System, as approved by development consent DA 35-2-2004 and described in the *Delta Link Project – Statement of Environmental Effects* (Umwelt, 2004). This development consent is held by Centennial Mandalong.

Centennial Mandalong sought to modify Development Consent DA 35-2-2004 (**MOD 1**) in September 2017 in order to increase the life of the Mandalong Coal Delivery System from 2021 to 2040. There was no change proposed to the volume of coal permitted to be transported via the Mandalong Coal Delivery System (4 Mtpa), nor any other proposed changes.

The modification would make the life of the Mandalong Coal Delivery System consistent with the life of Mandalong Mine as currently approved under Development Consent SSD-5144 and, as a result, enable continuation of the transportation of coal from Mandalong Mine to the Vales Point Power Station.

This was essentially an administrative amendment. The modification application was submitted to the NSW Department of Planning and Environment in September 2017 and was supported by an Environmental Assessment. Approval was granted by the Department of Planning & Environment on 17 October 2017.

3.1.4 Development Consent SSD-5145 for Northern Coal Logistics Project

Development Consent SSD-5145 for the Northern Coal Logistic Project was approved by the DPE on 29 September 2015. The approval consolidates the receipt, handling, processing and transport of run-of-mine coal from Centennial Coal's underground operations at Mandalong Mine, Newstan Colliery and Awaba Colliery.

The surface infrastructure and operations at the Cooranbong Entry Site are part of the Northern Coal Logistics Project SSD-5145, however continue to be managed by Centennial Mandalong.

The Centennial Northern Coal Services modification (SSD-5145 **MOD 1**) was approved by the Department of Planning & Environment on 25 January 2018. The modification allows Northern Coal Services to:

- Increase the number of full-time equivalent (FTE) employees based at the Cooranbong Entry Site from 14 to 60; and
- Amend the operational noise criteria specified by Condition 2 of Schedule 3 for the privately-owned residences in the vicinity of the Cooranbong Entry Site.

3.2 MINING AUTHORITIES

The Mandalong Mine holding comprises a number of leases as shown in **Table 3-1**.

3.3 ENVIRONMENT PROTECTION LICENCE

Centennial Mandalong holds Environment Protection Licence (EPL) 365 under the Protection of the Environment Operations Act 1997 for the Mandalong Mine, Cooranbong Entry Site, Mandalong South Surface Site and the Delta Entry Site.

3.4 AUTHORISATIONS & EXPLORATION LICENCES

The Mandalong Mine holding comprises a number of leases as shown in **Table 3-1**. There were no renewals completed for the Mandalong Mine Exploration Licences during 2019.

The approved Mining Operations Plan for the period 1 December 2016 to 30 November 2023 was amended in 2017 (Amendment A) for the extension of Longwalls 22 and 23. The MOP Amendment A was approved by the DPE Division of Resources and Geoscience (DRG) on 12 April 2017 and by DPE on 23 June 2017.

The approved Mining Operations Plan for the period 1 December 2016 to 30 November 2023 was amended in 2018 (Amendment B) for the extension of Longwall 24 and the addition of Longwall 24A. The MOP Amendment B was approved by the DPE Division of Resources and Geoscience (DRG) on 6 March 2018 and by DPE on 10 April 2018.

3.5 CONSENT CONDITIONS – ANNUAL REVIEW REQUIREMENTS

The Annual Review has been developed to satisfy the reporting requirements of the approvals listed in **Table 3-2.** Condition 12 of Schedule 6 of SSD-5144 and Condition 11 of Schedule 5 of SSD-5145 include the requirements for the Annual Review. Conditions 105-107 of DA97/800 (MOD 10) also detail requirements for an Annual Environmental Management Report (AEMR) (now referred to as an Annual Review). Schedule 3 Condition 4 of the Delta Entry Site Development Consent (DA 35-2-2004) requires an Annual Report to be submitted as part of the Mandalong Mine AEMR.

Table 3-2: Annual Review Requirements

Approval	Condition No	Requirement	Where addressed in Annual Review
SSD-5144	Schedule 6 Condition 12	By the end of March each year, or as otherwise agreed by the Secretary, the Applicant must submit a report to the Department reviewing the environmental performance of the development, to the satisfaction of the Secretary. This review must:	
		a) describe the development (including any rehabilitation) that was carried out in the last calendar year, and the development that is proposed to be carried out over the current calendar year;	**Section 2, Section 3, Section 8, & Section 12.**
		b) include a comprehensive review of the monitoring results and complaints records of the development over the past calendar year, which includes a comparison of these results against	**Section 6, Section 7,** & **Section 9.3.**

Approval	Condition No	Requirement	Where addressed in Annual Review
		the: • relevant statutory requirements, limits or performance measures/criteria; • requirements of any plan or program required under this consent; • monitoring results of previous years; and • relevant predictions in the documents identified in condition 2(a) and (b) of Schedule 2;	
		c) Identify any non-compliance over the past calendar year, and describe what actions were (or are being) taken to ensure compliance;	**Table 1-1, Table 1-2, & Table 11-1.**
		d) identify any trends in the monitoring data over the life of the development;	**Section 6, Section 7, & Section 9.3.**
		e) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies;	**Section 6, Section 7, & Section 9.3.**
		f) describe what measures will be implemented over the current calendar year to improve the environmental performance of the development.	**Section 12**
SSD-5145	Schedule 5 Condition 11	By the end of March each year, or as otherwise agreed by the Secretary, the Applicant must submit a report to the Department reviewing the environmental performance of the development to the satisfaction of the Secretary. This review must:	
		a) describe the development (including any rehabilitation) that was carried out in the past calendar year, and the development that is proposed to be carried out over the current calendar year;	**Section 2, Section 3, Section 8, & Section 12.**
		b) include a comprehensive review of the monitoring results and complaints records of the development over the past calendar year, which includes a comparison of these results against the: • relevant statutory requirements, limits or performance measures/criteria; • requirements of any plan or program	**Section 6, Section 7,** & **Section 9.3.**

Approval	Condition No	Requirement	Where addressed in Annual Review
		required under this consent; • monitoring results of previous years; and • relevant predictions in the documents identified in condition 2(a) of Schedule 2;	
		c) identify any non-compliance over the past calendar year, and describe what actions were (or are being) taken to ensure compliance;	**Table 1-1**, **Table 1-2,** & **Table 11-1**.
		d) identify any trends in the monitoring data over the life of the development;	**Section 6, Section 7, & Section 9.3.**
		e) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and	**Section 6, Section 7, & Section 9.3.**
		f) describe what measures will be implemented over the current calendar year to improve the environmental performance of the development.	**Section 12**
DA97/800	Condition 105	The Applicant shall through out the life of the mine and for a period of at least five years after the completion of mining, prepare and submit an Annual Environmental Management Report (AEMR) to the satisfaction of the Director General. The AEMR shall review the performance of the mine against the Environmental Strategy and the relevant Mining Operations Plans, the conditions of consent, and other licences and approvals relating to the mine. To enable ready comparison with the EIS predictions, diagrams and tables the report shall include, but not be limited to, the following matters:	
		i. An annual compliance audit of the performance of the project against the conditions of this consent and statutory approvals;	**Table 1-1**
		ii. A review of the effectiveness of the environmental management of the mine in terms of EPA, OEH, NOW, DRE and council requirements;	**Table 1-1**
		iii. Results of all environmental monitoring required under this consent or other approvals, including interpretations and discussion by a suitably qualified person;	**Section 6, Section 7, & Section 9.3.**

Approval	Condition No	Requirement	Where addressed in Annual Review
		iv. An assessment of any changes to agricultural land suitability resulting from the mining operations, including cumulative changes;	**Section 6.8**
		v. A listing of any variations obtained to approvals applicable to the subject area during the previous year;	**Section 3.1**
		vi. The outcome of the water budget for the year, the quantity of water used from water storages and details of discharge of any water from the site;	**Section 7.3**
		vii. Rehabilitation report; and	**Section 8**
		viii. Environmental management targets and strategies for the next year.	**Section 12**
	Condition 106	In preparing the AEMR the applicant shall:	
		I. Consult with the Director General during the preparation of each report for any additional requirements;	**Section 5**
		II. Comply with any requirements of the Director General or other relevant Government Agency; and	**Section 5**
		III. Ensure that the first report is completed and submitted within twelve months of this consent, or at a date determined by the Director General in consultation with the DRE, EPA and OEH.	N/A
	Condition 107	The applicant shall ensure that copies of each AEMR are submitted at the same time to the Department, EPA, OEH, NOW, Council and the Community consultative Committee, and made available for public information at Council within fourteen days of submission to these authorities.	**Section 3.5**
DA 35-2-2004	Schedule 3 Condition 1	The Applicant may incorporate any plan, audit or Annual Review required by this consent with the plans, audits or Annual Review required for the Mandalong Mine or any other adjoining operation in common ownership or under common management.	Noted.
	Schedule 3 Condition 4	By the end of March each year, or other timing as may be agreed by the Secretary, the Applicant must submit a report to the Department reviewing the environmental performance of the development, to the satisfaction of the Secretary. This review must:	
		a) provide monthly records of the amount of coal transported on the MCDS;	**Table 4-1**

Approval	Condition No	Requirement	Where addressed in Annual Review
		b) include a comprehensive review of the groundwater monitoring results of the development over the previous calendar year, which includes a comparison of these results against the: • relevant statutory requirements, limits or performance measures/criteria; • requirements of any plan or program required under this consent; • monitoring results of years prior; and • relevant predictions in the documents listed in condition 2(a) of Schedule 2;	**Section 7.4**
		c) evaluate and report on the compliance with the performance measures, criteria and operating conditions in this consent;	**Section 6, Section 7, & Section 9.3.**
		d) detail any non-compliance over the past calendar year, and describe what actions were (or are being) taken to rectify the non-compliance and avoid reoccurrence;	**Table 1-1**, **Table 1-2,** & **Table 11-1**.
		e) identify any trends in the monitoring data over the life of the development;	**Section 6, Section 7, & Section 9.3.**
		f) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies;	**Section 6, Section 7, & Section 9.3.**
		g) describe the measures to be implemented over the current calendar year to improve the environmental performance of the development; and	**Section 12**
		h) be prepared in accordance with the Department's *Annual Review Guideline (2015)*.	Noted.

The 2018 Annual Review (Centennial Mandalong, 2019) was provided to DPIE, DRG, LMCC, Central Coast Council, DPI-Water, EPA, OEH and the Mandalong Mine CCC consistent with DA97/800 condition 107.

As required by DA97/800 consent condition 105(v) a listing of any variations to approvals during the reporting period are provided in **Section 3.1**. DA97/800 Consent Condition 24 requires a Land Access, Management and Compensation Security in the form of a Bank Guarantee and that evidence of the Guarantee shall be provided in the Annual Review. A copy of the current Bank Guarantee is included in **Appendix 1**.

4 OPERATIONS SUMMARY

Table 4-1: Production Summary & Forecast

Material	Approved Limit (and source)	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Next Reporting Period (Forecast)
Waste Rock/ Overburden	N/A			
ROM Coal	6.5 MTPA	5,245,292	3,856,216	4,682,444
Coarse reject	N/A			
Fine reject (Tailings)	N/A			
Saleable product	6.5 MTPA	5,217,175	3,821,375	4,645,700

4.1 OTHER OPERATIONS

Table 4-2: Operations Summary

	Approved Limit	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Comment
Hours of operation	24/7	24/7	24/7	
Transport (rail)	N/A			
Product to Vales Point PS	4 MTPA	1,311,749	785,290	
Mandalong to Cooranbong	6 MTPA	3,933,543	3,070,926	
Product to Eraring PS	6 MTPA	2,580,681	1,788,049	
Cooranbong to Newstan for Washing	6 MTPA	1,354,495	1,422,604	

Table 4-3: Mandalong Coal Delivery System (Delta Entry Site) Monthly Tonnages

Month	Product to Vales Point PS (4 Mtpa limit)
January 2019	12,768
February 2019	24,192
March 2019	40,888
April 2019	83,273
May 2019	34,665
June 2019	90,319
July 2019	175,422
August 2019	76,861
September 2019	26,026
October 2019	115,361
November 2019	72,611
December 2019	32,904
Total 2019 CY	785,290

4.2 EXPLORATION

Centennial Mandalong drilled four exploration boreholes in 2019. The boreholes were primarily targeting further delineation of the extent of the igneous sill to the west of the proposed longwall panels.

All boreholes sites have been rehabilitated. Applications for additional boreholes will be ongoing as potential sites are identified.

5 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

DPIE in their letter dated 3 October 2019 found that the 2018 Annual Review was acceptable for the reporting period. DPIE noted several issues which were required to be addressed as detailed in **Table 5-1**.

Table 5-1: Actions from Previous Annual Review

Action Required	Requested By	Action Taken	Where addressed in Annual Review
Monitoring data - please present the reporting period's monitoring data in a form (table or graph) that provides the criteria and results in the body of the AR;	DPIE	Data and limit criteria provided in graphs and tables where applicable.	**Section 6, Section 7**
Electronic submission of the report is preferred, please submit to compliance@planning.nsw.gov.au	DPIE	Complete – 2019 Annual Review submitted electronically to DPIE.	N/A
Department notes dust monitoring location DG14 exceeded the impact criteria set out in Table 3 of Schedule 3, Condition 8 of SSD-5144, due to the continued influence of bird life attempting to nest in the dust gauge. Continued exceedances at this location will require relocation of the gauge to better assess compliance with the criteria. Please review the location of DG14 during the 2019 reporting period.	DPIE	Protection measures implemented for DG14 including fencing. A review of dust gauge results indicates that protective measures have been effective.	**Section 6.3.4**

5.1 MINE WATER REDUCTION TARGETS

DA97/800 Condition 66 requires the mine to investigate opportunities to reduce mine water discharge at Mandalong and report on such in the Annual Review. The water balance model (GHD, 2020a) estimated 629 ML of water from the underground mine and surface water was discharged via LDP001 in 2019 which is less than the water volume discharged in 2018 (748 ML).

Investigations into reducing the mine water discharge by recycling underground mine water were undertaken in 2009 and 2010. These included a water treatment options study and engineering design and feasibility assessments. The preferred option, recycling the underground mine water by treatment in a Reverse Osmosis (RO) plant, was assessed as not feasible for the Mine. The feasibility of the RO plant was limited due to the inability to discharge waste brine generated by the RO plant to receiving waters. Disposal methods, other than the discharge of waste brine, were cost prohibitive and not feasible at this stage. In addition the RO treatment plant was not capable of supplying mining equipment with potable water for 100% of the time as required by operations, due to equipment malfunction and routine maintenance requirements. Given the currently limited options for waste brine

disposal and RO treatment plant availability the investigations conclude recycling of underground mine water by an RO treatment, does not at this time, provide a feasible business option to reduce mine water discharges from the Mine.

5.2 WASTE MANAGEMENT

All opportunities for waste avoidance and minimisation are considered by all staff and contractors across all areas including; contracts, purchasing, equipment procurement and waste generation processes.

Waste oil and greases are stored in tanks and drums within bunded areas for removal by a licenced waste management contractor for recycling or disposal. Oil water separation is achieved by the use of hydro-cyclone oil water separators at Mandalong and at the Cooranbong Entry Site on flows from vehicle work and storage areas and the wash down bays.

Hydrocarbon spill kits are inspected weekly by a licenced waste management contractor and re-stocked as required. Oily rag bins and oil filter bins are also serviced on a weekly basis.

Office paper and cardboard is collected and recycled by a licenced waste management contractor on a weekly basis. Metals are collected and stored in steel bins at Mandalong and the Cooranbong Entry Site. In 2019, a total of 338.14 tonnes of scrap steel was recycled. This is a decrease compared to 2018 during which a total of 354.66 tonnes of scrap steel was recycled.

General refuse and non-recyclable materials are sorted and stored in 30m^3 steel bins at Mandalong and the Cooranbong Entry Site. The material was collected by a licenced waste management contractor for disposal. In 2019, 773.6 tonnes of refuse material was taken off-site for disposal which is an increase compared with 640.92 tonnes of refuse material in 2018.

Of the total waste collected at Mandalong in 2019, 87.75% was recycled including steel, timber, liquid waste, oils, paper and cardboard, filters grease, oily rags and oil filters. This compares with a recycling result of 65.7% in 2018.

6 ENVIRONMENTAL PERFORMANCE

Condition 12 of Schedule 6 of SSD-5144, Condition 11 of Schedule 5 of SSD-5145, Condition 4 of Schedule 3 of DA35-2-2004 and Condition 105(iii) of DA97/800 require the presentation and discussion on all monitoring required under the Development Consents and other approvals. **Table 6-1** includes a summary of the monitoring required by the Development Consents, current status and report section in the Annual Review

Table 6-1: Summary of Monitoring Requirements

Monitoring Type	Status	Report Section
Noise Monitoring	Annual survey	**Section 6.1**
Blast Monitoring	As required	**Section 6.2**
Air Quality Monitoring	Ongoing	**Section 6.3**
Independent Noise and Dust Monitoring	Not Requested	**N/A**
Greenhouse Gas reporting and abatement measures	Ongoing	**Section 6.3.10**
Biodiversity Monitoring	Ongoing	**Section 6.4**
Cultural Heritage Monitoring	Ongoing	**Section 6.5**
Meteorological Monitoring	Ongoing	**Section 6.6**
Surface Water Monitoring	Ongoing	**Section 7.2**
Groundwater Monitoring	Ongoing	**Section 7.4**
Rehabilitation Monitoring	Ongoing	**Section 8**

6.1 NOISE MONITORING

Annual noise monitoring was conducted to assess operational noise levels compared to the noise limits specified by SSD-5144, SSD-5145 and EPL 365 in accordance with the requirements of the Northern Region Noise Management Plan. The Mandalong Mine Noise Monitoring Program requires Centennial Mandalong to survey noise from the operation annually at the Mandalong Mine and the Cooranbong Entry Site (shown in **Figure 6-1** and **Figure 6-2),** and quarterly at the Mandalong South Surface Site (**Figure 6-3**).

Figure 6-1: Mandalong Mine Noise Monitoring Locations

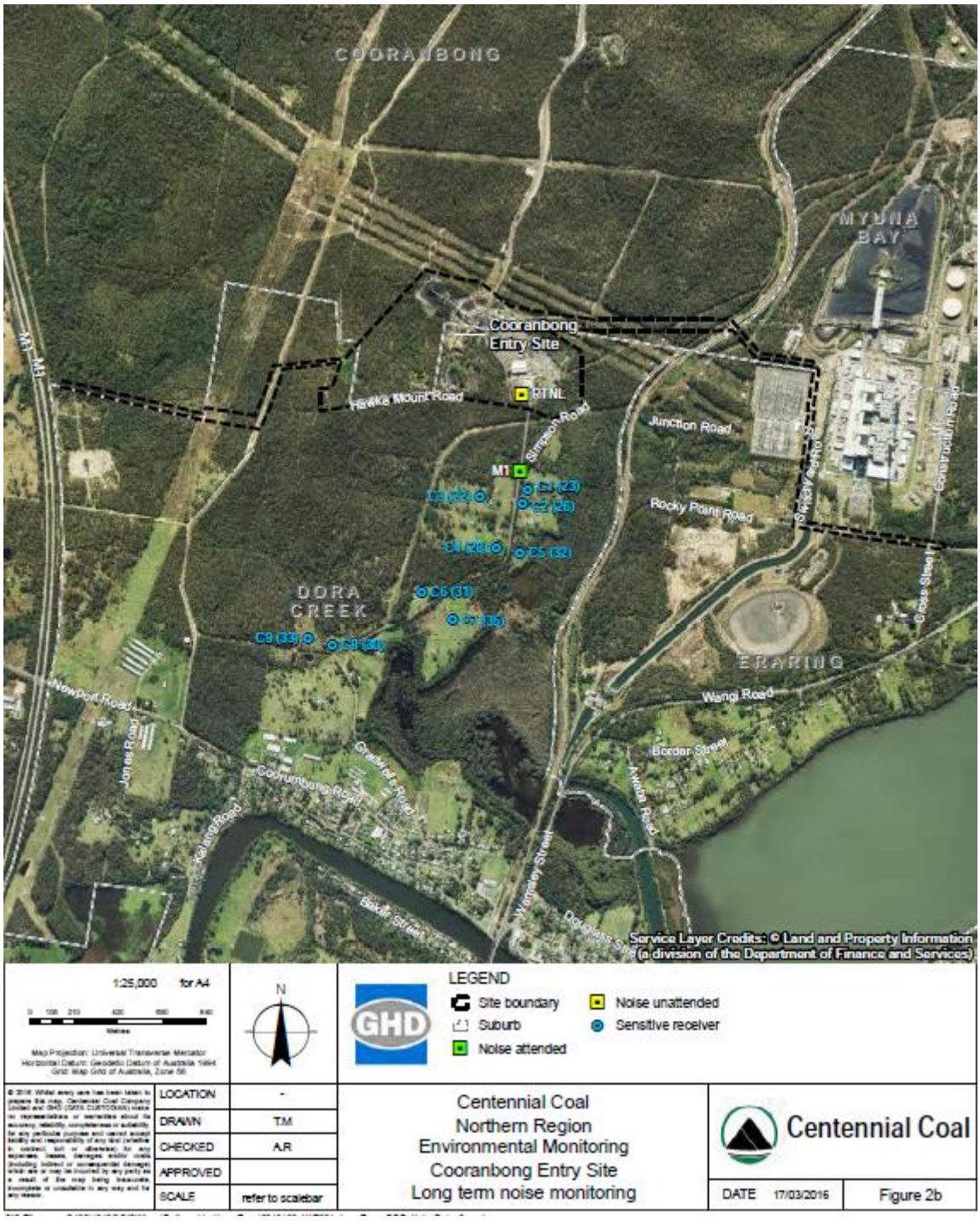


Figure 6-2: Cooranbong Entry Site Noise Monitoring Locations

The annual operator attended noise surveys were conducted from 26 July to 7 August 2019 at each of the 6 locations on three consecutive days for a minimum of 1.5 hours during the day, 30 minutes during the evening and 1 hour during the night, to determine the character and relative contribution of ambient noise sources and mine contributions.

Measurements were conducted during typical worst case operational conditions for both Mandalong and Cooranbong Entry Sites in order to capture associated typical worst case noise emission levels.

Noise monitoring during the construction of the Mandalong South Surface Site (MSSS) commenced in March 2017 on a quarterly basis in accordance with the Northern Region Noise Management Plan.

The Mandalong Southern Extension Project Environmental Impact Statement (SLR, 2013) described the results of operational noise modelling for the Mandalong Mine Access Site and indicated that the relevant intrusive and amenity noise criteria will be achieved at all the nearest sensitive receivers. The noise impact assessment completed as part of the Northern Coal Logistics Project Environmental Impact Statement (SLR, 2014) predicted that operational noise levels at the Cooranbong Entry Site will meet the project-specific noise criteria at all nominated residential locations.

6.1.1 Summary of Noise Monitoring Results

Annual Survey

GHD was engaged by Centennial Mandalong to conduct an annual noise compliance assessment for the Mandalong Mine and Cooranbong Entry Site in accordance with the Northern Region Noise Management Plan.

Operator attended noise measurements were conducted on Friday 26 July 2019, Saturday 27 July 2019, Sunday 28 July 2019, Monday 5 August 2019, Tuesday 6 August 2019 and Wednesday 7 August 2019 at the 6 focus locations surrounding the operations locations during the day, evening and night-time periods.

The operator attended operational noise monitoring showed that the noise contributions from the Mandalong Mine and Cooranbong Entry Site comply with the EPL 365, Development Consent SSD-5144 and SSD-5145 noise criteria at all monitoring locations and during all time periods. Noise levels measured at location M1 during the night-time period were greater than the SSD-5145 and EPL 365 criteria on 28 July 2019. However the measurements occurred during stability Category G weather conditions. As specified in condition L5.3 of EPL 365, the noise limits do not apply under these meteorological conditions.

The operator attended sleep disturbance noise monitoring results showed that the noise contributions from Mandalong Mine and Cooranbong Entry Site comply with the EPL 365, Development Consent SSD-5144 and SSD-5145 relevant sleep disturbance noise criteria at all monitoring locations. An exceedance of EPL 365 and SSD-5145 noise criteria was measured at location M1 and was primarily due to onsite impacts noises and alarms. However the measurements occurred during stability Category G weather conditions. As specified in condition L5.3 of EPL 365, the noise limits do not apply under these meteorological conditions.

Additional Survey

Following the July 2019 monitoring, further additional noise monitoring was recommended by GHD to be undertaken under normal meteorological conditions at M1 during the night time period. Monitoring was undertaken for 1 hour during the night-time on 27 November 2019.

The attended operational noise monitoring results showed that the noise contributions from Cooranbong Entry Site M1 monitoring location complied with the EPL 365 and SSD-5145 noise criteria during measurements 2 and 3 undertaken at the monitoring site. Noise contributions from the site during the 1st and 4th measurement exceeded both sets of noise criteria.

The exceedance that was recorded during the 1st measurement was attributed to coal loading activities based on observations made during the measurement.

Noise contributions from the site during the 4th measurement exceeded both sets of noise criteria. However the 4th measurement occurred during stability Category F weather conditions, as measured at the Mandalong AWS. As specified in condition L5.3 of EPL 365, the noise limits do not apply under these meteorological conditions.

The operator attended sleep disturbance noise monitoring results showed that the noise contributions from Cooranbong Entry Site were compliant with the EPL 365 and SSD-5145 relevant sleep disturbance noise criteria at the monitoring location during 3 of the 4

measurements undertaken at the monitoring site. The exceedance that was recorded during the first measurement was due to impact noises associated with coal loading activities.

Monitoring reports completed by GHD for the annual noise monitoring and the additional noise monitoring are included in **Appendix 5**.

6.1.1.1 Mandalong South Surface Site

GHD was engaged by Centennial Mandalong to conduct quarterly noise compliance assessments for the construction activities which commenced in February 2017 at the Mandalong South Surface Site in accordance with the Northern Region Noise Management Plan. The Noise Management Plan – Northern Region (May 2018) specifies the project-specific noise goals for construction activity (excluding shaft sinking). They have been established with reference to the Interim Construction Noise Guideline (ICNG) (DECC, 2009). The noise monitoring network locations at the Mandalong South Surface Site are shown in **Figure 6-3**.

Operator attended noise measurements were conducted on Saturday 2 and Tuesday 26 March 2019, Friday 31 May 2019, Monday 23 September 2019 and Thursday 12 December 2019. The noise assessment consisted of attended monitoring to quantify construction noise levels at three noise sensitive receivers (R12, R16 and R20) near the Mandalong South Surface Site.

The results of the 2019 quarterly noise surveys indicate that construction noise levels were below the relevant construction criteria at the closest residential receivers and therefore additional noise mitigation was not required.

The quarterly noise monitoring of the MSSS construction will continue in 2020. The development consent SSD-5144 specifies noise limit criteria for operational noise generated by the development including maintenance activities, shaft construction and exploration drilling. Shaft construction at the MSSS had begun in early 2019 and will continue into 2020.

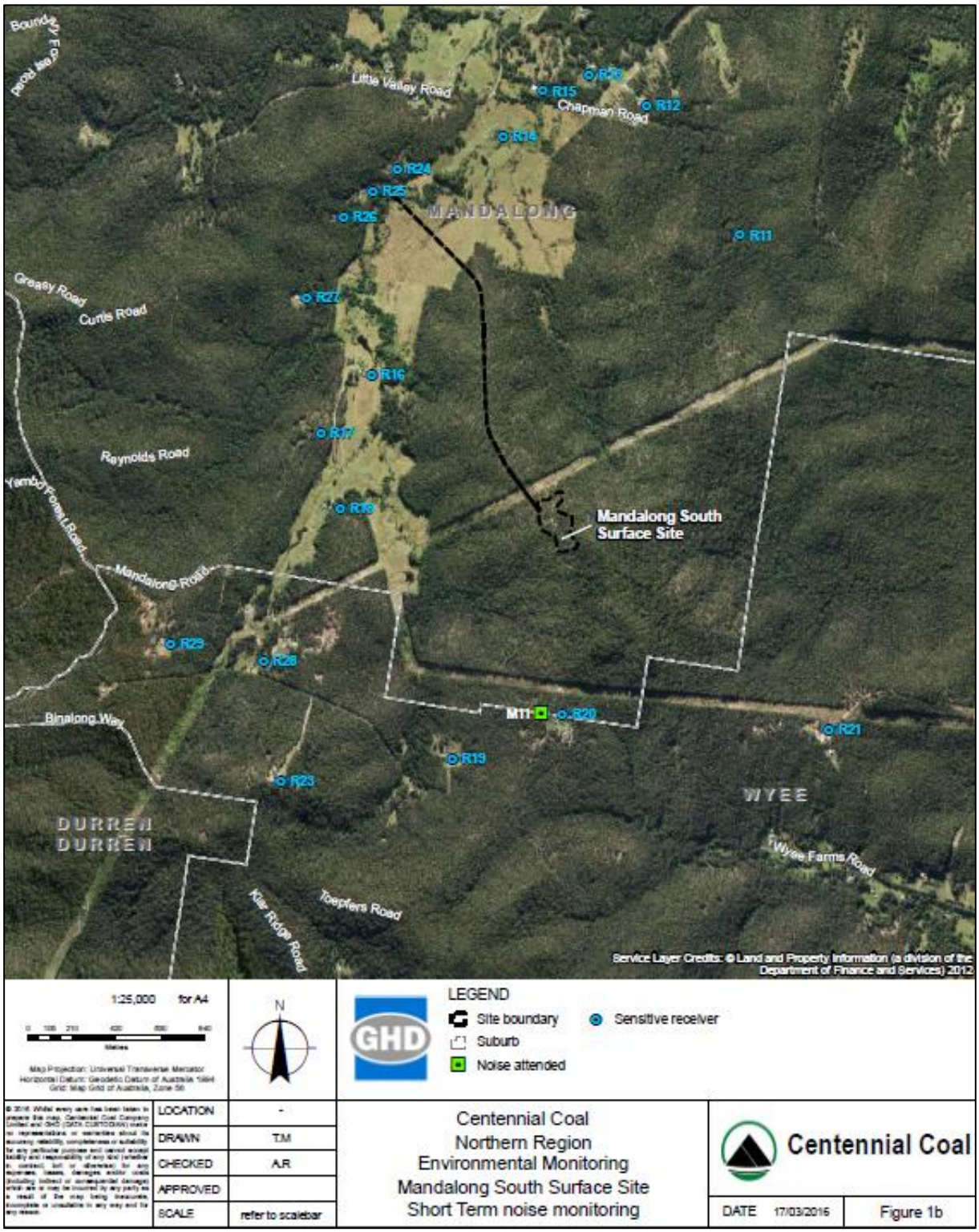


Figure 6-3: MSSS Noise Monitoring Locations

6.2 BLAST MONITORING

Mandalong

There was no blasting carried out at the Mandalong Mine in 2019.

Delta and Cooranbong Entry Sites

There was no blasting carried out at the Delta and Cooranbong Entry sites during 2019.

6.3 AIR QUALITY MONITORING

SSD-5144 Schedule 3 Condition 8 and Consent SSD-5145 Schedule 3 Condition 7 provide criteria for dust deposition cumulative impact and incremental impact. The cumulative impact is the increase in concentrations due to the development plus background concentrations. The cumulative impact is recorded as an annual monthly average and must not exceed 4g/m^2/month. The incremental impact is the increase in concentrations due to the development alone. The incremental impact calculation is the monthly average minus the pre construction average (PCA) recorded as an annual monthly average and must not exceed 2g/m^2/month.

The location description for each depositional dust gauge is provided in **Table 6-2**.

Table 6-2: Description of Depositional Dust Gauges

Dust Gauge No.	Locality
D4	41 Gradwells Road Dora Creek (near Cooranbong Entry Site)
D6	Mandalong Mine Site Eastern Boundary (Near Sediment Basin)
D8	West of main front entrance (Mandalong Site)
D9	184 Mandalong Road
D10	202 Mandalong Road West of Mandalong Mine
D12	Mandalong South Surface Site
D14	North of Mandalong South entrance road (near wetland)

6.3.1 Mandalong

Depositional dust monitoring results are shown in **Table 6-3**. The results are presented as:

- Long-term average (all data since the commencement of monitoring at its present location - Sept 1999 to present);
- Annual Average during the report period (January 2019 to December 2019); and
- Pre-construction average (September 1999 to August 2000).

Table 6-3: Summary of depositional dust results between January 2019 and December 2019 surrounding Mandalong Mine.

	Insoluble Solids (Combustible Matter + Ash) g/m^2/month			
	DG6	**DG8**	**DG9**	**DG10**
Long Term Average	1.3	0.8	1.1	1.6
Annual Average (2019 Reporting Period)	2.0	1.0	1.3	2.0
Pre-Construction Average	0.8	0.8	0.9	*
Limit Criteria	4.0	4.0	4.0	4.0

* Not available. Dust gauges installed after commencing construction.

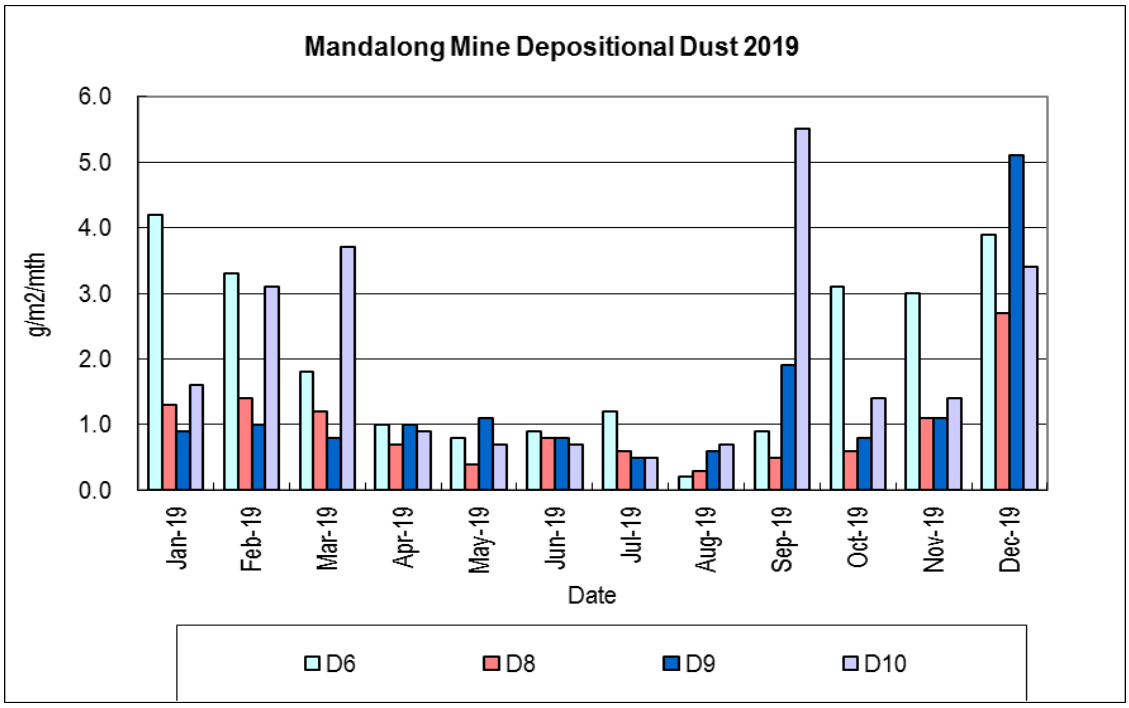


Figure 6-4: Monthly Depositional Dust Results 2019 Mandalong Mine

The cumulative impact result is shown in **Table 6-4** and **Table 6-5** as an annual average. All dust gauges were compliant with the condition for the report period. The maximum cumulative impact was 2.4 recorded at DG10.

The incremental impact result is shown in **Table 6-4** as the change from PCA. All dust gauges were compliant with the condition for the report period. The maximum incremental impact for DG6 is 1.2, DG8 is 0.2 and DG9 is 0.4.

Table 6-4: Detailed Dust Monitoring and Analysis showing the Annual Rolling Average and Change in Deposition from the Pre-construction Average (PCA) for Dust Gauges DG6, DG8 and DG9.

	DG6			DG8			DG9		
Date	Monitored Dust	Annual Average	Change from PCA	Monitored Dust	Annual Average	Change from PCA	Monitored Dust	Annual Average	Change from PCA
18/01/2019	4.2	1.7	0.9	1.3	0.7	-0.1	0.9	1.0	0.1
18/02/2019	3.3	1.9	1.1	1.4	0.8	0.0	1	1.1	0.2
20/03/2019	1.8	1.9	1.1	1.2	0.8	0.0	0.8	0.8	-0.1
17/04/2019	1	1.8	1.0	0.7	0.8	0.0	1	0.7	-0.2
17/05/2019	0.8	1.8	1.0	0.4	0.8	0.0	1.1	0.7	-0.2
17/06/2019	0.9	1.8	1.0	0.8	0.9	0.1	0.8	0.8	-0.1
19/07/2019	1.2	1.8	1.0	0.6	0.9	0.1	0.5	0.8	-0.1
19/08/2019	0.2	1.7	0.9	0.3	0.9	0.1	0.6	0.8	-0.1
18/09/2019	0.9	1.6	0.8	0.5	0.8	0.0	1.9	0.9	0.0
18/10/2019	3.1	1.8	1.0	0.6	0.8	0.0	0.8	0.9	0.0
18/11/2019	3	1.9	1.1	1.1	0.9	0.0	1.1	1.0	0.1
18/12/2019	3.9	2.0	1.2	2.7	1.0	0.2	5.1	1.3	0.4

Table 6-5 Detailed Dust Monitoring and Analysis showing the Annual Rolling Average for Dust Gauge 10

	DG10		
Date	**Monitored Dust**	**Annual Average**	**Change from PCA**
18/01/2019	1.6	2.2	n/a
18/02/2019	3.1	2.4	
20/03/2019	3.7	2.0	
17/04/2019	0.9	2.0	
17/05/2019	0.7	1.9	
17/06/2019	0.7	1.8	
19/07/2019	0.5	1.9	
19/08/2019	0.7	1.8	
18/09/2019	5.5	2.1	
18/10/2019	1.4	2.2	
18/11/2019	1.4	1.8	
18/12/2019	3.4	2.0	

6.3.2 Delta Entry Site

Three dust deposition gauges were installed at the Delta Entry Site in July 2004. These gauges were positioned to monitor depositional dust around the Delta Entry Site as per the conditions of EPL365.

The depositional dust gauges at the Delta Entry Site were removed from EPL365 in October 2018. The depositional dust gauges at the Delta Entry site were removed from the monitoring program in December 2018.

6.3.3 Cooranbong Entry Site

The Cooranbong Colliery Life Extension Project EIS predicted that dust emissions from the operational phase of the Cooranbong Preparation Plant were unlikely to cause a dust nuisance due to the distance to sensitive receptors (Umwelt, 1997). The Cooranbong Distribution Project EA (GSS Environmental, 2012) and the Northern Coal Logistics Project EIS (March 2014) modelling predictions for dust deposition also show that incremental and cumulative annual average dust deposition rates are predicted to be well below the impact criteria of 2g/m^2/month and 4g/m^2/month (assuming a background rate of 1.2 g/m^2/month) at the nearest surrounding residences.

Annual average depositional dust results for 2019 and the LTA are provided in **Table 6-6 and Table 6-7.** The complete monthly dust monitoring data is provided in **Figure 6-5**

The cumulative impact result for DG4 is shown in **Table 6-7** as Annual Average. DG4 was compliant with the condition for the report period. The maximum cumulative impact was 2.1.

The incremental impact result for DG4 is shown in **Table 6-7** as the change from PCA. DG4 was compliant with the condition for the reporting period. The maximum incremental impact for DG4 is 0.9.

Table 6-6: Summary of Depositional Dust Results between January 2019 and December 2019 surrounding the Cooranbong Entry Site.

	Insoluble Solids (Combustible Matter + Ash) g/m^2/month
	DG4
Long Term Average	1.3
Average 2019 (Reporting Period)	1.7
Limit criteria (annual average)	4.0

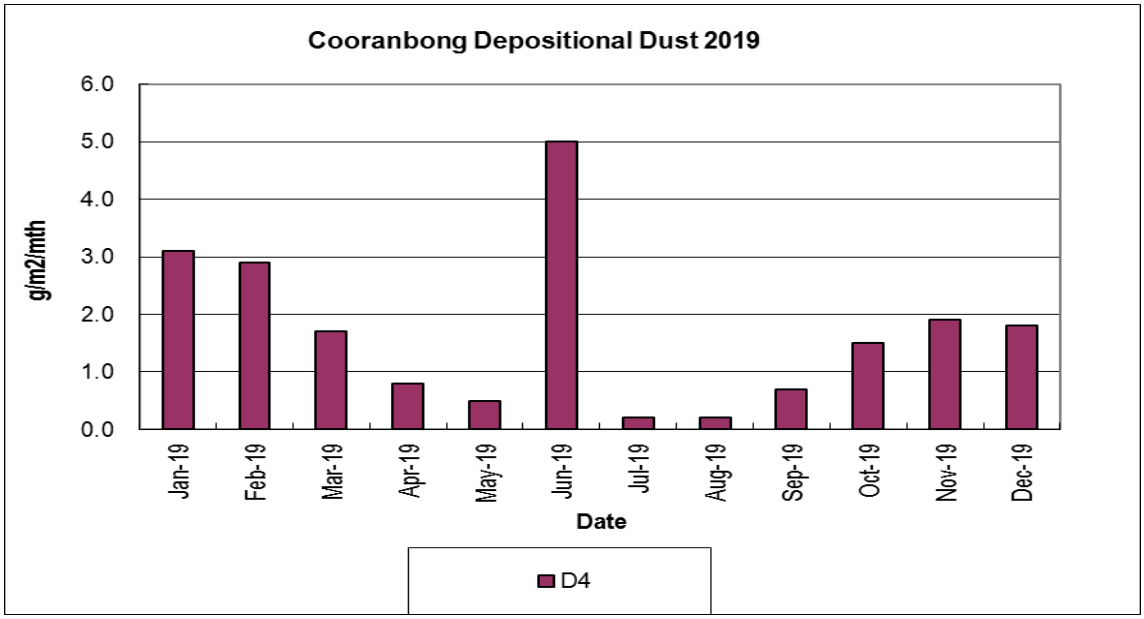


Figure 6-5 Monthly Depositional Results 2019 CES

Table 6-7 Detailed Dust Monitoring and Analysis showing the Annual Rolling Average and Change in Deposition from the Pre-construction Average (PCA) for Dust Gauge 4

	DG4		
Date	Monitored Dust	Annual Average	Change from PCA
18/01/2019	3.1	1.8	0.6
18/02/2019	2.9	2.0	0.8
20/03/2019	1.7	2.1	0.9
17/04/2019	0.8	1.7	0.5
17/05/2019	0.5	1.7	0.5
17/06/2019	5	2.1	0.9
19/07/2019	0.2	2.1	0.9
19/08/2019	0.2	2.1	0.9
18/09/2019	0.7	1.8	0.6
18/10/2019	1.5	1.8	0.6
18/11/2019	1.9	1.9	0.7
18/12/2019	1.8	1.7	0.5

6.3.4 Mandalong South Surface Site

Depositional dust gauges were installed at the Mandalong South Services Site in June 2014 for the purpose of pre-construction air quality monitoring. Construction of the Mandalong South Surface Site access road commenced in February 2017 and construction of the Surface Site commenced in July 2017. The monthly dust deposition results for DG12 and DG14 are provided in **Figure 6-6**. Annual average depositional dust results for 2019 and the consent criteria are provided in **Table 6-8**, **Table 6-9** and **Figure 6-7.**

Contaminants such as bird droppings, insects and plant material have been consistently identified in DG14 samples. The sample collected in March 2018 contained 70% organic material, April 2018, 97% organic material and May 2018, 90% organic material. Centennial Mandalong reported in November 2018 that a bird was building a nest in DG14. In order to prevent the ongoing contamination of DG14 cable ties were attached to the dust gauge to prevent birds from perching on the gauge. Following the disappearance of the cable ties and the unusually high results for DG14 a surveillance camera was installed next to DG14.

The Reconyx, Hyperfire 2 Covert, surveillance camera was installed on 14 March 2019 adjacent to DG14. The surveillance camera captured an image on 16 March 2019 of a cow with its nose on the gauge. The gauge has been raised higher and fenced to prevent cattle from interfering with the gauge. There are a number of cattle in the paddock where DG14 is located. The cable ties were re-attached to the dust gauge to prevent interference from birds.

There have not been any further contamination issues with DG14 since May 2019. The maximum recording since the protective measures were installed is 2.9g/m^2/month and an average of 1.4g/m^2/month.

Table 6-8: Summary of Depositional Dust Results between January 2019 and December 2019 surrounding the Mandalong South Surface Site.

	Insoluble Solids (Combustible Matter + Ash) g/m^2/month	
	DG12	**DG14**
Long Term Average	0.8	2.1
Average 2019 (Reporting Period)	1.1	1.4
Limit Criteria	4.0	4.0

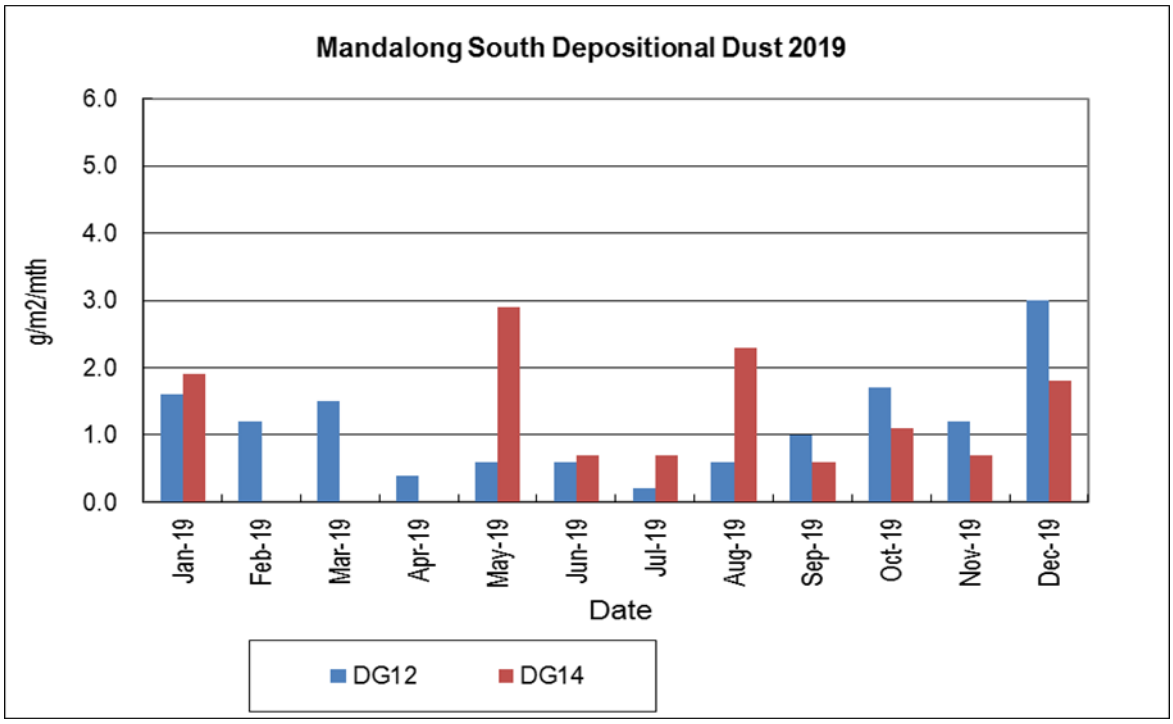


Figure 6-6 Monthly Dust Depositional Results 2019 MSSS

The cumulative impact result is shown in **Table 6-9** as an annual average. The dust gauges were compliant with the condition for the reporting period. The maximum cumulative impact at DG12 was 1.5 and DG14 was 2.9.

The incremental impact result is shown in **Table 6-9** as the change from PCA. The dust gauges were compliant with the condition for the reporting period. The maximum incremental impact for DG12 is 1.0 and DG14 is 1.3.

Table 6-9 Detailed Dust Monitoring and Analysis showing the Annual Rolling Average and Change in Deposition from the Pre-construction Average (PCA) for Dust Gauge DG12 and DG14

	DG12			DG14		
Date	Monitored Dust	Annual Average	Change from PCA	Monitored Dust	Annual Average	Change from PCA
18/01/2019	1.6	1.4	0.9	1.9	0.3	-1.3
18/02/2019	1.2	1.4	0.9			-1.6
20/03/2019	1.5	1.5	1.0			-1.6
17/04/2019	0.4	1.4	0.9			-1.6
17/05/2019	0.6	1.3	0.8	2.9	2.9	1.3
17/06/2019	0.6	1.3	0.8	0.7	1.8	0.2
19/07/2019	0.2	1.3	0.8	0.7	1.4	-0.2
19/08/2019	0.6	1.2	0.7	2.3	1.7	0.0
18/09/2019	1.0	1.1	0.6	0.6	1.4	-0.2
18/10/2019	1.7	1.1	0.6	1.1	1.4	-0.2
18/11/2019	1.2	1.1	0.6	0.7	1.3	-0.3
18/12/2019	3.0	1.1	0.6	1.8	1.4	-0.3

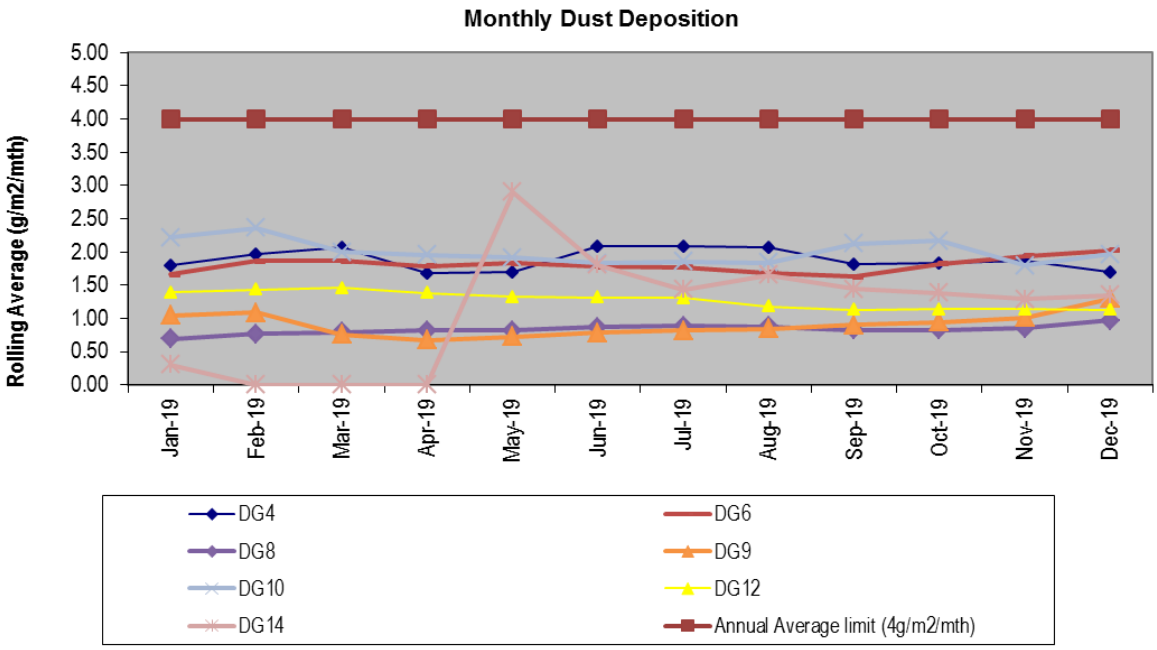


Figure 6-7 Dust Deposition Rolling Annual Average and Limit Criteria

6.3.5 Air Quality Monitoring Data Interpretation

6.3.5.1 Mandalong Mine

All dust gauges recorded results well below the dust deposition consent limit criteria of 4 g/m^2/month for cumulative impacts and 2g/m^2/month for incremental impacts. Dust levels at DG 8 & 9 show minor or no variation to the pre construction average, confirming that the activities had minimal impact on surrounding air quality in 2019 as predicted in the Mandalong Southern Extension Project EIS (SLR, 2013).

The annual average for each dust gauge is above the long term average. The greatest difference in averages was at DG6 which has a long term average of 1.3g/m^2/month and recorded an annual average of 2g/m^2/month.

The increase in the averages for the report year could be attributed to the poor air quality caused by the large scale local and regional bushfire events.

6.3.5.2 Cooranbong Entry Site

DG4 recorded results well below the dust deposition Consent limit criteria of 4 g/m^2/month for cumulative impacts and 2g/m^2/month for incremental impacts.

Average annual depositional dust results for DG4 are on average 0.7g/m^2/month above pre construction average. Dust deposition levels at DG4 located at the nearest sensitive receivers and on the operational boundary at Cooranbong show a small increase on the pre construction average, confirming that the Cooranbong operation had minimal impact on surrounding air quality in 2019 as predicted in the Cooranbong Colliery Life Extension Project EIS (Umwelt, 1997), the Cooranbong Distribution Project EA (GSS Environmental, 2012) and the Northern Coal Logistics Project EIS (SLR, 2014).

The annual average for DG4 is above the long term average.

6.3.5.3 Mandalong South Surface Site

DG12 and DG14 recorded results well below the dust deposition consent limit criteria of 4 g/m2/month for cumulative impacts and 2g/m2/month for incremental impacts.

Dust levels at DG12 show a small increase above the pre construction average and DG14 shows minor or no variation to the pre construction average, confirming that the activities had minimal impact on surrounding air quality in 2019 as predicted in the Mandalong Southern Extension Project EIS (SLR, 2013).

DG12 recorded an annual average higher than the long term average which is consistent with all the dust gauges for the report period except DG14 and could be attributed to the large scale local and regional bushfire events.

DG14 was the only dust gauge to record an annual average lower than the long term average. DG14 was affected by contamination from birds and cattle in 2018 and early in 2019. The annual average was 33% lower than the long term average. This may be due to the installation of protection against contamination. The previous ongoing contamination may have inflated the previous results recorded at DG14.

6.3.6 Particulate Matter

Continuous dust monitoring was installed in June 2013 at the Cooranbong Entry Site to monitor total suspended particles (TSP) and particulate matter (PM10) as per the condition M2.2 of EPL365. The limit criterion for PM10 annual average concentrations was reduced to 25ug/m^3 when the Northern Coal Services consent SSD-5145 was approved 29th September 2015. The consent SSD-5145 requires that air quality impacts at the Cooranbong Entry Site do not exceed the limit criteria of:

- 90ug/m^3 annual average for TSP;
- 25ug/m^3 annual average for PM10; and
- 50ug/m^3 24 hour average for PM10.

There were no exceedances of the PM10 and TSP annual average limit criteria for the report period. The 2019 annual average for PM10 was 22.2ug/m^3. The 2019 annual average for TSP was 25.4ug/m^3.

The 24-hr average PM10 concentrations recorded twenty three exceedances of the Development Consent SSD-5145 24-hr criterion of 50µg/m3 from 26 October to 31 December 2019 monitoring period.

The Maximum PM10 concentration 154.71 µg/m^3 was recorded on 3 December 2019. The maximum TSP recording was 163.89 µg/m3 which occurred on 3 December 2019. There is no maximum 24hr concentration limit for TSP.

Centennial Mandalong operations at the Cooranbong Entry Site and the Mandalong Mine Access Site were heavily impacted by bushfire smoke and particulates during the October to December 2019 period.

The results occurred due to the poor air quality created by local and regional bushfire events over an extended period of time. The following information was obtained from NSW RFS.

On 26 October 2019 there was a local bushfire event at Martinsville ten kilometers west of the Cooranbong site. The event was reported by the Martinsville and Dora Creek RFS. NSW RFS reported that the average air quality across the Lower Hunter was recorded as very poor to hazardous based on airborne particles associated with the smoke in the days following.

Between 8–13 November 2019, the Hawkmount Road fire (including fires at Toronto, Awaba, Dora Creek, Ryhope and Freemans Waterhole) impacted the Cooranbong Entry Site. The fire burnt bushland approximately 500 metres to the north of the Cooranbong Entry Site and impacted the Centennial owned section of the Newstan to Cooranbong haul road.

Regional bushfires continued to burn throughout November 2019 at the following locations; Little L Complex, Paddock Run, Gospers Mountain, Oaky Creek, Crumps Complex, Rugby Track, Three Mile and Owendale to the west of Centennial Mandalong's operations. A total of 467,500 hectares of bushland was burnt out during this period. In late November, the Centennial operations were also impacted by bushfires at Martinsville and at Eraring.

Bushfires continued to burn throughout December 2019 at the following locations; Little L Complex, Gospers Mountain, Crumps Complex, Three Mile, Owendale and Kerry Ridge to the west of Centennial Mandalong's operations. A total of 270,561 hectares of bushland was burnt out during this period. Local bushfires were also recorded at Charmhaven and at Wangi Wangi on 31 December 2019.

The 24-hour average PM10 criterion in SSD-5145 is to be considered incrementally (that is, the individual contribution of the project) with extraordinary events excluded. Therefore, Centennial Mandalong is of the opinion that the PM10 results recorded during the October - December 2019 period do not comprise criteria exceedances.

Additional air quality mitigation measures were implemented at the Cooranbong Entry Site and the Mandalong Mine during this period. The water cannon spray system was utilised on the Cooranbong ROM stockpile, the wheel wash was in operation at the Cooranbong Entry Site and additional water spraying around both sites was implemented with the water cart.

Centennial Mandalong notified DPIE of the exceedances 4 February 2020. DPIE acknowledged on 5 February 2020 that;

"*the dates of exceedances coincide with bushfire conditions in the area. As per note 'd' of Schedule 3, Condition 8 of SSD-5144 and Schedule 3, Condition 7 of SSD-5145, bushfire smoke is considered an extraordinary event and therefore not a non-compliance."*

"*In accordance with Schedule 5, Condition 1 of SSD-5144 and Schedule 4, Condition 1 of SSD-5145, Centennial are required to notify affected landowners following an exceedance of air quality criteria. However in this instance as the results are influenced by bushfire smoke, notification is not required."*

6.3.7 Air Quality Monitoring Data Interpretation

TSP and PM10 monitoring results are shown in **Figure 6-8**, **Figure 6-9**, **Figure** 6-10 and **Figure 6-11**. The results are presented as an annual average for the reporting period (January 2019 to December 2019). The monitoring results for the TSP and PM10 annual and 24 hour average from January to September 2019 are in accordance with the predictions from the air quality impact assessment for the Cooranbong Distribution Project EA (GSS Environmental, 2012) and the predictions from the air quality impact assessment for the Northern Coal Logistics Project EIS (SLR, 2014). The PM10 annual average increased from 16.4ug/m^3 on 25 October to 22.2ug/m^3 on 31 December 2019. The results from October to December 2019 show an increase in air particulate concentrations which coincides with the local and regional bushfire events.

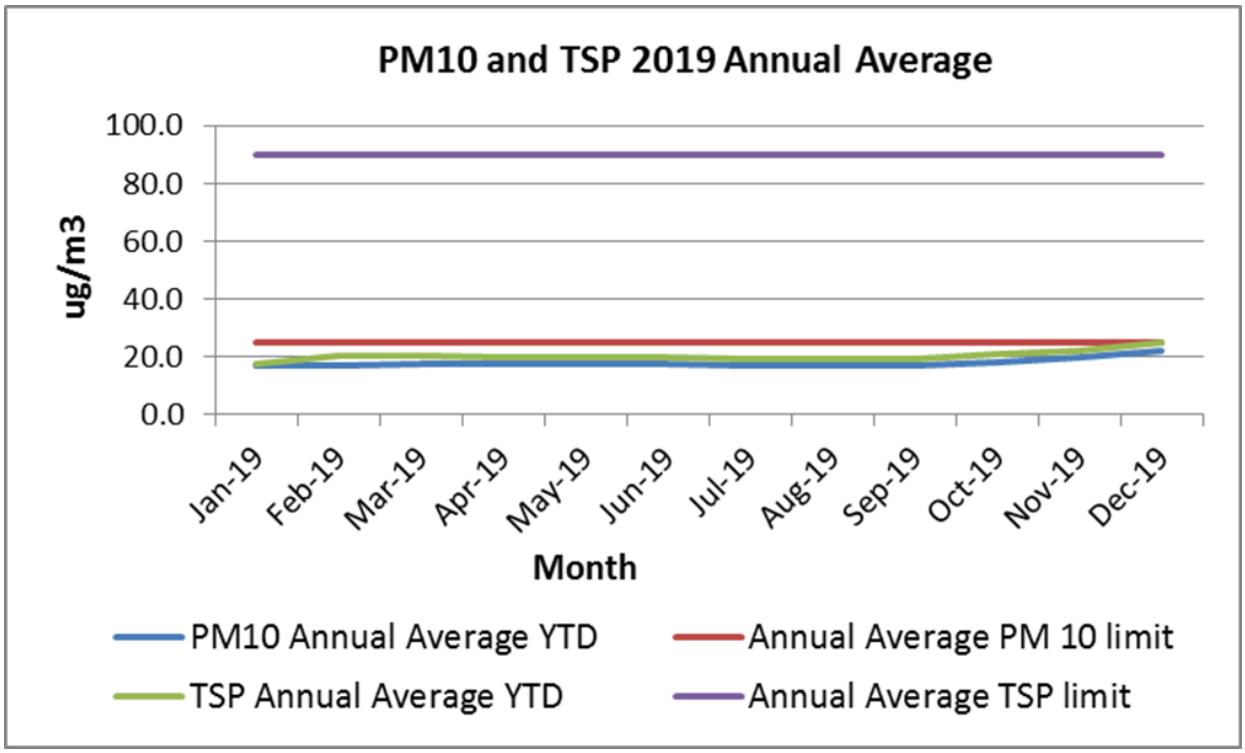


Figure 6-8: PM10 and TSP 2019 Annual Rolling Average and Limit Criteria

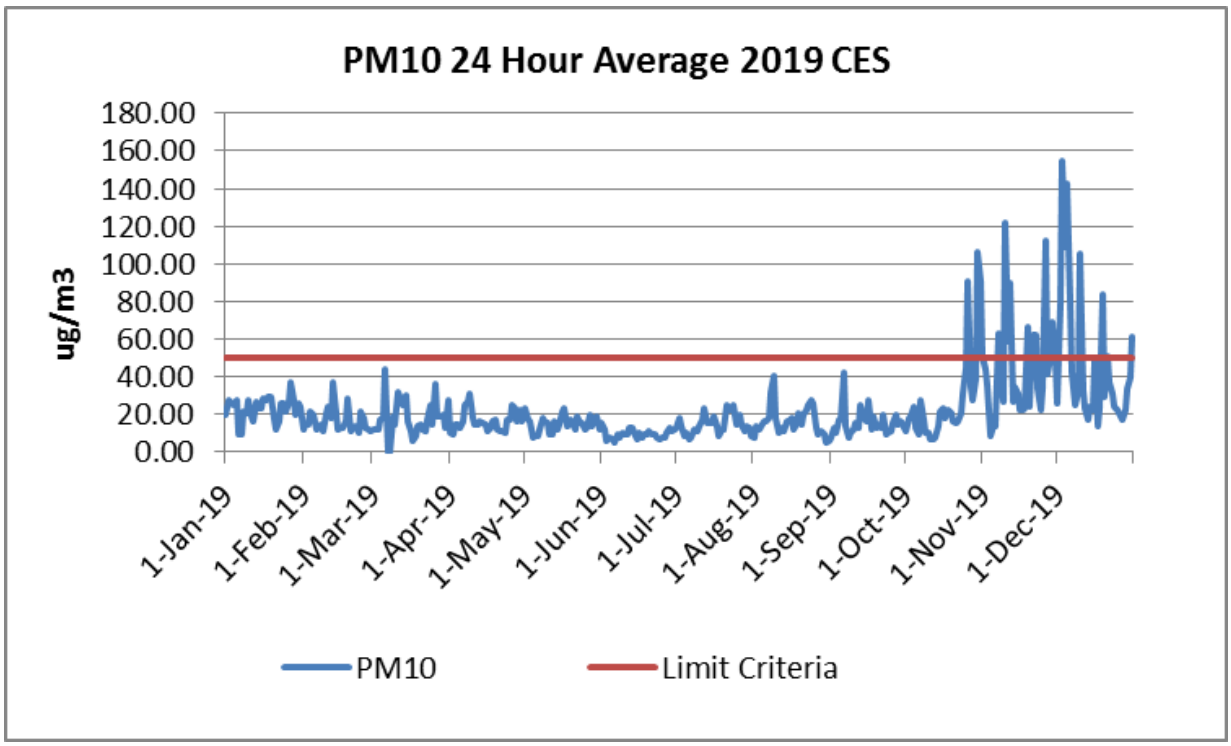


Figure 6-9: PM10 24 Hour Average 2019

6.3.8 HVAS (High Velocity Air Samplers)

PM_{10} and $PM_{2.5}$ high velocity air samplers were installed in January 2014 at Mandalong to monitor fine particles from the Mandalong Mine Access Site. The limit criterion for PM10 annual average concentrations was reduced from 30ug/m^3 to 25ug/m^3 with approval of Modification 6 of Consent SSD-5144 in April 2019. SSD-5144 requires that air quality impacts at the Mandalong Mine Access Site do not exceed the limit criteria of:

- 90ug/m^3 annual average for TSP;
- 25ug/m^3 annual average for PM10; and
- 50ug/m^3 24 hour average for PM10.

There were no exceedances of the PM10 and TSP annual average limit criteria for the report period. The 2019 annual average for PM10 was 18.5ug/m^3. The 2019 annual average for TSP was 21.06ug/m^3. The 2019 annual average for PM2.5 was 9ug/m^3.

The 24-hr average PM10 concentrations recorded five exceedances of the Development Consent SSD-5144 24-hr criterion of 50µg/m3 from 22 November to 16 December 2019 monitoring period.

The maximum PM10 concentration of 138µg/m^3, TSP concentration of 156µg/m^3 and PM2.5 concentration of 80µg/m^3 was recorded on 10 December 2019. There is no maximum 24hr concentration limit for TSP and PM2.5.

Centennial Mandalong operations at the Cooranbong Entry Site and the Mandalong Mine Access Site were heavily impacted by bushfire smoke and particulates during the October to December 2019 period.

As discussed above in **Section 6.3.6** the 24 hour average PM10 air quality exceedances coincided with an extraordinary event and therefore are not considered to be a non compliance.

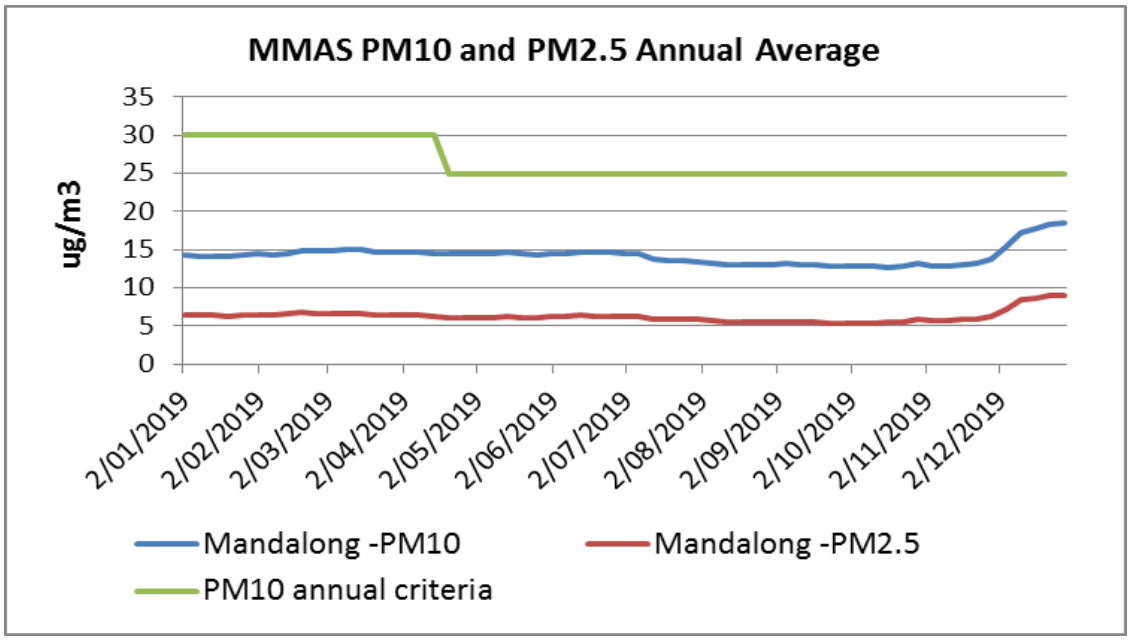


Figure 6-10: MMAS PM10 and PM2.5 Annual Average Monitoring Results and Limit Criteria

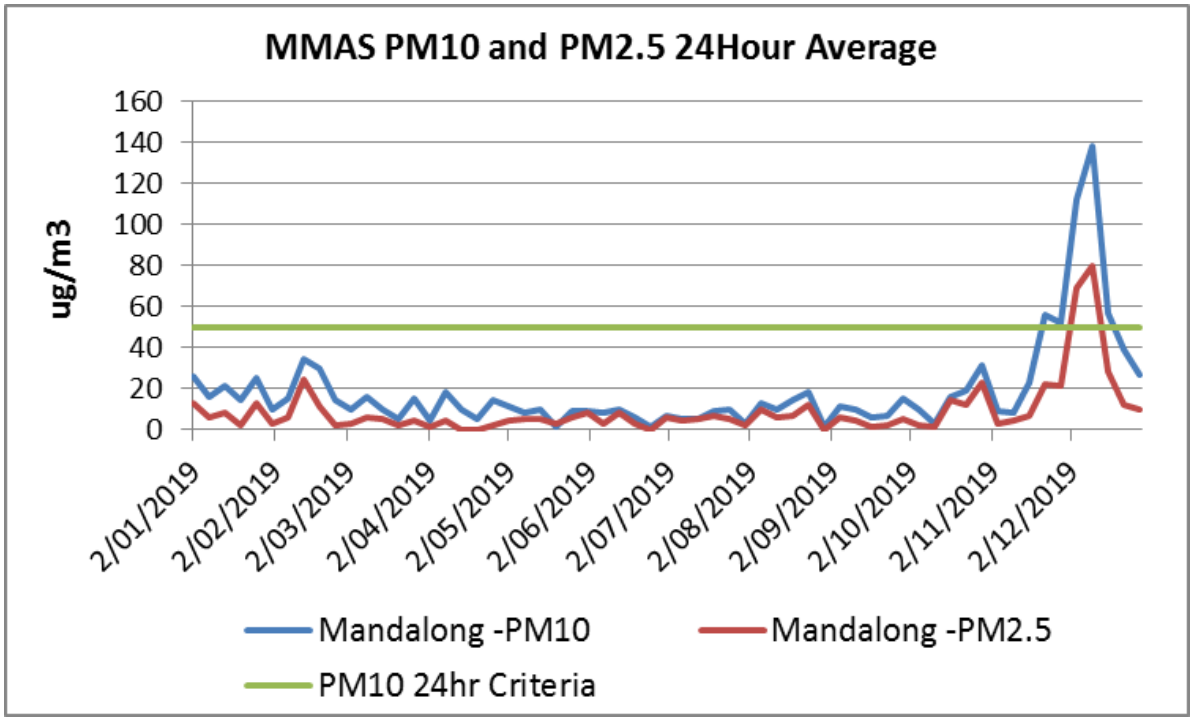


Figure 6-11: MMAS PM10 and PM2.5 24Hour Average Monitoring Results and Limit Criteria

6.3.9 Air Quality Monitoring Data Interpretation

PM10 and PM2.5 monitoring results are shown in

Figure 6-10 and **Figure 6-11**. The results are presented as an annual average for the report period (January 2019 to December 2019). The monitoring results for the TSP and PM10 annual and 24 hour average from January to September 2019 are in accordance with the predictions from the air quality impact assessment for the Mandalong Southern Extension

Project EIS (SLR, 2013). PM10 annual average increased from 12.9ug/m3 on 23 October to 18.5ug/m3 on 28 December 2019. The results from October to December 2019 show an increase in air particulate concentrations which coincides with the local and regional bushfire events.

6.3.10 Greenhouse Gas Monitoring

DA97/800 conditions 60A (i) & (iv) require Mandalong Mine to monitor greenhouse gas (GHG) emissions and report these in the Annual Review. In accordance with Centennial Coal's standard for GHG reporting the 2019 financial year (FY 1 July 2018 to 30 June 2019), emissions in CO2 equivalent tonnes (Co2-eT) as defined in the *National Greenhouse and Energy Reporting Act 2007* are provided in **Table 6-10**. Total GHG emissions for the 2019 FY period were 1,364,137 Co2-eT, which is lower than the 2018 FY emissions of 1,934,635 Co2-eT.

The majority of GHG emissions in 2019 were caused by fugitive methane contributing to 81.95% of all GHG emissions. Mandalong Mine as discussed below is currently working towards GHG reduction measures to abate fugitive methane emissions.

Table 6-10: Total GHG Emissions from Mandalong Mine in 2019 Financial Year

Emissions Summary (Co2-eT) July 2018 to June 2019	Total
Electricity	66,276
Diesel	6,005
Petroleum Based Oils and Greases (PBOG)	207
SF6	6
Fugitives - CH4	1,117,958
Fugitives - CO2	101,822
Fugitives – N_20	53
Surface Fugitive - Post Mining	71,810
TOTAL	1,364,137

6.3.11 Greenhouse Gas Abatement Investigations Measures

As reported in previous Annual Reviews, Centennial Coal has invested in technologies to reduce fugitive methane GHG emissions from the Mandalong Mine. A three stage process is planned to address this Greenhouse Abatement. Construction of Stage 1 and Stage 2 were completed in November 2013.

Stage 1 Gas Flares - A consent modification approval was obtained in 2005 to construct multiple enclosed flares planned to be used to reduce fugitive methane GHG emissions from the Mine's surface gas drainage plant. Civil works for construction of the gas flares commenced in October 2012, with final commissioning completed and automated operations commencing in November 2013. The construction of the enclosed gas flare will assist with abating drainage gas emissions of up to 1,500 litre/sec flow rate.

Stage 2 Ventilation Air Methane Regenerative After Burner (VAM RAB ®) - Approval for a modification to DA97/800 was sought in 2011, to allow for the installation and ongoing operation of a single VAM RAB® unit as a demonstration project to examine the performance capability. Approval was granted by the Planning Assessment Commission (PAC) on behalf of the Minister for the then Department of Planning and Infrastructure on 11 November 2011.

The VAM RAB® technology initially proposed for Mandalong includes installation and operation of a single VAM RAB® unit as part of a demonstration project to demonstrate capture and abatement of approximately 10 cubic metres per second (m^3/s) of the mine's total Ventilation Air Methane (VAM). The VAM is low concentration methane in the mine ventilation stream and the VAM RAB® system overcomes this technical difficulty by directing the mine ventilation air into a large oxidation vessel, oxidising the methane into carbon dioxide. This technology is based on well tested coke-oven principles, utilised in the steel industry.

Civil construction works on the surface pad for the VAM RAB® unit commenced in December 2011 and were completed in November 2013. The VAM RAB® demonstration plant has been heated up on a number of occasions during the last six months of 2014, with some minor configuration changes made in 2015 and 2016.

The VAM RAB® plant is currently impacted by technical issues. From a technical perspective, refinements are required for the VAM RAB® to reach a suitable temperature profile to allow trial abatement of methane. Over the project life, a number of test procedures have been conducted resulting in significant changes to the design and structure of the plant. These have included a rebuild of the VAM RAB® core.

The current status of the Project is that it is on hold in its commissioning phase. It has not progressed to, or completed, the formal experiment Stage 1 (6 week VAM simulation) or Stage 2 (12 months on VAM).

Stage 3 Gas Engines - In July 2009 Mandalong Mine received approval from the then DP&I to construct and operate multiple methane gas engines to generate electricity. If the generation facility is implemented, power will be supplied to the site and excess power sold to the grid. The flare units will remain available as back-up or for peak gas flows.

In 2018, Centennial Mandalong commenced planning and design works for the Gas Engines project. This project will continue to be progressed in 2020.

6.4 BIODIVERSITY MONITORING

6.4.1 LW22-24A Extraction Plan Area

The monitoring of sensitive environments subject to potential subsidence impacts is a requirement as per Schedule 4 Condition 6 of SSD-5144 and Condition 72 of DA97/800. The aim of the 2019/20 monitoring conducted by RPS was to detect any changes in sensitive ecological communities (EECs and Groundwater Dependent Ecosystems (GDEs)), which may be attributable to mining of LW22-24A (RPS, 2019a). Additionally, the program aims to evaluate the conditions of known populations of threatened flora against reference and baseline population conditions. This monitoring has also been extended to include amphibian monitoring. This was achieved by 'call playback' and 'spotlighting' techniques within suitable habitats of the impact area; during a variety of rainfall conditions. Repeated sampling will allow for the detection and quantification of change over time. The study area consists of the proposed subsidence extent of Longwalls LW22-24A covering approximately 279.90 hectares. The northern boundary of the study area extends into the Olney State Forest. The southern boundary area extends into heavily vegetated areas whilst the majority of the western and eastern boundaries are situated within rural agricultural lands with remnant patches of vegetation. The location of biometric plots with the LW22-24A area is shown in **Figure 6-13**.

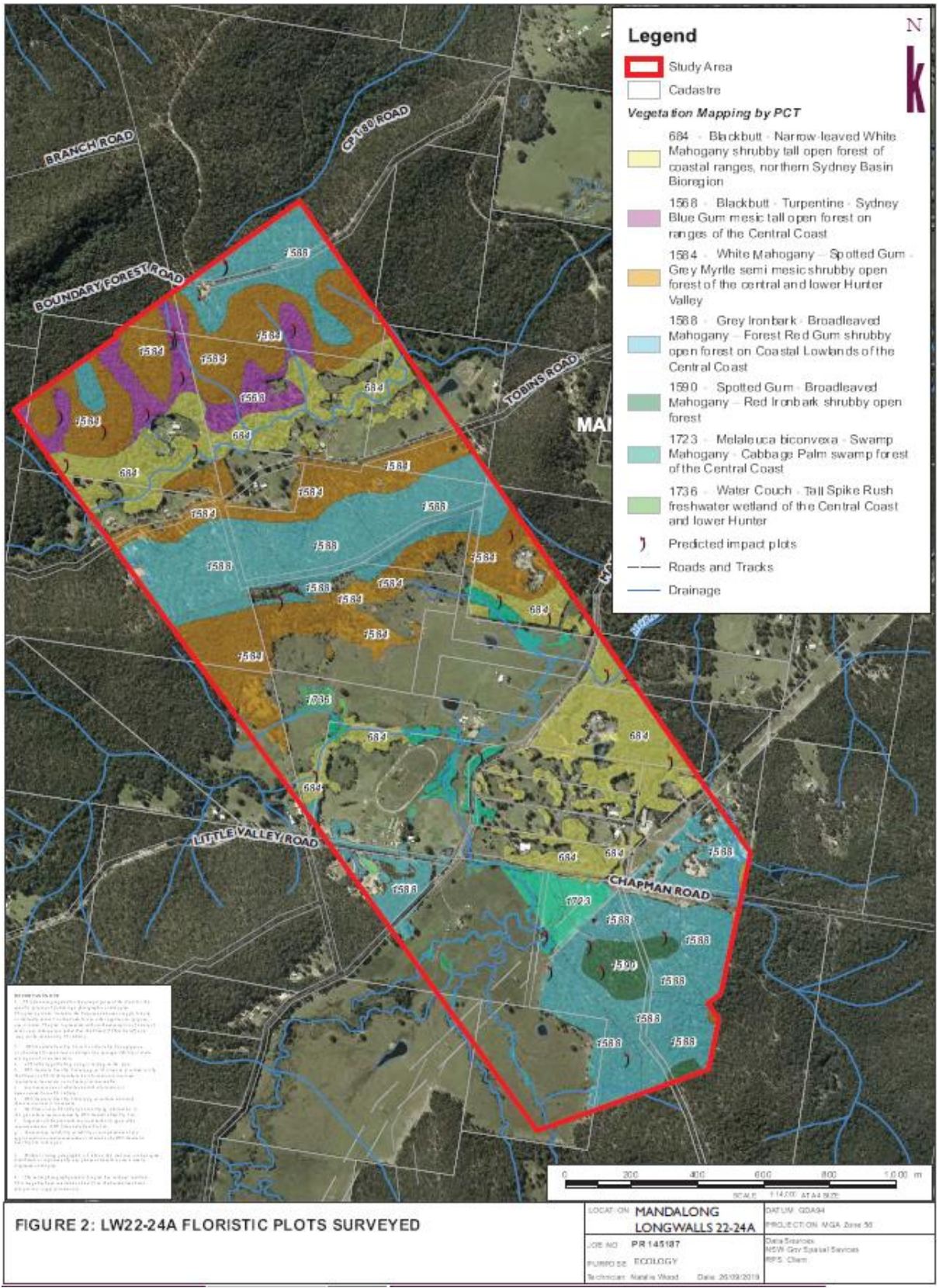
The monitoring is to be performed on an annual basis in accordance with the relevant approved Extraction Plan and associated Biodiversity Management Plan. Study methods include biometric plots and condition assessment for threatened species. Monitoring was conducted by RPS between September 2019 and March 2020; this extended monitoring period was due to the lack of rainfall during October and November. Further monitoring is scheduled for 2020.

The 2019/20 survey suggests that mining of LW22-24A is not having a substantial negative impact on vegetation communities that were predicted to experience impact, which were:

- PCT 684 Blackbutt - Narrow-leaved White Mahogany shrubby tall open forest of coastal ranges, northern Sydney Basin Bioregion;
- PCT 1723 Melaleuca biconvexa – Swamp Mahogany - Cabbage Palm swamp forest of the Central Coast (Swamp sclerophyll forest on coastal floodplains of the NSW North Coast| Sydney Basin and South East Corner bioregions TEC);
- PCT 1568 Blackbutt - Turpentine – Sydney Blue Gum mesic tall open forest on ranges of the Central Coast; and
- PCT 1587 White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley (RPS, 2019a).

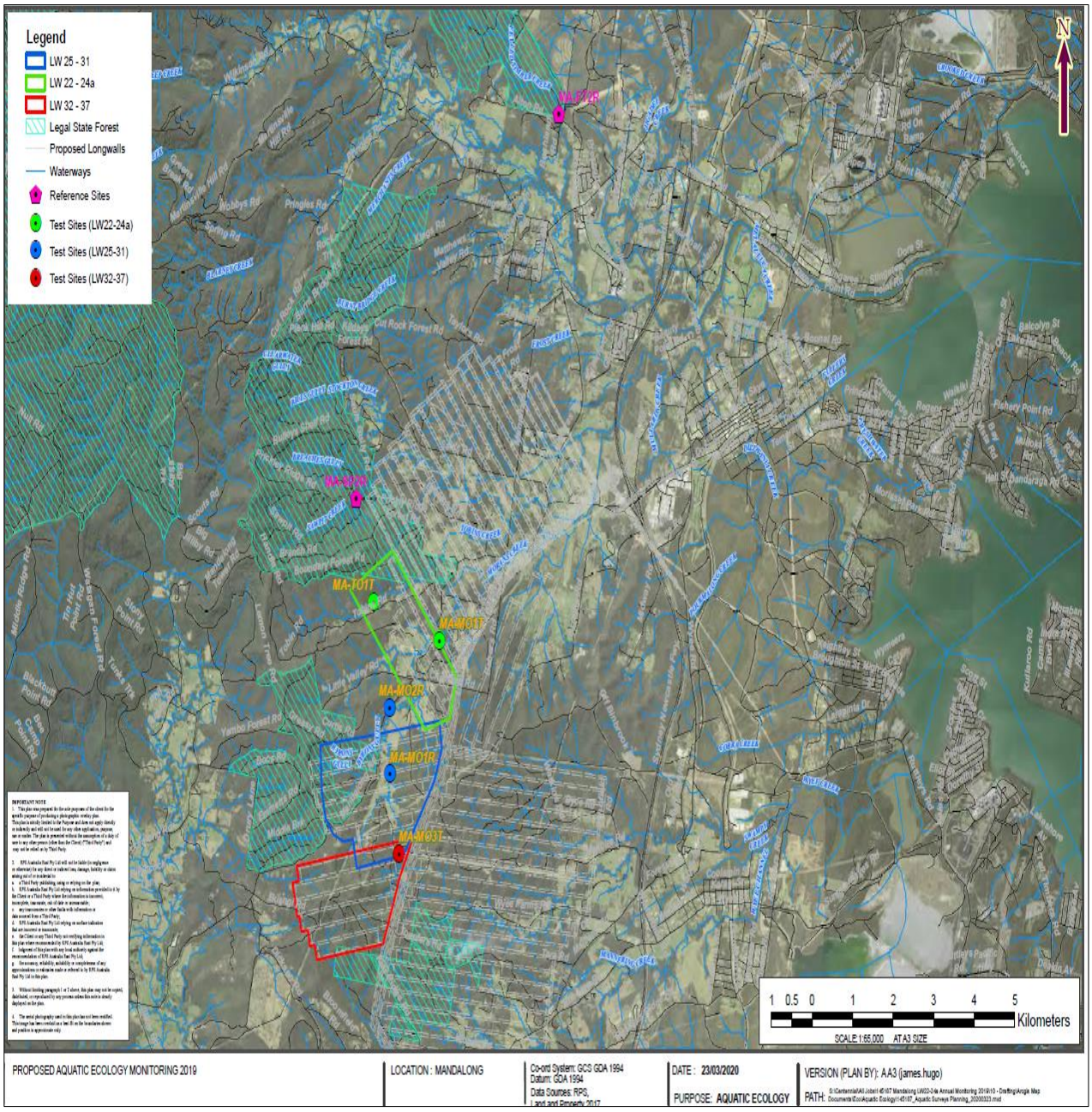
Additionally Amphibian monitoring found twelve species of frog, none of which are currently listed as threatened under the BC Act or EPBC Act. Future monitoring will allow for scope of impacts on these species.

Threatened flora baseline data has been collected from the impact area for threatened flora (i.e. *Melaleuca biconvexa* and *Maundia triglochinoides*). Consistency between the 2017 (pre-mining) and 2018/19/20 (post-mining) monitoring results suggest that mining LW22-24A is not having a substantial impact on M. biconvexa. Changes in floristic composition are consistent with control points and RPS attributes the differences as a result of warmer and drier summers. Impacts on M. triglochinoides were not assessable due to an absence of this species within plots. Future monitoring is recommended to determine if impacts to the vegetation and composition result from mining of LW22-24A over time (RPS, 2019a) and to detect a presence of threatened species that could potentially inhabit the surveyed areas.



Source: (RPS, 2019a).

Figure 6-12: Floristic Plots LW22-24A Sites



Source: (RPS, 2020b)

Figure 6-13: Aquatic Ecological Monitoring Locations

6.4.2 LW25-31 Extraction Plan Area

The monitoring of sensitive environments subject to potential subsidence impacts is a requirement as per Schedule 4 Condition 6 of SSD-5144 and Condition 72 of DA97/800. This monitoring is to be performed in accordance with the relevant approved Extraction Plan and associated BMP sub-plan. Approved BMPs for LW25-31 define the monitoring methods for threatened flora and Endangered Ecological Communities (EECs) that may be potentially influenced by subsidence-related impacts arising from the secondary extraction of LW25-31.

The baseline monitoring report was undertaken in 2018, with the current report prepared by RPS presenting results from the first annual monitoring effort in 2019. The 'impact area' for the monitoring program for LW25-31, as referred to in the present report, is shown in **Figure 6-14**. The impact area is defined as the area within the LW25-31 boundary.

Baseline surveys undertaken in 2018 by RPS used the Biodiversity Assessment Methodology (BAM 2016) to monitor vegetation condition. Surveys were repeated in 2019 using the BAM method to allow comparison of data between these two years.

Of the PCTs (plant community types) identified in the BMP as Sensitive Ecological Communities, due to their groundwater dependency, only PCT 1568 was found within the impact area upon ground-true-thing of vegetation mapping. However, PCT 1573 and 1723, which are also GDEs, were detected. These two PCTs have been included for ongoing monitoring (RPS, 2020a).

All control plots were resurveyed within the LW25-31 Project Area, all plots located in areas where impacts were predicted (i.e. ponding) were undertaken. Additional plots were also established and surveyed to increase survey effort representation for sensitive ecological communities.

At the time of survey, only limited vegetation plots were undermined by LW25. Consequently, an insufficient number of plots were undermined to statistically test for mining-related impacts. Nevertheless, of the plots resurveyed that were undermined by LW25 (i.e. plots 7 and 8), no mining-related impacts were detected. Hence, based on the data collected, no substantial negative impact on vegetation communities that are predicted to experience impact were detected (RPS, 2020a). Communities considered were:

- PCT 1568 Blackbutt - Turpentine – Sydney Blue Gum mesic tall open forest on ranges of the Central Coast;
- PCT 1573 Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment; and
- PCT 1723 Melaleuca biconvexa – Swamp Mahogany - Cabbage Palm swamp forest of the Central Coast.

Prior to the 2019 annual survey period, baseline monitoring plots were established for the threatened flora species M. biconvexa and R. rubescens. Twenty metre square plots were permanently established to monitor any changes in existing stands of M. biconvexa.

Only one plot (Plot 3; established in 2019), was located within the angle of draw for LW25. As such, there were insufficient plots undermined prior to the 2019 survey to statistically test for impacts to M. biconvexa. Nevertheless, there was no observable recent damage observed for M. biconvexa that may suggest mining-related impacts have occurred (RPS, 2020a).

Eight monitoring plots were established for R. rubescens (a newly State listed Critically Endangered species); four within the LW25-31 Project Area, whilst four are located outside areas impacted by mining (i.e. controls). None of the plots within the LW25-31 Project Area had been undermined at the time of the 2019 survey or were located within the angle of draw of LW25. Individual R. rubescens within each of the eight plots displayed at least some incidence of Myrtle Rust infection; a key threatening process for this species. These plots would be monitored concurrently during future annual survey campaigns in effort to detect any mining related impacts (RPS, 2020a).

Call playback and spotlighting were undertaken to search for amphibians within suitable habitats of the impact area. Surveys encompassed five areas, targeting habitat for threatened amphibians known to occur in the region, including the Green-thighed Frog (Litoria brevipalmata), Littlejohn's Tree Frog (Litoria littlejohni) and Giant Barred Frog (Mixophyes iteratus). Surveys were undertaken across four evenings, as prescribed by the relevant BMPs. Note that frog surveys were undertaken in early 2020 due to a lack of rainfall

over the summer of 2019: average annual rainfall since 2008 between October and December is 259.8 mm, whilst total rainfall for 2019 was only 59.2 mm (RPS, 2020a).

One threatened frog, Giant Barred Frog (Mixophyes iteratus), was detected within the Project Area. This species is listed as Endangered under the BC Act and EPBC Act. Two individuals were recorded in a location that has already been undermined by LW25A and 25B. Ongoing annual surveys will test for the persistence of this population of Giant Barred Frog, including the parallel monitoring of a nearby reference population to allow mining related impacts to be distinguishable from population fluxes driven by other stressors, such as climate-change (RPS, 2020a).

6.4.3 Aquatic Ecology Monitoring

The objectives of the monitoring conducted by RPS in the Spring of 2019 were to build upon an understanding of the macroinvertebrate communities within the downstream receiving environment of LW22-24a and LW25-31 extraction areas gain an understanding of the macroinvertebrate communities within the downstream receiving environment of the LW32-37 Extraction Plan areas; identify spatial and temporal changes in macroinvertebrate community structure; identify any potential key impacting processes resulting in changes to aquatic ecosystems health; identify the likely spatial and temporal scale of any potential impacts to aquatic communities; and provide recommendations for the improvement of future monitoring rounds (RPS, 2020b).

RPS was responsible for conducting the spring sampling event at multiple sites (**Figure 6-13**) in accordance with the Biodiversity Management Plan (BMP).

Key results were from the 2019 monitoring were:

- pH, EC and turbidity were within ANZECC (2000) guidelines at both reference and test sites;
- DO was below, whilst TN and TP were above ANZECC (2000) guidelines at both reference and test sites;
- Overall taxonomic and PET taxa richness of macroinvertebrate communities was lower in 2018 than 2019 at both reference and test sites; and
- mean signal2 scores increased across both test and reference sites between years (RPS, 2020b).

The elevated nutrients (TP) and low DO concentrations, observed within both test and control sites during both 2018 and 2019, are likely to be attributable to agricultural land use, which is prevalent within the Lake Macquarie and Tuggerah catchment. Specifically, the observed over-nutrification is consistent with issues arising from runoff from livestock grazing, which is a common land-use within floodplain areas adjacent or nearby the study sites (RPS, 2020b).

Based on the sampling undertaken to date, there does not appear to be any significant biological health or water quality impacts to the freshwater aquatic systems resulting from activities associated with the LW22-24a and LW25-31 extraction areas (RPS, 2020b).

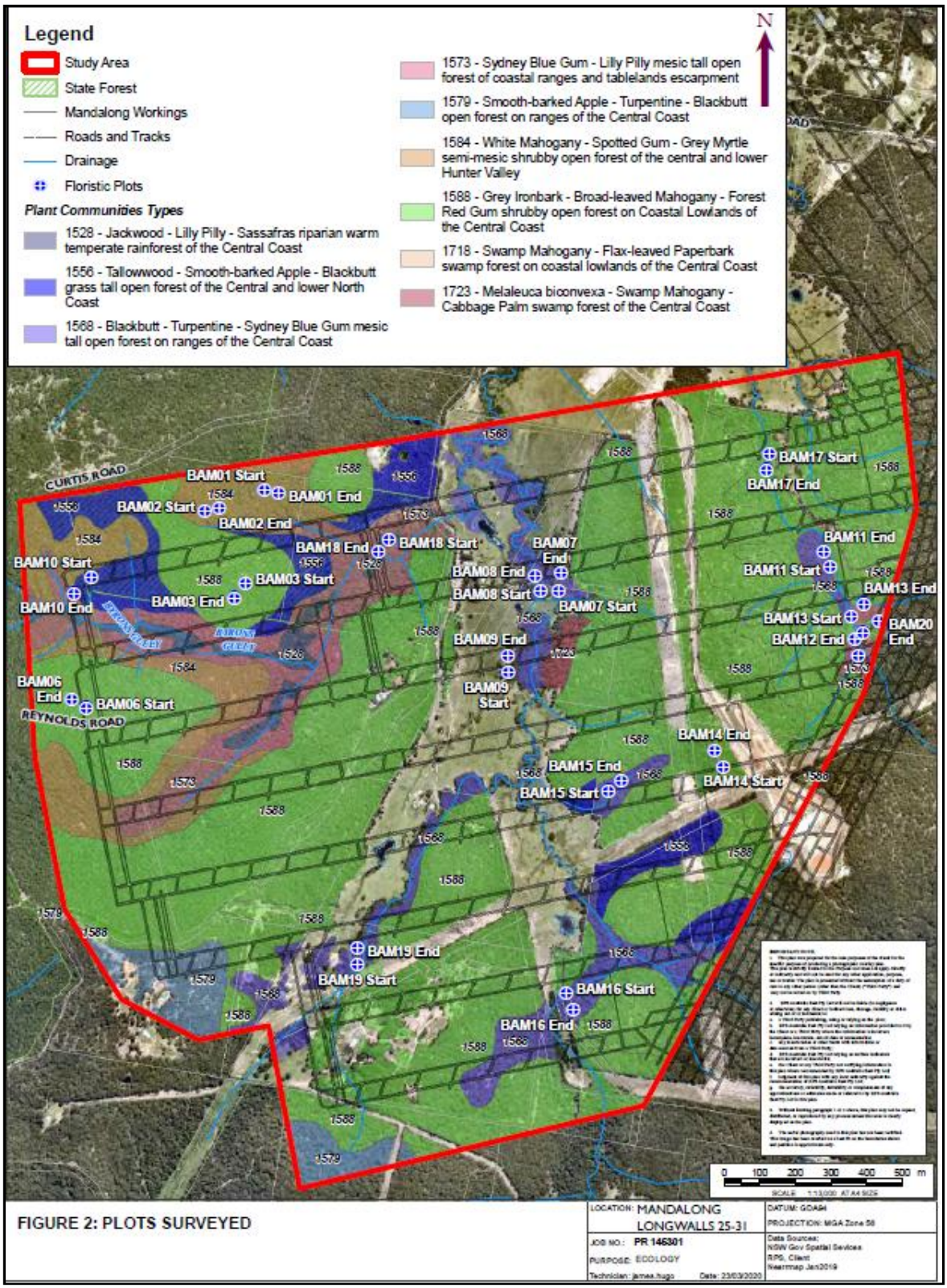


Figure 6-14: Monitoring Plots LW25-31 Sites

6.4.4 Land Management Strategy for the MSSS and TL24 Offset Areas

The construction of the MSSS and access road which was completed in 2017 resulted in the clearing of approximately 11.3 ha of MU 15: Coastal Foothills Spotted Gum – Ironbark Forest, which is not commensurate with any threatened ecological community listed under the Threatened Species Conservation Act (TSC Act 1995) or Environmental Protection and Biodiversity Conservation Act (EPBC Act 1999) (SLR, 2013a).

MU 15 is very common and widespread in the locality, occupying approximately 2,502 hectares within the Study Area and approximately 21,094 hectares between Ourimbah and Beresfield (NPWS 2003, cited in (SLR, 2013a). The proposed approved clearing area (which was 15.6 ha), therefore, amounts to approximately 0.6 percent of the total available vegetation community within the immediate area and approximately 0.07 percent of the total available vegetation community within the region. None of the land proposed to be cleared contains threatened flora species or endangered ecological communities.

For these reasons, Centennial Mandalong did not propose to provide a direct offset strategy. Rather, as a substantial landholder in the Mandalong Valley, Centennial Mandalong has developed a Land Management Strategy for land owned by Centennial in the Valley.

In addition, the relocation of TL24 has also resulted in 8.03 ha of vegetation clearing for the establishment of the new easement. Centennial Mandalong has also included in the Land Management Strategy an additional area of 73.6 ha in order to compensate for the loss of vegetation communities.

The Land Management Strategy provides for four lots identified in **Table 6-11**. The four lots form two sites referred to as Mandalong Road and Chapman Road. The two sites have been placed under a Conservation Property Vegetation Plan (PVP) under Native Vegetation Regulation 2013 (Clause 9(1)) in 2017.

Table 6-11: Land Management Strategy Site Locations

Approval Reference	LMS Site Reference	Lot	DP	Ownership	LGA	Area (ha)
SSD-5144	Mandalong Road Northern Lot	580	733227	Centennial Fassifern Pty Ltd	LMCC	18.37
	Mandalong Road Southern Lots	Lot A	110119	Centennial Fassifern Pty Ltd	LMCC	106.52
		902	541065	Centennial Fassifern Pty Ltd	LMCC	
SSD-5144 (MOD 1)	Chapman Road	152	755238	Centennial Fassifern Pty Ltd	LMCC	72.3

The objective of land management at Mandalong Road and Chapman Road are as follows -
Mandalong Road Objective - coexistence of conservation and agricultural practices that retain or improve habitat.

Chapman Road Objective - retain/maintain or improve ecological diversity of land to a self-sustaining system/environment.

RPS Australia East Pty Ltd (RPS) was engaged by Centennial Mandalong Pty Ltd to undertake the 2019 annual ecological monitoring of the land management sites as described in the Mandalong Land Management Strategy (LMS). These sites comprise land described as Lot 580 DP733227; Lot A DP110119; Lot 902, DP541065 and Lot 152, DP755238 as shown in **Figure 6-15** and **Figure 6-16** and their total areas indicated in **Table 6-11.**

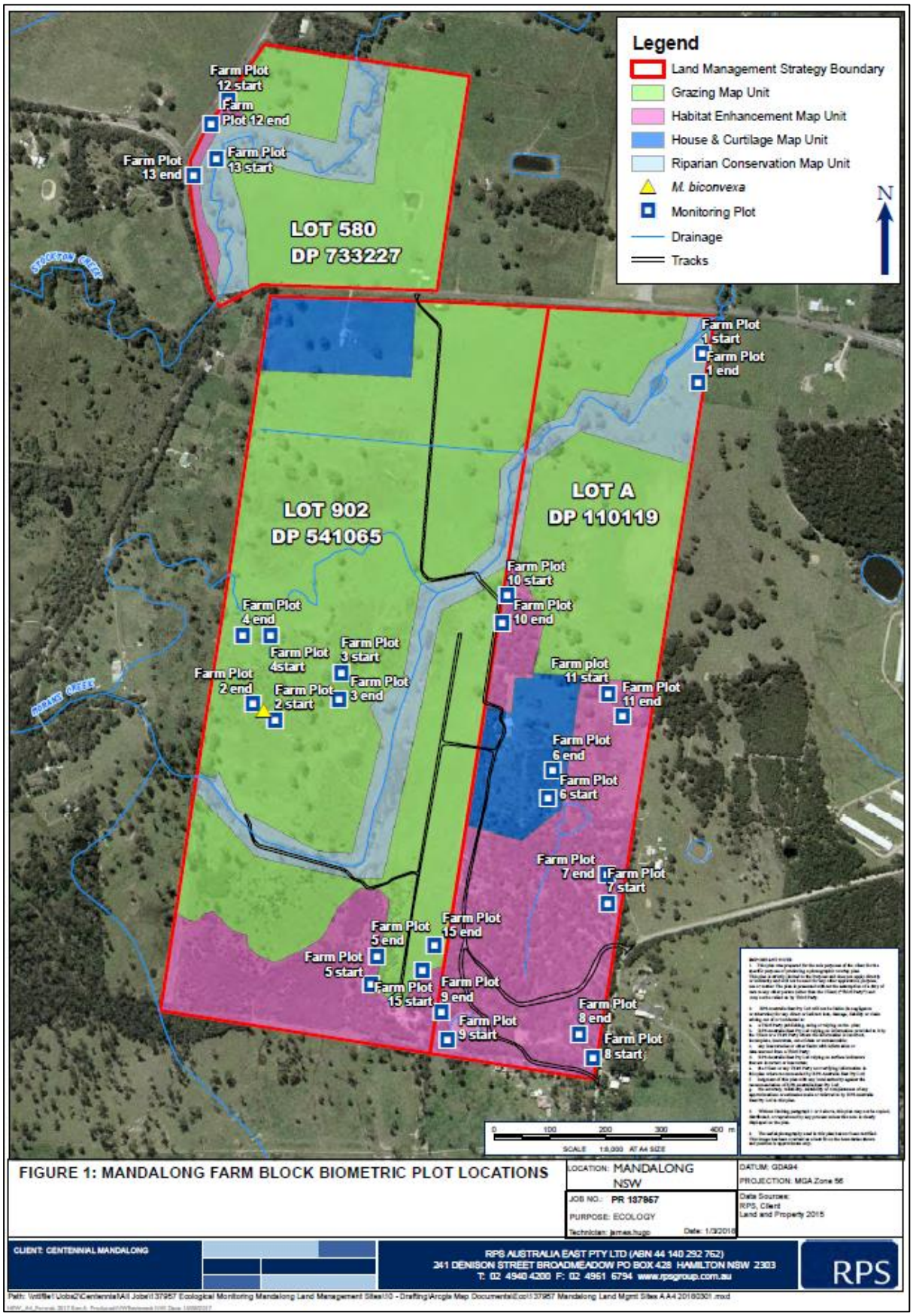
Baseline flora and fauna surveys were undertaken by RPS ecologists from 9-12, 16-20 and 23-27 March 2015. Repeat annual monitoring surveys of 22 BioMetric plots were undertaken by RPS ecologists on 21, 22, 24 and 25 October 2019. Habitat assessment has been completed to determine condition of floristics within the Habitat Enhancement Map Units of the land management sites. Native and exotic plant species were recorded within a 20m x 20m (400 m2) plot nested within the 50m x 20m (1,000 m2) Cover abundance for each plant species was estimated and recorded. Species composition, condition and photographic data was also recorded.

BioMetric (Gibbons et al. 2009), as amended by the NSW BioBanking Assessment Methodology 2014 (BBAM 2014) (Office of Environment and Heritage, OEH 2014), was used as the monitoring method. Calculations were performed using the online NSW BioBanking Credit Calculator (BBCC) to compare monitoring data. The NSW Vegetation Information System (VIS) was interrogated to extract current benchmark data for BioMetric Vegetation Types (BVTs) used to classify each vegetation community examined in the monitoring program.

Comparisons between previous years and 2019/20 monitoring and benchmark data indicates that the site value scores (SVS) across all plots can be classed as being in moderate/ good (medium-high) condition. An improvement on the previous year, with several plots within Melaleuca Scrub – HU 930 Endangered Ecological Community (EEC) – PCT 1716 (Grazing and House & Curtilage Map unit (MU)), Carex Grasslands – HU 812 (derived) – PCT 1598 (Grazing MU) and Coastal Ranges Open Forest – HU 770 – PCT 1556 (Habitat Enhancement MU) increasing from moderate/good (poor) to moderate/good (medium).

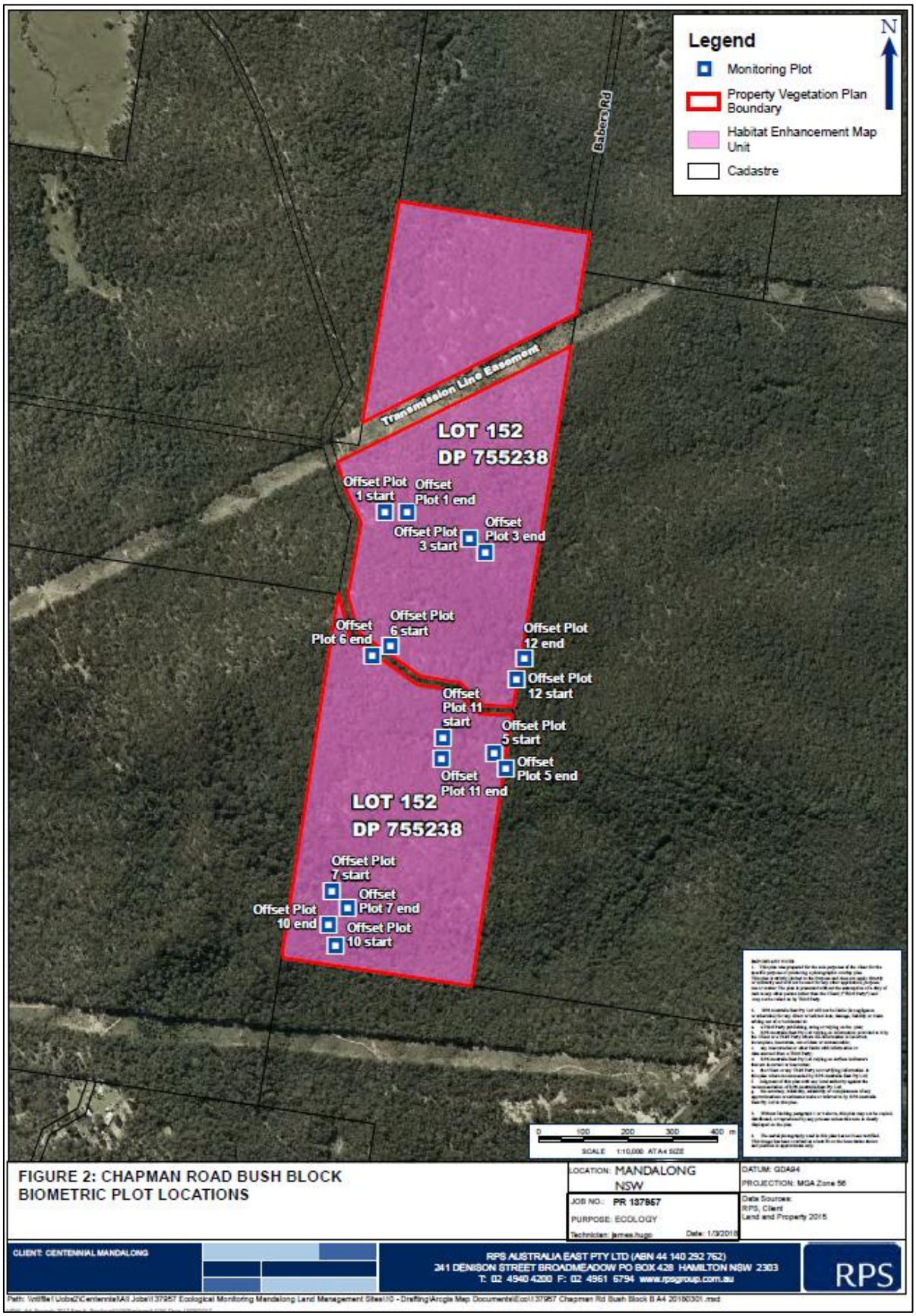
Mandalong Farm mean SVSs illustrated an increase across all BioMetric plots within the Habitat Enhancement and Riparian Conservation MUs, except for Farm plot 1 (Regenerating vegetation HU 812 (derived) – PCT 1598 (Riparian)). The incremental decrease in SVS for Farm plot 1, was attributed to the decrease in Mid-storey Cover (MSC) (largely targeted exotic species) and a decrease in species richness of Native Ground Cover Grass (NGCG) and Native Ground Cover Other (NGCO), which is a typical temporary occurrence following primary weed management activities. It is predicted that the SVS score will increase again following continued management activities promoting natural succession and regeneration of the mid-storey and groundcover stratums.

Chapman Road Bush Block SVSs illustrated increases in SVSs within all plots. However, Coastal Narrabeen Moist Forest – HU 794 – PCT 1580 (Habitat Enhancement MU) illustrated a minor decrease in SVSs. The observed reduction in SVSs calculated is mostly due to low detection of the Number of Hollow-bearing Trees (NHT), as all other attributes are stable and Native Plant Species Richness (NPSR) showed an increase to near benchmark condition.



Source: (RPS, 2018c)

Figure 6-15: Mandalong Farm Offset Area



Source: (RPS, 2018c).

Figure 6-16 : Chapman Road Bush Block Offset Area

6.4.5 MSSS & TL24 Nest Box Monitoring

In June and December 2019 RPS ecologists undertook the bi-annual monitoring of 158 nest boxes. The nest boxes were installed as a result of hollow-bearing tree loss associated with the Mandalong South Surface Site and associated Access Road, and the TL24 Relocation Project. This nest box monitoring program included:

- 128 nest boxes installed for the Transmission Line off-set (TL24-13 to TL24-140).
- 30 nest boxes previously installed for the Mandalong South Surface Site and Transmission Line offset (MSSS-01 to MSSS-18 and TL24-1 to TL24-12).

All nest boxes were inspected using a scope and camera to minimise disturbance to any fauna occupying the nest boxes and to minimise personal safety risks involved with climbing ladders.

During the monitoring round in June 2019, three nest boxes contained micro bats totalling a number of 8 individuals. Two nest boxes were found to contain the amphibian species Litoria peronii. Obvious nesting from arboreal mammals, excluding microbats, was observed in 10 nest boxes. There were a total of 12 nest boxes (7.6%) that exhibited signs of “use” without having a nest.

In December 2019, one nest box was found to contain a Brush-tailed Possum (Trichosurus vulpecula). Obvious nesting from arboreal mammals was observed in five nest boxes. An additional one nest box exhibited signs of “use” without having a nest.

6.4.6 VAM-RAB Rehabilitation Off-Set Monitoring

Centennial Mandalong received approval in 2011 (DA97/800 Modification 7) for the trial installation of a ventilation air methane regenerative afterburner unit (VAM-RAB) that would remove and breakdown the exhaust methane.

Installation of the VAM-RAB unit necessitated clearing of some native vegetation. Two endangered ecological communities (EEC) listed in Schedule 3 of the NSW Threatened Species Conservation Act 1995 were included in the areas to be cleared. These were: Swamp Sclerophyll Forest (SSF) on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions; and River-Flat Eucalypt Forest (RFEF) on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.

DA97/800 Condition 76A included a requirement for a 1.25 hectare rehabilitation off-set area to be established on cleared land adjoining the VAM-RAB construction site. These EEC were represented by communities described in the regional vegetation mapping and classification (NPWS 2000) as: MU37 Swamp Mahogany Paperbark Forest (SSF); and MU38 Redgum – Rough-barked Apple Swamp Forest (RFEF).

An ecology survey (Hunter Eco, 2011) prepared for the VAM-RAB project application described the area to be rehabilitated as mostly dominated by weeds. This being the case, active regeneration was required and this was commenced in January 2012 and completed in March 2012.

Further to the requirement to rehabilitate, DA97/800 Condition 76A also requires that the progress of the rehabilitation be monitored annually for five years. Hunter Eco commenced baseline monitoring in October and November of 2012, with the first annual monitoring completed in October 2013, the second annual round of monitoring completed in December 2014, the third annual round of monitoring completed in December 2015, the fourth annual round of monitoring completed in October 2016, the fifth round of monitoring completed in December 2017, the sixth round of monitoring completed in December 2018, with the seventh round of monitoring conducted in December 2019 (Hunter Eco, 2019).

The aim of the monitoring program conducted by Hunter Eco was to collect data that would enable a quantitative comparison between the relatively undisturbed communities and the

areas being rehabilitated. This is achieved through the collection of floristic data from 400 m^2 permanently established plots. The normal plot size is 20 m x 20 m but the dimension can vary depending on the configuration of the available space. Two plots were established in each of the two undisturbed communities and two in each of the two areas being rehabilitated to these communities; eight plots in all.

All plots were permanently established with star pickets at each corner in 2012, and floristic data was collected on 4 December 2019. Hunter Eco has found that rehabilitation areas remain substantially different to that in the reference areas. However, the cover contribution of the planted species is increasing and has contributed to improved similarity with many of the planted trees now growing vigorously. Some of the plantings in Plots 4 and 5 are beginning to develop.

Hunter Eco (2019) have identified that Plots 4 and 5 again contain early developing clusters of Noogoora Burr plants and it is essential that these be eradicated before they flower and develop fruit either by spraying or simply being pulled out. Blackberry had recently been sprayed successfully with little regrowth at the time of monitoring and in response to the 2018 recommendation South African Pigeon Grass (Setaria sphacelata) has been successfully eradicated.

Hunter Eco (2019) has described the results of what is effectively six years of rehabilitation given the initial year lost to herbivory prior to fencing. Overall the results to date are encouraging suggesting that the measures taken should result in successful rehabilitation, although over a longer period than the required five year monitoring program.

Source: (Hunter Eco, 2017)

Figure 6-17: Location of Floristic Sample Plots

6.4.7 Green & Golden Bell Frog Research Program

In 2016 Centennial Mandalong commenced the preparation and implementation of a research and monitoring program for the Green and Golden Bell Frog (GGBF) in accordance with EPBC approval (2013/6906) conditions of the Northern Coal Logistics Project.

As part of current operations at the Cooranbong Entry Site, underground mine water is pumped from the existing Mandalong Mine underground workings at an average rate of 0.6 to 2.5 ML/day and is discharged into an unnamed creek from Licensed Discharge Point 001 (LDP001) at the Cooranbong Entry Site. The unnamed creek flows into Muddy Lake which is also connected to Lake Macquarie via Lake Eraring.

Ecological surveys were first undertaken at Muddy Lake in October 2015. During these surveys, approximately five Green and Golden Bell Frog *Litoria aurea* (GGBF) individuals were identified. The Green and Golden Bell Frog is listed as an endangered species under the NSW *Threatened Species Conservation Act* 1995 (TSC Act) and as a vulnerable species under the Commonwealth *Environmental Protection and Biodiversity Conservation Act* 1999 (EPBC Act).

The GGBFs identified at Muddy Lake are the only known records of the species within a 10 km radius of the Cooranbong Entry Site.

The research project will monitor GGBF populations and habitat quality within Muddy Lake in conjunction with reference populations to fulfil the relevant EPBC approval conditions. Monitoring commenced in late 2016, with approval received from the Department of Environment & Energy on 30 November 2016 for Professor Michael Mahoney to act as an independent peer reviewer for the purpose of reviewing the Green and Golden Bell Frog Research Program's methodology and final report.

Surveys were conducted by GHD within the study area over a two-week period in January - February 2017 and also in Spring 2017 and Summer 2017 / 18. Adult males, adult females and juvenile Green and Golden Bell Frogs were captured during the surveys. The size of the juveniles indicated that breeding has occurred either within the study area or within adjacent habitat in the past twelve months. At this stage, this suggests that the population is viable, although further surveys will be required to examine trends in population structure. The presence of a viable population on the Central Coast, a large distance from the two known key populations, is likely to be important for the conservation of the species in the region.

Further surveys were conducted by GHD in December 2018 and in total, around 150 Green and Golden Bell Frog individuals were recorded during surveys across the lake. In the December 2018 surveys, 37 individuals were captured and released during the targeted surveys, an additional 85 individuals recorded as a result of canoe based surveys, and 25 individuals observed or heard during spotlighting surveys. Canoe-based surveys have shown to be a successful technique at Muddy Lake for assessing occupancy and population numbers (GHD, 2019b).

A lower number of Green and Golden Bell Frog individuals were recorded during the December 2019 surveys compared to the December 2018 surveys. This is likely due to a combination of survey intensity (fewer surveyors) and sub-optimal survey conditions and the effects of drought. Where habitat condition was good (generally deeper and clearer water with a range of microhabitat types present) multiple frogs were observed, although numbers were lower than those observed in December 2018. Where habitat conditions were poor (dry pools or very muddy pools) no frogs were observed.

Water quality and habitat quality at Muddy Lake has been impacted by drought conditions experienced in 2019, resulting in evaporation, increases in salinity and increases in

concentration of suspended sediments. pH at Muddy Lake is generally within the range tolerated by the Green and Golden Bell Frog, although one location (site 5) recorded pH levels higher than the SSGV. This area had many dry areas that had previously been pools, and no frogs were observed in this area during the survey. Salinity is high for a freshwater system, and exceeded SSGV values at all sites on at least one night during the surveys. High salinity is expected given the interaction with brackish water from Lake Eraring and the discharges into the lake, combined with low rainfall prior to surveys. Further increases in salinity could impact breeding, however salinity is likely to reduce as a result of heavy summer rains experienced in January and February 2020 although the Lake Macquarie area is still drought-affected and further impacts on habitat values at Muddy Lake may occur (GHD, 2020).

There is no evidence of a decline in the extent, quality or availability of Green and Golden Bell Frog habitat downstream of the discharge locations and resulting from these discharges, and there is no evidence of a decline in the abundance or extent of the Muddy Lake Green and Golden Bell Frog population as a result of discharges. Changes to habitat quality observed during surveys are likely to be a result of drought conditions reducing inflows rather than impacts of discharges. Discharges are more likely to be maintaining permanent habitat at Muddy Lake, and thus could be important for the ongoing survival of the species at this location, and in particular under drought conditions as many other wetlands in the area were observed to be dry in 2019 (GHD, 2020).

Changes to the survey intensity occurred, with only one team conducting surveys over three nights. Given that Green and Golden Bell Frogs were observed in various locations despite the poor weather conditions this change is not considered detrimental to the monitoring program. In addition, the reduction in handling and habitat impacts from trampling is in line with animal ethics code, which requires projects to consider ways to refine and reduce animal use. This change to one team for single survey monitoring events is recommended to continue for future surveys. Note, however, that the next round of surveys (spring summer 2020/2021) is proposed to comprise detailed monitoring, consisting of two survey periods with pit-tagging and genetic sampling by two teams, as recommended in the management plan (GHD 2019a).

6.5 CULTURAL HERITAGE & ARCHAEOLOGY

6.5.1 Aboriginal Archaeology –LW22-23 & LW24-24A Extraction Plan Areas

In 2016, RPS prepared a Heritage Management Plan (RPS, 2016) to support an Extraction Plan for the extraction of coal from Mandalong Mine Longwalls 22 and 23. The Study Area for the Heritage Management Plan encompassed the 26.5 degree angle of draw around the secondary extraction areas of Longwalls 22 and 23.

A survey of the Longwall 22-23 Study Area was undertaken by RPS archaeologists Cheng Yen Loo and Jo Nelson on 14 and 15 June 2016 accompanied by Phil Enright (Centennial Mandalong Mining Approvals Coordinator). Based on the areas surveyed and ground truthing of existing sites, a total of four Aboriginal sites were located inside the Study Area: three that were previously identified in 2011 and one newly recorded scarred tree site named #45-3-3678 (RPS Mand 2016_1).

Two of the sites inside the Study Area were artefact scatters (#45-3-3446/45-3-3537 and #45-3-3538), one was a grinding groove site (#45-3-3454) located in the angle of draw for Longwall 21 which would not be directly undermined as a result of the extraction of Longwalls 22 or 23, and the fourth was a scarred tree site (#45-3-3678 - RPS Mand 2016_1).

Table 6-12: Subsidence on Aboriginal Cultural Heritage Sites (LW22-24A)

AHIMS Number	Artefact No.	Aboriginal Cultural Heritage Site	Mining Location	Predicted Subsidence	Actual Subsidence	Comment
45-3-3454	RPS MAND Nth 5	Grinding Groove	Angle of Draw Longwall 21	<-20mm		Not undermined
45-3-3453	RPS MAND Nth 6	Artefact Scatter	Outside influence of mining.	-100mm		Not mined – LW20 shortened due to seam intruded by igneous sill.
45-3-3446 45-3-3537		Artefact Scatter	Longwall 22 abutment pillar	-40mm	<20mm	Based on nearest monitoring point. Inspection 14/11/18 – no impact observed.
45-3-3538		Isolated Find	Longwall 23	-60mm		Phase 3 post mining inspection 14/11/18 - no impact observed...
45-3-3678	RPS Mand 2016_1	Scarred Tree	Longwall 24	-700mm	700mm	Based on nearest monitoring point (TL24 Tower 45). Phase 2 – Initial post mining inspection completed on 14/11/18. Phase 3 post mining inspection 5/9/19 - no impact observed

A pre-mining baseline recording of Aboriginal grinding groove site AHIMS #45-3-3454-RPS (Mand North 5) was undertaken on 1 November 2016 by Tessa Boer-Mah (RPS), Arthur Fletcher (Wonn1), Mark Harrower (Centennial), Jeffrey Dunwoodie (Centennial) and Tim Gayner (Centennial). The baseline recording located the grinding grooves to survey control

standard, included a detailed archaeological recording and archival photography, as well as a 3D scan.

The baseline pre-mining recording was undertaken in accordance with Phase 1 of the ACHMP (RPS 2016). The post mining initial condition inspection (Phase 2) was undertaken on 1 March 2017 and the post mining secondary condition inspection (Phase 3) was undertaken on 23 October 2017. All recording and inspections were undertaken with Aboriginal community participation. No mining induced changes were noted for each of the grinding grooves as the site (RPS, 2017a).

The artefact scatter (#45-3-3446/45-3-3537) located above the Longwall 22 abutment pillar and the isolated find (#45-3-3538) above Longwall 23 were monitored in 2018. The baseline pre-mining recording was undertaken for both sites in accordance with Phase 1 of the ACHMP (RPS 2016) on 1 March 2017. The post mining initial condition inspection (Phase 2) was undertaken on 23 October 2017 at the artefact scatter ((#45-3-3446/45-3-3537) and on 8 March 2018 for the isolated find. The post mining secondary condition inspection (Phase 3) was undertaken on 23 October 2017 for both sites (RPS, 2018a). All recording and inspections were undertaken with Aboriginal community participation. No visible evidence of harm to the Aboriginal sites through subsidence was identified.

AHIMS # 45-3-3678 scarred tree was originally recorded by RPS archaeologists. A detailed baseline recording was undertaken on 23 October 2017 by Tessa Boer-Mah (RPS), Tracey Howie (Guringai Tribal Link), Jackson Walker (Awabakal Traditional Owners Aboriginal Corporation), Kane Leven (Awabakal Descendants Traditional Aboriginal Owners Corporation), Mark Harrower (Centennial) and Jeffrey Dunwoodie (Centennial). The post mining initial condition inspection (Phase 2) was undertaken on 14 November 2018 with members of the Aboriginal community present. The post mining secondary condition inspection (Phase 3) was undertaken on 5 September 2019. All recording and inspections were undertaken with Aboriginal community participation. No visible evidence of harm to the scarred tree through subsidence was identified.

6.5.2 Aboriginal Archaeology – LW25-31 Extraction Plan Area

In 2018, RPS prepared a Heritage Management Plan (RPS, 2018b) to support an Extraction Plan for the extraction of coal from Mandalong Mine Longwalls 25 to 31. The Study Area for the Heritage Management Plan encompassed the 26.5 degree angle of draw around the secondary extraction areas of Longwalls 25 to 31. Eleven (11) Aboriginal heritage sites/items are located inside the Longwall 25-31 Extraction Plan Area. As shown in

AHIMS Number	Artefact No.	Aboriginal Cultural Heritage Site	Mining Location	Predicted Subsidence	Actual Subsidence	Comment
45-3-1223	Moran's Creek	Artefact Scatter	Longwall 31	-620mm		
45-3-3469	RPS MAND STH AH03	Grinding Groove	Longwall 27	<-20mm		
45-3-3490	RPS MAND STH CYL07	Grinding Groove	Longwall 25	-80mm	-59mm	Phase 2 post-mining inspection was conducted on 5 September 2019. No visible or measured impact.

AHIMS Number	Artefact No.	Aboriginal Cultural Heritage Site	Mining Location	Predicted Subsidence	Actual Subsidence	Comment
45-3-3501	RPS DF03	Grinding Groove	Longwall 25	-70mm	+13mm	Phase 2 post-mining inspection was conducted on 5 September 2019. No visible or measured impact.
45-3-3502	RPS DF04	Grinding Groove	Longwall 25	<-20mm	+17mm	Phase 2 post-mining inspection was conducted on 5 September 2019. Grinding Groove Trial Mitigation
45-3-3506	RPS MAND STH PS11	Grinding Groove	Longwall 25	-90mm	+17mm	Phase 2 post-mining inspection was conducted on 5 September 2019. No visible or measured impact. Grinding Groove Trial Mitigation
45-3-3536	RPS MAND STH TBM29	Artefact Scatter	Longwall 30	-640mm		
45-3-3539	RPS MAND STH TBM31	Grinding Groove	Longwall 28	-870mm		
45-3-3540	RPS MAND STH TBM32	Stone Arrangement	Longwall 28	-880mm		
45-3-3541	RPS MAND STH TBM33	Modified Tree (carved or scarred)	Longwall 28	-910mm		
45-3-3542	RPS MAND STH TBM34	Grinding Groove	Longwall 28	-720mm		

Table 6-13 these eleven Aboriginal heritage sites/items are located within the mine workings area and thus may be impacted by subsidence.

AHIMS Number	Artefact No.	Aboriginal Cultural Heritage Site	Mining Location	Predicted Subsidence	Actual Subsidence	Comment
45-3-1223	Moran's Creek	Artefact Scatter	Longwall 31	-620mm		

AHIMS Number	Artefact No.	Aboriginal Cultural Heritage Site	Mining Location	Predicted Subsidence	Actual Subsidence	Comment
45-3-3469	RPS MAND STH AH03	Grinding Groove	Longwall 27	<-20mm		
45-3-3490	RPS MAND STH CYL07	Grinding Groove	Longwall 25	-80mm	-59mm	Phase 2 post-mining inspection was conducted on 5 September 2019. No visible or measured impact.
45-3-3501	RPS DF03	Grinding Groove	Longwall 25	-70mm	+13mm	Phase 2 post-mining inspection was conducted on 5 September 2019. No visible or measured impact.
45-3-3502	RPS DF04	Grinding Groove	Longwall 25	<-20mm	+17mm	Phase 2 post-mining inspection was conducted on 5 September 2019. Grinding Groove Trial Mitigation
45-3-3506	RPS MAND STH PS11	Grinding Groove	Longwall 25	-90mm	+17mm	Phase 2 post-mining inspection was conducted on 5 September 2019. No visible or measured impact. Grinding Groove Trial Mitigation
45-3-3536	RPS MAND STH TBM29	Artefact Scatter	Longwall 30	-640mm		
45-3-3539	RPS MAND STH TBM31	Grinding Groove	Longwall 28	-870mm		
45-3-3540	RPS MAND STH TBM32	Stone Arrangement	Longwall 28	-880mm		
45-3-3541	RPS MAND STH TBM33	Modified Tree (carved or scarred)	Longwall 28	-910mm		

AHIMS Number	Artefact No.	Aboriginal Cultural Heritage Site	Mining Location	Predicted Subsidence	Actual Subsidence	Comment
45-3-3542	RPS MAND STH TBM34	Grinding Groove	Longwall 28	-720mm		

Table 6-13: Aboriginal Cultural Heritage Sites (LW25-31)

A pre-mining baseline recording of Aboriginal grinding groove sites AHIMS 45-3-3501, AHIMS 45-3-3490, AHIMS 45-3-3502 and AHIMS 45-3-3506 (RPS names DF03, CYL07, DF04 and PS11) was undertaken on 8 March 2018 by Tessa Boer-Mah and Dragomir Garbov of RPS along with the following RAP representatives: Peter Leven of Awabakal Descendants Traditional Owners Aboriginal Corporation (ADTOAC), Tracey Howie of Guringai Tribal Link Aboriginal Corporation (GTLAC), Jackson Walker (ATOAC) and Darcy Dole (Wonn1). The baseline recording located the grinding grooves to survey control standard, included a detailed archaeological recording and archival photography, as well as a 3D scan.

An initial posting mining inspection of Aboriginal grinding groove sites AHIMS 45-3-3501, AHIMS 45-3-3490, AHIMS 45-3-3502 and AHIMS 45-3-3506 (RPS names DF03, CYL07, DF04 and PS11) was undertaken on 5 September 2019 by Benjamin Slack of RPS along with the several RAP representatives. There were no impacts identified to the grinding groove sites, with a final post mining inspection scheduled to be completed in early 2020 in accordance with the requirements of Condition 10 of Schedule 4 of SSD-5144 (Grinding Groove Trial Mitigation) with monitoring results to be presented in the 2020 Annual Review.

6.5.3 European Heritage

A Historic Heritage Management Plan was developed for Mandalong in 2016 to address European Heritage items located within the Mandalong lease boundary. The archival recording of the Landing Skid 2 which is located within the Mandalong South Surface Site disturbance boundary was completed by RPS in 2016 (RPS, 2017b). Landing Skid 2 was subsequently demolished in 2017 during the construction of the Mandalong South Surface Site. There were no further impacts to European Heritage items in 2019.

Subsidence on the section of Convict Road (Brisbane Waters to Wallis Plains Road) above Longwall panels 1 and 2 was last recorded at 320mm in 2012. No observed subsidence damage was identified to the road which is in accordance with the predictions in the EIS (Umwelt, 1997). Subsidence monitoring was completed in 2012 as approved by the DRG.

6.6 RAINFALL MONITORING RESULTS

The total monthly rainfall data is shown below in **Table 6-14** and in **Figure 6-18**.

Table 6-14: Rainfall at Mandalong Mine for the Period January 2019 to December 2019.

2019 Month	Mandalong Mine Total Rainfall (mm)
January	**62.2**
February	**94.4**
March	**154.8**
April	**45**
May	**7.4**
June	**114**
July	**40.6**
August	**118.2**
September	**138**
October	**20.2**
November	**23**
December	**4.6**
Total	**822.4**

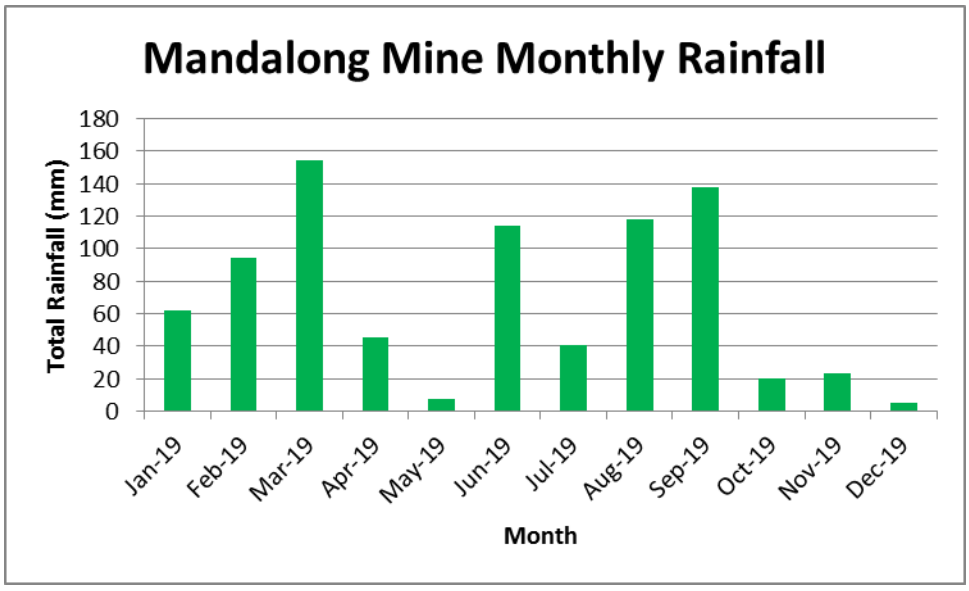


Figure 6-18: Mandalong Monthly Rainfall

A total of 822.4 mm of rainfall was recorded at the Mandalong Mine site during the reporting period. The total annual rainfall for 2019 was lower than the annual average rainfall (1,124 mm) recorded at the Cooranbong Station (BOM station number 61012) from 1889 to 2016. The wettest monthly period in 2019 was March recording 154.8mm. 2019 was the third consecutive year of below average rainfall.

6.7 SUBSIDENCE MONITORING

Subsidence monitoring programs are developed and approved for each Extraction Plan. During early 2019 the Extraction Plan for Longwalls 25 to 31 was approved by DPIE. Subsidence effects from mining Longwall 25 and Longwall 26 were managed in accordance with the Extraction Plan.

Subsidence monitoring aims to confirm that subsidence predictions and expected subsidence impacts are consistent with the Extraction Plan. Where subsidence predictions and or impacts are greater than predicted, Trigger Action Response Plans (TARPs) provide the appropriate and agreed management. The subsidence monitoring program includes monitoring for subsidence performance on built features including private dwellings, public roads, Telstra Network, Ausgrid powerlines, TransGrid 330kV towers and natural features including wetlands, creeks, steep slopes and flood path inspections.

6.7.1 Subsidence Performance Measures

The Extraction Plan for Longwall 25 to 31 operated within mining leases ML1722 and ML1744 and is approved under Development Consent SSD-5144 MOD 5. Subsidence Performance Measures are detailed in Schedule 4, Condition 1 Table 6 and Condition 4 Table 7as shown below in **Table 6-15** and **Table 6-16** respectively.

Table 6-15: SSD-5144 Subsidence Performance Measures – Natural and Heritage Features

Watercourses	
3rd Order and above streams Groundwater-dependent Ecosystems	• No connective cracking between the surface, or the base of the alluvium, and the underground workings. • No subsidence impact or environmental consequence greater than minor.
1st and 2nd Order streams	• No subsidence impact or environmental consequences greater than predicted in the documents listed in condition 2(b) of Schedule 2. • No connective cracking between the surface and the underground workings.
Aquatic and riparian ecosystems, including affected sections of Morans Creek, Wyee Creek, Tobins Creek and Mannering Creek	• Maintain or improve baseline channel stability. • Develop site-specific in-stream water quality objectives in accordance with ANZECC 2000 and *Using the ANZECC Guidelines and Water Quality Objectives in NSW* procedures (DECC 2006), or their latest versions.
Land	
Steep slopes and rock outcrops	• No subsidence impact or environmental consequence greater than predicted in the documents listed in condition 2(b) of Schedule 2.
Agriculture	• No loss of agricultural productivity greater than minor.
Biodiversity	
Threatened species, threatened populations and endangered ecological communities	• Negligible environmental consequences.
Heritage sites	
Stone Arrangement RPS TBM 32	• Negligible subsidence impacts or environmental consequences
All other Aboriginal Cultural Heritage sites/items at the site	• No subsidence impact or environmental consequence greater than predicted in the documents listed in condition 2(b) of Schedule 2.

Mine workings	
First workings under an approved Extraction Plan beneath any feature where performance measures in this table require negligible subsidence impacts or negligible environmental consequences	• To remain long-term stable and non-subsiding.
Second workings	• To be carried out only within the approved mine plan, in accordance only with an approved Extraction Plan.

Table 6-16: SSD-5144 Subsidence Performance Measures – Built Features

Key Public Infrastructure	
M1 Motorway	Always safe and serviceable.
Main Northern Railway	
330 kV power supply infrastructure	Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired.
Other Built Infrastructure	
Power lines and power poles	Always safe.
Telecommunications infrastructure	
Privately-owned residences	Serviceability should be maintained wherever practicable.
Local Roads	
Other built features and improvements, (including access roads, farm dams, swimming pools, tracks and fences)	Loss of serviceability must be fully compensated. Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.
Public Safety	
Public Safety	Negligible additional risk.

6.7.2 Subsidence Reporting

The Extraction Plans provide six-monthly reporting in accordance with the Extraction Plan Guidelines. All reports were completed at the specified timeframes as detailed in **Table 6-17**.

Table 6-17: Subsidence Reports 2019

Report	Report Period	Date Issued
Six Monthly Report Extraction Plan LW24-24A and LW25-31	1 October 2018 to 31 March 2019	April 2019
Six Monthly Report Extraction Plan LW25-31	1 April 2019 to 30 September 2019	December 2019

6.7.3 Subsidence Performance Summary

Subsidence performance was reviewed by Ditton Geotechnical Services (2019c) following the completion of Longwall 25. Subsidence over the longwall panels was measured along crosslines and monitoring installed on properties, dwellings and transmission towers as shown in **Figure 6-19**.

A significant NW-striking fault zone was identified during development of the gate roads for Longwall 25. The faulted area comprised several normal faults with throws ranging between 0.05 m to 0.5 m with poor roof and rib conditions encountered. The mine opted to relocate the longwall around the geologically disturbed area, leaving two panels with void lengths of 688 m (LW25A) and 1409 m (LW25B). The panels were separated by a 111.5 m wide barrier pillar between that contained the fault.

The subsidence predictions previously presented for Extraction Plan LW25-31 (Ditton Geotechnical Services, 2018) approval were adjusted to reflect the possible weakening effects of the faulted area on the overburden as detailed in the Extraction Plan variation for Longwall 25 (Ditton Geotechnical Services, 2019a).

Mining in Longwall 25A commenced on 10 March and completed extraction on 24 May 2019. Subsequently, Longwall 25B commenced on 13 June and completed extraction on 17 September 2019.

During the retreat of Longwall 25B, subsidence monitoring was conducted along Crossline 21 (Mandalong Rd), Crossline 22 (TL24 transmission line easement), LW25 Centreline and TransGrid Transmission Line No. 24 Towers 38X and 39X. **Figure 6-19** shows the depth of cover and subsidence monitoring lines surveyed during and after the extraction of Longwall 25B.

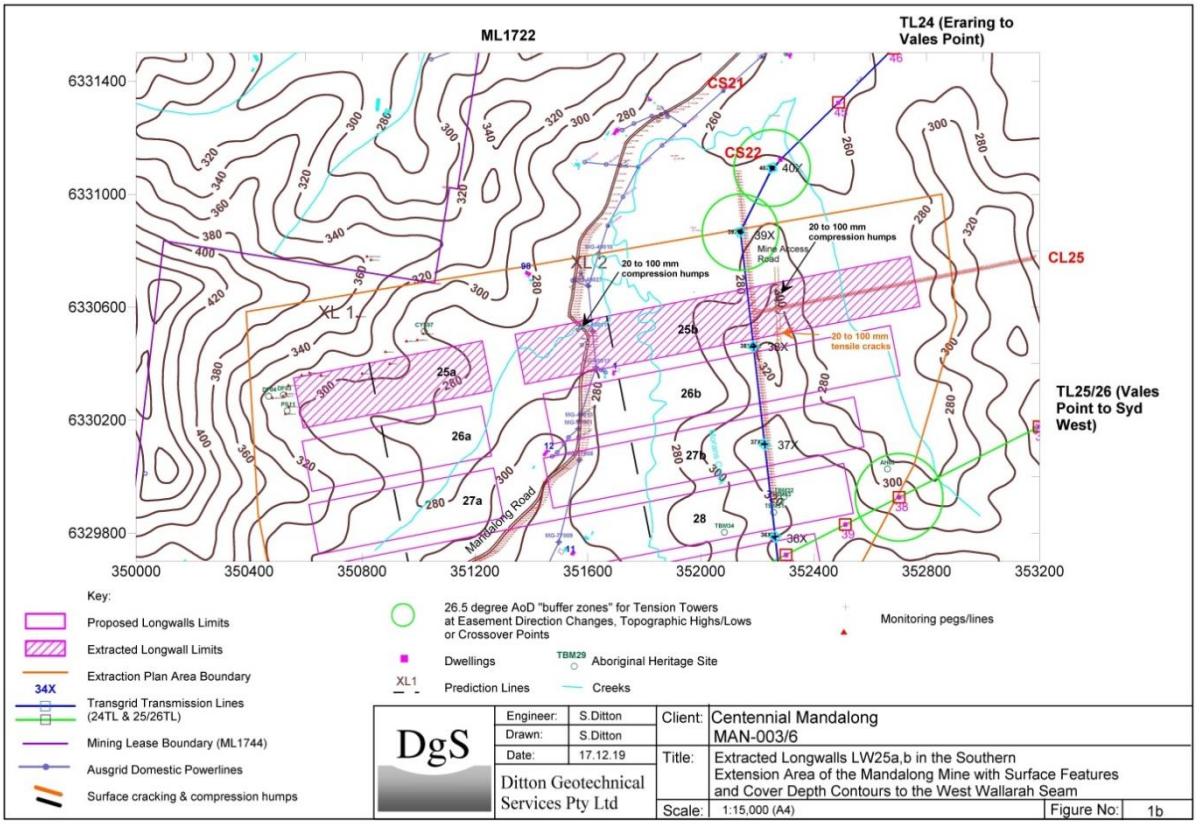


Figure 6-19: Location of Subsidence Monitoring Lines

6.7.3.1 Comparison of Results against Predicted Subsidence

The subsidence effect contour predictions for LW25 (mean & Upper 95% Confidence Level) were presented in Ditton Geotechnical Service (2019a) report for the LW25 variation. The predicted v. measured subsidence effects for the proposed modifications to LW25 are presented in **Table 6-18** and **Table 6-19**.

The predictions for the proposed panels considered the effects of geological structure by reducing previously assessed Subsidence Reduction Potential (SRP) of the overburden conglomerate units from 'High' to 'Moderate' along XL2. Based on a review of measured subsidence data above LW1 to 24A (Ditton Geotechnical Services, 2018) it was determined that it 'unlikely' that that any faulting encountered in the proposed Extraction Plan area will reduce the (SRP) to below a 'Moderate' SRP (i.e. the previously assessed SRP for XL1 above LW25A remains unchanged).

The measured subsidence values were found to be within the mean to U95%CL range except along the centreline (CL25) where subsidence was 7% higher. As all other measured effects are 'bracketed' by the predicted range it is concluded the assumed SRP (i.e. Moderate) was reasonable. It is therefore not necessary to adjust the prediction model for subsequent longwalls at this stage (Ditton Geotechnical Services, 2019c).

Table 6-18 – Summary of Measured and Predicted Subsidence above LW25B

LW#	Survey Line	Panel Width W (m)	Cover Depth H (m)	W/H	Mining Height T (m) [Assumed]	First Maximum Subsidence First S_{max} (m) [Final]		Goaf Edge Subsidence S_{goe} (m)		AoD to 20 mm Subsidence Contour (o)	
						Predicted*	Meas.^	Predicted	Meas.	Predicted	Meas.
25b	Finishing End Centreline (CL25b)	180	280	0.64	4.3 - 3.6 [4.5]	0.62 - 0.79 [0.89 - 1.05]	*0.85*	0.14 - 0.23	0.024	25 - 41	1
	Mandalong Rd Crossline (XL21)		273	0.66			0.75		0.043 - 0.080		14 - 36
	Easement Crossline (XL22)		288	0.63			0.63		0.112 - 0.120		12 - 41

Predicted values are mean to U95%CL; Meas. = Measured; *Italics* - measured effect exceeds the predicted value by <15%; **Bold** - measured effect value exceeds prediction by more than >15%.

Source: (Ditton Geotechnical Services, 2019c)

Table 6-19 – Summary of Measured and Predicted Tilts and Strains above LW25B

LW#	Survey Line	Maximum Tilt T_{max} (mm/m)		Maximum Compressive Strain $-E_{max}$ (mm/m) [Discontinuous values]*		Maximum Tensile Strain $+E_{max}$ (mm/m) [Discontinuous Values]*	
		Predicted	Meas.	Predicted	Meas.	Predicted	Meas.
25b	Finishing End Centreline (CL25b)	11 - 17	7.7	5 - 8 [10 - 16]	3.0	4 - 6 [8 - 12]	9.8 (cracking)
	Mandalong Rd Crossline (XL21)		10.6		3.5		2.7
	Easement Crossline (XL22)		8.9		4.5		2.6

Predicted values are mean to U95%CL; Meas. = Measured; *Italics* - measured effect exceeds the predicted value by <15%;
* - Predicted strains are for a surface with deep soil cover and a 'smooth' profile. Near surface rock may cause strain concentrations which are 2 x 'smooth' profile strains.

Source: (Ditton Geotechnical Services, 2019c)

Steep Slopes

There are moderately steep slopes above LW25A and LW25B ranging between 10° and 18°. Based on the subsidence effect predictions, surface cracks ranging from 20 mm to 100 mm width may occur on the slopes. Areas with slopes < 18° are also expected to have only low erosion rate increases.

Tensile cracks and compression 'humps' ranging between 20 mm and 100 mm were observed across Mandalong Road and the mine access road near the crest of a ridge. The impacts were consistent with predictions and remediated in accordance with the Built Features Management Plan.

The approved longwalls were previously assessed as 'unlikely' to cause deep seated or shallow instability on the slopes due to tilting and/or cracking impacts. The predicted post-mining surface slope gradient changes (based on U95%CL values) for the approved and variation were presented in (Ditton Geotechnical Services, 2019a). The revised longwall layout for LW25A and 25B was estimated to increase the slope gradients by +0.5° and -0.6°.

It was assessed that the changes to the previously assessed factors of safety are only slight. No slope instability has been detected on the subsided slopes to date.

Mandalong Road

The subsidence effects for Mandalong Road above Longwall 25B are summarised in **Table 6-20**.

Table 6-20 – Summary of Subsidence Predictions v Measured for Mandalong Road

LW	Final Maximum Subsidence S_{max} (m)		Final Maximum Tilt T_{max} (mm/m)		Final Maximum Tensile Strain* (mm/m)		Final Maximum Compressive Strain* (mm/m)	
	Predicted	Measured	Predicted	Measured	Predicted	Measured	Predicted	Measured
25b	0.79	0.66	17	10.6	5.0	2.7	7.0	3.5

* - Measured tensile and compressive strains may increase up to 2 times the predicted smooth profile strain occasionally due to crack development.

Source: (Ditton Geotechnical Services, 2019c)

Subsidence measurements were consistent with predicted values. A number of compression humps developed in the pavement, requiring repairs by LMCC.

TransGrid Towers

Predictions v. Measured subsidence, tilt, horizontal displacement and strain at each of the TransGrid Towers along TL25/26 Line due to LW25B are summarised in **Table 6-21**. The measured values were all with the predicted ranges with no visible impacts occurring.

Table 6-21 – Predicted v Measured Subsidence Effects at TransGrid Towers 38X and 39X

Tower No.	LW#	Final Subsidence S_{max} (m)		Maximum Tilt T_{max} (mm/m)		Maximum Displacement U_{max} (mm)		Maximum Strain E_{max} (mm/m)	
		Predicted	Measured	Predicted	Measured	Predicted	Measured	Predicted	Measured
38X	LW25b	0.59	0.13	2.8	0.2	56	52	2.9	0.3 - 1.9
39X		0.01	0.006	0.4	0.2	18	9	0.3	+/- 0.3

Source: (Ditton Geotechnical Services, 2019c)

Ausgrid 11kV Power Poles

The subsidence effect predictions v. measured values at the four (4) Ausgrid timber power poles above Longwall 25B are shown in Table 6-22. The measured values were generally less than the predicted values. There has been no observed impact to the power line network.

Table 6-22 – Predicted v Measured Subsidence Effects for Ausgrid Power Poles

Pole No.	LW No.	Final Subsidence S_{max} (m)		Final Tilt T_{max} (mm/m)		Final Ground Strain+ (mm/m)	
		Predicted	Measured	Predicted	Measured	Predicted	Measured
MG-40013	26	1.02	0.005	6.1	0.3	-2.6	-0.1 - 0.2
MG-40012	25b	0.82	0.29 - 0.39	9.8	8.4 - 10.6	1.3	-0.2 - 0.0
MG-40011	25b	0.43	0.20 - 0.15	14.8	2.7 - 0.5	3.1	0.5 - 2.7
MG-40027	>25	0.09	0.026	0	0.0 - 0.1	-0.4	0.1

+ - Tensile strains are positive.

Source: (Ditton Geotechnical Services, 2019c)

Aboriginal Heritage Sites

There are four heritage features located within the angle of draw from LW25A. The predicted subsidence impacts at each feature were based on U95%CL tilts and strains presented the subsidence predictions for the Extraction Plan LW25-31 (Ditton Geotechnical Services, 2018) and summarised in **Table 6-23**. The measured vertical subsidence was between 0.000m and +0.017m at the four sites. There were no cracking impacts at the groove sites as indicated by the predicted values.

Table 6-23 – Predicted v Measured Impacts at Aboriginal Heritage Sites

Site No	Site Type	Subsidence (m)		Horizontal Strain (mm/m)^		Cracking Damage Potential*	Tilt (mm/m)		Erosion Damage Potential*
		Pred.	Meas.	Pred.	Meas.		Pred.	Meas.	
RPS CYL07	Grinding Groove	0.10	0.00	1.6	<1	Unlikely	<1	<1	V. Unlikely
RPS DF03$	Grinding Groove	0.02	0.013	1.2	<1	Unlikely	<1	<1	Unlikely
RPS DF04$	Grinding Groove	0.01	0.017	0.4	<1	V. Unlikely	< 1	<1	V. Unlikely
RPS PS11	Grinding Groove	0.03	0.017	1.3	<1	Unlikely	1.4	<1	Unlikely

^ - Tensile strain is positive,V. Unlikely - Very Unlikely; * - see ***Table 28*** in **DgS, 2018** for Impact Potential definitions; $ - grinding grooves are located on detached or loose boulders and unlikely to be affected by cracking;

Source: (Ditton Geotechnical Services, 2019c)

Table 6-24 provides a summary of the assessment of subsidence performance against the specified subsidence performance measures and predicted impacts Extraction Plan LW25-31. As shown in the summary table, subsidence impacts were within the predicted levels for private property, surface infrastructure, natural features and heritage items.

Table 6-24: Assessment of Subsidence Performance against Performance Measures and Predicted Impacts

Feature	Subsidence Performance Measures	Predicted Subsidence Impact EP LW25-31	Assessment of Performance against Predicted Impact
Private Property			
Dwellings	*Always safe.* *Serviceability should be maintained wherever practicable.* *Loss of serviceability must be fully compensated.* *Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.*	Subsidence predictions below SSR criteria, with all dwellings remaining SSR.	***Impact as predicted*** One private dwelling was affected by subsidence from LW25B and remained SSR. Subsidence repairs to the dwellings are being managed by Centennial and SA NSW.
Flood – dwelling and access	*Dwelling floor level to remain 0.5m above post mining 100 year ARI flood level - acquisition and compensation procedure*	All dwellings freeboard remains above 100 year flood level at the maximum predicted subsidence and two times maximum	***Impact as predicted*** Maximum subsidence was consistent with prediction and flood modelling sensitivity analysis at the

Feature	Subsidence Performance Measures	Predicted Subsidence Impact EP LW25-31	Assessment of Performance against Predicted Impact
	if subsided floor level is below flood level.	predicted subsidence.	dwelling locations.
Agriculture	*No loss of agricultural productivity greater than minor.*	No loss of land use to State Forest or agricultural productivity to private property (hobby farms) and Centennial properties.	***Impact as predicted*** No reported or observed impact to land use. Temporary remnant ponding repaired in consultation with landowner.
Infrastructure			
Local Roads and Access	*Always safe.* *Serviceability should be maintained wherever practicable.* *Loss of serviceability must be fully compensated.* *Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.* Public Roads Management Plan LW25-31	Low level of damage predicted Mandalong Rd. To remain safe, serviceable and repairable. No change to flood hazard.	***Impact as predicted*** Subsidence impacts consistent with prediction. Two compression humps and a number of tension cracks developed on Mandalong Rd. pavement over LW25B. Temporary repairs were completed by LMCC. The compression humps were removed and a asphalt replaced on a section of the pavement. Final repairs to be untaken when subsidence is completed over LW26B.
Electricity Transmission Lines (330kV)	*Always safe and serviceable.* *Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired*. Transmission Line Management Plan LW25-31 for TL24 Towers 33X to 38X.	No impact to serviceability of transmission lines. A section of TL24 was relocated and new towers constructed from 33X to 40X. Concrete cruciform footings constructed on towers 33X to 38X.	***Impact as predicted*** No observed or reported damage to transmission line TL24 towers 38X and 39X. Vertical subsidence, tilts and strains were with prediction on both towers.
Powerlines (11kV)	*Always safe and serviceable.* *Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired* Powerline Management Plan LW25-31	No impact to serviceability of powerlines. Mitigation measures were installed by Ausgrid on powerlines prior to development of subsidence.	***Impact as predicted*** No observed impact to powerlines affected by LW25B. No interruption to service detected or reported.
Communications	Telstra Management Plan	Low impact. No disruption to copper cable network.	***Impact as predicted*** Subsidence monitoring

Feature	Subsidence Performance Measures	Predicted Subsidence Impact EP LW25-31	Assessment of Performance against Predicted Impact
			confirmed subsidence consistent with predicted maximum values (strains). No interruption to service detected or reported.
Natural Features			
Biodiversity	*Negligible environmental consequences to threatened species, threatened populations and endangered ecological communities*	Negligible environmental consequences.	***Impact as predicted*** There has been no measured or reported impact to threatened flora and fauna affected by LW25A and LW25B subsidence.
Floodplain	Floodplain inspection and monitoring	Minimal changes to creek channel flows or alignment. Predicted no surface cracking on floodplain.	***Impact as predicted*** Minimal changes to creek channel grades resulting in a negligible change to stream flows. No mining induced erosion or deterioration in stream bank condition. No subsidence related soil cracking was observed in report period in areas with higher depth of cover or alluvial flood plain area above LW1 to LW25.
Remnant Ponding	Flood Modelling	Minor increase to existing ponding predicted over LW25 to LW31.	***Impact as predicted*** No remnant ponding observed over LW25A and LW25B to date or at Observations Points 'A' and 'B'. Remediation of remnant ponding on private properties located over LW23 to LW24A have been completed or currently in progress.
Groundwater	Groundwater Monitoring and Management Plan	Predicted no adverse subsidence related impacts on alluvium groundwater levels and water quality.	***Impact as predicted*** The monitoring data indicates that there is no adverse impact on groundwater levels in the alluvial aquifers.
Steep Slopes and rock outcrops	*No subsidence impact or environmental consequence greater than predicted in the documents listed in SSD-5144 Condition 2(b) of Schedule 2.*	No additional risk to public safety. No cliffs or potential for rock fall hazards exist. Possible opening of rock joints.	***Impact as predicted*** No observed impact to steep slopes or evidence of rock falls or rollout. Minor opening of rock joints and surface cracking (50mm)

Feature	Subsidence Performance Measures	Predicted Subsidence Impact EP LW25-31	Assessment of Performance against Predicted Impact
	Public Safety Management Plan LW25-31 Public Safety Management Plan LW25-31		was observed over LW25B.
Heritage			
Heritage and Archaeology	*No subsidence impact or environmental consequence greater than predicted in the documents listed in SSD-5144 Condition 2(b) of Schedule 2.*	No impact to the Aboriginal cultural heritage sites identified within EP LW25-31. Four grinding groves located within LW25A angle of draw.	***Impact as predicted*** Subsidence within prediction at sites and no impact to heritage items observed during post-mining inspections. A final post mining inspection will be completed in mid 2020.

6.8 AGRICULTURAL LAND SUITABILITY

This section details the assessment of changes to agricultural land suitability resulting from the mining operations, including cumulative changes, at the Mandalong Site as required by DA97/800 condition 105(iv).

6.8.1 Agricultural Suitability Classification

The agricultural suitability and land capability of the Mandalong area was classified in the Environmental Impact Statement titled *"Cooranbong Colliery Life Extension Project"* (Umwelt, 1997). As stated in the EIS the land areas range from fairly level country in which the majority of the areas have been cleared, to steep heavily timbered country which is not capable of sustaining economically viable agricultural operations. Agricultural land suitability classification is mapped using the definitions in the Department of Urban Affairs and Planning *"Rural Land Evaluation Manual",* which classifies land into five different classes, based on the potential productivity of the land in the relevant social and economic context. The agricultural suitability system classifies land in terms of suitability for general agricultural use, including both cropping and pastoral purposes.

The Agricultural Suitability of the land in the Mandalong area was assessed in the EIS (Umwelt, 1997) to range from class 3 to 5. The majority of the level land at Mandalong has an Agricultural Suitability of 3, suited to grazing and limited cultivation in rotation pasture. The timbered area on level ground and timbered areas on sloping foothills were classified in the EIS with an Agricultural Suitability of 4 and 5 respectively. Agricultural Suitability with a classification of 4 is not suitable for cultivation but is suitable for grazing. These areas tend to be prone to water logging and production of these areas is constrained by the land size. Timbered land with an Agricultural Suitability of 5 in the Mandalong area is not suitable for agricultural production due to major constraints by native vegetation regulation and the costs associated with improving this land to a productive level.

To update information in the EIS (Umwelt, 1997) 19 agricultural assessments have been completed on properties during the development of Private Property Subsidence Management Plans (PSMP's). In 2009 an additional five agricultural surveys were undertaken on private properties located above longwall panels 11 to 14 for PSMP's. No further agricultural assessments were required in 2019.

The agricultural assessments completed in 2009 concurred with the agricultural suitability classes described in the EIS. Monitoring has confirmed that Longwalls 1 to 24 are stable. Tilts and strains have also remained unchanged over these 24 longwall panels. Agricultural assessments for the properties above these panels are unchanged from previous Annual Reviews and as such are removed from **Table 6-25**. The properties situated above the current zone of subsidence in 2018 above Longwall 23-24A are highlighted in **Table 6-25** and have an agricultural classification ranging from three to five as defined above.

Table 6-25: Agricultural Suitability Classification and Land Use

Property Reference (Number)	Agricultural Suitability Class 3	Agricultural Suitability Class 4	Agricultural Suitability Class 5	Current Agricultural Land use
73	**x**	**x**	**x**	Biodynamic farming is practiced on the property including a small orchard.
80		**x**	**x**	
86	**x**			Farm - cattle, horses, pigs, emus, goats, lamas, alpacas.
203		**x**	**x**	Farm - cattle, horses, pigs, emus, goats, lamas, alpacas.
87	**x**	**x**		Farm - cattle, horses, pigs, emus, goats, lamas, alpacas.
88	**x**			Farm - cattle, horses, pigs, emus, goats, lamas, alpacas.
90	**x**			Cattle
221	**x**			
220	**x**			Horses
207	**x**			Horses
212	**x**	**x**		Farm - cattle, horses, pigs, emus, goats, lamas, alpacas
219	**x**	**x**		
Centennial 222	**x**		**x**	
213	**x**			Agistment
205			**x**	Horses
218	**x**			Orchards
223	**x**			Orchards

6.8.2 Assessment of Agricultural Suitability

Since commencing longwall mining operations, Mandalong Mine has fully extracted Longwalls 1 to 26. No additional subsidence was recorded above Longwalls 1 to 24. As such the agricultural suitability following mining is as reported in previous Annual Reviews. 17 properties were influenced by subsidence movements on Longwalls 23 to 24A. Of these 17 as highlighted in **Table 6-25**, 13 currently use land for agricultural purposes and typically

have agricultural land suitability of class 3 or 4. The predominant land use on these properties is recreational/lifestyle, horse breeding and agistment and cattle/horse grazing.

6.8.3 Agricultural Suitability Impact Assessment

Vertical subsidence levels over Longwalls 23 to 24A were generally between the maximum and up to 1.5 times the predicted maximum at a number of locations. The distribution of subsidence above Longwalls 23 to 24A indicates subsidence on the floodplain, where the majority of pasture areas are found, typically ranges up to 1.2 m. There is little evidence that these relatively low levels of subsidence have impacted on pasture condition.

A number of private and Centennial owned properties as described in **Table 6-25** were noted as undertaking cattle and horse enterprises. Inspections of these properties were undertaken during surveys to assess the level of subsidence related changes. No significant changes to stock levels were reported as a result of subsidence following the extraction of longwall panels in 2019.

Remnant ponding locations have been identified by Hunter Eco and Centennial Mandalong as per the predictions in the flood modelling assessments, most of which were in open grassland and have since been drained and restored by Centennial Mandalong. **Table 6-26** provides a description of each ponding instance and what if any remediation was undertaken.

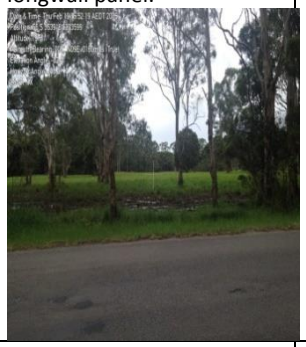
Table 6-26: Details of Ponding & Remedial Action

Remnant Ponding Remediation							
Location	**Description**	**Remediation**	**Remediation Comments**	**Ponding Predicted**	**Subsidence Completed**	**Status**	**Property Ref. Lot & DP**
Longwall 1 (P1)	Open grassland	No remediation required.	Negotiations with landowner finalised.	No	Yes	Completed	Ref. 6 2/557230
Longwall 2 (P2)	Open grassland	Drained	Constructed open drain and connected to nearby water course.	Yes	Yes	Completed	Ref. 7, 8 1/557230 3/557230

Remnant Ponding Remediation							
Location	**Description**	**Remediation**	**Remediation Comments**	**Ponding Predicted**	**Subsidence Completed**	**Status**	**Property Ref. Lot & DP**
Longwall 3 (P3)	Open grassland	Drained	Constructed open drain and connected to nearby water course.	Yes	Yes	Completed	Ref. 7 1/557230
Longwall 4 (P4)	Open grassland	Allowed to remain as a source of water for stock.		Yes	Yes	Completed	Ref. 7, 59 1//557230 580/733227
Longwall 5 (P5)	Open grassland	Drained	Constructed open drain and connected to nearby water course. Fenced to restrict stock access causing erosion.	No	Yes	Completed	Ref. 59 580/733227

Remnant Ponding Remediation							
Location	**Description**	**Remediation**	**Remediation Comments**	**Ponding Predicted**	**Subsidence Completed**	**Status**	**Property Ref. Lot & DP**
Longwall 6 (P6)	Open grassland	Drained	Installed sub-surface drainage and drainage to Stockton Creek.	Yes	Yes	Completed	Ref. 56 12/582283
Longwall 6 (P6A)	Open grassland	Drained	Improved existing open drainage to ponded area.	No	Yes	Completed	Ref. 61 903/542306
Longwall 7 (P7)	Open grassland fringed with Cabbage Gums and *Melaleuca biconvexa*.	Drained	Open drain constructed and connected to nearby water course. Drainage designed to allow access across by farm machinery and stock.	Yes	Yes	Completed	Ref. 56 12//582283
Longwall 7 (P7A)	Open grassland	Allowed to remain as extension of existing dam.	Extension of existing dam	Yes	Yes	Completed	Ref. 55 11/582283
Longwall 7 (P7B)	Open grassland		Regrade natural drainage line and open drain.	No	Yes	Completed	Ref. 52 93/9632

Remnant Ponding Remediation							
Location	**Description**	**Remediation**	**Remediation Comments**	**Ponding Predicted**	**Subsidence Completed**	**Status**	**Property Ref. Lot & DP**
Longwall 8 (P8)	Expansion of an already wet area having scattered Swamp Mahogany and *Melaleuca biconvexa*.	Remain as expansion of existing freshwater wetland and fenced. Included in Wetland Monitoring Program as Wetland 9.	Following a period of monitoring and limited options for drainage, a decision was made to fence the wetland to protect from stock and allow to develop as a freshwater wetland. 	Yes	Yes	Completed	Ref. 55 11/582283
Longwall 8 (P8A)	Open grassland and *Melaleuca biconvexa* Existing wetland	Expansion of existing Wetland 8.	To remain as a wetland.	No	Yes	Completed	Ref.42 25/755238
Longwall 9 (P9)	Mixed Cabbage Gum and paperbark forest.	Remain as extension of existing freshwater wetland.	Several threatened *Melaleuca biconvexa* paperbarks are present and remediation would involve losses of these through gaining access by machinery. Consequently remediation was not undertaken.	Yes	Yes	Completed	Ref. 57 180/859434
Longwall 10 (P10)	Mixed Cabbage Gum and paperbark forest.	Remain as freshwater wetland.	Several threatened paperbarks *Melaleuca biconvexa* are present and remediation would involve losses of these through gaining access by machinery. Consequently remediation was not undertaken.	No	Yes	Completed	Ref. 57 180/859434

Remnant Ponding Remediation							
Location	**Description**	**Remediation**	**Remediation Comments**	**Ponding Predicted**	**Subsidence Completed**	**Status**	**Property Ref. Lot & DP**
Longwall 11 (P11)	Mixed paperbark woodland in an already periodically inundated area. Contains threatened *Melaleuca biconvexa* paperbarks. Ponding has extended an existing wetland.	Remain as freshwater wetland	To remain as a freshwater wetland.	Yes	Yes	Completed	Ref. 44 9/800491
Longwall 13 (P13)	Open grassland and Redgum Rough-barked Apple Forest	Minor increase in low lying area. No permanent ponding.	Existing ponding has been moved towards centre of longwall panel. 	No	Yes	Completed	Ref. 44 , 50 9/800491 10/800491
Longwall 13 (P13A)	Open grassland	Minor increase in low lying area. No permanent ponding.	No impact on grazing area.	Yes	Yes	Completed	Ref. 26 10/650914
Longwall 15 (P15)	Alluvial Tall Moist Forest and Redgum Rough-barked Apple Forest.	No remediation required.	No increase to existing ponding evident.	Yes	Yes	Completed	Ref. 67, 69 16//813385 61/755238

Remnant Ponding Remediation							
Location	**Description**	**Remediation**	**Remediation Comments**	**Ponding Predicted**	**Subsidence Completed**	**Status**	**Property Ref. Lot & DP**
Longwall 16 (P16)	Redgum Rough-barked Apple Forest and Coastal Foothill Spotted Gum-Ironbark Forest.	Increase in existing ponded area remediated to pre-mining condition. Minimal impact on flora	Constructed open drain and connected to nearby water course to return existing ponding to pre-mining levels. Quarterly ecology monitoring program completed. 	Yes	Yes	Completed	Ref. 69 61/755238
Longwall 16 (P16A)	Open grassland	Filled and drain installed to restore drainage due to increase in depth and extent of ponding.		Yes	Yes	Completed	Ref.33 861/835160
Longwall 17 (P17)	Freshwater Wetland Complex EEC and Redgum Rough-barked Apple Forest EEC	No remediation required.	Marginal increase in extent and depth of wetland as predicted. No predicted long-term impact on wetland. Wetland 4 & 5 in Wetland Management Plan – property sole and monitoring finished 	Yes	Yes	Completed	Ref. 68 22/812406

Remnant Ponding Remediation							
Location	**Description**	**Remediation**	**Remediation Comments**	**Ponding Predicted**	**Subsidence Completed**	**Status**	**Property Ref. Lot & DP**
Longwall 17 (P17A)	Open grassland and Redgum Rough-barked Apple Forest EEC	Installed open drain and pipes to reduce slight increase in area and depth of existing ponding.		Yes	Yes	Completed	Ref. 70 54/755238
Longwall 18 (P18)	Freshwater Wetland Complex EEC and Redgum Rough-barked Apple Forest EEC	No remediation required.	Marginal increase in extent and depth of wetland predicted. No predicted long-term impact on wetland. Wetland 4 & 5 in Wetland Management Plan. Property sold and monitoring finished	Yes	Yes	Completed	Ref. 68 22/812406
Longwall 18 (P18A)	Open grassland	Filled ponded area to restore pasture.		No	Yes	Completed	Ref. 70 54/755238
Longwall 18 (P18B)	Prickly Ridge Forest Road Hunter Valley Moist Forest Open grassland	Upgraded road and installed additional drainage lines.	Increase in length and depth of ponding along Prickly Ridge Forest Road was remediated and road upgraded as agreed by Forest Corporation NSW. 	Yes	Yes	Completed	Ref. 71, 37 45/1159229 46/755238
Longwall 18 (P18C)	Access road and open grassland	Raise access road, install pipes and regrade existing drain.		Yes	Yes	Completed	Ref. 70 54/755238
Longwall 18 (P18D)	Open grassland	Construct drain from dam overflow to the existing drain and regrade.		Yes	Yes	Completed	Ref. 70 54/755238

Remnant Ponding Remediation							
Location	**Description**	**Remediation**	**Remediation Comments**	**Ponding Predicted**	**Subsidence Completed**	**Status**	**Property Ref. Lot & DP**
Longwall 18 (P18E)	Open grassland	Constructed dam at location of existing ponding site. Overflow constructed with open drain and pipes to creek.		Yes	Yes	Completed	Ref. 70 54/755238
Longwall 18 (P18F)	Open grassland	Filled minor ponding with top soil.		No	Yes	Completed	Ref. 77 1/1063659
Longwall 19 (P19)	Farm dam and open grassland	No ponding occurred.	No ponding occurred due to LW18 and LW19 being shortened to protect property improvements.	Yes	No	Completed	Ref. 82 1/957458
Longwall 19 (P19A)	Open grassland and access road	Installed drainage to creek and upgraded access road.	Ponding against and along access road was remediated with sub-surface drainage. Upgraded access road.	No	Yes	Completed	Ref. 82 1/957458
Longwall 19 (P19B)	Open grassland and dam	No remediation required to minor increase in existing ponding near dam.		No	Yes	Completed	Ref. 82 1/957458
Longwall 19 (P19C)	Open grassland	Regraded existing drain to remove remnant ponding in paddock.		No	Yes	Completed	Ref. 70 54/755238

Remnant Ponding Remediation							
Location	**Description**	**Remediation**	**Remediation Comments**	**Ponding Predicted**	**Subsidence Completed**	**Status**	**Property Ref. Lot & DP**
Longwall 20 (P20)	Open grassland	Installed four pipes at existing ponding site and minor regrading of existing drainage line. Replace open drain with 350mm diameter pipes.		Yes	Yes	Completed	Ref. 82 1/957458
Longwall 21 (P21)	Open grassland and dam	Ponding did not occur. Constructed swale drain to restore dam catchment. Modify dam inlet and cleaned out sediment from dam.	Topography of dam catchment near centre of longwall affected. Constructed open drain to restore catchment 	Yes	Yes	Completed	Ref. 74 76/755238
Longwall 22 (P22)	Observation Point F Open grassland near creek	No evidence of ponding.	Photographic monitoring points established on chain pillars and centre of Longwall 22 and 23.	Yes	Yes	Completed	Ref. 73 93/755238
Longwall 22 (P22A)	Observation Point 'G' and 'N' Open grassland		Predicted increase in existing ponding.	Yes	Yes	Monitoring	Ref. 85 4/957458
Longwall 22 (P22B)	Observation Point 'O' Channel and floodplain		Predicted increase in existing ponding.	Yes	Yes	Monitoring	Ref. 89 41/755238
Longwall 22 (P22C)	Open grassland and dam	Fill and construct drainage line to restore paddocks.	Construct table drain and fill low lying areas to provide access. Fill and construct access along boundary fence. 				

Remnant Ponding Remediation							
Location	**Description**	**Remediation**	**Remediation Comments**	**Ponding Predicted**	**Subsidence Completed**	**Status**	**Property Ref. Lot & DP**
Longwall 23 (P23)	Observation Point E Dam	Construct new drainage system, fill areas, adjust dam overflow and upgrade pipe under access road	Increase in ponding between dam and raised access road. 	Yes	Yes	Completed	Ref. 90 11/869483
Longwall 23 (P23A)	Paddock	Filled ponded area with topsoil		No	No	Completed	Ref. 220 3/168774
Longwall 23 (P23B)	Road reserve and driveway	Constructed new drainage lines, upgrade property access and filled ponded areas with topsoil.	Ponding along road reserve and property access road. 	No	Yes	Completed	Ref. 212 3/3039
Longwall 24 (P24)	Observation Point 'K' Trotting track	Constructed new drainage system around track and resurface affected sections. Upgrade dams and catchment.	Affected existing drainage around entire trotting track. Affected dams and catchment 	Yes	Yes	Completed	Ref. 213 2/755238
Longwall 24 (P24A)	Observation Point L Open grassland and dam	Reinstate dam overflow, fill areas, install new drainage lines and upgrade access road.	Increase in ponding on floodplain and dam. 	Yes	Yes	Completed	Ref. 219 4/168774

Remnant Ponding Remediation							
Location	**Description**	**Remediation**	**Remediation Comments**	**Ponding Predicted**	**Subsidence Completed**	**Status**	**Property Ref. Lot & DP**
Longwall 24 (P24B)	Observation Point 'M' Morans Creek		Potential increase in ponding along drainage line near Chapman Rd.	Yes	No	Monitoring	Ref. 218 17/755238
Longwall 24 (P24C)	Paddock and drainage line.	Partially filled ponded area and minor adjustment to existing drain grades.	Increased ponding in paddock adjacent Mandalong Rd. 	Yes	Yes	Monitoring	Ref. 220 3/168774
Longwall 24A P24AA	Dam	Raised dam overflow point to restore capacity. Constructed new dam and upgrade access track.	Tilted dam and reduced capacity.	Yes	Yes	Completed	Ref. 212 3/3039
Longwall 24A P24AB	Trotting Track	Constructed new drainage system and restored dams and catchment.	Alteration of drainage system around track. Loss of catchment to horse swimming dam.	Yes	Yes	Completed	Ref. 213 7/755238
Longwall 24A (P24AC)	Dam	Dam resealed.	Opening of sandstone joints in the base of the dam.	No	Yes	Completed	Ref. 214 198/727714
Longwall 24A (P24AD)	Open grassland and access road.		Ponding and poor drainage at property access road, parking area and garage. Detail survey and design completed for landowner review.	No	Yes	In progress	Ref. 223 17/755238
Longwall 25A	Drainage line Observation Point A		Potential remnant ponding identified in flood model.	Yes	No	Monitoring	Ref. MS0050 79/755238
Longwall 25B	Drainage line Observation Point B		Potential remnant ponding identified in flood model.	Yes	No	Monitoring	Ref. MS0019 179/755238

6.9 FLOODPATH MONITORING

The condition of flood paths and stream channels are discussed in the Mandalong Mine "*Floodpath Condition Report 2019*" (Centennial Mandalong, 2020) in **Appendix 2**. DA97/800 and the LW22-23, LW24-24A and LW25-31 Extraction Plan – Water Management Plans require the condition of major flood paths be inspected every six months or following a flood event. This Floodpath Condition Report for 2019 has been developed to compile survey and photographic records of subsidence induced changes to Morans Creek Tobins Creek and Byrons Gully as per the assessment methodology in **Appendix 2**.

Appendix 2 assesses the changes to the condition of flood paths along stream reaches undermined by Longwalls 25 to 31 in 2019 and previously subsided Longwall 23, 24 and 24A in 2018 and longwall panels 15 to 22, identifying the effects of subsidence on the flood paths. The pre-mining condition of the flood paths above longwall panels 25 to 31 is also documented in this report.

On the basis of the information obtained from field surveys, the pre mining characteristics of Morans Creek and Tobins Creek can be described as having a generally poorly defined channel system, in which creek lines give way to undefined overland flow paths in several areas. The levels of predicted subsidence and associated grade changes along Morans Creek and Tobins Creek over Longwalls 23, 24 and 24A and also Byrons Gully over LW25 to 31 are of a similar order of magnitude to the existing creek bed slopes. The levels of predicted subsidence along Morans Creek and Tobins Creek are relatively small over Longwalls 23, 24 and 24A and LW25 to 31 and it is therefore considered that these will not significantly alter the flow conveyance capacity of the existing channels. The associated impacts on the maximum flood depths and flood hazards that have been modelled are not considered to be significant.

7 WATER MANAGEMENT

7.1 WATER EXTRACTION

Mandalong Mine holds a water access licence (WAL39767) permitting the extraction of groundwater from the coal measures encountered during the process of mining. This water access licence permits the Mine to dewater the underground coal measures via a submersible dewatering pump located at Cooranbong. The WAL entitles the Mine to extract 1825 ML of groundwater annually for the period 1 July to 30 June from North Coast Fractured and Porous Rock Groundwater Sources. This mine water is subsequently discharged at LDP001.

Mandalong Mine extracted a total volume of 708ML of ground water during the annual period 1 July 2018 to 30 June 2019. There are no other conditions on the Water Access Licence.

The passive take inflow (groundwater make) for the 2019 report period was calculated to be 155ML (GHD, 2020a) which is a decrease on the 334ML for 2018 report period (GHD, 2019a).

An average of the passive take inflow volume for 2019 and 2020 water balance report periods will be used as an estimate for the water access licence period. The estimated passive take volume for the water access licence annual period is 244.5ML.

Table 7-1: Water Take

License #	Water Sharing Plan, source and management zone (as applicable)	Entitlement	Passive take / inflows	Active pumping	TOTAL (1 July to 30 June).
WAL39767	North Coast Fractured and Porous Rock Groundwater Sources	1825 ML	244.5 ML	708 ML	463.5 ML

7.2 SURFACE WATER MONITORING

7.2.1 Mandalong & Cooranbong Entry Site

There is an established surface water quality monitoring program for the Mandalong catchment conducted since periodic sampling commenced in 1996, with the program established on a regular frequency since August 1999. Three surface water monitoring points (SW13-15) above licenced discharge points LDP001 and LDP002 at the Cooranbong Entry Site and two monitoring points (SW16-17) in the receiving waters below the LDP's were added in late 2011. The monitoring locations are shown on **Plan MG10722b**, **Plan MG10502**, **Plan MG10722d, and Plan MG10722f** and are summarised below in **Table 7-3.**

7.2.2 Surface Water Discharge

Mandalong Mine currently holds EPL 365, with water licensed to be discharged from the CES, MMAS and MSSS through the following LDPs:

- LDP001 – Located at the CES and discharges into an unnamed tributary of Muddy Lake.
- LDP002 – Located at the CES 5 ML Dam and discharges into an unnamed tributary of Muddy Lake.
- LDP003 – Located at the MMAS Sediment Dam.
- LDP004 – Located at the MSSS Sediment Dam.

LDP003 and LDP004 were added to EPL365 in October 2018.

Water volume discharged off site is measured through licence discharge points (LDPs). Environmental Protection Licence 365 limits the maximum volume of water to be discharged at LDP001 to 5000 Kilolitres per day (note: condition L3.2 of EPL365 permits the volume limit to be exceeded if a rainfall event greater than 10 mm occurred in the prior 24 hours).

The following water quality parameters pH, Total Suspended Solids (TSS mg/L), Electrical Conductivity (EC µs/cm) and Oil and Grease (mg/L) are monitored at Licenced Discharge Point LDP001, LDP003 and LDP004 daily during discharge and LDP002 is monitored weekly during discharge in accordance with the requirements of Environmental Protection Licence 365.

An EPL365 water quality limit criterion for LDP001, LDP002, LDP003 and LDP004 is provided in **Table 7-2.**

Table 7-2 LDP Limit Criteria

Pollutant	Units of measure	100 percentile limit
Oil & Grease	mg/L	10
pH	pH	6.5-8.5
Total Suspended Solids	mg/L	50

7.2.3 Cooranbong Haul Road

The Cooranbong Haul Road crosses three ephemeral creeks in the Lords Creek sub-catchment. Six sediment basins have been constructed along the haul road to contain dirty water runoff. Monitoring of the water quality in the haul road sediment control dams was undertaken in 2019 to assess the effectiveness of water treatment prior to controlled releases.

7.2.4 Surface Water Monitoring Results

Surface water quality is monitored at 23 locations on a monthly or quarterly basis. These locations encompass four different catchment areas. The water is tested for pH, Total Suspended Solids (TSS) and Electrical Conductivity (EC). The annual average and long-term average (LTA) results are summarised in **Table 7-4**.

Table 7-3: Summary of Monitoring Locations with Respect to Position within the Catchments

Location Reference	Creek Sub-catchment
SW008	Upper Stockton Creek
SW004	Mid Stockton Creek
SW012	Lower Stockton Creek
SW011	Upper Morans Creek
SW003	Mid Morans Creek
SW006	Lower Morans Creek
SW002	At confluence of Morans Creek and Stockton Creek
SW001	Downstream confluence on Stockton Creek
SW009	South Pourmalong Creek
SW010	North Pourmalong Creek
SW018	Mandalong Mine Site
SWMP01	Mannering Creek within Olney State Forest
SWMP02	Mannering Creek at Hue Hue Road
SWMP03	Wyee Creek at Wyee Farms Road
SWMP04	Wyee Creek at Wyee Farms Road Bridge
SWMP05	Wyee Creek at junction of Schofield Road and Manhire Road
SWMP06	Morans Creek at Mandalong Road
SWMP07	Upper catchment of Morans Creek
SW13	Muddy Lake (Unnamed tributary upstream LDP001).
SW14	Muddy Lake (Unnamed tributary upstream LDP002).
SW15	Muddy Lake (Unnamed tributary upstream LDP002).
SW16	Muddy Lake (Unnamed water body 1km downstream Simpson Rd Causeway Crossing)
SW17	Muddy Lake (North Dora Creek Village)

Table 7-4: Average Surface Water Quality for the 12 month Period from January 2019 to December 2019 ('Annual') and the Long-term Average ('LTA').

Site Location	Catchment	pH		TSS		Specific Conductance uS/cm	
		Average	LTA	Average	LTA	Average	LTA
SW008	Stockton	6.7	6.2	24.0	29.4	891.0	859.3
SW004		6.7	6.7	14.3	18.4	373.0	729.0
SW012		6.3	6.1	61.5	32.1	592.5	1110.1
SW018			7.3		40.1		566.8
SW011	Moran's		6.6		50.4		559.6
SW006		6.4	6.5	77.5	20.0	363.0	512.8
SW003		6.4	6.4	165.3	20.3	363.0	475.5
SWMP06		6.3	6.5	33.5	50.9	265.0	642.5
SWMP07		6.2	6.7	47.0	11.6	342.5	527.0
SW002	Stockton and Moran's Creek (Confluence)	6.6	6.9	14.0	14.4	21121.8	14942.6
SW001		7.3	7.1	24.8	12.7	42400.0	30270.0
SW009	Pourmalong	6.6	6.4	18.8	17.5	239.3	297.4
SW010		7.5	6.1	45.0	31.0	801.0	482.1
SWMP01	Mannering Creek	6.3	6.7	11.5	5.5	407.5	407.5
SWMP02		6.4	6.6	15.5	12.8	302.0	454.7
SWMP03	Wyee Creek	6.5	6.6	20.0	13.0	345.5	404.7
SWMP04		6.6	6.7	25.0	14.0	442.3	637.3
SWMP05		6.6	6.6	19.0	27.1	306.8	495.0
SW013	Muddy Lake	7.7	6.7	4.5	9.1	3280.0	3314.0
SW014		6.8	6.9	27.6	16.1	1141.0	748.7
SW015		5.4	5.6	293.4	113.3	61.4	80.8
SW016		8.5	8.3	144.1	651.9	3276.0	3264.1
SW017		8.6	8.3	30.4	14.9	3201.7	3228.4

7.2.4.1 Surface Water Discharge Monitoring

The maximum daily volume discharged from LDP001 was 2616kL. There was no exceedance of the discharge volume limit of 5000kL per day. The total volume of water discharged from LDP001 for the report period was 629ML. The average daily discharge volume was 1724kL.

Table 7-5: LDP001 Discharge Volume

Frequency	No. of measurements made	Lowest result (kL)	Mean result (kL)	High result (kL)
Daily during any discharge	365	0	1724	2616

There were no exceedances of the water quality limits at LDP001 for the report period. During the report period three hundred and forty five LDP001 samples were analysed. The maximum recording for oil and grease was 6mg/L, total suspended solids was 20mg/L and pH ranged from 7.44 to 8.15. The average annual results at LDP001 are summarised in **Table 7-6**.

Table 7-6: Water Quality LDP001

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of samples	Highest sample value
Oil & Grease	milligrams per litre	333	345	0	0.08	6
pH	pH	333	345	7.44	7.76	8.15
Total suspended solids	milligrams per litre	333	345	0	2.07	20

There were no exceedances of the water quality limits at LDP002 for the report period. During the report period four LDP002 samples were analysed. The maximum recording for oil and grease was 0mg/L, total suspended solids was 34mg/L and pH ranged from 6.69 to 7.07. The average annual results at LDP002 are summarised in **Table 7-7.**

Table 7-7: Water Quality LDP002

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of samples	Highest sample value
Oil & Grease	milligrams per litre	4	4	0	0	0
pH	pH	4	4	6.69	6.86	7.07
Total suspended solids	milligrams per litre	4	4	7	16.2	34

There were no exceedances of oil and grease and pH limits at LDP003 for the reporting period. There were two exceedances of total suspended solid limit criteria at LDP003. During the reporting period three LDP003 samples were analysed. The maximum recording for oil and grease was 5mg/L, total suspended solids was 153mg/L and pH ranged from 6.73 to 7.21. The average annual results at LDP003 are summarised in **Table 7-8**. The details of the non compliances are provided in **Section 11.**

Table 7-8: Water Quality LDP003

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of samples	Highest sample value
Oil & Grease	milligrams per litre	3	3	0	3.33	5
pH	pH	3	3	6.73	6.97	7.21
Total suspended solids	milligrams per litre	3	3	47	89	153

There were no exceedances of the water quality limits at LDP004 for the reporting period. During the reporting period three LDP004 samples were analysed. The maximum recording for oil and grease was 0mg/L, total suspended solids was 27mg/L and pH ranged from 7.04 to 8.08. The average annual results at LDP004 are summarised in **Table 7-9.**

Table 7-9: Water Quality LDP004

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of samples	Highest sample value
Oil & Grease	milligrams per litre	3	3	0	0	0
pH	pH	3	3	7.04	7.68	8.08
Total suspended solids	milligrams per litre	3	3	0	11.3	27

Table 7-10 LDP Annual Average and Long Term Average

Site Location	pH		TSS		Oil Grease	
	Average	LTA	Average	LTA	Average	LTA
LDP001	7.76	7.85	2.07	2.12	0.08	0.14
LDP002	6.86	6.9	16.2	26.1	0	0
LDP003	6.97	na	89	na	3.33	na
LDP004	7.68	na	11.33	na	0	na

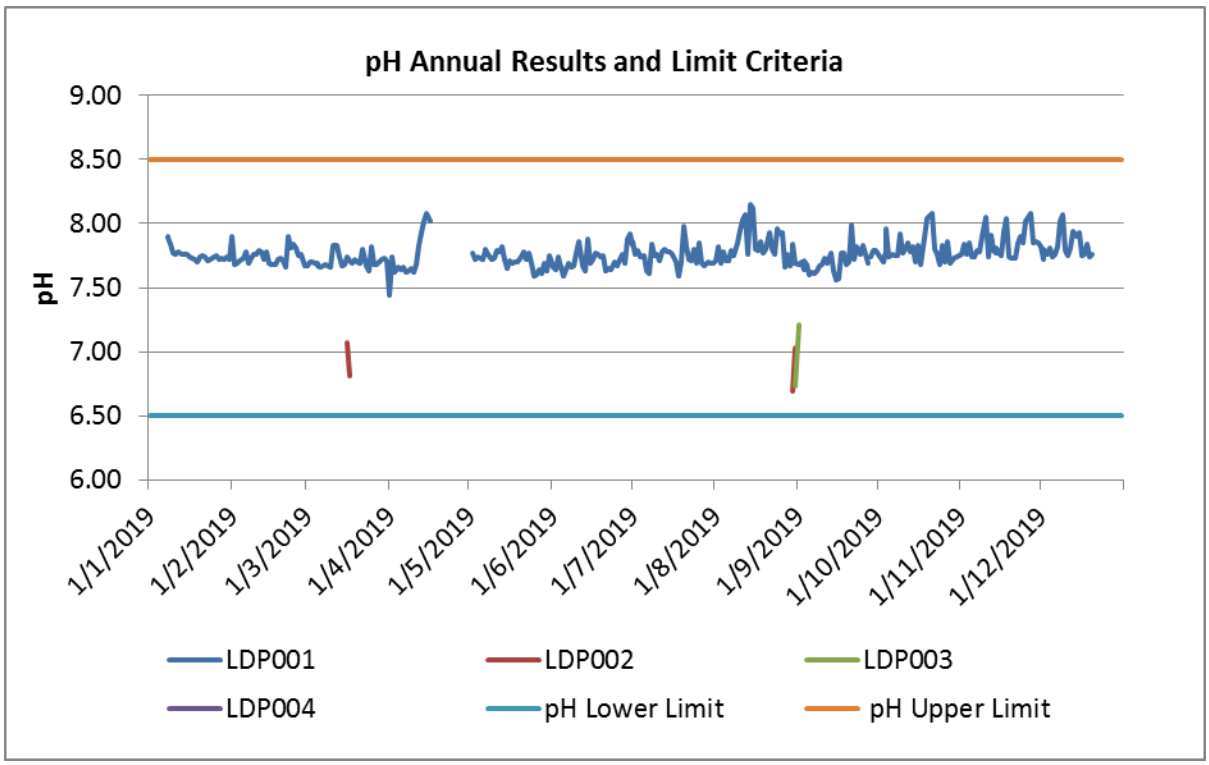


Figure 7-1 Annual pH Monitoring Results and Limit Criteria

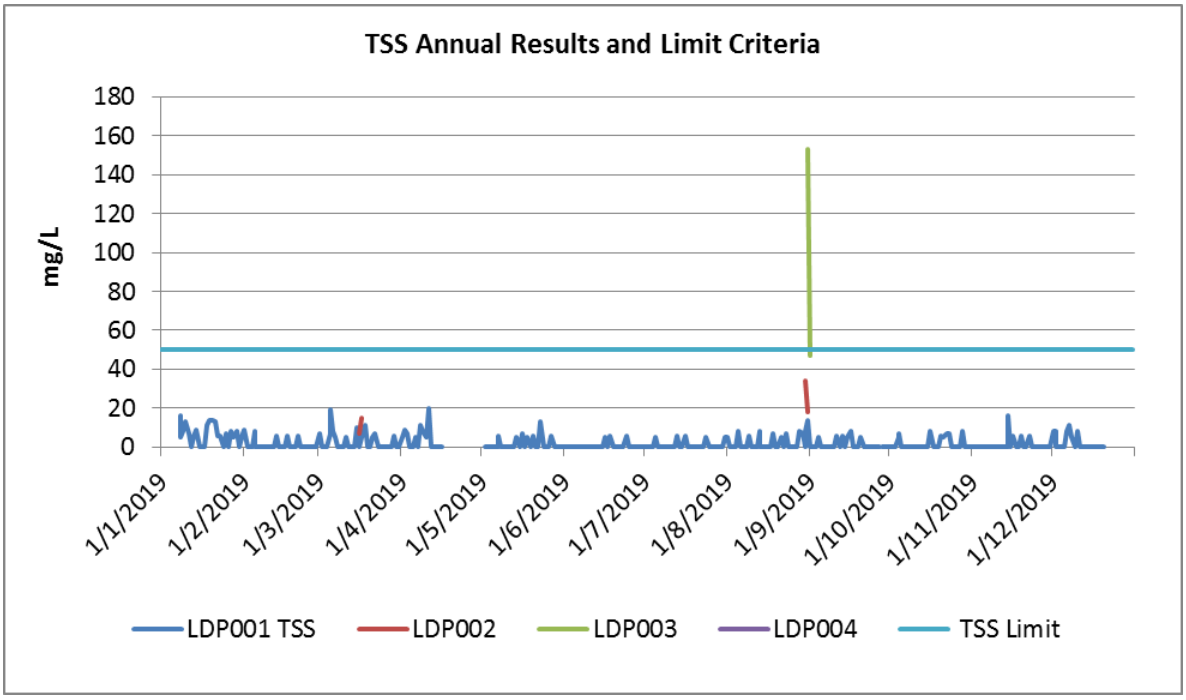


Figure 7-2 Annual TSS Monitoring Results and Limit Criteria

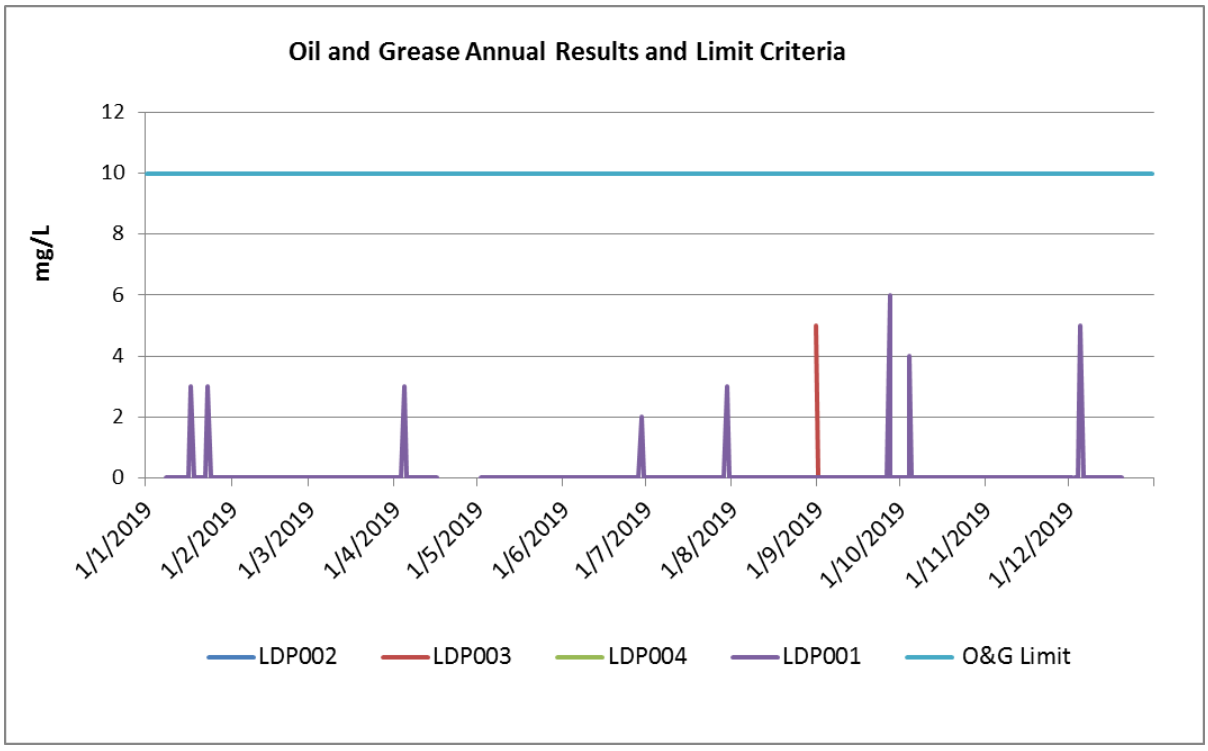


Figure 7-3 Annual Oil & Grease Monitoring Results and Limit Criteria

7.2.5 Data Interpretation

The results presented in **Table 7-4** are characteristic of the natural conditions of the area, particularly for Stockton, Moran's, Mannering & Wyee Creeks. Both Stockton and Morans Creek are the main drainage systems for the Mandalong area. Stockton Creek is located within the longwall mining area (LW1-16) and Morans Creek is also located within the current longwall mining area (LW15-25). Both Mannering and Wyee Creek are located within the Mandalong Southern Extension Area (future longwall mining).

7.2.5.1 Mandalong and Mandalong South Surface Site

Surface waters are tested for pH, TSS and EC and the annual and LTA results are summarised in **Table 7-4**. The Cooranbong Entry Site monitoring sites SW13, SW14, SW15, SW16 and SW17 were sampled monthly. The monitoring sites SW001, SW002, SW003, SW004, SW006, SW008, SW009, SW010, SW011, SW012, and SW018 were sampled quarterly during the reporting period. The Mandalong Southern Extension monitoring sites SWMP01, SWMP02, SWMP03, SWMPO04, SWMP05, SWMP06 and SWMP07 were also sampled quarterly during the reporting period. There were no results recorded for SW011 and SW018 during the monitoring period due to insufficient water at the monitoring point.

The EC (salt content) for the 2019 period shows a relatively consistent level compared with the long-term average.

The annual averages TSS for 2019 are relatively low and are characteristic of natural surface water conditions in creeks. All sites had a 2019 annual average that was similar to the LTA. The highest annual average TSS for 2019 was recorded at SW015 with 293.4 mg/L. The SW015 annual average was higher than the LTA (113.3mg/L) by 180mg/L due to high results in June and October 2019.

All monitoring points recorded a pH annual average similar to the LTA. SW15 had the lowest pH annual average of 5.4 in 2019. The highest pH annual average during 2019 was 8.6 recorded at SW017.

7.2.5.2 Surface Water Discharge Trends

The water quality results for LDP001 and LDP002 (Table 7-10) show the 2019 annual averages for pH, TSS and Oil & Greases are similar to the long term averages. LDP003 and LDP004 have not been in place long enough to have a LTA to compare against. LDP001 has a consistent discharge throughout the year as can be seen from **Figure 7-1**, **Figure 7-2** and **Figure 7-3**. The water quality results for LDP001 show little variation. LDP002, LDP003 and LDP004 discharges occur from high rainfall events and have greater variability.

7.2.5.3 Cooranbong Haul Road

Monitoring for the surface water in the six sediment control dams on the haul road was conducted to determine compliance with the EPL limits prior to discharge. Prior to discharge the sediment control dams were treated by adding a flocculent to the water to remove suspended solids. The water quality of the haul road sediment control dams is required to meet the water quality discharge criteria detailed in the EPL and the Cooranbong Haul Road Surface Water Management Plan.

7.3 WATER BUDGET

The 2019 water balance analysis was prepared by GHD (2020a) in the report titled *"Mandalong Mine 2019 Annual Water Balance"*. The water balance for 2019 is shown in **Table 7-11.** In accordance with DA97/800 condition 105 (vi) the quantity of water used from water storages and details of water discharges from the Mine are discussed below.

7.3.1 Water Supply, Use & Discharge

The Mandalong Mine is connected to town water and sewer. Potable water for underground use is currently supplied by Hunter Water Corporation (HWC) via pipelines to the Cooranbong Entry Site and to the Mandalong Mine. Potable quality water is used underground in mining equipment as uncontaminated water is required for cooling systems on drive motors, in dust suppression sprays on miners and transfer points. The total potable water used in 2019 was 564 ML. A total of 457 ML was supplied via the Cooranbong Entry Site and Mandalong Mine Site to underground equipment. A total of 1 ML was used on the surface within the Cooranbong CHP and bathhouse, 12 ML in the Mandalong Mine bathhouse and 11 ML for Mandalong Mine Surface operations. 63 ML was used for Delta surface operations.

The total potable water usage (564ML) for 2019 is an increase on the water usage in 2018 (500.1 ML). Potable water was primarily supplied to the longwall and underground equipment (longwall, continuous miners and conveyors) for coolant on motor transmissions and dust suppression.

GHD's (2020a) water balance model reports 726 ML was discharged in the 2019 report period from the Mandalong Mine, Mandalong South Surface Site, Cooranbong Entry Site and the Delta Entry Site. The volume of water discharged for the Cooranbong Entry Site at LDP001 is 629 ML, at LDP002 is 1ML and the Construction Dam (clean water dam) is 9 ML. 86 ML of surface water run off water was discharged from Delta Entry Site dams. 1 ML was discharged from LDP004 at the Mandalong South Surface Site and LDP003 at the Mandalong Mine.

Table 7-11: 2019 Summary of Water Inputs and Outputs

Element	Transfer in 2019 (ML/year)
INPUTS	
Direct rainfall onto water storages	15
Catchment runoff	118
Potable water supply	564
Groundwater inflows	155
TOTAL INPUTS (rounded)	**852**
OUTPUTS	
Evaporation	24
Spray irrigation	18
Sewage to HWC	12
Discharge through LDP001 (Cooranbong Entry Site)	629
Discharge through LDP002 (Cooranbong Entry Site)	1
Discharge from Construction Dam (Cooranbong Entry Site)	9
Discharge from LDP003 (Mandalong Mine Access Site)	1
Discharge from Delta Entry Site	86
Discharge from LDP004 (Mandalong South Surface Site)	1
Extracted ROM coal moisture	115
Enhanced reuse at MSSS	11
TOTAL OUTPUTS (rounded)	**907**
CHANGE IN STORAGE	
Cooranbong Underground Storage	-55
Surface water storages	0
TOTAL CHANGE IN STORAGE (rounded)	-55
BALANCE	
Inputs – outputs – change in storage	0.0

7.3.1.1 Mandalong Mine

Managing runoff from rainfall events is the only surface water management required at the Mandalong Mine Pit-Top. Clean water is diverted around the western area of the site. A dam has been constructed to capture this water. Clean water runoff from Mandalong Road, the M1 Motorway on-ramps and the car park has been diverted around the eastern perimeter of the site.

Water from all other areas of the surface is considered ‘dirty’ and is directed to sediment control systems. Surface and subsurface drainage directs dirty water to the sediment control system. This system comprises of a gross pollutant trap (GPT) and a sediment control dam. Water from the sediment control dam is used for irrigation of surrounding grassed areas as required. An oil water separator at the GPT removes hydrocarbons from potentially

contaminated runoff from the refuelling bay, oil store, workshop, washdown bay and equipment yard.

7.3.1.2 Cooranbong Entry Site

Water from the hardstand area is directed to the 5 ML dam for treatment before discharge by an overflow culvert at LDP002. A dewatering pump installed in the 5 ML Dam allows low water levels in the dam to be maintained. Contaminated water from the workshop, equipment storage and washdown bay areas drain to an oil water separator used to remove hydrocarbons from waste water.

Dirty water contaminated with coal fines from the CHP, conveyor gantries and ROM stockpile is directed to dedicated sediment control sumps to remove course fines material. Dirty water is then directed to the large GPT for further settlement of fines. Treated water from the GPT is then pumped to Sediment Dam 1 or directly underground. Sediment Dams 1 and 2 have a capacity of 7.6 ML.

A sediment control dam (ROM Stockpile Dam) and GPT were constructed in 2010 to capture and treat contaminated surface water runoff from the 100,000 T ROM coal stockpile. Sediment is captured in the ROM Stockpile Dam prior to flowing via pipeline into Sediment Dam 1 (via the Export Bin Sump).

7.3.1.3 Delta Entry Site

Clean and dirty water systems have been constructed at the Delta Entry Site. Site runoff also utilises the existing stormwater infrastructure at the Wyee Coal Unloader, which includes clean water diversion drainage and two large dirty water settling ponds (9ML capacity) sufficient to treat contaminated water prior to discharge.

Another settling pond was constructed down slope of the decline portal for the pre-treatment of dirty water from the Delta Site. Sediment in runoff is settled out via the Final Sediment Sump and the decline settling pond prior to discharge into the large 9 ML settlings ponds.

7.3.1.4 Cooranbong Haul Road

Clean and dirty water are separated along the haul road. Clean water is diverted by drains away from the haul road. Dirty water from the haul road and batters, is captured and treated within six sediment basins constructed along the haul road. Dirty water contained within the sediment basins is required to meet specific water quality criteria prior to discharge.

7.3.2 Mine Water Management

7.3.2.1 Mandalong Mine

Water from the active underground mining area is pumped to a temporary settling area to reduce suspended solids. All water is then pumped to a goaf area (Cooranbong underground longwall void) in the north-west of the Cooranbong Entry Site. This void area has a significant storage capacity, and also acts as a primary settlement area for the removal of suspended solids. Dirty water from the Cooranbong Sediment Dams is also pumped or decanted via the existing infrastructure to the Cooranbong void to maintain low water levels in the surface dams.

Water in the Cooranbong void is then pumped to the surface through a borehole pump and overland to the Borehole Dam at the Cooranbong Entry Site. Water discharges via a surface pipeline directly to LDP001.

7.3.2.2 Delta Site

No mine water is discharged from the Delta Entry Site, as inseam water from the Delta underground headings and decline tunnel is pumped to the existing Mandalong Mine water system.

7.4 GROUNDWATER MANAGEMENT

7.4.1.1 Mandalong Mine

An annual review of the groundwater monitoring results was undertaken by GHD tilted *"Centennial Mandalong Annual Groundwater Monitoring Review 2019"* (GHD, 2020c). An extensive groundwater monitoring network has been developed at Mandalong Mine with monitoring undertaken on many of the bores since August 1997. This program has been established to provide timely warnings of deviations from natural or background levels, so that if necessary, remedial measures and/or management strategies can be put in place.

The network consists of standpipe monitoring bores installed in alluvial and fractured rock groundwater sources. Locations were monitored monthly for groundwater level and limited water quality parameters (electrical conductivity and pH).

Monitoring data for Mandalong South presented herein is limited to MSGW04 series, given their proximity to current mining of Longwalls 23, 24 and 24A. Two private bores, GW105311 and GW078043, were identified within 1 km of Longwalls 24 and 24A. On inspection, GW105311 was found to be blocked at 12.6 m below top of casing. GW078043 has been incorporated within the monitoring program since July 2017 (GHD, 2020c).

Details of the groundwater monitoring bores in the current groundwater monitoring program are summarised in **Table 7-12.** The location of the groundwater monitoring bores is shown in

Figure 7-4.

Table 7-12: Groundwater Monitoring Bore Details

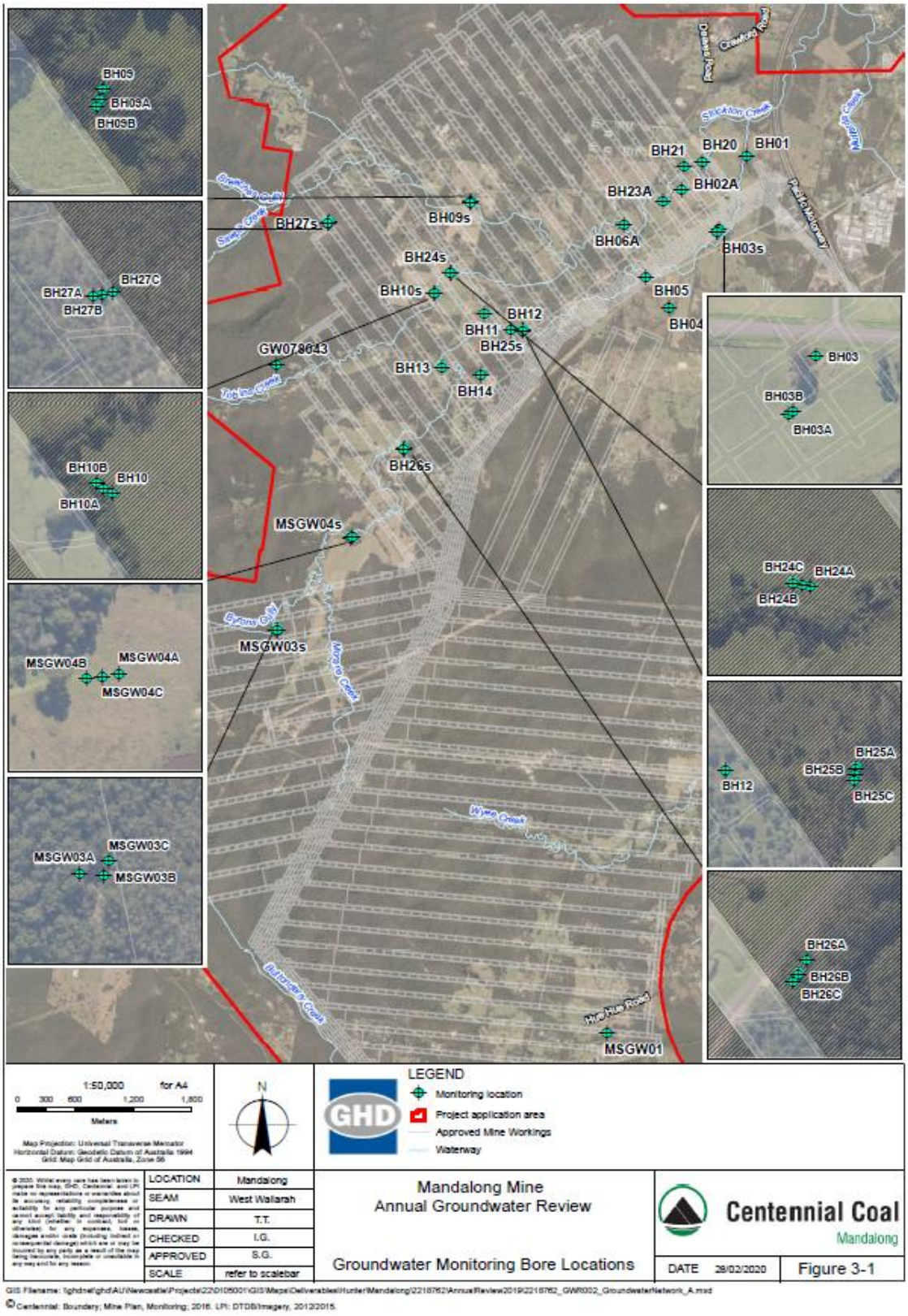
Bore	Monitoring Period	Lithology	Longwall Area
BH01	Aug 1997 – present	Alluvium	–
BH02A	Oct 2005 – present	Sandstone	LW3
BH03	Aug 1997 – present	Alluvium	–
BH03A	Nov 2005 – present	Alluvium	–
BH03B	Dec 2005 – present	Sandstone	–
BH04	Aug 1997 – present	Alluvium	–
BH05	Aug 1997 – present	Alluvium	–
BH06A	Nov 2005 – present	Sandstone	LW7
BH07B	Jan 2006 – present	Siltstone	LW10/11
BH09	Aug 1997 – present	Alluvium	LW12
BH09A	Jun 2010 – present	Mudstone/sandstone	LW12
BH09B	July 2010 – present	Mudstone/sandstone	LW12
BH10	Aug 1997 – present	Alluvium	LW16
BH10A	Jun 2010 – present	Mudstone/sandstone	LW16
BH10B	Jun 2010 – present	Sandstone	LW16

Bore	Monitoring Period	Lithology	Longwall Area
BH11	Aug 1997 – present	Alluvium	LW15
BH12	Aug 1997 – present	Alluvium	LW14/15
BH13	Aug 1997 – present	Alluvium	LW18
BH14	Aug 1997 – present	Alluvium	LW17
BH20	Dec 2003 – present	Conglomerate	LW1
BH21	Dec 2003 –present	Conglomerate	LW2
BH23A	Jan 2006 – present	Mudstone	LW4/5
BH24A	Jun 2010 – present	Alluvium	LW15
BH24B	Jun 2010 – present	Sandstone	LW15
BH24C	Jun 2010 – present	Mudstone/sandstone	LW15
BH25A	Jun 2010 – present	Alluvium	LW14
BH25B	Jun 2010 – present	Sandstone	LW14
BH25C	Jun 2010 – present	Mudstone/sandstone	LW14
BH26A	Oct 2011 – present	Alluvium	LW22
BH26B	Oct 2011 – present	Sandstone	LW22
BH26C	Oct 2011 – present (blocked at 35 m at Jan 2018)	Conglomerate	LW22
BH27A	Oct 2011 – present	Alluvium	LW18/19
BH27B	Oct 2011 – present	Sandstone	LW18/19
BH27C	Oct 2011 – present	Conglomerate	LW18/19
MSGW04A	Sept 2011 – present	Morans Creek alluvium	-
MSGW04B	Sept 2011 - present	Sandstone (Tuggerah)	-
MSGW04C	Sept 2011 – present	Conglomerate (Munmorah)	-
GW078043	August 2017 – present	Sandstone/Conglomerate	-

Source: (GHD, 2020c).

7.4.1.2 Delta Entry Site

Groundwater monitoring at the Delta site was finalised at the completion of construction in December 2005. No groundwater is discharged at the Delta site. The Delta underground workings are limited to two Maingate roadways therefore, inseam groundwater make is minimal and is pumped via the existing inseam dewatering system to the Cooranbong longwall void area and discharged via LDP001 at the Cooranbong Entry Site.



Source: (GHD, 2020c)

Figure 7-4: Mandalong Mine Groundwater Monitoring Locations.

7.4.2 Groundwater Levels

7.4.2.1 *Alluvial Groundwater Sources*

Groundwater levels fell after undermining at BH24A from approximately 16.8 m AHD in January 2014 to 14.8 m AHD in August 2014. Recovery was observed from June 2015, with groundwater levels recorded at 15.7 m AHD in November 2019. HARTT analysis of post-August 2014 groundwater levels at BH24A indicates the increasing trend in groundwater levels is independent of rainfall.

The overall decreasing trend in groundwater level at BH25A reflects decreasing rainfall trend and is therefore not predominately attributed to mining. The variation in groundwater levels at BH25A may be a result of the development of shallow tensile and compressive cracks resulting in localised increases in hydraulic conductivity and porosity. It is expected that such voids will fill over time and the hydraulic conductivity and porosity should return to pre-mining values. Supporting evidence has been observed at BH22A, and now also in the rising levels at BH24A.

HARTT analysis was not undertaken for the data set at BH27A due to limited observed water level records (four within 2012 only). BH27A has been dry post 2012, likely due to no alluvial aquifer being intercepted at this location a top a ridge.

Trigger values for alluvial groundwater levels have been defined in the WMP. Observed levels for 2019 have been compared to trigger values in the Annual Ground Water Monitoring Review (GHD, 2020c).

Exceedances of trigger values occurred at three locations being BH12, BH13 and BH25A. Exceedances were considered minor (<0.5 m) and temporary (occurring without an ongoing decreasing trend over a period of 6 months).

The variation in groundwater levels at BH25A may be a result of the development of shallow tensile and compressive cracks resulting in localised increases in hydraulic conductivity and porosity. BH12 and BH13 are located within 1 km of BH25A, and therefore the decreasing trends are considered likely to result from the same. The low groundwater levels are also attributable to drying climatic conditions. As the site has experienced below average rainfall over the period of decreasing trend, and as there was a generally increasing trend during 2019 (although still below the trigger level in some cases), the exceedance of the trigger values are not considered attributable to mining related activities at this stage (GHD, 2020c).

7.4.2.2 Fractured and porous rock aquifers

At the time of the assessment completed by GHD (2020c), all deeper monitoring bores, with the exception of MSGW04B and MSGW04C, had been directly undermined by longwall panels. These bores are screened within Triassic sandstone and conglomerate.

Monitoring bores BH02A, BH03B, BH06A, BH09A, BH09B, BH10A, BH10B, BH23A, BH24B, BH24C, BH25B, BH25C and BH27B are screened within the sandstone and siltstone of the Tuggerah Formation approximately 120 m to 230 m above the coal seam. A consistent drop in groundwater pressure at most of these locations (with the exception of BH27B), has been observed post undermining. The gradual drop in groundwater pressure suggests that discontinuous fractures have developed in the rock overlying the mine workings at these locations, consistent with EIS predictions (GHD, 2020c).

A number of these locations (including BH02A, BH03B, BH09A, BH09B and BH23A), have had levels re-stabilise to between 2 m AHD and -12 m AHD or have shown slight increases towards pre-mining levels three to five years post-undermining.

Monitoring bores BH20, BH21 and BH27C are screened within the Munmorah Conglomerate, underlying the sandstone of the Tuggerah Formation. All have recorded decreasing groundwater elevations over the monitoring period. Groundwater elevations at BH20 and BH21 initially dropped suddenly and have fluctuated between approximately -40 AHD and-50 m AHD since. Groundwater levels at BH27C showed a decreasing pre-mining trend including a sudden drop in levels in November 2014 related to purging and sampling. BH27C was undermined in July 2015, resulting in the bore becoming dry. Continued monitoring at this location has been prevented due to shortening of the bore (originally 165 m BGL, now registering a depth of 125 m BGL). Most likely post-mining movement of the strata has caused damage to the bore. Movement of strata may explain the temporary increase in groundwater level at adjacent bore BH27B following undermining. The sources monitored by these bores are approximately 100 m to 170 m above the coal seam (GHD, 2020c).

7.4.3 Groundwater Quality

7.4.3.1 Alluvial Groundwater Sources

Alluvial groundwater is generally characterised by pH within the range of 5 to 8 (predominantly 6 to 7) and electrical conductivity (EC) ranging from less than 1,000 µS/cm to over 10,000 µS/cm. Alluvial groundwater quality data is plotted and tabulated in Table 5-1 and Table 5-2 of the Annual Groundwater Monitoring Review 2019 (GHD, 2020c).

Prior to 2015, bailing sampling methods were used, resulting in variability in alluvial groundwater salinity that was considered unrelated to mining activity (AGE 2014). However, since January 2015, alluvial bores have been sampled by low flow techniques (i.e. peristaltic pump) with purging continuing until pH and EC parameters show stabilisation. Accordingly, variability within individual location datasets has generally reduced, however different locations continue to range from fresh to saline conditions.

Review of 2019 results and historical trends indicates:

- Gradually decreasing EC at BH01, which continued during 2019.
- Generally stable EC and pH trend at BH09, BH10, BH11, BH12, BH13, BH14, BH24A, BH25A, BH26A, MSGW03A and MSGW04B since low flow sampling was implemented in 2015.
- Stable EC and pH trend at BH03, BH03A, BH03B, BH04 after 2017.
- Continued wide variance in EC and pH at BH05, without discernible trend.

Site specific trigger values for groundwater quality are presented in the LW24-24A Extraction Plan WMP and the performance criteria are described in the WMP. No exceedances occurred in alluvial bores during 2019.

No complaints from adjacent landholders regarding groundwater quality were received in 2019.

7.4.3.2 Fractured and porous rock groundwater sources

Rock aquifer groundwater is generally characterised by a pH range of 7 to 8 and an EC range of 6,000 to 10,000 µS/cm. The EC range was notably broader at locations BH03B, BH07B, BH20 and BH21 during 2019. In addition to the high degree of temporal variability, considerable spatial variability is evident. Fractured and porous rock groundwater quality data have been plotted (GHD, 2020a) in appendix B and a summary of the data is provided in appendix C of the Annual Groundwater Monitoring Review 2019 (GHD, 2020a).

Review of 2019 results and historical trends indicates:

- Elevated EC at BH10A during 2018 persisted in 2019, with gradually decreasing pH trend.
- Increasing trends and increasing variability in pH and EC at BH20 and BH21.
- The previously increasing trend in pH at MSGW04B has reversed in 2019.

Monitoring locations BH20 and BH21 are bailed on account of insufficient well volumes to allow other sampling methods. Water volumes are typically less than one bail; no purging is undertaken given the low recharge rates and therefore the samples are not considered representative of the aquifer. Continued quality sampling of these locations will be reviewed.

Site specific trigger values for groundwater quality are provided in the LW24-24A WMP and the performance criteria are described in the WMP (refer to Table 5-2). Stage 1 EC triggers were exceeded for BH26B, MSGW03B and MSGW04B as follows:

- EC exceedance (three consecutive 80th percentile upper bound) for all monitoring events during 2019.

EC at these locations had a slightly decreasing trend, meaning that the historically high EC is most likely attributable to persistent below average rainfall condition during 2019.

There were no complaints from adjacent landholders regarding groundwater quality in 2019.

8 REHABILITATION

The Rehabilitation Management Plan / Mining Operations Plan (MOP) was prepared in 2016 for the period 1 December 2016 to 30 November 2023 in accordance with SSD-5144 Schedule 3 Condition 33. The MOP was approved by DRG on 29 November 2016 and by DPE on 2 February 2017.

A MOP amendment (Amendment A) was prepared following the approval of a modification (MOD 4) to SSD-5144 in 2017. The MOP Amendment A was approved by DRG on 12 April 2017 and by DPE on 23 June 2017.

A MOP amendment (Amendment B) was prepared following the approval of a modification (MOD 5) to SSD-5144 in August 2017. The MOP Amendment B was approved by DRG on 6 March 2018 and by DPE on 10 April 2018.

As described in the MOP, the conceptual long term mine rehabilitation objective is to provide a low maintenance, geotechnically stable and safe landform. Specific conceptual long-term objectives include:

- Prevent public access to former underground workings;
- Re-establishing land disturbed by the operations of Centennial Mandalong to an appropriate final land use;
- Provide habitat for fauna and corridors for fauna movement within the final landform;
- Monitor rehabilitation success in terms of physical and biological parameters;
- Relinquishment of the surface leases as rehabilitation objectives are achieved; and
- Compliance with appropriate Centennial and regulatory policies and guidelines.

Post mining land use options for the Mandalong Mine (MMAS and MSSS) were assessed in the *Mandalong Southern Extension Project Decommissioning and Rehabilitation Strategy* (SLR, 2013) which was prepared for the Mandalong Southern Extension Project EIS. Post mining land use options for the CES were assessed in the *Northern Coal Logistics Project Decommissioning and Rehabilitation* (SLR, 2014) which was prepared for the Northern Coal Logistics Project EIS.

It is intended to re-develop the MMAS and the CES for an industrial based land use(s). The option of leaving this infrastructure in the final landform will be discussed in consultation with DRE and after discussions with potential buyers have been held.

The intended post-mining land use for the MSSS is native bushland commensurate with the pre-mining conditions.

Post-mining land use for the Delta Entry Site will be addressed in consultation with Delta Electricity with the intended post-mining land use being native bushland commensurate with the pre-mining conditions.

As Mandalong is an underground mine, the majority of the MOP Area will not be disturbed. The exception to this might be areas impacted by subsidence which will be addressed and managed on an ongoing basis through the approved SMP or Extraction Plan. As there will be limited disturbance, the pre-mining land use(s) will not be significantly impacted and therefore the post-mining land use(s) will be consistent with pre-mining conditions.

Table 8-1: Rehabilitation and Disturbance Rates during the MOP Term

Year	Total Disturbance Area (ha)	Total Rehabilitation Area (ha)	Cumulative Rehabilitation Area (ha)
Start of MOP*	33.4	2.7	2.7
2017	13.2 (11.3 actual for MSSS in 2017).	0	2.7
2018	6.8 (0 actual for 2018).	0	2.7
2019	0.2 (MSSS Stockpile Dam)	0	2.7
2020	0	0	2.7
2021	0	0	2.7
2022	0	0	2.7
2023	0	0	2.7
End of MOP*	53.6	2.7	2.7

Note: Start of MOP is 1 December 2016 and end of MOP is 30 November 2023. Cumulative rehabilitation area includes the Biodiversity Offset Area to the north and east of the Mandalong Mine Access Site ventilation and gas management facilities.

8.1 PROGRESSIVE REHABILITATION AND COMPLETION

Since the Mandalong Mine is an underground mine, the relatively small disturbance footprint associated with surface infrastructure means that there are limited opportunities for progressive rehabilitation. To what extent is appropriate, rehabilitation will be undertaken progressively on areas that cease to be used for mining or mining related activities as soon as is reasonably practicable.

Rehabilitation activities forecast for the current MOP term (2016-2023) include:

- Rehabilitation of areas disturbed during the construction of the MSSS and access road;
- Progressive rehabilitation of exploration and/or groundwater monitoring sites;
- Rehabilitation of areas affected by subsidence, as required, in accordance with an approved SMP or Extraction Plan;
- Maintenance and monitoring of the VAM-RAB offset area which was established in 2012 at the Mandalong Mine;
- Maintenance and monitoring of the MSSS and TL24 offset areas; and
- Maintenance and monitoring of areas of existing rehabilitation.

Following the construction of the relocated TL24 transmission line and demolition of the redundant section, disturbance around the new and redundant tower sites and any temporary access tracks established to the redundant tower sites were rehabilitated in accordance with TransGrid's rehabilitation objectives and in consultation with landholders. The new towers, easement and access tracks will remain in place to allow TransGrid to operate and maintain the transmission line.

8.2 MANDALONG MINE REHABILITATION

The majority of Mandalong Mine Access Site has been rehabilitated following the completion of construction activities in 2005. Rehabilitated sections of the Mine's surface area are well established and have provided vegetation cover to effectively minimise the potential for erosion.

Centennial Mandalong received approval in 2011 (DA97/800 Modification 7) for the trial installation of a ventilation air methane regenerative afterburner unit (VAM-RAB) that would remove and breakdown the exhaust methane. Installation of the VAM-RAB unit in 2012 necessitated clearing of some native vegetation. Two endangered ecological communities (EEC) listed in Schedule 3 of the NSW Threatened Species Conservation Act 1995 were included in the areas to be cleared. These were: Swamp Sclerophyll Forest (SSF) on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions; and River-Flat Eucalypt Forest (RFEF) on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.

DA97/800 Condition 76A included a requirement for a 1.25 hectare rehabilitation off-set area to be established on cleared land adjoining the VAM-RAB construction site. These EEC were represented by communities described in the regional vegetation mapping and classification (NPWS 2000) as: MU37 Swamp Mahogany Paperbark Forest (SSF); and MU38 Redgum – Rough-barked Apple Swamp Forest (RFEF).

An ecology survey (Hunter Eco, 2011) prepared for the VAM-RAB project application described the area to be rehabilitated as mostly dominated by weeds. This being the case, active regeneration was required and this was commenced in January 2012. Further to the requirement to rehabilitate, DA97/800 Condition 76A also requires that the progress of the rehabilitation be monitored annually for five years. This monitoring was conducted by Hunter Eco in December 2019 and is described in **Section 6.4.6** of the Annual Review.

8.2.1 Longwall Mining Area

The surface areas above the completed longwall mining panels are inspected as per the schedules prescribed in the LW22-23, LW24-24A and LW25-31 Extraction Plan Water Management Plans (WMP). The LW22-23, LW24-24A and LW25-31 Extraction Plan WMPs require that the floodpaths are to be inspected every six months or after a flood event (refer to **Appendix 2**). During the course of these inspections observations are made on the progress of remedial measures implemented to minimise subsidence related effects (refer **Table 6-26**).

An update on ponding remediation completed in 2019 is provided in **Table 6-26**.

8.2.2 Exploration Sites

Four surface exploration drill sites were prepared in 2019. The sites were located on private property and were rehabilitated following the sealing of the borehole. Existing tracks were utilised to gain access to the exploration drill site where possible and required no vegetation clearing. The sites were seeded with sterile grass species to stabilise the drill site following the re-instatement of the land surface. Landholder sign-off was received for rehabilitated sites on private property.

Ongoing rehabilitation of exploration sites will be conducted in 2020 and reported in the Annual Review.

8.2.3 Delta Entry Site

Construction of the Delta coal clearance system was largely completed in 2005 and rehabilitation of the site was completed in 2006. Rehabilitation at the Delta Entry Site was inspected in 2019 to assess the effectiveness of the works to stabilise disturbed areas onsite. The direct seeding rehabilitation methods used have been successful in establishing a substantial area of the site with pasture and tree groundcover. Ground cover on the direct tree seeded areas is approximately ninety percent similar to those recorded in 2018. Ninety-

five percent ground cover has been achieved in rehabilitated pasture seeded areas. The area is slashed to maintain access to infrastructure and as part of the asset protection zone.

8.2.4 Cooranbong Entry Site

A total of 3.9 hectares have been disturbed from the construction of the upgrades to the CHP and haul road at the Cooranbong Entry Site in 2009. Construction activities were completed in May 2010 with all disturbed areas rehabilitated by the Contractor shortly after. No further rehabilitation works were undertaken in 2019.

8.2.5 Cooranbong Haul Road

The haul road construction resulted in approximately 18 hectares of disturbance. Of this 3.9 hectares of disturbed land associated with the CHP upgrades (stockpile and conveyor) and haul road are located on Mandalong Mine's Mining Lease. 1.25 hectares of disturbed area not occupied with haul road and CHP infrastructure was rehabilitated in 2010. The remaining areas are located on the Newstan Colliery Mining Lease CCL764. Of this, nine hectares along the haul road was rehabilitated in 2009. Six hectares of land will not be rehabilitated as it is occupied by the haul road infrastructure.

As per the requirement of the Mandalong Haul Road Landscape and Rehabilitation Plan, the Mandalong Environment & Community Officer audited the rehabilitation on the haul road in October 2019. The audit assessment required the following issues be addressed: -

- An *assessment of surface and slope stability.*
- *Properties of the soil or root zone media (such as chemistry, fertility and water relations).*
- *Plant community structural attributes (such as cover, woody species, density and height).*
- *Plant community composition (such as presence of desirable species, weeds).*
- *Selected indicators of ecosystem functioning analysis (such as soil microbial biomass).*

The 2019 audit focused on identifying sites where remedial action or maintenance is required to bring sites to an acceptable standard. The inspection strategy involved one person inspecting the full length of the Haul Road to access 100% of the disturbed area.

In total six sites were inspected and recorded an action priority from highest to lowest. The highest priorities included maintenance of sediment and erosion controls along the Haul Road drains and at the dam inlets.

The audit provides a useful assessment of baseline rehabilitation completed to date on the haul road following the completion of all construction activities in 2011. In general rehabilitated sections of the haul road are well established and continued growth occurred in 2019. Maintenance and effectiveness of the haul road rehabilitation will be assessed in 2020 and reported in the next Annual Review.

8.2.6 Mandalong South Surface Site

The construction of the access road for the MSSS was completed in 2018. The clearing of the MSSS was completed in 2018, with shaft sinking commencing in late 2018. The construction of the access road and clearing of the MSSS resulted in approximately 11.3 hectares of disturbance.

The areas disturbed by the construction of the access road were stabilised in 2018 with the application of hydro-mulch and bark-blower mulch / seed which was applied to the road batters. Hydro-mulch and bark-blower mulch was also applied to the batters of the MSSS in 2018.

The weekly environmental construction inspection procedure (WP-7154) has been updated to include the rehabilitation areas around the access road and MSSS. The monitoring procedure includes a requirement for an assessment of new or increased erosion (including batters), growth improvement, weeds and remedial work if required.

A review of stockpile locations was completed with the main stockpile established to the north-west of the MSSS in 2018. VENM testing was completed and 7500m3 of material from the stockpile was transported to Newstan as described in the MSEP EIS (SLR, 2013). The weekly environmental construction inspection procedure (WP-7154) also includes a requirement to review erosion and sediment control issues associated with the MSSS, the access road and the main stockpile area.

A qualified ecologist from Kleinfelder was engaged by Centennial Mandalong to conduct a survey of the rehabilitated areas associated with the construction, roadside access and infrastructure areas of the Mandalong South Surface Site.

The work was conducted as a survey of the disturbed areas beginning to the north of the main access road at Moran's Creek and following the access road to the southern extremity of the MSSS infrastructure. Photo points were collected at several locations, marked by GPS and the bearing of the photo direction noted. Native plants species, weeds, erosion and overall vegetative cover were noted for each area. An unofficial nomenclature was established for each zone.

The aim of the monitoring event was to determine what, if any management actions are deemed to be necessary to prevent environmental degradation of the surrounding native vegetation.

The ecologist found that the rehabilitated areas have been revegetated with a good mix of native species, which combined with natural recruitment from the adjoining vegetation will serve to provide a good basis when the final revegetation is undertaken at the end of the project.

Weeds are the major concern with Chloris gayana (Rhodes Grass) and Cynodon dactylon (Couch – even though it is considered a native species) being the two more invasive species that have potential to spread into the surrounding vegetation. The Moran's Creek area does have other weed species such as Ligustrum sinensis (Small-leaved Privet) and Rubus fruticosus spp. agg. (Blackberry). While these do require treatment, they are likely to be legacy weeds spread up and down the creek line.

Several of the monitoring areas had sections of bare soil that require seeding and/or planting with suitable native species. This will serve to limit the spread of exotic species and to help stabilise these areas.

Erosion is of concern in three areas, the Pipeline Area, the Sediment Dam Compound and the South Terrace and required remedial action.

Maintenance and effectiveness of the rehabilitation will be assessed in 2020 and reported in the next Annual Review.

8.3 BUILDINGS

8.3.1 Mandalong Mine

No buildings or infrastructure were removed or decommissioned in 2019.

8.3.2 Delta Entry Site

All buildings at the Delta Entry Site are associated with the coal conveying system and as such are a permanent fixture. The buildings associated with the construction of the site were decommissioned and removed prior to the site being rehabilitated in 2006. No decommissioning of buildings occurred at the Delta Entry Site in 2019 and as such no rehabilitation of buildings was undertaken.

New portable buildings were installed in 2018 at the Delta Entry Site which included office and lunchroom facilities.

8.3.3 Cooranbong Entry Site

To ensure continuation of coal handling operations and mine support infrastructure, surface buildings and mine related infrastructure have been retained at the Cooranbong Entry Site. The Cooranbong Entry Site, CHP and supporting infrastructure were used in 2019 to supply coal to the Eraring Power Station and to Newstan.

No buildings or infrastructure at the Cooranbong Entry Site were removed or decommissioned in 2019.

8.4 REHABILITATION TRIALS AND RESEARCH

8.4.1 Use of Analogue Sites

Data from analogue rehabilitation sites is an integral part of the monitoring procedure throughout the monitoring process. The purpose of analogue sites is to provide a reference against which to document the progress of rehabilitation towards reaching ecosystem health, structure and composition consistent with undisturbed areas.

During the MOP term (2016 - 2023) in 2020, Centennial Mandalong will engage a suitably qualified person to select and monitor analogue sites to assess whether they are suitable in the context of the proposed final land use and to suggest the species that will be appropriate for revegetation.

Analogue sites are proposed with undisturbed areas in the vicinity of the proposed Mandalong South Surface Site (MSSS) and the Delta Entry Site corresponding with the intended post mining land use of native bushland, commensurate with pre-mining conditions.

The majority of the Mandalong Mine Access Site and the Cooranbong Entry Site are proposed to be retained as infrastructure and therefore no reference monitoring in the vicinity is deemed necessary.

Specific analogue sites will be selected based on the following general criteria:

- Contain vegetation types similar to the rehabilitation sites;
- Secure from future mining related disturbance; and
- Contain vegetation and conditions suitable as a basis for rehabilitation performance criteria.

The monitoring results from analogue sites will provide the basis for comparison to measure the success of the rehabilitation against the relevant closure criteria. Results of analogue site monitoring will be reported in future Annual Reviews.

8.4.2 Mandalong Mine VAM-RAB Offset Area

Refer to **Section 6.4.6** of the Annual Review for details on the Mandalong Mine VAM-RAB Offset Area.

8.4.3 Land Management Strategy for the MSSS and TL24 Offset Areas

Refer to **Section 6.4.4** of the Annual Review for details on the Mandalong Mine Land Management Strategy for the MSSS and TL24 Offset Areas.

8.4.4 Moran's Creek Rehabilitation Trial

During consultation with local landowners, concerns were raised regarding historical land management practices which have resulted in extensive clearing of native vegetation and severe erosion of creek banks and drainage lines across the Mandalong Valley. The Moran's Creek rehabilitation trial was initiated in 2007 to respond to local landowner concerns in particular the historical erosion on Morans Creek caused by flood flows and stock accessing

creek areas. Local landowner's sited evidence that excavation of the creek in the 1950's caused the creek to widen as a result of the creek banks eroding.

In November 2007 a trial commenced to rehabilitate a section of Morans Creek on a Centennial owned property. The objective of the trial is to assess the effectiveness of direct seeding and tube stock planting to re-establish a native vegetation community on a degraded section of Moran's Creek.

Direct seeding of the trial area commenced in January 2008 with annual inspections since 2011 concluding that the direct seeding method has been successful in establishing tree cover over the majority of the area. Juvenile species including *Eucalyptus tereticornis*, *E. robusta* and *Casuarina glauca* have successfully established on the trial area. The trial direct seeding area has been largely successful in re-establishing the native vegetation found along Morans Creek. Further weed spraying was conducted in 2019 to control Tobacco weed (*Elephantopus mollis*), Scotch Thistle (*Onopordum acanthium*) and Blackberry (*Rubus fruticosus*).

The 2,000 tube stock planted in November 2008 along the fenced Morans Creek rehabilitation corridor are now established along Moran's Creek with trees heights of up to 4 to 5 m. The rehabilitation site is a reference site for the Catchment Management Authority (CMA) vegetation monitoring report. The monitoring has recorded the baseline vegetation conditions and will evaluate the rehabilitation measures implemented at Moran's Creek.

A Macquarie University Research Project was completed in November 2013 titled "*How has the Water Quality of Morans Creek Changed Since Rehabilitation*?" A variety of methods were employed in order to answer the questions regarding the health of Morans Creek, including water quality sampling and counting of macroinvertebrates. The study concluded that:

- Riparian vegetation and bank stability had increased at the rehabilitation site; and
- Banks remain unstable and riparian zones small if they exist at all within the fences area beyond the rehabilitation site.

9 COMMUNITY CONSULTATION

Mandalong Mine consults with the community through forums such as, the Mandalong Mine Community Consultative Committee and community organised events.

Meetings of the Mandalong Mine Community Consultative Committee (CCC) were held in February, June and October 2019. Representatives of the Mandalong community, a Dora Creek community representative, appointed community representatives; relevant government organisations and company representatives attended the meetings. A detailed presentation was provided to attendees at each CCC meeting on the Mine's production, geological update, subsidence results, environmental monitoring, Extraction Plan update, upcoming projects and sponsorship.

Additional agenda items discussed in 2019 included the Mandalong South Extension Project, MSSS construction and traffic management, MSSS shaft drilling, 33Kv Extension Project, Modifications to the Development Consent, exploration drilling program and Centennial's land management programs.

9.1 EXTRACTION PLAN CONSULTATION

Extensive community consultation with landowners in the Mandalong mining area is undertaken for the purpose of monitoring and assessing subsidence effects on private properties. In general, the Mandalong Mine community consultation has included:

- Community consultation in line with the Stakeholder Engagement Strategy;
- Individual landowner notification and consultation associated with the implementation of Extraction Plans LW24-24A and LW25-31 and their associated PSMP's;
- Consultation and general communication with all relevant government agencies and infrastructure owners during the implementation of the Extraction Plan LW24-24A and Extraction Plan LW25-31;
- Individual landowner consultation and implementation of PSMPs during mining of Longwalls 25 to 31;
- Individual landowner consultation for rehabilitation of remnant ponding and subsidence related repairs to property (LW23-25);
- Three meetings of the Mandalong Mine Community Consultative Committee (MMCCC) chaired by Margaret MacDonald-Hill delivered updates on the status of Development Consent modifications, Extraction Plan approvals, Mining Operations Plan, subsidence monitoring and subsidence management on Centennial property, private property and public infrastructure.
- The MMCCC attended one site inspection of the Mandalong South Surface Site during shaft drilling;
- Ongoing consultation with relevant stakeholders on the development and implementation of Infrastructure Management Plans including Public Roads (LMCC), powerlines (Ausgrid), communication lines (Telstra) and high voltage transmission lines (TransGrid);
- One month mining notifications were provided to landowners prior to mining beneath their property, with follow-up meetings and inspections undertaken; and
- Six-monthly Reports were prepared and provided to DRE, DPE, CCC and stakeholders in April 2019 and December 2019 as required by the Extraction Plans for LW24-24A and LW25-31.

9.2 COMMUNITY SPONSORSHIP

The Mandalong Mine continues to support the local community through various sponsorship avenues to the following community activities, groups and associations in 2019 –

- Sponsorship of Morisset Agricultural Society Show held in February 2019;
- St. John Vianney Morisset School end of year awards presentations;
- Cooranbong Public School end of year awards presentations;
- Cooranbong Pony Club;
- Support provided for local community service - Cooranbong Pre-school;
- Lake Macquarie Heritage College Spring Fair & Fun Day;
- LMCC 2019 School Environment Awards;
- Mandalong Community Association;
- Morisset United Soccer Club;
- Northlakes Rugby Club Budgewoi;
- Morisset Rotary Golf Day;
- PCYC Morisset; and
- Southlakes Carers Community Christmas Lunch;

9.3 COMMUNITY COMPLAINTS

Three complaints were received by Centennial Mandalong from the community during the period January 2019 to December 2019, as described in **Table 9-1**.

Table 9-1: 2019 Community Complaint Details.

Mandalong Complaint Log Number	Date Complaint Logged	Type of Complaint	Comments
4/2019/ccapp 1000537	23/01/2019	A complaint was received by Mandalong via phone at 10am on 23 January 2019 from a Mandalong Road resident. The complaint is in relation to night-time noise believed to be from the Mandalong South Surface Site (MSSS) shaft drilling operations.	Centennial Mandalong investigated all possible noise mitigation measures for the MSSS night-time shaft drilling. GHD completed a noise investigation on 30/1 to determine the main sources and to identify possible mitigation measures.
4/2019/ccapp 1000540	31/01/2019	A complaint was received by Mandalong via phone at 10.30am on 31 January 2019 from a Mandalong Road resident. The complaint is in relation to continuing night-time noise from the Mandalong South Surface Site (MSSS) shaft drilling operations.	Centennial Mandalong provided an update on progress to the complainant several times since complaint. Met with complainant on 1/2/19with a further meeting held on 8/2/19. Noise mitigation measures were implemented for the shaft drilling operations and on-site generators.
4/2019/ccapp 1000541	7/02/2019	A complaint was received by Mandalong via phone at 10am on 7 February 2019 from a Mandalong Road resident. The complaint is in relation to continuing night-time noise from the Mandalong South Surface Site (MSSS) shaft drilling operations.	Attended noise monitoring completed by GHD at the complainants residence recorded a night-time noise level from MSSS as 27dBa (criteria at the residence is 35dBa). GHD will continue to complete monitoring on a weekly basis to assess whether noise mitigation measures have been effective.

Three community complaints were received in 2019, showing a minor increase in complaints compared with the previous reporting period.

Table 9-2: Record of annual community complaints for 2017 to 2019

Community Complaints						
Year	**Air**	**Water**	**Noise**	**Waste**	**Other**	**Total**
2017	0	0	0	0	3	3
2018	0	0	0	0	1	1
2019	0	0	3	0	0	3

Figure 9-1 shows a general decrease in the number of community complaints received since 2011 with only one complaint received in 2013, 2014, 2015 and 2018. There has been a slight increase in complaints received since 2015 with two complaints in 2016, three in 2017 and three in 2019. 2019 has seen an increase in complaints with three complaints up from one in the previous year. Since 2011 no community complaints have been received regarding air quality or waste. The three complaints received in 2019 were raised by one complainant for a noise issue.

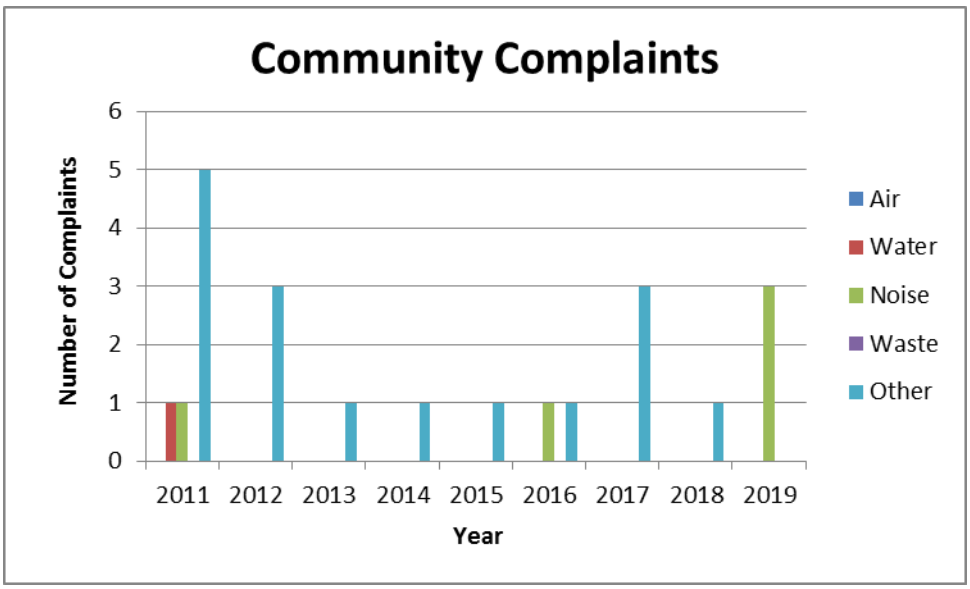


Figure 9-1: Annual Community Complaints

10 INDEPENDENT ENVIRONMENTAL AUDIT

An Independent Environmental Audit (MCW Environmental, 2019) of the Mandalong's operations was completed by MCW Environmental in June 2019. The audit report is publically available on the Centennial Mandalong website, and a copy was provided to CCC members and the DPIE on 14 June 2019.

The Independent Environmental Audit completed by MCW Environmental assessed six approvals and licences in detail and over 20 environmental management strategies, plans and programs in a more general manner. A total of 476 approval and licence conditions and commitments were assessed resulting in seven non-compliances. Two of the seven non compliances were administrative. A risk assessment on the six non-compliances that were not administrative was conducted based on the risk assessment framework in the Post Approval Guidelines: Independent Audits (Department of Planning & Environment, 2015). The compliance assessment resulted in the following seven non-compliances:

- SSD-5144 (Conditions of Approval): two non-compliances from a total of 82 conditions;
- EPL 365 four non-compliances from a total of 78 conditions; and
- ML1722 one non-compliance from a total of 12 conditions.

Some of the non-compliances related to the same issue which, due to the duplication of requirements between approval documents, raised the same non-compliance multiple times. The issue of water management and discharge in accordance with the EPL resulted in five non-compliances.

The compliance assessment identified that overall Centennial Mandalong has achieved a high level of compliance as:

- The seven non-compliances represent 1.5% of the total 476 conditions and commitments;
- The compliance assessment did not identify any non-compliances regarding management plan conditions referred to in the regulatory approvals.

The Mandalong Mine action plan prepared in response to the non-compliances and recommendations listed in the 2019 Independent Environmental Audit was provided to DPIE on 14 June 2019 and an updated version is included in **Appendix 3**.

Correspondence from DPIE dated 12th July 2019 stated that the Department considered the EIA report and response to audit recommendations (RAR) generally satisfied the requirements of the approval. DPIE requested a status update on each RAR action is included in future Annual Reviews.

The next Independent Environmental Audit of the Mandalong Mine operations in accordance with SSD-5144 Schedule 6 Condition 13 and DA97/800 (MOD10) Condition 108 is required to be commissioned prior to March 31 2022.

11 NON-COMPLIANCES DURING THE REPORTING PERIOD

Table 11-1: Non-Compliance 1

Nature of the incident/non-compliance	Exceedance of EPL365 Condition L2.4 water quality total suspended solids limit criteria of 50mg/L. TSS result of 153mg/L.
Date of incident / non-compliance (if known; if not known state not known)	30 August 2019
The location of the incident/ non-compliance (include a figure if appropriate), if known	Mandalong Mine LDP003, Kerry Anderson Drive Mandalong
Detail the cause of the incident/non-compliance	The Mandalong Mine Automatic Weather Station (AWS) recorded a total of 90mm of rainfall between noon on Thursday 29 August 2019 and 10.31pm on Saturday 30 August 2019 (commencement of the discharge from LDP003) which resulted in the discharge event from the MMAS Sediment Control Dam. A total of 122mm of rainfall was recorded by the Mandalong Mine AWS between noon on Thursday 29 August 2019 and 6.00pm on Sunday 31 August 2019. The Sediment Control Dam was maintained at a low level prior to this event.
Detail action that has been, or will be, taken to mitigate any adverse effects of the incident/ non-compliance	Flocculent dosing was undertaken to reduce the suspended solids loads in the MMAS Sediment Control Dam at 10.30am on 30 August 2019. Sampling at LDP003 by AECOM employees as required by EPL 365 on 30 August 2019, 31 August 2019 and 1 September 2019. Pump operation to the MMAS irrigation system during rainfall event. Skimmer pump operation in the MMAS Sediment Control Dam to the Gross Pollutant Trap (GPT) for the entirety of the rainfall event to remove potential hydrocarbons. The MMAS Sediment Control Dam was pumped down to the minimum level by 4 September 2019. Receipt of TSS results from ALS on 9 September 2019, and notification to the EPA, DPIE and NSW Resources Regulator on 9 September 2019.
Detail action that has been, or will be, taken to prevent recurrence of the incident/ non-compliance	Centennial Mandalong completed a review of the performance of the MMAS Sediment Control Dam and determined options to improve the water quality / prevent future discharges from LDP003. Centennial Mandalong completed a review of the Mandalong Mine Water Management Plan following this incident.

Table 11-2 Non-Compliance 2

Nature of the incident/non-compliance	Exceedance of EPL365 condition L2.4 Water quality, total suspended solids, limit criteria of 50mg/L. TSS result of 67mg/L.
Date of incident / non-compliance (if known; if not known state not known)	31 August 2019
The location of the incident/ non-compliance (include a figure if appropriate), if known	Mandalong Mine LDP003, Kerry Anderson Drive Mandalong
Detail the cause of the incident/non-compliance	The Mandalong Mine Automatic Weather Station (AWS) recorded a total of 90mm of rainfall between noon on Thursday 29 August 2019 and 10.31pm on Saturday 30 August 2019 (commencement of the discharge from LDP003) which resulted in the discharge event from the MMAS Sediment Control Dam. A total of 122mm of rainfall was recorded by the Mandalong Mine AWS between noon on Thursday 29 August 2019 and 6.00pm on Sunday 31 August 2019. The Sediment Control Dam was maintained at a low level prior to this event.
Detail action that has been, or will be, taken to mitigate any adverse effects of the incident/ non-compliance	Flocculent dosing was undertaken to reduce the suspended solids loads in the MMAS Sediment Control Dam at 10.30am on 30 August 2019. Sampling at LDP003 by AECOM employees as required by EPL 365 on 31 August 2019 and 1 September 2019. Pump operation to the MMAS irrigation system during rainfall event. Skimmer pump operation in the MMAS Sediment Control Dam to the Gross Pollutant Trap (GPT) for the entirety of the rainfall event to remove potential hydrocarbons. The MMAS Sediment Control Dam was pumped down to the minimum level by 4 September 2019. Receipt of TSS results from ALS on 9 September 2019, and notification to the EPA, DPIE and NSW Resources Regulator on 9 September 2019.
Detail action that has been, or will be, taken to prevent recurrence of the incident/ non-compliance	Centennial Mandalong completed a review of the performance of the MMAS Sediment Control Dam and determined options to improve the water quality / prevent future discharges from LDP003. Centennial Mandalong completed a review of the Mandalong Mine Water Management Plan following this incident.

Table 11-3 Non-Compliance 3

Nature of the incident/non-compliance	Exceedance of operational noise limit criteria EPL365 Condition L5.1 and Development Consent SSD-5145 Schedule 3 Condition 3.
Date of incident / non-compliance (if known; if not known state not known)	27 November 2019
The location of the incident/ non-compliance (include a figure if appropriate), if known	Cooranbong Entry Site noise monitoring location M1 Gradwells road, Dora Creek.
Detail the cause of the incident/non-compliance	Noise contributions from the site during the 1st and 4th 15-minute measurements exceeded both sets of noise criteria. The exceedance that was recorded during the 1st 15-minute measurement was attributed to coal loading activities based on observations made during the measurement. The operator attended sleep disturbance noise monitoring results recorded contributions from the Cooranbong Entry Site which comply with the EPL 365 and Development Consent SSD-5145 relevant sleep disturbance noise criteria during three of the four measurements. The exceedances that were observed during the 1st 15-minute measurement were due to coal loading activities. GHD note that the meteorological conditions, observed at the Mandalong Automatic Weather Station (AWS), during the 4th measurement were during stability category F conditions. As specified in condition L5.3 of EPL 365 and Appendix 3 of SSD-5145, the noise limits do not apply under these conditions.
Detail action that has been, or will be, taken to mitigate any adverse effects of the incident/ non-compliance	
Detail action that has been, or will be, taken to prevent recurrence of the incident/ non-compliance	Centennial Mandalong will submit a formal application to vary Condition L5.4 (a) of EPL 365 to allow Centennial Mandalong to consider the Cooranbong Entry Site Automatic Weather Station data to determine meteorological conditions as the Mandalong Mine AWS is located approximately 6.9 km from the Cooranbong Entry Site.

12 ACTIVITES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

Table 12-1: Forecast Operations for 2020

Centennial Mandalong
Implement Environmental Management Plans required by SSD-5144. Implement LW25-31 Extraction Plan Management Plans Commence LW32-37 Extraction Plan and continue baseline monitoring.
Mandalong Mine Access Site
Commence construction of Gas Engines.
Cooranbong Entry Site
Nil major targets for 2020.
Delta Entry Site
Nil major targets for 2020.
Mandalong South Surface Site
Continue construction of the Mandalong South Surface Site and continue shaft sinking. Commence construction of 33kV power supply to MSSS.

13 REFERENCES

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PLANS

ML 1722
ML 1443
ML 1543
LONGWALL 23
LONGWALL 24
LONGWALL 24A
LONGWALL 25
LONGWALL 26
LONGWALL 27
LONGWALL 28
LONGWALL 29
LONGWALL 30
LONGWALL 31
LONGWALL 32
TL 24
Mandalong South Surface Site
ML 1722 Surface Lease

LEGEND:

- Project Disturbance Area
- Existing workings
- Proposed workings
- Mining Lease boundary (ML)
- Watercourse
- Existing contour (10m)
- Power Lines
- Power Pole
- High Tension Power Lines
- High Tension Tower
- Telecommunication Cable

Primary Domains

- Domain 8 - Underground Mining Area
- Domain 9 - Conservation and Biodiversity Offset Area

Secondary Domains

- Domain E - Rehabilitation Area Woodland
- Domain F - Rehabilitation Area Forest
- Domain G - Rehabilitation Area Rural Land
- Domain J - Conservation and Biodiversity Offset

N

0.0 200 400 M

Certification

I, Clint Allen, being a Registered Mining Surveyor pursuant to the Surveying & Spatial Information Act 2002, certify the accuracy of this plan at the time of dating.

This certification of accuracy is only for workings mined or proposed to be mined and drawn during the period of appointment as Mine Surveyor at Mandalong Mine

New South Wales BOSSI Registration Identification No. 8560

..... Date .....

I, John Turner, being a Mine Manager (Mining Engineering Manager), pursuant to the Work Health and Safety (Mines and Petroleum Sites) Regulations 2014, certify the accuracy of this plan at the time of dating.

This certification of accuracy is only for workings mined or proposed to be mined and drawn during the period of appointment as Mine Manager at Mandalong Mine.

NSW Mine Managers Certificate of Competency No. 2634

..... Date .....

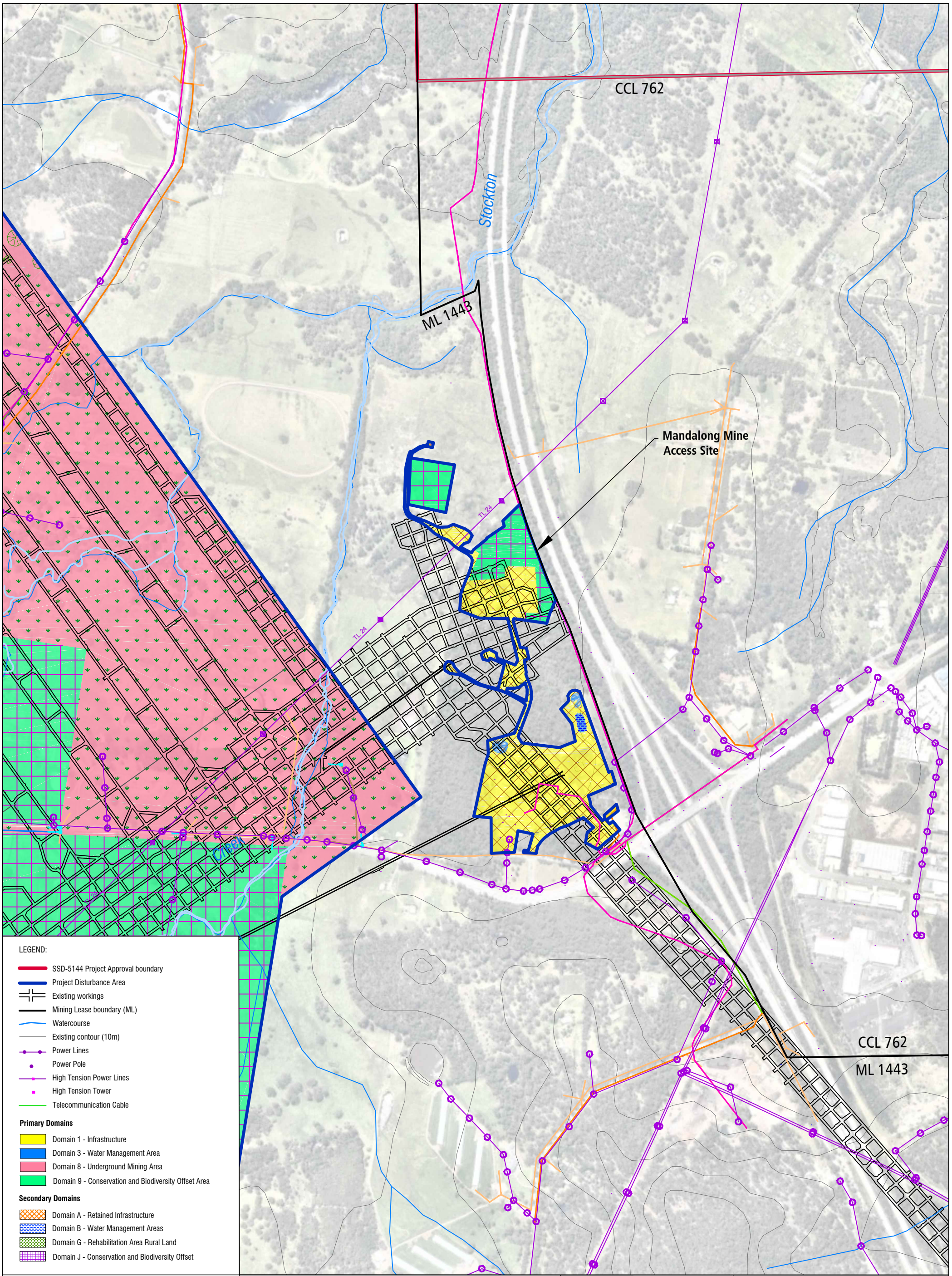
Date:	13/2/18
Drawn:	LJF
Scale:	1:7500
Coordinate System:	GDA 94 Zone 56
Sheet Size:	A3
File Name:	Plan 2-1_630.11975_V8
Revision:	08
Prepared by:	SLR Consulting

Centennial Coal
Mandalong

MINING OPERATIONS PLAN

Mine Domains at Commencement of MOP

PLAN 2-1



LEGEND:

- SSD-5144 Project Approval boundary
- Project Disturbance Area
- Existing workings
- Mining Lease boundary (ML)
- Watercourse
- Existing contour (10m)
- Power Lines
- Power Pole
- High Tension Power Lines
- High Tension Tower
- Telecommunication Cable

Primary Domains

- Domain 1 - Infrastructure
- Domain 3 - Water Management Area
- Domain 8 - Underground Mining Area
- Domain 9 - Conservation and Biodiversity Offset Area

Secondary Domains

- Domain A - Retained Infrastructure
- Domain B - Water Management Areas
- Domain G - Rehabilitation Area Rural Land
- Domain J - Conservation and Biodiversity Offset

0.0 200 400 M

Certification

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New South Wales BOSSI Registration Identification No. 8560

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NSW Mine Managers Certificate of Competency No. 2634

..... Date .....

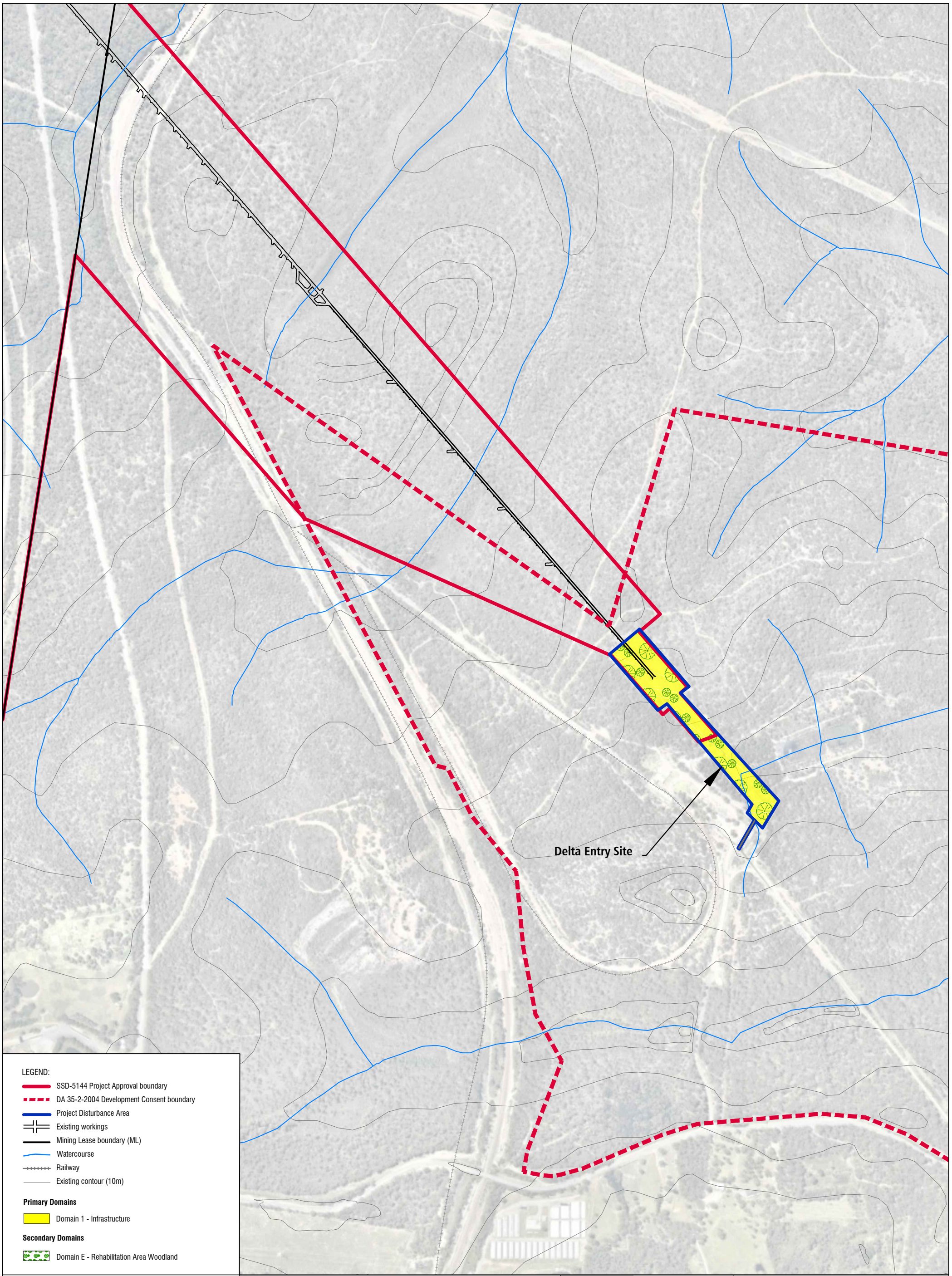
Date:	13/2/18
Drawn:	LJF
Scale:	1:7500
Coordinate System:	GDA 94 Zone 56
Sheet Size:	A3
File Name:	Plan 2-2_630.11975_V8
Revision:	08
Prepared by:	SLR Consulting

Centennial Coal
Mandalong

MINING OPERATIONS PLAN

Mine Domains at Commencement of MOP

PLAN 2-2



LEGEND:

- SSD-5144 Project Approval boundary
- DA 35-2-2004 Development Consent boundary
- Project Disturbance Area
- Existing workings
- Mining Lease boundary (ML)
- Watercourse
- Railway
- Existing contour (10m)

Primary Domains

- Domain 1 - Infrastructure

Secondary Domains

- Domain E - Rehabilitation Area Woodland

0.0 200 400 M

Certification

I, Clint Allen, being a Registered Mining Surveyor pursuant to the Surveying & Spatial Information Act 2002, certify the accuracy of this plan at the time of dating.

This certification of accuracy is only for workings mined or proposed to be mined and drawn during the period of appointment as Mine Surveyor at Mandalong Mine

New South Wales BOSSI Registration Identification No. 8560

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This certification of accuracy is only for workings mined or proposed to be mined and drawn during the period of appointment as Mine Manager at Mandalong Mine.

NSW Mine Managers Certificate of Competency No. 2634

..... Date .....

Date:	13/2/18
Drawn:	LJF
Scale:	1:7500
Coordinate System:	GDA 94 Zone 56
Sheet Size:	A3
File Name:	Plan 2-3_630.11975_V8
Revision:	08
Prepared by:	SLR Consulting

Centennial Coal
Mandalong

MINING OPERATIONS PLAN

Mine Domains at Commencement of MOP

PLAN 2-3

Cooranbong Entry Site

LEGEND:

- SSD-5144 Project Approval boundary
- Project Disturbance Area
- Mining Lease boundary (ML)
- Watercourse
- Railway
- Existing contour (10m)
- Power Lines
- Power Pole
- High Tension Power Lines
- High Tension Tower

Primary Domains

- Domain 1 - Infrastructure
- Domain 3 - Water Management Area
- Domain 5 - Stockpiled Material

Secondary Domains

- Domain A - Retained Infrastructure
- Domain B - Water Management Areas
- Domain E - Rehabilitation Area Woodland

0.0 200 400 M

Certification

I, Clint Allen, being a Registered Mining Surveyor pursuant to the Surveying & Spatial Information Act 2002, certify the accuracy of this plan at the time of dating.

This certification of accuracy is only for workings mined or proposed to be mined and drawn during the period of appointment as Mine Surveyor at Mandalong Mine

New South Wales BOSSI Registration Identification No. 8560

..... Date .....

I, John Turner, being a Mine Manager (Mining Engineering Manager), pursuant to the Work Health and Safety (Mines and Petroleum Sites) Regulations 2014, certify the accuracy of this plan at the time of dating.

This certification of accuracy is only for workings mined or proposed to be mined and drawn during the period of appointment as Mine Manager at Mandalong Mine.

NSW Mine Managers Certificate of Competency No. 2634

..... Date .....

Date:	13/2/18
Drawn:	LJF
Scale:	1:7500
Coordinate System:	GDA 94 Zone 56
Sheet Size:	A3
File Name:	Plan 2-4_630.11975_V8
Revision:	08
Prepared by:	SLR Consulting

Centennial Coal
Mandalong

MINING OPERATIONS PLAN

Mine Domains at Commencement of MOP

PLAN 2-4

N

MGA 94

Little Valley Road

Mandalong Road

Morans Creek

330 kV Transmission Line

Access Road MSSS

Chapman Road

Morans Creek

MAIN HEADINGS

WEST HEADINGS

TAILGATE 25

LONGWALL 25B

LONGWALL 25A

MAINGATE 25

LONGWALL 26B

LONGWALL 26A

MAINGATE 26

LONGWALL 27

MAINGATE 27

LONGWALL 28

MAINGATE 28

MAINGATE 29

SOUTHWEST-MAINS

Mandalong South Surface Site

0km 0.5km 1km

LEGEND

JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER

Creek
Drainage Line
Sealed Road
330kV Transmission Line
Dwelling
Building
Olney State Forest

LOCATION	MANDALONG
SEAM	WEST WALLARAH
DRAWN	DH 23.01.2008
CHECKED	
APPROVED	
SCALE	1:10000

Centennial Coal
Mandalong

MONTHLY PRODUCTION 2019

CONTRACT No.	
PLOTFILE No.	MG10815_rev15.pdf
A3	MG 10815
DRAWING REVISION	15 - 11.03.2020

LEGEND

- Dust Monitoring Point
- Surface Water Monitoring Point

0 100m 200m 300m 400m

nearmap.com

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LOCATION	MANDALONG
SEAM	WEST WALLARAH
DRAWN	PJS 08/10/07
CHECKED	
APPROVED	

SCALE 1 : 2500

Centennial Coal
Mandalong

Mandalong Mine
Location of Environmental Monitoring Points

CONTRACT	
PLOTFILE	
A3	**MG10722d**
REVISION	Rev 14 29/07/19

LEGEND

Dust Monitoring Point

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LOCATION	MANDALONG
SEAM	WEST WALLARAH
DRAWN	PJS 08/10/07
CHECKED	
APPROVED	
SCALE	1: 5000

Centennial Coal
Mandalong

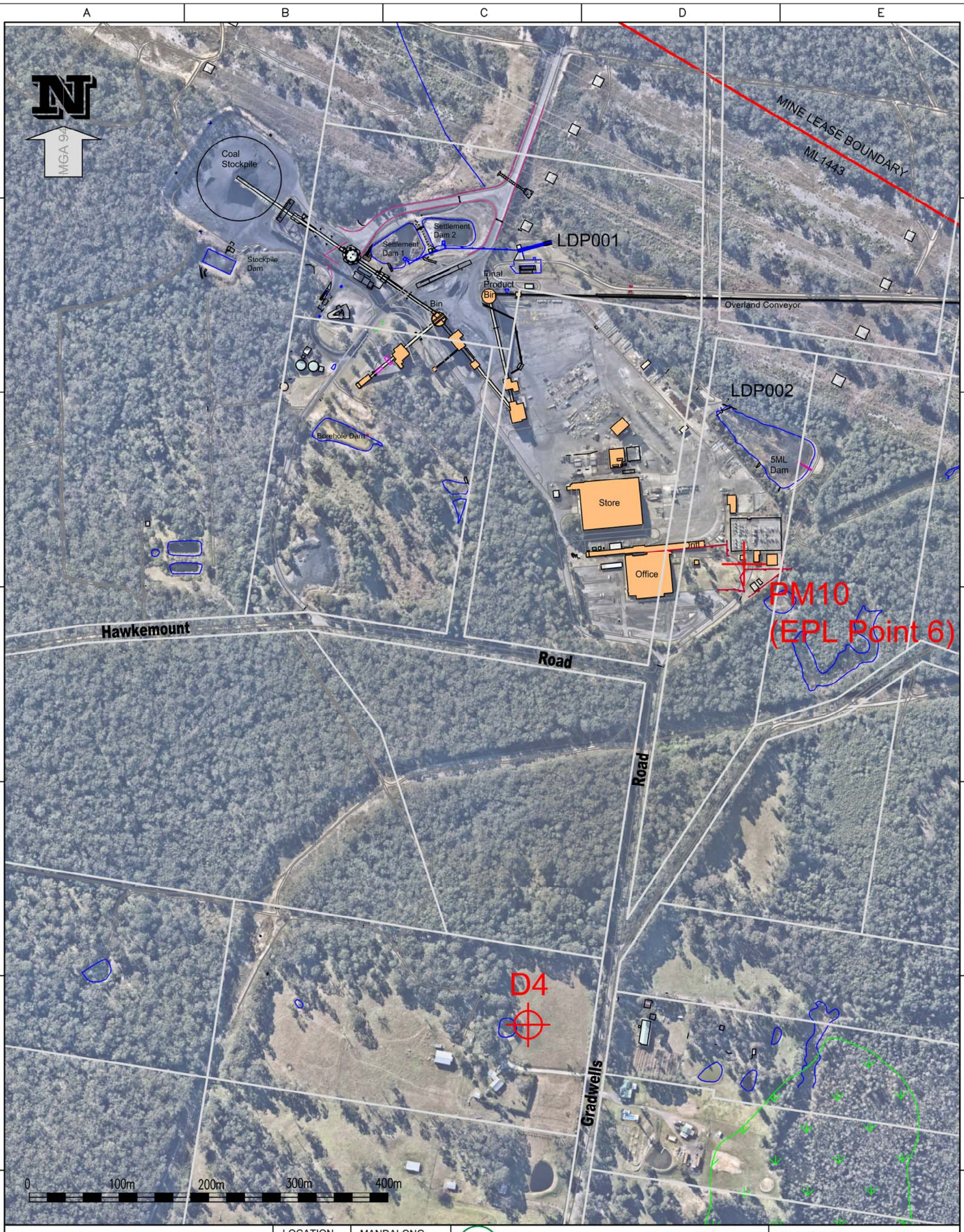
Delta Entry Site -
Location of Environmental Monitoring Points

CONTRACT

PLOTFILE: MG10722c_rev10.pdf

A3 **MG10722c**

DRAWING REV. 10 - 25.02.2025



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LOCATION	MANDALONG
SEAM	WEST WALLARAH
DRAWN	PJS 08/10/07
CHECKED	
APPROVED	

SCALE 1 : 250

Centennial Coal
Mandalong

Cooranbong Pit Top
Location of Environmental Monitoring Points

CONTRACT	
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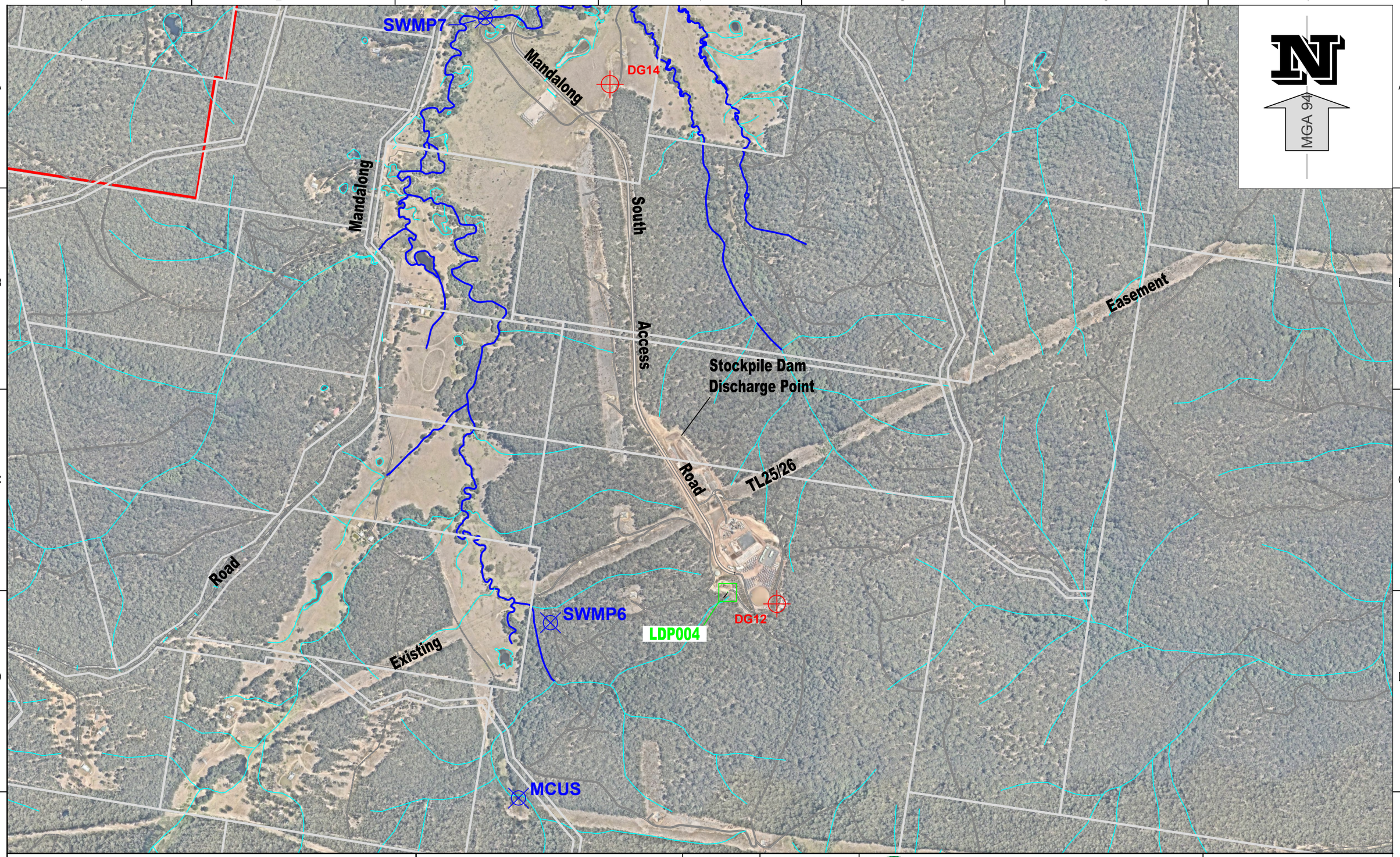
DRAWING REVISION	10-23.01.18



LEGEND

- Dust Monitoring Point
- Surface Water Monitoring Point
- Licence Discharge Point

0 100m 200m 300m 400m

nearmap.com

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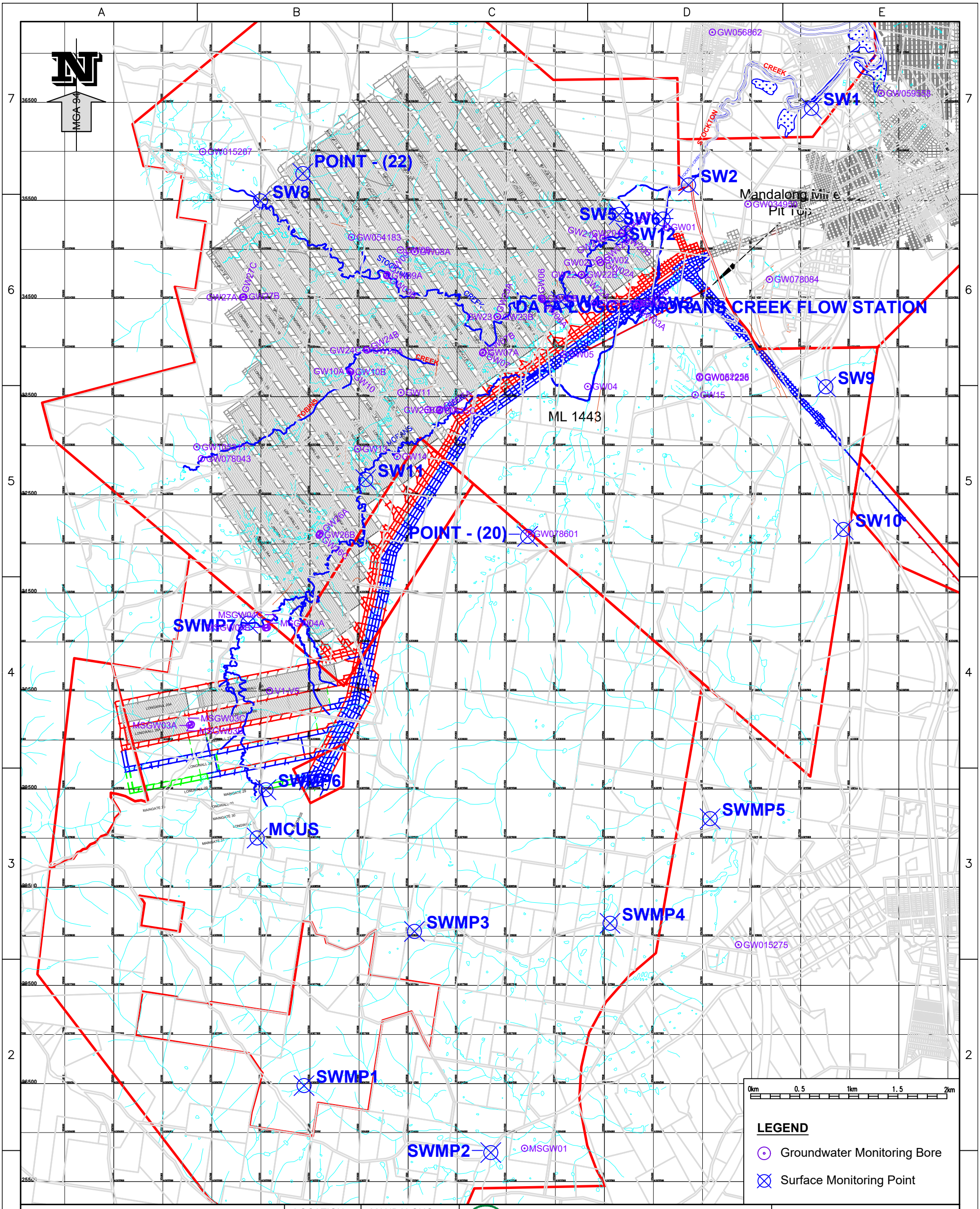
LOCATION	MANDALONG
SEAM	WEST WALLARAH
DRAWN	PJS 08/10/07
CHECKED	J.D 18/12/18
APPROVED	

SCALE 1 : 10,000

Centennial Coal
Mandalong

Mandalong South Surface Site
Location of Environmental Monitoring Points

CONTRACT	
PLOTFILE	
A3	MG10722F
REVISION	3 12/02/2020 T.S.G.



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LOCATION	MANDALONG
SEAM	WEST WALLARAH
DRAWN	T.S.G. 14/03/17
CHECKED	J.D. 14/03/17
APPROVED	
SCALE :	Refer to Scale Bar

Centennial Coal
Mandalong

Location of Ground Water and Surface Monitoring Points - Mandalong Mine

CONTRACT

PLOTFILE: MG10502_200225

A3 **MG10502**

DRAWING REVISION

APPENDICES

Appendix 1: Bank Guarantee – DA97/800 CC24

Beneficiary
Minister for Planning
For the State of New South Wales, Australia

Applicant
Centennial Coal Company Limited
ABN 30 003 714 538
Level 18,
1 Market St
Sydney NSW 2000 Australia

Date of Issue
10/01/19

Guarantee Amount:
Not exceeding AUD 2,000,000.00
Two Million Australian Dollars

Description of Contract/Agreement:
National Australia Bank (NAB) asks the Beneficiary to accept this bank guarantee ('Undertaking') in connection with a contract or agreement between the Beneficiary and Applicant for: Deed between Centennial Mandalong Pty Limited and Department of Planning with respect to the Company's compliance with Clause 24 of the Mandalong Development Consent.

Guarantee Amount:
In consideration of the Beneficiary accepting this Undertaking and its terms, NAB undertakes unconditionally to pay the Beneficiary on written demand from time to time any sum or sums up to an aggregate amount not exceeding:
Australian Dollars Two Million and Nil cents only (AUD2,000,000.00) ("Amount").

Undertaking:
NAB will pay the amount or any part of it to the Beneficiary upon presentation of this original Undertaking (accompanied by a written demand) at Level 24, 255 George St Sydney NSW 2000 without reference to the applicant and even if the Applicant has given NAB notice not to pay the money, and without regard to the performance or non-performance of the Applicant or Beneficiary under the terms of the contract or agreement.

By accepting this undertaking, the Beneficiary acknowledges and agrees that NAB may rely entirely on any demand or notice presented to it and has no responsibility or obligation to investigate the authenticity or correctness of the matters stated demand or notice, he signatures on the same, the positions of such signatories or the capacity or entitlement of the Beneficiary to give and execute the demand or notice.

Any alterations to the terms of the contract or agreement or any extensions of time or any other forbearance by the Beneficiary or Applicant will not impair or discharge NAB's liability under the Undertaking.

This Undertaking remains in force until the first to occur of:
i. The Beneficiary notifies NAB in writing that the Undertaking is no longer needed;
ii. This original Undertaking is returned to Level 24, 255 George St Sydney NSW 2000;
iii. NAB has paid to the Beneficiary the Amount or the balance outstanding of the Amount.
iv. 4.00pm on 31st day of October, 2021 in the State or Territory of presentation ("Expiry Date").
If the Expiry date is not a business day in the State or Territory, then the Expiry date shall be deemed to occur on the next business

Notwithstanding anything stated in this Undertaking, NAB has the right to terminate it at any time by paying the Beneficiary the Amount or balance outstanding of the Amount, or any lesser amount that the Beneficiary may require.

This Undertaking is personal to the Beneficiary. The Beneficiary cannot assign, transfer, charge or otherwise deal with its rights under this Undertaking and NAB will not recognise any purported assignment, transfer, charge or other dealing.

CENTENNIAL 00231

©2012 National Australia Bank Limited ABN 12 004 044 937 AFSL and Australian Credit Licence 230686 60165A0312

This Undertaking will be governed by the current laws of the location of presentation.

SIGNED, SEALED AND DELIVERED)
For and on behalf of NATIONAL)
AUSTRALIA BANK LIMITED by its)
Duly constituted attorney)
ANTON GREENHALGH)
DIRECTOR)
)
Under Power of Attorney dated 1 March 2007)
in the presence of:)
)
)
Signature of Witness)
)
Lisa Yan)
Name of Witness)

10/01/2019

Appendix 2: Floodpath Condition Report - 2019

Centennial Mandalong Mine Floodpath Condition Report 2019

For the Period 1 January 2019 to 31 December 2019

Owned & Operated by Centennial Mandalong
(Dated January 2020)

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Appendix 2 - Floodpath Condition Record.

Appendix 3 - Floodpath Condition Photographic Monitoring Points.

DOCUMENT DETAILS	Name:	Mandalong Mine Floodpath Condition Report 2019
	Author:	Jeff Dunwoodie
	Reference:	
	Revision No.:	
	Document Status	Approved for Submission

APPROVAL DETAILS

Revision No.	Date Sent	Details of Approval	Approved By	Approval Date
0		Draft review	P Enright	January 2020
1		Final	J. Dunwoodie	January 2020

Circulation Details

Name	Department	Copies

1.0 Induction and Objectives

1.1 Background

Mandalong Mine is owned and operated by Centennial Mandalong ('Centennial Mandalong'), a subsidiary of Centennial Coal Company Limited ('Centennial'). Mandalong Mine is a modern underground longwall operation located in Lake Macquarie, near Morisset west of the Pacific Motorway and is situated in the sub catchment of Mandalong. The Mandalong catchment is located to the west of Lake Macquarie consisting of alluvial floodplain that contains Stockton and Moran's Creek, draining into Dora Creek. The Mine extends beneath a number of surface features including rural residential properties, an alluvial floodplain and the foot slopes of the Watagan Ranges.

DA97/800 and the LW22-23, LW24-24A and LW25-31 Extraction Plan – Water Management Plans requires the condition of major floodpaths, in an area subject to a Subsidence Management Plan (SMP) or Extraction Plan, be inspected every six months or following a flood event. The floodpaths at Mandalong have been identified by the Martinez and Swann report titled "Mandalong South Flood Assessment" dated July 2018 and are as shown overlying Longwall panels 1 to 31 in Figure 1 (Umwelt, 2018) of Appendix 1. The floodpaths within the current longwall mining area generally consist of ephemeral tributaries draining to Morans Creek.

Previously the condition of floodpaths and properties on the floodplain were described in the reports submitted to DPI-Water titled:-

- "Longwall Panels 1 to 6 Property and Creek Line Pre and Post Mining Assessments" dated November 2006 by International Environmental Consultants Pty Ltd; and

The following reports prepared by Centennial Mandalong:

- "Centennial Mandalong Mine Flood Path Condition Report 2007" dated January 2008
- "Centennial Mandalong Mine Flood Path Condition Report 2008" dated January 2009
- "Centennial Mandalong Mine Flood Path Condition Report 2009" dated January 2010
- "Centennial Mandalong Mine Flood Path Condition Report 2010" dated January 2011
- "Centennial Mandalong Mine Flood Path Condition Report 2011" dated January 2012
- "Centennial Mandalong Mine Flood Path Condition Report 2012" dated January 2013
- "Centennial Mandalong Mine Flood Path Condition Report 2013" dated February 2014
- "Centennial Mandalong Mine Flood Path Condition Report 2014" dated February 2015
- "Centennial Mandalong Mine Flood Path Condition Report 2015" dated March 2016
- "Centennial Mandalong Mine Flood Path Condition Report 2016" dated March 2017
- "Centennial Mandalong Mine Flood Path Condition Report 2017" dated March 2018
- "Centennial Mandalong Mine Flood Path Condition Report 2018" dated March 2019

Following on from the information contained in the above documents, this report compiles survey information and photographic records of floodpaths as per the methodology in **Section 2.0**.

1.2 Scope

The report assesses the changes to the condition of floodpaths along stream reaches undermined by Longwalls 23, 24 and 24A in 2018 and Longwall 25 and 26 in 2019 and previously subsided longwalls 15 to 22, identifying the effects of subsidence on the floodpaths. The pre-mining condition of the floodpaths above Longwalls 27 to 31 are also documented in this report.

1.3 Predicted Changes to Streams and Flooding Regime

Under the River Styles framework (Brierley, 2005) the morphology of both Morans Creek and Tobins Creek is classified as fine-grained meandering systems. This watercourse type exhibits a moderately sinuous channel set within continuous floodplains composed of alluvial sandy silt. The channels are symmetrical to asymmetrical on bends and have low to moderate width/depth ratios. Banks are typically well-vegetated with a range of native and exotic species (GHD, 2016).

A section of Tobins Creek was under-mined by Longwalls 21, 22 and 23 during 2017. The maximum predicted subsidence in the vicinity of Tobins Creek over Longwall 21 was 0.95m, 0.85m for Longwall 22 and 0.80m for Longwall 23. The predicted maximum differential subsidence (from the chain pillar to the centre of the longwall) is approximately 0.20m for both Longwall 21 and Longwall 22 and 0.40m for Longwall 23.

A section of Morans Creek was mined beneath by Longwall 23, Longwall 24 and Longwall 24A in 2018. The creek has a generally poorly defined channel system, in which creek lines give way to undefined overland flow paths in several areas ((Hughes Trueman, 2004). The channels sections of Morans Creek in this area have an average channel bed slope of 0.25 % with typical channel widths of 7.5 m to 25 m and typical channel depths of 1.0 m to 2.2m ((Hughes Trueman, 2004). The creek meanders considerably through these areas and as such a length of approximately 1040 m was undermined by the three longwall panels. The maximum predicted subsidence in the vicinity of Morans Creek over Longwall 23 and Longwall 24 is approximately 0.70m and 0.40m for Longwall 24A. The predicted maximum differential subsidence (from the chain pillar to the centre of the longwall) is approximately 0.20m for Longwall 24.

An increase in existing ponding was predicted to occur in the Flood Assessment for LW24-24A (Umwelt, 2017). Four potential remnant ponding locations to develop over Longwalls 22 and 24 including one site along Morans Creek. The occurrence of ponding and remediation works are detailed in the Mandalong Mine 2019 Annual Review.

The levels of predicted subsidence and associated grade changes along Morans Creek and Tobins Creek over Longwalls 21, 22, 23, 24 and 24A are of a similar order of magnitude to the existing creek bed slopes. The level of predicted subsidence along Morans Creek and Tobins Creek is relatively small and it is therefore considered that these will not significantly alter the flow conveyance capacity of the existing channels. The associated impacts on the maximum flood depths and flood hazards that have been modelled are not considered to be significant.

The maximum predicted subsidence for Longwall 25 to 31 over Morans Creek is approximately 1.3m and for Byrons Gully is approximately 930mm (Umwelt, 2018). The Mandalong South Flood Assessment for LW25-31 (Umwelt, 2018) states that the levels of predicted subsidence over Longwalls 25 to 31 are not expected to significantly alter the flow conveyance capacity of the existing channels. The associated impacts on the maximum modelled flood depths and flood hazard categories are not considered to be significant.

There is minimal potential for channel realignment of Morans Creek, Tobins Creek and Byrons Gully due to underground mining. The potential to increase erosion on the landform is expected to be minimal due to the limited amount of exposed soils, high level of groundcover and the relatively low in channel and out of channel velocities.

2.0 Methodology

2.1 Survey Methodology

The assessment methodology comprised of detailed surveys of the floodpath condition within current and planned longwall mining areas with specific attention given to major flood paths including the tributaries and reaches of Morans and Tobins Creek and flood prone areas. Field surveys were undertaken in June and December 2019. Floodpath condition monitoring for Stockton Creek has been completed as subsidence has been completed following final subsidence of Longwall 15. Floodpath condition monitoring will continue to be undertaken on Morans Creek, Tobins Creek and Byrons Gully in 2020.

The assessment methodology consisted of surveying subsidence along Morans and Tobins Creek to measure vertical subsidence movement as to derive longitudinal grades from the surveys. Stream condition surveys where undertaken at the photographic monitoring points. These monitoring points where sited at the locations shown in **Figure MG10687** of **Appendix 1**. The monitoring points are in areas of highest potential differential subsidence, typically above the edges of Maingate roadways, to monitor the effects of subsidence on stream condition and changes in stream grade. Observations on the stream's condition where recorded as presented in **Appendix 2** at these points including, stream geomorphology, bank height and width, bed condition (where observable), erosion, channel flood brake out, vegetation community and subsidence deformation.

2.2 Impact Assessment

The predicted subsidence related changes to stream channel condition are assessed in the report for each reach above the longwall panels, by using the photographic monitoring points to define the pre-mining channel condition and subsidence induced changes to stream characteristics. The stream grade changes and subsidence effects (i.e. ponded or pooled areas, soil cracking) are assessed to determine if these have resulted in evidence of erosion or significant channel realignment. These changes are then evaluated in relation to relevant trigger conditions contained in the Longwall 18-21 Environmental Management Plan, the Longwall 22-23 Extraction Plan - Water Management Plan, the Longwall 24-24A Extraction Plan - Water Management Plan and the Longwall 25-31 Extraction Plan - Water Management Plan.

3.0 Floodpath Survey Assessment

This section of the report describes the floodpath and stream condition recorded for the longwall mining areas in relation to geomorphic units, subsidence and vegetation characteristics in relation to their position of the stream reach above longwall panels.

3.1 Morans Creek Longwall 25 to 31

3.1.1 Pre-mining Survey Assessment

Monitoring points 76 to 100 (**Appendix 3**) are located above Maingate 25, 26, 28, 30 and 31 and also Longwall 25, 26, 27, 30 and 31 as well as Tailgate 31. Morans Creek in this area is predominately well forested, with sandy soils and some rocks ranging in size up to 200 millimetres in diameter. The soil landscapes within the upper slope areas are of Gorokan soil landscapes within the foot-slope areas and Yarramalong and Wyong soil landscapes within the floodplain area (Umwelt, 2013). The channels have a relatively low longitudinal gradient of approximately 0.32%.

During December 2019 it was observed that there was no stream flows with approximately half the sites having still pooling with water quality ranging from turbid to clear. The vegetation observed is consistent with the Alluvial Tall Forest (MU5), Coastal Foothills Spotted Gum – Ironbark Forest (MU15) and small amounts of Riparian Melaleuca swamp woodland (MU42) and Coastal Narrabeen Moist Forest (MU6).

3.1.1 Post-Mining Survey Assessment

The post mining surveys completed in 2019 observed dry conditions with minimal pooling with water quality ranging from clear to turbid. The stream conditions were similar to those identified in the pre-mining survey conducted in June 2018 with low flows and pool sequence identified 2019. The December 2019 monitoring presented dry conditions with limited to no rainfall over the previous months. The vegetation community for the area, Alluvial Tall Moist Forest, (MU5), Riparian Melaleuca swamp woodland (MU42) and Coastal Narrabeen Moist Forest (MU6) mapped by Hunter Eco (September 2011), has been observed to remain unchanged to date following mining.

3.1.2 Impact Assessment

As of the December 2019 survey, Longwall 25 had been completed covering monitoring points 76 to 82, and 85 to 88. The maximum vertical subsidence measured over Longwall 25 centerline was 0.68m, Subsidence recorded over the Maingate pillars was consistent with predictions, with 0.06m over the Maingate and 0.01 over the Tailgate. The changes in gradient over the fully subsided Longwall 25 were 0.30% and 0.27%. Points 78 and 80 had no subsidence as per predictions. All monitoring points over longwall 25 have had a gradient change no greater than 0.30% to the creekline.

During the 2019 flood path inspections there was no evidence of surface cracking, ponding or erosion within the creekline. Monitoring is ongoing to assess any subsidence impacts to the creekline and the predicted increase in ponding.

3.2 Morans Creek (Main Tributary) Longwall 23, 24 & 24A

3.2.1 Pre-mining Survey Assessment

Monitoring points 74, 75, MCT-1, MCT-6, MCT-7, MCT-8, MCT-9, MCT-10, MCT-11, MCT-12, MCT-13 and MCT-14 (**Appendix 3**) are located above Maingate 23, 24 and 24A as well as Longwall 23, 24 and 24A. Morans Creek in this area is classified as fine-grained meandering system. Banks are typically well vegetated with a range of native and exotic species. As a result, in combination with relatively cohesive bank sediments, the occurrence and rates of bank erosion are low. Channel beds are dominated by fine-grained sediments with occasional bank attached sand bars. The channels have a relatively low longitudinal gradient of approximately 0.35%. Bed controls are dominated by timber accumulations and there is no bedrock influencing channel stability. As a result, the channel beds have the potential to incise through headcuts (GHD, 2016).

Stream flows were minor with pool sequence observed in 2017. The water quality was slightly turbid. Morans Creek along this reach has remnant vegetation some 50 m to 90 m wide either side of the creek banks, consistent with the Alluvial Tall Moist Forest (MU5) mapped by Hunter Eco ((Hunter Eco, 2011)).

3.2.1 Post-Mining Survey Assessment

The post mining surveys completed in 2018 and 2019 observed low flows and pooling with water quality ranging from clear to turbid. The stream conditions were similar to those identified in the pre-mining survey conducted in June 2017 with low flows and pool sequence identified in 2017, 2018 and 2019. The vegetation community for the area Alluvial Tall Moist Forest (MU5) mapped by Hunter Eco (September 2011) has been observed to remained unchanged to date following mining.

3.2.1 Impact Assessment

The maximum vertical subsidence measured over Longwall 23 centerline was 1.12m, 1.07m over Longwall 24 and 0.87m over LW24A. Subsidence recorded over the Maingate pillars was consistent with predictions, with 0.7m over Maingate 22, 0.74m over Maingate 23, 0.63m over Maingate 24 and 0.08m over Longwall 24A. The changes in gradient over the fully subsided Longwall 23 were 0.25% and 0.35%, over Longwall 24 were 0.21% and 0.13% and over Longwall 24A were 0.18% and 0.5%.

During the 2019 flood path inspections there was no evidence of surface cracking, ponding or erosion within the creekline. Monitoring is ongoing to assess any subsidence impacts to the creekline and the predicted increase in ponding.

3.3 Morans Creek (Main Tributary) Longwall 21 and 22

3.3.1 Pre-mining Survey Assessment

Monitoring points 70, 71, 72 and 73 (**Appendix 3**) are located above Maingate 21 and 22 as well as Longwall 21 and 22. Morans Creek in this area is classified as fine-grained meandering systems. Banks are typically well-vegetated with a range of native and exotic species. As a result, in combination with relatively cohesive bank sediments, the occurrence and rates of bank erosion are low. Channel beds are dominated by fine-grained sediments with occasional bank attached sand bars. The channels have a relatively low longitudinal gradient of approximately 0.35%. Bed controls are dominated by timber accumulations and there is no bedrock influencing channel stability. As a result, the channel beds have the potential to incise through headcuts (GHD, 2016).

Stream flows were minor with pool sequence observed in November 2015. The water quality was slightly turbid. Morans Creek along this reach has remnant vegetation some 50 m to 90 m wide either side of the creek banks, consistent with the Alluvial Tall Moist Forest (MU5) mapped by Hunter Eco (Hunter Eco, 2011).

3.3.2 Post-Mining Survey Assessment

The post mining surveys conducted in 2016, 2017, 2018 and 2019 observed minor flows above Maingate 21 and Maingate 22 as well as Longwalls 21 and 22. The stream conditions were similar to those identified in the pre-mining survey conducted in November 2015 with low flows and pool sequence identified in 2016, 2017, 2018 and 2019. The vegetation community the Alluvial Tall Moist Forest (MU5) mapped by Hunter Eco (September 2011) remained unchanged to date following mining.

3.3.3 Impact Assessment

Consistent with the subsidence predictions, the maximum vertical subsidence measured over Longwall 21 centreline was 0.93m and 0.70m over measured over Longwall 22. Subsidence recorded over the maingate pillars was also consistent with predictions, with 0.31m over Maingate 20, 0.60m over Maingate 21 and 0.7m over Maingate 22. The changes in grade over the fully subsided Longwall 21 were 0.08% and 0.15%. Changes in grade over Longwall 22 were 0.2% and 0.29%.

During the 2017, 2018 and 2019 flood path inspections there was no evidence of surface cracking, ponding or erosion within the creekline. Monitoring is ongoing to assess any subsidence impacts to the creekline and the predicted increase in ponding.

3.4 Morans Creek (Main Tributary) Longwall 19 and 20

3.4.1 Pre-mining Survey Assessment

Monitoring points 64, 65, 66, 67, 68 and 69 (**Appendix 3**) are located above Maingate 19 and Maingate 20 as well as Longwalls 19 and 20. The reach consists of channel widths 5 -10 m wide. Bank heights of are between 1-2.2m and a clay / gravel stream bed was observed. Stream flows were minor with pool sequence observed in November 2015. The water quality was slightly turbid. Morans Creek along this reach has remnant vegetation some 50 m to 90 m wide either side of the creek banks, consistent with the Alluvial Tall Moist Forest (MU5) mapped by Hunter Eco (Hunter Eco, 2011).

3.4.2 Post-Mining Survey Assessment

The post mining surveys conducted in 2015, 2016, 2017, 2018 and 2019(Only for point 69) observed minor flows above Maingate 19 and Maingate 20 as well as Longwalls 19 and 20. The reach consists of channel widths 2 -5 m wide. Bank heights of are between 1 - 2.2m and a clay / gravel stream bed was observed. The stream conditions were similar to those identified in the pre-mining survey conducted in December 2014 with low flows and pool sequence identified in 2015, 2016, 2017, 2018 and 2019 (Only point 69). The vegetation community the Alluvial Tall Moist Forest (MU5) mapped by Hunter Eco (September 2011) remained unchanged to date following mining.

3.4.3 Impact Assessment

The largest vertical subsidence recorded over Longwall 19 in the vicinity of Morans Creek was 0.74m, and for Longwall 20 was 0.44m, with a maximum differential subsidence from the chain pillars to the centre of the panel in the order of 0.5m for Longwall 19, representing a change in grade along the creek of 0.3%.

During the December 2014, 2015, 2016, 2017, 2018, and 2019(Only for point 69) flood path inspections there was no evidence of surface cracking, ponding or erosion within the creekline. The subsidence and stream grade changes are below the anomalous results triggers in the LW15-17 and LW18-21 EMPs. Monitoring is ongoing to assess any subsidence impacts to the creekline and the predicted increase in ponding.

3.5 Morans Creek (Main Tributary) Longwall 17 and 18

3.5.1 Pre-mining Survey Assessment

Monitoring points 58, 59, 60, 61, 62 and 63 (**Appendix 3**) are located above Maingate 16, Maingate 17, Maingate 18 and Longwalls 17 and 18. The reach consists of channel widths 5 -10 m wide. Bank heights of are between 1-2.2m and a clay / gravel stream bed was observed. Stream flows were minor with pool sequence observed in December 2014. The water quality was turbid. Morans Creek along this reach has remnant vegetation some 50 m to 90 m wide either side of the creek banks, consistent with the Alluvial Tall Moist Forest (MU5) mapped by Hunter Eco (Hunter Eco, 2011).

3.5.1 Post-Mining Survey Assessment

The post mining surveys conducted in 2015, 2016, 2017 and 2018 observed minor flows above Maingate 16 and 17, Longwall 17 and 18. The reach consists of channel widths 5 -10 m wide. Bank heights are between 1 - 2.2m and a clay / gravel stream bed was observed. The stream conditions were similar to those identified in the pre-mining survey conducted in December 2014 with low flows and pool sequence identified in 2015, 2016, 2017 and 2018. Evidence of flood break out was observed in May 2015 as well as evidence of erosion at monitoring points 58 and 59 (not subsidence related). Evidence of minor erosion was observed in December 2018 at monitoring point 58 (not subsidence related). The vegetation community the Alluvial Tall Moist Forest (MU5) mapped by Hunter Eco (September 2011) remained unchanged to date following mining.

3.5.2 Impact Assessment

The largest vertical subsidence recorded over Longwall 17 and 18 in the vicinity of Morans Creek was 0.80m measured on 17 Centreline 14 subsidence line, with differential subsidence from the chain pillars to the centre of the panel in the order of 0.5m, representing a change in grade along the creek of 0.2%.

During the December 2014, 2015, 2016, 2017 and 2018 flood path inspections there was no evidence of surface cracking, ponding or erosion within the creekline with the exception of erosion observed at monitoring point 58 and 59. The erosion observed is due to stream bank undercutting from a flood event and not subsidence related. The subsidence and stream grade changes are below the anomalous results triggers in the LW15-17 and LW18-21 EMPs. Monitoring is ongoing to assess any subsidence impacts to the creekline and the predicted increase in ponding.

3.6 Morans Creek (Main Tributary) Longwall 15 and 16

3.6.1 Pre-mining Survey Assessment

Monitoring points 54, 55, 56 & 57 (**Appendix 3**) are located above Maingate 14, Maingate 15 and Longwalls 15 and 16. The reach consists of channel widths 5 -10 m wide. Bank heights of are between 1 - 2.2m and a clay / gravel stream bed was observed. Stream flows were minor with pool sequence observed in 2014 and 2015. The water quality was turbid. Morans Creek along this reach has remnant vegetation some 50 m to 90

m wide either side of the creek banks, consistent with the Alluvial Tall Moist Forest (MU5) mapped by Hunter Eco (Hunter Eco, 2011).

3.6.2 Post-Mining Survey Assessment

The post mining surveys conducted 2014, 2015, 2016, 2017 and 2018 observed minor flows above Longwall 15 and 16. The pooled water conditions were similar to the pre mining conditions. The stream conditions where similar to those found in the pre mining survey (March & June 2014) with no observable change in channel widths or bank heights above Longwall 15 or 16. In March and May of 2015 surveys showed turbid water with no flow; flow returned in November 2015, a slow flow was recorded in June 2016 and no flow was recorded in December 2016, July 2017 and December 2017. No evidence of subsidence induced soil cracking or additional erosion on the stream's banks or bed were observed at the monitoring points in December 2014, March 2015, May 2015, November 2015, June 2016, December 2016, July 2017, December 2017 and December 2018. The vegetation community the Alluvial Tall Moist Forest (MU5) mapped by Hunter Eco (September 2011) remained unchanged to date following mining. Subsidence monitoring has confirmed the presence of some increase in out of channel ponding. Remediation of ponding associated with Longwall 16 was completed in 2015 as described in the Annual Review.

3.6.3 Impact Assessment

The largest vertical subsidence recorded over Longwall 15 in the vicinity of Morans Creek was 0.55m measured on 15 Morans Creek subsidence line, with differential subsidence from the chain pillars to the centre of the panel in the order of 0.5m, representing a change in grade along the creek of 0.8%.

The largest vertical subsidence recorded over Longwall 16 in the vicinity of Morans Creek was 0.82m measured on 15 Morans Creek subsidence line, with differential subsidence from the chain pillars to the centre of the panel in the order of 0.7m, representing a change in grade along the creek of 0.4%.

During the 2014, 2015, 2017 and 2018 flood path inspections there was no evidence of surface cracking, ponding or erosion within the creekline. The subsidence and stream grade changes are below the anomalous results triggers in the LW15-17 EMP. Monitoring is ongoing to assess any subsidence impacts to the creek-line and the predicted increase in ponding.

3.7 Tobins Creek (Main Tributary) Longwall 22-24A

3.7.1 Pre-mining Survey Assessment

Monitoring points TC7, TC8, TC9 and TC10 (Appendix 3) are located above Maingate 24 and 24A as well as Longwall 24 and 24A. Tobins Creek in this area is classified as fine-grained meandering systems. Banks are typically well-vegetated with a range of native and exotic species. As a result, in combination with relatively cohesive bank sediments, the occurrence and rates of bank erosion are low. Channel beds are dominated by fine-grained sediments with occasional bank attached sand bars. The channels have a relatively low longitudinal gradient of approximately 0.35%. Bed controls are dominated by timber accumulations and there is no bedrock influencing channel stability. As a result, the channel beds have the potential to incise through headcuts (GHD, 2016).

Stream flows were minor with pool sequence observed in December 2017. The water quality was turbid.

3.7.2 Post-Mining Survey Assessment

The post mining surveys conducted in 2017, 2018 and 2019 observed minor flows above Maingate 21, Maingate 22 and Maingate 23 as well as Longwalls 21, 22 and 23. The stream conditions were similar to those identified in the pre-mining survey conducted in March, April and July 2017 with low flows and pool sequence identified in 2017. The vegetation community the Alluvial Tall Moist Forest (MU5) mapped by RPS (2016) remained unchanged to date following mining.

3.7.3 Impact Assessment

The nearest subsidence monitoring line to Tobins Creek is located along the adjacent Tobins Rd, approximately 120m from the creekline. Subsidence is estimated to be consistent with the subsidence predictions, the maximum vertical subsidence measured over Longwall 22 centreline was 1.03m, 0.86m over Longwall 23 and 0.25m over Longwall 24. Subsidence recorded over the maingate pillars was also estimated to be consistent with the predictions, with 0.75m over Maingate 22, 0.45m over Maingate 23 and 0.10m over Maingate 24.

The maximum change in grade over the fully subsided Longwall 22 was 0.25%. Changes in grade over Longwall 23 were 0.09% and 0.36%. Longwall 24 and 24A did not directly undermine Tobins Creek.

There has been no evidence of significant change to the head-cut located on Tobins Creek (TC5) located directly above Longwall 23 in 2017, 2018 or 2019. Monitoring of the head-cut at TC5 will continue in 2020.

4.0 Discussion

The maximum vertical subsidence measured over Longwall 23 centerline was 1.12m, 1.07m over Longwall 24 and 0.87m over LW24A. Subsidence recorded over the Maingate pillars was consistent with predictions, with 0.7m over Maingate 22, 0.74m over Maingate 23, 0.63m over Maingate 24 and 0.08m over Longwall 24A. The changes in gradient over the fully subsided Longwall 23 were 0.25% and 0.35%, over Longwall 24 were 0.21% and 0.13% and over Longwall 24A were 0.18% and 0.5%. During the 2014, 2015, 2016, 2017, 2018 and 2019 flood path inspections along Morans Creek there was no evidence of surface cracking, ponding or erosion within the creekline. The subsidence and stream grade changes are below the triggers in the LW22-23 Extraction Plan – Water Management Plan and the LW24-24A Extraction Plan – Water Management Plan. Monitoring is ongoing to assess any subsidence impacts to the creekline and the predicted increase in ponding with further reporting to be provided in the next update to this report in 2021.

The nearest subsidence monitoring line to Tobins Creek is located along the adjacent Tobins Rd, approximately 120m from the creekline. Subsidence is estimated to be consistent with the subsidence predictions, the maximum vertical subsidence measured over Longwall 22 centreline was 1.03m, 0.86m over Longwall 23 and 0.25m over Longwall 24. Subsidence recorded over the maingate pillars was also estimated to be consistent with the predictions, with 0.75m over Maingate 22, 0.45m over Maingate 23 and 0.10m over Maingate 24. The maximum change in grade over the fully subsided Longwall 22 was 0.25%. Changes in grade over Longwall 23 were 0.09% and 0.36%. Longwall 24 and 24A did not directly undermine Tobins Creek.

Longwall 25 was completed in 2019 covering sections of Morans Creek and Byrons Gully. Nearest subsidence monitoring is located along Mandalong Road for Morans Creek and the heritage survey sites for Byrons Gully. The maximum vertical subsidence measured over Longwall 25 centerline was 0.68m, Subsidence recorded over the Maingate pillars was consistent with predictions, with 0.06m over the Maingate and 0.01 over the Tailgate. The changes in gradient over the fully subsided Longwall 25 were 0.30% and 0.27%. All monitoring points over longwall 25 have had a gradient change no greater than 0.30% to the creekline

During the 2017, 2018 and 2019 flood path inspections on Morans Creek, Tobins Creek and Byrons Gully there was no evidence of surface cracking, ponding or erosion within the creekline. The subsidence and stream grade changes are consistent with the normal condition within the LW22-23, LW24-24A and LW25-31 Extraction Plan – Water Management Plan TARP triggers. Monitoring is ongoing to assess any subsidence impacts to the creekline and the predicted increase in ponding with further reporting to be provided in the next update to this report in March 2021.

Floodpath condition monitoring will be undertaken on Morans Creek, Tobins Creek and Byrons Gully in 2020.

5.0 References

6.0 Bibliography

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APPENDIX 1 -
Figure 1.1 100 year ARI storm event – maximum flood depths pre mining landform & Photographic Location Points (Plan MG10687)

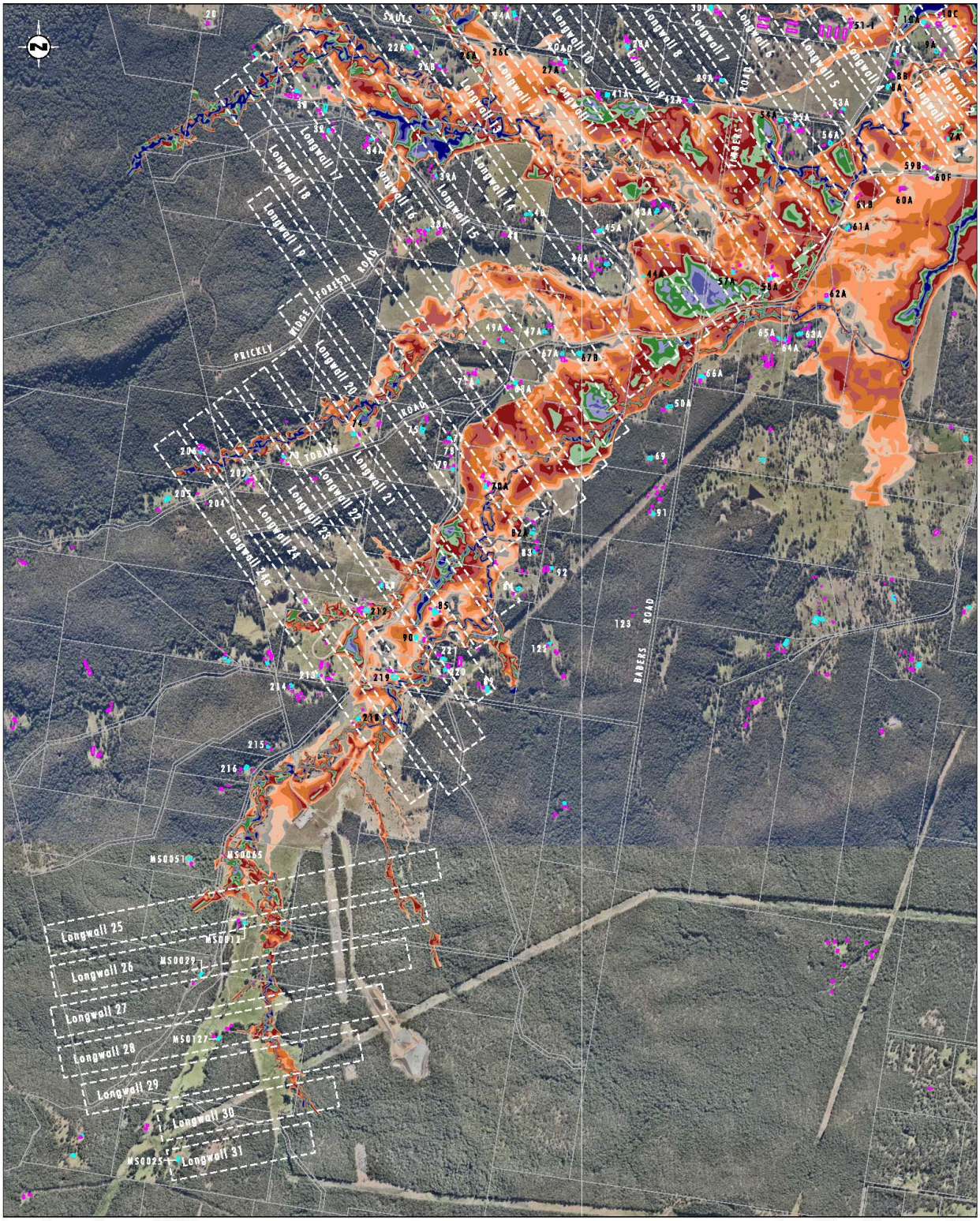

Image Source: Nearmap (2018)
Data Source: LPI NSW (2009), Centennial Mandalong (2016)

0 0.25 0.5 1.0km
1:20 000

Legend

- Longwall Locations
- Dwelling
- Other Structure
- Cadastral Boundary

Water Depth (m)

- Range [0.001 : 0.100]
- Range [0.100 : 0.300]
- Range [0.300 : 0.500]
- Range [0.500 : 0.700]
- Range [0.700 : 0.900]
- Range [0.900 : 1.100]
- Range [1.100 : 1.300]
- Range [1.300 : 1.500]
- Range [1.500 : 1.700]
- Range [1.700 : 1.900]
- Range [>1.900]

FIGURE 2

100 year ARI Storm Event:
Maximum Flood Depth Approved Longwalls 1 - 24a

File Name (A3): R07/3685_1200.dgn
20180629 9:55

Point Table		
Point #	Easting	Northing
1	354964	6334427
2	355018	6334409
3	355095	6334552
4	355076	6334700
5	355225	6334723
6	355308	6334724
7	355364	6334826
8	355356	6334943
9	355444	6335029
10	355466	6335047
11	355587	6335080
12	355712	6335200
13	354634	6334936
14	354763	6335022
15	354826	6335019
16	354894	6335072
17	354955	6335127
19	355295	6335247
20	355315	6335205
27	354683	6334522
28	354591	6334553
29	354639	6334488
30	354537	6334371
31	354508	6334315
36	354453	6334304
41	354370	6334250
42	354393	6334122
43	353979	6334420
44	353866	6334501
45	353544	6334562
46	353219	6334787
47	353207	6334717
48	352983	6334780
49	352943	6334714
50	352594	6335026
51	352479	6335079
52	352306	6335120
53	352040	6335423
54	353767	6333164
55	353717	6333093
56	353613	6333045
57	353508	6333021
58	353429	6332972
59	353304	6332958
60	353252	6332918
61	353207	6332880
62	353149	6332788
63	353055	6332706
64	353006	6332661
65	353012	6332495
66	353007	6332359
67	353062	6332405
68	353033	6332225
69	353056	6332070
70	352943	6332022
71	352815	6332021
72	352785	6331932
73	352697	6331864
74	352686	6331715
75	352595	6331697
TC1	352043.898	6333078
TC2	351989.21	6333053
TC3	351878.795	6333014
TC4	351806.318	6332994
TC5	351773.612	6333013
TC6	351688	6332949
TC7	351575	6332925
TC8	351486	6332885
TC9	351388	6332859
TC10	351334	6332763
MCT1	352212	6332496
MCT2	352282	6332492
MCT3	352485	6332396
MCT4	352680	6332200
MCT5	352548	6332100
MCT6	352444	6332061
MCT7	352361	6332043
MCT8	352296	6332068
MCT9	352217	6332060
MCT10	352111	6332026
MCT11	351981	6332028
MCT12	351880	6332078
MCT13	351969	6331897
MCT14	352344	6331774
TCT1	351784	6333189
TCT2	351860	6333091
TCT3	351880	6332921
76	351646	6330599
77	351504	6330527
78	351362	6330449
79	351194	6330504
80	351302	6330383
81	351178	6330270
82	350696	6330403
83	350805	6329745
84	350633	6329701
85	350564	6330285
86	351795	6330617
87	351846	6330511
88	351860	6330394
89	351883	6330276
90	351838	6330165
91	351840	6330047
92	351378	6329380
93	351333	6329270
94	351222	6329143
95	352003	6329525
96	352025	6329412
97	352062	6329329
98	351971	6329253
99	351890	6329153
100	351913	6329040

Plot 14/01/2020 A1 Scale 1 : 12,500
MG10687

Appendix 2
Floodpath Condition Record

Photographic Monitoring Point	Survey Coordinates	Position above longwall	Drainage path description	Survey Date	Visual Water Quality / Flow	Flood Break out	Pooling	Erosion	Subsidence Cracking	Soil Cracking	Veg Cover (%)
54	353767, 6333164	MG14	Morans Creek (Ref No.69)	19/06/2014	No flow / turbid	None	Yes	None	None	None	80
54	353767, 6333164	MG14	Morans Creek (Ref No.69)	16/12/2014	No flow / turbid	None	Yes	None	None	None	80
54	353767, 6333164	MG14	Morans Creek (Ref No.69)	10/03/2015	Turbid, no flow	No	Pool	No	No	No	90
54	353767, 6333164	MG14	Morans Creek (Ref No.69)	10/06/2015	Turbid, no flow	Yes	Pool	No	No	No	70
54	353767, 6333164	MG14	Morans Creek (Ref No.69)	3/11/2015	Turbid, flow	No	Pool	No	No	No	80
54	353767, 6333164	MG14	Morans Creek (Ref No.69)	22/6/1/6	Turbid, flow	No	Pool	No	No	No	90
54	353767, 6333164	MG14	Morans Creek (Ref No.69)	16/12/16	No flow	No	Pool	Yes -minor	No	No	70
54	353767, 6333164	MG14	Morans Creek (Ref No.69)	10/07/2017	Turbid, no flow	No	Yes	No	No	No	100
54	353767, 6333164	MG14	Morans Creek (Ref No.69)	28/12/2017	Turbid, no flow	No	Yes	No	No	No	90
54	353767, 6333164	MG14	Morans Creek (Ref No.69)	17/07/2018	Turbid, no flow	No	Yes	No	No	No	90

54	353767, 6333164	MG14	Moran's Creek	3/12/2018	Turbid, Slow flow	No	Yes	No	No	No	95
55	353717, 6333093	LW15	Morans Creek (Ref No.69)	19/06/2014	No flow / turbid	None	Yes	None	None	None	90
55	353717, 6333093	LW15	Morans Creek (Ref No.69)	16/12/2014	No flow / turbid	None	Yes	None	None	None	90
55	353717, 6333093	LW15	Morans Creek (Ref No.69)	10/03/2015	No flow / turbid	None	Yes	None	None	None	90
55	353717, 6333093	LW15	Morans Creek (Ref No.69)	10/06/2015	No flow / turbid	yes	Yes	None	None	None	80
55	353717, 6333093	LW15	Morans Creek (Ref No.69)	3/11/2015	Flow / turbid	None	Yes	None	None	None	80
55	353717, 6333093	LW15	Morans Creek (Ref No.69)	22/06/2016	Flow / turbid	None	Yes	None	None	None	100
55	353717, 6333093	LW15	Morans Creek (Ref No.69)	16/12/2016	No flow	None	Yes	Yes - minor	None	None	90
55	353717, 6333093	LW15	Morans Creek (Ref No.69)	10/07/2017	Turbid, no flow	None	Yes	No	No	No	90
55	353717, 6333093	LW15	Morans Creek (Ref No.69)	28/12/2017	Turbid, no flow	None	Yes	No	No	No	90
55	353717, 6333093	LW15	Morans Creek (Ref No.69)	17/07/2018	Turbid, no flow	None	Yes	No	No	No	90
55	353717, 6333093	LW 15 Centre	Moran's Creek	3/12/2018	Turbid, Slow flow	No	Yes	No	No	No	90
56	353613, 6333045	MG15	Morans Creek (Ref No.69)	19/06/2014	No flow / turbid	None	Yes	None	None	None	90

56	353613, 6333045	MG15	Morans Creek (Ref No.69)	16/12/2014	No flow / turbid	None	Yes	None	None	None	100
56	353613, 6333045	MG15	Morans Creek (Ref No.69)	10/03/2015	No flow / turbid	None	Yes	None	None	None	90
56	353613, 6333045	MG15	Morans Creek (Ref No.69)	10/06/2015	slight flow / turbid	yes	Yes	None	None	None	90
56	353613, 6333045	MG15	Morans Creek (Ref No.69)	3/11/2015	Flow / turbid	None	Yes	None	None	None	90
56	353613, 6333045	MG15	Morans Creek (Ref No.69)	22/06/2016	Flow / turbid	None	Yes	None	None	None	100
56	353613, 6333045	MG15	Morans Creek (Ref No.69)	16/12/2016	No flow	None	Yes	Yes - minor	None	None	90
56	353613, 6333045	MG15	Morans Creek (Ref No.69)	10/07/2017	Turbid, no flow	No	Yes	No	No	No	100
56	353613, 6333045	MG15	Morans Creek (Ref No.69)	28/12/2017	Turbid, no flow	No	Yes	No	No	No	90
56	353613, 6333045	MG15	Morans Creek (Ref No.69)	17/07/2018	Turbid, no flow	No	Yes	No	No	No	90
56	353613, 6333045	MG15	Moran's Creek	3/12/2018	Turbid, Slow flow	No	Yes	No	No	No	95
57	353508, 6333021	LW16	Morans Creek (Ref No.69)	19/06/2014	No flow / turbid	None	Yes	None	None	None	90
57	353508, 6333021	LW16	Morans Creek (Ref No.69)	16/12/2014	No flow / turbid	None	Yes	None	None	None	100
57	353508, 6333021	LW16	Morans Creek (Ref No.69)	10/03/2015	No flow / turbid	None	Yes	None	None	None	90

57	353508, 6333021	LW16	Morans Creek (Ref No.69)	10/06/2015	No flow / turbid	yes	Yes	None	None	None	90
57	353508, 6333021	LW16	Morans Creek (Ref No.69)	3/11/2015	flow / turbid	None	Yes	None	None	None	90
57	353508, 6333021	LW16	Morans Creek (Ref No.69)	22/06/2016	flow / turbid	None	Yes	None	None	None	100
57	353508, 6333021	LW16	Morans Creek (Ref No.69)	16/12/2016	flow / turbid	None	Yes	Yes - minor	None	None	80
57	353508, 6333021	LW16	Morans Creek (Ref No.69)	10/07/2017	Turbid, no flow	None	Yes	None	None	None	80
57	353508, 6333021	LW16	Morans Creek (Ref No.69)	28/12/2017	Turbid, no flow	None	Yes	None	None	None	100
57	353508, 6333021	LW16 Centre	Morans Creek (Ref No.69)	17/07/2018	Turbid, no flow	None	Yes	None	None	None	95
57	353508, 6333021	LW16 Centre	Moran's Creek	3/12/2018	Turbid, Slow flow	No	Yes	No	No	No	90
58	353429, 6332972	MG16	Morans Creek (Ref No.69)	19/06/2014	No flow / turbid	None	Yes	None	None	None	100
58	353429, 6332972	MG16	Morans Creek (Ref No.69)	16/12/2014	No flow / turbid	None	Yes	None	None	None	90
58	353429, 6332972	MG16	Morans Creek (Ref No.69)	10/03/2015	No flow / turbid	None	Yes	None	None	None	90
58	353429, 6332972	MG16	Morans Creek (Ref No.69)	10/06/2015	No flow / turbid	yes	Yes	yes	None	None	70
58	353429, 6332972	MG16	Morans Creek (Ref No.69)	3/11/2015	flow / turbid	None	Yes	None	None	None	90

58	353429, 6332972	MG16	Morans Creek (Ref No.69)	22/06/2016	flow / turbid	None	Yes	None	None	None	90
58	353429, 6332972	MG16	Morans Creek (Ref No.69)	16/12/2016	No flow	None	Yes	Yes - minor	None	None	90
58	353429, 6332972	MG16	Morans Creek (Ref No.69)	10/07/2017	Turbid, no flow	No	Yes	No	No	No	90
58	353429, 6332972	MG16	Morans Creek (Ref No.69)	28/12/2017	Turbid, no flow	No	Yes	No	No	No	90
58	353429, 6332972	MG16	Morans Creek (Ref No.69)	17/07/2018	Turbid, no flow	No	Yes	No	No	No	95
58	353429, 6332972	MG16	Moran's Creek	3/12/2018	Turbid, Slow flow	No	Yes	Yes – minor (banks)	No	No	90
59	353304, 6332958	LW17	Morans Creek (Ref No.68)	16/12/2014	No flow / turbid	None	Yes	None	None – pre mining	None – pre mining	100
59	353304, 6332958	LW17	Morans Creek (Ref No.68)	10/03/2015	No flow / turbid	None	Yes	None	None – pre mining	None – pre mining	70
59	353304, 6332958	LW17	Morans Creek (Ref No.68)	10/06/2015	flow / turbid	yes	Yes	yes	None – pre mining	None – pre mining	70
59	353304, 6332958	LW17	Morans Creek (Ref No.68)	3/11/2015	flow / turbid	None	Yes	None	None – pre mining	None – pre mining	90
59	353304, 6332958	LW17	Morans Creek (Ref No.68)	22/06/2016	flow / turbid	Yes	Yes	Yes	None	None	80
59	353304, 6332958	LW17	Morans Creek (Ref No.68)	16/12/2016	No flow	None	Yes	Yes – minor (bank)	None	None	90
59	353304, 6332958	LW17	Morans Creek (Ref No.68)	10/07/2017	Turbid, no flow	No	Yes	No	No	No	90

59	353304, 6332958	LW17	Morans Creek (Ref No.68)	28/12/2017	Turbid, no flow	No	Yes	Yes - bank	No	No	90
59	353304, 6332958	LW17 Centre	Morans Creek (Ref No.68)	17/07/2018	Turbid, no flow	No	Yes	No	No	No	95
59	353303, 6332958	LW 17 Centre	Moran's Creek	3/12/2018	Turbid, Slow flow	No	Yes	No	No	No	90
60	353252, 6332918	MG17	Morans Creek (Ref No.70)	16/12/2014	No flow / turbid	None	Yes	None	None – pre mining	None – pre mining	100
60	353252, 6332918	MG17	Morans Creek (Ref No.70)	10/03/2015	No flow / turbid	yes	Yes	None	None – pre mining	None – pre mining	90
60	353252, 6332918	MG17	Morans Creek (Ref No.70)	10/06/2015	flow / slight turbid	None	Yes	None	None – pre mining	None – pre mining	100
60	353252, 6332918	MG17	Morans Creek (Ref No.70)	3/11/2015	Flow / turbid	None	Yes	None	None – pre mining	None – pre mining	90
60	353252, 6332918	MG17	Morans Creek (Ref No.70)	22/06/2016	Flow / turbid	None	Yes	None	None	None	100
60	353252, 6332918	MG17	Morans Creek (Ref No.70)	16/12/2016	Flow / turbid	None	Yes	Yes – minor (bank)	None	None	90
60	353252, 6332918	MG17	Morans Creek (Ref No.70)	10/07/2017	Slight Turbid, slow flow	No	Yes	No	No	No	100
60	353252, 6332918	MG17	Morans Creek (Ref No.70)	28/12/2017	Turbid, no flow	No	Yes	No	No	No	90
60	353252, 6332918	MG17	Morans Creek (Ref No.70)	17/07/2018	Clear, no flow	No	Yes	No	No	No	90
60	353252, 6332918	MG17	Moran's Creek	3/12/2018	Turbid, Slow flow	No	Yes	No	No	No	90

61	353207, 6332880	MG17	Morans Creek (Ref No.70)	16/12/2014	No flow / turbid	None	Yes	None	None – pre mining	None – pre mining	90
61	353207, 6332880	MG17	Morans Creek (Ref No.70)	10/03/2015	Turbid, no flow	No	Yes	No	No	No	90
61	353207, 6332880	MG17	Morans Creek (Ref No.70)	10/06/2015	Turbid, flow	Yes	Yes	No	No	No	90
61	353207, 6332880	MG17	Morans Creek (Ref No.70)	3/11/2015	Turbid, flow	No	Yes	No	No	No	90
61	353207, 6332880	MG17	Morans Creek (Ref No.70)	22/06/2016	Turbid, flow	No	Yes	No	No	No	80
61	353207, 6332880	MG17	Morans Creek (Ref No.70)	16/12/2016	No flow	No	Yes	Yes – minor (bank)	No	No	80
61	353207, 6332880	MG17	Morans Creek (Ref No.70)	10/07/2017	Turbid, no flow	No	Yes	No	No	No	100
61	353207, 6332880	MG17	Morans Creek (Ref No.70)	28/02/2017	Turbid, no flow	No	Yes	No	No	No	80
61	353207, 6332880	MG17	Morans Creek (Ref No.70)	17/07/2018	Clear, no flow	No	Yes	No	No	No	95
61	353207, 6332880	MG17	Moran's Creek	3/12/2018	Turbid, Slow flow	No	Yes	No	No	No	90
62	353149, 6332788	LW18	Morans Creek (Ref No.70)	16/12/2014	No flow / turbid	None	Yes	No	None – pre mining	None – pre mining	100
62	353149, 6332788	LW18	Morans Creek (Ref No.70)	10/03/2015	Turbid, no flow	No	Yes	No	No	No	100
62	353149, 6332788	LW18	Morans Creek (Ref No.70)	10/06/2015	Turbid, low flow	Yes	Yes	No	No	No	80

62	353149, 6332788	LW18	Morans Creek (Ref No.70)	3/11/2015	Turbid, flow	No	Yes	No	No	No	90
62	353149, 6332788	LW18	Morans Creek (Ref No.70)	22/06/2016	Turbid, flow	No	Yes	No	No	No	90
62	353149, 6332788	LW18	Morans Creek (Ref No.70)	16/12/2016	No flow	No	Yes	Yes – bank minor.	No	No	90
62	353149, 6332788	LW18	Morans Creek (Ref No.70)	10/07/2017	Turbid, no flow	No	Yes	No	No	No	100
62	353149, 6332788	LW18	Morans Creek (Ref No.70)	28/12/2017	Turbid, no flow	No	Yes	No	No	No	90
62	353149, 6332788	LW18	Morans Creek (Ref No.70)	17/07/2018	Clear, no flow	No	Yes	No	No	No	95
62	353149, 6332788	LW18 Centre	Moran's Creek	3/12/2018	Turbid, Slow flow	No	Yes	No	No	No	95
63	353055, 6332706	MG18	Morans Creek (Ref No.70)	16/12/2014	No flow / turbid	None	Yes	None	None – pre mining	None – pre mining	100
63	353055, 6332706	MG18	Morans Creek (Ref No.70)	10/03/2015	Turbid, no flow	No	Yes	No	No	No	100
63	353055, 6332706	MG18	Morans Creek (Ref No.70)	10/06/2015	Turbid, no flow	Yes (significant)	Yes	Yes – on bank.	No	No	80
63	353055, 6332706	MG18	Morans Creek (Ref No.70)	3/11/2015	Turbid, flow	No	Yes	No	No	No	100
63	353055, 6332706	MG18	Morans Creek (Ref No.70)	22/06/2016	Turbid, flow	No	Yes	No	No	No	80
63	353055, 6332706	MG18	Morans Creek (Ref No.70)	16/12/2016	No flow	No	No	Yes	No	No	80

63	353055, 6332706	MG18	Morans Creek (Ref No.70)	10/07/2017	No water	No	No	No	No	No	100
63	353055, 6332706	MG18	Morans Creek (Ref No.70)	28/12/2017	No water	No	No	No	No	No	100
63	353055, 6332706	MG18	Morans Creek (Ref No.70)	17/07/2018	Clear, No flow	No	Yes	No	No	No	90
63	353055, 6332706	MG18	Moran's Creek	3/12/2018	Turbid, Slow flow	No	Yes	No	No	No	95
64	353006, 633261	LW19	Morans Creek	3/11/2015	Clear,	No	Yes	No	No	No	90
64	353006, 633261	LW19	Morans Creek	22/06/2016	Turbid / slow flow	No	Yes	No	No	No	90
64	353006, 633261	LW19	Morans Creek	16/12/2016	No flow	No	Yes	No	No	No	90
64	353006, 633261	LW19	Morans Creek	17/07/2017	Turbid, no flow	No	Yes	No	No	No	100
64	353006, 633261	LW19	Morans Creek	29/12/2017	Turbid, no flow	No	Yes	No	No	No	100
64	353006, 633261	LW19, Centre	Morans Creek	17/07/2018	Clear, no flow	No	Yes	No	No	No	90
64	353006, 6332661	LW19 Centre	Moran's Creek	3/12/2018	Turbid, Slow flow	No	Yes	No	No	No	100
65	353012, 6332495	MG19	Morans Creek	3/11/2015	Slightly turbid	No	Yes	No	No	No	80
65	353012, 6332495	MG19	Morans Creek	22/06/2016	Slightly turbid / flow	No	Yes	No	No	No	80
65	353012, 6332495	MG19	Morans Creek	16/12/2016	No flow	No	Yes	Yes	No	No	60
65	353012, 6332495	MG19	Morans Creek	17/07/2017	Turbid, slow flow	No	Yes	No	No	No	80

65	353012, 6332495	MG19	Morans Creek	29/12/2017	Turbid, no flow	No	Yes	No	No	No	90
65	353012, 6332495	MG19	Morans Creek	17/07/2018	Clear, no flow	No	Yes	No	No	No	90
65	353012, 6332495	MG19	Moran's Creek	3/12/2018	Turbid, Slow flow	No	Yes	No	No	No	90
66	353007, 6332359	LW20	Morans Creek	3/11/2015	Slightly turbid	No	Yes	No	No	No	80
66	353007, 6332359	LW20	Morans Creek	22/06/2016	Slightly turbid / flow	No	Yes	No	No	No	90
66	353007, 6332359	LW20	Morans Creek	16/12/2016	No flow / dry	No	Yes	Yes	No	No	80
66	353007, 6332359	LW20	Morans Creek	17/07/2017	Turbid, no flow	No	Yes	No	No	No	90
66	353007, 6332359	LW20	Morans Creek	29/12/2017	Turbid, no flow	No	Yes	No	No	No	80
66	353007, 6332359	LW20, Centre	Morans Creek	29/12/2017	Clear, no flow	No	Yes	No	No	No	90
66	353007, 6332359	LW20 Centre	Moran's Creek	3/12/2018	Turbid, Slow flow	No	Yes	No	No	No	90
67	353062, 6332405	MG19	Morans Creek	3/11/2015	Slightly turbid	No	Yes	No	No	No	90
67	353062, 6332405	MG19	Morans Creek	22/06/2016	Slightly turbid / slow	No	Yes	No	No	No	90
67	353062, 6332405	MG19	Morans Creek	16/12/2016	No flow	No	Yes	Yes - banks	No	No	80
67	353062, 6332405	MG19	Morans Creek	17/07/2017	Turbid, no flow	No	Yes	No	No	No	100
67	353062, 6332405	MG19	Morans Creek	29/12/2017	Turbid, no flow	No	Yes	No	No	No	90
67	353062, 6332405	MG19	Morans Creek	17/07/2018	Clear, no flow	No	Yes	No	No	No	90

67	353062, 6332405	MG19	Moran's Creek	3/12/2018	Turbid, Slow flow	No	Yes	No	No	No	90
68	353033, 6332225	LW 20	Morans Creek	3/11/2015	Clear	No	Yes	No	No	No	100
68	353033, 6332225	LW 20	Morans Creek	22/06/2016	Slightly turbid / slow flow	No	Yes	No	No	No	90
68	353033, 6332225	LW 20	Morans Creek	16/12/2016	No flow	No	Yes	No	No	No	100
68	353033, 6332225	LW 20	Morans Creek	17/07/2017	Turbid, slow flow	No	Yes	No	No	No	90
68	353033, 6332225	LW 20	Morans Creek	29/12/2017	Turbid, no flow	No	Yes	No	No	No	90
68	353033, 6332225	LW 20, Centre	Morans Creek	17/07/2018	Clear, no flow	No	Yes	No	No	No	90
68	353033, 6332225	LW20 Centre	Moran's Creek	3/12/2018	Turbid, Slow flow	No	Yes	No	No	No	90
69	353056, 6332070	MG20	Morans Creek	3/11/2015	Slightly Turbid	No	Yes	No	No	No	90
69	353056, 6332070	MG20	Morans Creek	22/06/2016	Slightly Turbid / slow flow	No	Yes	No	No	No	100
69	353056, 6332070	MG20	Morans Creek	16/12/2016	No flow	No	Yes	No	No	No	95
69	353056, 6332070	MG20	Morans Creek	17/07/2017	Turbid, slow flow	No	Yes	No	No	No	100
69	353056, 6332070	MG20	Morans Creek	29/12/2017	Turbid, no flow	No	Yes	No	No	No	100
69	353056, 6332070	MG20	Morans Creek	17/07/2018	Clear, no flow	No	Yes	No	No	No	90
69	353056, 6332070	MG20	Moran's Creek	3/12/2018	Turbid, Slow flow	No	Yes	No	No	No	90
69	353056, 6332070	MG20	Moran's Creek	20/06/2019	Turbid, No flow	No	Yes	No	No	No	90

69	353056, 6332070	MG20	Moran's Creek	3/12/2019	No flow	No	Yes	No	No	No	95
70	352943, 6332022	LW21	Morans Creek	3/11/2015	Slightly Turbid	No	Yes	No	No	No	80
70	352943, 6332022	LW21	Morans Creek	22/06/2016	Slightly Turbid / slow flow	No	Yes	No	No	No	80
70	352943, 6332022	LW21	Morans Creek	16/12/2016	No flow	No	Yes	Yes	No	No	60
70	352943, 6332022	LW21	Morans Creek	17/07/2017	Turbid, no flow	No	Yes	No	No	No	100
70	352943, 6332022	LW21	Morans Creek	29/12/2017	Turbid, No flow	No	Yes	No	No	No	80
70	352943, 6332022	LW21, Centre	Morans Creek	17/07/2018	Clear, No flow	No	Yes	No	No	No	90
70	352943, 6332022	LW21 Centre	Moran's Creek	3/12/2018	Turbid, Slow flow	No	Yes	No	No	No	90
70	352943, 6332022	LW21 Centre	Moran's Creek	20/06/2019	Turbid, No flow	No	Yes	No	No	No	90
70	352943, 6332022	LW21 Centre	Moran's Creek	3/12//2019	Turbid, No flow	No	Yes	No	No	No	95
71	352815, 6332021	MG21	Morans Creek	3/11/2015	Slightly Turbid	No	Yes	No	No	No	100
71	352815, 6332021	MG21	Morans Creek	22/06/2016	Slightly Turbid / slow flow	No	Yes	No	No	No	90
71	352815, 6332021	MG21	Morans Creek	16/12/2016	No flow	No	Yes	Yes	No	No	60
71	352815, 6332021	MG21	Morans Creek	17/07/2017	Turbid, no flow	No	Yes	No	No	No	100
71	352815, 6332021	MG21	Morans Creek	19/12/2017	Turbid, no flow	No	Yes	No	No	No	90
71	352815, 6332021	MG21	Morans Creek	17/07/2018	Clear, no flow	No	Yes	No	No	No	90

71	352815, 6332021	MG21	Moran's Creek	3/12/2018	Turbid, Slow flow	No	Yes	No	No	No	90
71	352815, 6332021	MG21	Moran's Creek	20/06/2019	Turbid, No flow	No	Yes	No	No	No	100
71	352815, 6332021	MG21	Moran's Creek	3/12/2019	Turbid, No flow	No	Yes	No	No	No	95
72	352785, 6331932	LW22	Morans Creek	15/02/2017	No flow / dry	No	No	No	No – pre-mining	No – pre-mining	100
72	352785, 6331932	LW22	Morans Creek	17/07/2017	Turbid, no flow	No	Yes	No	No	No	100
72	352785, 6331932	LW22	Morans Creek	29/12/2017	No water	No	No	No	No	No	100
72	352785, 6331932	LW22, Centre	Morans Creek	17/07/2018	Clear, no flow	No	Yes	No	No	No	90
72	352785, 6331932	LW22 Centre	Moran's Creek	3/12/2018	Turbid, Still	No	Yes	No	No	No	100
72	352785, 6331932	LW22 Centre	Moran's Creek	20/06/2019	No flow, No water	No	Yes	No	No	No	90
72	352785, 6331932	LW22 Centre	Moran's Creek	3/12//2019	No flow, No water	No	No	No	No	No	90
73	352697, 6331864	MG22	Morans Creek	15/02/2017	No flow - turbid	No	Yes	No	No – pre-mining	No – pre-mining	80
73	352697, 6331864	MG22	Morans Creek	17/07/2017	No flow - turbid	No	Yes	No	No	No	100
73	352697, 6331864	MG22	Morans Creek	29/12/2017	No flow - turbid	No	Yes	No	No	No	90
73	352697, 6331864	MG22	Morans Creek	17/07/2018	No flow - clear	No	Yes	No	No	No	90
73	352697, 6331864	MG22	Moran's Creek	3/12/2018	Turbid, Still	No	Yes	No	No	No	95
73	352697, 6331864	MG22	Moran's Creek	20/06/2019	Turbid, no Flow	No	Yes	No	No	No	90

73	352697, 6331864	MG22	Moran's Creek	3/12/2019	Turbid, no Flow	No	Yes	No	No	No	90
74	352686, 6331715	LW23	Morans Creek	17/07/2017	Turbid, no flow	No	Yes	No	No	No	100
74	352686, 6331715	LW23	Morans Creek	19/12/2017	Turbid, no flow	No	Yes	No	No	No	90
74	352686, 6331715	LW23, Centre	Morans Creek	17/07/2018	Clear, no flow	No	Yes	No	No	No	90
74	352686, 6331715	LW23 Centre	Moran's Creek	3/12/2018	Turbid, Still	No	Yes	No	No	No	90
74	352686, 6331715	LW23 Centre	Moran's Creek	20/06/2019	Turbid, no Flow	No	Yes	No	No	No	90
74	352686, 6331715	LW23 Centre	Moran's Creek	3/12/2019	Turbid, no Flow	No	Yes	No	No	No	90
75	352595, 6331697	MG23	Morans Creek	21/08/2017	Turbid, no flow	No	Yes	No	No	No	100
75	352595, 6331697	MG23	Morans Creek	29/12/2017	Turbid, no Flow	No	Yes	No	No	No	70
75	352595, 6331697	MG23	Morans Creek	17/07/2018	Clear, no Flow	No	Yes	No	No	No	90
75	352595, 6331697	MG23	Moran's Creek	3/12/2018	Turbid, Still	No	Yes	No	No	No	90
75	352595, 6331697	MG23	Moran's Creek	20/06/2019	Turbid, No flow	No	Yes	No	No	No	90
75	352595, 6331697	MG23	Moran's Creek	3/12/2019	Turbid, No flow	No	Yes	No	No	No	90
76	351646.465, 6330598.812	MG25	Byrons Gully	10/12/2018	Clear Still	No	Yes	No	No	No	100
76	351646.465, 6330598.812	MG25	Byrons Gully	17/06/2019	Clear Still	No	Yes	No	No	No	100
76	351646.465, 6330598.812	MG25	Byrons Gully	2/12/2019	Clear Still	No	Yes	No	No	No	95

77	351503.709, 6330526.546	MG25	Byrons Gully	10/12/2018	Clear Still	No	Yes	No	No	No	100
77	351503.709, 6330526.546	MG25	Byrons Gully	20/06/2019	Clear Still	No	Yes	No	No	No	100
77	351503.709, 6330526.546	MG25	Byrons Gully	2/12/2019	Clear Still	No	Yes	No	No	No	95
78	351362.485, 6330448.605	LW25 Centre	Byrons Gully	10/12/2018	Clear Still	No	Yes	No	No	No	100
78	351362.485, 6330448.605	LW25 Centre	Byrons Gully	17/06/2019	Dry	No	No	No	No	No	90
78	351362.485, 6330448.605	LW25 Centre	Byrons Gully	2/12/2019	Dry	No	No	No	No	No	90
79	351193.537404, 6330503.50678	MG25	Byrons Gully	10/12/2018	Dry	No	No	No	No	No	100
79	351193.537404, 6330503.50678	MG25	Byrons Gully	17/06/2019	Dry	No	No	No	No	No	90
79	351193.537404, 6330503.50678	MG25	Byrons Gully	2/12/2019	Dry	No	No	No	No	No	90
80	351302.114103, 6330383.48311	LW25 Centre	Byrons Gully	10/12/2018	Clear Still	No	No	No	No	No	100
80	351302.114103, 6330383.48311	LW25 Centre	Byrons Gully	17/06/2019	Dry	No	No	No	No	No	100
80	351302.114103, 6330383.48311	LW25 Centre	Byrons Gully	2/12/2019	Dry	No	No	No	No	No	90
81	351178.14029, 6330270.43218	MG26	Byrons Gully	10/12/2018	Clear Still	No	Yes	No	No	No	80
81	351178.14029, 6330270.43218	MG26	Byrons Gully	17/06/2019	Clear Still	No	Yes	No	No	No	90
81	351178.14029, 6330270.43218	MG26	Byrons Gully	2/12/2019	Dry	No	No	No	No	No	95
82	350695.984342, 6330402.64814	MG25	Byrons Gully	10/12/2018	Dry	No	No	Yes – minor	No	No	80

								(Channel)			
82	350695.984342, 6330402.64814	MG25	Byrons Gully	17/06/2019	Dry	No	No	Yes – minor (Channel)	No	No	90
82	350695.984342, 6330402.64814	MG25	Byrons Gully	2/12/2019	Dry	No	No	Yes – minor (Channel)	No	No	80
83	350805.391, 6329744.687	MG28	Byrons Gully	10/12/2018	Dry	No	No	No	No	No	80
83	350805.391, 6329744.687	MG28	Byrons Gully	17/06/2019	Dry	No	No	No	No	No	95
83	350805.391, 6329744.687	MG28	Byrons Gully	2/12/2019	Dry	No	No	No	No	No	90
84	350633.062, 6329701.096	MG28	Byrons Gully	10/12/2018	Dry	No	No	No	No	No	95
84	350633.062, 6329701.096	MG28	Byrons Gully	17/06/2019	Dry	No	No	Yes - Minor	No	No	90
84	350633.062, 6329701.096	MG28	Byrons Gully	10/12/2018	Dry	No	No	No	No	No	80
85	350564.197, 6330285.06	Lw25 End of Block	Moran's Creek	10/12/2018	Dry	No	No	No	No	No	80
85	350564.197, 6330285.06	Lw25 End of Block	Moran's Creek	17/06/2019	Dry	No	No	No	No	No	95
85	350564.197, 6330285.06	Lw25 End of Block	Moran's Creek	2/12/2019	Dry	No	No	No	No	No	90
86	351794.998, 6330617.455	MG25	Moran's Creek	10/12/2018	Dry	No	No	No	No	No	80
86	351794.998, 6330617.455	MG25	Moran's Creek	17/06/2019	Dry	No	Yes	No	No	No	95
86	351794.998, 6330617.455	MG25	Moran's Creek	2/12/2019	Dry	No	Yes	No	No	No	95

87	351846.312, 6330510.973	LW25 Centre	Moran's Creek	10/12/2018	Clear Still	No	Yes	No	No	No	100
87	351846.312, 6330510.973	LW25 Centre	Moran's Creek	17/06/2019	Dry	No	No	No	No	No	100
87	351846.312, 6330510.973	LW25 Centre	Moran's Creek	2/12/2019	Dry	No	No	No	No	No	100
88	351860.427. 6330393.581	MG26	Moran's Creek	10/12/2018	Clear Still	No	Yes	No	No	No	100
88	351860.427. 6330393.581	MG26	Moran's Creek	17/06/2019	Dry	No	No	No	No	No	95
88	351860.427. 6330393.581	MG26	Moran's Creek	2/12/2019	Dry	No	No	No	No	No	95
89	351883.404, 6330275.995	LW26 Centre	Moran's Creek	10/12/2018	Clear Still	No	Yes	No	No	No	100
89	351883.404, 6330275.995	LW26 Centre	Moran's Creek	17/06/2019	Clear Still	No	Yes	No	No	No	95
89	351883.404, 6330275.995	LW26 Centre	Moran's Creek	2/12/2019	Clear Still	No	Yes	Yes – Minor (Undercut ting)	No	No	95
90	351837.907, 6330164.733	MG27	Moran's Creek	10/12/2018	Clear Still	No	Yes	No	No	No	90
90	351837.907, 6330164.733	MG27	Moran's Creek	17/06/2019	Clear Still	No	Yes	No	No	No	90
90	351837.907, 6330164.733	MG27	Moran's Creek	2/12/2019	Clear Still	No	Yes	No	No	No	95
91	351840.4812, 6330047.0381	LW27 Centre	Moran's Creek	10/12/2018	Clear Still	No	Yes	No	No	No	90
91	351840.4812, 6330047.0381	LW27 Centre	Moran's Creek	17/06/2019	Clear Still	No	Yes	No	No	No	90
91	351840.4812, 6330047.0381	LW27 Centre	Moran's Creek	2/12/2019	Clear Still	No	Yes	No	No	No	90

92	351378.081, 6329379.794	MG30	Moran's Creek	10/12/2018	Clear Still	No	Yes	No	No	No	85
92	351378.081, 6329379.794	MG30	Moran's Creek	24/06/2019	Turbid Still	No	Yes	No	No	No	90
92	351378.081, 6329379.794	MG30	Moran's Creek	2/12/2019	Turbid Still	No	Yes	No	No	No	90
93	351333.0818, 6329270.3389	LW30 Centre	Moran's Creek	10/12/2018	Clear Still	No	Yes	No	No	No	90
93	351333.0818, 6329270.3389	LW30 Centre	Moran's Creek	24/06/2019	Slow flow Turbid	Yes	Yes	No	No	No	90
93	351333.0818, 6329270.3389	LW30 Centre	Moran's Creek	2/12/2019	Dry	No	No	No	No	No	90
94	351222.206, 6329142.571	MG31 End of Block	Moran's Creek	10/12/2018	Dry	No	No	No	No	No	100
94	351222.206, 6329142.571	MG31 End of Block	Moran's Creek	24/06/2019	Slow flow Turbid	Yes	Yes	No	No	No	90
94	351222.206, 6329142.571	MG31 End of Block	Moran's Creek	2/12/2019	Dry	No	No	No	No	No	90
95	352002.841, 6329525.271	MG30	Moran's Creek	10/12/2018	Dry	No	No	No	No	No	100
95	352002.841, 6329525.271	MG30	Moran's Creek	17/06/2019	Dry	No	No	No	No	No	100
95	352002.841, 6329525.271	MG30	Moran's Creek	3/12/2019	Dry	No	No	No	No	No	90
96	352025.475661, 6329412.02406	LW30 Centre	Moran's Creek	10/12/2018	Clear Still	No	Yes	No	No	No	100
96	352025.475661, 6329412.02406	LW30 Centre	Moran's Creek	17/16/2019	Dry	No	No	No	No	No	90
96	352025.475661, 6329412.02406	LW30 Centre	Moran's Creek	3/12/2019	Dry	No	No	No	No	No	90

97	352062.122, 6329329.483	MG31	Moran's Creek	10/12/2018	Clear Still	No	Yes	No	No	No	100
97	352062.122, 6329329.483	MG31	Moran's Creek	17/06/2019	Dry	No	No	No	No	No	95
97	352062.122, 6329329.483	MG31	Moran's Creek	3/12/2019	Dry	No	No	No	No	No	90
98	351971.1925, 6329253.2651	MG31	Moran's Creek	10/12/2018	Clear Still	No	Yes	No	No	No	100
98	351971.1925, 6329253.2651	MG31	Moran's Creek	17/06/2019	Dry	No	No	No	No	No	90
98	351971.1925, 6329253.2651	MG31	Moran's Creek	3/12/2019	Dry	No	No	No	No	No	90
99	351890, 6329153.07692	LW31 Centre	Moran's Creek	10/12/2018	Clear Still	No	Yes	No	No	No	80
99	351890, 6329153.07692	LW31 Centre	Moran's Creek	16/06/2019	Dry	No	No	No	No	No	80
99	351890, 6329153.07692	LW31 Centre	Moran's Creek	3/12/2019	Dry	No	No	No	No	No	90
100	351912.548, 6329039.617	TG31	Moran's Creek	10/12/2018	Clear Still	No	Yes	Yes – minor (Channel)	No	No	80
100	351912.548, 6329039.617	TG31	Moran's Creek	17/06/2019	Clear Still	Yes	No	No	No	No	80
100	351912.548, 6329039.617	TG31	Moran's Creek	3/12/2019	Clear Still	No	No	Yes – Minor (undercut)	No	No	90
TC1	352044, 6333078.4	MG21	Tobins Creek	6/03/2017	No water	No	No	No	No	No	60
TC1	352044, 6333078.4	MG21	Tobins Creek	24/07/2017	Turbid, no flow	No	Yes	No	No	No	50
TC1	352044, 6333078.4	MG21	Tobins Creek	9/01/2018	No water	No	No	No	No	No	70

TC1	352044, 6333078.4	MG21	Tobins Creek	16/07/2018	No water	No	No	No	No	No	90
TC1	352044, 6333078.4	MG21	Tobins Creek	4/12/2018	Clear, No flow	No	Yes	Bank Cattle	No	no	90
TC1	352044, 6333078.4	MG21	Tobins Creek	17/06/2019	Clear, No flow	No	Yes	No	No	no	95
TC1	352044, 6333078.4	MG21	Tobins Creek	2/12/2019	Dry	No	No	No	No	no	90
TC2	351989, 6333053.2	LW22	Tobins Creek	6/03/2017	Turbid, no flow	No	Yes	No	No	No	60
TC2	351989, 6333053.2	LW22	Tobins Creek	24/07/2017	Turbid, no flow	No	Yes	No	No	No	50
TC2	351989, 6333053.2	LW22	Tobins Creek	9/01/2018	Turbid, no flow	No	Yes	No	No	No	70
TC2	351989, 6333053.2	LW22, centre	Tobins Creek	16/07/2018	clear, no flow	No	Yes	No	No	No	95
TC2	351989, 6333053.2	LW22 Centre	Tobins Creek	4/12/2018	Clear, No flow	No	Yes	No	No	no	90
TC2	351989, 6333053.2	LW22 Centre	Tobins Creek	17/06/2019	Clear, No flow	No	Yes	No	No	no	95
TC2	351989, 6333053.2	LW22 Centre	Tobins Creek	2/12/2019	Turbid, No flow	No	Yes	No	No	no	90
TC3	351879, 6333014	MG22	Tobins Creek	6/03/2017	Turbid, no flow	No	Yes	No	No	No	90
TC3	351879, 6333014	MG22	Tobins Creek	24/07/2017	Turbid, no flow	No	Yes	No	No	No	100
TC3	351879, 6333014	MG22	Tobins Creek	9/01/2018	Turbid, no flow	No	Yes	No	No	No	50
TC3	351879, 6333014	MG22	Tobins Creek	16/07/2018	No water	No	No	No	No	No	100
TC3	351879, 6333014	MG22	Tobins Creek	4/12/2018	Clear, No flow	No	Yes	No	No	no	95

TC3	351879, 6333014	MG22	Tobins Creek	17/06/2019	Clear, No flow	No	Yes	No	No	no	95
TC3	351879, 6333014	MG22	Tobins Creek	2/12/2019	Dry	No	No	No	No	no	80
TC4	351806, 6332993.6	LW23 Centre	Tobins Creek	6/03/2017	Turbid, no flow	No	Yes	No	No	No	80
TC4	351806, 6332993.6	LW23 Centre	Tobins Creek	24/07/2017	Turbid, no flow	No	Yes	No	No	No	100
TC4	351806, 6332993.6	LW23 Centre	Tobins Creek	9/01/2018	Turbid, no flow	No	Yes	No	No	No	60
TC4	351806, 6332993.6	LW23 Centre	Tobins Creek	16/07/2018	No water	No	No	No	No	No	95
TC4	351806, 6332993.6	LW23 Centre	Tobins Creek	4/12/2018	Clear, No flow	No	Yes	No	No	no	90
TC4	351806, 6332993.6	LW23 Centre	Tobins Creek	17/06/2019	Clear, No flow	No	Yes	No	No	no	95
TC4	351806, 6332993.6	LW23 Centre	Tobins Creek	2/12/2019	Dry	No	No	No	No	no	90
TC5	351774, 633013.3	LW23	Tobins Creek	6/03/2017	No water	No	No	Yes	No	No	50
TC5	351774, 633013.3	LW23	Tobins Creek	24/07/2017	Turbid, no flow	No	Yes	Yes - Head end	No	No	60
TC5	351774, 633013.3	LW23	Tobins Creek	9/01/2018	No water	No	No	Yes	No	No	40
TC5	351774, 633013.3	LW23, Centre	Tobins Creek	16/07/2018	No water	No	No	Yes	No	No	95
TC5	351774, 6333013.3	LW23 Centre	Tobins Creek	4/12/2018	Clear, No flow	No	Yes	Yes – minor (Channel)	No	no	90
TC5	351774, 6333013.3	LW23 Centre	Tobins Creek	17/06/2019	Dry	No	No	No	No	no	95
TC5	351774, 6333013.3	LW23 Centre	Tobins Creek	2/12/2019	Dry	No	No	Yes - Minor	No	no	90

TC6	351688, 6332949	MG23	Tobins Creek	6/03/2017	No water	No	No	No	No	No	60
TC6	351688, 6332949	MG23	Tobins Creek	24/07/2017	Turbid, no flow	No	Yes	No	No	No	70
TC6	351688, 6332949	MG23	Tobins Creek	9/01/2018	No water	No	No	No	No	No	70
TC6	351688, 6332949	MG23	Tobins Creek	16/07/2018	No water	No	No	No	No	No	95
TC6	351688, 6332949	MG23	Tobins Creek	4/12/2018	Clear, Slow flow	No	Yes	No	No	no	90
TC6	351688, 6332949	MG23	Tobins Creek	17/06/2019	Dry	No	No	No	No	no	95
TC6	351688, 6332949	MG23	Tobins Creek	2/12/2019	Dry	No	No	No	No	no	90
TC7	351575, 6332925	LW24	Tobins Creek	9/01/2018	Turbid, no flow	No	Yes	No	No	No	60
TC7	351575, 6332925	LW24 Centre	Tobins Creek	16/07/2018	Clear, no flow	No	Yes	No	No	No	95
TC7	351575, 6332925	LW24 Centre	Tobins Creek	4/12/2018	Clear, Slow flow	No	Yes	No	No	no	90
TC7	351575, 6332925	LW24 Centre	Tobins Creek	17/06/2019	Dry	No	No	No	No	no	95
TC7	351575, 6332925	LW24 Centre	Tobins Creek	2/12/2019	Dry	No	No	No	No	no	90
TC8	351486, 6332885	MG24	Tobins Creek	9/01/2018	Turbid, no flow	No	Yes	No	No	No	80
TC8	351486, 6332885	MG24	Tobins Creek	16/07/2018	No Water	No	No	No	No	No	95
TC8	351486, 6332885	MG24	Tobins Creek	17/06/2019	Dry	No	No	No	No	No	95
TC8	351486, 6332885	MG24	Tobins Creek	2/12/2019	Dry	No	No	No	No	No	90

TC8	351486, 6332885	MG24	Tobins Creek	4/12/2018	Clear, Slow flow	No	Yes	No	No	no	90
TC9	351388, 6332859	LW24A	Tobins Creek	9/01/2018	No water	No	No	No	No	No	70
TC9	351388, 6332859	LW24A	Tobins Creek	16/07/2018	No water	No	No	No	No	No	100
TC9	351388, 6332859	LW24A Centre	Tobins Creek	4/12/2018	Clear, Slow flow	No	Yes	No	No	no	90
TC9	351388, 6332859	LW24A Centre	Tobins Creek	17/06/2019	Dry	No	No	No	No	no	95
TC9	351388, 6332859	LW24A Centre	Tobins Creek	2/12/2019	Dry	No	No	No	No	no	95
TC10	0351376, 6332800	MG24A	Tobins Creek	9/01/2018	Turbid, no flow	No	Yes	No	No	No	15
TC10	0351376, 6332800	MG24A	Tobins Creek	16/07/2018	Turbid, no flow	No	Yes	No	No	No	90
TC10	351334, 6332763	MG24A	Tobins Creek	4/12/2018	Clear, Slow flow	No	Yes	No	No	no	100
TC10	0351376, 6332800	MG24A	Tobins Creek	17/06/2019	Clear, Slow flow	No	Yes	No	No	no	95
TC10	351334, 6332763	MG24A	Tobins Creek	2/12/2019	Clear, Slow flow	No	Yes	No	No	no	80
TCT1	351784, 6333189	LW22	Tobins Creek	27/04/2017	No water	No	No	No	No	No	100
TCT1	351784, 6333189	LW22	Tobins Creek	24/07/2017	No water	No	No	No	No	No	100
TCT1	351784, 6333189	LW22	Tobins Creek	9/01/2018	No water	No	No	No	No	No	60
TCT1	351784, 6333189	LW22	Tobins Creek	16/07/2018	No water	No	No	No	No	No	95
TCT1	351784, 6333189	LW22 Centre	Tobins Creek	4/12/2018	No water	No	No	No	No	no	90

TCT1	351784, 6333189	LW22 Centre	Tobins Creek	17/06/2019	Dry	No	No	No	No	No	95
TCT1	351784, 6333189	LW22 Centre	Tobins Creek	2/12/2019	Dry	No	No	No	No	No	90
TCT2	351860, 6333091	LW22	Tobins Creek	27/04/2017	No water	No	No	No	No	No	100
TCT2	351860, 6333091	LW22	Tobins Creek	24/07/2017	No water	No	No	No	No	No	100
TCT2	351860, 6333091	LW22	Tobins Creek	9/01/2018	No water	No	No	No	No	No	80
TCT2	351860, 6333091	LW22, Centre	Tobins Creek	16/07/2018	No water	No	No	No	No	No	100
TCT2	351860, 6333091	LW22 Centre	Tobins Creek	4/12/2018	No water	No	No	No	No	No	95
TCT2	351860, 6333091	LW22, Centre	Tobins Creek	17/06/2019	Dry	No	No	No	No	No	95
TCT2	351860, 6333091	LW22 Centre	Tobins Creek	2/12/2019	Dry	No	No	No	No	No	90
TCT3	351880, 6332921	LW23	Tobins Creek	27/04/2017	No water	No	No	No	No	No	100
TCT3	351880, 6332921	LW23	Tobins Creek	24/07/2017	No water	No	No	No	No	No	100
TCT3	351880, 6332921	LW23	Tobins Creek	9/01/2018	No water	No	No	No	No	No	80
TCT3	351880, 6332921	LW23, Centre	Tobins Creek	16/07/2018	No flow,turbid	No	yes	No	No	No	100
TCT3	351880, 6332921	LW23 Centre	Tobins Creek	4/12/2018	No water	No	No	No	No	No	95
TCT3	351880, 6332921	LW23, Centre	Tobins Creek	17/06/2019	No flow	No	Yes	No	No	No	95
TCT3	351880, 6332921	LW23 Centre	Tobins Creek	2/12/2019	No flow	No	Yes	No	No	No	90

MCT1	352212, 6332496	LW23	Morans Creek	14/06/2017	Turbid, slow flow	No	Yes	Yes – cattle and spillway	No	No	60
MCT1	352212, 6332496	LW23	Morans Creek	17/07/2017	Turbid, no flow	No	Yes	Yes – cattle	No	No	70
MCT1	352212, 6332496	LW23	Morans Creek	9/01/2018	Turbid, no flow	No	Yes	No	No	No	60
MCT1	352212, 6332496	LW23, Centre	Morans Creek	16/07/2018	Turbid, no flow	No	Yes	Yes	No	No	90
MCT1	352212, 6332496	LW23	Moran's Creek	3/12/2018	Turbid, Still	No	Yes	Yes	No	no	90
MCT1	352212, 6332496	LW23, Centre	Morans Creek	17/06/2019	Turbid, Still	No	Yes	Yes - Overflow	No	no	90
MCT1	352212, 6332496	LW23	Moran's Creek	2/12/2019	Turbid, Still	No	Yes	Yes - Overflow	No	no	90
MCT2	352282, 6332492	MG22	Morans Creek	14/06/2017	Turbid, slow flow	No	Yes	Yes – access tracks	No	No	90
MCT2	352282, 6332492	MG22	Morans Creek	17/07/2017	No water	No	No	No	No	No	100
MCT2	352282, 6332492	MG22	Morans Creek	28/12/2017	No water	No	No	No	No	No	90
MCT2	352282, 6332492	MG22	Morans Creek	16/07/2018	No water	No	No	No	No	No	100
MCT2	352282, 6332492	MG22	Moran's Creek	3/12/2018	No water	No	No	No	No	no	80
MCT2	352282, 6332492	MG22	Morans Creek	17/06/2019	Dry	No	No	No	No	No	90
MCT2	352282, 6332492	MG22	Moran's Creek	2/12/2019	Dry	No	No	No	No	No	80
MCT3	352485, 6332396	LW22	Morans Creek	14/06/2017	Turbid, slow flow	No	Yes	Yes – access track	No	No	90

MCT3	352485, 6332396	LW22	Morans Creek	17/07/2017	Turbid, no flow	No	Yes	Yes- Cattle	No	No	90
MCT3	352485, 6332396	LW22	Morans Creek	28/12/2017	No water	No	No	No	No	No	100
MCT3	352485, 6332396	LW22	Morans Creek	16/07/2018	No Flow	No	yes	No	No	No	90
MCT3	352485, 6332396	LW22 Centre	Moran's Creek	3/12/2018	Turbid, Still	No	Yes	No	No	no	100
MCT3	352485, 6332396	LW22	Morans Creek	17/06/2019	No flow	No	Yes	No	No	no	90
MCT3	352485, 6332396	LW22 Centre	Moran's Creek	3/12/2019	No flow	No	Yes	No	No	no	90
MCT4	352680, 6332200	MG21	Morans Creek	14/06/2017	Turbid, slow flow	No	Yes	No	No	No	100
MCT4	352680, 6332200	MG21	Morans Creek	17/07/2017	Turbid, no flow	No	Yes	No	No	No	100
MCT4	352680, 6332200	MG21	Morans Creek	28/12/2017	No water	No	No	No	No	No	100
MCT4	352680, 6332200	MG21	Morans Creek	16/07/2018	No water	No	No	No	No	No	100
MCT4	352680, 6332200	MG21	Moran's Creek	3/12/2018	Clear , Still	No	Yes	No	No	no	90
MCT4	352680, 6332200	MG21	Morans Creek	20/06/2019	No flow/ Turbid	No	Yes	No	No	no	100
MCT4	352680, 6332200	MG21	Moran's Creek	3/12/2019	No flow/ Turbid	No	Yes	No	No	no	95
MCT5	352548, 6332100	MG22	Morans Creek	14/06/2017	Turbid, slow flow	No	Yes	Yes – bank	No	No	90
MCT5	352548, 6332100	MG22	Morans Creek	17/07/2017	Turbid, slow flow	No	Yes	No	No	No	100
MCT5	352548, 6332100	MG22	Morans Creek	28/12/2017	Clear, no flow	No	Yes	No	No	No	100

MCT5	352548, 6332100	MG22	Morans Creek	16/07/2018	Clear, no flow	No	Yes	No	No	No	90
MCT5	352548, 6332100	MG22	Moran's Creek	3/12/2018	Turbid , Still	No	Yes	Yes Bank	No	no	90
MCT5	352548, 6332100	MG22	Morans Creek	20/06/2019	Clear, no flow	No	Yes	No	No	No	90
MCT5	352548, 6332100	MG22	Moran's Creek	3/12/2019	Clear, no flow	No	Yes	No	No	No	90
MCT6	352444, 6332061	LW23	Morans Creek	17/07/2017	Turbid, no flow	No	Yes	No	No	No	70
MCT6	352444, 6332061	LW23	Morans Creek	9/01/2018	Clear, no flow	No	Yes	No	No	No	50
MCT6	352444, 6332061	LW23, Centre	Morans Creek	16/07/2018	Clear, no flow	No	Yes	No	No	No	90
MCT6	352444, 6332061	LW23 Centre	Moran's Creek	4/12/2018	Clear , Still	No	Yes	No	No	no	100
MCT6	352444, 6332061	LW23	Morans Creek	20/06/2019	Turbid, no flow	No	Yes	Yes - Horses	No	No	90
MCT6	352444, 6332061	LW23, Centre	Morans Creek	3/12/2019	Turbid, no flow	No	Yes	No	No	No	80
MCT7	352361, 6332043	MG23	Morans Creek	17/07/2017	Clear, no flow	No	Yes	No	No	No	95
MCT7	352361, 6332043	MG23	Morans Creek	9/01/2018	Turbid, no flow	No	Yes	No	No	No	100
MCT7	352361, 6332043	MG23	Morans Creek	16/07/2018	Clear, no flow	No	Yes	No	No	No	90
MCT7	352361, 6332043	MG23	Moran's Creek	4/12/2018	Clear , Slow	No	Yes	No	No	no	100
MCT7	352361, 6332043	MG23	Morans Creek	20/06/2019	Clear, no flow	No	Yes	No	No	No	90
MCT7	352361, 6332043	MG23	Moran's Creek	3/12/2019	Dry	No	No	No	No	No	80

MCT8	352296, 6332068	MG23	Morans Creek	17/07/2017	Turbid, no flow	No	Yes	No	No	No	100
MCT8	352296, 6332068	MG23	Morans Creek	9/01/2018	No water	No	No	No	No	No	80
MCT8	352296, 6332068	MG23	Morans Creek	16/07/2018	Clear, no flow	No	Yes	No	No	No	90
MCT8	352296, 6332068	MG23	Moran's Creek	4/12/2018	Clear , Slow	No	Yes	No	No	no	90
MCT8	352296, 6332068	MG23	Morans Creek	20/06/2019	No flow, turbid	No	Yes	Yes - Cattle	No	no	90
MCT8	352296, 6332068	MG23	Moran's Creek	3/12/2019	No water	No	No	No	No	No	80
MCT9	352217, 6332060	LW23	Morans Creek	9/01/2018	No water	No	No	No	No	No	70
MCT9	352217, 6332060	LW23	Morans Creek	16/07/2018	Clear, no flow	No	Yes	No	No	No	95
MCT9	352217, 6332060	LW24 Centre	Moran's Creek	4/12/2018	Clear , Slow	No	Yes	No	No	no	95
MCT10	352111, 6332026	MG24	Morans Creek	9/01/2018	Turbid, no flow	No	Yes	No	No	No	75
MCT10	352111, 6332026	MG24	Morans Creek	16/07/2018	Clear, no flow	No	No	No	No	No	95
MCT10	352111, 6332026	MG24	Moran's Creek	4/12/2018	Clear , Slow	No	Yes	No	No	no	100
MCT11	351981, 6332028	LW24A	Morans Creek	9/01/2018	No water	No	No	No	No	No	80
MCT11	351981, 6332028	LW24A	Morans Creek	16/07/2018	No water	No	No	No	No	No	95
MCT11	351981, 6332028	LW24A Centre	Moran's Creek	4/12/2018	Clear , Slow	No	Yes	No	No	no	100
MCT12	351880, 6332078	MG24A	Morans Creek	9/01/2018	Clear, no flow	No	Yes	No	No	No	70

MCT12	351880, 6332078	MG24A	Morans Creek	16/07/2018	No water	No	No	No	No	No	100
MCT12	351880, 6332078	MG24A	Moran's Creek	4/12/2018	Dry	No	Yes	No	No	no	100
MCT12	351880, 6332078	MG24A	Morans Creek	20/06/2019	No Water	No	No	No	No	No	80
MCT12	351880, 6332078	MG24A	Moran's Creek	3/12/2019	No Water	No	No	No	No	No	80
MCT13	351969, 6331897	MG24A	Morans Creek	9/01/2018	No Water	No	No	No	No	No	70
MCT13	351969, 6331897	MG24A	Morans Creek	9/01/2018	No Water	No	No	No	No	No	100
MCT13	351969, 6331897	MG24A	Moran's Creek	4/12/2018	Turbid Still	No	Yes	No	No	no	100
MCT14	352344, 6331774	MG24A	Morans Creek	9/01/2018	Turbid, no flow	No	Yes	No	No	No	100
MCT14	352344, 6331774	MG24A	Morans Creek	9/01/2018	Clear, no flow	No	Yes	No	No	No	100
MCT-14	352344, 6331774	LW24	Moran's Creek	3/12/2018	Turbid Still	No	Yes	No	No	no	100
MCT14	352344, 6331774	MG24A	Morans Creek	20/06/2019	No Water	No	No	No	No	No	100
MCT-14	352344, 6331774	LW24	Moran's Creek	3/12/2019	No Water	No	No	No	No	No	90

Appendix 3
Floodpath Condition Photographic Monitoring Points

PT54 MG14 - Morans Creek March 2014

PT54 MG14 - Morans Creek June 2014

PT54 MG14 - Morans Creek December 2014

PT54 MG14 - Morans Creek March 2015

PT54 MG14 - Morans Creek May 2015

PT54 MG14 - Morans Creek September 2015

PT54 MG14 - Morans Creek June 2016

PT54 MG14 - Morans Creek December 2016

PT54 MG14 - Morans Creek July 2017

PT54 MG14 - Morans Creek December 2017

PT54 MG14 - Morans Creek July 2018

PT54 MG14 - Morans Creek December 2018

PT55 LW15 C/L - Morans Creek March 2014

PT55 LW15 C/L - Morans Creek June 2014

PT55 LW15 C/L - Morans Creek December 2014

PT55 LW15 C/L - Morans Creek March 2015

PT55 LW15 C/L - Morans Creek May 2015

PT55 LW15 C/L - Morans Creek September 2015

PT55 LW15 C/L - Morans Creek June 2016

PT55 LW15 C/L - Morans Creek December 2016

PT55 LW15 C/L - Morans Creek July 2017

PT55 LW15 C/L - Morans Creek December 2017

PT55 LW15 C/L - Morans Creek July 2018

PT55 LW15 C/L - Morans Creek December 2018

PT56 MG15 - Morans Creek March 2014

PT56 MG15 - Morans Creek June 2014

PT56 MG15 - Morans Creek December 2014

PT56 MG15 - Morans Creek March 2015

PT56 MG15 - Morans Creek May 2015

PT56 MG15 - Morans Creek September 2015

PT56 MG15 - Morans Creek June 2016

PT56 MG15 - Morans Creek December 2016

PT56 MG15 - Morans Creek July 2017

PT56 MG15 - Morans Creek December 2017

PT56 MG15 - Morans Creek July 2018

PT56 MG15 - Morans Creek December 2018

PT57 LW16 C/L - Morans Creek March 2014

PT57 LW16 C/L - Morans Creek June 2014

PT57 LW16 C/L - Morans Creek December 2014

PT57 LW16 C/L - Morans Creek March 2015

PT57 LW16 C/L - Morans Creek May 2015

PT57 LW16 C/L - Morans Creek September 2015

PT57 LW16 C/L - Morans Creek June 2016

PT57 LW16 C/L - Morans Creek December 2016

PT57 LW16 C/L - Morans Creek July 2017

PT57 LW16 C/L - Morans Creek December 2017

PT57 LW16 C/L - Morans Creek July 2018

PT57 LW16 C/L - Morans Creek December 2018

PT58 MG16 - Morans Creek March 2014

PT58 MG16 - Morans Creek June 2014

PT58 MG16 - Morans Creek December 2014

PT58 MG16 - Morans Creek March 2015

PT58 MG16 - Morans Creek May 2015

PT58 MG16 - Morans Creek September 2015

PT58 MG16 - Morans Creek June 2016

PT58 MG16 - Morans Creek December 2016

PT58 MG16 - Morans Creek July 2017

PT58 MG16 - Morans Creek December 2017

PT58 MG16 - Morans Creek July 2018

PT58 MG16 - Morans Creek December 2018

PT59 LW17 C/L - Morans Creek December 2014

PT59 LW17 C/L - Morans Creek March 2015

PT59 LW17 C/L - Morans Creek May 2015

PT59 LW17 C/L - Morans Creek September 2015

PT59 LW17 C/L - Morans Creek June 2016

PT59 LW17 C/L - Morans Creek December 2016

PT59 LW17 C/L - Morans Creek July 2017

PT59 LW17 C/L - Morans Creek December 2017

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PT60 MG17 - Morans Creek December 2014

PT60 MG17 - Morans Creek March 2015

PT60 MG17 - Morans Creek May 2015

PT60 MG17 - Morans Creek September 2015

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PT60 MG17 - Morans Creek December 2018

PT61 MG17 - Morans Creek December 2014

PT61 MG17 - Morans Creek March 2015

PT61 MG17 - Morans Creek May 2015

PT61 MG17 - Morans Creek September 2015

PT61 MG17 - Morans Creek June 2016

PT61 MG17 - Morans Creek December 2016

PT61 MG17 - Morans Creek July 2017

PT61 MG17 - Morans Creek December 2017

PT61 MG17 - Morans Creek July 2018

PT61 MG17 - Morans Creek December 2018

PT62 LW18 C/L - Morans Creek December 2014

PT62 LW18 C/L - Morans Creek March 2015

PT62 LW18 C/L - Morans Creek May 2015

PT62 LW18 C/L - Morans Creek September 2015

PT62 LW18 C/L - Morans Creek June 2016

PT62 LW18 C/L - Morans Creek December 2016

PT62 LW18 C/L - Morans Creek July 2017

PT62 LW18 C/L - Morans Creek December 2017

PT62 LW18 C/L - Morans Creek July 2018

PT62 LW18 C/L - Morans Creek December 2018

PT63 MG18 - Morans Creek December 2014

PT63 MG18 - Morans Creek March 2015

PT63 MG18 - Morans Creek May 2015

PT63 MG18 - Morans Creek September 2015

PT63 MG18 - Morans Creek June 2016

PT63 MG18 - Morans Creek December 2016

PT63 MG18 - Morans Creek July 2017

PT63 MG18 - Morans Creek December 2017

PT63 MG18 - Morans Creek July 2018

PT63 MG18 - Morans Creek December 2018

PT64 LW19 C/L - Morans Creek September 2015

PT64 LW19 C/L - Morans Creek June 2016

PT64 LW19 C/L - Morans Creek December 2016

PT64 LW19 C/L - Morans Creek July 2017

PT64 LW19 C/L – Moran Creek December 2017

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PT64 LW19 C/L - Morans Creek July 2018

PT64 LW19 C/L - Morans Creek December 2018

PT65 MG19 - Morans Creek September 2015

PT65 MG19 - Morans Creek June 2016

PT65 MG19 - Morans Creek December 2016

PT65 MG19 - Morans Creek July 2017

PT65 MG19 - Morans Creek December 2017

PT65 MG19 - Morans Creek July 2018

PT65 MG19 - Morans Creek December 2018

PT66 LW20 C/L - Morans Creek September 2015

PT66 LW20 C/L - Morans Creek June 2016

PT66 LW20 C/L - Morans Creek December 2016

PT66 LW20 C/L - Morans Creek July 2017

PT66 LW20 C/L - Morans Creek December 2017

PT66 LW20 C/L - Morans Creek July 2018

PT66 LW20 C/L - Morans Creek December 2018

PT67 MG19 - Morans Creek September 2015

PT67 MG19 - Morans Creek June 2016

PT67 MG19 - Morans Creek December 2016

PT67 MG19 - Morans Creek July 2017

PT67 MG19 - Morans Creek December 2017

PT67 MG19 - Morans Creek July 2018

PT67 MG19 - Morans Creek December 2018

PT68 LW20 C/L - Morans Creek September 2015

PT68 LW20 C/L - Morans Creek June 2016

PT68 LW20 C/L - Morans Creek December 2016

PT68 LW20 C/L - Morans Creek July 2017

PT68 LW20 C/L - Morans Creek December 2017

PT68 LW20 C/L - Morans Creek July 2018

PT68 LW20 C/L - Morans Creek December 2018

PT69 MG20 - Morans Creek September 2015

PT69 MG20 - Morans Creek June 2016

PT69 MG20 - Morans Creek December 2016

PT69 MG20 - Morans Creek July 2017

PT69 MG20 - Morans Creek December 2017

PT69 MG20 - Morans Creek July 2018

PT69 MG20 - Morans Creek December 2018

PT69 MG20 - Morans Creek June 2019

PT69 MG20 - Morans Creek December 2019

PT70 LW21 C/L - Morans Creek September 2015

PT70 LW21 C/L - Morans Creek June 2016

PT70 LW21 C/L - Morans Creek December 2016

PT70 LW21 C/L - Morans Creek July 2017

PT70 LW21 C/L - Morans Creek December 2017

PT70 LW21 C/L - Morans Creek July 2018

PT70 LW21 C/L - Morans Creek December 2018

PT70 LW21 C/L - Morans Creek June 2019

PT70 LW21 C/L - Morans Creek December 2019

PT71 MG21 - Morans Creek September 2015

PT71 MG21 - Morans Creek June 2016

PT71 MG21 - Morans Creek December 2016

PT71 MG21 - Morans Creek July 2017

PT71 MG21 - Morans Creek December 2017

PT71 MG21 - Morans Creek July 2018

PT71 MG21 - Morans Creek December 2018

PT71 MG21 - Morans Creek June 2019

PT71 MG21 - Morans Creek December 2019

PT72 LW22 C/L - Morans Creek February 2017

PT72 LW22 C/L - Morans Creek July 2017

PT72 LW22 C/L – Moran Creek December 2017

PT72 LW22 C/L - Morans Creek July 2018

PT72 LW22 C/L - Morans Creek December 2018

PT72 LW22 C/L - Morans Creek June 2019

PT72 LW22 C/L - Morans Creek December 2019

PT73 MG22 - Morans Creek February 2017

PT73 MG22 - Morans Creek July 2017

PT73 MG22 - Morans Creek December 2017

PT73 MG22 - Morans Creek July 2018

PT73 MG22 - Morans Creek December 2018

PT73 MG22 - Morans Creek June 2019

PT73 MG22 - Morans Creek December 2019

PT74 LW23 C/L - Morans Creek July 2017

PT74 LW23 C/L - Morans Creek December 2017

PT74 LW23 C/L - Morans Creek July 2018

PT74 LW23 C/L - Morans Creek December 2018

PT74 LW23 C/L - Morans Creek June 2019

PT74 LW23 C/L - Morans Creek December 2019

PT75 MG23 - Morans Creek August 2017

PT75 MG23 - Morans Creek December 2017

PT75 MG23 - Morans Creek July 2018

PT75 MG23 - Morans Creek December 2018

PT75 MG23 - Morans Creek June 2019

PT75 MG23 - Morans Creek December 2019

PT76 MG25 – Byrons Gully December 2018

PT76 MG25 – Byrons Gully June 2019

PT76 MG25 – Byrons Gully December 2019

PT77 MG25 – Byrons Gully December 2018

PT77 MG25 – Byrons Gully June 2019

PT77 MG25 – Byrons Gully December 2019

PT78 LW25 Centre – Byrons Gully December 2018

PT78 LW25 Centre – Byrons Gully June 2019

PT78 LW25 Centre – Byrons Gully December 2019

PT79 MG25 – Byrons Gully December 2018

PT79 MG25 – Byrons Gully June 2019

PT79 MG25 – Byrons Gully December 2019

PT80 LW25 Centre – Byrons Gully December 2018

PT80 LW25 Centre – Byrons Gully June 2019

PT80 LW25 Centre – Byrons Gully December 2019

PT81 MG26 – Byrons Gully December 2018

PT81 MG26 – Byrons Gully June 2019

PT81 MG26 – Byrons Gully December 2019

PT82 MG25 – Byrons Gully December 2018

PT82 MG25 – Byrons Gully June 2019

PT82 MG25 – Byrons Gully December 2019

PT83 MG28 – Byrons Gully December 2018

PT83 MG28 – Byrons Gully June 2019

PT83 MG28 – Byrons Gully December 2019

PT84 MG28 – Byrons Gully December 2018

PT84 MG28 – Byrons Gully June 2019

PT84 MG28 – Byrons Gully December 2019

PT85 LW25 End of Block – Byrons Gully December 2018

PT85 LW25 End of Block – Byrons Gully June 2019

PT85 LW25 End of Block – Byrons Gully December 2019

PT86 MG25 – Morans Creek December 2018

PT86 MG25 – Morans Creek June 2019

PT86 MG25 – Morans Creek December 2019

PT87 LW25 Centre – Morans Creek December 2018

PT87 LW25 Centre – Morans Creek June 2019

PT87 LW25 Centre – Morans Creek December 2019

PT88 MG26 – Morans Creek December 2018

PT88 MG26 – Morans Creek June 2019

PT88 MG26 – Morans Creek December 2019

PT89 LW26 Centre – Morans Creek December 2018

PT89 LW26 Centre – Morans Creek June 2019

PT89 LW26 Centre – Morans Creek December 2019

PT90 MG27 – Morans Creek December 2018

PT90 MG27 – Morans Creek June 2019

PT90 MG27 – Morans Creek December 2019

PT91 LW27 Centre – Morans Creek December 2018

PT91 LW27 Centre – Morans Creek June 2019

PT91 LW27 Centre – Morans Creek December 2019

PT92 MG30 – Morans Creek December 2018

PT92 MG30 – Morans Creek June 2019

PT92 MG30 – Morans Creek December 2019

PT93 LW30 Centre – Morans Creek December 2018

PT93 LW30 Centre – Morans Creek June 2019

PT93 LW30 Centre – Morans Creek December 2019

PT94 MG31 End of Block Centre – Morans Creek December 2018

PT94 MG31 End of Block Centre – Morans Creek June 2019

PT94 MG31 End of Block Centre – Morans Creek December 2019

PT95 MG30 – Morans Creek December 2018

PT95 MG30 – Morans Creek July 2019

PT95 MG30 – Morans Creek December 2019

PT96 LW30 Centre – Morans Creek December 2018

PT96 LW30 Centre – Morans Creek June 2019

PT96 LW30 Centre – Morans Creek December 2019

PT97 MG31 – Morans Creek December 2018

PT97 MG31 – Morans Creek June 2019

PT97 MG31 – Morans Creek December 2019

PT98 MG31 – Morans Creek December 2018

PT98 MG31 – Morans Creek June 2019

PT98 MG31 – Morans Creek December 2019

PT99 LW31 Centre – Morans Creek December 2018

PT99 LW31 Centre – Morans Creek June 2019

PT99 LW31 Centre – Morans Creek December 2019

PT100 TG31– Morans Creek December 2018

PT100 TG31– Morans Creek June 2019

PT100 TG31– Morans Creek December 2019

MCT1 LW23 – Morans Creek June 2017

MCT1 LW23 – Morans Creek July 2017

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MCT3 LW22 C/L – Morans Creek June 2019

MCT3 LW22 C/L – Morans Creek December 2019

MCT4 MG21 – Moron's Creek June 2017

MCT4 MG21 – Morans Creek July 2017

MCT4 MG21 – Morans Creek December 2017

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MCT4 MG21 – Morans Creek June 2019

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MCT5 MG22 – Morans Creek December 2019

MCT6 LW23 C/L – Morans Creek July 2017

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MCT6 LW23 C/L – Morans Creek December 2018

MCT6 LW23 C/L – Morans Creek June 2019

MCT6 LW23 C/L – Morans Creek December 2019

MCT7 MG23 – Morans Creek July 2017

MCT7 MG23 – Morans Creek January 2018

MCT7 MG23 – Morans Creek July 2018

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MCT8 MG23 – Morans Creek June 2019

MCT8 MG23 – Morans Creek December 2019

MCT9 LW24 C/L – Morans Creek January 2018

MCT9 LW24 C/L – Morans Creek July 2018

MCT9 LW24 C/L – Morans Creek December 2018

MCT10 MG24 – Morans Creek January 2018

MCT10 MG24 – Morans Creek July 2018

MCT10 MG24 – Morans Creek December 2018

MCT11 LW24A C/L – Morans Creek January 2018

MCT11 LW24A C/L – Morans Creek July 2018

MCT11 LW24A C/L – Morans Creek December 2018

MCT12 MG24A – Morans Creek January 2018

MCT12 MG24A – Morans Creek July 2018

MCT12 MG24A – Morans Creek December 2018

MCT12 MG24A – Morans Creek June 2019

MCT12 MG24A – Morans Creek December 2019

MCT13 MG24A – Morans Creek January 2018

MCT13 MG24A – Morans Creek July 2018

MCT13 MG24A – Morans Creek December 2018

MCT14 LW24 – Morans Creek January 2018

MCT14 LW24 – Morans Creek July 2018

MCT14 LW24 – Morans Creek December 2018

MCT14 LW24 – Morans Creek June 2019

MCT14 LW24 – Morans Creek December 2019

TC1 MG21 – Tobins Creek March 2017

TC1 MG21 – Tobins Creek July 2017

TC1 MG21 – Tobins Creek January 2018

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TC2 LW22 C/L – Tobins Creek March 2017

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TC3 MG22 – Tobins Creek March 2017

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TC4 LW23 C/L – Tobins Creek June 2019

TC4 LW23 C/L – Tobins Creek December 2019

TC5 LW23 C/L – Tobins Creek March 2017

TC5 LW23 C/L – Tobins Creek July 2017

TC5 LW23 C/L – Tobins Creek January 2018

TC5 LW23 C/L – Tobins Creek July 2018

TC5 LW23 C/L – Tobins Creek December 2018

TC5 LW23 C/L – Tobins Creek June 2019

TC5 LW23 C/L – Tobins Creek December 2019

TC6 MW23 – Tobins Creek March 2017

TC6 MW23 – Tobins Creek July 2017

TC6 MW23 – Tobins Creek January 2018

TC6 MW23 – Tobins Creek July 2018

TC6 MW23 – Tobins Creek December 2018

TC6 MW23 – Tobins Creek June 2019

TC6 MW23 – Tobins Creek December 2019

TC7 LW24 C/L – Tobins Creek January 2018

TC7 LW24 C/L – Tobins Creek July 2018

TC7 LW24 C/L – Tobins Creek December 2018

TC7 LW24 C/L – Tobins Creek June 2019

TC7 LW24 C/L – Tobins Creek December 2019

TC8 MG24 – Tobins Creek January 2018

TC8 MG24 – Tobins Creek July 2018

TC8 MG24 – Tobins Creek December 2018

TC8 MG24 – Tobins Creek June 2019

TC8 MG24 – Tobins Creek December 2019

TC9 LW24A C/L – Tobins Creek January 2018

TC9 LW24A C/L – Tobins Creek July 2018

TC9 LW24A C/L – Tobins Creek December 2018

TC9 LW24A C/L – Tobins Creek June 2019

TC9 LW24A C/L – Tobins Creek December 2019

TC10 MG24A – Tobins Creek January 2018

TC10 MG24A – Tobins Creek July 2018

TC10 MG24A – Tobins Creek December 2018

TC10 MG24A – Tobins Creek June 2019

TC10 MG24A – Tobins Creek December 2019

Appendix 3: 2019 Independent Environmental Audit Action Plan

Mandalong Mine Independent Environmental Audit 2019 – Action Plan

Approval & Condition Number	Recommendation	Action Owner	Action Description	Action Due Date	Completion Date
SSD-5144 S3 – 13	**Non-Compliance** **Water Pollution** **Auditor Finding:** Prior to a new discharge point (LDP004) being added to EPL 365 in October 2018, Centennial Mandalong reported one incident relating to an unlicensed discharge to water on 26 February 2018. Centennial Mandalong reported that immediate actions were taken to stop the discharge and reduce the suspended solids loads in flows to the sediment basin and removal of water by a suction tanker truck was undertaken. An environmental incident report was prepared and submitted to DPE, EPA and DRG which detailed the measures proposed to prevent a reoccurrence. **Recommendation:** Review water management and ERSED controls around the Mandalong South shaft stockpile area and fines drying area to ensure controls are adequate to avoid potential turbid water discharge from the area.	Environmental Coordinator / Mandalong South Project Manager.	Complete a review of water management and ERSED controls around the Mandalong South shaft stockpile area and fines drying area to ensure controls are adequate to avoid potential turbid water discharge from the area.	30 September 2019	**A review was completed by GHD in September 2019.**
SSD-5144 S3 – 16	**Non-Compliance** **Water Management** **Finding 1**	Environmental Coordinator / Mandalong South Project Manager	Confirm that the sediment structures at the MSSS are compliant with all aspects of the	30 September 2019	**A review was completed by GHD in September 2019.**

Approval & Condition Number	Recommendation	Action Owner	Action Description	Action Due Date	Completion Date
	Pit top disturbance and construction is managed in accordance with the Northern Region WMP and where construction works are significant an erosion and sediment control plan (ESCP) and EMP will be prepared. A CEMP has been prepared for construction activities at MSSS which are inspected weekly as part of the environmental construction inspection checklist (WP-7154). Additional verification regarding construction management is provided in SSD-5144 CoA A8-1. However, as discussed in EPL365 L.1.1 the water management and ERSED controls around the Mandalong South shaft stockpile area and fines drying area should be reviewed to ensure controls are adequate to avoid potential turbid water discharge from the area. **Finding 2** The CEMP also requires a progressive Erosion and Sediment Control Plan (ESCP) to be implemented. While an initial plan was sighted, no progressive ESCPs had been completed, indicating that formal documented controls in the MSSS area had not been implemented. **Recommendation 1** Confirm that the sediment structures at the MSSS are compliant with all aspects of the Managing Urban Stormwater: Soils and Construction. **Recommendation 2** Ensure that progressive Erosion and Sediment		Managing Urban Stormwater: Soils and Construction. Mandalong to implement progressive Erosion and Sediment Control Plans are implemented at the MSSS with input from a specialist Erosion and Sediment control expert.		

Approval & Condition Number	Recommendation	Action Owner	Action Description	Action Due Date	Completion Date
	Control Plans are implemented at the MSSS. These should have input by a specialist Erosion and Sediment control expert.				
EPL 365 L1.1	**Non-Compliance** **Pollution of waters** **Finding** Prior to a new discharge point (LDP004) being added to EPL 365 in October 2018, Centennial Mandalong reported one incident relating to an unlicensed discharge to water on 26 February 2018. Centennial Mandalong reported that immediate actions were taken to stop the discharge and reduce the suspended solids loads in flows to the sediment basin and removal was water by a suction tanker truck. An environmental incident report was prepared and submitted to DPE,EPA and DRG which detailed the measures proposed to prevent a reoccurrence. During the site inspection of the shaft construction works it was observed that there was a risk of discharge from the stockpile area for the works. The area is also used for the drying out of wet fines from the shaft excavation process. A small dam near the stockpile was relatively full of water and some clear seepage from the dam was observed. In order to ensure compliance with this condition, it is considered that further water	Environmental Coordinator / Mandalong South Project Manager.	Complete a review of water management and ERSED controls around the Mandalong South shaft stockpile area and fines drying area to ensure controls are adequate to avoid potential turbid water discharge from the area.	30 September 2019	**A review was completed by GHD in September 2019.**

Approval & Condition Number	Recommendation	Action Owner	Action Description	Action Due Date	Completion Date
	management controls, including ERSED controls are required to manage water in this area. Following the inspection Mandalong reported that the water was to be pumped up to the main sediment dam to provide more capacity in the dam and reduce the risk of overtopping the small dam at that time. Discharges from the small dam are not licenced on the EPL. **Recommendation** Review water management and ERSED controls around the Mandalong South shaft stockpile area and fines drying area to ensure controls are adequate to avoid potential turbid water discharge from the area.				
EPL 365 L5.4	**Non-Compliance** **Noise limits** **Finding** As reported in the IEA for Newstan Colliery and Northern Coal Services (2018), the 2016 annual noise monitoring report (SLR, 2016) appears to use the Lake Macquarie Bureau of Meteorology Station data (provided as Appendix C within the monitoring report) for the purposes of determining meteorological conditions for the noise assessment. The 2017 and 2018 noise monitoring reports do not appear to specify which meteorological data source it uses. As this condition requires that the meteorological station identified in this licence as EPA	Environmental Coordinator	Meteorological data to be used for determining meteorological conditions is the data recorded at the meteorological station identified in the EPL as EPA Identification Point W1.	Not applicable	**Complete – GHD have commenced using W1 data from November 2018.**

Approval & Condition Number	Recommendation	Action Owner	Action Description	Action Due Date	Completion Date
	Identification Point W1 be used to determine the meteorological conditions, this condition is considered non-compliant at least for the 2016 monitoring program. Additional operator attended noise monitoring was undertaken by GHD in November 2018 at one location (M1) during the evening and night time. Centennial Mandalong reported that meteorological station identified Point W1 was being used for noise monitoring since receiving the Newstan / NCS IEA in December 2018. No noise monitoring has been undertaken at Mandalong to verify this. **Recommendation** Ensure the meteorological data to be used for determining meteorological conditions is the data recorded at the meteorological station identified in the EPL as EPA Identification Point W1.				
EPL 365 M2.3	**Non-compliance** **Water and / or land monitoring requirements** **Finding** Centennial Mandalong have notified the EPA and reported in the monthly Environmental Monitoring reports and EPA Annual Returns the following non-compliances with EPL condition M2 sampling frequency: • 18 December 2016 no grab sample was collected from LDP001 during discharge.	Environmental Coordinator	Not applicable	Not applicable	Not applicable

Approval & Condition Number	Recommendation	Action Owner	Action Description	Action Due Date	Completion Date
	In response to the EPL non-compliances, it is understood that CES subsequently installed an automated notification system such that relevant persons are notified when the pump becomes operational in order to prevent recurrence of missed sampling. On the basis that LDP001 was not always sampled in accordance with Special Frequency 1 during the audit period, the monitoring at the CES is considered non-compliant with this condition. **Recommendation** As Centennial Mandalong has undertaken corrective actions to address the cause of the missed samples, no further recommendations have been identified.				
EPL 365 M4.1	**Non-compliance** **Environmental monitoring** **Finding** As reported in the NCS IEA, 2018, although attended noise monitoring of all Mandalong locations was undertaken each year over at least three consecutive days, the monitoring was not undertaken over three consecutive days at some of the individual locations (highlighted in Table B-1.3). Furthermore, it is considered that the intent of this part of this condition requires day period monitoring of M1 on three consecutive days, evening period monitoring of M1 on three	Environmental Coordinator	Centennial Mandalong to undertake consultation with the EPA on noise monitoring requirements for M4.1(d) and prepare a licence variation application if required.	31 December 2019.	**On 17 July 2019, Centennial Mandalong provided a submission to the EPA with comments on EPL 365 for consideration during the EPA's licence review process. The EPA is yet to respond and Centennial Mandalong will submit a formal licence variation application in March / April 2020.**

Approval & Condition Number	Recommendation	Action Owner	Action Description	Action Due Date	Completion Date
	consecutive days and night period monitoring of M1 on three consecutive days. **Recommendation** Centennial Mandalong either undertake annual attended noise monitoring during the day period on three consecutive days, evening period on three consecutive days and night period on three consecutive days as required of Condition M4.1 or seek a license variation to amend this licence condition to reflect the current work practices.				
ML1722 4	**Non-compliance** **Reporting** **Finding** Under the previous version of Condition 4 (a), (b), (c), (d) and (e): The first Compliance Report was required to be lodged with the DRE by 17 December 2016. In the period prior to 19 February 2018 Centennial Mandalong submitted a Compliance Report ML1722 (APP148954) to DRE on 10 March 2017 reporting no non-compliances with ML1772. This report was due on 17 December 2016. Centennial Coal received an official caution from the Resources Regulator on 6 April 2017 for an offence that occurred on 17 December 2017. **Recommendation** As Centennial Mandalong has lodged the	Mining Approvals Coordinator	No action required. Condition Obsolete Note that the replacement conditions and actions have been scheduled and assigned in the Centennial Compliance Database.	Not applicable	Not applicable

Approval & Condition Number	Recommendation	Action Owner	Action Description	Action Due Date	Completion Date
	Compliance Report reporting no non-compliances required by this condition and this condition has been superseded, no further recommendations have been identified.				
SSD-5144 CoA S2 - 13	**Recommendation** Continue to work with DPE in regards to surrender of development consent DA 97/800 in accordance with Section 104A of the EP&A Act.	Environmental Coordinator	DPE have granted an extension to surrender DA97/800 until 30 April 2020.	30 April 2020	
SSD-5144 CoA S3 - 3	**Recommendation** That Mandalong discuss the inconsistency regarding unattended monitoring between condition c and the approved noise management plan with DPE to assess if action is required to remove any inconsistency.	Environmental Coordinator	Mandalong to discuss the inconsistency regarding unattended monitoring between condition c and the approved noise management plan with DPE to assess if action is required to remove any inconsistency.	9 August 2019	**Completed consultation with DPIE on 31 July 2019. Revised version of the Noise Management Plan was submitted to DPIE on 14/10/19 within 3 months of completing the IEA.**
SSD-5144 CoA S3 - 8	**Opportunity for Improvement** Mandalong to continue to investigate sources of contamination in Deposited Dust Gauge DG14 and to develop and implement means of preventing known sources of contamination of the dust gauges.	Environmental Coordinator	Mandalong will continue to investigate sources of contamination in Deposited Dust Gauge DG14 and to develop and implement means of preventing known sources of contamination of the dust gauges.	Ongoing	**Ongoing – Fencing has been installed around DG14. The dust gauge height has also been raised. Both measures have been implemented to prevent cattle accessing the dust gauge.**

Approval & Condition Number	Recommendation	Action Owner	Action Description	Action Due Date	Completion Date
SSD-5144 CoA S3 - 15	**Opportunity for Improvement** Mandalong to consider if an Administrative Modification is supported to remove references to CES from this condition.	Environmental Coordinator	Mandalong will consider if an Administrative Modification is supported to remove references to CES from this condition.	31 October 2019	**An administrative modification is not justified for SSD-5144, Schedule 3 Condition 15 at this time. Centennial Mandalong may consider requesting an amendment as part of a future modification.**
SSD-5144 CoA S3 - 16	**Opportunity for Improvement** Implement mandatory actions identified in the Water Efficiency Audit (Hunter Water, June 2018) at the MMAS.	Engineering Superintendent	Mandalong to investigate which actions from the Hunter Water Efficiency Audit can be implemented.	31 December 2019.	**Complete – mandatory actions completed by 31/12/2019.**
SSD-5144 CoA S3 - 17	**Opportunity for Improvement** Review the effectiveness of oil separation from the MMAS workshop and improve performance as required	Environmental Coordinator	Mandalong to review the effectiveness of oil separation from the MMAS workshop to improve performance as required.	31 December 2019.	**A review was completed by Mandalong in 2019. Repairs have been made to the skimmer operating floats, which were identified as the cause of hydrocarbons entering the Mine Dam. A skimmer pump has been installed in the Mandalong Mine Dam in the event that a hydrocarbon spill enters the dam. The installation of a pump to de-water the Mine Dam into the Mandalong u/g workings was installed in February 2020.**
SSD-5144 CoA S3 - 32	**Recommendation** That Mandalong organise for a specialist to regularly monitor and assess the progressive rehabilitation against the Criteria defined in Condition S3-31 including weed management and control. Actions to address issues identified during the monitoring should be implemented.	Environmental Coordinator	A specialist ecologist will be engaged to complete monitoring and assessment of the progressive rehabilitation at the MSSS.	31 December 2019.	**Complete – a rehabilitation review at the MSSS was conducted by Kleinfelder in November 2019.**

Approval & Condition Number	Recommendation	Action Owner	Action Description	Action Due Date	Completion Date
SSD-5144 CoA S3 - 32	**Recommendation** It is recommended that in future rehabilitation of the remaining areas of the MSSS that invasive exotic grasses are not included in the seed mix.	Environmental Coordinator	Noted. Exotic grasses are not included in the seed mix for rehabilitation.	Not applicable	Not applicable
SSD-5144 CoA S6 – 8 and Statement of Commitments A8 - 1	**Recommendation** That Mandalong ensure the implementation of Progressive ESCPs as identified in the main CEMP (Section 4.1.4).	Environmental Coordinator / Mandalong South Project Manager.	Mandalong to implement progressive Erosion and Sediment Control Plans are implemented at the MSSS with input from a specialist Erosion and Sediment control expert.	30 September 2019	**A review was completed by GHD in September 2019. An update to the MSSS CEMP was finalised in January 2020.**
SSD-5144 Statement of Commitments A8 - 1	**Recommendation** That Mandalong assess whether adequate storage capacity for spoil disposal requirements exists at the stockpile area.	Mandalong South – Project Manager	Mandalong to complete an assessment to determine whether adequate storage capacity for spoil disposal requirements exists at the stockpile area at the MSSS.	Not applicable	**Complete – an assessment of stockpiling capacity was completed at the MSSS by GHD in April 2019.**
SSD-5144 Statement of Commitments A8 - 22	**Recommendation** Based on the success of the various rehabilitation approaches used to date, further investigate and determine the best rehabilitation methods to use in the remaining areas of the MSSS noting the absence of topsoils available.	Environmental Coordinator	Mandalong has used the bark blower product at the MSSS as a topsoil replacement with successful results to date.	Not applicable	**Complete**

Approval & Condition Number	Recommendation	Action Owner	Action Description	Action Due Date	Completion Date
DA 35-2-2004 CoA S2 - 8	**Opportunity for Improvement** Repair sediment controls at the stockpiles at the Delta Entry Site.	Environmental Coordinator	Repair sediment controls at the stockpiles at the Delta Entry Site.	Not applicable	**Complete – works completed in March 2019.**
DA 97/800 CoA S2-60A	**Opportunity for Improvement** Noting that GHG emissions have been steadily rising that Mandalong expedite the Gas Engines Project and where practicable investigate, develop and implement other GHG abatement projects.	Mine Manager	Centennial Mandalong have commenced construction works for the Gas Engines Project. Contractual negotiations are ongoing for the project.	Ongoing	**Ongoing - Gas Engines project at Mandalong is being progressed by EDL in 2020.**
DA 97/800 CoA S2 - 103	**Opportunity for Improvement** Review how the local community is kept informed of the progress of the project and assess if they address all requirements of Condition CoA S2 - 7 in consultation with council. (It is noted that SSD-5144 has specific community consultation requirements that will supercede this condition once DA 97/800 is surrendered, in which case this OFI may not be relevant).	Environmental Coordinator	Community consultation is undertaken with the requirements of SSD-5144, Schedule 6, Condition 9. A CCC is in place for the Mandalong Mine with attendance from a representation of the Lake Macquarie City Council.	Not applicable	**Complete – community consultation is ongoing.**
DA 97/800 Statement of Commitments A1 MOD 4 - 10	**Opportunity for Improvement** Review how environmental management initiatives are communicated to the community and assess if the frequency is sufficient to meet this requirement. (It is noted that SSD-5144 has specific community consultation requirements that will supercede this commitment once DA	Environmental Coordinator	Community consultation is undertaken with the requirements of SSD-5144, Schedule 6, Condition 9. A CCC is in place for the	Not applicable	**Complete – community consultation is ongoing.**

Approval & Condition Number	Recommendation	Action Owner	Action Description	Action Due Date	Completion Date
	97/800 is surrendered, in which case this OFI may not be relevant).		Mandalong Mine with attendance from a representation of the Lake Macquarie City Council.		
EPL 365 P1.1	**Opportunity for Improvement** Update figures attached to the monthly monitoring reports to ensure they are consistent with the monitoring locations from the current EPL.	Environmental Coordinator	Figures attached to the monthly monitoring reports will be reviewed to ensure they are consistent with the monitoring locations from the current EPL.	14 August 2019	**Complete – figures were updated for the July 2019 website report.**
EPL 365 P1.2	**Opportunity for Improvement** Update figures attached to the monthly monitoring reports to ensure they are consistent with the monitoring locations as detailed in the current EPL (LDP003).	Environmental Coordinator	Figures attached to the monthly monitoring reports will be reviewed to ensure they are consistent with the monitoring locations from the current EPL.	14 August 2019	**Complete – figures were updated for the July 2019 website report to include LDP003.**
EPL 365 L5.1	**Recommendation** Mandalong to continue to instigate measures to reduce noise levels from the shaft construction and address future complaints as appropriate.	Environmental Coordinator	Centennial Mandalong to continue to monitor noise levels from the shaft construction project and implement mitigation measures as required.	Not applicable	**Ongoing – noise mitigation measures have been implemented at the MSSS.**

Approval & Condition Number	Recommendation	Action Owner	Action Description	Action Due Date	Completion Date
EPL 365 L5.6	**Recommendation** Centennial Mandalong seeks a license variation to amend this licence condition to reflect the current work practices.	Environmental Coordinator	Centennial Mandalong to prepare a licence variation application to amend EPL 365 to be consistent with the noise monitoring program in the approved Noise Management Plan.	31 December 2019	**Complete - Centennial Mandalong provided a response to an EPL 365 licence review notice on 17 July 2019 which requested that the noise monitoring points are added to the EPL to be consistent with the long-term noise monitoring locations listed in the Noise Management Plan for NCS and Mandalong.**
ML1443 CoA 31	**Recommendation** That temporary maintenance of roads such as patching is conducted promptly after cracking from subsidence damage to reduce risks on smaller vehicles and bicycles. It is understood that this is a Council obligation in conjunction with Centennial Mandalong	Mining Approvals Coordinator	Consult with LMCC to discuss options and timeframes for temporary road pavement repairs where subsidence has not yet been finalised.	30 September 2019	**In September 2019, LMCC advised that the use of AC10 asphalt for the temporary repairs to subsidence damage road pavement is the best option for medium traffic roads such as Mandalong Road.** **AC10 asphalt is flexible and hardens with time and traffic use. It will typically stay flexible for four to six weeks, depending on weather conditions i.e. flexibility is reduced as the volatiles in the asphalt are lost.** **Where additional subsidence is expected, the delay in hardening of the asphalt will assist with maintaining the integrity of the repaired section of road pavement.** **On low traffic roads, the use of the more flexible cold asphalt overlay**

Approval & Condition Number	Recommendation	Action Owner	Action Description	Action Due Date	Completion Date
					may be used. **On high traffic roads, the use of AC14 asphalt is preferred.** **Temporary repairs were undertaken on Mandalong Road pavement following subsidence from LW25B. Within days of the subsidence damage occurring, LMCC conducted temporary repairs by milling off the compression humps and application of AC10 asphalt over a 3m section of pavement. The repaired section of road has remained safe and serviceable during the full development of subsidence over LW25B.**
ML1722 CoA 2	**Recommendation** That Mandalong consider the commencement of monitoring of rehabilitation by a suitable specialist in 2019 to gain an earlier perspective of the success (or otherwise) of the rehabilitation and to enable earlier implementation of corrective measures if required.	Environmental Coordinator	A specialist ecologist will be engaged to complete monitoring and assessment of the progressive rehabilitation at the MSSS.	31 December 2019	**Complete - Kleinfelder have completed the MSSS rehabilitation monitoring in November 2019.**
ML1722 CoA 2	**Recommendation** That Mandalong review their responses to the actions defined by the Resources Regulator with a third party expert to better address the actions.	Environmental Coordinator	Centennial Mandalong have responded to items raised by DRG (May 2018) in regard to the MSSS in the 2018 Annual Review.	Not applicable	**Complete**

Approval & Condition Number	Recommendation	Action Owner	Action Description	Action Due Date	Completion Date
ML1722 CoA 3	**Opportunity for Improvement** Improve the detail of reporting in the Annual Review the performance of progressive rehabilitation conducted along the access road and around the stockpile area at the Mandalong South Project Area. It is noted that the access road was only completed in 2018 and hence reporting to date may be limited.	Environmental Coordinator	Centennial Mandalong will include an update on the progressive rehabilitation at the MSSS in the 2019 Annual Review.	30 March 2020	**Complete – update on progressive rehabilitation included in 2019 Annual Review.**
Northern Region Noise Management Plan	**Recommendation** Centennial Mandalong discuss the inconsistency regarding unattended monitoring between condition c and the approved noise management plan with DPE to assess if action is required to remove any inconsistency.	Environmental Coordinator	Mandalong to discuss the inconsistency regarding unattended monitoring between condition c and the approved noise management plan with DPE to assess if action is required to remove any inconsistency.	31 October 2019	**Completed consultation with DPIE on 31 July 2019. Revised version of the Noise Management Plan was submitted to DPIE on 14/10/19 within 3 months of completing the IEA.**
Northern Region Water Management Plan	**Recommendation** Consider the update of the Water Management Plan to address issues identified at the MSSS as discussed in this report including the CEMP adequacy assessment below, unless this would be covered in other documents.	Environmental Coordinator	Mandalong to complete a review of the Mandalong Mine – Water Management Plan to further address water management at the MSSS. This will of the Water Management Plan will also address the SSD-5144 MOD 6 approval.	12 August 2019 (within 4 months of the Mod 6 approval).	**The Mandalong Mine WMP was revised following the M0D6 approval and submitted to DPIE for approval on 12/8/19.**

Approval & Condition Number	Recommendation	Action Owner	Action Description	Action Due Date	Completion Date
Construction Environmental Management Plan	**Recommendation** That Mandalong review the water management and ERSED controls around the Mandalong South stockpile area to confirm that the controls at MSSS and the related stockpile area are compliant with all aspects of the Managing Urban Stormwater: Soils and Construction and adequate to avoid potentially turbid water discharge from the area. This review should also consider the practice of storage of water on top of the stockpile. Outcomes of the reviews and revised mitigation measures should be reflected in revised management plans for the area.	Environmental Coordinator / Mandalong South Project Manager.	Mandalong to complete a review of water management and ERSED controls around the Mandalong South shaft stockpile area and fines drying area to ensure controls are adequate to avoid potential turbid water discharge from the area. The Construction Environmental Management Plan (CEMP) for the MSSS will then be updated.	30 September 2019	**A review was completed by GHD in September 2019. An update to the MSSS CEMP was finalised in January 2020.**
Site Observation MMAS Photo 20	**Opportunity for Improvement** Review the effectiveness of oil separation from workshop and improve performance as required.	Environmental Coordinator	Mandalong to review the effectiveness of oil separation from the MMAS workshop to improve performance as required.	31 December 2019	**A review was completed by Mandalong in 2019. Repairs have been made to the skimmer operating floats, which were identified as the cause of hydrocarbons entering the Mine Dam. A skimmer pump has been installed in the Mandalong Mine Dam in the event that a hydrocarbon spill enters the dam. The installation of a pump to de-water the Mine Dam into the Mandalong u/g workings was installed in February 2020.**

Appendix 4: Centennial Mandalong Rehabilitation Security Estimate

Appendix 5: Annual Compliance Noise Monitoring Reports

Centennial Mandalong Pty Ltd

Mandalong Mine Access Site & Cooranbong Entry Site

Annual Compliance Monitoring 2019

October 2019

Glossary

Term	Definition
AS	Australian Standard
dB	Decibel is the unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dB(A)	Frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at very low and very high frequencies.
NPI	*Noise Policy for Industry*
$L_{Aeq(period)}$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
$L_{A10(period)}$	The sound pressure level that is exceeded for 10% of the measurement period.
$L_{A1(period)}$	The sound pressure level that is exceeded for 1% of the measurement period.
$L_{A90(period)}$	The sound pressure level that is exceeded for 90% of the measurement period.
L_{Amax}	The maximum sound level recorded during the measurement period.
LGA	Local Government Area
MSSS	Mandalong South Surface Site
MMAS	Mandalong Mine Access Site
Noise Sensitive Receiver	Noise sensitive land use at which noise from a development can be heard.
PSNG	Project Specific Noise Goals
Rating Background Level (RBL)	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period.

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Appendix H – Unattended statistical ambient noise levels charts

Appendix I – Mandalong AWS & BOM Lake Macquarie AWS

1. Introduction

1.1 Overview

GHD Pty Ltd (GHD) has been engaged by Centennial Mandalong Pty Ltd (Centennial) to conduct annual operational noise compliance monitoring associated with the Mandalong Mine Access Site (MMAS) and the Cooranbong Entry Site (Cooranbong).

1.2 Purpose of this report

The purpose of this report is to present the findings of the latest annual operational noise compliance monitoring survey and assess this monitoring data against noise criteria set out in Centennial's *Noise Management Plan – Northern Region May 2018,* Environmental Protection Licence EPL 365, Development Consent SSD-5144 and SSD-5145 for this site.

1.3 Scope of work

The scope of work undertaken by GHD for this assessment is summarised below:

- Operator attended operational compliance noise monitoring was undertaken at six (6) locations identified as M1, M4, M6, M7, M8, and M10 in the *Noise Management Plan – Northern Region May 2018*. Monitoring was undertaken for 1.5 hours during the daytime, 30 minutes during the evening and 1 hour during the night-time at each location over three (3) consecutive days as per the EPL 365.
- Access and permission was not granted to conduct noise monitoring at the selected residential properties. As a result, noise monitoring was undertaken at suitable locations on public property representative of the nearest affected properties.
- Measured operational noise levels have been assessed against the development consent conditions.
- If measured noise levels indicated exceedance of the noise targets, GHD consulted with Centennial to agree upon the preferred noise control strategy.
- Where noise levels exceed noise goals, in-principle noise mitigation recommendations have been provided.
- All measurements were conducted in accordance with the specifications detailed in the following documents:
  - Development Consent SSD 5144
  - Development Application SSD-5145
  - Environmental Protection Licence (EPL) 365
  - Noise Management Plan – Northern Region May 2018
  - NSW Noise Policy for Industry (EPA, 2017)
  - Australia Standards AS1055: 2018 *Acoustics – Description and Measurement of Environmental Noise*

1.4 Limitations

This report has been prepared by GHD for Centennial Mandalong Pty Ltd and may only be used and relied on by Centennial Mandalong Pty Ltd for the purpose agreed between GHD and Centennial Mandalong Pty Ltd as set out in Section 1.2 and 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Centennial Mandalong Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The noise monitoring results outlined in this report represent the findings apparent at the date and time of the conducted and the conditions of the area at the time. It is the nature of environmental assessments that all variations in environmental conditions cannot be accessed and all uncertainty concerning the conditions of the ambient noise environment cannot be eliminated. Professional judgement must be exercised in the investigation and interpretation of observations.

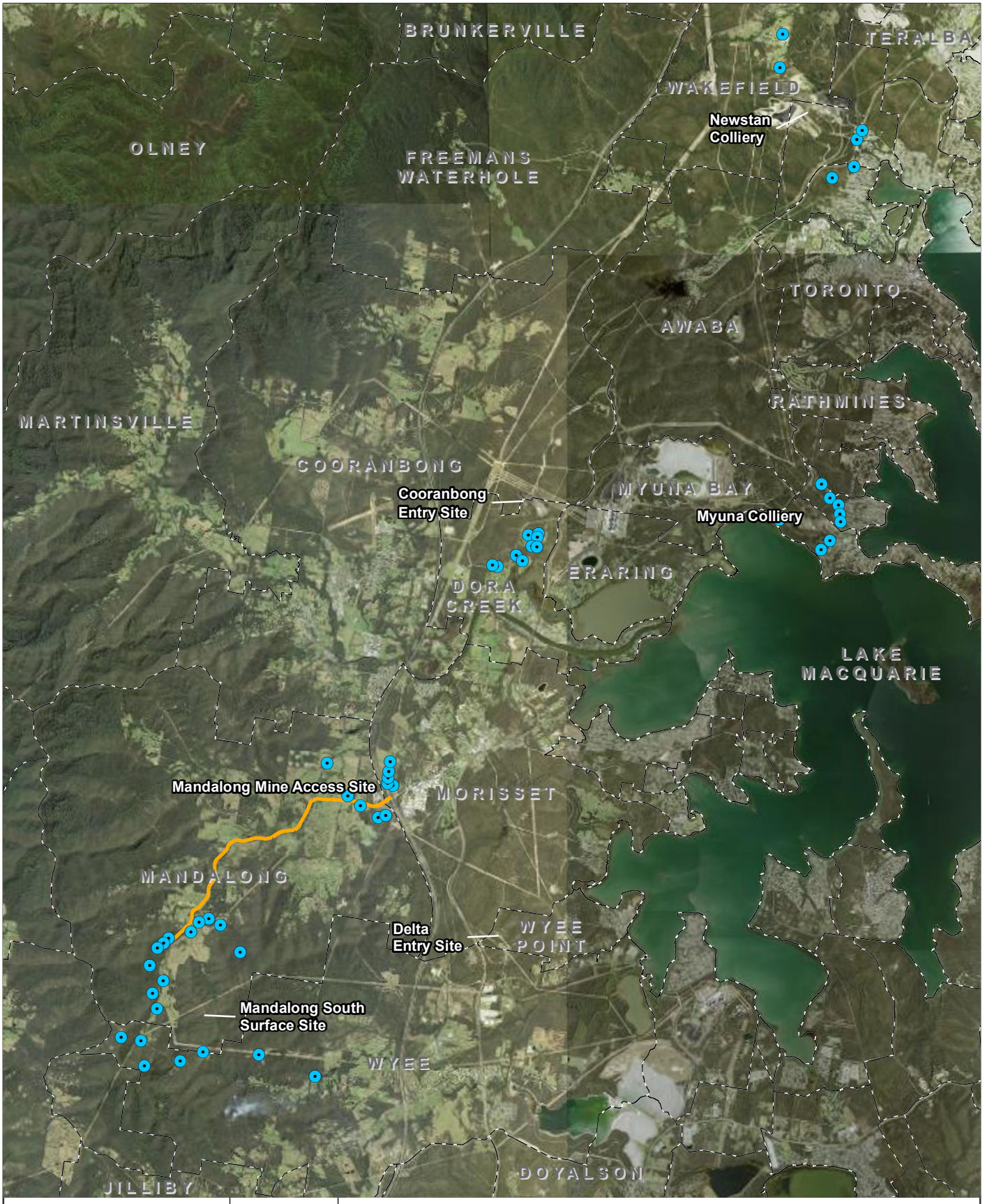
In conducting this assessment and preparing the report, current guidelines for noise were referred to. This work has been conducted in good faith with GHD's understanding of the client's brief and the generally accepted consulting practice.

No other warranty, expressed or implied, is made as to the information and professional advice included in this report. It is not intended for other parties or other uses.

2. Site description

Mandalong Mine is an existing underground coal mine operation located in the Lake Macquarie Local Government Area (LGA). It is situated approximately 130 km north of Sydney and 35 km south-west of Newcastle near Morisset within the Newcastle Coalfield of NSW.

Figure 2-1 shows the Mandalong Mine Access Site (MMAS) and the Cooranbong Entry Site (Cooranbong) in its regional setting on the western side of Lake Macquarie within both the Lake Macquarie and Wyong LGAs.



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0 500 1,000 2,000 3,000 4,000

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

LEGEND

- Suburb
- Haul Road
- Sensitive receiver

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LOCATION	-
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SCALE	refer to scalebar

Centennial Coal Northern Region Environmental Monitoring Operation Locations and Sensitive Receivers

Centennial Coal

DATE 3/10/2019

Figure 2-1

GIS Filename: G:\22\12510863\GIS\Maps\Deliverables\LongTerm\2212510863_NLT007_LongTerm_Overview_ReceiversOnly_A.mxd

Data source: LPI: DTDB / DCDB / Aerial Imagery, 2017. Created by:pkiem

3. Noise criteria

3.1 Development Consent SSD-5144

Development Consent SSD-5144 provides the relevant noise criteria and is reproduced as follows:

Operational Noise Criteria

2. *The Applicant must ensure that the operational noise generated by the development (including maintenance activities, shaft construction and exploration drilling) does not exceed the criteria in Table 2 at any residence on privately-owned land.*

Table 2: Operational Noise Criteria

Receivers	*Noise Limit (dB(A))*			
	Day $L_{Aeq\ (15\ minute)}$	*Evening* $L_{Aeq\ (15\ minute)}$	*Night* $L_{Aeq\ (15\ minute)}$	*Night* $L_{A1\ (1\ minute)}$
R2	*40*	*40*	*40*	*52*
R3	*42*	*42*	*42*	*52*
R4	*39*	*39*	*39*	*52*
R5	*41*	*41*	*41*	*61*
R6	*40*	*40*	*40*	*61*
R7 & R8	*43*	*43*	*43*	*61*
R9	*42*	*42*	*42*	*61*
R10	*39*	*39*	*39*	*61*
All other residences on privately-owned land	*35*	*35*	*35*	*45*

Note: The receiver locations in Table 2 are shown in Figure 1 of Appendix 4.

Noise generated by the development is to be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy. Appendix 3 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

However, these criteria do not apply if the Applicant has an agreement with the relevant landowner to exceed the noise criteria in Table 2, and the Applicant has advised the Department in writing of the terms of this agreement.

Operating Conditions

3. The Applicant must:

(a) Implement best management practice to minimise the construction, operational and road noise of the development;

(b) Use its best endeavours to facilitate the connection to, and use of, a permanent electricity source to undertake ventilation shaft sinking activities at the MSSS;

(c) Operate an on-site noise management system that uses a combination of predictions, forecasting, and attended and unattended monitoring of all noise associated with the development, to ensure compliance with the relevant conditions of this consent, including noise during construction and operations;

(d) *Minimise the noise impacts of the development during meteorological conditions under which the noise limits in this consent do not apply (see Appendix 3); and*

e) *Regularly assess noise monitoring data to determine whether the development is complying with the relevant conditions of consent, to the satisfaction of the Secretary.*

APPENDIX 3: NOISE ASSESSMENT

Applicable Meteorological Conditions

1. *The noise criteria in Table 2 of the conditions are to apply under all meteorological conditions except the following:*

(a) *Wind speeds greater than 3 m/s at 10 m above ground level; or*

(b) *Temperature inversion conditions between 1.5 ºC and 3ºC/100 m and wind speeds greater than 2 m/s at 10 m above ground level; or*

(c) *Temperature inversion conditions greater than 3ºC/100 m.*

Determination of Meteorological Conditions

2. *Except for wind speed at microphone height, the data to be used for determining meteorological conditions must be that recorded by the meteorological station located in the vicinity of the site.*

Compliance Monitoring

3. *Attended monitoring is to be used to evaluate compliance with the relevant conditions of this consent.*

4. *Unless the Secretary agrees otherwise, this monitoring is to be carried out in accordance with the relevant requirements for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:*

(a) *Monitoring locations for the collection of representative noise data;*

(b) *Meteorological conditions during which collection of noise data is not appropriate;*

(c) *Equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and*

(d) *Modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.*

3.2 Development Consent SSD-5145

Development Consent SSD-5145 provides the relevant noise criteria and is reproduced as follows:

Operational Noise Criteria

2. *Until the automated coal recovery and train loading system required by condition 8 of Schedule 2 is in use, the Applicant must ensure that the operational noise generated by the development (including maintenance activities) does not exceed the criteria in Table 2 at any residence on privately-owned land.*

Table 2: Operational Noise Criteria

Receiver	Morning Shoulder $L_{Aeq(15minute)}$	Day $L_{Aeq(15minute)}$	Evening $L_{Aeq(15minute)}$	Night $L_{Aeq(15minute)}$	Night $L_{A1(1minute)}$
NC2	36	36	35	35	45
NC3, Residences around NC6	40	40	39	39	45
23	-	37	37	37	45
26	-	36	36	36	45
All other residences on privately-owned land	-	35	35	35	45
$L_{Aeq(1\ hour)}$					
NC6 (school),when in use	-	45(external to school building)	-	-	-

Notes to Table 2:

The receiver locations in Table 2 are shown in Figures 1 and 2 of Appendix 4.

Criteria for the Morning Shoulder period only applicable where these have been specifically developed for this period.

Noise generated by the development is to be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the NSW Noise Policy for Industry (EPA, 2017). Appendix 3 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

However, these criteria do not apply if the Applicant has an agreement with the relevant landowner to exceed the noise criteria in Table 2, and the Applicant has advised the Department in writing of the terms of this agreement.

3. Once the automated coal recovery and train loading system required by condition 8 of schedule 2 is in use, and thereafter, the Applicant must ensure that the operational noise generated by the development (including maintenance activities) does not exceed the criteria in Table 3 at any residence on privately-owned land.

Table 3: Operational Noise Criteria

Receiver	Morning Shoulder $L_{Aeq(15minute)}$	Day $L_{Aeq(15minute)}$	Evening $L_{Aeq(15minute)}$	Night $L_{Aeq(15minute)}$	Night $L_{A1(1minute)}$
NC2	35	35	35	35	45
NC3, Residences around NC6	38	38	37	37	45
23	-	37	37	37	45
26	-	36	36	36	45
All other residences on privately-owned land	-	35	35	35	45
$L_{Aeq(1\ hour)}$					
NC6 (school),when in use	-	45(external to school building)	-	-	-

Notes to Table 2:

The receiver locations in Table 2 are shown in Figures 1 and 2 of Appendix 4.

Criteria for the Morning Shoulder period only applicable where these have been specifically developed for this period

Noise generated by the development is to be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the NSW Noise Policy for Industry (EPA, 2017). Appendix 3 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

However, these criteria do not apply if the Applicant has an agreement with the relevant landowner to exceed the noise criteria in Table 3, and the Applicant has advised the Department in writing of the terms of this agreement.

Operating Conditions

4. The Applicant must:

(a) Implement best management practice to minimise the construction, operational, road and rail noise of the development;

(b) Operate an on-site noise management system that uses a combination of predictions, forecasting and real-time and attended noise monitoring of all noise associated with the development, to ensure compliance with the relevant conditions of this consent, including noise during construction and operations;

(c) Minimise the noise impacts of the development during meteorological conditions under which the noise limits in this consent do not apply (see Appendix 3); and

(d) Regularly assess noise monitoring data to determine whether the development is complying with the relevant conditions of consent, to the satisfaction of the Secretary.

APPENDIX 3: NOISE ASSESSMENT

Applicable Meteorological Conditions

1. The noise criteria in Table 2 of the conditions are to apply under all meteorological conditions except the following:

(a) Wind speeds greater than 3 m/s at 10 m above ground level; or

(b) Temperature inversion conditions between 1.5 ºC and 3ºC/100 m and wind speeds greater than 2 m/s at 10 m above ground level; or

(c) Temperature inversion conditions greater than 3ºC/100 m.

Determination of Meteorological Conditions

2. Except for wind speed at microphone height, the data to be used for determining meteorological conditions shall be that recorded by the meteorological station located on the site.

Compliance Monitoring

3. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this consent.

4. Unless the Secretary agrees otherwise, this monitoring is to be carried out in accordance with the relevant requirements for reviewing performance set out in the NSW Noise Policy for Industry 2017 (EPA, 2017) (as amended from time to time), in particular the requirements relating to:

(a) Monitoring locations for the collection of representative noise data;

(b) Meteorological conditions during which collection of noise data is not appropriate;

(c) *Equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and*

(d) *Modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.*

3.3 Environmental Protection Licence 365

Conditions of the Environmental Protection Licence (EPL) 365 provide noise criteria for Mandalong Mine and are reproduced as follows:

L5 Noise limits

L5.1 The licensee must ensure that noise generated by the activities within the premises do not exceed the following criteria measured by dB(A) at any of the following locations or on more than 25% of any privately-owned land.

Location	*Day* $L_{Aeq\ (15\ minute)}$	*Evening* $L_{Aeq\ (15\ minute)}$	*Night* $L_{Aeq\ (15\ minute)}$	*Night* $L_{A1\ (1\ minute)}$
23 Gradwells Rd	*37*	*37*	*37*	*45*
26 Gradwells Rd	*36*	*36*	*36*	*45*
R2 (82)	*40*	*40*	*40*	*52*
R3 (97)	*42*	*42*	*42*	*52*
R5 (110)	*41*	*41*	*41*	*61*
R6 (86) (87)	*40*	*40*	*40*	*61*
R7 (85) (89)	*43*	*43*	*43*	*61*
R8 (72)	*43*	*43*	*43*	*61*
R9 (73)	*42*	*42*	*42*	*61*
R10 (66)	*39*	*39*	*39*	*61*
All other privately owned land	*35*	*35*	*35*	*45*
NC2	*36*	*35*	*35*	*45*
NC3, Residences around NC6	*40*	*39*	*39*	*45*
R4 (109)	*39*	*39*	*39*	*52*

Note: *Locations NC2, NC3, Residences around NC6, 23 and 26, are as defined in Condition 2, Schedule 3 and shown in Appendix 3: Noise Assessment, figures 1 and 2, of SSD-5145 (MOD1).*
Locations R2, R3, R4, R5, R6, R7, R8, R9, R10, are defined in Condition 2, Schedule 3 and shown in Figure 1 of SSD-5144 (MOD 5). (DOC18/293965)
The licensee may provide to the EPA written evidence of any agreement with a landholder which is subject to the above noise limits. The written evidence may be submitted with a licence variation to remove the landholder from the above table.

L5.2 *For the purpose of condition L5.1:*

(a) *Day is defined as the period from 7 am to 6 pm Monday to Saturday and 8 am to 6 pm Sunday and public holidays;*

(b) *Evening is defined as the period 6 pm to 10 pm, and*

(c) *Night is defined as the period from 10 pm to 7 am Monday to Saturday and 10 pm to 8 am Sunday and public holidays.*

L5.3 The noise limits set out in conditions L5.1 apply under all meteorological conditions except for any one of the following:

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

(b) *Stability category F temperature inversion conditions and wind speeds greater the 2 metres/second at 10 metres above ground level; or*

(c) Stability category G temperature inversion conditions.

L5.4 For the purpose of condition L5.3:

(a) The meteorological data to be used for determining meteorological conditions is the data recorded at the meteorological station identified in this licence as EPA Identification Point W1.

(b) Stability category temperature inversion conditions are to be determined by the sigma-theta method referred to in Part E4 of Appendix E to the NSW industrial Noise Policy (EPA 2000)

Note: The weather station must be designed, commissioned and operated in a manner to obtain the necessary parameters required under the above condition.

L5.5 For the purpose of determining the noise generated at the premises the licensee must use a Class 1 or Class 2 noise monitoring device as defined by AS IEC61672.1 and AS IEC61672.2-2004, or other noise monitoring equipment accepted by the EPA in writing.

L5.6 To determine compliance:

1. With the LAeq(15 min) noise limits in condition L5.1, the licensee must locate noise monitoring equipment;

(a) Within 30 metres of a dwelling facade (but not closer than 3 metres) where any dwelling on the property is situated more than 30 metres from the property boundary that is closest to the premises;

(b) Approximately on the boundary where any dwelling is situated 30 metres or less from the property boundary that is closest to the premises, or, where applicable,

(c) Within approximately 50 metres if the boundary of a national park or nature reserve.

2. With the LA1(1 minute) noise limits in condition L5.1, the noise monitoring equipment must be located within 1 metre of a dwelling facade.

3. With the noise limits in condition L5.1, the noise monitoring equipment must be located;

(a) At the most affected point at a location where there is no dwelling at the location, or

(b) At the most affected point within an area at a location prescribed by conditions L5.6 1(a) or L5.6 1(b).

L5.7 A non-compliance of condition L5.1 will still occur where noise generated from the premises in excess of the appropriate limit is measure;

- At a location other than an area prescribed by conditions L5.6 1(a) and L5.6 1(b), and/or

- At a point other than the most affected point at a location.

M4.1 To determine compliance with condition L5.1, attended noise monitoring must be undertaken in accordance with conditions L5.5 and L5.6, and

(a) At each one of the locations listed in condition L5.1;

(b) Occur annually within the reporting period of the Environment Protection Licence;

(c) Occur during each day, evening and night period as defined in the NSW Industrial Noise Policy (EPA2000) for a minimum of 1.5 hours during the day; 30 minutes during the evening; and 1 hours during the night, and

(d) Occur for three (3) consecutive days.

4. Annual compliance noise monitoring methodology

4.1 Annual compliance noise monitoring

4.1.1 General requirements

The operational noise monitoring programme was conducted with reference to the *Noise Management Plan Northern Region (May 2018),* Development Consent SSD-5144 and SSD-5145, EPL 365 Conditions L5.3, L5.4 and L5.6 and *AS 1055: 2018 Acoustics –Description and Measurement of Environmental Noise.*

Operator attended noise surveys were conducted at each of the six locations, (refer to Table 4-1) for a minimum of 1.5 hours during the day, 30 minutes during the evening and 1 hour during the night, over three consecutive days to determine the character and relative contribution of ambient noise sources and mine contributions.

Measurements were conducted during typical worst case operational conditions for both Mandalong and Cooranbong sites in order to capture associated typical worst case noise emission levels. This entailed both sites operating as per normal with all equipment operational.

Attended noise measurements were taken using two (2) SVAN 977 Type 1 sound level meters (serial number 36821 and 45751). This instrument is capable of measuring continuous A-weighted 1/3 octave sound pressure levels and able to record L_{Amin}, L_{A90}, L_{A10}, L_{A1}, L_{Amax} and L_{Aeq} noise descriptors.

The noise contribution from the site was estimated based on the observations of site equipment sound pressure level and their duration. Where the sound pressure level was not easily defined due to extraneous noise other means such as spectral analysis and relative audibility of the noise source in comparisons to the background were employed.

To assist in determining noise contribution from the site, one (1) SVAN977 environmental noise logger (SN 45746) was installed at Location UNL as shown in Figure 4-1.

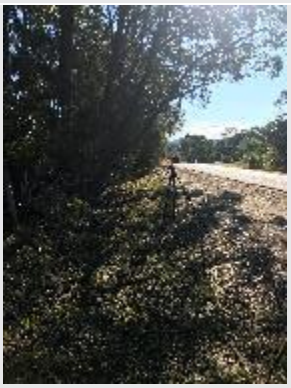
Field calibrations were checked by GHD immediately before and after each set of measurements using a Larson and Davis CAL200 sound level calibrator (serial number 9193) and Brüel & Kjær 4231 sound level calibrator (serial number 2542101). In all cases, pre and post calibration checks were within the acceptable range of 94 dB +/- 0.5 dB.

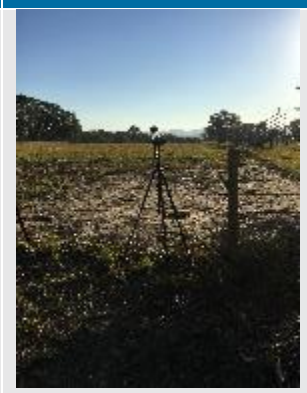
All instrumentation used during noise measurements comply with the requirements of AS IEC 61672.1-2019 *Electroacoustics - Sound Level Meters – Specifications*, AS IEC 61672.2-2019, AS IEC 61672.3-2019 and carry current NATA or manufacturer calibration certificates. Calibration Certificates for the sound level meters used during the monitoring are attached in Appendix A.

4.1.2 Monitoring locations

In accordance with EPL 365 condition M4.1, operator-attended noise surveys at each of the locations listed in Table 4-1 and shown in Figure 4-1 and Figure 4-2, will occur annually within the reporting period of the Environment Protection Licence. The monitoring locations are consistent with the long-term noise monitoring locations specified in the Centennial Coal Noise Management Plan – Northern Region – May 2018.

Table 4-1 Monitoring locations

Monitoring location	Receiver ID	UTM Zone 56		Picture
		Easting (mE)	Northing (mN)	
M1	23 Gradwells Rd 26 Gradwells Rd	360188	6340617	
M4	R3 (97)	356216	6334412	
M6	R5 (110)	356727	6334290	
M7	R7 (85) (89) R6 (86) (87)	356855	6334788	

Monitoring location	Receiver ID	UTM Zone 56		Picture
		Easting (mE)	Northing (mN)	
M8	R8 (72)	356867	6334974	
M10	R10 (66)	356887	6335120	
UNL	-	356371	633449	

It is relevant to note that permission to access each of the residential properties was not obtained and as such all noise monitoring was conducted on the road side/boundary fence of each assessment location. Furthermore, monitoring location M1 was representative of receiver locations 23 and 26 and monitoring location M7 was representative of locations R6 and R7.

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0 40 80 160 240 320

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

LEGEND

- Site boundary
- Suburb
- MET station
- Noise attended
- Noise unattended
- Sensitive receiver

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LOCATION	-
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Centennial Coal
Northern Region
Environmental Monitoring
Mandalong Mine Access Site
Long term noise monitoring

Centennial Coal

DATE 3/10/2019

Figure 4-1

GIS Filename: G:\22\12510863\GIS\Maps\Deliverables\LongTerm\2212510863_NLT001_LongTerm_DDP_NoiseData_0.mxd

Data source: LPI: DTDB / DCDB / Aerial Imagery, 2017. Created by:pkiem

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0 105 210 420 630 840
Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

LEGEND

- Site boundary
- Suburb
- Noise attended
- Noise unattended
- Sensitive receiver

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LOCATION	-
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SCALE	refer to scalebar

Centennial Coal
Northern Region
Environmental Monitoring
Cooranbong Entry Site
Long term noise monitoring

Centennial Coal

DATE 3/10/2019

Figure 4-2

GIS Filename: G:\22\12510863\GIS\Maps\Deliverables\LongTerm\2212510863_NLT001_LongTerm_DDP_NoiseData_0.mxd

Data source: LPI: DTDB / DCDB / Aerial Imagery, 2017. Created by:pkiem

5. Compliance noise monitoring

5.1 Operator attended noise monitoring results

Operator attended noise measurements were conducted on Friday 26 July 2019 to Sunday 28 July 2019 and Monday 5 August to Wednesday 7 August 2019 at the locations identified in Table 4-1.

The results of the operator attended noise measurements are given in Table 5-1 to Table 5-3. Ambient noise levels given in the tables include all noise sources such as traffic, insects, birds, mine operations as well as any other industrial operations.

The tables provide the following information:

- Monitoring location
- Date and start time
- Wind velocity (m/s), temperature (ºC), relative humidity (%) and cloud cover at the measurement location
- Stability category
- Typical maximum instantaneous dBA values and contributed noise levels

Furthermore, the monitoring results are presented graphically in Appendix B to Appendix G.

Weather data was obtained using hand held weather meters as well as from the Mandalong weather station located on the Mandalong site and the BOM Lake Macquarie weather station.

Table 5-1 Day time operator attended noise survey results

Date/start time Weather (operator) SLM Details	Measurement location/relevant criteria $L_{Aeq(15minute)}$		Measurement number	Primary noise descriptor (dBA re 20 µPa)					Description of noise emission and typical maximum levels L_{Amax} (dBA)
	EPL 365	SSD-5144 and SSD-5145		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
26/07/2019 16:02 W = Calm Temp = 15°C Stability Category: G (Bill Elder) SVAN 977 S/N 36821			1	69	58	48	40	46	Birds – 41 to 70 dBA Train passby – 46 to 62 dBA Gradwells Road – 48 to 85 dBA Distant road traffic – 38 to 40 dBA Insects - < 41 to 45 dBA Dogs barking – 47 to 66 dBA Geese - 53 to 64 dBA Aircraft flyover – 45 to 48 dBA Eraring power station – 36 dBA Cooranbong entry site: Faint hum – 36 to 40 dBA
			2	72	63	52	41	51	
			3	75	66	56	44	55	
			4	66	61	54	44	51	
			5	85	69	57	43	59	
			6	77	65	52	42	54	
			Cooranbong Entry Site $L_{Aeq\ (15\ minute)}$ 34 dBA						
27/07/2019 15:38 W = Calm – 1.5m/s SE Temp = 17°C Stability Category: E, D & G (Bill Elder) SVAN 977 S/N 36821	M1 R23 Gradwells Rd L_{Aeq} 37 dBA R26 Gradwells Rd L_{Aeq} 36 dBA	M1 R23 Gradwells Rd L_{Aeq} 37 dBA R26 Gradwells Rd L_{Aeq} 36 dBA	1	70	64	55	37	51	Birds – 41 to 73 dBA Train passby – 44 to 63 dBA Gradwells Road – 48 to 73 dBA Distant road traffic – 38 to 51 dBA Aircraft flyover – 51 to 59 dBA Insects - 38 to 41 dBA Dogs barking – 46 to 68 dBA Geese – 46 to 61 dBA Eraring power station – 35 to 40 dBA Noise at residences: Door slam – 44 dBA Children playing – 59 dBA
			2	70	59	49	37	47	
			3	71	59	49	38	47	
			4	70	60	53	39	50	
			5	73	62	56	44	53	
			6	73	62	50	40	50	
			Cooranbong Entry Site Not discernible						
28/07/2019 14:04 W = Calm – 1.9m/s SSW, S Temp = 19°C Stability Category: B, C & D (Bill Elder) SVAN 977 S/N 36821			1	65	53	43	35	41	Birds – 35 to 62 dBA Train passby – 41 to 63 dBA Gradwells Road – 43 to 83 dBA Distant road traffic – 33 to 41 dBA Aircraft flyover – 40 to 47 dBA Insects - 33 to 38 dBA Dogs barking – 41 to 52 dBA Wind in trees – 33 to 38 dBA Geese – 56 dBA Eraring power station – 33 to 34 dBA Noise at residences – 42 to 54 dBA
			2	77	65	45	34	53	
			3	73	62	45	34	48	
			4	83	60	44	33	53	
			5	74	64	47	34	50	
			6	75	64	52	34	52	
			Cooranbong Entry Site Not discernible						

Date/start time Weather (operator) SLM Details	Measurement location/relevant criteria $L_{Aeq(15minute)}$		Measurement number	Primary noise descriptor (dBA re 20 µPa)					Description of noise emission and typical maximum levels L_{Amax} (dBA)
	EPL 365	SSD-5144 and SSD-5145		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
05/08/2019 14:14 W = 0.6 to 0.9m/s NE, ENE Temp = 19°C Stability Category: B & C (Bill Elder) SVAN 977 S/N 36821	M4 R3 (97) L_{Aeq} 42 dBA	M4 L_{Aeq} 39 dBA	1	79	72	66	54	62	Birds – 56 to 69 dBA Mandalong Road traffic – 57 to 79 dBA Distant road traffic (M1) – 52 to 57 dBA Siren – 58 to 65 dBA
			2	79	71	65	53	62	
			3	79	71	65	53	62	
			4	77	71	65	53	61	
			5	74	69	65	53	61	
			6	78	71	66	53	62	
			Mandalong Mine Not discernible						
06/08/2019 14:01 W = 0.4 to 0.7m/s E, ENE Temp = 21°C Stability Category: B (Bill Elder) SVAN 977 S/N 36821			1	79	72	65	47	61	Birds – 46 to 72 dBA Mandalong Road traffic – 58 to 80 dBA Distant road traffic (M1) – 45 to 54 dBA Aircraft flyover – 66 to 70 dBA Truck airbrakes on side of road – 57 dBA Mandalong Mine: Truck airbrakes - < 44 dBA Metal bangs - < 44 dBA Engine noise - < 46 dBA
			2	75	70	65	47	60	
			3	78	71	65	47	60	
			4	80	73	66	48	62	
			5	76	72	67	51	62	
			6	74	70	66	51	61	
			Mandalong Mine $L_{Aeq\ (15\ minute)}$ < 34 dBA						
07/08/2019 15:50 W = 0.2 to 0.8m/s WSW Temp = 23°C Stability Category: A (Bill Elder) SVAN 977 S/N 36821			1	74	71	66	47	61	Birds – 45 to 69 dBA Mandalong Road traffic – 50 to 78 dBA Distant road traffic (M1) – 42 to 54 dBA Wind in trees – 48 to 53 dBA Aircraft flyover – 51 to 52 dBA
			2	75	71	66	47	61	
			3	77	70	65	44	60	
			4	76	70	65	44	60	
			5	78	71	67	50	62	
			6	77	72	68	51	63	
			Mandalong Mine Not discernible						
05/08/2019 16:05 W = 0.1 to 0.4m/s NE, NNE, WNW, WSW Temp = 17°C Stability Category: C (Bill Elder) SVAN 977 S/N 36821	M6 R5 (110) L_{Aeq} 41 dBA	M6 L_{Aeq} 40 dBA	1	76	69	64	58	62	Birds – 59 to 64 dBA Old Maitland Road traffic – 64 to 88 dBA Distant road traffic (M1) – 58 to 75 dBA
			2	78	69	64	59	62	
			3	82	72	65	60	64	
			4	84	74	66	61	65	
			5	87	72	67	61	65	
			6	85	72	67	61	65	
			Mandalong Mine Not discernible						
06/08/2019 15:44			1	76	70	63	58	61	Birds – 59 to 64 dBA

Date/start time Weather (operator) SLM Details	Measurement location/relevant criteria $L_{Aeq(15minute)}$		Measurement number	Primary noise descriptor (dBA re 20 µPa)					Description of noise emission and typical maximum levels L_{Amax} (dBA)
	EPL 365	SSD-5144 and SSD-5145		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
W = 0.2 to 0.6m/s E, ESE, SSE, SSW Temp = 18°C Stability Category: A, B & C (Bill Elder) SVAN 977 S/N 36821			2	79	70	63	58	62	Old Maitland Road traffic – 60 to 83 dBA Distant road traffic (M1) – 58 to 69 dBA Aircraft flyover - 64 to 65 dBA
			3	76	70	64	59	62	
			4	77	67	64	59	62	
			5	83	71	65	59	63	
			6	78	70	64	58	62	
			Mandalong Mine Not discernible						
07/08/2019 14:06 W = 0.7 to 1.0m/s W, WSW Temp = 23°C Stability Category: A (Bill Elder) SVAN 977 S/N 36821			1	80	74	61	55	61	Birds – 57 to 71 dBA Old Maitland Road traffic – 57 to 89 dBA Distant road traffic (M1) – 53 to 70 dBA Wind in trees - 54 to 60 dBA Aircraft flyover – 59 to 66 dBA Mandalong Mine: Impact noise - <57 dBA Horn - <50 dBA
			2	76	71	60	55	59	
			3	79	72	60	54	60	
			4	77	71	60	54	60	
			5	79	71	60	55	60	
			6	89	74	61	54	64	
			Mandalong Mine $L_{Aeq\ (15\ minute)}$ < 34 dBA						
05/08/2019 14:19 W = 0.6 to 0.9 m/s ENE, NE Temp = 19ºC Stability Category: B & E (Andy Cheung) SVAN 977 S/N 45751	M7 R6 (86) (87) L_{Aeq} 40 dBA R7 (85) (89) L_{Aeq} 43 dBA	M7 L_{Aeq} 43 dBA	1	76	70	63	57	61	Birds – 56 to 75 dBA Train passby: <58 dBA Gimberts Road traffic – 56 to 83 dBA Distant road traffic (M1) – 56 to 77 dBA Siren – 61 to 70 dBA Mandalong Mine: Distant tone - <57 dBA
			2	79	69	60	56	60	
			3	74	71	61	56	60	
			4	78	69	61	56	60	
			5	83	72	61	57	62	
			6	77	72	61	57	61	
			Mandalong Mine $L_{Aeq\ (15\ minute)}$ 40 dBA						
06/08/2019 14:05 W = 0.4 to 0.7 m/s ENE, E Temp = 21ºC Stability Category: B (Andy Cheung) SVAN 977 S/N 45751			1	77	70	61	57	61	Birds – 56 to 68 dBA Gimberts Road traffic – 56 to 82 dBA Distant road traffic (M1) – 55 to 75 dBA Aircraft flyover – 63 to 66 dBA Mandalong Mine: Horn - <58 dBA
			2	77	69	61	57	60	
			3	82	71	61	57	61	
			4	78	73	62	57	62	
			5	82	72	62	58	62	
			6	79	72	63	58	62	
			Mandalong Mine $L_{Aeq\ (15\ minute)}$ 33 dBA						

Date/start time Weather (operator) SLM Details	Measurement location/relevant criteria $L_{Aeq(15minute)}$		Measurement number	Primary noise descriptor (dBA re 20 µPa)					Description of noise emission and typical maximum levels L_{Amax} (dBA)
	EPL 365	SSD-5144 and SSD-5145		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
07/08/2019 14:08 W = 0.5 to 0.9 m/s WSW Temp = 23ºC Stability Category: A (Andy Cheung) SVAN 977 S/N 45751			1	76	69	63	59	62	Birds – 58 to 67 dBA Gimberts Road traffic – 60 to 83 dBA Distant road traffic (M1) – 57 to 68 dBA Aircraft flyover – 60 to 61 dBA Mandalong Mine: Horn - <58 to 60 dBA Metal impact noise - <59 to 68 dBA
			2	75	70	64	59	62	
			3	77	70	64	58	62	
			4	76	71	62	57	61	
			5	78	72	63	59	62	
			6	83	72	64	59	63	
			Mandalong Mine $L_{Aeq\ (15\ minute)}$ 38 dBA						
05/08/2019 15:58 W = 0.1 to 0.4 m/s NE, NNE, SE, WNW Temp = 18ºC Stability Category: C (Andy Cheung) SVAN 977 S/N 45751	M8 R8 (72) L_{Aeq} 43 dBA	M8 L_{Aeq} 43 dBA	1	78	73	63	53	61	Birds – 54 to 70 dBA Rail passby: <54 dBA (faint) Gimberts Road traffic – 55 to 87 dBA Distant road traffic (M1) – 54 to 61 dBA Dogs barking – 55 to 62 dBA
			2	77	73	63	54	61	
			3	87	74	63	54	63	
			4	77	73	61	55	61	
			5	78	71	59	55	60	
			6	77	71	60	56	60	
			Mandalong Mine Not discernible						
06/08/2019 15:43 W = 0.2 to 0.6 m/s E, ENE, ESE, SE, SSW Temp = 18ºC Stability Category: A, B & C (Andy Cheung) SVAN 977 S/N 45751			1	77	71	59	53	59	Birds – 54 to 71 dBA Gimberts Road traffic – 54 to 86 dBA Distant road traffic (M1) – 53 to 65 dBA Dogs barking – 59 dBA Aircraft flyover – 54 to 60 dBA
			2	83	73	63	54	62	
			3	80	73	61	54	61	
			4	86	74	65	55	63	
			5	78	72	61	56	61	
			6	80	73	62	57	62	
			Mandalong Mine Not discernible						
07/08/2019 15:44 W = 0.2 to 0.8 m/s WSW, W, SW Temp = 21ºC Stability Category: A & B (Andy Cheung) SVAN 977 S/N 45751			1	77	71	64	59	62	Birds – 58 to 70 dBA Gimberts Road traffic – 57 to 88 dBA Distant road traffic (M1) – 56 to 67 dBA Dogs barking – 59 dBA Wind in trees - <60 dBA Mandalong mine: Horn - <60 dBA
			2	78	74	66	58	64	
			3	88	74	65	57	64	
			4	78	73	64	57	62	
			5	78	74	65	58	63	
			6	83	73	64	59	63	
			Mandalong Mine						

Date/start time Weather (operator) SLM Details	Measurement location/relevant criteria $L_{Aeq(15minute)}$		Measurement number	Primary noise descriptor (dBA re 20 µPa)					Description of noise emission and typical maximum levels L_{Amax} (dBA)
	EPL 365	SSD-5144 and SSD-5145		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
			$L_{Aeq\ (15\ minute)}$ 35 dBA						
26/07/2019 14:01 W = Calm – 0.4m/s W, SW Temp = 20°C Stability Category: A (Bill Elder) SVAN 977 S/N 36821	M10 R10 (66) L_{Aeq} 39 dBA	M10 L_{Aeq} 39 dBA	1	78	72	58	51	59	Birds – 52 to 69 dBA Gimberts Road – 55 to 83 dBA Distant road traffic (M1) – 48 to 56 dBA (constant) Aircraft flyover – 63 to 78 dBA
			2	82	73	57	51	59	
			3	83	73	57	51	60	
			4	80	72	59	50	59	
			5	80	75	57	51	60	
			6	81	76	63	52	63	
			Mandalong Mine Not Discernible						
27/07/2019 13:43 W = Calm – 0.8m/s SE Temp = 18°C Stability Category: A & B (Bill Elder) SVAN 977 S/N 36821			1	80	71	56	50	58	Birds – 49 to 74 dBA Gimberts Road – 57 to 88 dBA Distant road traffic (M1) – 48 to 62 dBA (constant)
			2	71	61	57	49	54	
			3	81	72	58	53	59	
			4	88	72	56	50	60	
			5	84	67	57	51	59	
			6	77	65	56	51	56	
			Mandalong Mine Not Discernible						
28/07/2019 16:02 W = Calm – 0.4m/s S, W Temp = 16°C Stability Category: A & B (Bill Elder) SVAN 977 S/N 36821			1	79	70	57	53	58	Birds – 54 to 73 dBA Gimberts Road – 60 to 83 dBA Distant road traffic (M1) – 54 to 63 dBA (constant) Aircraft flyover – 58 to 61 dBA
			2	82	74	59	53	60	
			3	83	70	59	54	60	
			4	80	72	59	54	60	
			5	77	66	58	54	58	
			6	73	65	62	57	60	
			Mandalong Mine Not Discernible						

Note 1: Day is defined as the period from 7:00 am to 6:00 pm Monday to Saturday; or 8 am to 6 pm on Sundays and Public Holidays.

Table 5-2 Evening time operator attended noise survey results

Date/start time Weather (operator) SLM Details	Measurement location/relevant criteria $L_{Aeq(15minute)}$		Measurement number	Primary noise descriptor (dBA re 20 µPa)					Description of noise emission and typical maximum levels L_{Amax} (dBA)
	EPL 365	SSD-5144 and SSD-5145		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
26/07/2019 18:00 W = Calm Temp = 12°C Stability Category: G (Bill Elder) SVAN 977 S/N 36821	M1 R23 Gradwells Rd L_{Aeq} 37 dBA R26 Gradwells Rd L_{Aeq} 36 dBA	M1 R23 Gradwells Rd L_{Aeq} 37 dBA R26 Gradwells Rd L_{Aeq} 36 dBA	1	78	58	49	44	51	Train passby – 48 to 59 dBA Gradwells Road – 50 to 78 dBA Insects - < 45 to 47 dBA Dogs barking – 48 to 52 dBA Aircraft flyover – 47 to 49 dBA Eraring power station – 39 to 40 dBA Cooranbong entry site: Faint hum – 39 to 40 dBA
			2	76	65	52	45	54	
			Cooranbong Entry Site $L_{Aeq\ (15\ minute)}$ 35 dBA						
27/07/2019 18:00 W = Calm Temp = 12°C Stability Category: G (Bill Elder) SVAN 977 S/N 36821			1	76	60	43	40	50	Birds – 42 to 47 dBA Train passby – 51 to 55 dBA Gradwells Road – 45 to 77 dBA Distant road traffic – 44 to 51 dBA Insects - < 40 to 43 dBA Geese – 47 dBA Eraring power station – 36 dBA Cooranbong entry site: Faint hum – 37 dBA
			2	76	70	51	42	55	
			Cooranbong Entry Site $L_{Aeq\ (15\ minute)}$ 30 dBA						
28/07/2019 18:52 W = Calm Temp = 8°C Stability Category: G (Bill Elder) SVAN 977 S/N 36821			1	53	47	46	43	44	Train passby – 47 to 55 dBA Distant road traffic – <46 to 48 dBA Aircraft flyover – 46 to 56 dBA Insects - < 42 to 44 dBA Dogs barking – 46 to 62 dBA Eraring power station – <42 dBA Noise at residences – 47 to 53 dBA Cooranbong entry site: Alarms – 43 to 47 dBA Banging – 42 to 49 dBA
			2	63	53	48	42	46	
			Cooranbong Entry Site $L_{Aeq\ (15\ minute)}$ 34 dBA						
05/08/2019 18:00 W = Calm Temp = 11°C Stability Category: F (Bill Elder) SVAN 977 S/N 36821	M4 R3 (97) L_{Aeq} 42 dBA	M4 L_{Aeq} 39 dBA	1	75	70	65	55	61	Birds – 58 to 60 dBA Mandalong Road traffic – 60 to 73 dBA Distant road traffic (M1) – 53 to 61 dBA Insects < 54 dBA
			2	72	69	64	53	60	
			Mandalong Mine Not Discernible						
06/08/2019 18:00			1	74	70	65	49	61	Mandalong Road traffic – 52 to 72 dBA

Date/start time Weather (operator) SLM Details	Measurement location/relevant criteria $L_{Aeq(15minute)}$		Measurement number	Primary noise descriptor (dBA re 20 µPa)					Description of noise emission and typical maximum levels L_{Amax} (dBA)
	EPL 365	SSD-5144 and SSD-5145		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
W = Calm Temp = 10°C Stability Category: D (Bill Elder) SVAN 977 S/N 36821			2	71	69	65	48	60	Distant road traffic (M1) – 46 to 51 dBA Insects – 48 to 51 dBA
			Mandalong Mine Not Discernible						
07/08/2019 18:33 W = Calm to 0.2m/s WSW Temp = 10°C Stability Category: F (Bill Elder) SVAN 977 S/N 36821			1	74	70	64	55	61	Birds – 58 to 63 dBA Mandalong Road traffic – 56 to 74 dBA Distant road traffic (M1) – 50 to 63 dBA Insects – <50 dBA
			2	72	69	63	53	59	
			Mandalong Mine Not Discernible						
05/08/2019 18:36 W = Calm to 0.1m/s W Temp = 9°C Stability Category: F (Bill Elder) SVAN 977 S/N 36821	M6 R5 (110) L_{Aeq} 41 dBA	M6 L_{Aeq} 40 dBA	1	78	66	64	59	62	Old Maitland Road Traffic – 64 to 78 dBA Distant road traffic (M1) – 60 to 69 dBA
			2	78	71	65	59	63	
			Mandalong Mine Not discernible						
06/08/2019 18:34 W = 0.3 to 0.4m/s S, SSE Temp = 9°C Stability Category: D (Bill Elder) SVAN 977 S/N 36821			1	76	67	62	55	60	Old Maitland Road Traffic – 58 to 76 dBA Distant road traffic (M1) – 55 to 66 dBA
			2	67	64	62	55	59	
			Mandalong Mine Not discernible						
07/08/2019 18:00 W = 0.2m/s WSW Temp = 12°C Stability Category: F (Bill Elder) SVAN 977 S/N 36821			1	75	71	66	60	64	Old Maitland Road Traffic – 60 to 76 dBA Distant road traffic (M1) – 58 to 74 dBA
			2	76	71	65	60	63	
			Mandalong Mine Not discernible						
05/08/2019 18:00 W = 0.1 m/s	M7 R6 (86) (87)	M7 L_{Aeq} 43 dBA	1	77	73	64	60	63	Birds - <58 to 60 dBA Gimberts Road traffic - 61 to 77 dBA
			2	72	65	64	59	62	

Date/start time Weather (operator) SLM Details	Measurement location/relevant criteria $L_{Aeq(15minute)}$		Measurement number	Primary noise descriptor (dBA re 20 µPa)					Description of noise emission and typical maximum levels L_{Amax} (dBA)
	EPL 365	SSD-5144 and SSD-5145		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
W, SW Temp = 11ºC Stability Category: F (Andy Cheung) SVAN 977 S/N 45751	L_{Aeq} 40 dBA R7 (85) (89) L_{Aeq} 43 dBA		Mandalong Mine Not discernible						Distant road traffic (M1) - 58 to 67 dBA
06/08/2019 18:00 W = 0.2 to 0.3 m/s SSW, S Temp = 10ºC Stability Category: D (Andy Cheung) SVAN 977 S/N 45751			1	79	73	63	60	63	Birds - <60 dBA Gimberts Road traffic - 61 to 79 dBA Distant road traffic (M1) - 60 to 64 dBA Mandalong Mine: Horn - <60 dBA
			2	76	70	63	60	62	
			Mandalong Mine $L_{Aeq\ (15\ minute)}$ <35 dBA						
07/08/2019 18:00 W = 0.1 to 0.2 m/s W, WSW Temp = 10ºC Stability Category: F (Andy Cheung) SVAN 977 S/N 45751			1	79	74	64	60	64	Birds - <60 to 62 dBA Rail passby - <61 dBA (faint) Gimberts Road traffic - 61 to 81 dBA Distant road traffic (M1) - 58 to 67 dBA Insects - <58 to 61 dBA
			2	81	66	64	60	63	
			Mandalong Mine Not discernible						
05/08/2019 18:37 W = Calm to 0.1 m/s W Temp = 9ºC Stability Category: F (Andy Cheung) SVAN 977 S/N 45751	M8 R8 (72) L_{Aeq} 43 dBA	M8 L_{Aeq} 43 dBA	1	78	64	61	57	60	Gimberts Road traffic - 58 to 80 dBA Distant road traffic (M1) - 56 to 65 dBA Insects - <56 dBA
			2	80	64	61	57	60	
			Mandalong Mine Not discernible						
06/08/2019 18:34 W = 0.3 to 0.4 m/s S, SSE Temp = 9ºC Stability Category: D (Andy Cheung) SVAN 977 S/N 45751			1	68	64	61	58	60	Birds - <59 dBA Gimberts Road traffic - 58 to 68 dBA Distant road traffic (M1) - 57 to 64 dBA Insects - <58 dBA Mandalong mine: Metal impact noise - <58 dBA Horn - <60 dBA
			2	62	61	60	57	59	
			Mandalong Mine $L_{Aeq\ (15\ minute)}$ <40 dBA						
07/08/2019 18:34			1	75	66	63	59	62	Birds - <60 dBA

Date/start time Weather (operator) SLM Details	Measurement location/relevant criteria $L_{Aeq(15minute)}$		Measurement number	Primary noise descriptor (dBA re 20 µPa)					Description of noise emission and typical maximum levels L_{Amax} (dBA)
	EPL 365	SSD-5144 and SSD-5145		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
W = 0.1 m/s WSW, SW Temp = 9ºC Stability Category: F (Andy Cheung) SVAN 977 S/N 45751			2	72	66	64	59	62	Gimberts Road traffic - 60 to 75 dBA Distant road traffic (M1) - 57 to 69 dBA Insects - <61 dBA Mandalong mine: Horn - <60 dBA
			Mandalong Mine $L_{Aeq\ (15\ minute)}$ <35 dBA						
26/07/2019 18:49 W = Calm Temp = 11°C Stability Category: E & F (Bill Elder) SVAN 977 S/N 36821	M10 R10 (66) L_{Aeq} 39 dBA	M10 L_{Aeq} 39 dBA	1	82	62	60	56	59	Birds – 58 to 60 dBA Gimberts Road – 62 to 82 dBA Distant road traffic (M1) – 55 to 62 dBA (constant) Insects – 55 to 56 dBA (constant)
			2	72	61	59	56	58	
			Mandalong Mine Not Discernible						
27/07/2019 18:54 W = Calm Temp = 10°C Stability Category: F (Bill Elder) SVAN 977 S/N 36821			1	81	61	58	54	57	Birds – 56 to 57 dBA Gimberts Road – 57 to 81 dBA Distant road traffic (M1) – 53 to 62 dBA (constant) Insects – <54 dBA (constant)
			2	62	59	57	54	56	
			Mandalong Mine Not Discernible						
28/07/2019 18:00 W = Calm Temp = 9°C Stability Category: F (Bill Elder) SVAN 977 S/N 36821			1	79	67	62	57	60	Gimberts Road – 60 to 80 dBA Distant road traffic (M1) – 55 to 64 dBA (constant) Insects – <57 dBA (constant)
			2	80	64	61	57	60	
			Mandalong Mine Not Discernible						

Note 1: Evening is defined as the period from 6:00 pm to 10:00 pm.

Table 5-3 Night time operator attended noise survey results

Date/start time Weather (operator) SLM Details	Measurement location/relevant criteria $L_{Aeq(15minute)}$		Measurement number	Primary noise descriptor (dBA re 20 µPa)					Description of noise emission and typical maximum levels L_{Amax} (dBA)
	EPL 365	SSD-5144 and SSD-5145		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
26/07/2019 22:18 W = Calm Temp = 9°C Stability Category: G (Bill Elder) SVAN 977 S/N 36821	M1 R23 Gradwells Rd L_{Aeq} 37 dBA R26 Gradwells Rd L_{Aeq} 36 dBA L_{A1} 45 dBA	M1 R23 Gradwells Rd L_{Aeq} 37 dBA R26 Gradwells Rd L_{Aeq} 36 dBA L_{A1} 45 dBA	1	55	52	45	41	44	Train passby – 45 to 56 dBA Insects - < 40 to 45 dBA Dogs barking – 50 to 53 dBA Aircraft flyover – 45 to 46 dBA Geese – 46 to 51 dBA Operator sneeze – 61 dBA Eraring power station – 39 to 40 dBA Cooranbong entry site: Faint hum – 38 to 42 dBA
			2	48	46	45	42	44	
			3	56	48	46	43	45	
			4	61	51	47	43	45	
			Cooranbong Entry Site $L_{Aeq\ (15\ minute)}$ 35 dBA $L_{A1\ (1\ minute)}$ 42 dBA						
27/07/2019 22:30 W = Calm Temp = 9°C Stability Category: G (Bill Elder) SVAN 977 S/N 36821			1	66	61	49	43	49	Birds – 44 to 45 dBA Train passby – 47 to 66 dBA Gradwells Road – 45 to 74 dBA Insects – <39 to 45 dBA Dogs barking – 43 to 62 dBA Eraring power station – 37 to 40 dBA Cooranbong entry site: Faint hum – 39 to 40 dBA Banging – 41 to 49 dBA
			2	62	48	45	39	43	
			3	49	46	45	42	43	
			4	74	54	43	40	48	
			Cooranbong Entry Site $L_{Aeq\ (15\ minute)}$ 36 dBA $L_{A1\ (1\ minute)}$ 43 dBA						
28/07/2019 22:00 W = Calm Temp = 5°C Stability Category: G (Bill Elder) SVAN 977 S/N 36821			1	51	49	48	45	46	Train passby – 48 to 61 dBA Insects - < 44 dBA Eraring power station – <44 dBA Cooranbong entry site: Alarms – 44 to 46 dBA Banging – 48 to 62 dBA
			2	62	58	51	45	49	
			3	57	54	51	44	48	
			4	61	58	51	44	49	
			Cooranbong Entry Site $L_{Aeq\ (15\ minute)}$ 40 dBA $L_{A1\ (1\ minute)}$ 49 dBA						
05/08/2019 23:09 W = Calm Temp = 3ºC Stability Category: E (Bill Elder) SVAN 977 S/N 36821	M4 R3 (97) L_{Aeq} 42 dBA L_{A1} 52 dBA	M4 L_{Aeq} 39 dBA L_{A1} 52 dBA	1	68	60	57	49	54	Birds – 50 to 61 dBA Mandalong Road Traffic – 56 to 71 dBA Distant road traffic (M1) – 49 to 62 dBA Insects - < 49 dBA Mandalong Mine: Horn - <45 dBA
			2	71	66	58	51	56	
			3	71	65	57	49	55	
			4	69	63	58	49	55	
			Mandalong Mine $L_{Aeq\ (15\ minute)}$ <35 dBA $L_{A1\ (1minute)}$ <35 dBA						

Date/start time Weather (operator) SLM Details	Measurement location/relevant criteria $L_{Aeq(15minute)}$		Measurement number	Primary noise descriptor (dBA re 20 µPa)					Description of noise emission and typical maximum levels L_{Amax} (dBA)
	EPL 365	SSD-5144 and SSD-5145		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
06/08/2019 23:08 W = Calm Temp = 2ºC Stability Category: D & E (Bill Elder) SVAN 977 S/N 36821			1	73	64	58	47	56	Birds – 58 to 59 dBA Mandalong Road Traffic – 52 to 79 dBA Distant road traffic (M1) – 46 to 64 dBA Insects - < 46 dBA Mandalong Mine: Horn - 46 dBA
			2	68	63	56	48	54	
			3	79	67	60	51	58	
			4	71	64	60	51	57	
			Mandalong Mine $L_{Aeq\ (15\ minute)}$ <35 dBA $L_{A1\ (1minute)}$ <35 dBA						
07/08/2019 22:00 W = 0.1m/s SSW Temp = 5ºC Stability Category: F (Bill Elder) SVAN 977 S/N 36821			1	74	68	61	52	58	Birds – 54 to 61 dBA Mandalong Road Traffic – 56 to 75 dBA Distant road traffic (M1) – 46 to 63 dBA Aircraft flyover – 51 to 54 dBA Mandalong Mine: Alarm – 57 to 60 dBA Metal bangs - 51 dBA Horn – 45 dBA
			2	75	68	59	50	57	
			3	75	67	56	49	55	
			4	68	63	57	49	54	
			Mandalong Mine $L_{Aeq\ (15\ minute)}$ 37 dBA $L_{A1\ (1minute)}$ 47 dBA						
05/08/2019 22:00 W = Calm to 0.1m/s WSW Temp = 4ºC Stability Category: G & F (Bill Elder) SVAN 977 S/N 36821	M6 R5 (110) L_{Aeq} 41 dBA L_{A1} 61 dBA	M6 L_{Aeq} 40 dBA L_{A1} 61 dBA	1	76	68	62	54	59	Old Maitland Road traffic – 57 to 76 dBA Distant road traffic (M1) – 53 to 65 dBA Mandalong Mine: Horn - < 53 dBA
			2	82	67	62	54	60	
			3	67	64	62	53	58	
			4	70	64	61	54	59	
			Mandalong Mine $L_{Aeq\ (15\ minute)}$ <35 dBA $L_{A1\ (1minute)}$ 41 dBA						
06/08/2019 22:00 W = 0.1m/s W, WSW Temp = 3ºC Stability Category: E & F (Bill Elder) SVAN 977 S/N 36821			1	78	65	63	56	60	Old Maitland Road traffic – 59 to 79 dBA Distant road traffic (M1) – 52 to 66 dBA Mandalong Mine: Horn - < 52 dBA
			2	68	65	61	55	59	
			3	66	64	62	56	59	
			4	78	67	62	54	60	
			Mandalong Mine $L_{Aeq\ (15\ minute)}$ <35 dBA $L_{A1\ (1minute)}$ 40 dBA						
07/08/2019 23:04 W = Calm Temp = 6ºC Stability Category: E (Bill Elder) SVAN 977 S/N 36821			1	72	69	65	54	61	Old Maitland Road traffic – 56 to 79 dBA Distant road traffic (M1) – 49 to 71 dBA Hammering at residence – 53 to 54 dBA Mandalong Mine: Alarm – 53 to 56 dBA
			2	71	68	65	54	62	
			3	70	68	65	53	61	
			4	79	69	65	54	62	
			Mandalong Mine $L_{Aeq\ (15\ minute)}$ <35 dBA $L_{A1\ (1minute)}$ 45 dBA						

Date/start time Weather (operator) SLM Details	Measurement location/relevant criteria $L_{Aeq(15minute)}$		Measurement number	Primary noise descriptor (dBA re 20 µPa)					Description of noise emission and typical maximum levels L_{Amax} (dBA)
	EPL 365	SSD-5144 and SSD-5145		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
05/08/2019 22:00 W = Calm to 0.1 m/s W Temp = 5ºC Stability Category: G (Andy Cheung) SVAN 977 S/N 45751	M7 R6 (86) (87) L_{Aeq} 40 dBA L_{A1} 61 dBA R7 (85) (89) L_{Aeq} 43 dBA L_{A1} 61 dBA	M7 L_{Aeq} 43 dBA L_{A1} 61 dBA	1	69	66	63	57	61	Gimberts Road traffic - 56 to 72 dBA Road traffic (M1) - 54 to 69 dBA
			2	72	64	62	57	60	
			3	64	63	61	55	59	
			4	65	64	62	57	60	
			Mandalong Mine Not discernible						
06/08/2019 22:00 W = 0.1 W, WSW Temp = 3ºC Stability Category: F (Andy Cheung) SVAN 977 S/N 45751			1	79	67	64	59	62	Train passby: <59 dBA (faint) Gimberts Road traffic - 61 to 79 dBA Road traffic (M1) - 56 to 70 dBA Mandalong Mine: Horn - <57 dBA Metal impact noise – 61 to 69 dBA
			2	66	64	63	57	60	
			3	73	66	63	58	61	
			4	68	65	63	57	61	
			Mandalong Mine $L_{Aeq\ (15\ minute)}$ 39 dBA $L_{A1\ (1minute)}$ 51 dBA						
07/08/2019 22:00 W = Calm to 0.1 m/s SSW, SW Temp = 5ºC Stability Category: F (Andy Cheung) SVAN 977 S/N 45751			1	73	67	65	58	62	Gimberts Road traffic - 57 to 76 dBA Road traffic (M1) - 55 to 69 dBA Mandalong Mine: Horn - <61 dBA Metal impact noise – <57 to 60 dBA
			2	72	67	65	57	62	
			3	68	66	64	58	62	
			4	76	67	64	58	62	
			Mandalong Mine $L_{Aeq\ (15\ minute)}$ 33 dBA $L_{A1\ (1minute)}$ 45 dBA						
05/08/2019 23:08 W = Calm Temp = 3ºC Stability Category: E (Andy Cheung) SVAN 977 S/N 45751	M8 R8 (72) L_{Aeq} 43 dBA L_{A1} 61 dBA	M8 L_{Aeq} 43 dBA L_{A1} 61 dBA	1	64	62	61	56	59	Birds – <57 dBA Rail passby: <57 dBA (faint) Gimberts Road – 58 to 69 dBA Distant road traffic (M1) – 53 to 66 dBA Insects – <53 dBA Mandalong mine: Gas plant very faintly audible - < 53 dBA Horn - <57 dBA Impact noises – 60 dBA
			2	69	64	61	55	59	
			3	67	65	62	56	60	
			4	64	63	61	54	58	
			Mandalong Mine Audible $L_{Aeq\ (15\ minute)}$ 34 dBA $L_{A1\ (1minute)}$ 45 dBA						
06/08/2019 23:05 W = Calm to 0.1 m/s WNW Temp = 2°C Stability Category: D & E (Andy Cheung) SVAN 977 S/N 45751			1	63	62	60	51	57	Birds – 53 to 69 dBA Gimberts Road – 58 to 65 dBA Distant road traffic (M1) – 50 to 69 dBA Insects – <58 dBA Mandalong mine: Gas plant very faintly audible - < 50 dBA Horn – 61 to 63 dBA
			2	69	65	62	55	59	
			3	70	65	62	55	59	
			4	65	63	61	56	59	
			Mandalong Mine Audible $L_{Aeq\ (15\ minute)}$ 38 dBA $L_{A1\ (1minute)}$ 49 dBA						

Date/start time Weather (operator) SLM Details	Measurement location/relevant criteria $L_{Aeq(15minute)}$		Measurement number	Primary noise descriptor (dBA re 20 µPa)					Description of noise emission and typical maximum levels L_{Amax} (dBA)
	EPL 365	SSD-5144 and SSD-5145		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
07/08/2019 23:04 W = Calm to 0.1 m/s SSW Temp = 6°C Stability Category: E (Andy Cheung) SVAN 977 S/N 45751			1	70	67	64	57	62	Birds – <58 dBA Gimberts Road – 58 to 71 dBA Distant road traffic (M1) – 50 to 71 dBA Insects – <50 dBA Mandalong mine: Gas plant very faintly audible - < 50 dBA Horn – 61 dBA Metal impact noise – 66 dBA
			2	69	66	64	56	61	
			3	71	68	65	55	62	
			4	68	66	64	56	61	
			Mandalong Mine Audible $L_{Aeq\ (15\ minute)}$ 41 dBA $L_{A1\ (1minute)}$ 51 dBA						
26/07/2019 22:17 W = Calm Temp = 8°C Stability Category: F (Andy Cheung) SVAN 977 S/N 45751	M10 R10 (66) L_{Aeq} 39 dBA L_{A1} 61 dBA	M10 L_{Aeq} 39 dBA L_{A1} 61 dBA	1	80	66	63	57	61	Birds – <54 to 58 dBA Gimberts Road – 59 to 80 dBA Distant road traffic (M1) – 56 to 67 dBA (constant) Insects – <55 to 58 (constant) Mandalong mine: Gas plant very faintly audible - < 54 dBA Horn 58 to 62 dBA
			2	73	65	62	55	59	
			3	66	64	61	55	59	
			4	67	63	60	53	57	
			Mandalong Mine $L_{Aeq\ (15\ minute)}$ 35 dBA $L_{A1\ (1\ minute)}$ 47 dBA						
27/07/2019 22:30 W = Calm Temp = 8°C Stability Category: E & D (Andy Cheung) SVAN 977 S/N 45751			1	78	61	58	53	56	Birds – <54 to 56 dBA Gimberts Road – 55 to 78 dBA Distant road traffic (M1) – 52 to 66 dBA (constant) Insects – <52 (constant) Mandalong mine: Gas plant very faintly audible - < 52 dBA Horn 54 to 60 dBA
			2	76	63	59	53	57	
			3	62	60	57	51	55	
			4	63	60	57	52	55	
			Mandalong Mine $L_{Aeq\ (15\ minute)}$ 33 dBA $L_{A1\ (1\ minute)}$ 45 dBA						
28/07/2019 22:00 W = Calm Temp = 5°C Stability Category: D (Andy Cheung) SVAN 977 S/N 45751			1	67	65	62	56	60	Birds – <54 to 59 dBA Train passby - 56 to 58 dBA Gimberts Road – 56 to 65 dBA Distant road traffic (M1) – 56 to 67 dBA (constant) Insects – <54 to 56 (constant) Mandalong mine: Gas plant very faintly audible - < 52 dBA Horn 58 dBA
			2	64	62	60	54	58	
			3	68	63	61	55	59	
			4	78	66	61	54	59	
			Mandalong Mine $L_{Aeq\ (15\ minute)}$ 31 dBA $L_{A1\ (1\ minute)}$ 43 dBA						

Note 1: Night time is defined as the period between 10:00 pm to 7:00 am Monday to Saturday, or 7:00 am to 8:00 am on Sundays and Public Holidays

It is relevant to note that property access was not possible during the noise monitoring periods, all noise monitoring locations were either monitored at 30 m from a dwelling or at the property boundary fence to obtain the $L_{Aeq(15minute)}$ and $L_{A1(1minute)}$ noise contributions.

5.2 Operational compliance noise monitoring discussion of results

5.2.1 Operational noise

A summary of the operational noise compliance results are presented in Table 5-4.

Table 5-4 Operational noise compliance results summary

Measurement location	Date	Period	Measured noise level $L_{Aeq\ (15minute)}$	Relevant criteria $L_{Aeq(15minute)}$		Compliance
				EPL 365[2]	SSD-5144 and SSD-5145[2]	
M1	26/07/2019	Day	34 dBA	23 Gradwells Rd L_{Aeq} 37 dBA 26 Gradwells Rd L_{Aeq} 36 dBA	23 Gradwells Rd L_{Aeq} 37 dBA 26 Gradwells Rd L_{Aeq} 36 dBA	Yes
		Evening	35 dBA			Yes
		Night	35 dBA			Yes
	27/07/2019	Day	Not discernible			Yes
		Evening	30 dBA			Yes
		Night	36 dBA			Yes
	28/07/2019	Day	Not discernible			Yes
		Evening	34 dBA			Yes
		Night	40 dBA			N/A. Stability Category G temperature inversion conditions.
M4	05/08/2019	Day	Not discernible	R3 (97) L_{Aeq} 42 dBA	L_{Aeq} 39 dBA	Yes
		Evening	Not discernible			Yes
		Night	<35 dBA			Yes
	06/08/2019	Day	<34 dBA			Yes
		Evening	Not discernible			Yes
		Night	<35 dBA			Yes
	07/08/2019	Day	Not discernible			Yes
		Evening	Not discernible			Yes
		Night	37 dBA			Yes
M6	05/08/2019	Day	Not discernible	R5 (110) L_{Aeq} 41 dBA	L_{Aeq} 40 dBA	Yes
		Evening	Not discernible			Yes
		Night	<35 dBA			Yes
	06/08/2019	Day	Not discernible			Yes
		Evening	Not discernible			Yes

Measurement location	Date	Period	Measured noise level $L_{Aeq\ (15minute)}$	Relevant criteria $L_{Aeq(15minute)}$		Compliance
				EPL 365[2]	SSD-5144 and SSD-5145[2]	
		Night	<35 dBA			Yes
	07/08/2019	Day	<34 dBA			Yes
		Evening	Not discernible			Yes
		Night	<35 dBA			Yes
M7	05/08/2019	Day	40 dBA	R6 (86) (87) L_{Aeq} 40 dBA R7 (85) (89) L_{Aeq} 43 dBA	L_{Aeq} 43 dBA	Yes
		Evening	Not discernible			Yes
		Night	Not discernible			Yes
	06/08/2019	Day	33 dBA			Yes
		Evening	<35 dBA			Yes
		Night	39 dBA			Yes
	07/08/2019	Day	38 dBA			Yes
		Evening	Not discernible			Yes
		Night	33 dBA			Yes
M8	05/08/2019	Day	Not discernible	R8 (72) L_{Aeq} 43 dBA	L_{Aeq} 43 dBA	Yes
		Evening	Not discernible			Yes
		Night	34 dBA			Yes
	06/08/2019	Day	Not discernible			Yes
		Evening	<40 dBA			Yes
		Night	38 dBA			Yes
	07/08/2019	Day	35 dBA			Yes
		Evening	<35 dBA			Yes
		Night	41 dBA			Yes
M10	26/07/2019	Day	Not discernible	R10 (66) L_{Aeq} 39 dBA	L_{Aeq} 39 dBA	Yes
		Evening	Not discernible			Yes
		Night	35 dBA			Yes
	27/07/2019	Day	Not discernible			Yes
		Evening	Not discernible			Yes
		Night	33 dBA			Yes
	28/07/2019	Day	Not discernible			Yes
		Evening	Not discernible			Yes
		Night	31 dBA			Yes

Note 1: Day is defined as the period from 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and Public Holidays. Evening is defined as the period from 6 pm to 10 pm. Night time is defined as 10:00 pm to 7:00 am; or 7:00 am to 8:00 am on Sundays and Public Holidays.

Note 2: *The noise limits apply under all meteorological conditions except for any one of the following:*

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

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

(c) Stability category G temperature inversion conditions.

The attended operational noise monitoring results are summarised and presented in Table 5-4. The noise contributions from Mandalong Mine and Cooranbong Entry Site comply with the EPL 365, Development Consent SSD-5144 and SSD-5145 noise criteria at all monitoring locations and during all time periods under the applicable meteorological conditions.

Noise levels measured at locations M1 during the night-time period were greater than the SSD-5145 and EPL 365 criteria on 28/07/2019. However the measurements occurred during stability Category G weather conditions. As specified in condition L5.3 of EPL 365, the noise limits do not apply under these meteorological conditions.

The primary noise sources from the site, which contributed to the measured levels at location M1, were alarms and impact noises.

5.2.2 Sleep disturbance

A summary of the sleep disturbance noise compliance results are presented in Table 5-5.

Table 5-5 Sleep disturbance noise compliance results summary

Measurement location	Date[1]	Measured noise level $L_{A1\ (1\ minute)}$ (dBA)	Relevant criteria $L_{A1\ (1\ minute)}$		Compliance
			EPL 365[2]	SSD-5144 and SSD-5145[2]	
M1	26/07/2019	42	23 Gradwells Rd L_{A1} 45 dBA 26 Gradwells Rd L_{A1} 45 dBA	23 Gradwells Rd L_{A1} 45 dBA 26 Gradwells Rd L_{A1} 45 dBA	Yes
	27/07/2019	43			Yes
	28/07/2019	49			N/A. Stability Category G temperature inversion conditions.
M4	05/08/2019	<35	R3 (97) L_{A1} 52 dBA	L_{A1} 52 dBA	Yes
	06/08/2019	<35			Yes
	07/08/2019	47			Yes
M6	05/08/2019	41	R5 (110) L_{A1} 61 dBA	L_{A1} 61 dBA	Yes
	06/08/2019	40			Yes
	07/08/2019	45			Yes
M7	05/08/2019	Not discernible	R6 (86) (87) L_{A1} 61 dBA R7 (85) (89) L_{A1} 61 dBA	L_{A1} 61 dBA	Yes
	06/08/2019	54			Yes
	07/08/2019	45			Yes
M8	05/08/2019	45	R8 (72) L_{A1} 61 dBA	L_{A1} 61 dBA	Yes
	06/08/2019	49			Yes
	07/08/2019	51			Yes
M10	26/07/2019	47	R10 (66) L_{A1} 61 dBA	L_{A1} 61 dBA	Yes
	27/07/2019	45			Yes
	28/07/2019	43			Yes

Note 1: Sleep disturbance is assessed during the night time period only. Night time is defined as 10:00 pm to 7:00 am; or 7:00 am to 8:00 am on Sundays and Public Holidays

Note 2: *The noise limits apply under all meteorological conditions except for any one of the following:*

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

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

(c) Stability category G temperature inversion conditions.

The operator attended sleep disturbance noise monitoring results summary presented in Table 5-5 show that the noise contributions from Mandalong Mine and Cooranbong Entry Site are compliant with the EPL 365, Development Consent SSD-5144 and SSD-5145 relevant sleep disturbance noise criteria at all monitoring locations.

An exceedance of EPL 365, Development Consent SSD-5144 and SSD-5145 was measured at location M1 and was primarily due to onsite impacts noises and alarms. However the measurements occurred during stability Category G weather conditions. As specified in condition L5.3 of EPL 365, the noise limits do not apply under these meteorological conditions.

The EPA's current approach to assessing potential sleep disturbance is to apply an initial screening criterion of background plus 15 dB (as described in the Application Notes to the NPI) and to undertake further detailed analysis if the screening criterion cannot be achieved. The sleep disturbance screening criterion applies outside bedroom windows during the night-time period.

Where the screening criterion cannot be met, the additional analysis should consider the number of potential sleep disturbance events during the night, the level of exceedance and noise from other events. It may also be appropriate to consider other guidelines including the RNP which contains additional guidance relating to the potential sleep disturbance impacts.

A review of research on sleep disturbance in the RNP indicates that in some circumstances, higher noise levels may occur without significant sleep disturbance. Based on studies into sleep disturbance, the RNP concludes that:

- Maximum internal noise levels below 50 dBA to 55 dBA are unlikely to cause awakening reactions.
- One or two noise events per night, with maximum internal noise levels of 65 dBA to 70 dBA, are not likely to affect health and wellbeing significantly.

It is generally accepted that internal noise levels in a dwelling, with the windows open, are 10 dB lower than external noise levels. Based on a worst case minimum attenuation, with windows open, of 10 dB, the first conclusion above suggests that short term external noises of 60 dBA to 65 dBA are unlikely to cause awakening reactions. The second conclusion suggests that one or two noise events per night with maximum external noise levels of 75 dBA to 80 dBA are not likely to affect health and wellbeing significantly.

Given the preceding, since the short term external noise levels were equal to or below 69 dBA, the measured exceedances are not likely to affect health and wellbeing significantly.

Furthermore, the operator attended monitoring results presented in Table 5-3 show that receptors in the existing acoustic environment at location M1 are already exposed to maximum noise level events higher than those caused by the Cooranbong Entry Site. Train passby movements measured at location M1 were between L_{Amax} 45 to 66 dBA.

5.3 Unattended noise monitoring results

To assist in determining noise contribution from the site, one (1) SVAN 977 environmental noise logger (SN 45746) was installed at Location UNL as shown in Figure 4-1. Ambient noise levels were monitored from Friday 26 July 2019 to Wednesday 31 July 2019 and from Tuesday 6 August 2019 to Thursday 8 August 2019.

Rating background levels and ambient noise levels recorded are summarised in Table 5-6 and Table 5-7. Daily noise level charts for the entire monitoring period are presented in Appendix H.

Table 5-6 Summary of noise monitoring results, dBA (26/07/19 to 30/07/19)

Date	Rating background level 90th percentile $L_{A90(15min)}$			Ambient noise levels, $L_{Aeq(period)}$		
	Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]
Friday-26-Jul-19	45[2]	45	34	50[2]	49	46
Saturday-27-Jul-19	39	41	35	48	46	48
Sunday-28-Jul-19	39	46	40	48	49	53
Monday-29-Jul-19	39	38	37	51	44	47
Tuesday-30-Jul-19	42	40	37[2]	49	46	42[2]
RBL and Leq Overall	**39**	**41**	**37**	**50**	**47**	**49**

Note 1: Daytime 7.00 am to 6.00 pm, Evening 6.00 pm to 10.00 pm, Night-time 10.00 pm to 7.00 am; On Sundays and Public Holidays, Daytime 8.00 am to 6.00 pm, Evening 6.00 pm to 10.00 pm, Night-time 10.00 pm to 8.00 am.

Note 2: Periods where invalid data has been excluded due to adverse weather.

Table 5-7 Summary of noise monitoring results, dBA (06/08/19 to 08/08/19)

Date	Rating background level 90th percentile $L_{A90(15min)}$			Ambient noise levels, $L_{Aeq(period)}$		
	Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]
Tuesday-6-Aug-19	44	42	44	52	51	57
Wednesday-7-Aug-19	40	51	46	53	55	55
Thursday-8-Aug-19	49[2]			57[2]		
RBL and Leq Overall	**44**	**46**	**45**	**54**	**53**	**56**

Note 1: Daytime 7.00 am to 6.00 pm, Evening 6.00 pm to 10.00 pm, Night-time 10.00 pm to 7.00 am; On Sundays and Public Holidays, Daytime 8.00 am to 6.00 pm, Evening 6.00 pm to 10.00 pm, Night-time 10.00 pm to 8.00 am.

Note 2: Periods where invalid data has been excluded due to adverse weather.

6. Recommendations

Given the preceding compliance noise monitoring results presented in Section 5, it is recommended that additional noise monitoring be conducted at Location M1 during the night-time period. It is recommended that the additional noise monitoring is conducted during time periods not affected by the meteorological conditions as specified in the EPL 365 condition L5.3. However it should be recognised that forecasting of temperature inversion weather conditions is difficult and may require multiple monitoring survey periods to capture data during valid weather conditions.

It is also recommended that that onsite behavioural practices, in particular, the importance of avoiding dropping of materials from height or throwing of metal items wherever feasible and reasonable, is iterated to staff working on the surface during pre-start tool box talks.

7. Conclusion

GHD was engaged by Centennial Coal Company Limited to conduct an annual noise compliance assessment for the Mandalong Mine and Cooranbong Entry Site in accordance with the Noise Management Plan Northern Region (May 2018), Environmental Protection Licence EPL 365, Development Consent SSD-5144 and SSD-5145.

Operator-attended noise measurements were conducted at the six (6) locations surrounding the mine site from Friday 26 July to Sunday 28 July 2019 and Monday 5 August to Wednesday 7 August 2019. Measurements were conducted during typical worst case operational scenarios for both Mandalong and Cooranbong sites in order to capture associated typical worst case noise levels.

To assist in determining noise contributions from the site unattended noise monitoring was conducted at one (1) location nearby to the Mandalong Mine. Ambient noise levels were monitored from Friday 26 July 2019 to Wednesday 31 July 2019 and from Tuesday 6 August to Thursday 8 August 2019.

The operator attended operational noise monitoring showed that the noise contributions from Mandalong Mine and Cooranbong Entry Site comply with the EPL 365, Development Consent SSD-5144 and SSD-5145 noise criteria at all monitoring locations and during all time periods. Noise levels measured at location M1 during the night-time period were greater than the SSD-5145 and EPL 365 criteria on 28/07/2019. However the measurements occurred during stability Category G weather conditions. As specified in condition L5.3 of EPL 365, the noise limits do not apply under these meteorological conditions.

The primary noise sources from the sites, which contributed to the measured levels at location M1, were alarms and impact noises.

The operator attended sleep disturbance noise monitoring results showed that the noise contributions from Mandalong Mine and Cooranbong Entry Site comply with the EPL 365, Development Consent SSD-5144 and SSD-5145 relevant sleep disturbance noise criteria at all monitoring locations. An exceedance of EPL 365, Development Consent SSD-5144 and SSD-5145 was measured at location M1 and was primarily due to onsite impacts noises and alarms. However the measurements occurred during stability Category G weather conditions. As specified in condition L5.3 of EPL 365, the noise limits do not apply under these meteorological conditions.

Given the preceding, since the short term external noise levels were equal to or below 69 dBA, the measured exceedances are not likely to affect health and wellbeing significantly.

8. References

Australian Standard AS1055: 2019. *Acoustics – Description and Measurement of Environmental Noise, Part 1 General Procedures.*

Australian Standard AS2436-2010 (R2016). *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*.

AS IEC 61672.1: 2019 *Electroacoustics - Sound level meters – Specifications*.

Centennial Coal Noise Management Plan – Northern Region May 2018.

Development Consent SSD 5144.

Development Consent SSD 5145.

Development Application DA 97/800.

Development Application DA 35-2-2004.

Environmental Protection License (EPL) 365.

NSW Environmental Protection Authority, 2017. New South Wales *Noise Policy for Industry.*

NSW Environmental Protection Authority, 2013. *Noise Guide for Local Government*.

NSW Interim Construction Interim construction noise guideline (ICNG) (DECC, 2009).

Appendices

Appendix A – Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: SLM 24491 & FILT 5122

Equipment Description:	Sound & Vibration Analyser		
Manufacturer:	Svantek		
Model No:	Svan-977	**Serial No:**	36821
Microphone Type:	7052E	**Serial No:**	52114
Preamplifier Type:	SV12L	**Serial No:**	30276
Filter Type:	1/3 Octave	**Serial No:**	36821
Comments:	All tests passed for class 1. (See over for details)		
Owner:	GHD Pty Ltd Level 3, 24 Honeysuckle Drive Newcastle, NSW 2300		
Ambient Pressure:	1009 hPa ±1.5 hPa		
Temperature:	23 °C ±2° C	**Relative Humidity:**	54% ±5%
Date of Calibration:	15/04/2019	**Issue Date:**	16/04/2019
Acu-Vib Test Procedure:	AVP10 (SLM) & AVP06 (Filters)		

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

NATA
WORLD RECOGNISED ACCREDITATION

ACU-VIB
ELECTRONICS
HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
web site: www.acu-vib.com.au

Accredited Lab. No. 9262
Acoustic and Vibration Measurements

CERTIFICATE NO.: SLM 24491 & FILT 5122

The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013

Tests Performed:	*Clause*	*Result*
Absolute Calibration	10	Pass
Acoustical Frequency Weighting	12	Pass
Self Generated Noise	11.1	Entered
Electrical Noise	11.2	Entered
Long Term Stability	15	Pass
Electrical Frequency Weightings	13	Pass
Frequency and Time Weightings	14	Pass
Reference Level Linearity	16	Pass
Range Level Linearity	17	Pass
Toneburst	18	Pass
Peak C Sound Level	19	Pass
Overload Indicator	20	Pass
High Level Stability	21	Pass

Statement of Compliance: The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.
A full technical report is available if required.

This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:

1. Relative attenuation clause 5.3

Date of Calibration: 15/04/2019 **Issue Date:** 16/04/2019

Checked by: RKB

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

NATA
WORLD RECOGNISED ACCREDITATION

Accredited Lab. No. 9262
Acoustic and Vibration Measurements

ACU-VIB ELECTRONICS
HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: SLM 24943 & FILT 5243

Equipment Description:	Sound & Vibration Analyser		
Manufacturer:	Svantek		
Model No:	Svan-977B	**Serial No:**	45751
Microphone Type:	7052E	**Serial No:**	62242
Preamplifier Type:	SV12L	**Serial No:**	30274
Filter Type:	1/3 Octave	**Serial No:**	45751
Comments:	All tests passed for class 1. (See over for details)		
Owner:	GHD Pty Ltd Level 3, 24 Honeysuckle Drive Newcastle, NSW 2300		
Ambient Pressure:	1006 hPa ±1.5 hPa		
Temperature:	23 °C ±2° C	**Relative Humidity:**	37% ±5%
Date of Calibration:	14/06/2019	**Issue Date:**	14/06/2019
Acu-Vib Test Procedure:	AVP10 (SLM) & AVP06 (Filters)		

CHECKED BY: MKB **AUTHORISED SIGNATURE:** ..... Jack Kielt

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CERTIFICATE NO.: SLM 24943 & FILT 5243

The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013

Tests Performed:	*Clause*	*Result*
Absolute Calibration	10	Pass
Acoustical Frequency Weighting	12	Pass
Self Generated Noise	11.1	Entered
Electrical Noise	11.2	Entered
Long Term Stability	15	Pass
Electrical Frequency Weightings	13	Pass
Frequency and Time Weightings	14	Pass
Reference Level Linearity	16	Pass
Range Level Linearity	17	Pass
Toneburst	18	Pass
Peak C Sound Level	19	Pass
Overload Indicator	20	Pass
High Level Stability	21	Pass

Statement of Compliance: The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.
A full technical report is available if required.

This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:

1. Relative attenuation clause 5.3

Date of Calibration: 14/06/2019 **Issue Date:** 14/06/2019

Checked by: YKB.

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 24520

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: Larson Davis
Type No: CAL200 **Serial No:** 9193
Owner: GHD Pty Ltd
Level 3, 24 Honeysuckle Drive
Newcastle, NSW 2300

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	94.13	999.97	1.58
Level 2:	NA	N	114.19	1000.00	0.56
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 1010 hPa ±1.5 hPa **Relative Humidity:** 55% ±5%
Temperature: 23 °C ±2° C
Date of Calibration: 16/04/2019 **Issue Date:** 16/04/2019
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017
CHECKED BY: JKB **AUTHORISED SIGNATURE:** .....
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Acoustic and Vibration Measurements

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Mobile: 0413 809806
Web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 25473

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4231 **Serial No:** 2542101
Owner: GHD Pty Ltd
Level 3, 24 Honeysuckle Drive
Newcastle, NSW 2300

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	93.97	999.97	0.56
Level 2:	NA	N	113.97	999.97	0.32
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 1004 hPa ±1.5 hPa **Relative Humidity:** 42% ±5%
Temperature: 23 °C ±2° C
Date of Calibration: 02/09/2019 **Issue Date:** 02/09/2019
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017
CHECKED BY: NKB **AUTHORISED SIGNATURE:** .....
Jack Rielt

.Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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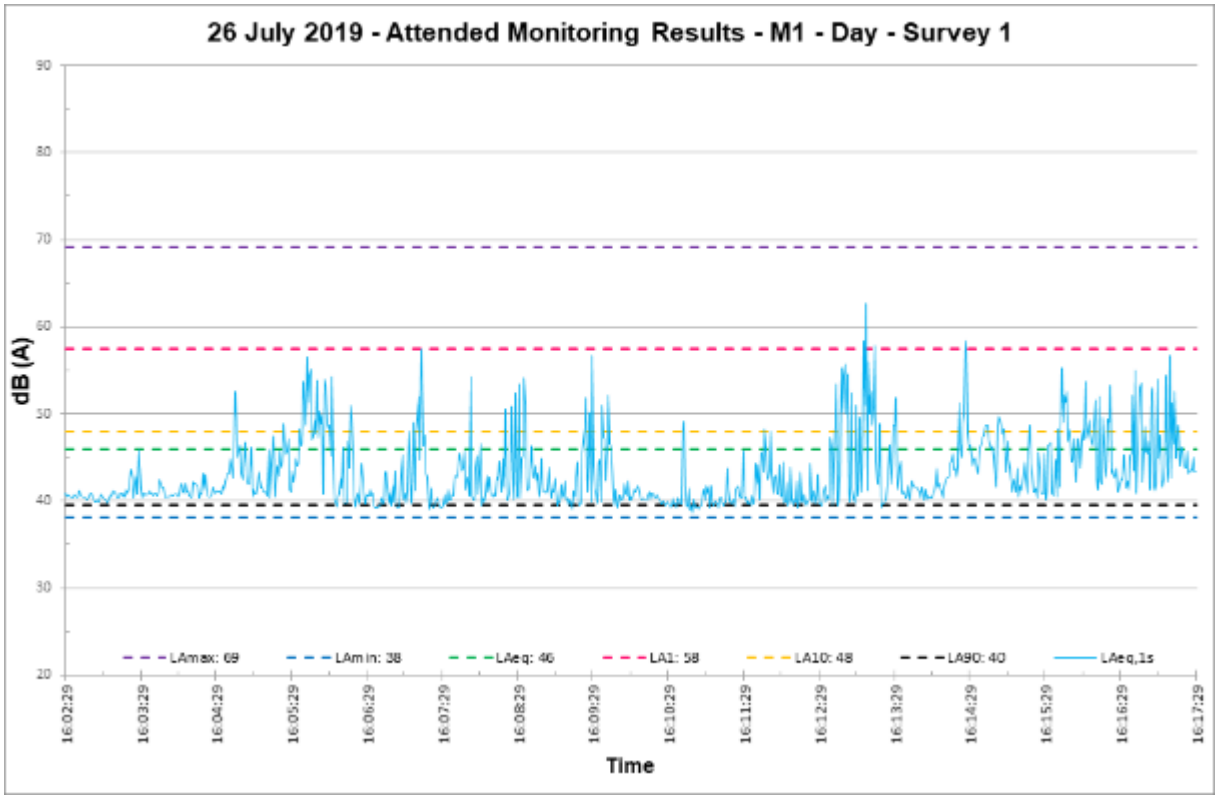
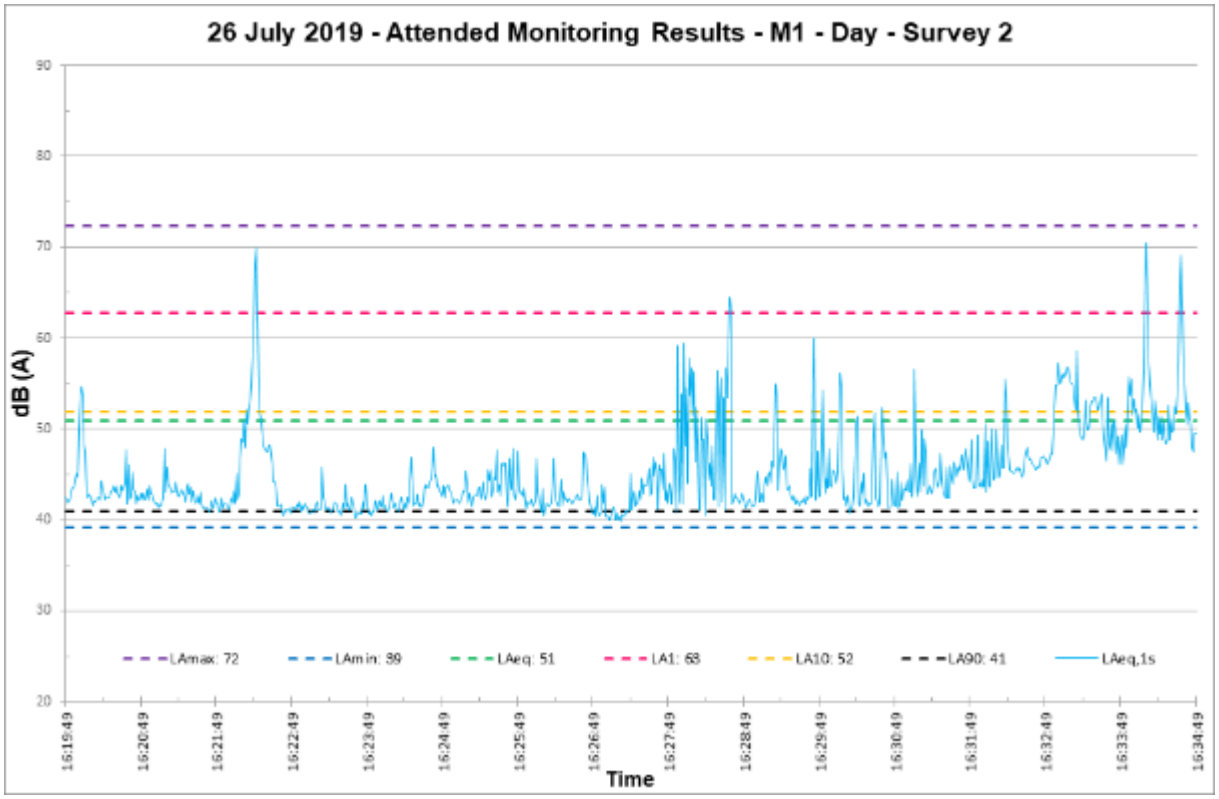
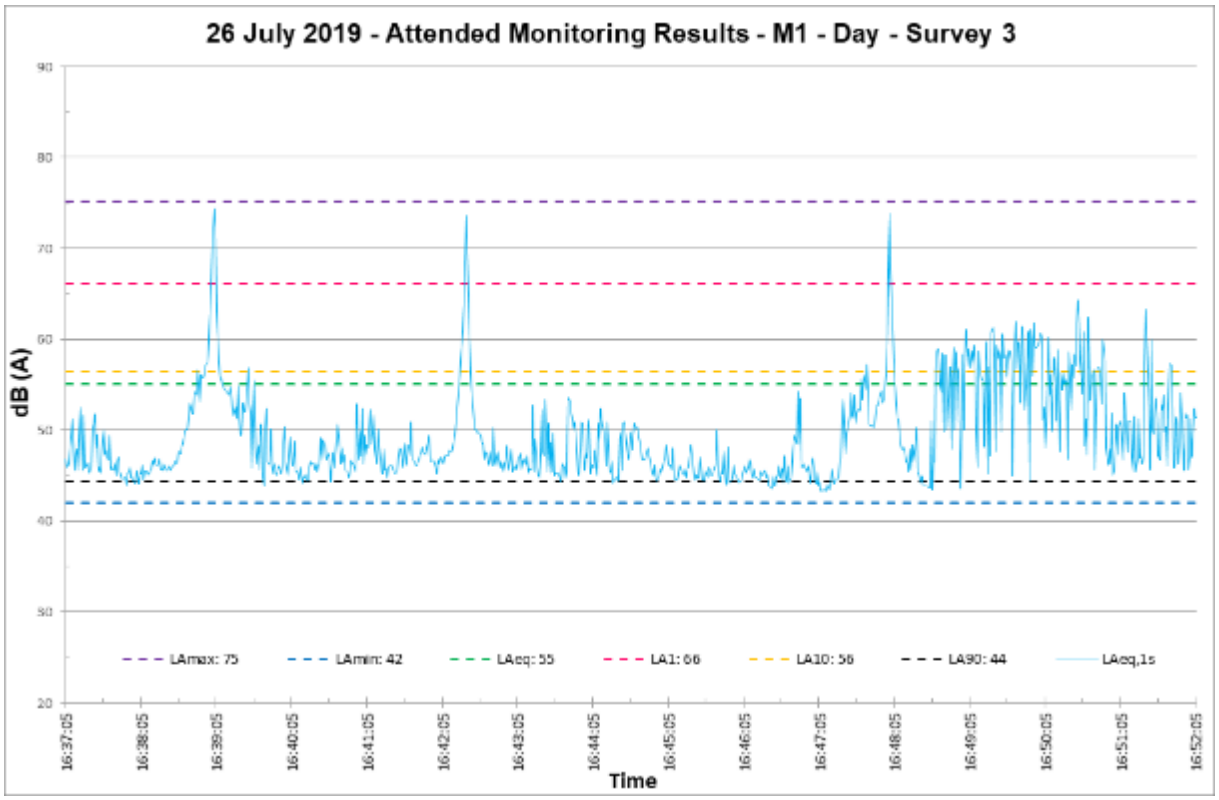
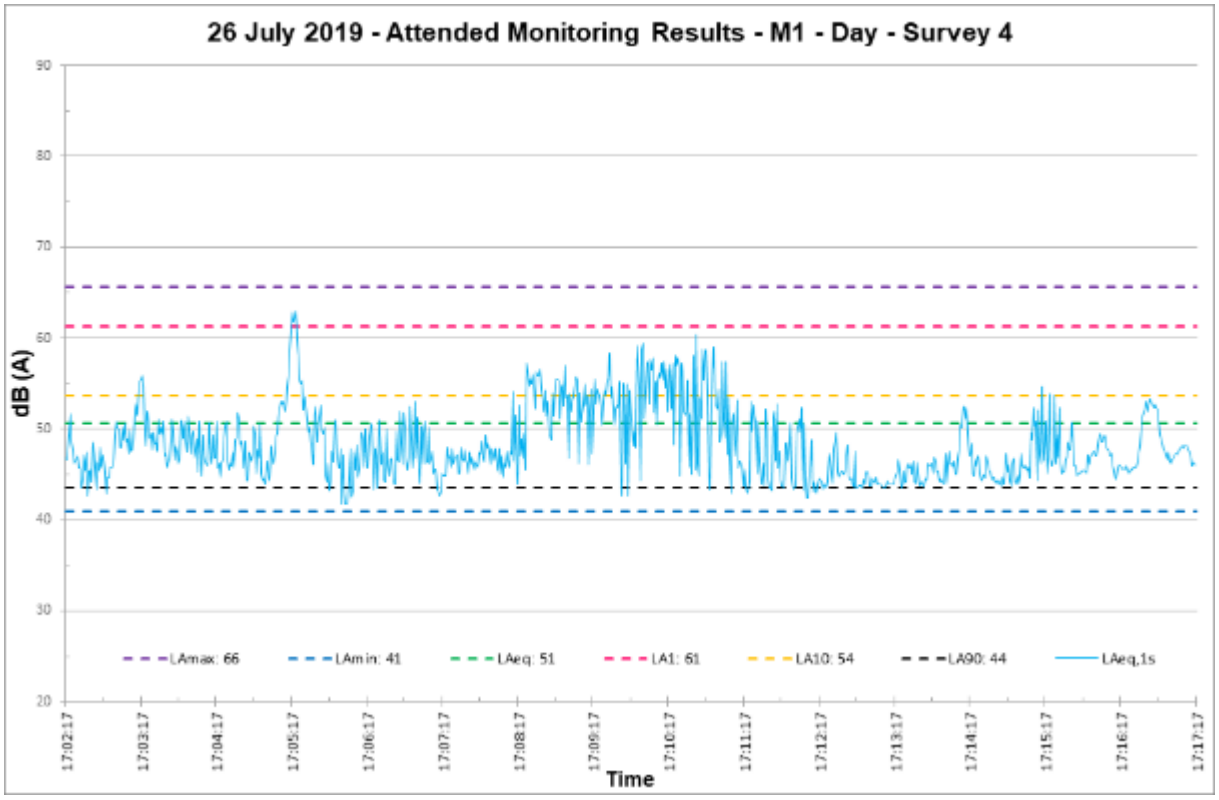
Appendix B – Operator attended noise monitoring results – Location M1

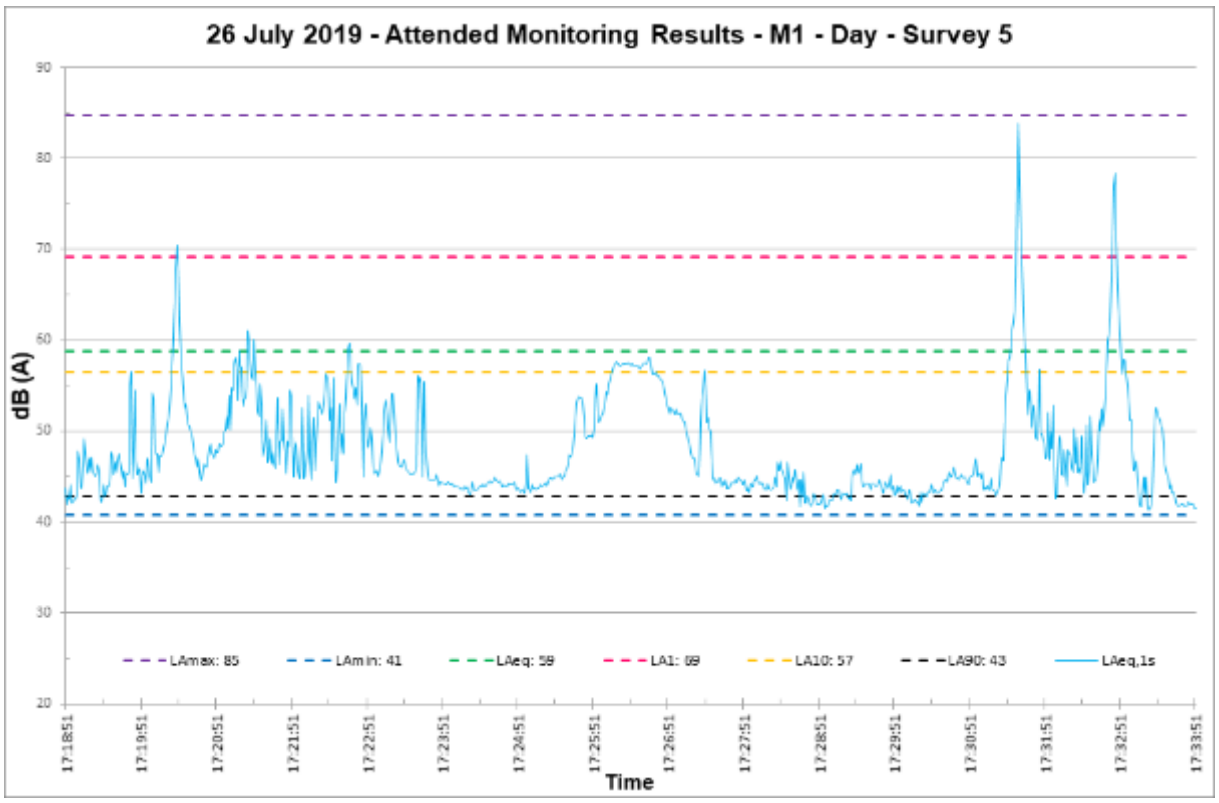
Day – 26/07/2019

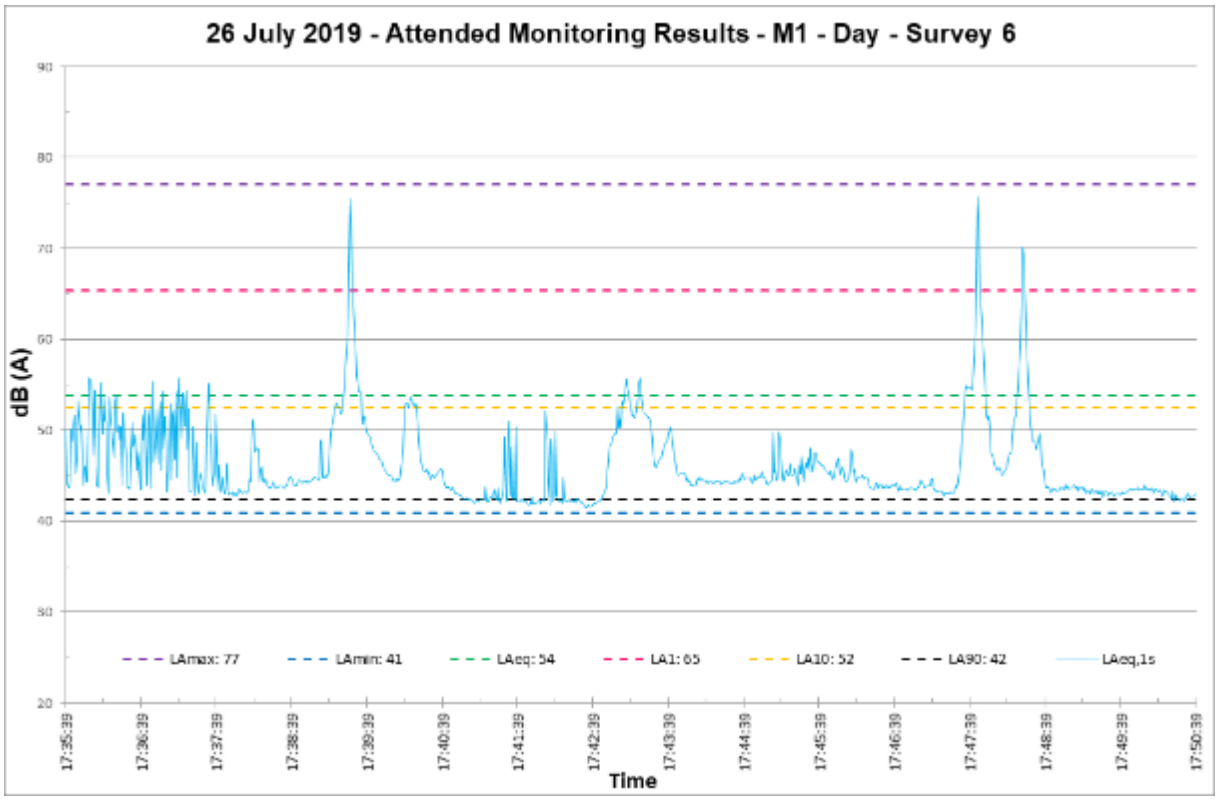




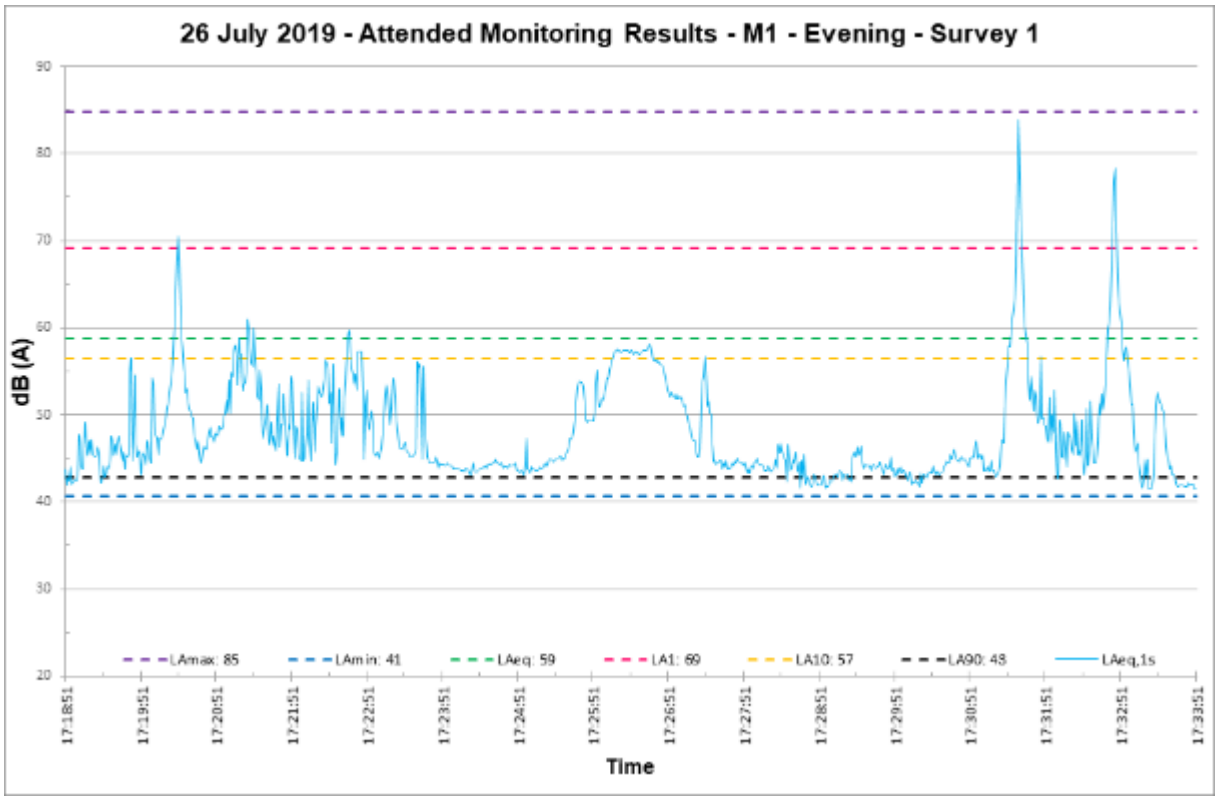

26 July 2019 - Attended Monitoring Results - M1 - Day - Survey 3
dB (A)
Time
LAmax: 75
LAmin: 42
LAeq: 55
LA1: 66
LA10: 56
LA90: 44
LAeq,1s

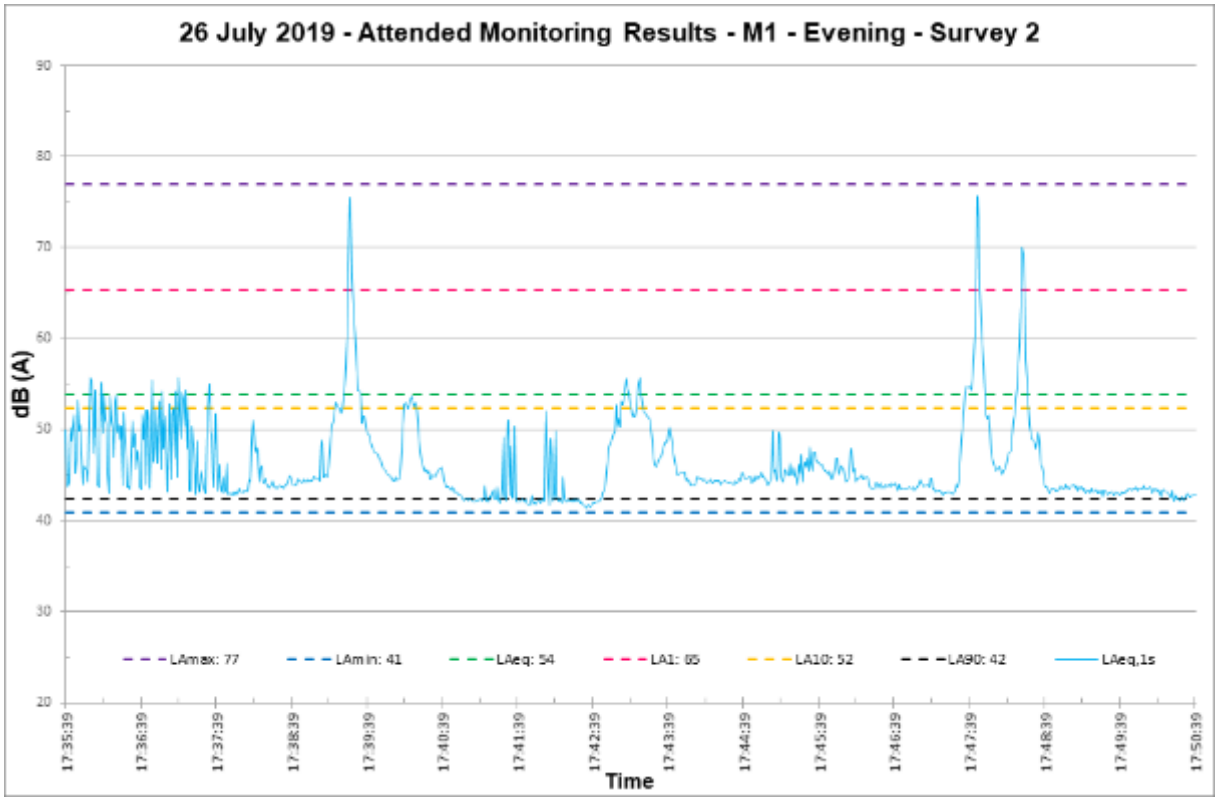

26 July 2019 - Attended Monitoring Results - M1 - Day - Survey 4
dB (A)
Time
LAmax: 66
LAmin: 41
LAeq: 51
LA1: 61
LA10: 54
LA90: 44
LAeq,1s


26 July 2019 - Attended Monitoring Results - M1 - Day - Survey 5
dB (A)
Time
LAmax: 85
LAmin: 41
LAeq: 59
LA1: 69
LA10: 57
LA90: 43
LAeq,1s

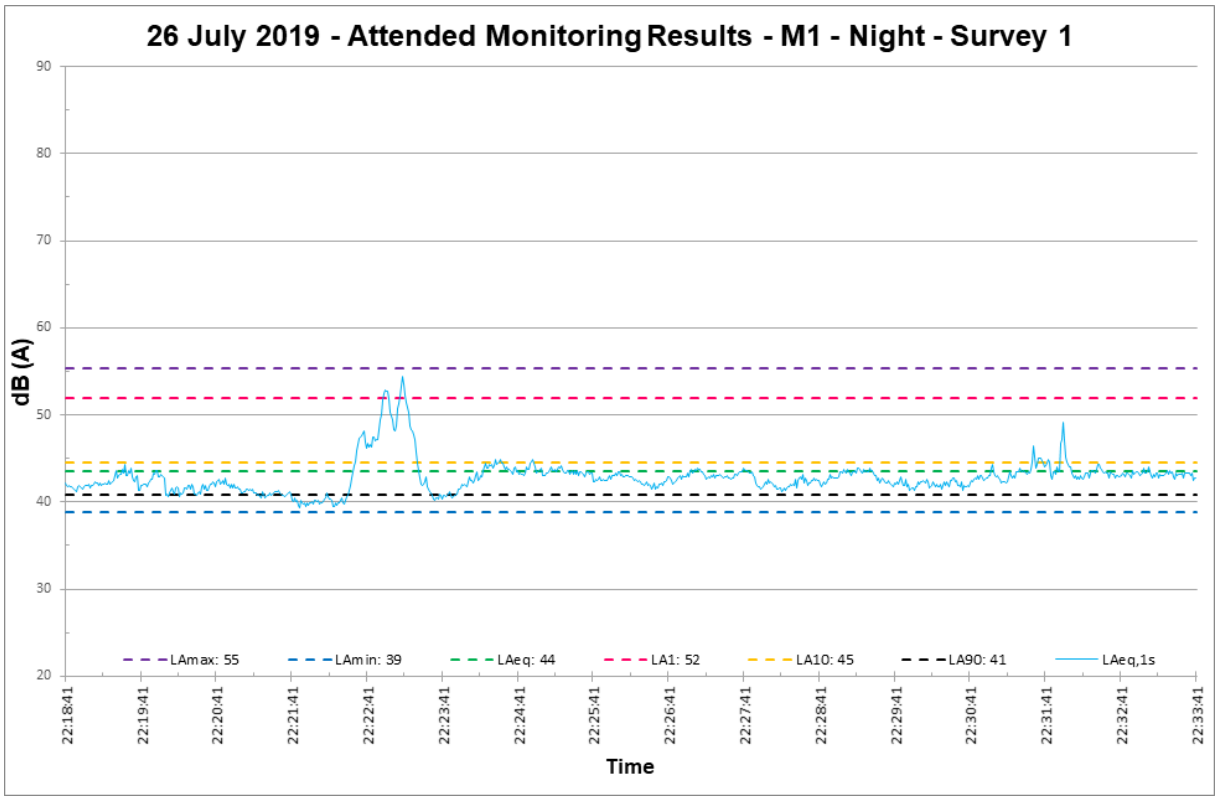

26 July 2019 - Attended Monitoring Results - M1 - Day - Survey 6
dB (A)
Time
LAmax: 77
LAmin: 41
LAeq: 54
LA1: 65
LA10: 52
LA90: 42
LAeq,1s

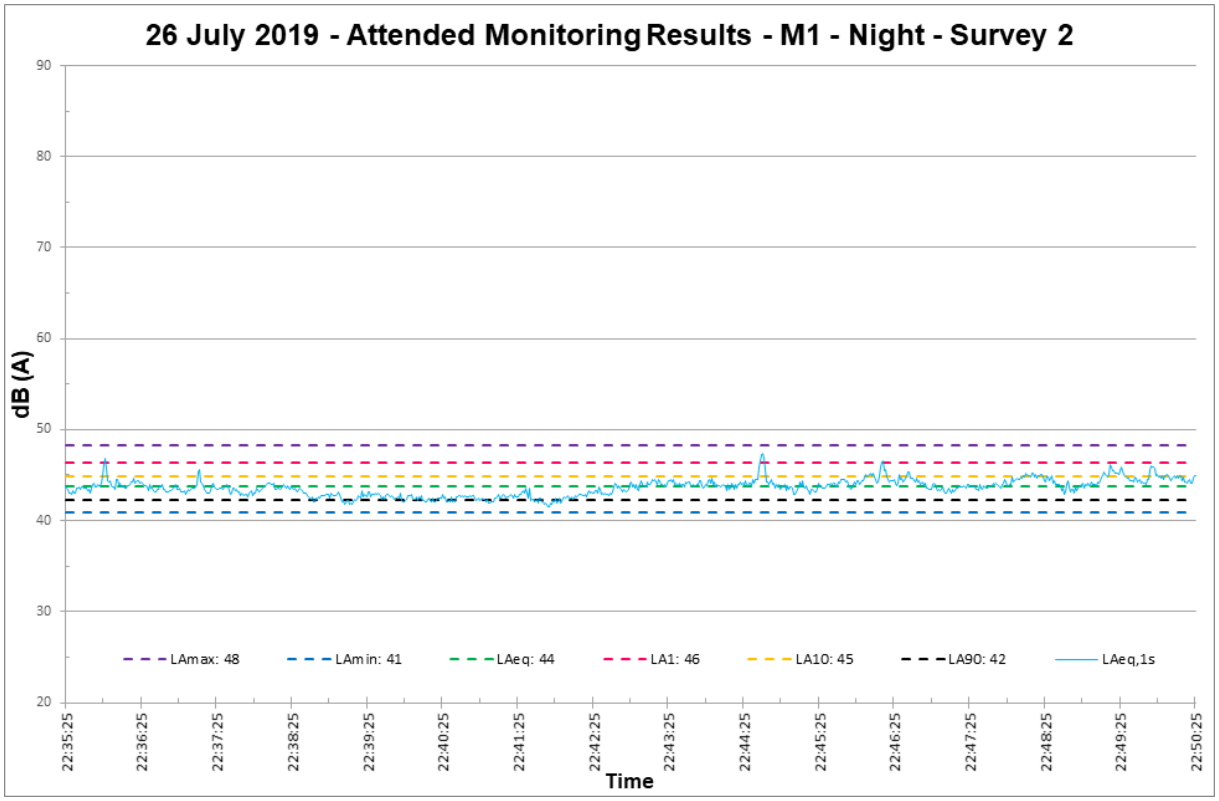
Evening – 26/07/2019

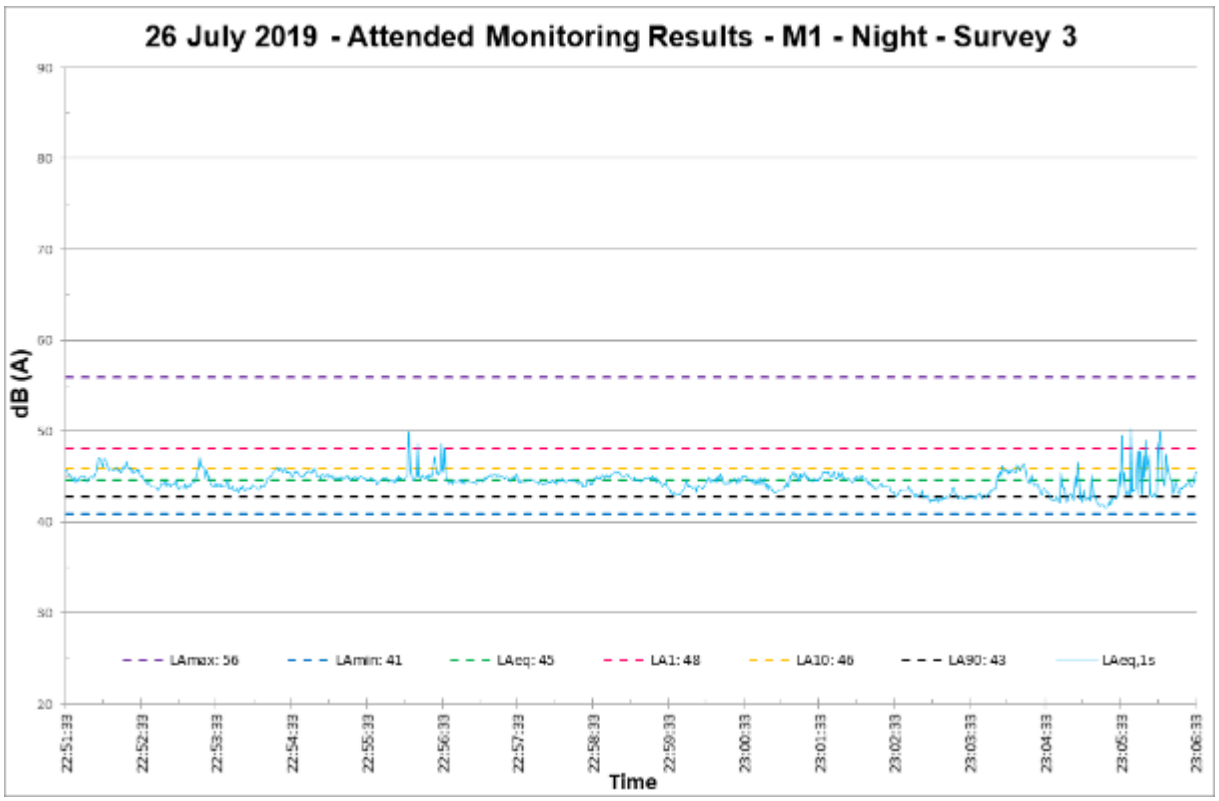


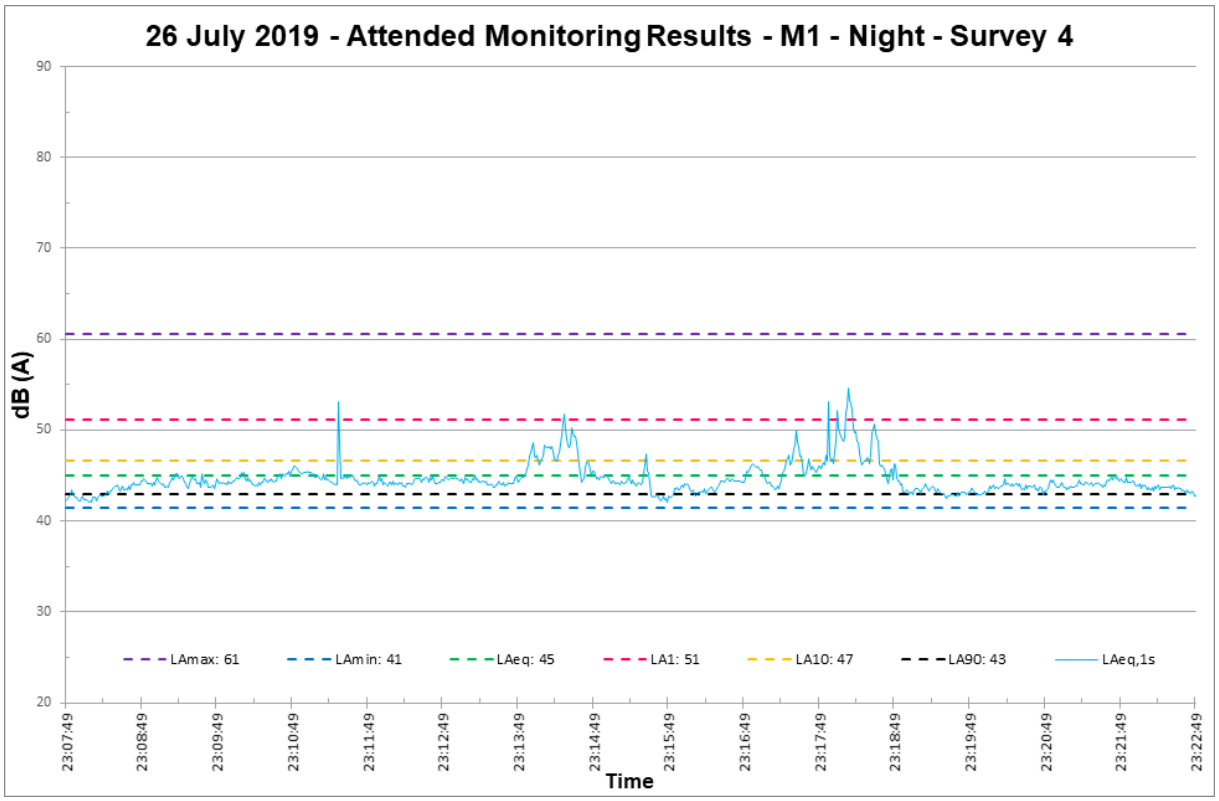


Night – 26/07/2019

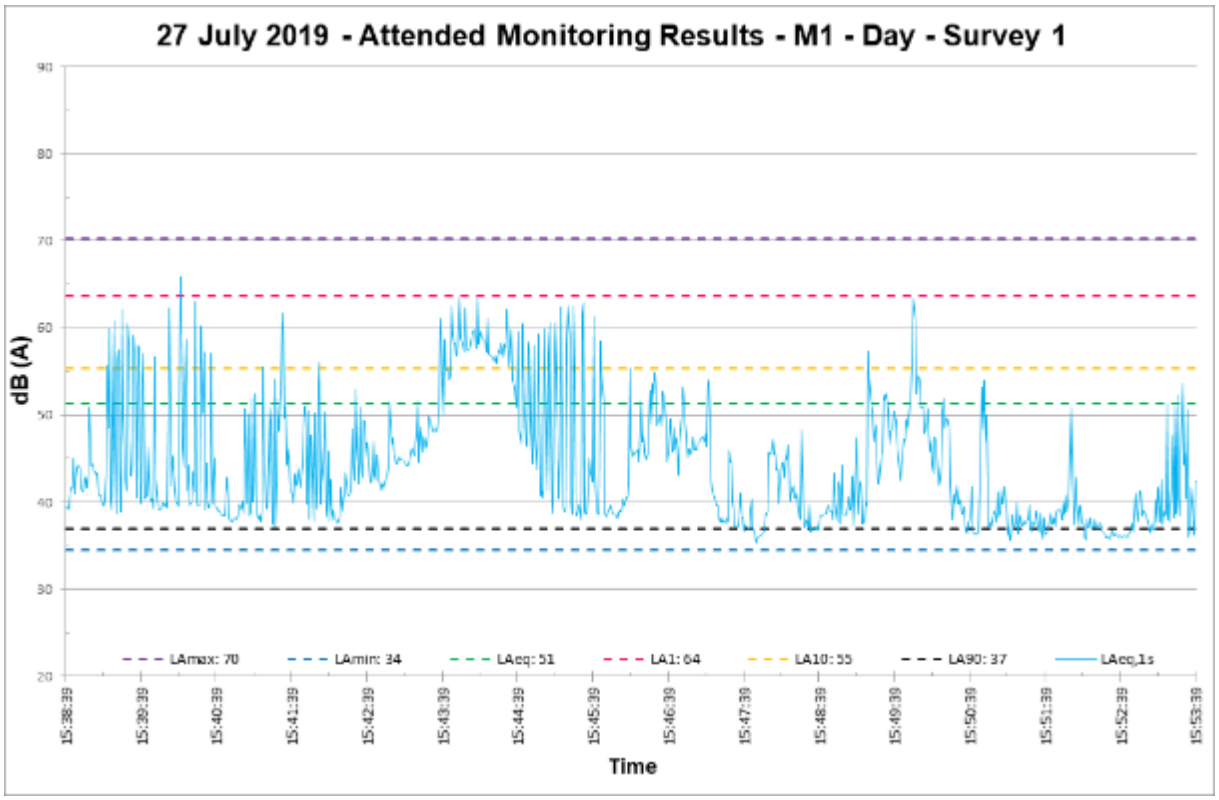


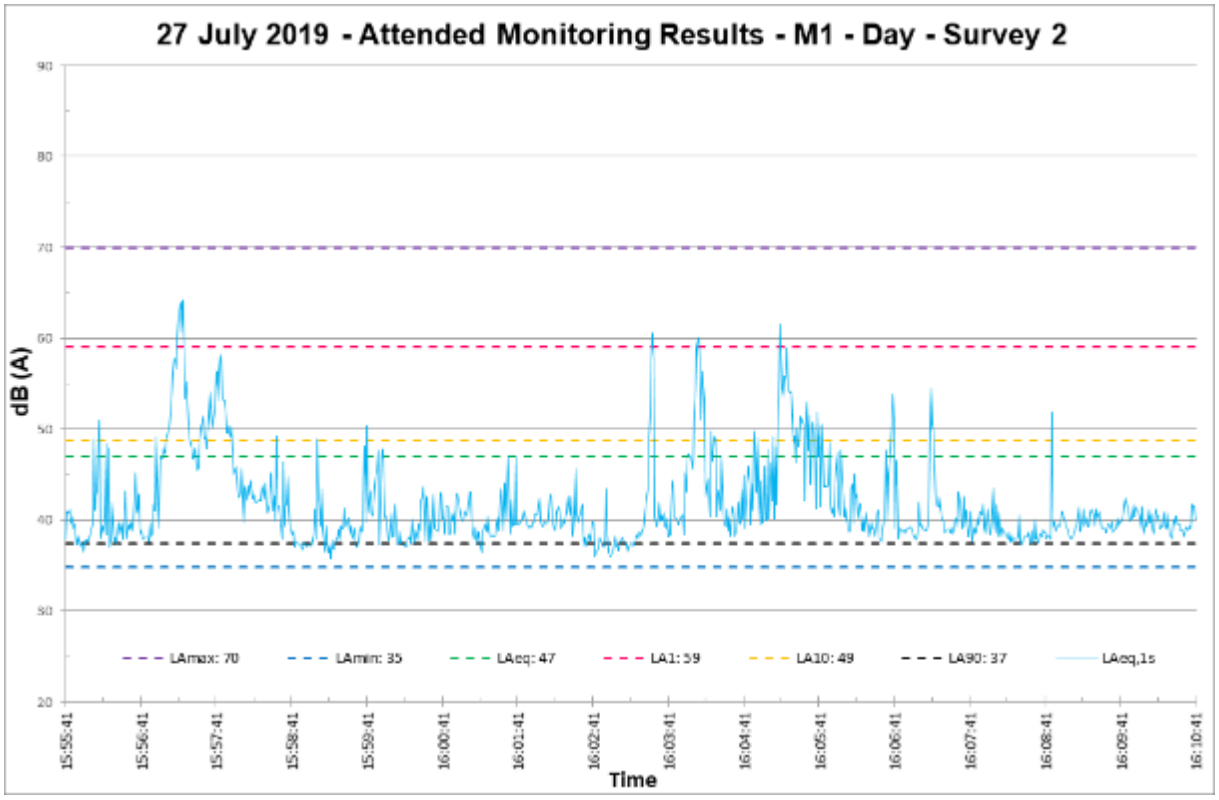


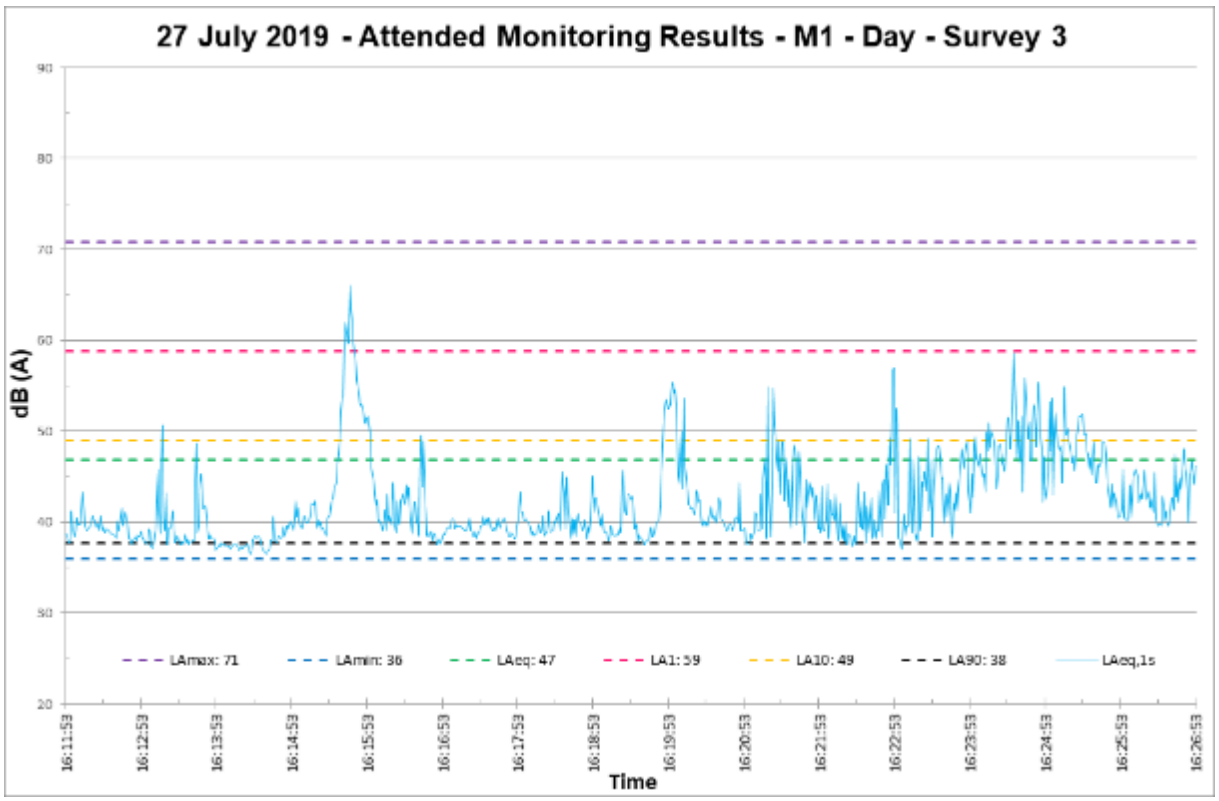

26 July 2019 - Attended Monitoring Results - M1 - Night - Survey 3
dB (A)
90
80
70
60
50
40
30
20
LAmax: 56
LAmin: 41
LAeq: 45
LA1: 48
LA10: 46
LA90: 43
LAeq,1s
22:51:33
22:52:33
22:53:33
22:54:33
22:55:33
22:56:33
22:57:33
22:58:33
22:59:33
23:00:33
23:01:33
23:02:33
23:03:33
23:04:33
23:05:33
23:06:33
Time

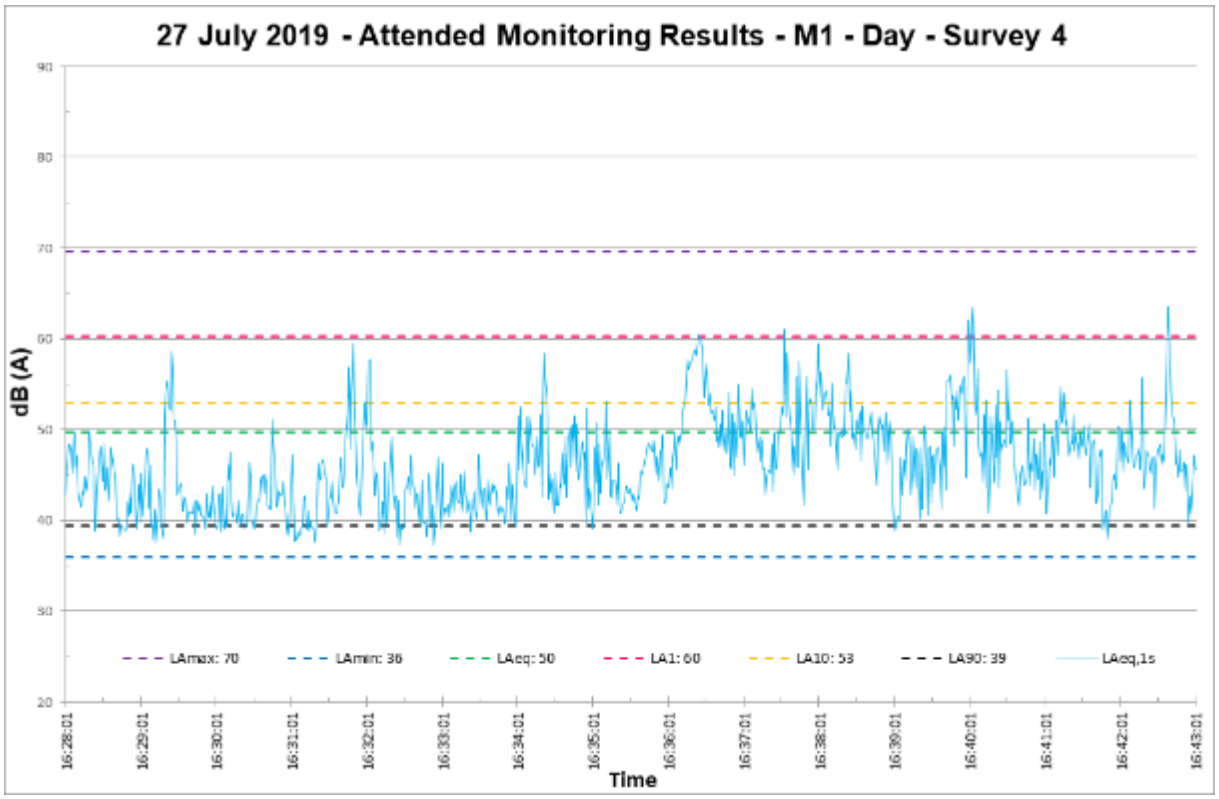

26 July 2019 - Attended Monitoring Results - M1 - Night - Survey 4
dB (A)
90
80
70
60
50
40
30
20
LAmax: 61
LAmin: 41
LAeq: 45
LA1: 51
LA10: 47
LA90: 43
LAeq,1s
23:07:49
23:08:49
23:09:49
23:10:49
23:11:49
23:12:49
23:13:49
23:14:49
23:15:49
23:16:49
23:17:49
23:18:49
23:19:49
23:20:49
23:21:49
23:22:49
Time

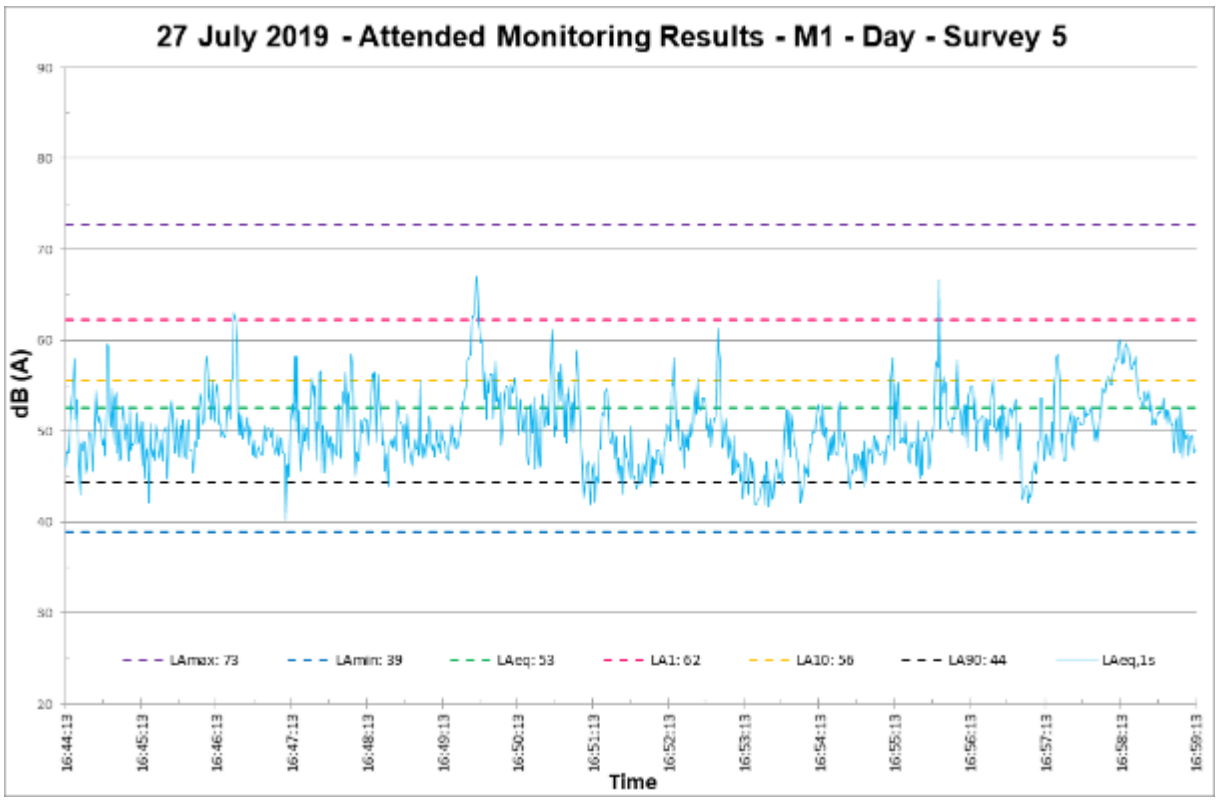
Day – 27/07/2019

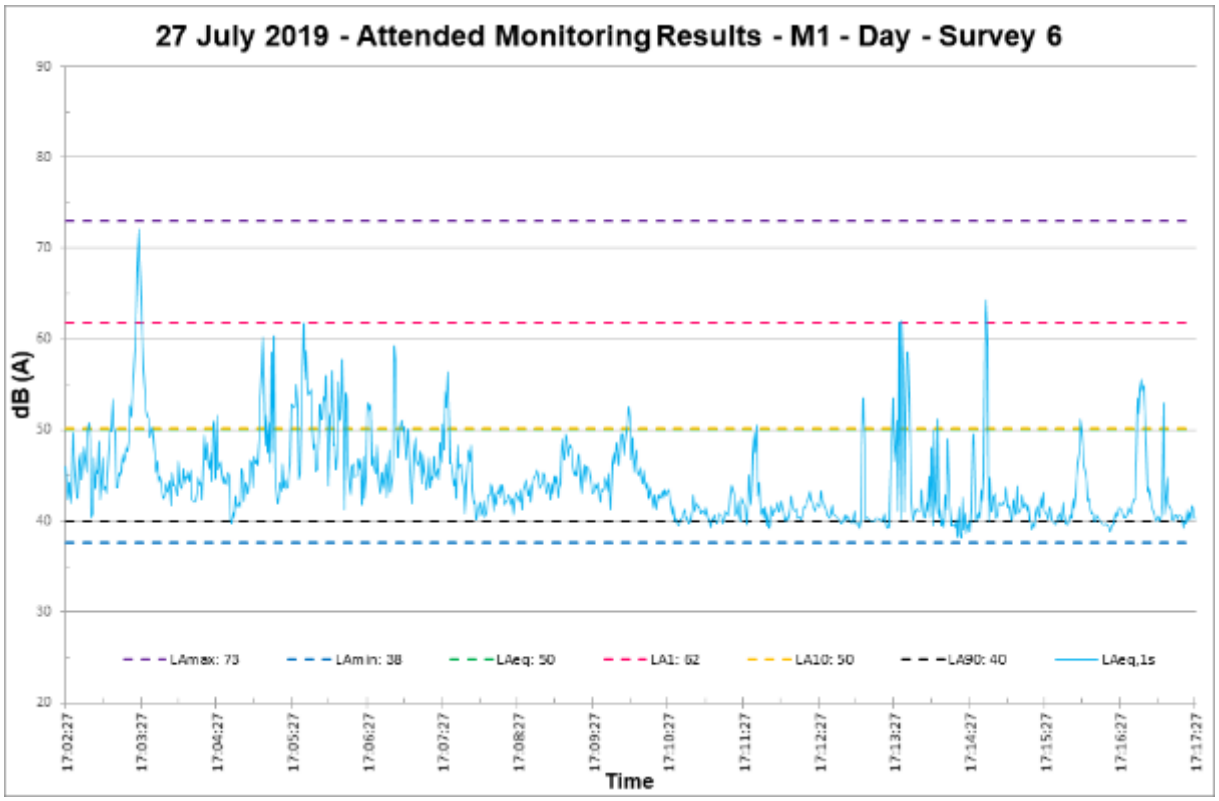




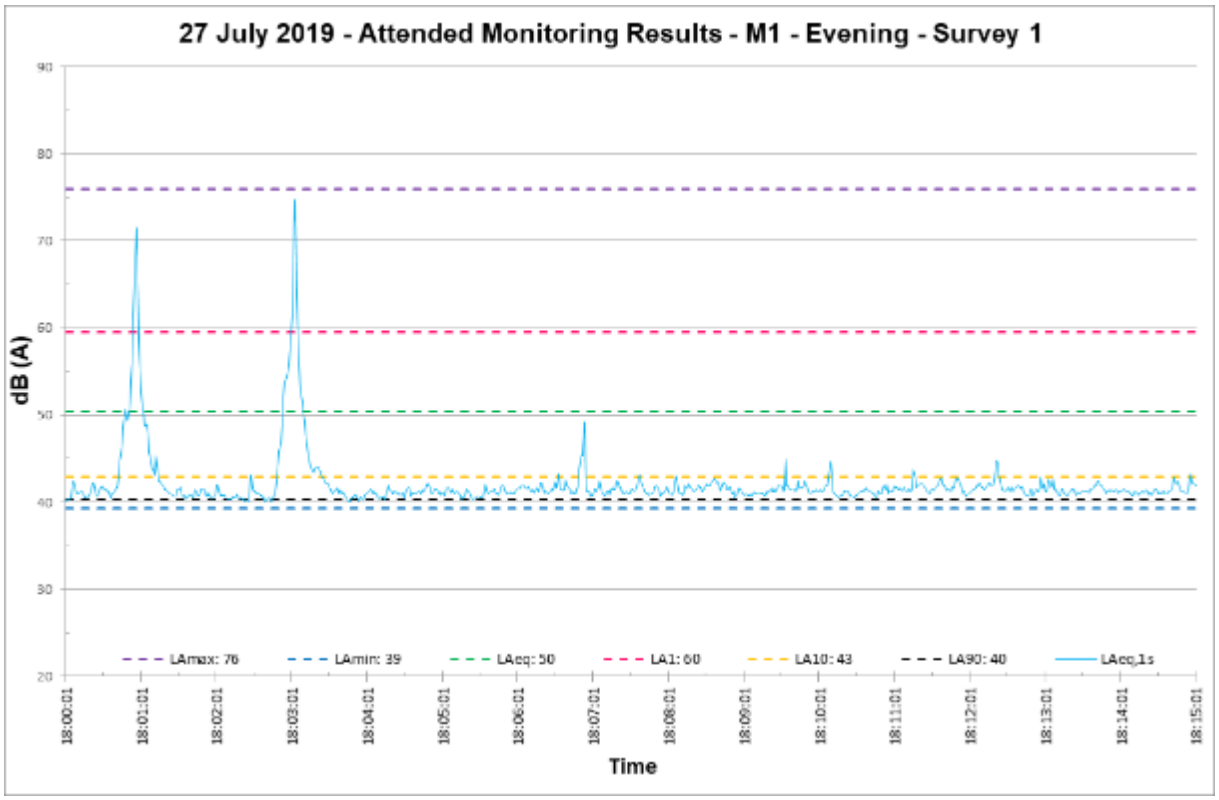

27 July 2019 - Attended Monitoring Results - M1 - Day - Survey 3
dB (A)
Time
LAmax: 71
LAmin: 36
LAeq: 47
LA1: 59
LA10: 49
LA90: 38
LAeq,1s

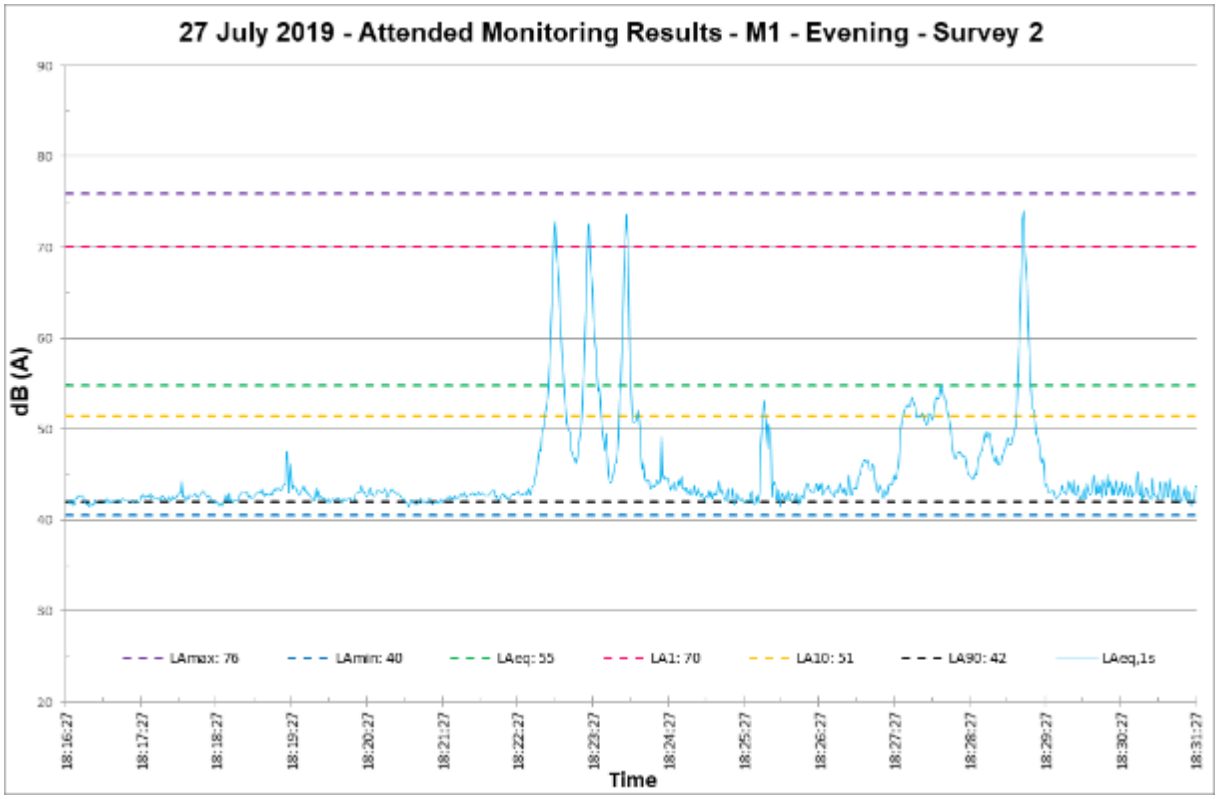

27 July 2019 - Attended Monitoring Results - M1 - Day - Survey 4
dB (A)
Time
LAmax: 70
LAmin: 36
LAeq: 50
LA1: 60
LA10: 53
LA90: 39
LAeq,1s


27 July 2019 - Attended Monitoring Results - M1 - Day - Survey 5
dB (A)
90
80
70
60
50
40
30
20
LAmax: 73
LAmin: 39
LAeq: 53
LA1: 62
LA10: 56
LA90: 44
LAeq,1s
16:44:13
16:45:13
16:46:13
16:47:13
16:48:13
16:49:13
16:50:13
16:51:13
16:52:13
16:53:13
16:54:13
16:55:13
16:56:13
16:57:13
16:58:13
16:59:13
Time

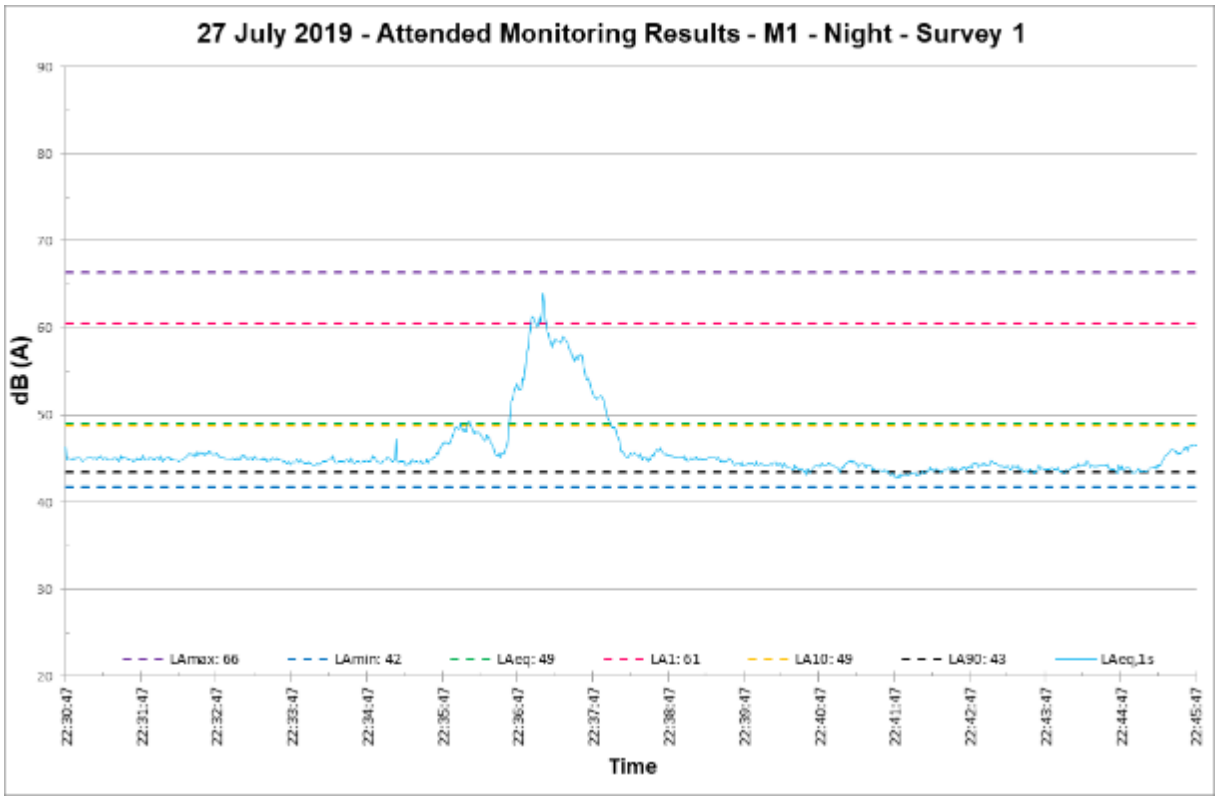

27 July 2019 - Attended Monitoring Results - M1 - Day - Survey 6
dB (A)
90
80
70
60
50
40
30
20
LAmax: 73
LAmin: 38
LAeq: 50
LA1: 62
LA10: 50
LA90: 40
LAeq,1s
17:02:27
17:03:27
17:04:27
17:05:27
17:06:27
17:07:27
17:08:27
17:09:27
17:10:27
17:11:27
17:12:27
17:13:27
17:14:27
17:15:27
17:16:27
17:17:27
Time

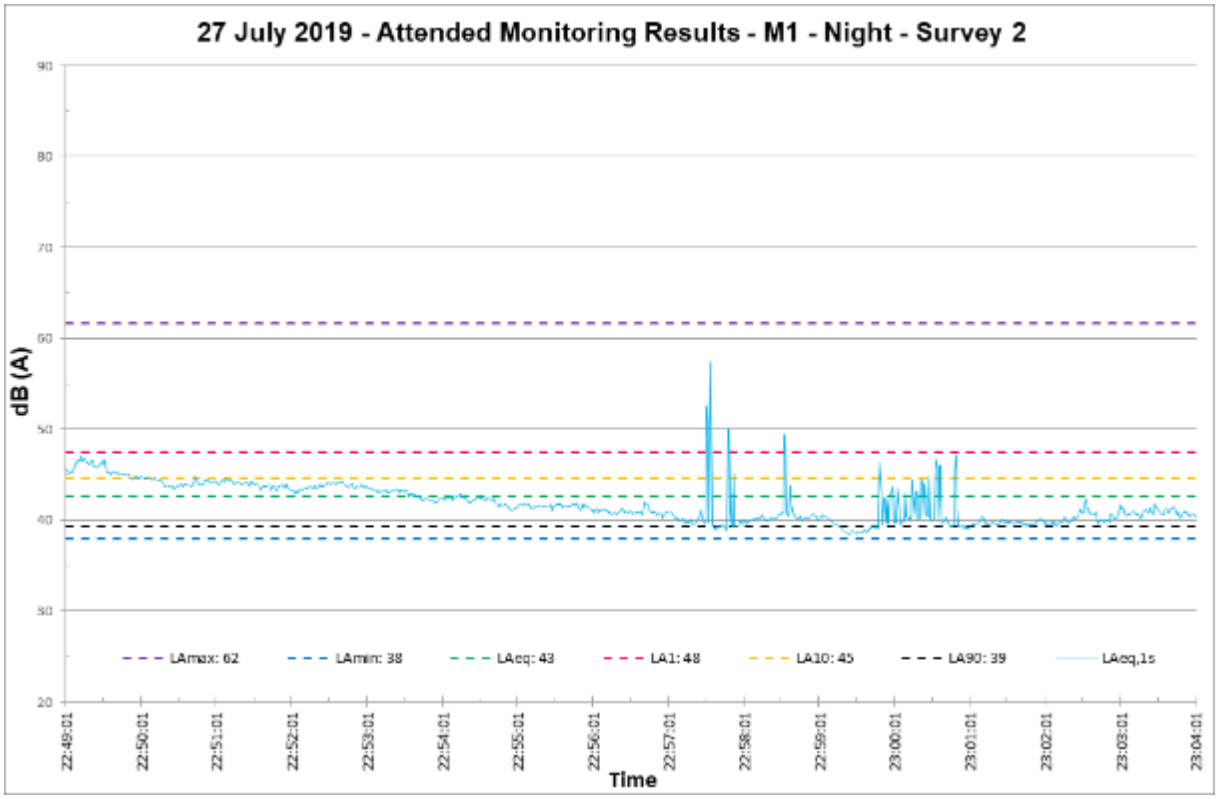
Evening – 27/07/2019

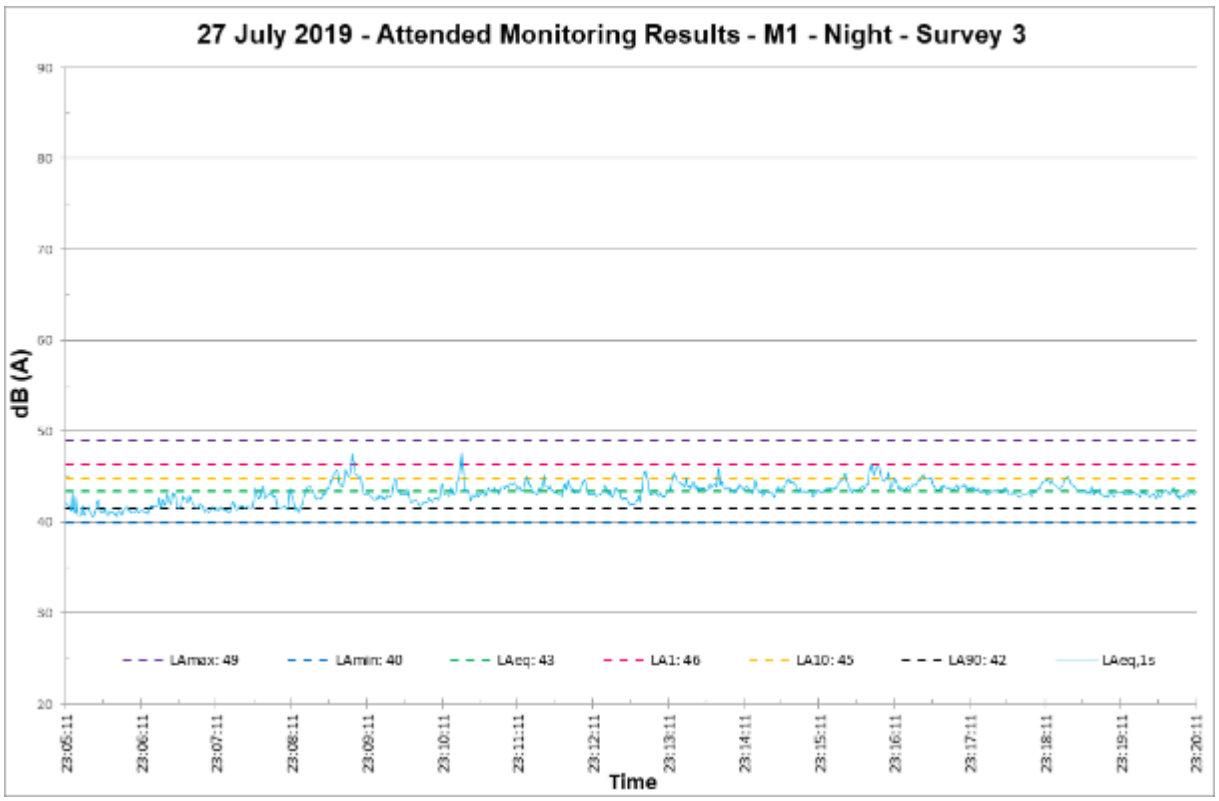


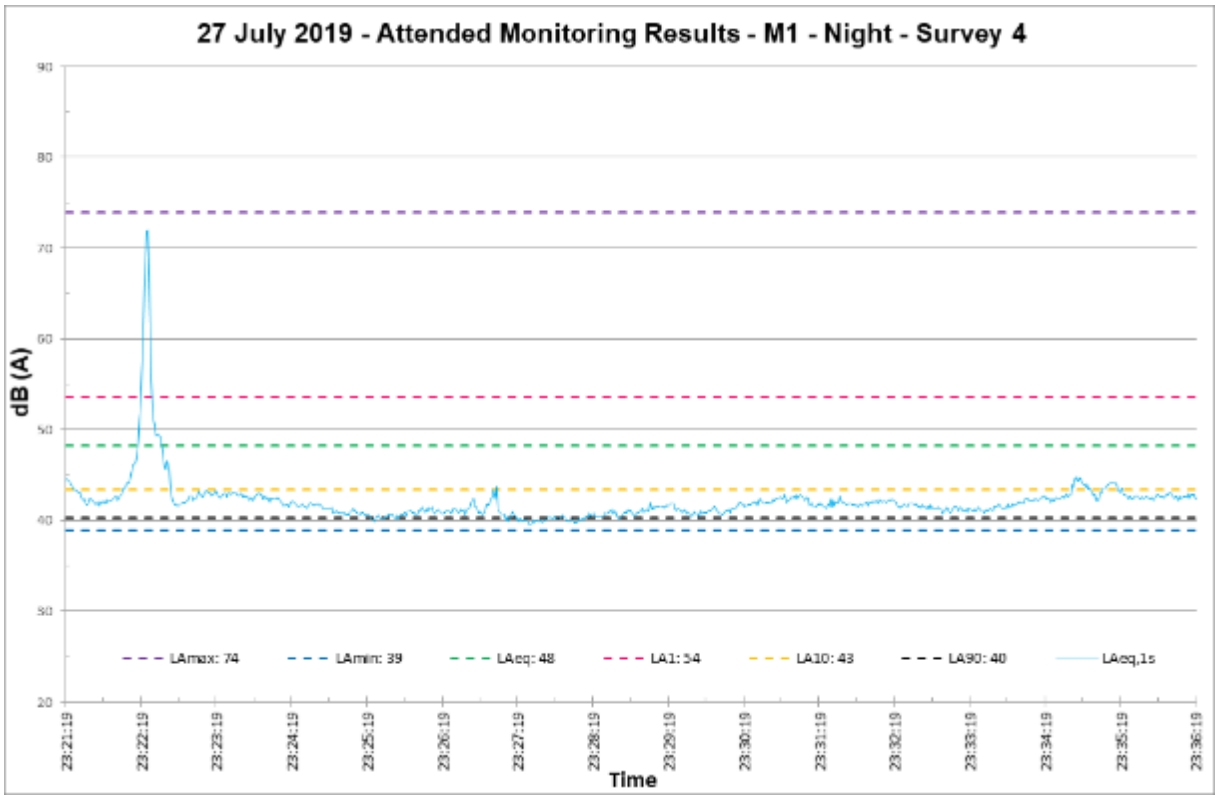


Night – 27/07/2019

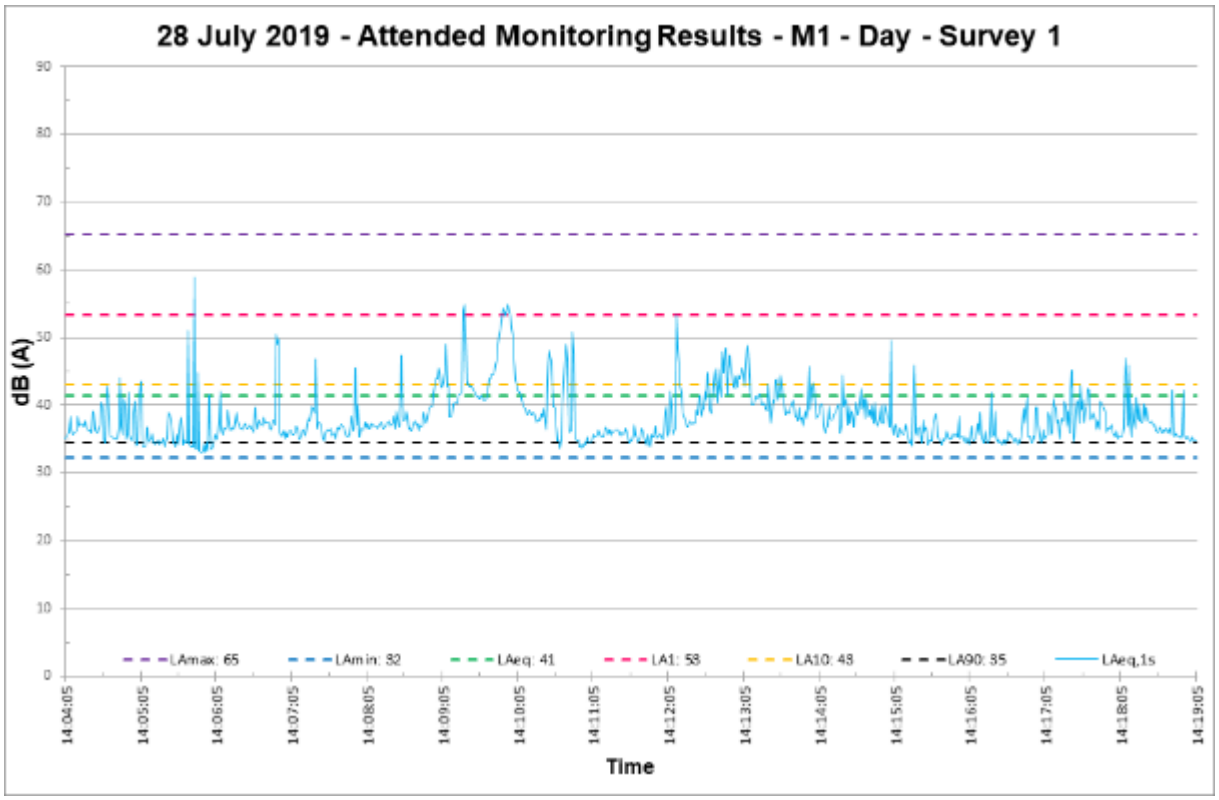


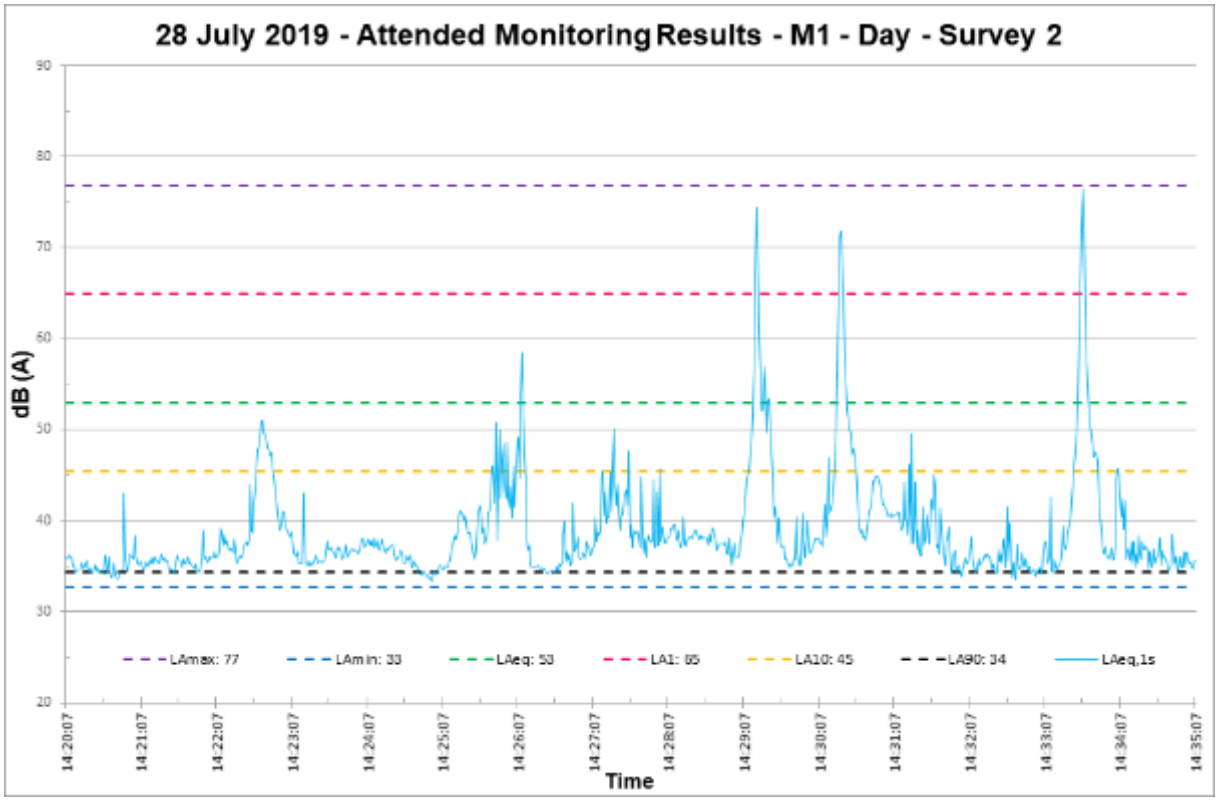


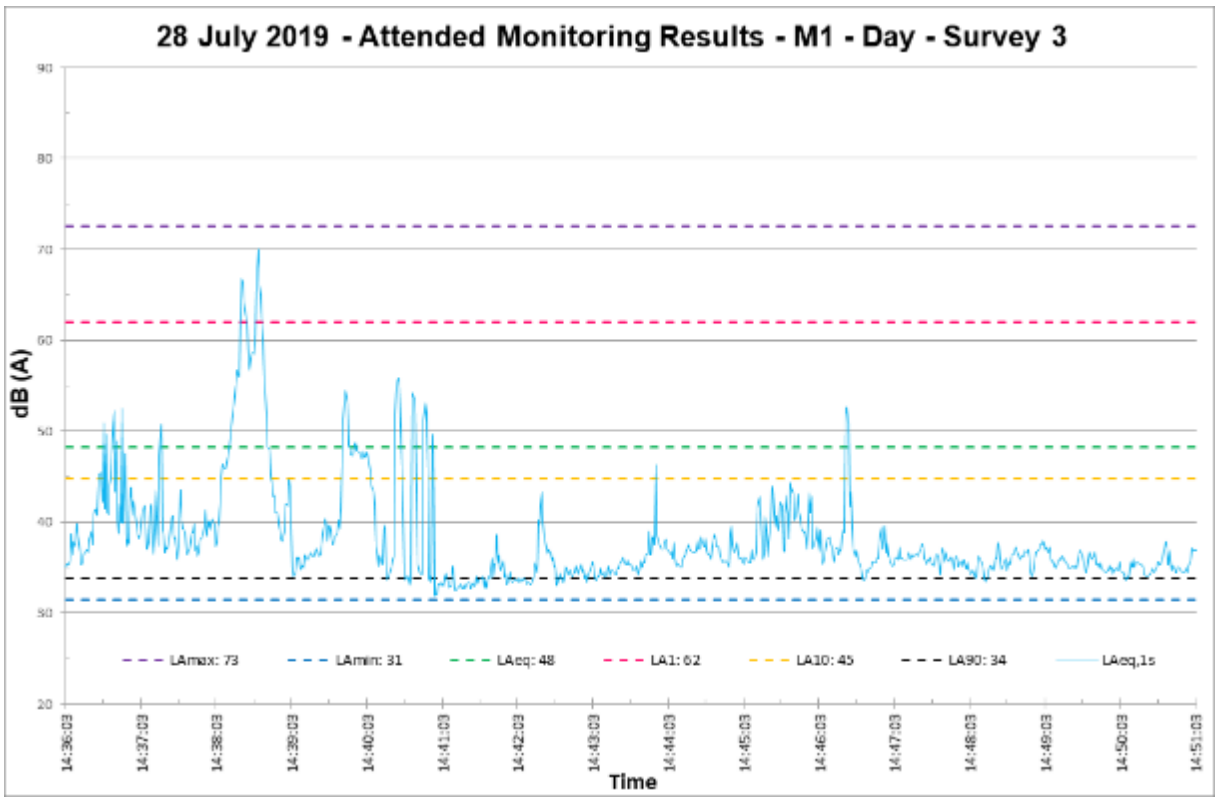

27 July 2019 - Attended Monitoring Results - M1 - Night - Survey 3
dB (A)
Time
LAmax: 49
LAmin: 40
LAeq: 43
LA1: 46
LA10: 45
LA90: 42
LAeq,1s

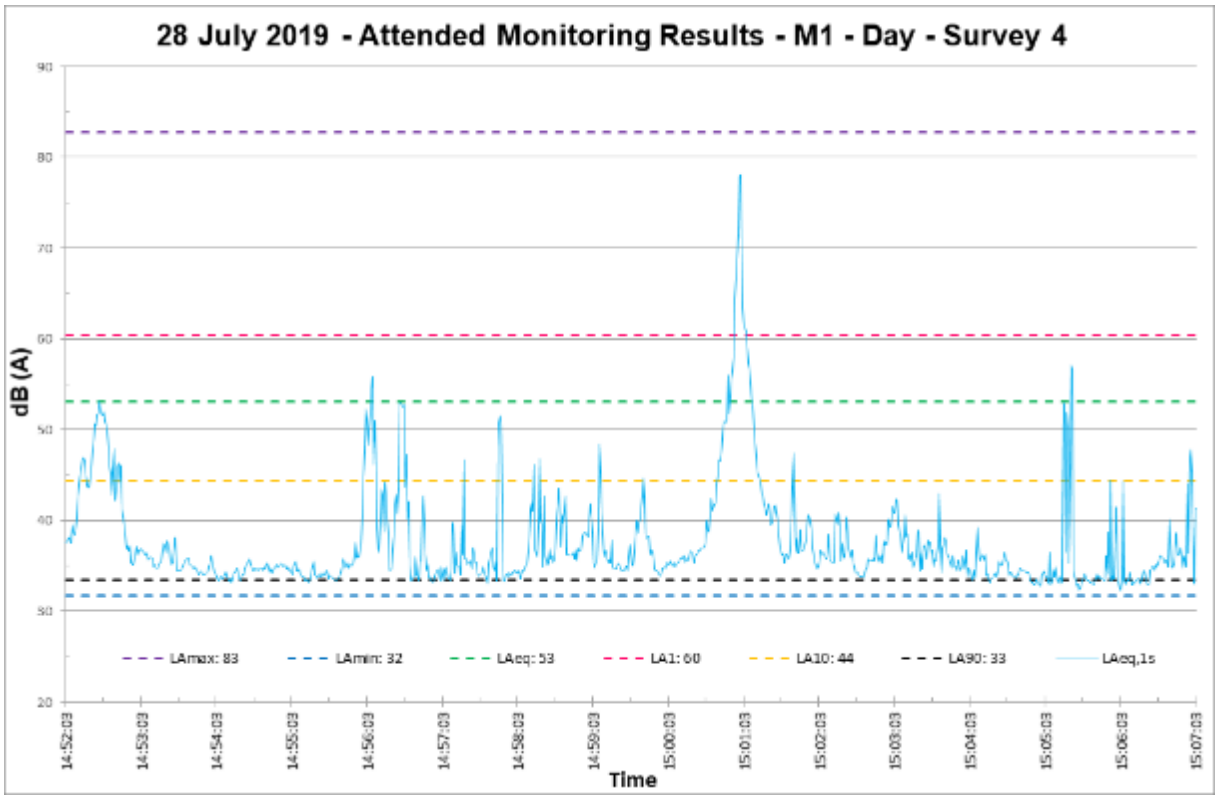

27 July 2019 - Attended Monitoring Results - M1 - Night - Survey 4
dB (A)
Time
LAmax: 74
LAmin: 39
LAeq: 48
LA1: 54
LA10: 43
LA90: 40
LAeq,1s

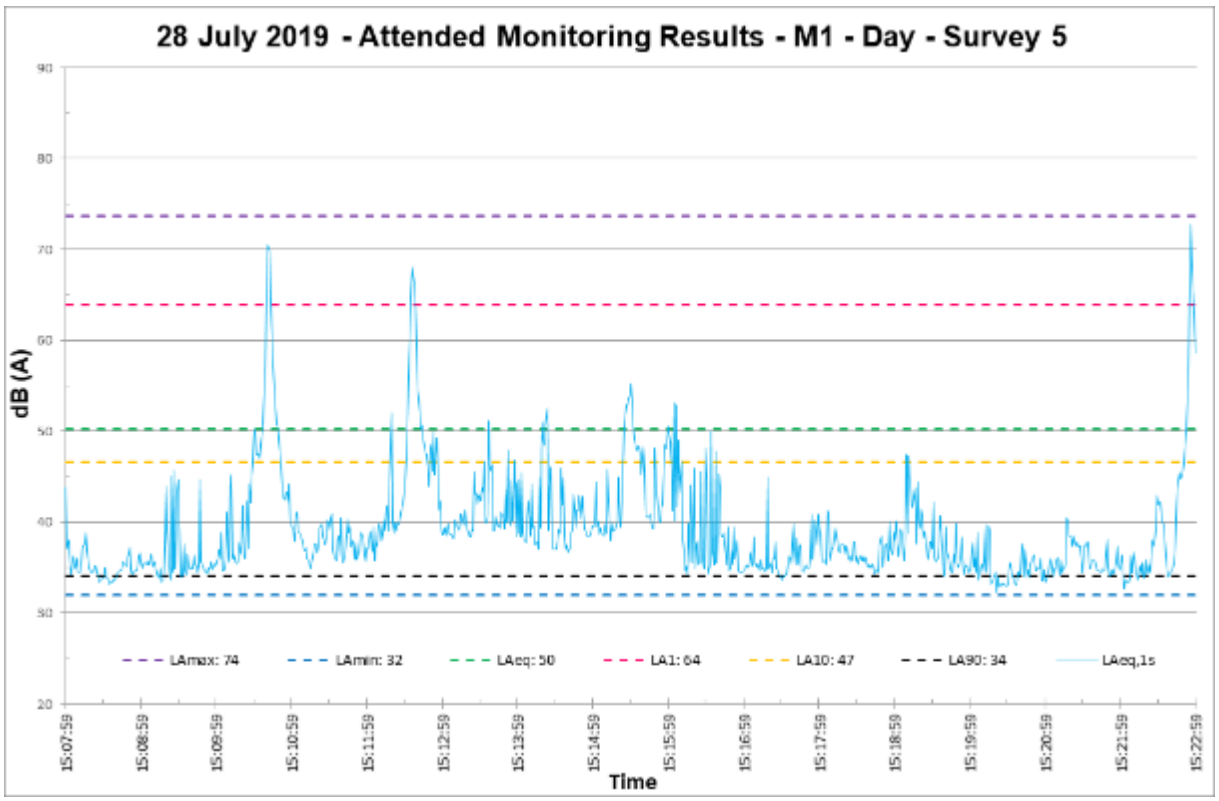
Day – 28/07/2019

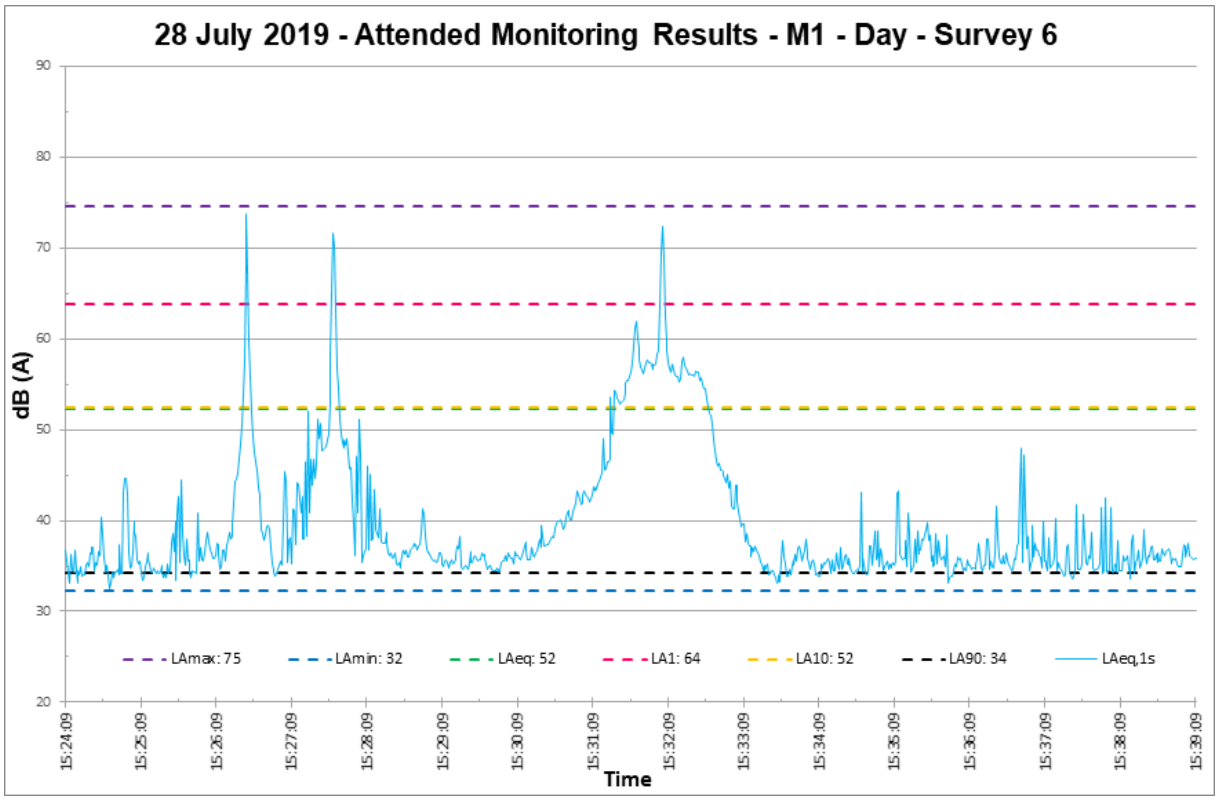




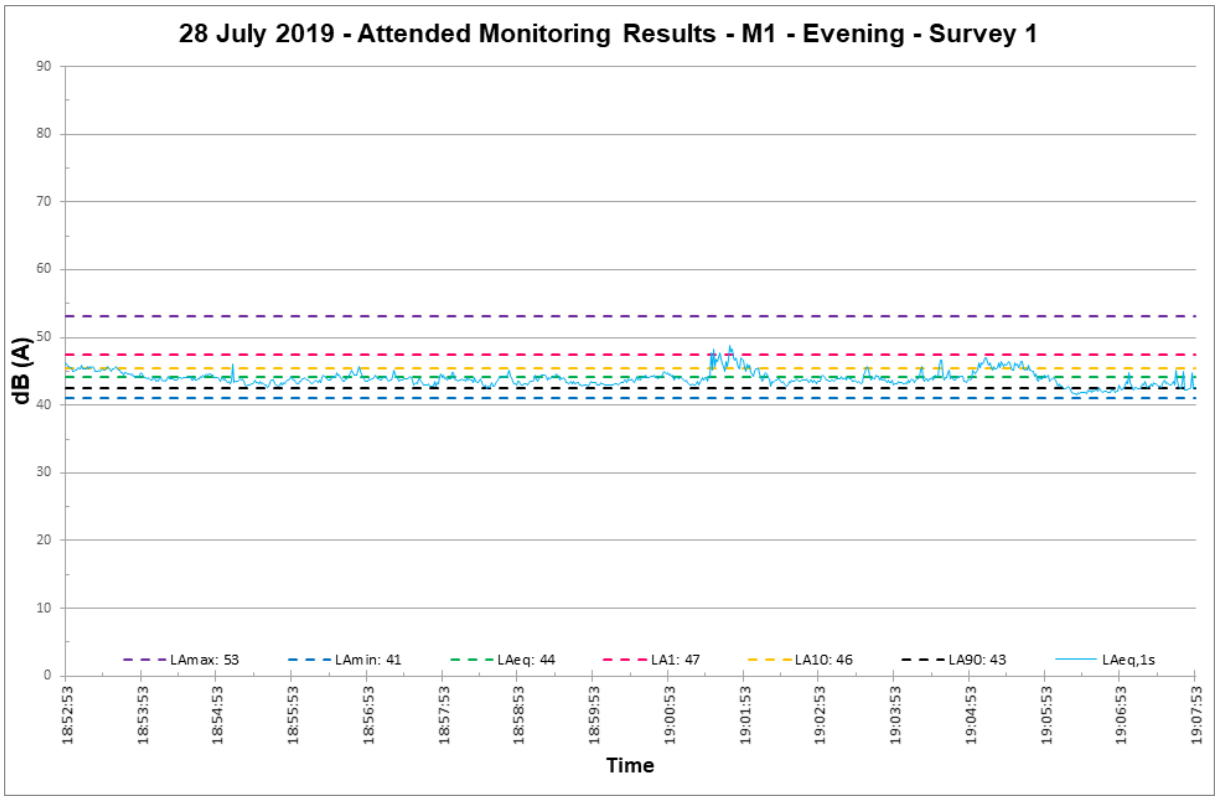

28 July 2019 - Attended Monitoring Results - M1 - Day - Survey 3
dB (A)
Time
LAmax: 73
LAmin: 31
LAeq: 48
LA1: 62
LA10: 45
LA90: 34
LAeq,1s

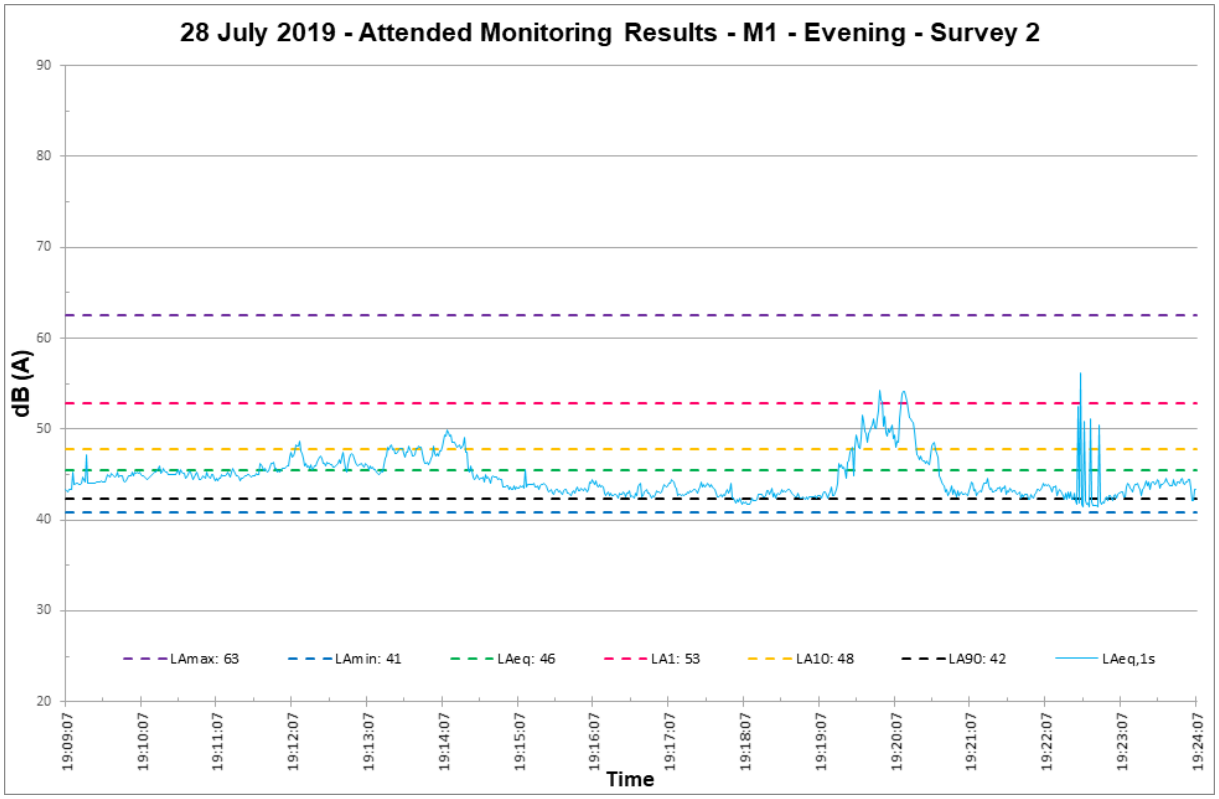

28 July 2019 - Attended Monitoring Results - M1 - Day - Survey 4
dB (A)
Time
LAmax: 83
LAmin: 32
LAeq: 53
LA1: 60
LA10: 44
LA90: 33
LAeq,1s


28 July 2019 - Attended Monitoring Results - M1 - Day - Survey 5
dB (A)
Time
LAmax: 74
LAmin: 32
LAeq: 50
LA1: 64
LA10: 47
LA90: 34
LAeq,1s

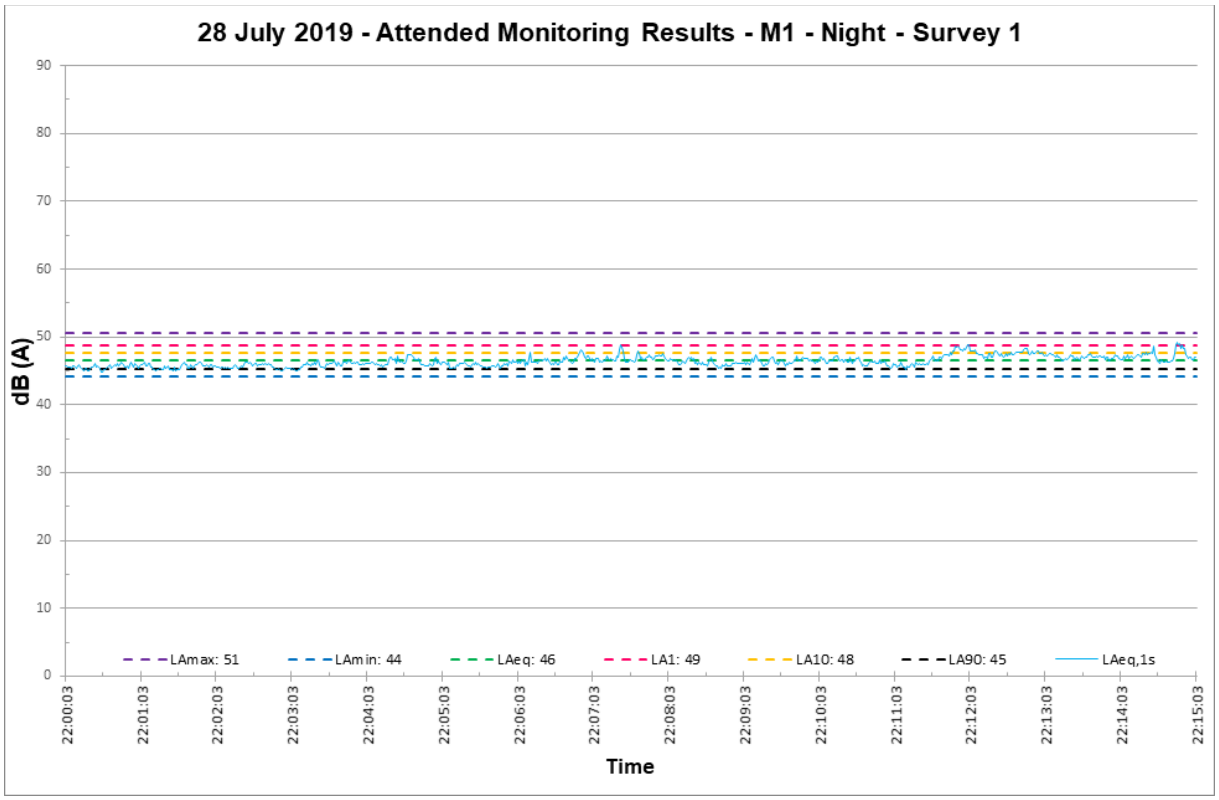

28 July 2019 - Attended Monitoring Results - M1 - Day - Survey 6
dB (A)
Time
LAmax: 75
LAmin: 32
LAeq: 52
LA1: 64
LA10: 52
LA90: 34
LAeq,1s

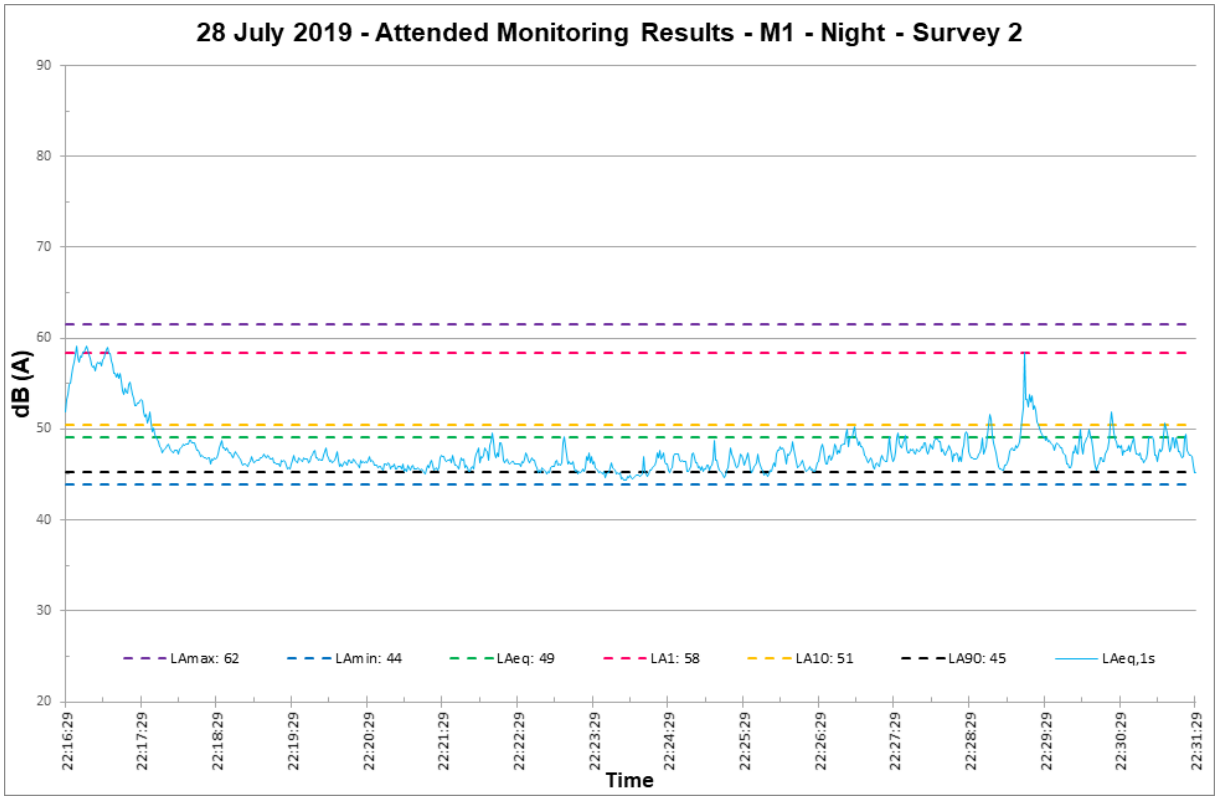
Evening – 28/07/2019

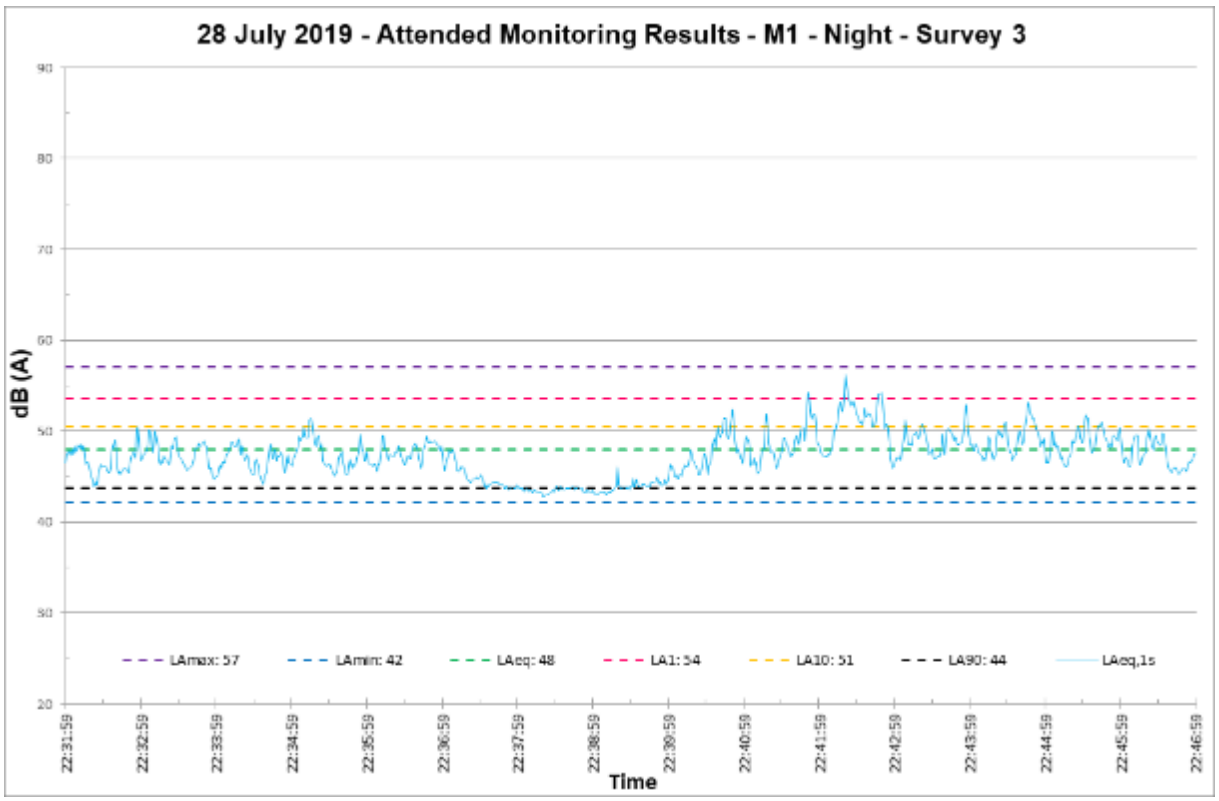


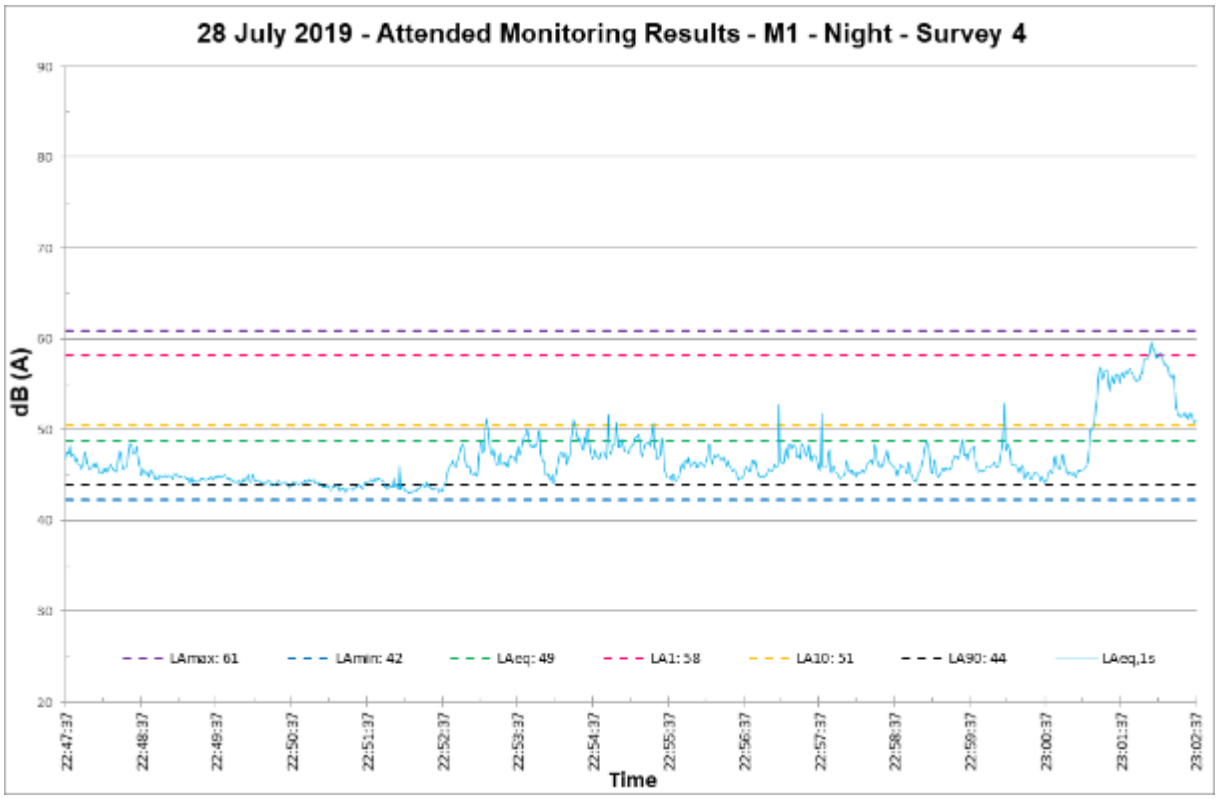


Night – 28/07/2019



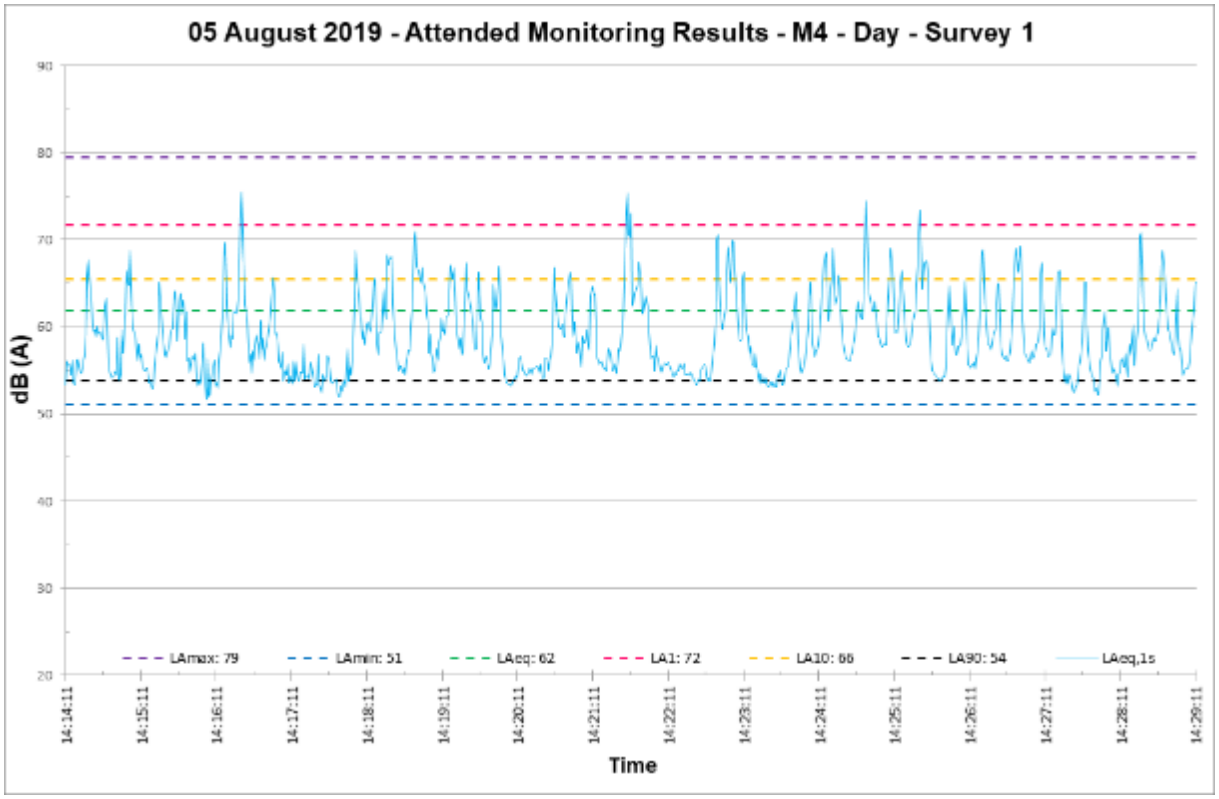


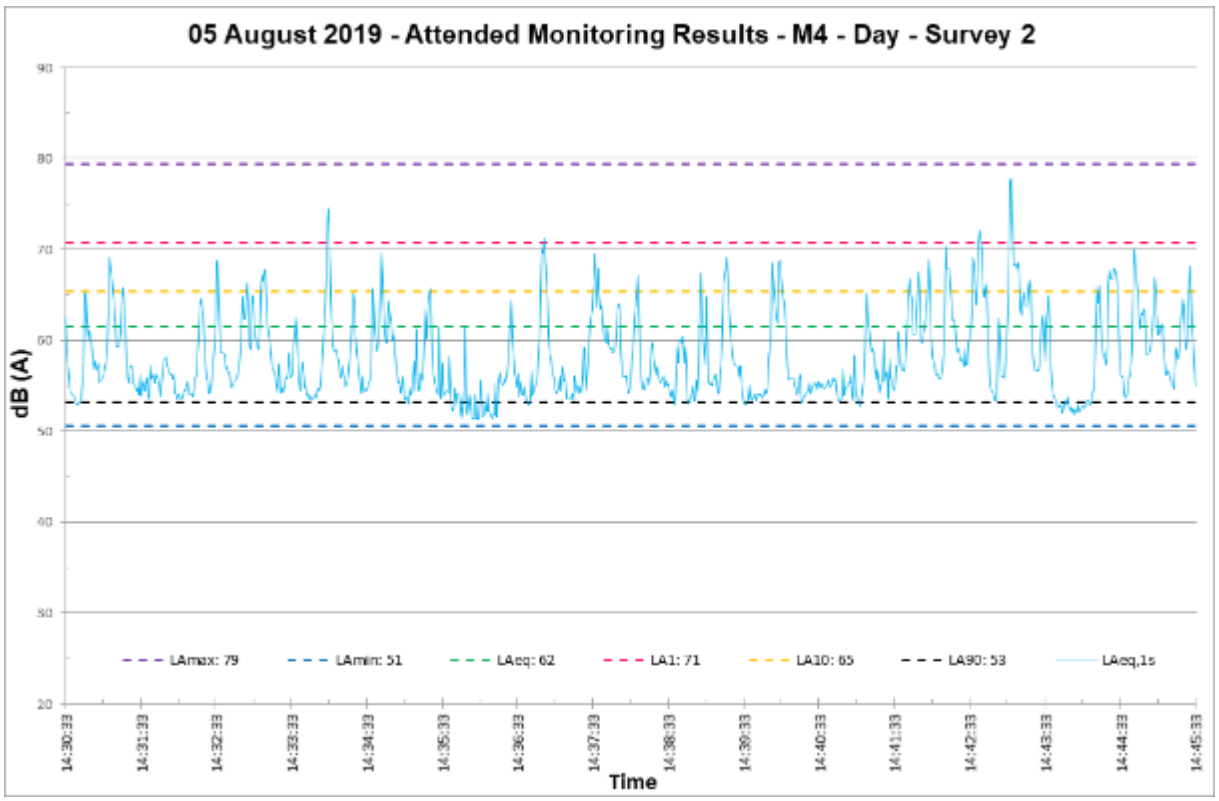

28 July 2019 - Attended Monitoring Results - M1 - Night - Survey 3
dB (A)
90
80
70
60
50
40
30
20
LAmax: 57
LAmin: 42
LAeq: 48
LA1: 54
LA10: 51
LA90: 44
LAeq,1s
22:31:59
22:32:59
22:33:59
22:34:59
22:35:59
22:36:59
22:37:59
22:38:59
22:39:59
22:40:59
22:41:59
22:42:59
22:43:59
22:44:59
22:45:59
22:46:59
Time

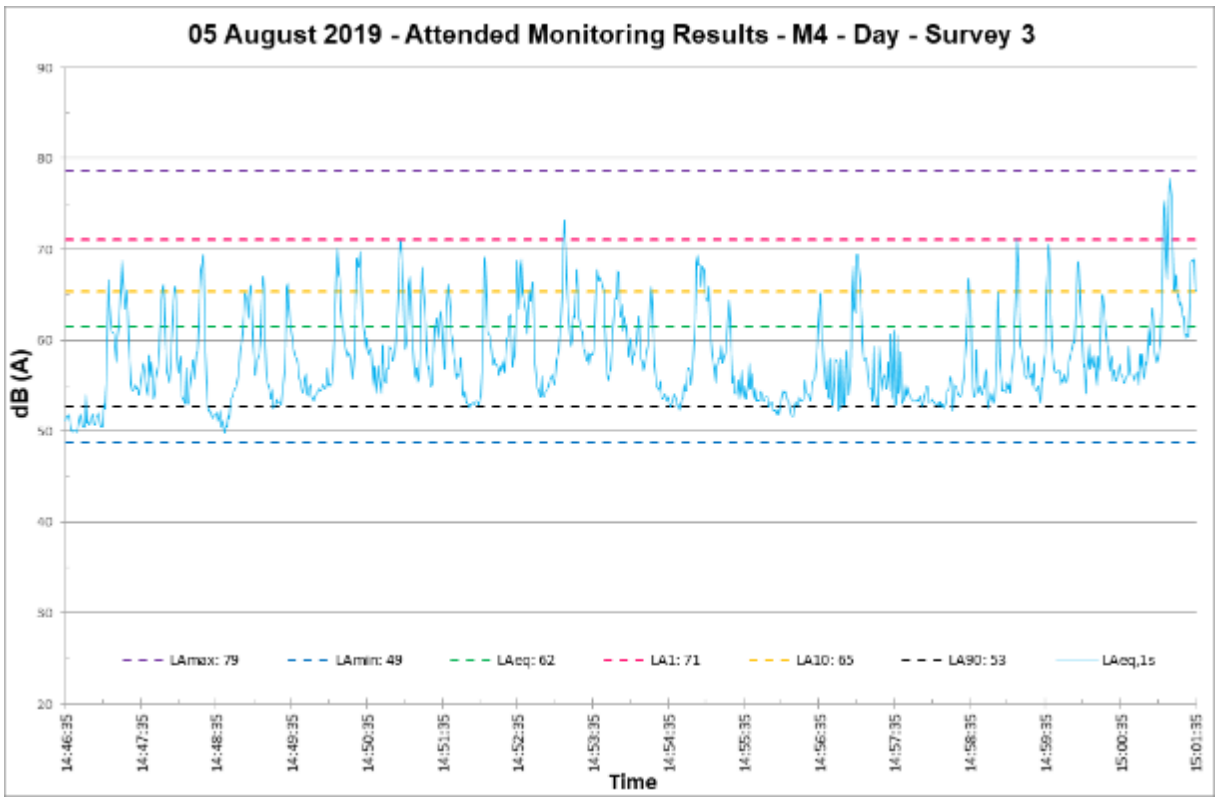

28 July 2019 - Attended Monitoring Results - M1 - Night - Survey 4
dB (A)
90
80
70
60
50
40
30
20
LAmax: 61
LAmin: 42
LAeq: 49
LA1: 58
LA10: 51
LA90: 44
LAeq,1s
22:47:37
22:48:37
22:49:37
22:50:37
22:51:37
22:52:37
22:53:37
22:54:37
22:55:37
22:56:37
22:57:37
22:58:37
22:59:37
23:00:37
23:01:37
23:02:37
Time

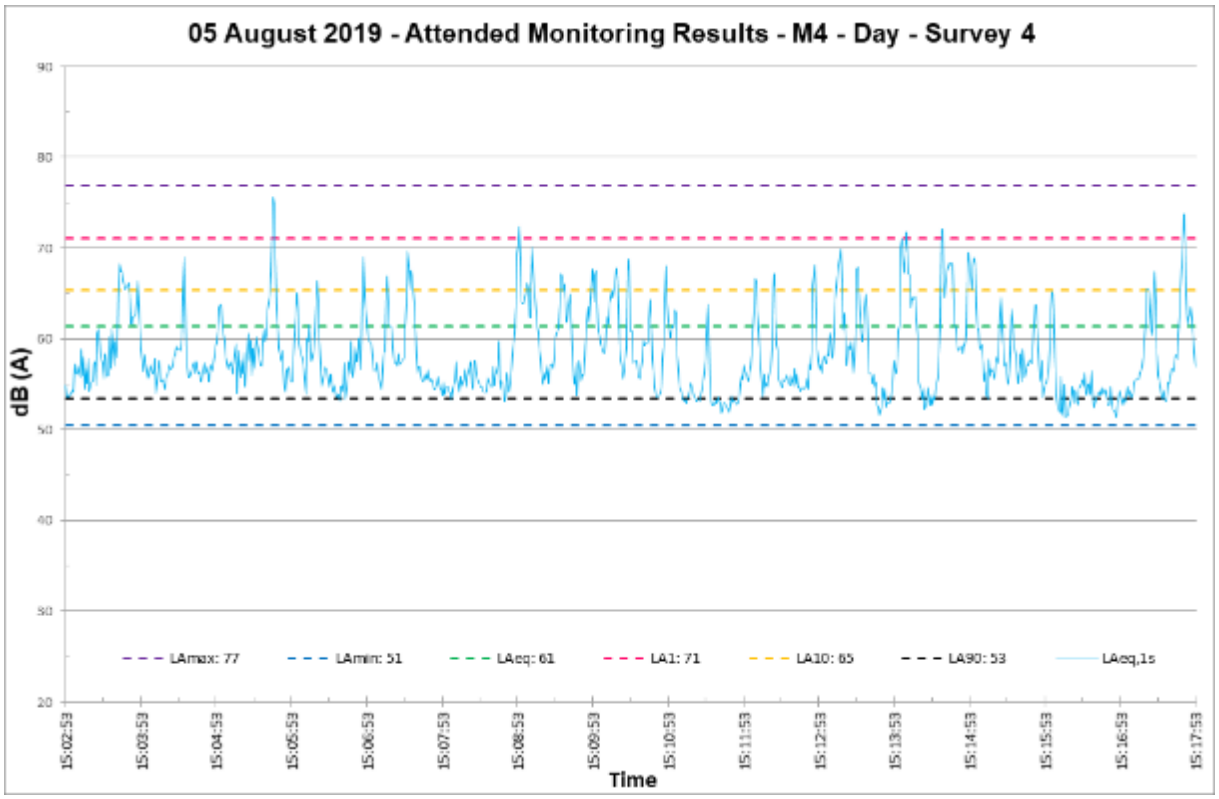
Appendix C – Operator attended noise monitoring results – Location M4

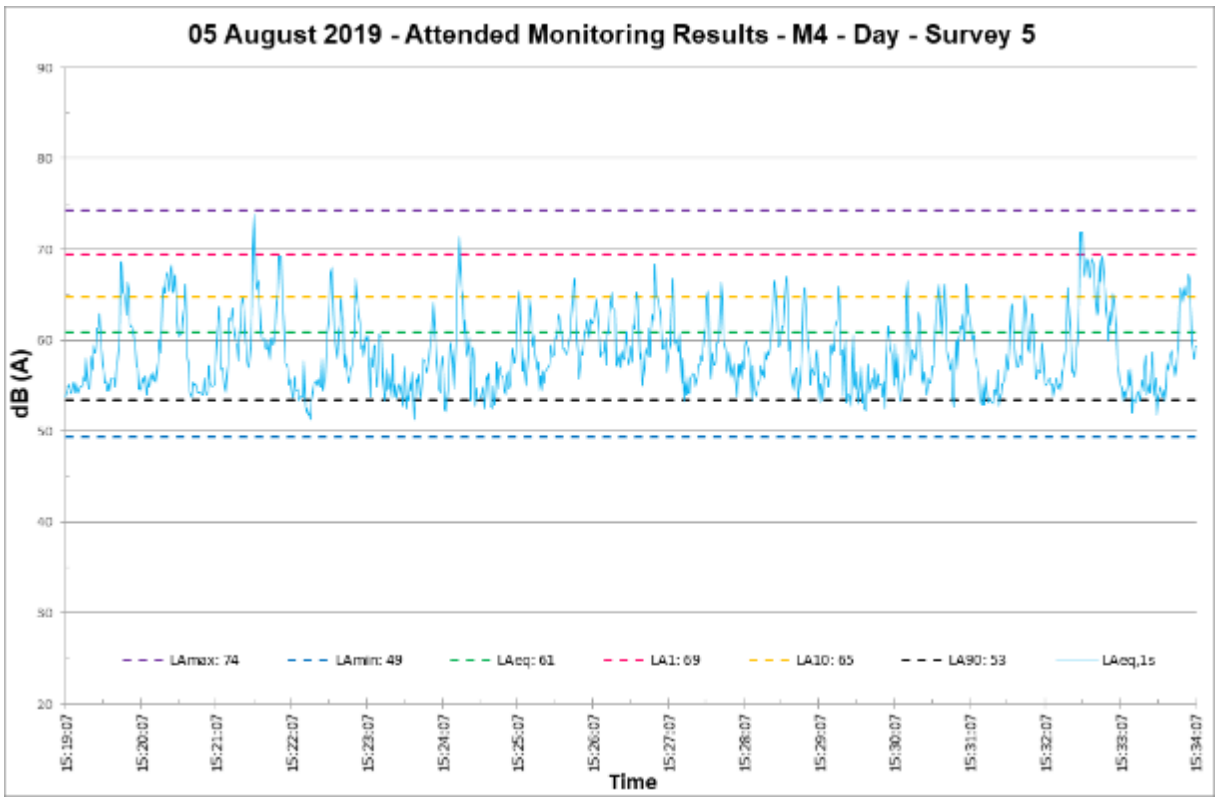
Day – 05/08/2019

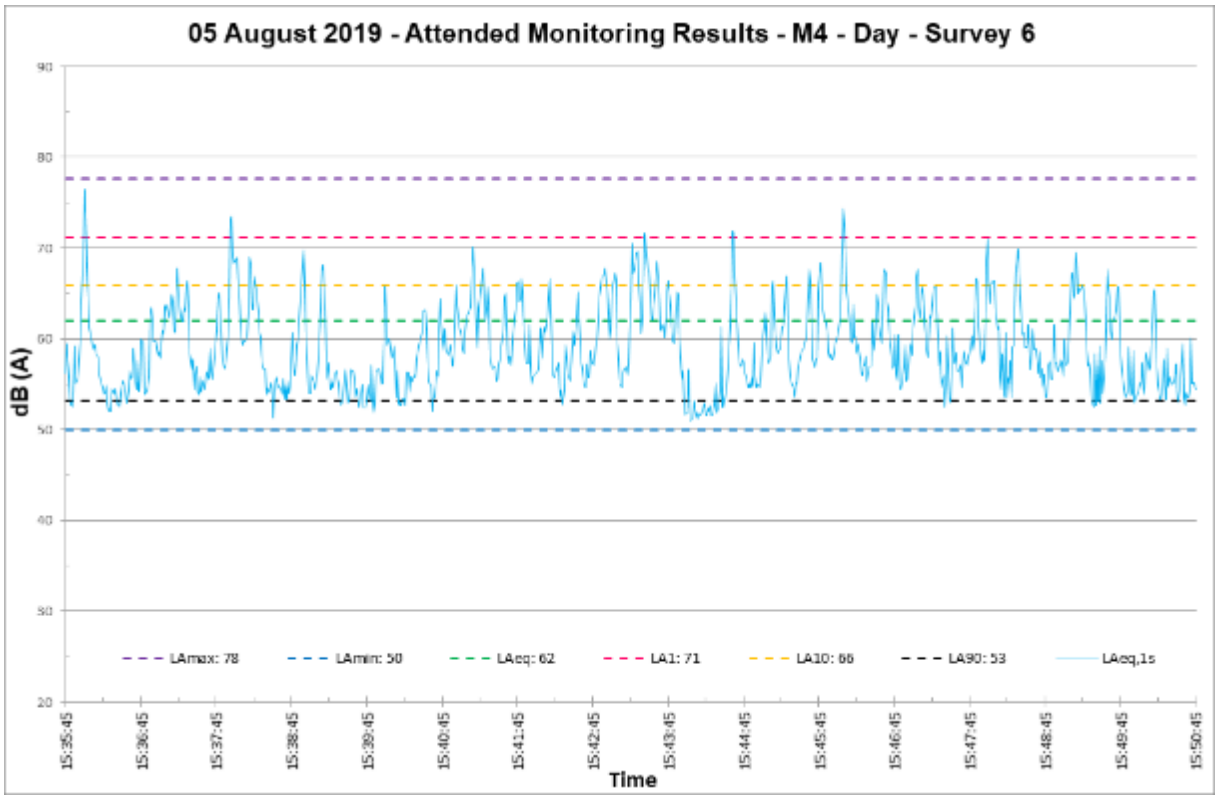




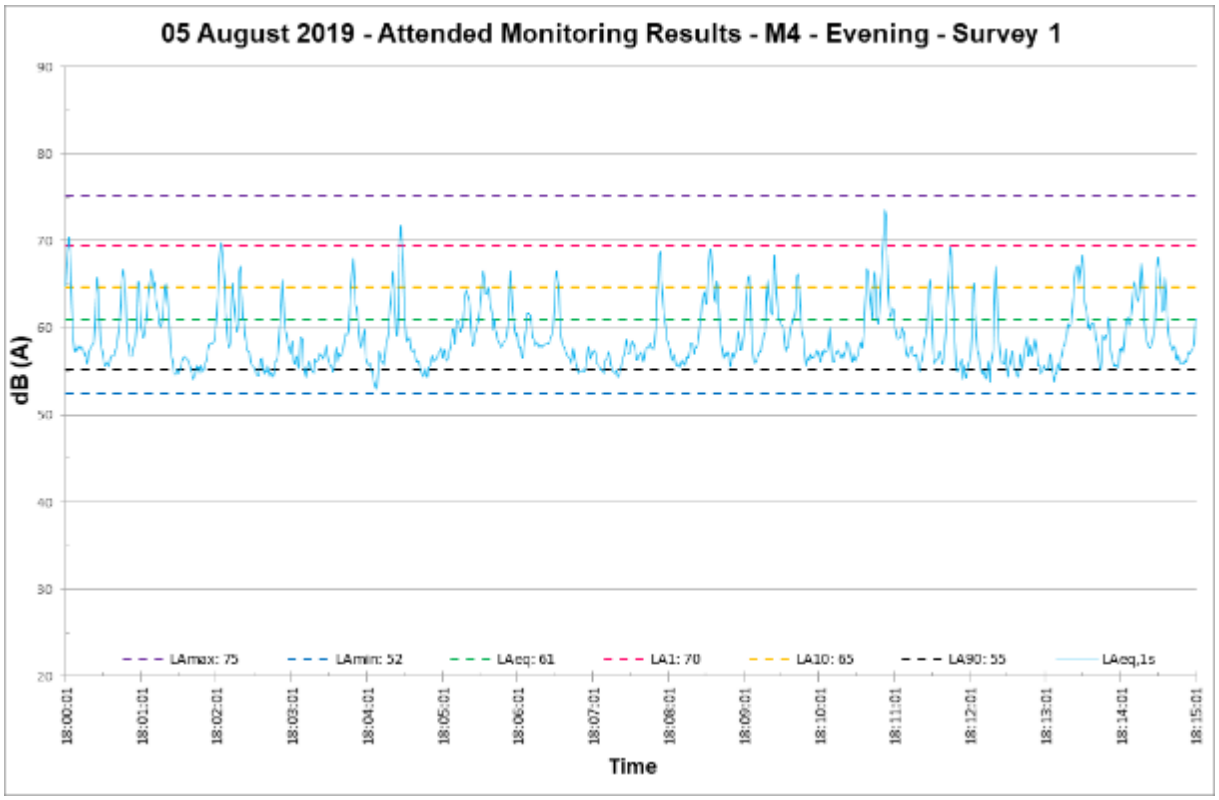

05 August 2019 - Attended Monitoring Results - M4 - Day - Survey 3
dB (A)
Time
LAmax: 79
LAmin: 49
LAeq: 62
LA1: 71
LA10: 65
LA90: 53
LAeq,1s

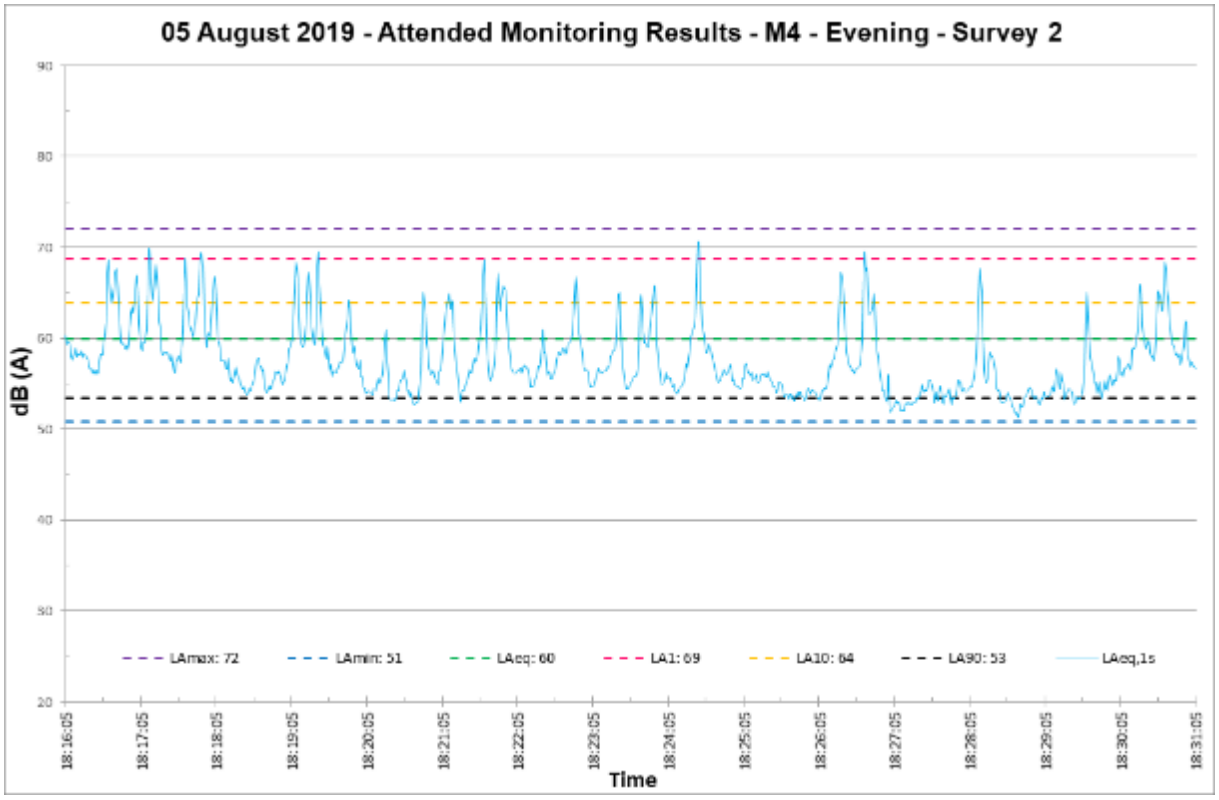

05 August 2019 - Attended Monitoring Results - M4 - Day - Survey 4
dB (A)
Time
LAmax: 77
LAmin: 51
LAeq: 61
LA1: 71
LA10: 65
LA90: 53
LAeq,1s


05 August 2019 - Attended Monitoring Results - M4 - Day - Survey 5
dB (A)
Time
LAmax: 74
LAmin: 49
LAeq: 61
LA1: 69
LA10: 65
LA90: 53
LAeq,1s

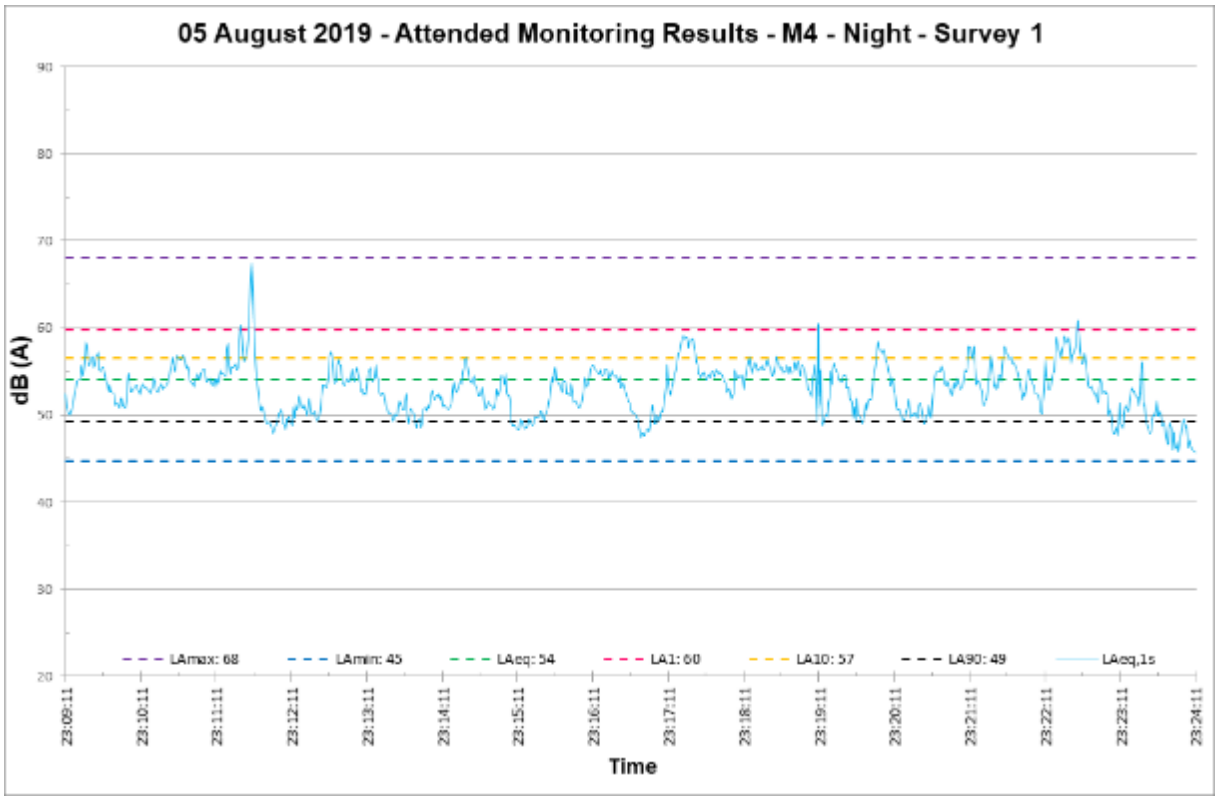

05 August 2019 - Attended Monitoring Results - M4 - Day - Survey 6
dB (A)
Time
LAmax: 78
LAmin: 50
LAeq: 62
LA1: 71
LA10: 66
LA90: 53
LAeq,1s

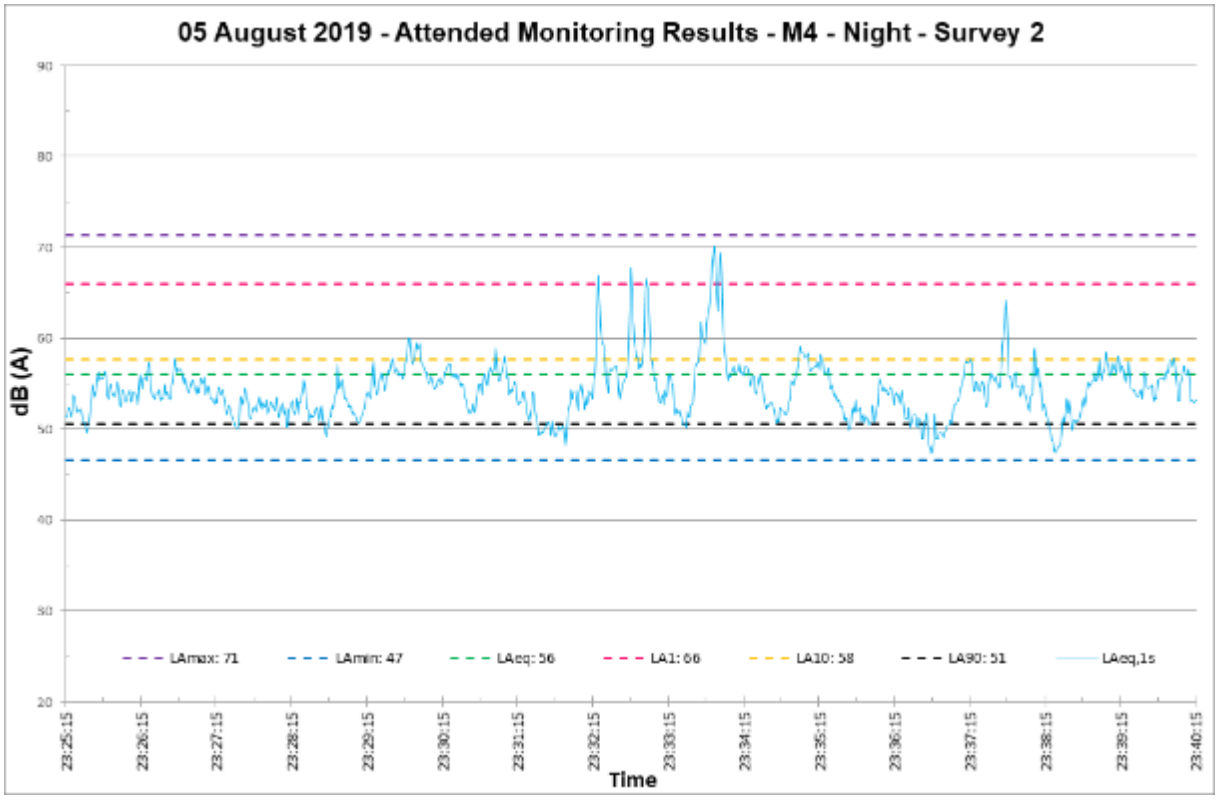
Evening – 05/08/2019

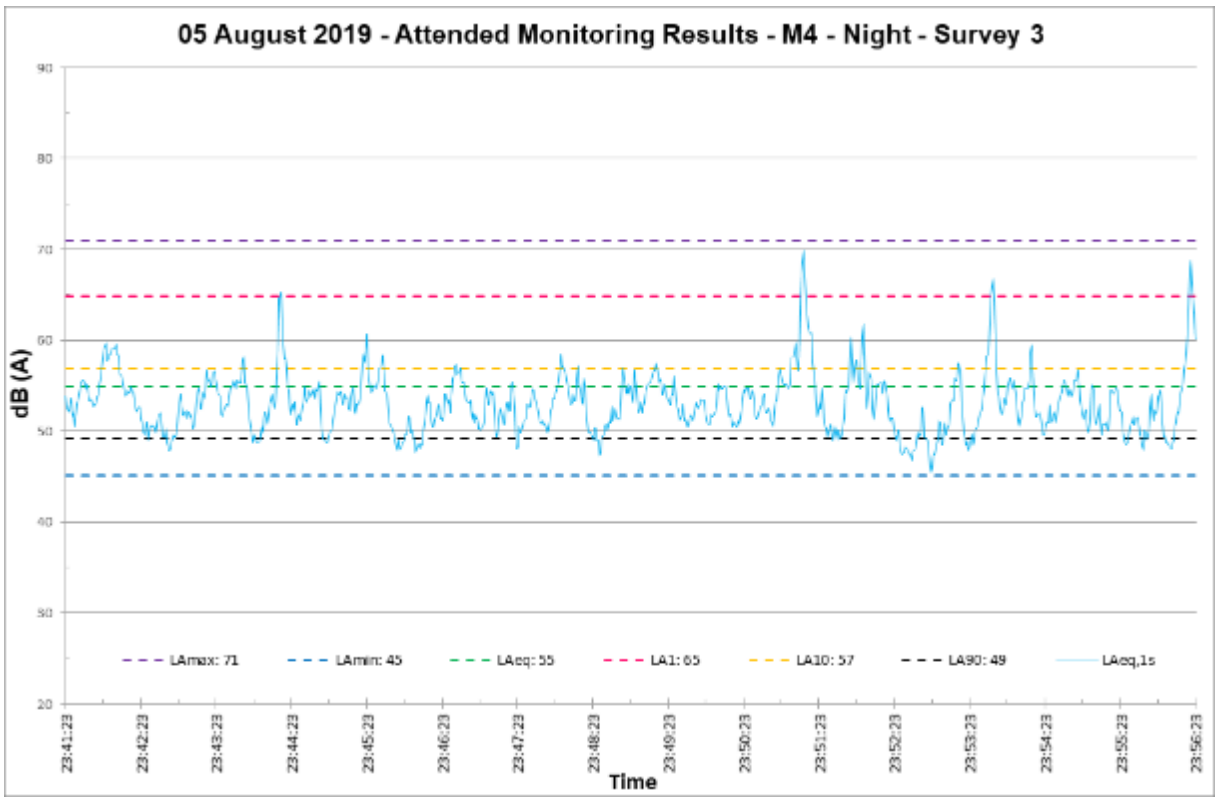


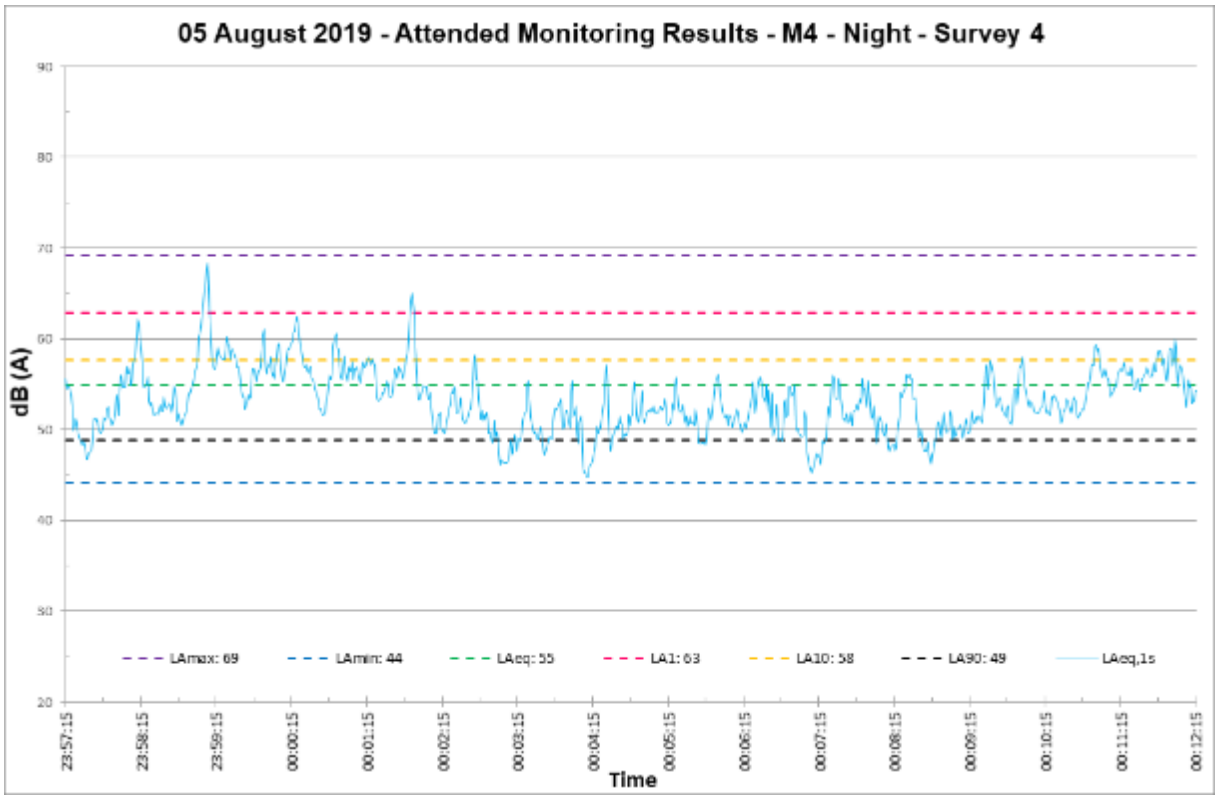


Night – 05/08/2019

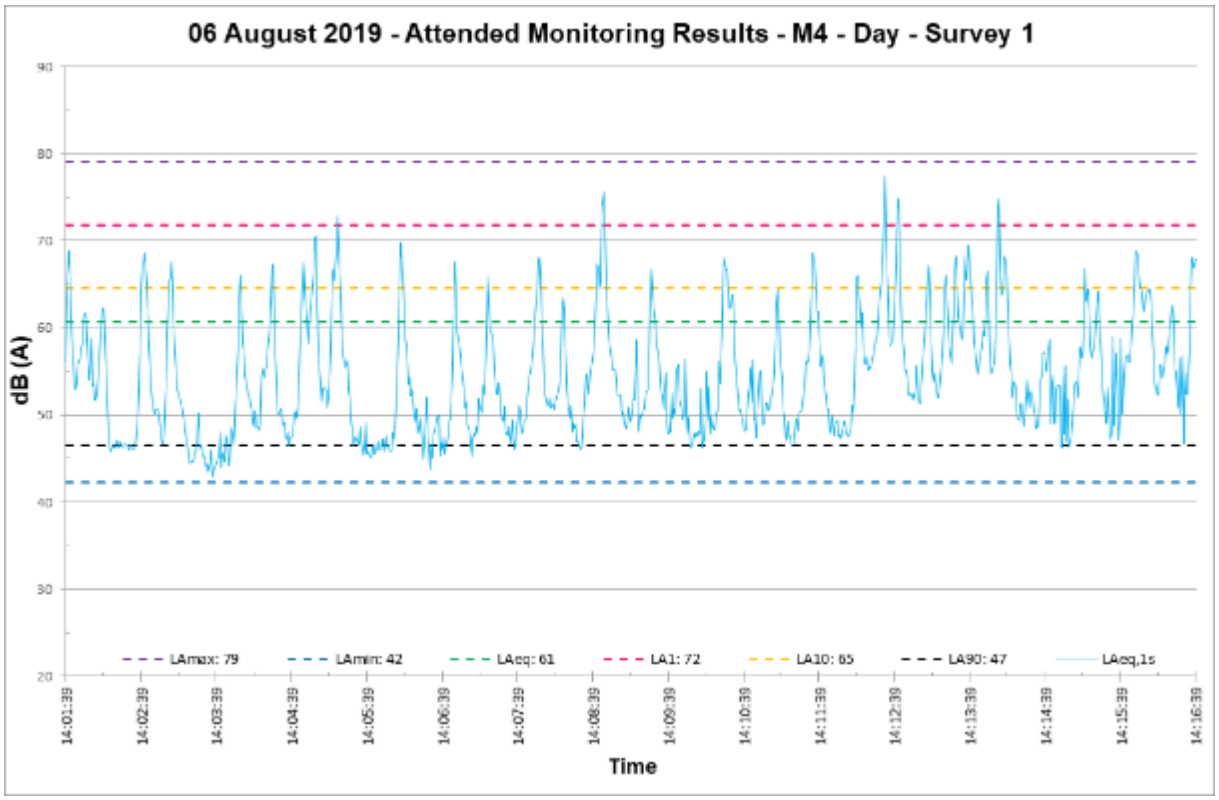


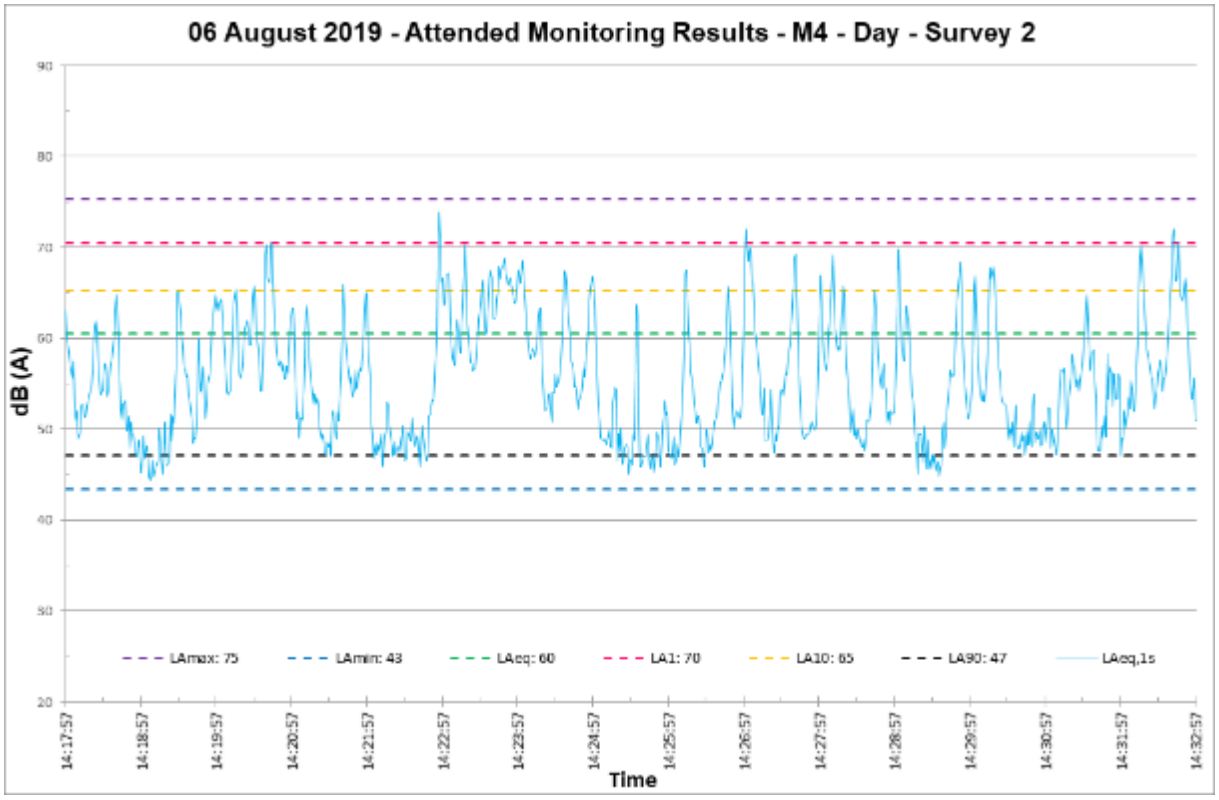


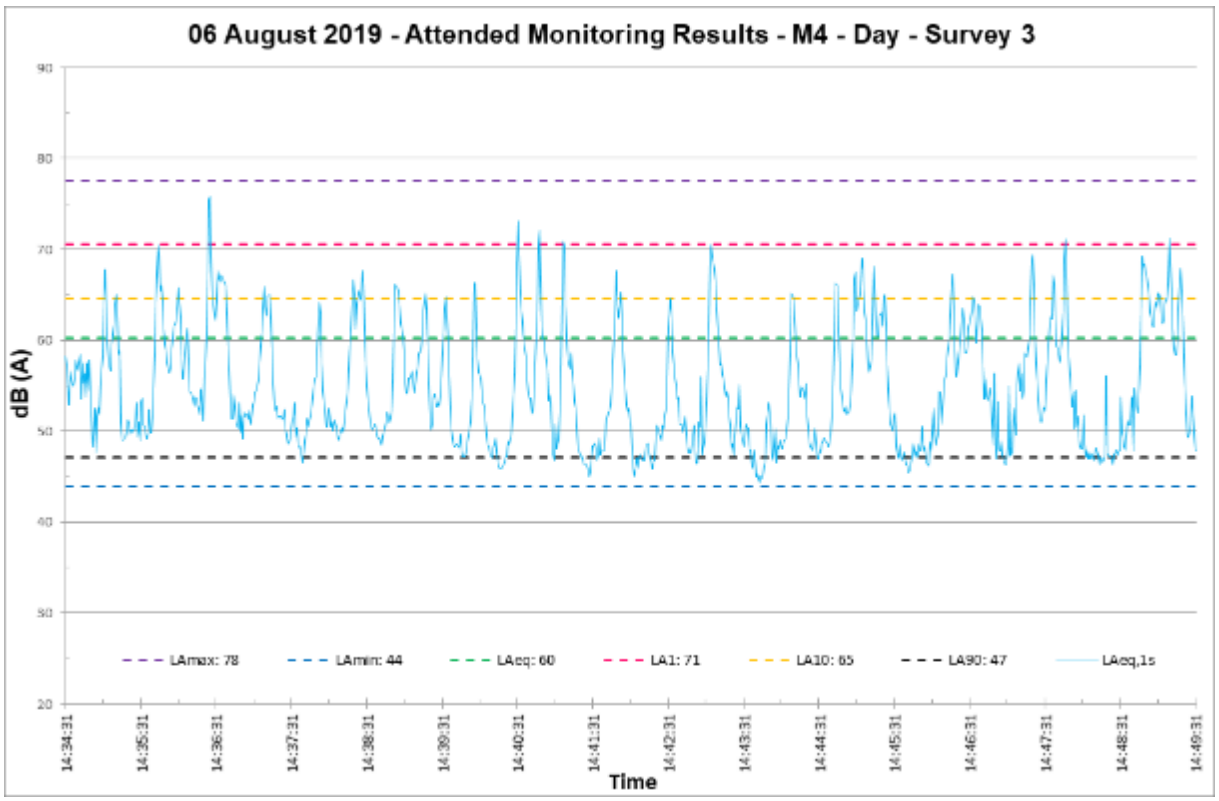

05 August 2019 - Attended Monitoring Results - M4 - Night - Survey 3
dB (A)
Time
LAmax: 71
LAmin: 45
LAeq: 55
LA1: 65
LA10: 57
LA90: 49
LAeq,1s

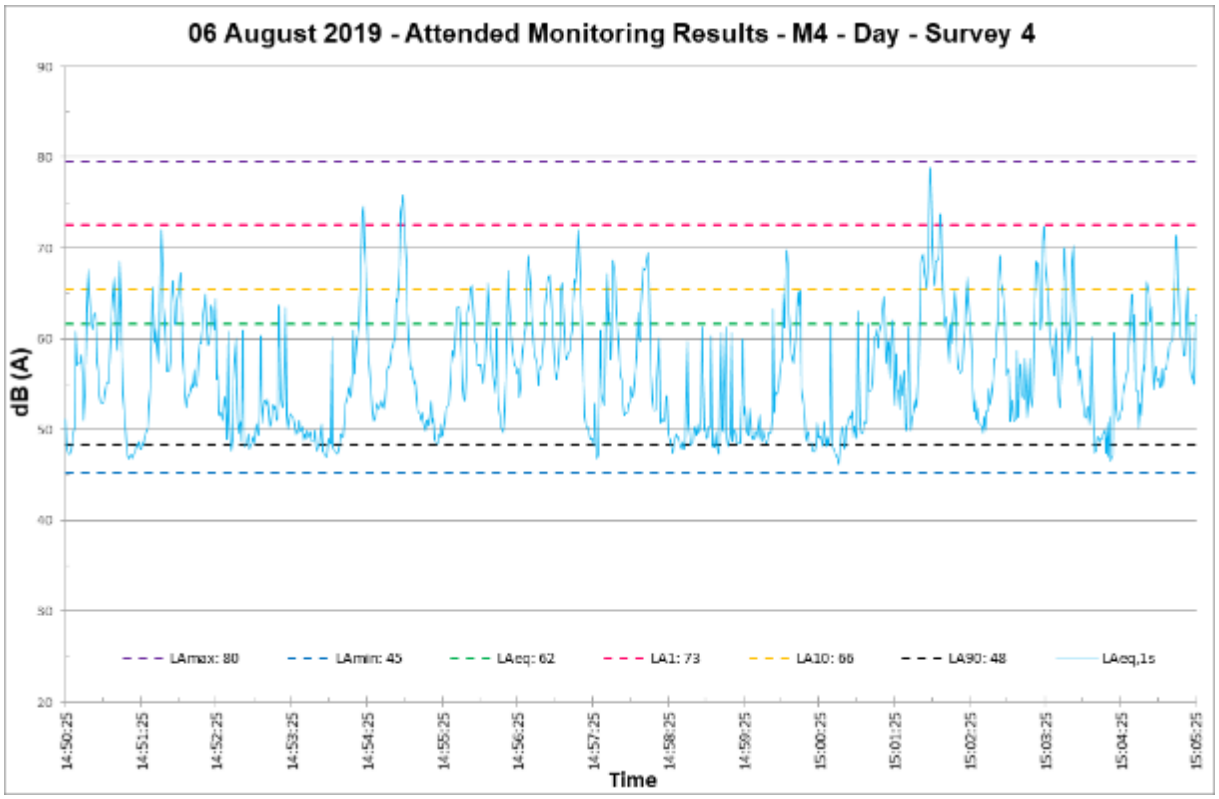

05 August 2019 - Attended Monitoring Results - M4 - Night - Survey 4
dB (A)
Time
LAmax: 69
LAmin: 44
LAeq: 55
LA1: 63
LA10: 58
LA90: 49
LAeq,1s

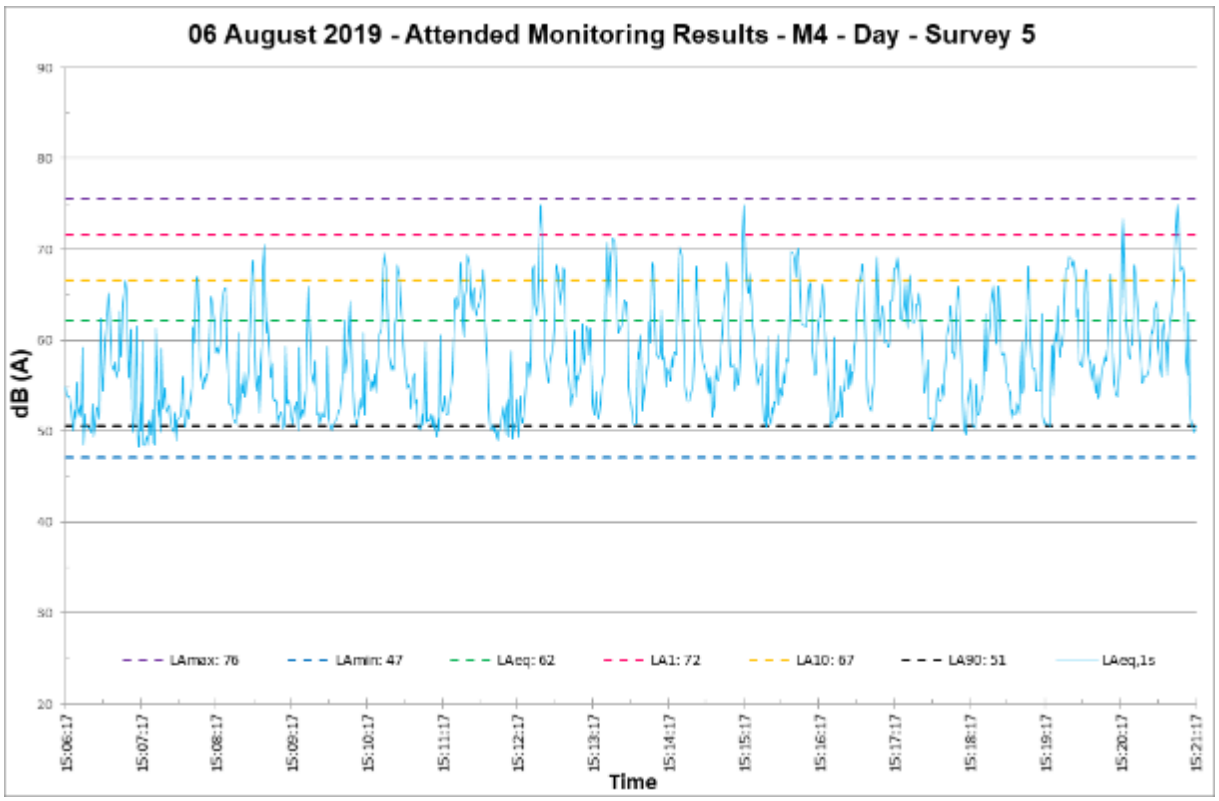
Day – 06/08/2019

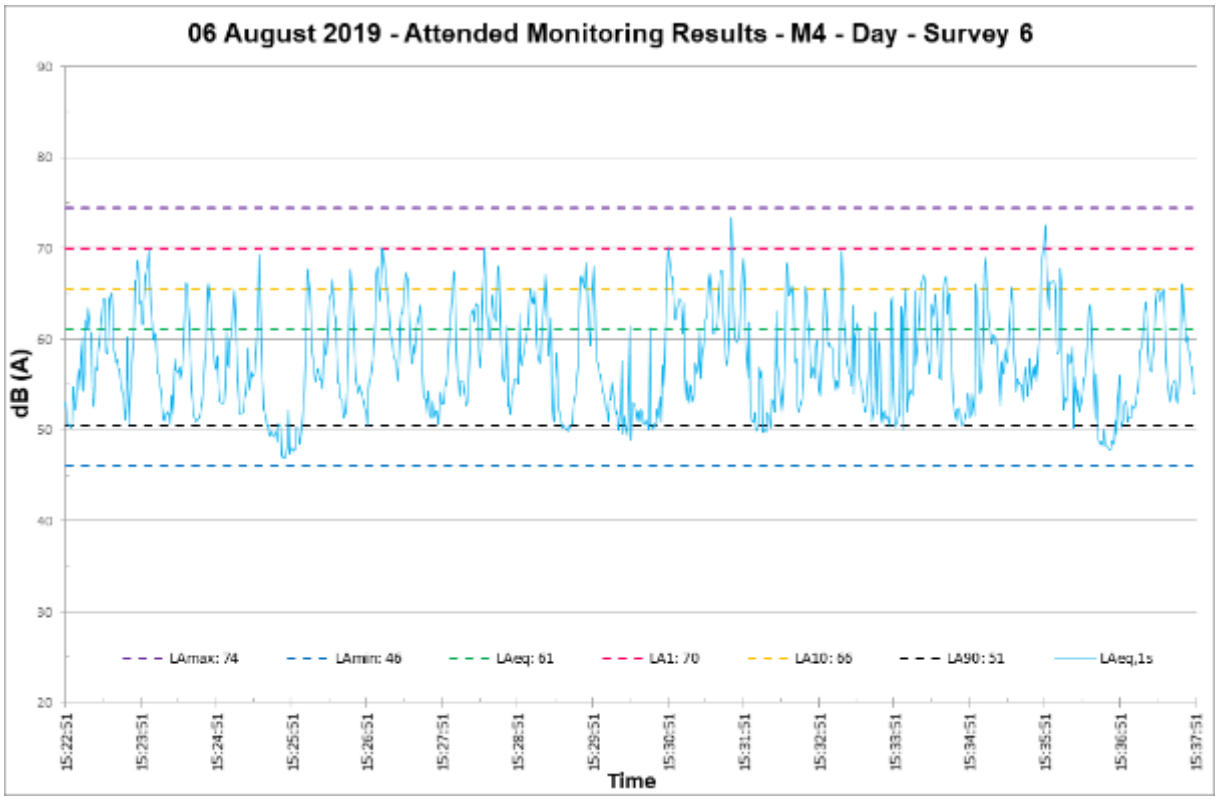




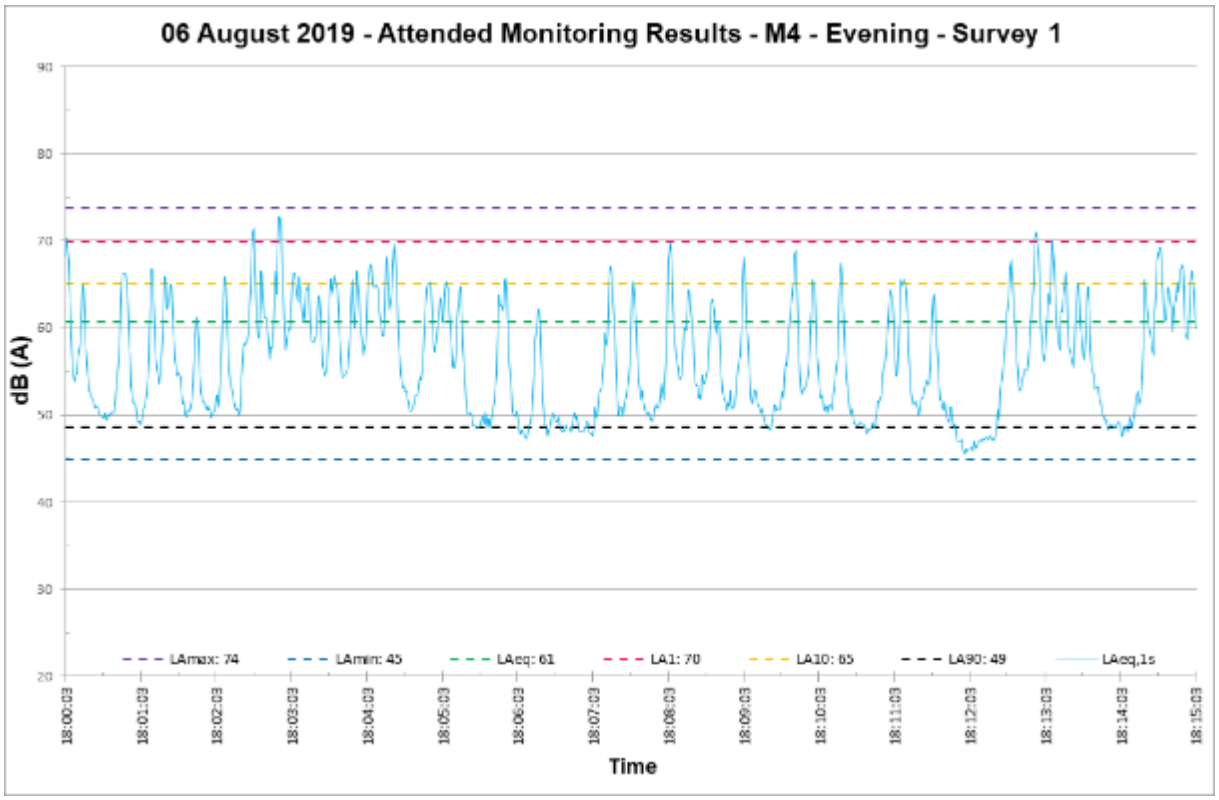

06 August 2019 - Attended Monitoring Results - M4 - Day - Survey 3
dB (A)
Time
LAmax: 78
LAmin: 44
LAeq: 60
LA1: 71
LA10: 65
LA90: 47
LAeq,1s

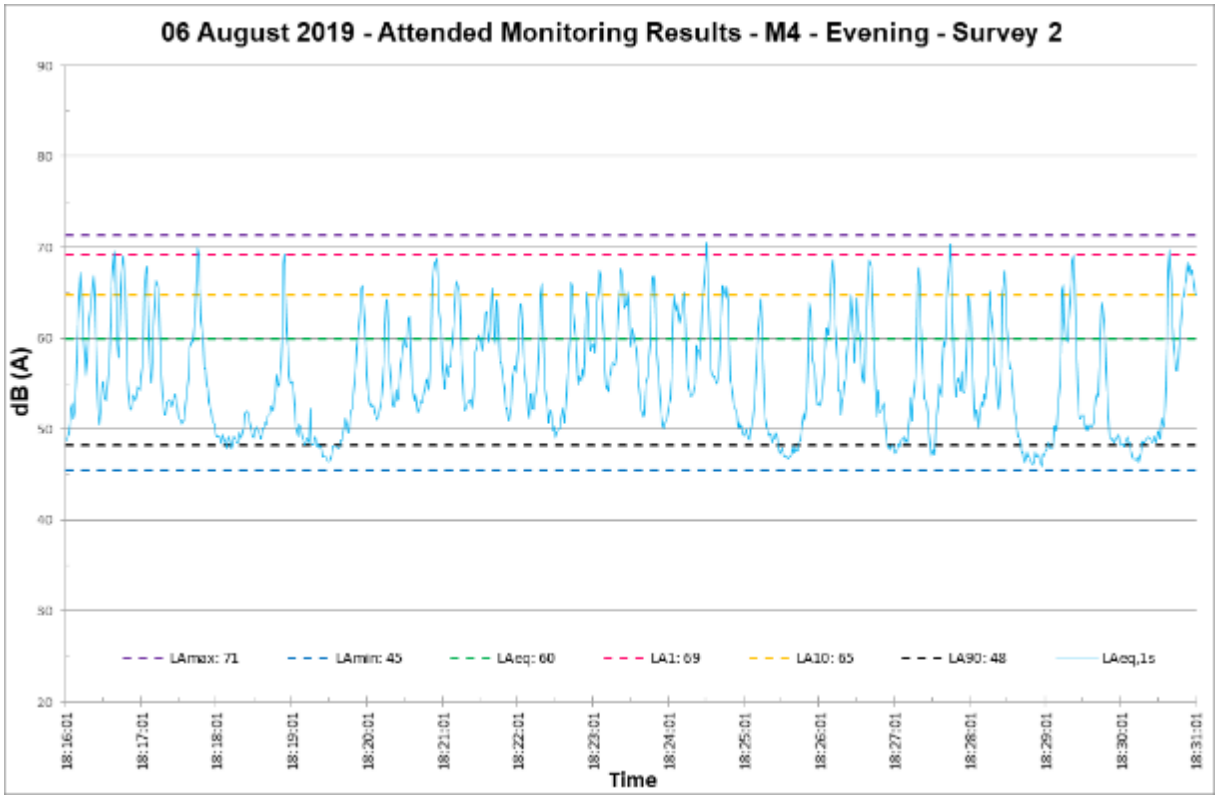

06 August 2019 - Attended Monitoring Results - M4 - Day - Survey 4
dB (A)
Time
LAmax: 80
LAmin: 45
LAeq: 62
LA1: 73
LA10: 66
LA90: 48
LAeq,1s


06 August 2019 - Attended Monitoring Results - M4 - Day - Survey 5
dB (A)
Time
LAmax: 76
LAmin: 47
LAeq: 62
LA1: 72
LA10: 67
LA90: 51
LAeq,1s

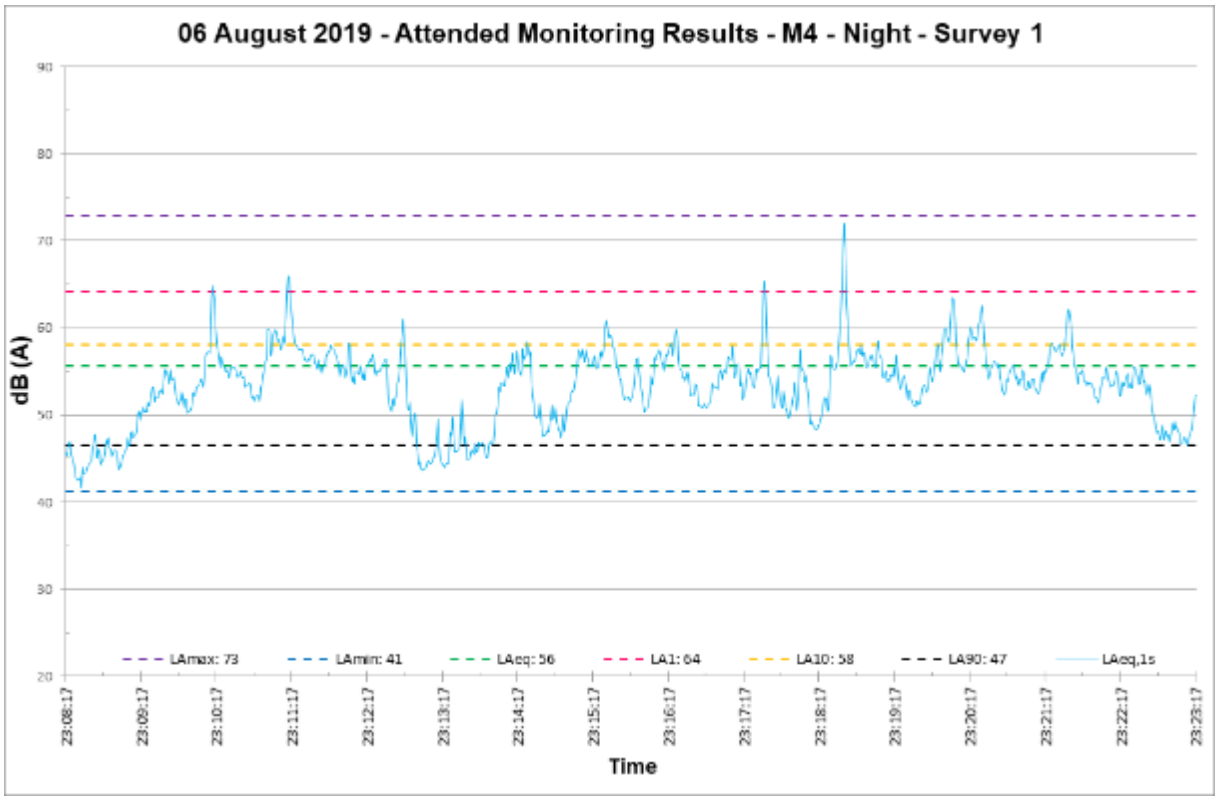

06 August 2019 - Attended Monitoring Results - M4 - Day - Survey 6
dB (A)
Time
LAmax: 74
LAmin: 46
LAeq: 61
LA1: 70
LA10: 66
LA90: 51
LAeq,1s

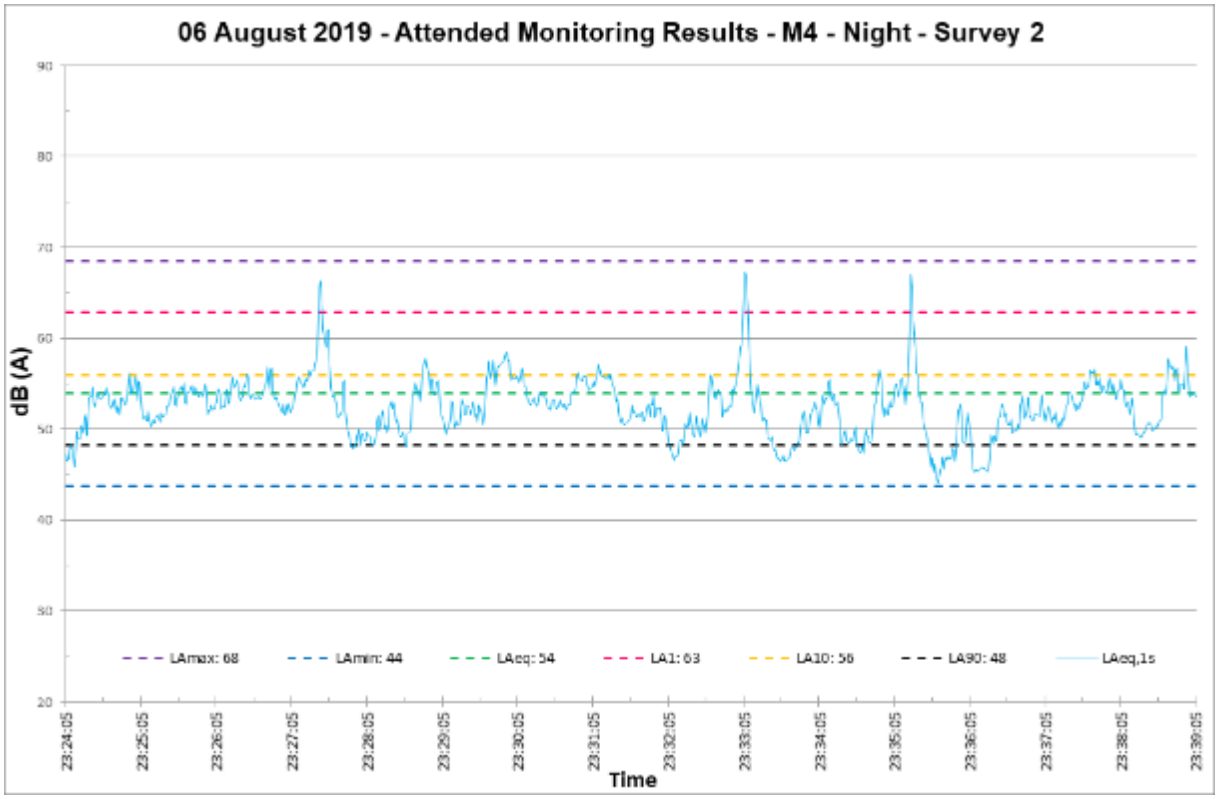
Evening – 06/05/2019

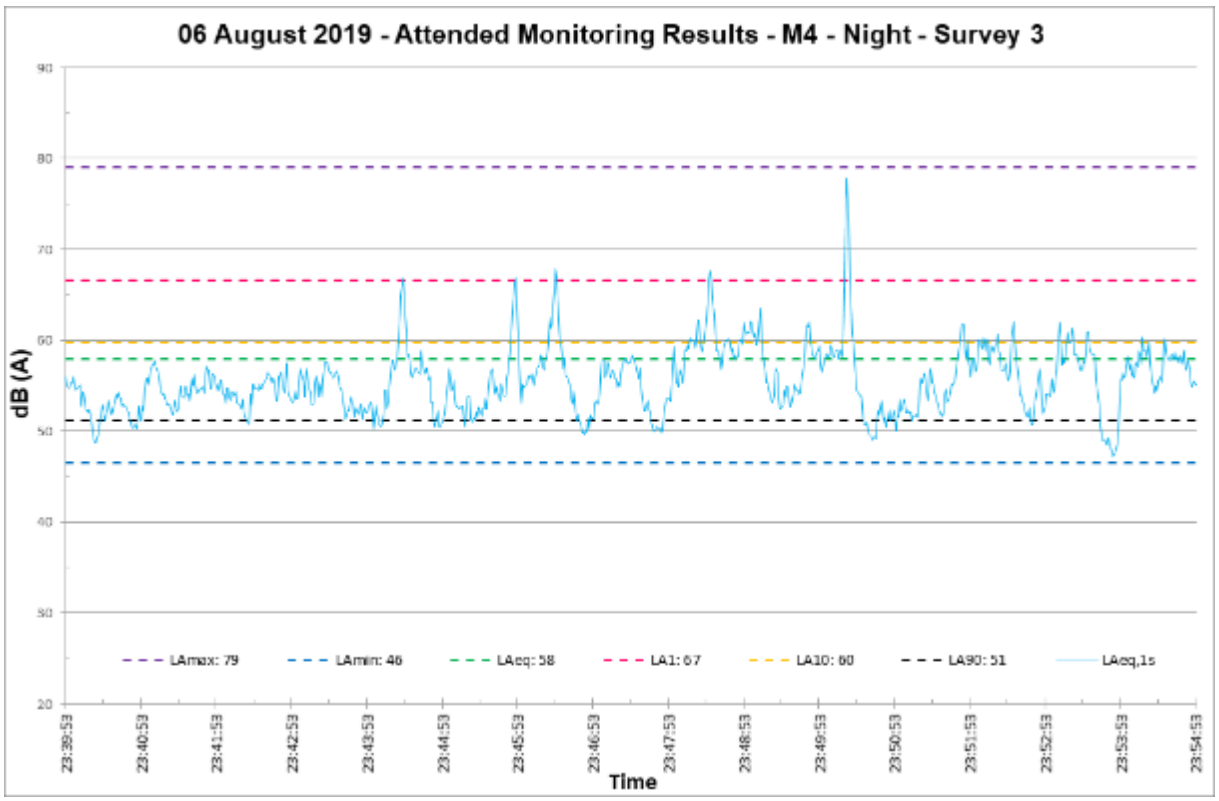


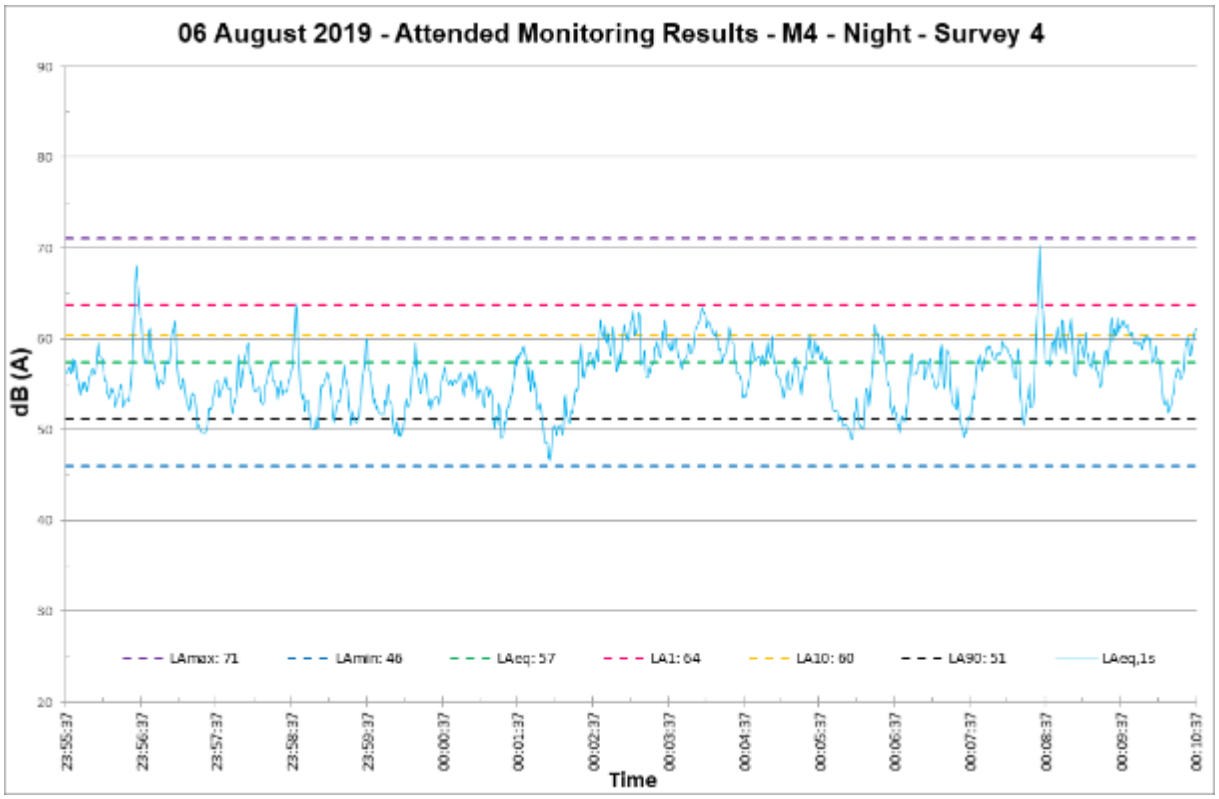


Night – 06/05/2019

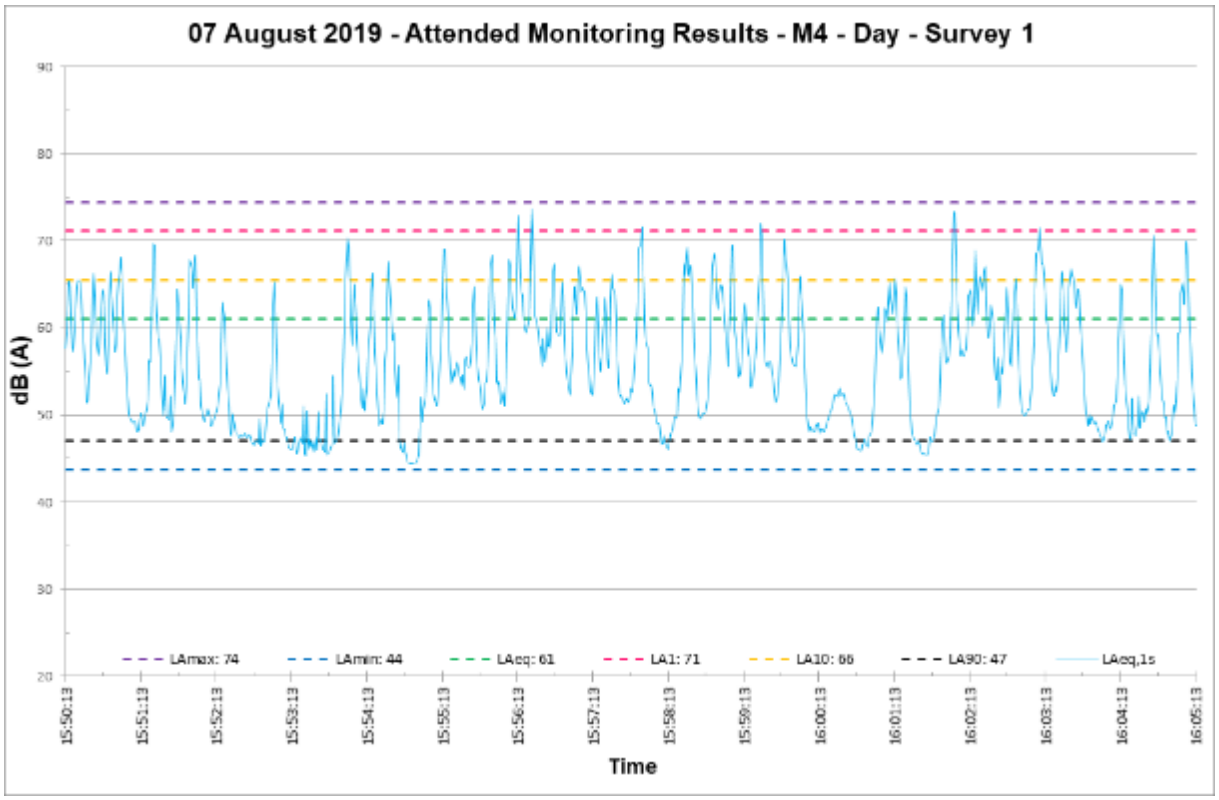


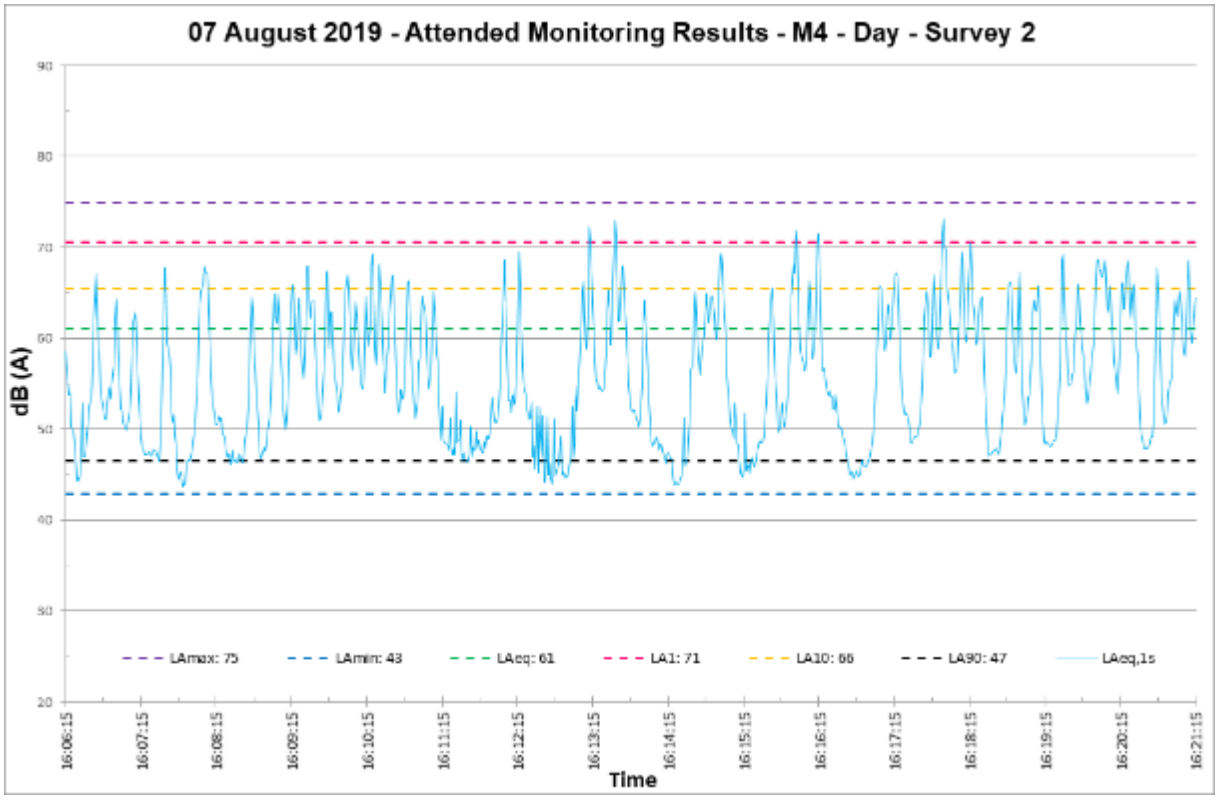


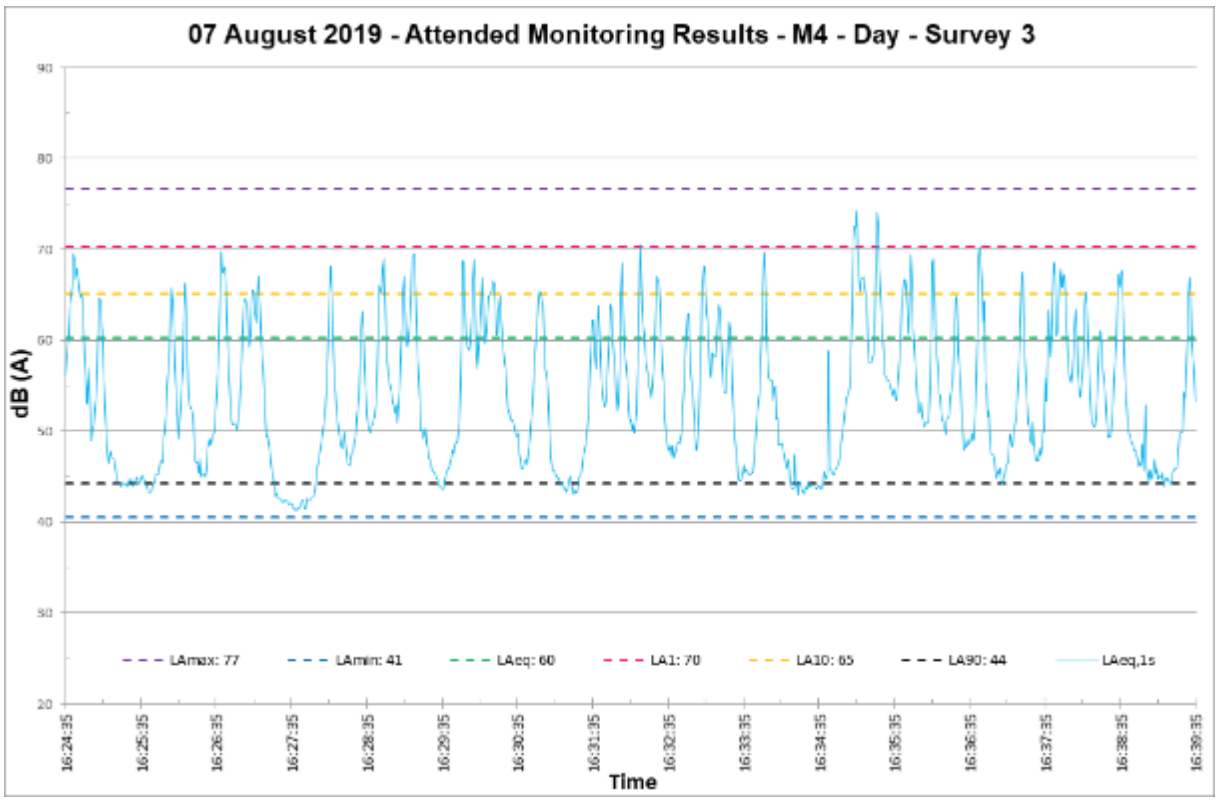

06 August 2019 - Attended Monitoring Results - M4 - Night - Survey 3
dB (A)
Time
LAmax: 79
LAmin: 46
LAeq: 58
LA1: 67
LA10: 60
LA90: 51
LAeq,1s

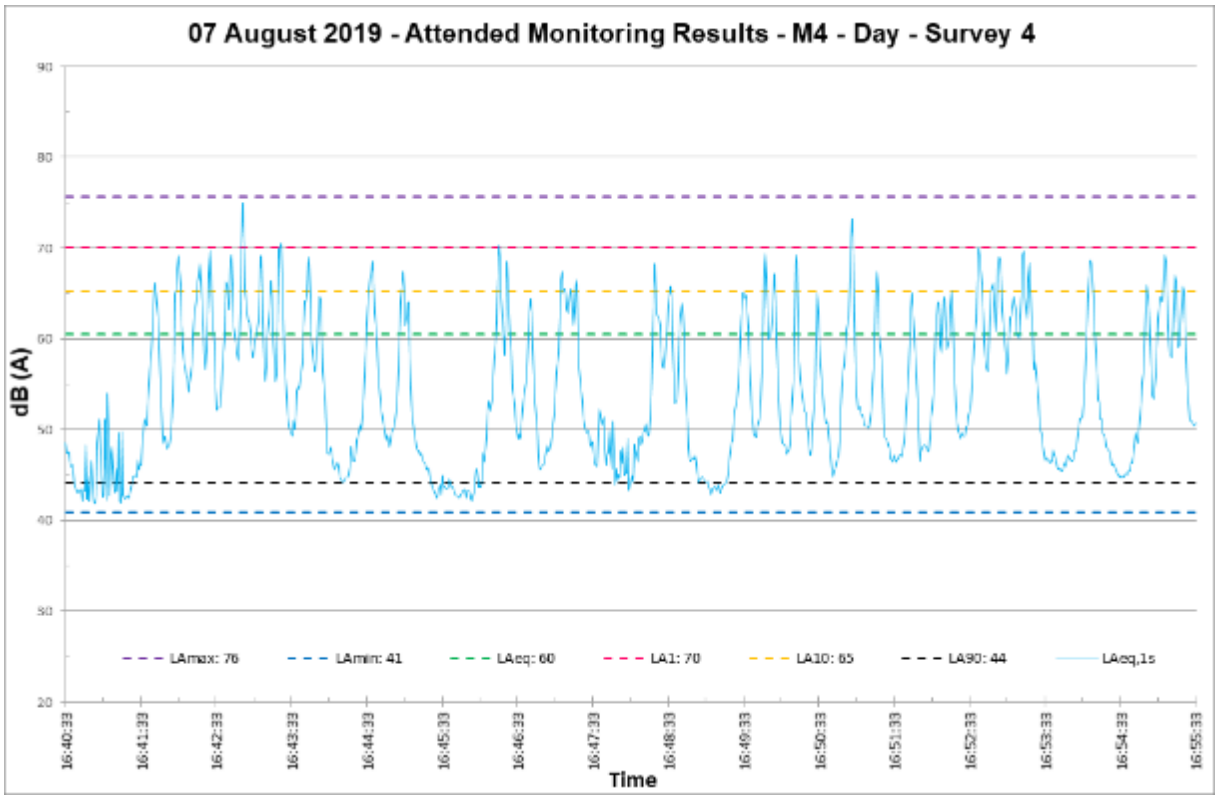

06 August 2019 - Attended Monitoring Results - M4 - Night - Survey 4
dB (A)
Time
LAmax: 71
LAmin: 46
LAeq: 57
LA1: 64
LA10: 60
LA90: 51
LAeq,1s

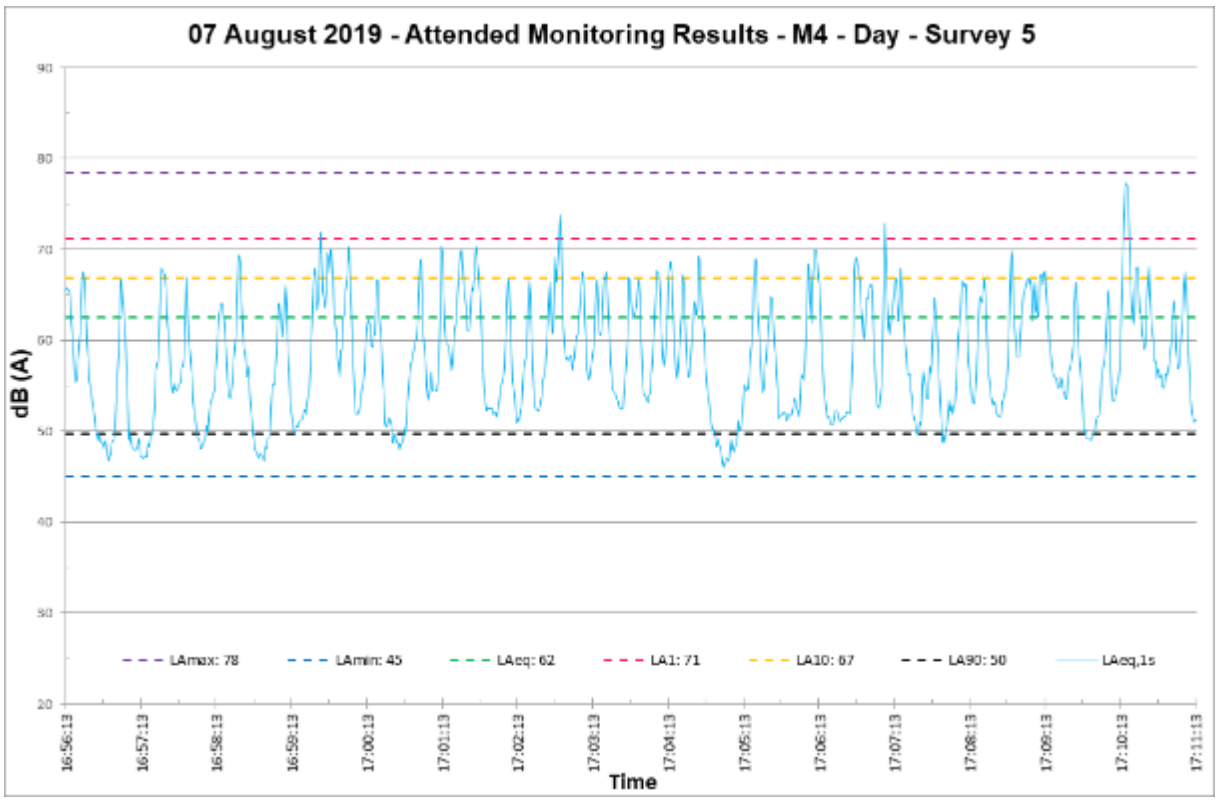
Day – 07/08/2019

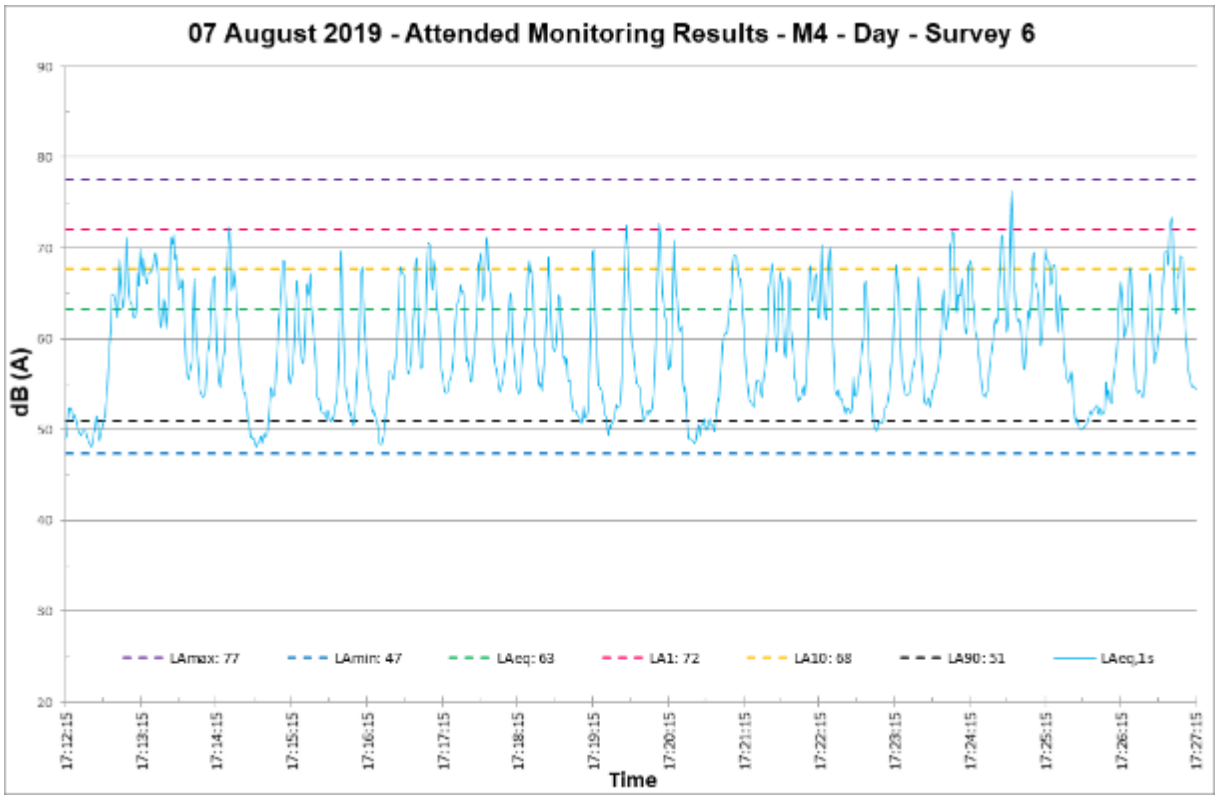




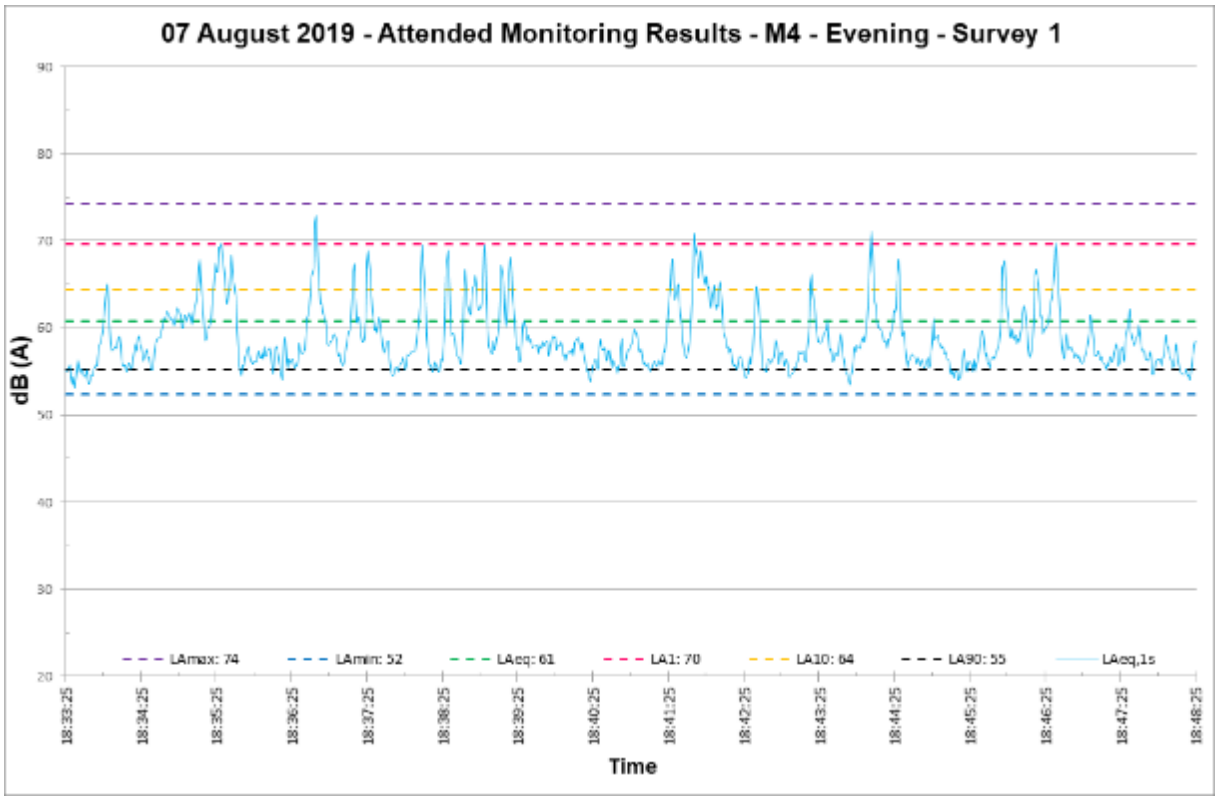

07 August 2019 - Attended Monitoring Results - M4 - Day - Survey 3
dB (A)
Time
LAmax: 77
LAmin: 41
LAeq: 60
LA1: 70
LA10: 65
LA90: 44
LAeq,1s

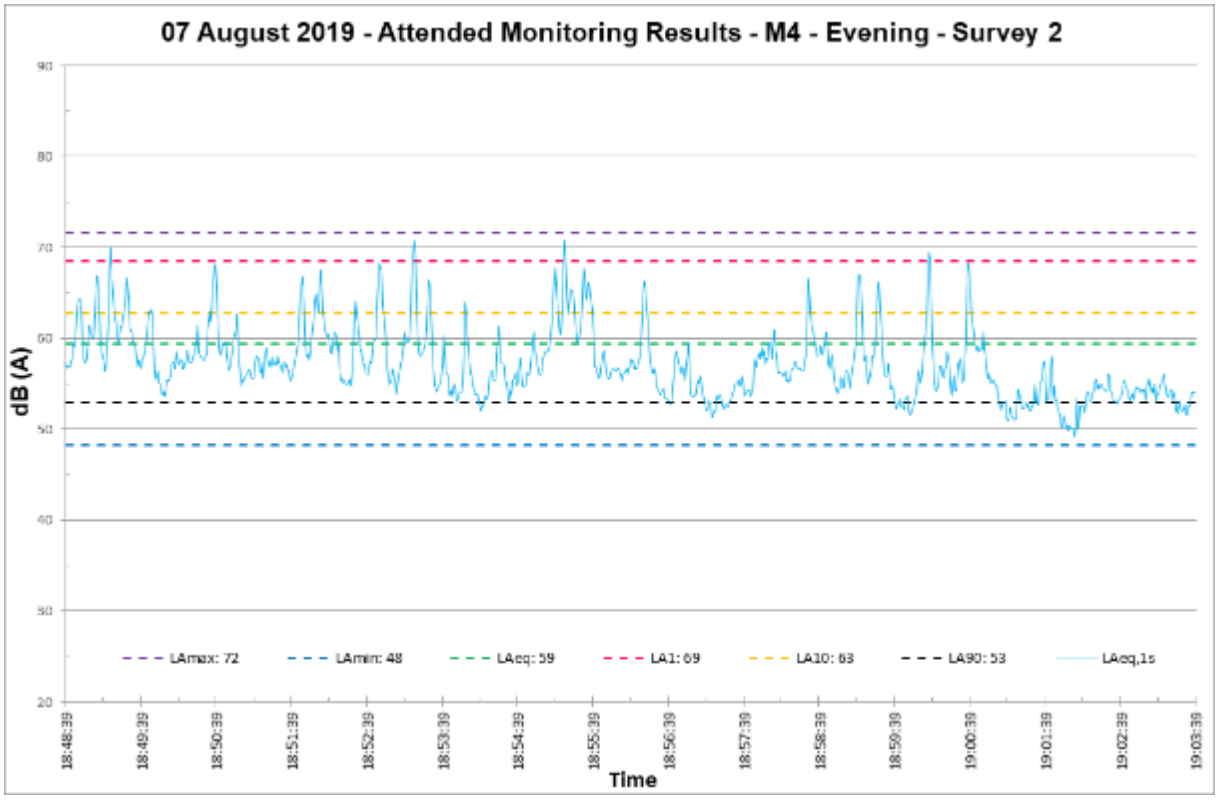

07 August 2019 - Attended Monitoring Results - M4 - Day - Survey 4
dB (A)
Time
LAmax: 76
LAmin: 41
LAeq: 60
LA1: 70
LA10: 65
LA90: 44
LAeq,1s


07 August 2019 - Attended Monitoring Results - M4 - Day - Survey 5
dB (A)
Time
LAmax: 78
LAmin: 45
LAeq: 62
LA1: 71
LA10: 67
LA90: 50
LAeq,1s

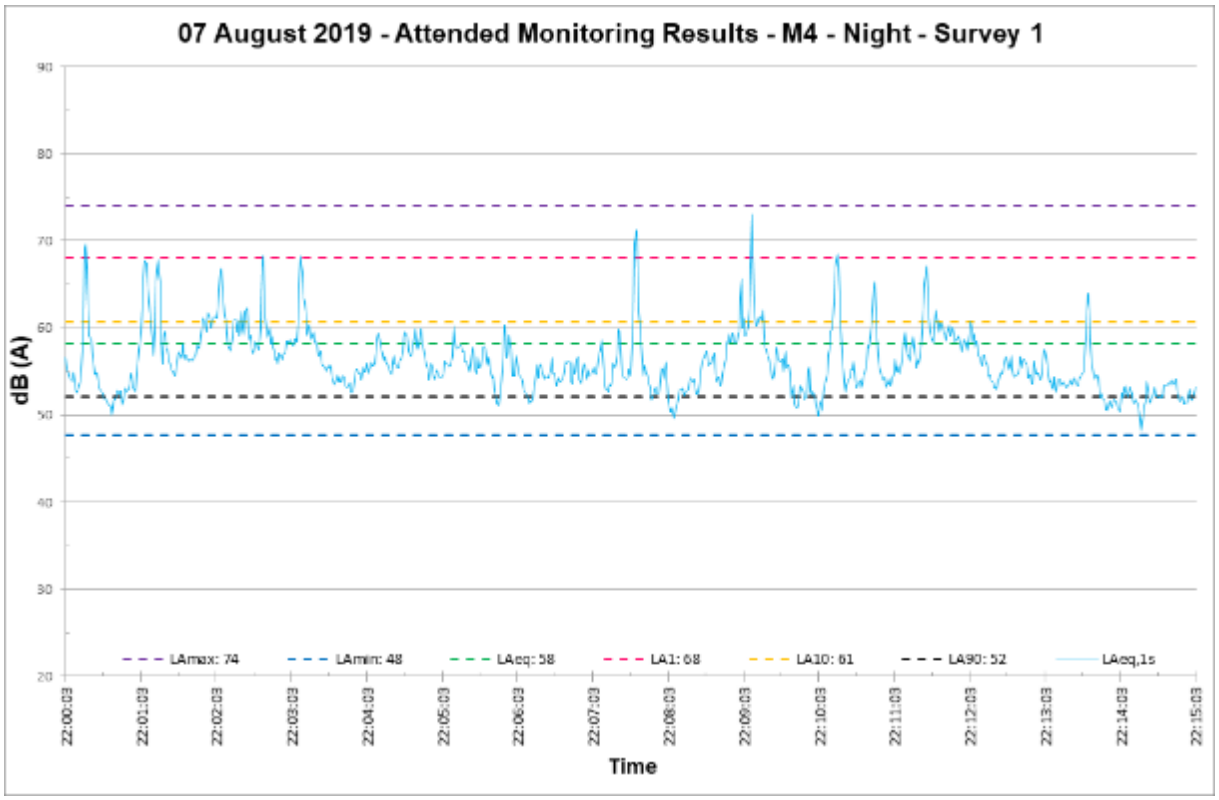

07 August 2019 - Attended Monitoring Results - M4 - Day - Survey 6
dB (A)
Time
LAmax: 77
LAmin: 47
LAeq: 63
LA1: 72
LA10: 68
LA90: 51
LAeq,1s

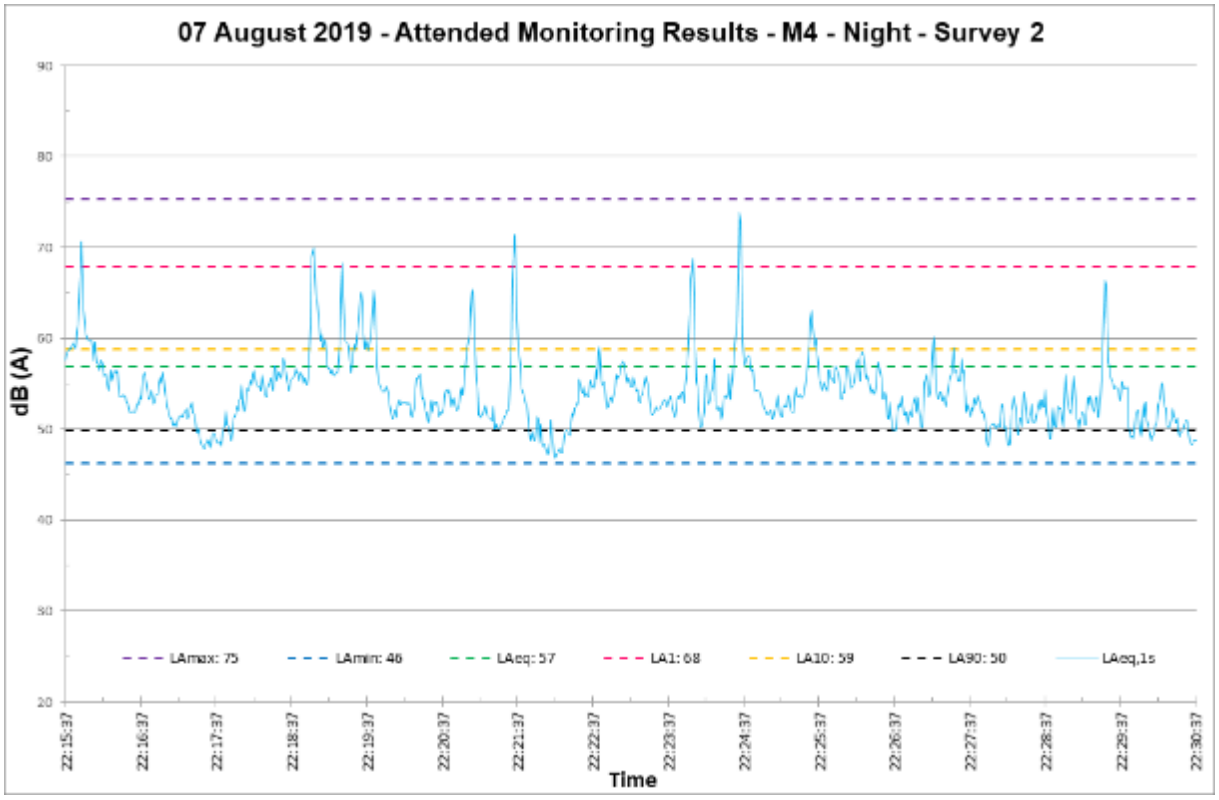
Evening – 07/08/2019

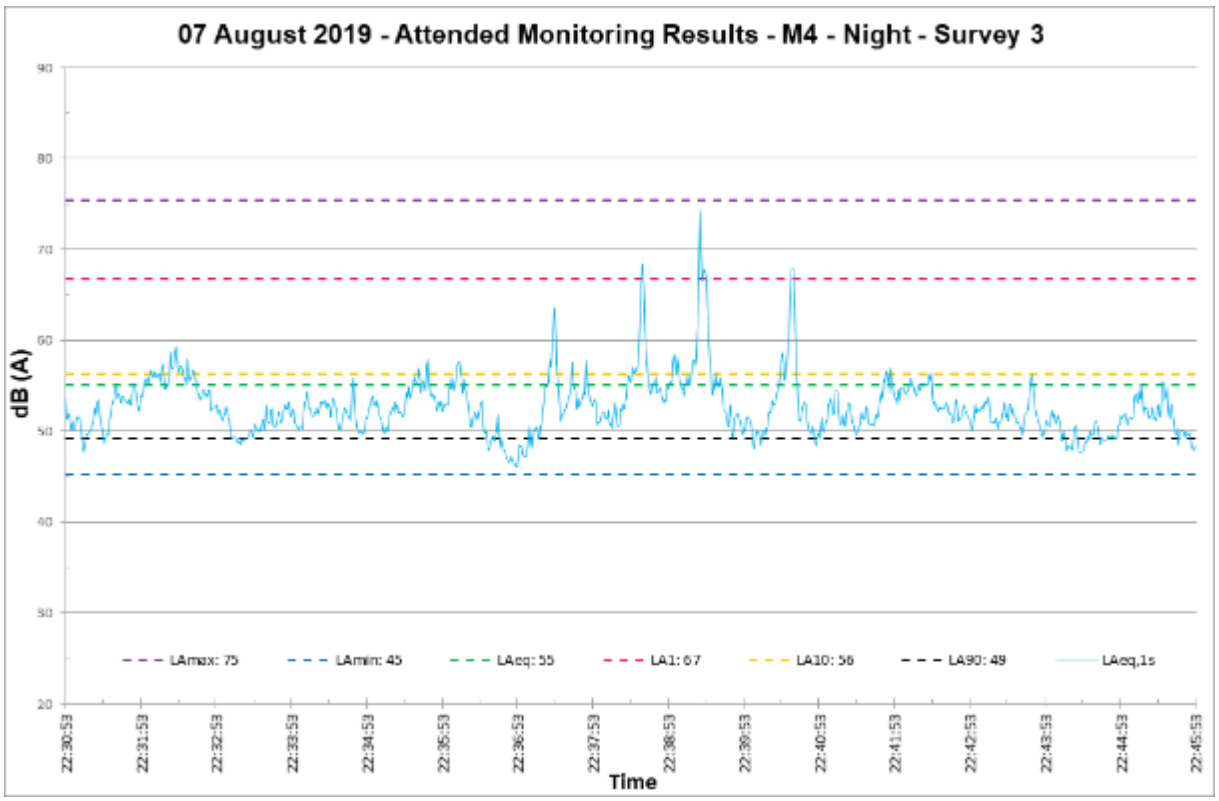


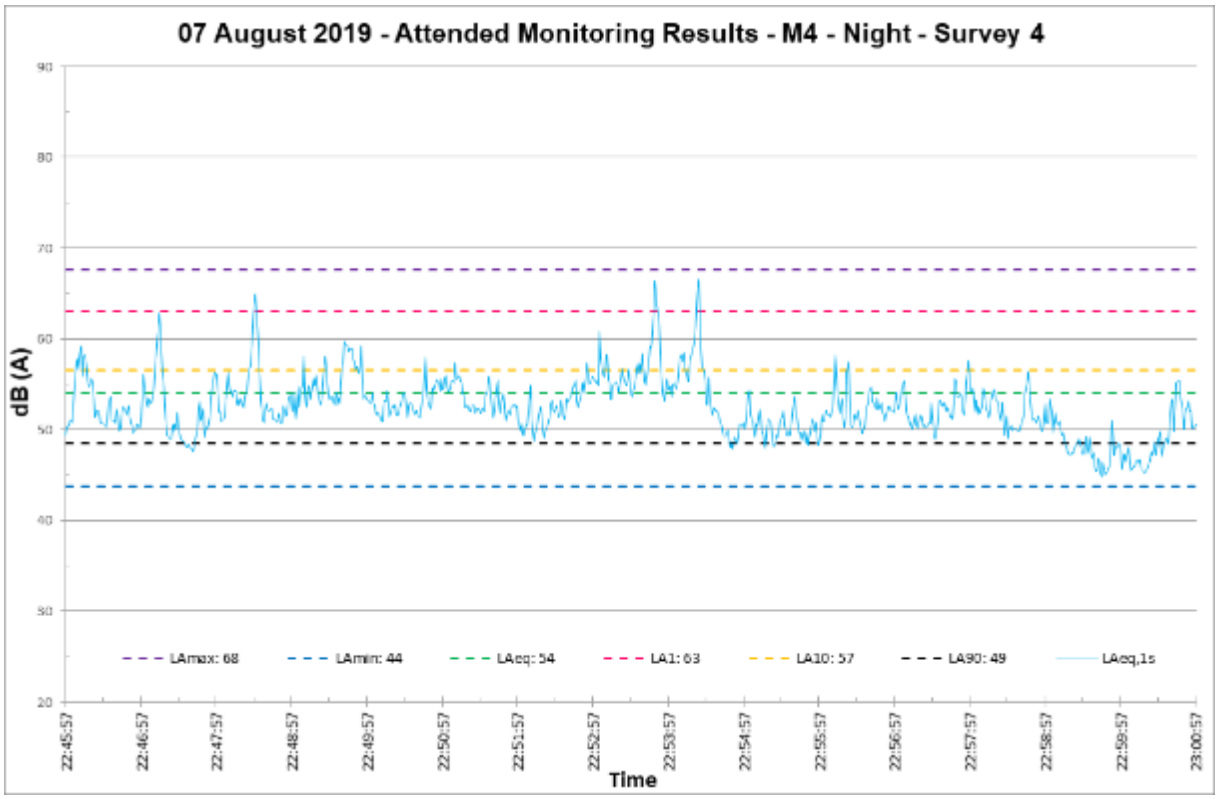


Night – 07/08/2019



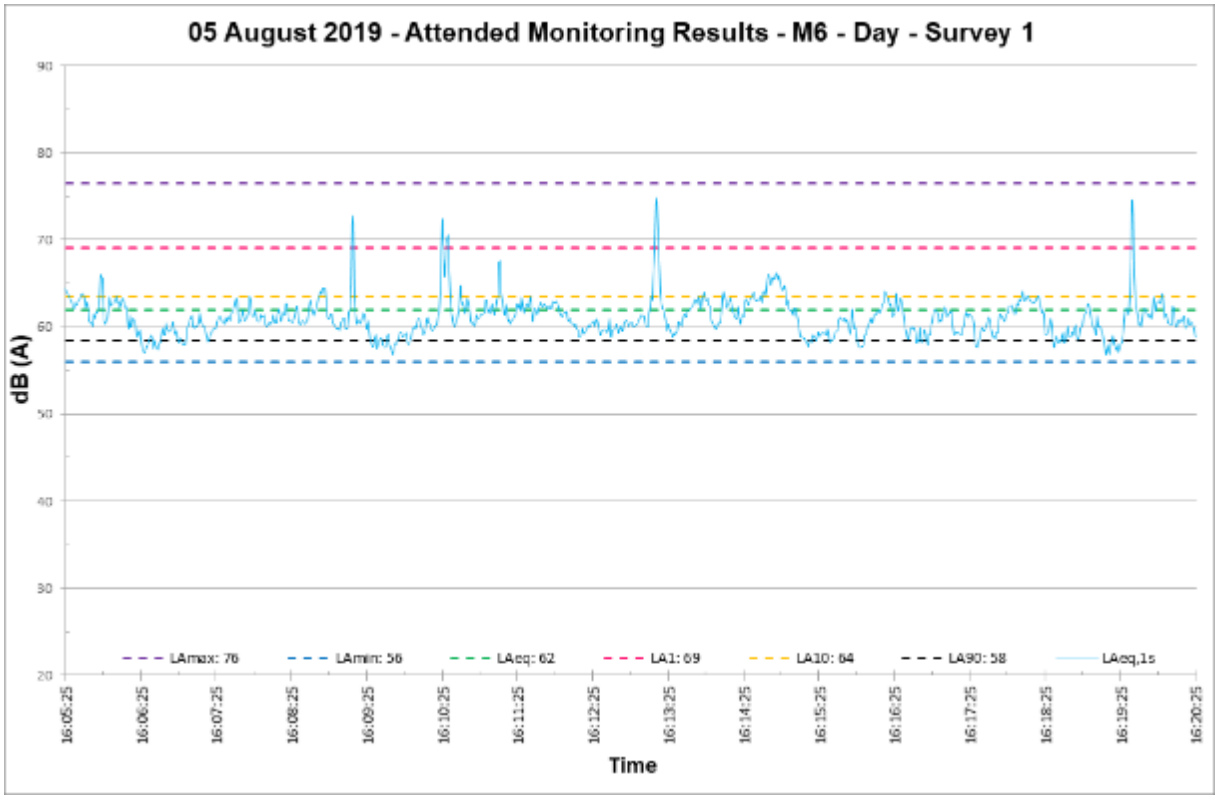


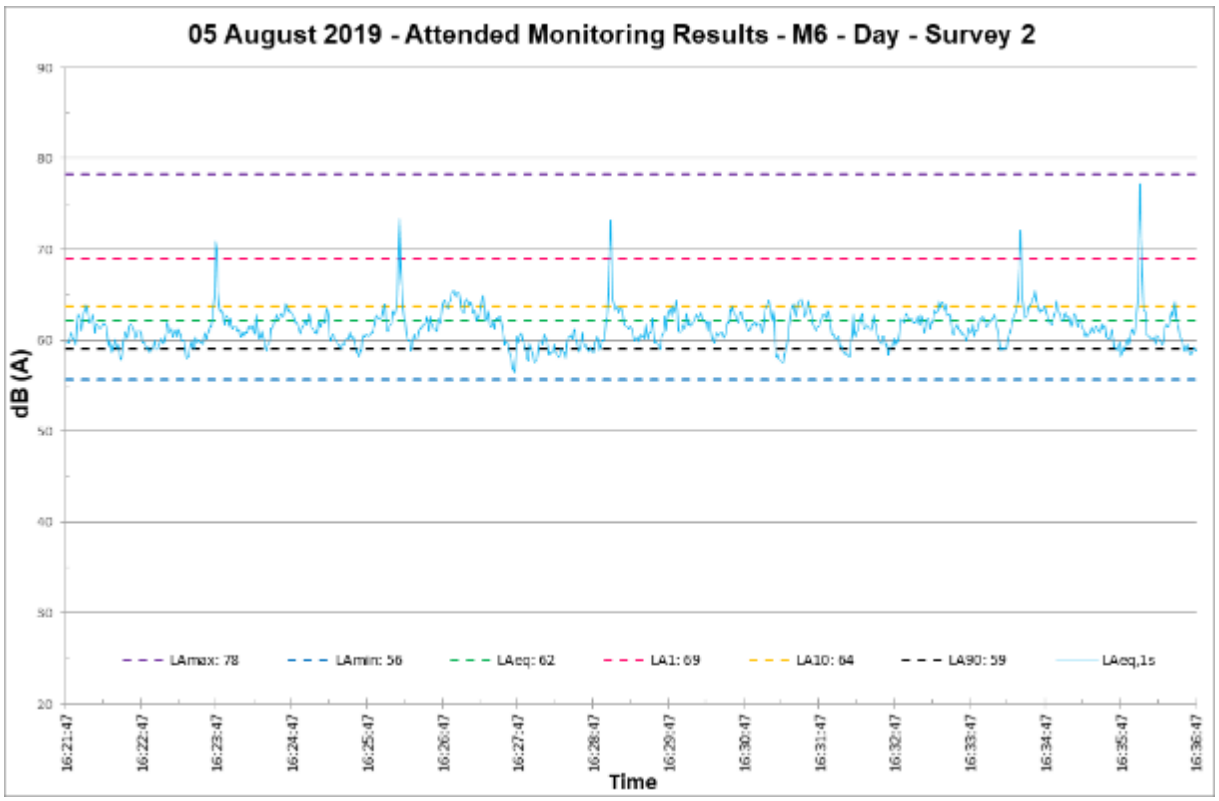

07 August 2019 - Attended Monitoring Results - M4 - Night - Survey 3
dB (A)
90
80
70
60
50
40
30
20
LAmax: 75
LAmin: 45
LAeq: 55
LA1: 67
LA10: 58
LA90: 49
LAeq,1s
22:30:53
22:31:53
22:32:53
22:33:53
22:34:53
22:35:53
22:36:53
22:37:53
22:38:53
22:39:53
22:40:53
22:41:53
22:42:53
22:43:53
22:44:53
22:45:53
Time

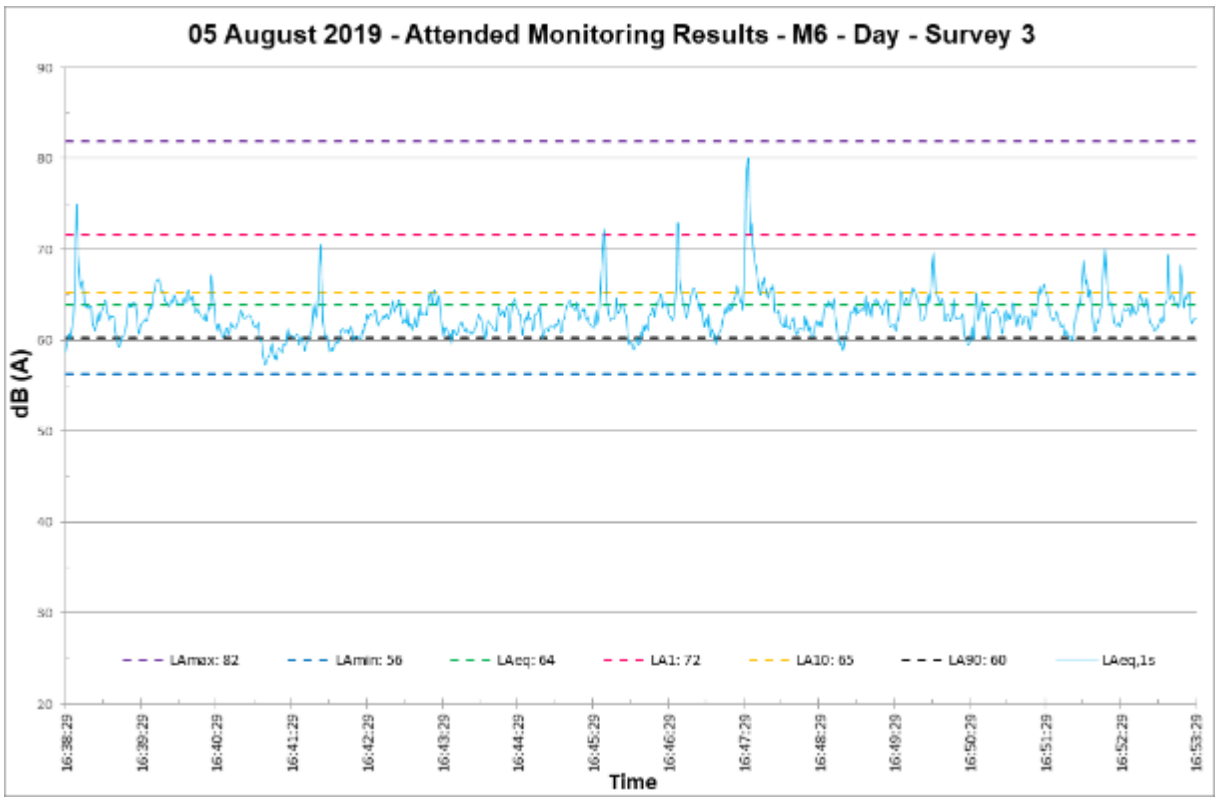

07 August 2019 - Attended Monitoring Results - M4 - Night - Survey 4
dB (A)
90
80
70
60
50
40
30
20
LAmax: 68
LAmin: 44
LAeq: 54
LA1: 63
LA10: 57
LA90: 49
LAeq,1s
22:45:57
22:46:57
22:47:57
22:48:57
22:49:57
22:50:57
22:51:57
22:52:57
22:53:57
22:54:57
22:55:57
22:56:57
22:57:57
22:58:57
22:59:57
23:00:57
Time

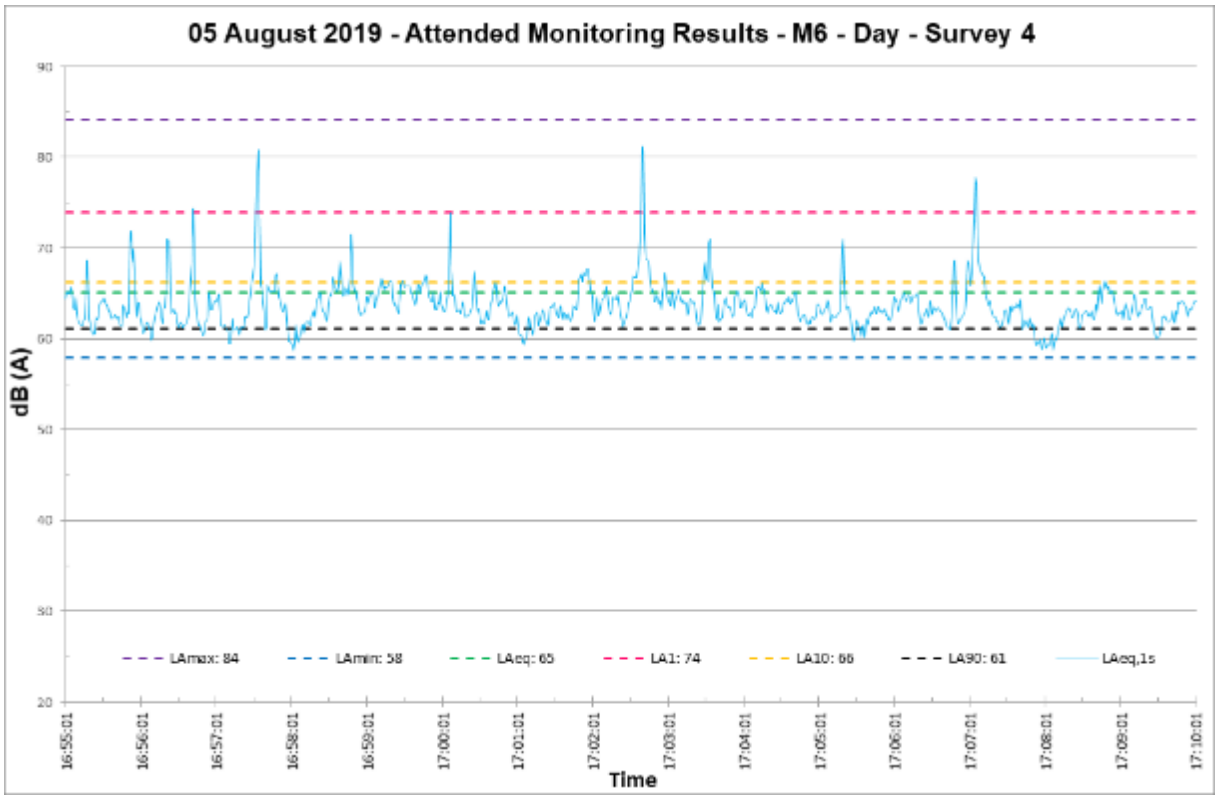
Appendix D – Operator attended noise monitoring results – Location M6

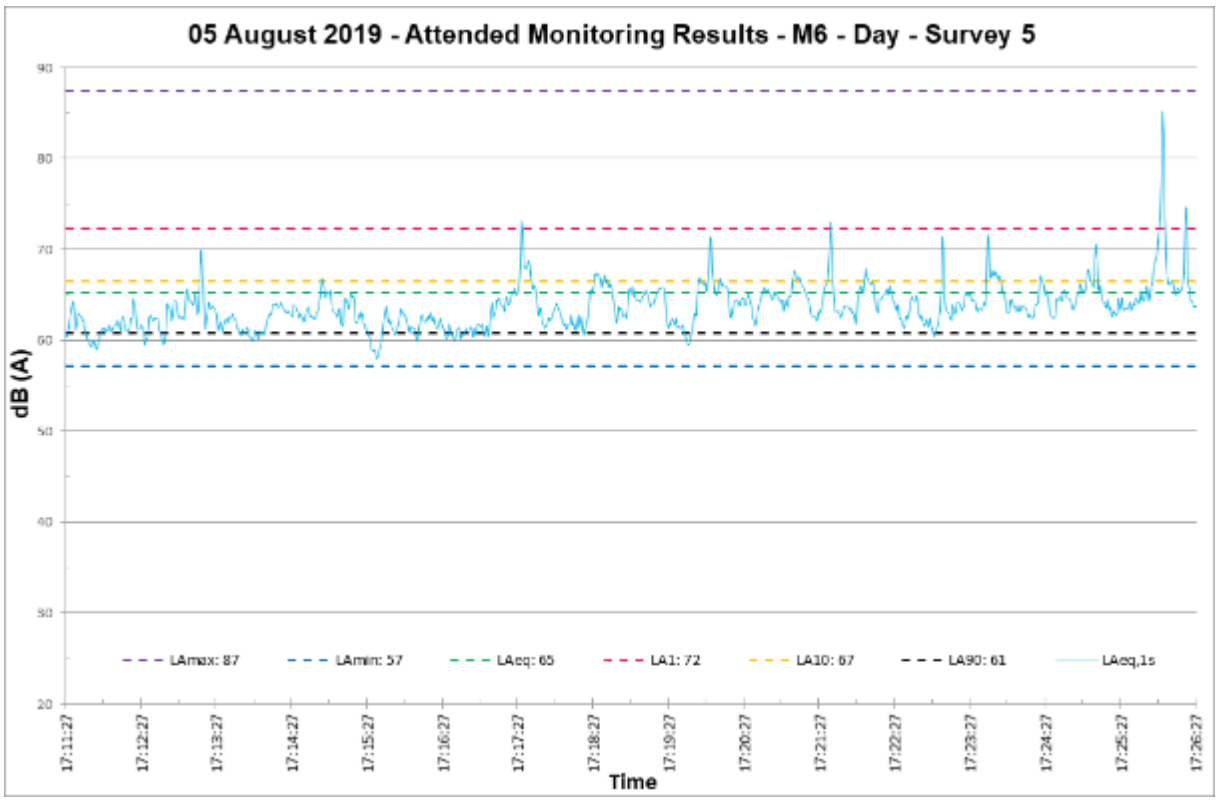
Day – 05/0/2019

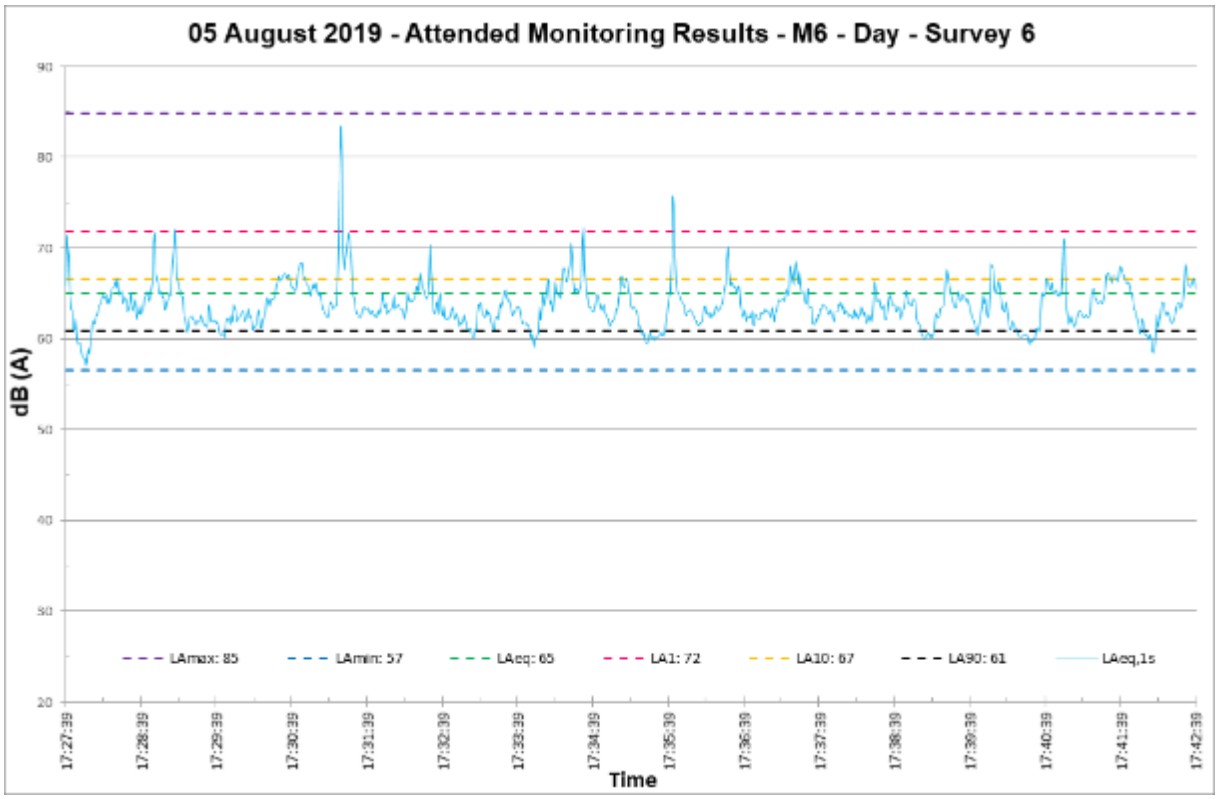




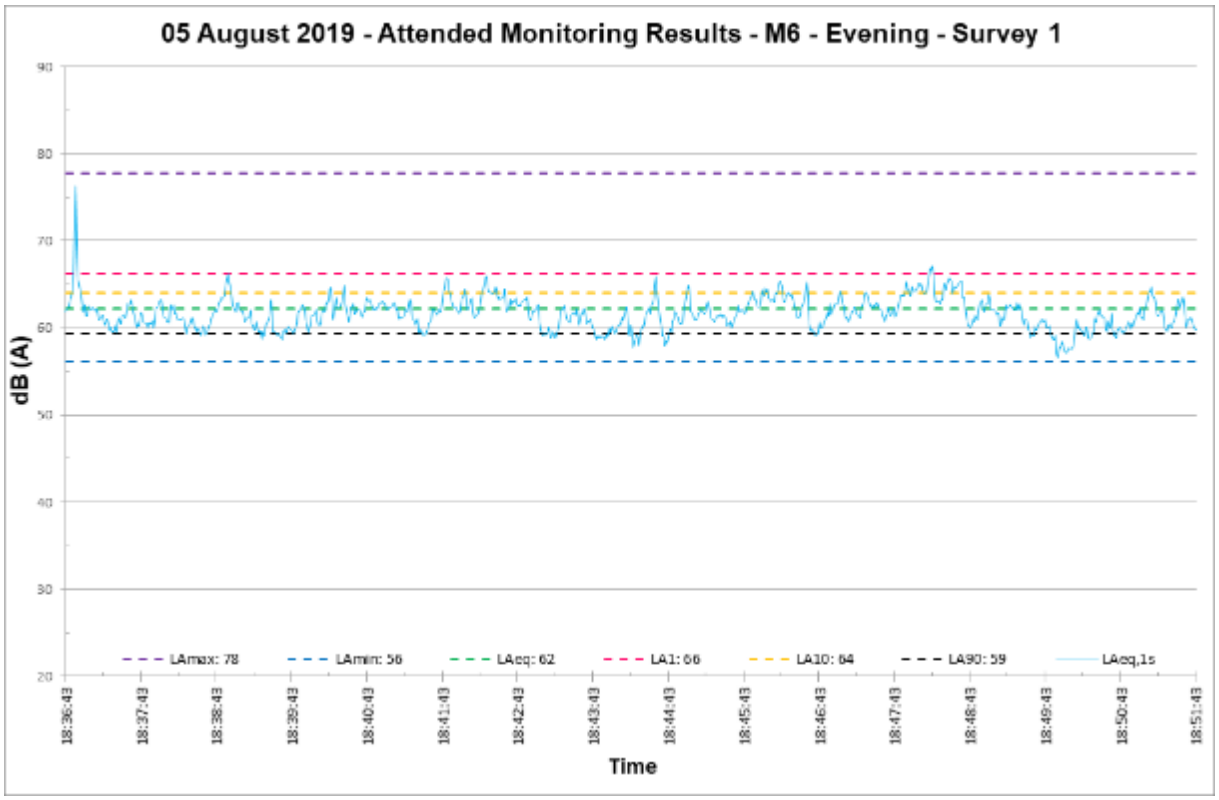

05 August 2019 - Attended Monitoring Results - M6 - Day - Survey 3
dB (A)
Time
LAmax: 82
LAmin: 56
LAeq: 64
LA1: 72
LA10: 65
LA90: 60
LAeq,1s

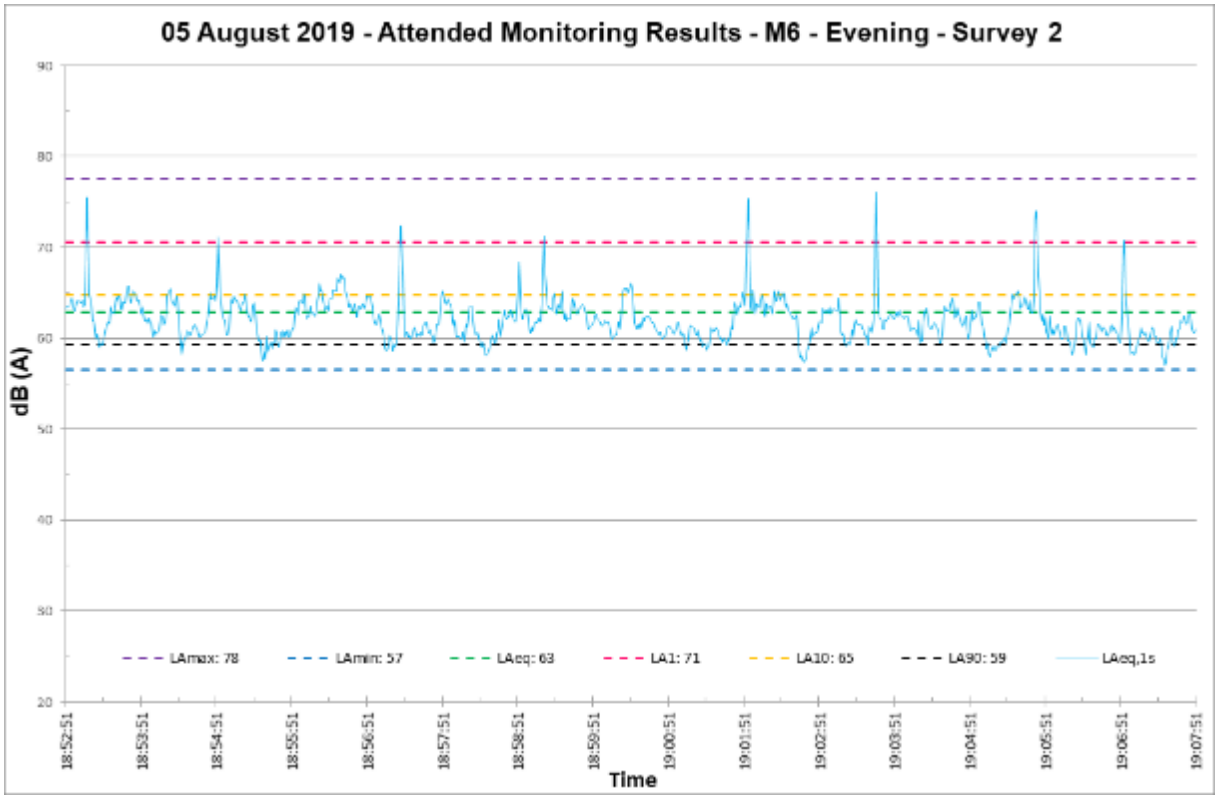

05 August 2019 - Attended Monitoring Results - M6 - Day - Survey 4
dB (A)
Time
LAmax: 84
LAmin: 58
LAeq: 65
LA1: 74
LA10: 66
LA90: 61
LAeq,1s


05 August 2019 - Attended Monitoring Results - M6 - Day - Survey 5
dB (A)
Time
LAmax: 87
LAmin: 57
LAeq: 65
LA1: 72
LA10: 67
LA90: 61
LAeq,1s

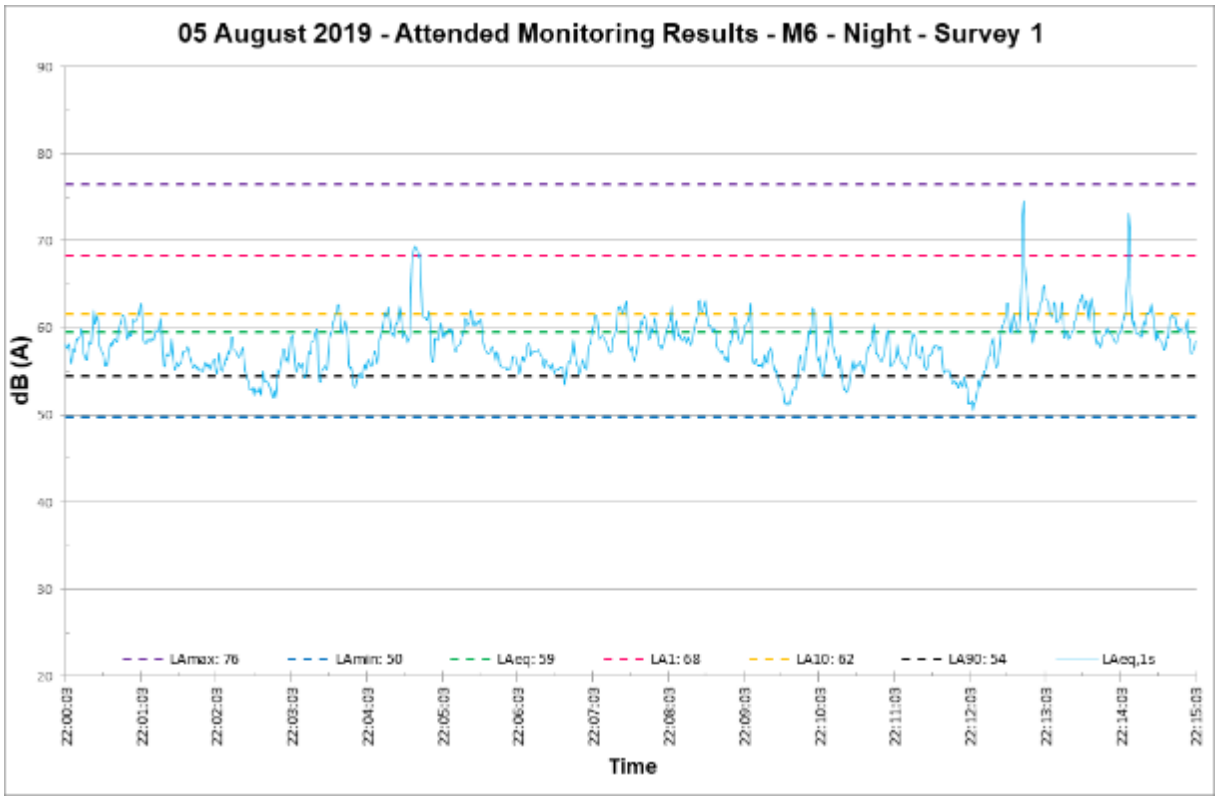

05 August 2019 - Attended Monitoring Results - M6 - Day - Survey 6
dB (A)
Time
LAmax: 85
LAmin: 57
LAeq: 65
LA1: 72
LA10: 67
LA90: 61
LAeq,1s

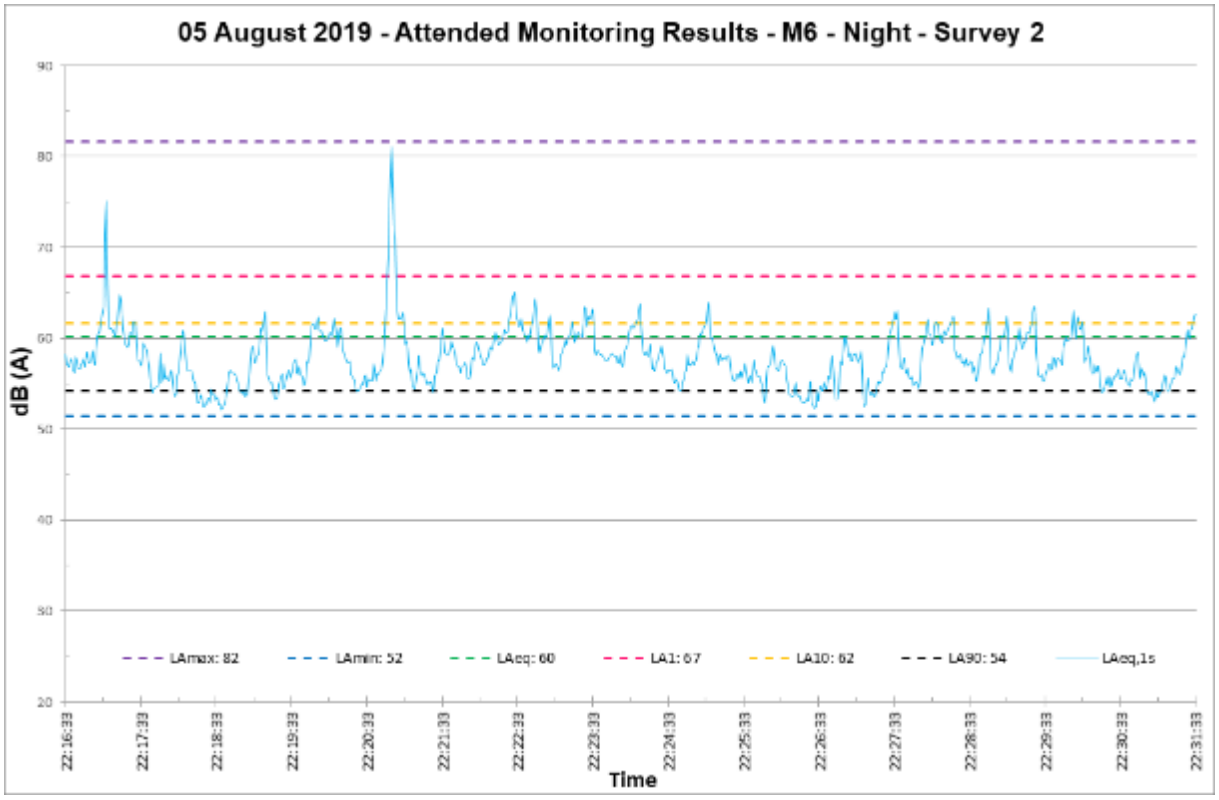
Evening – 05/08/2019

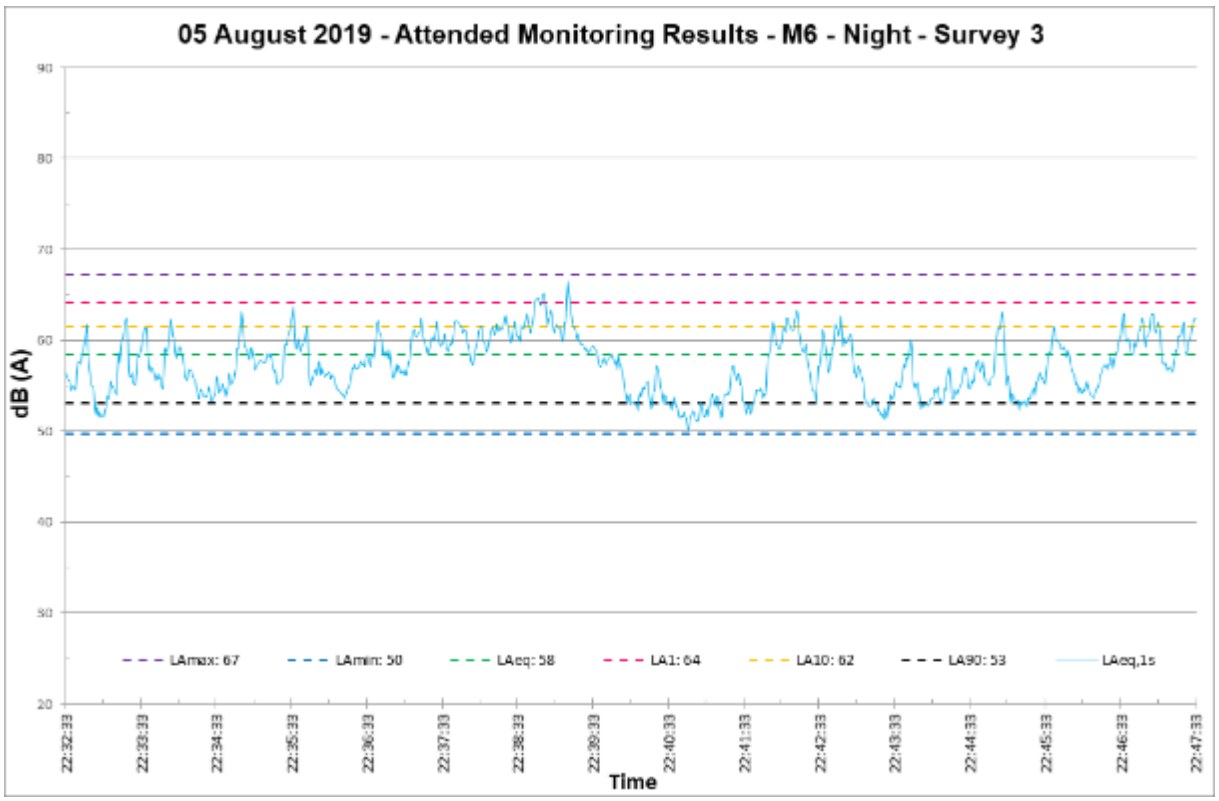


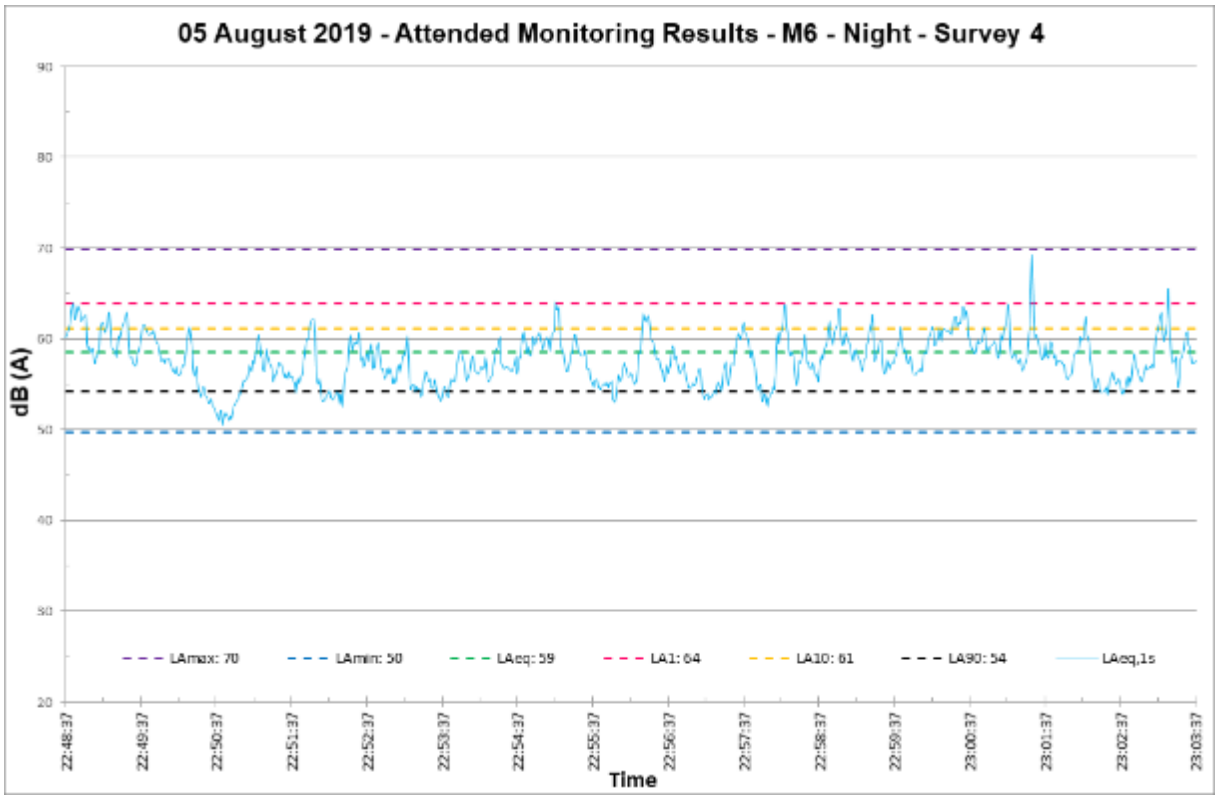


Night – 05/08/2019

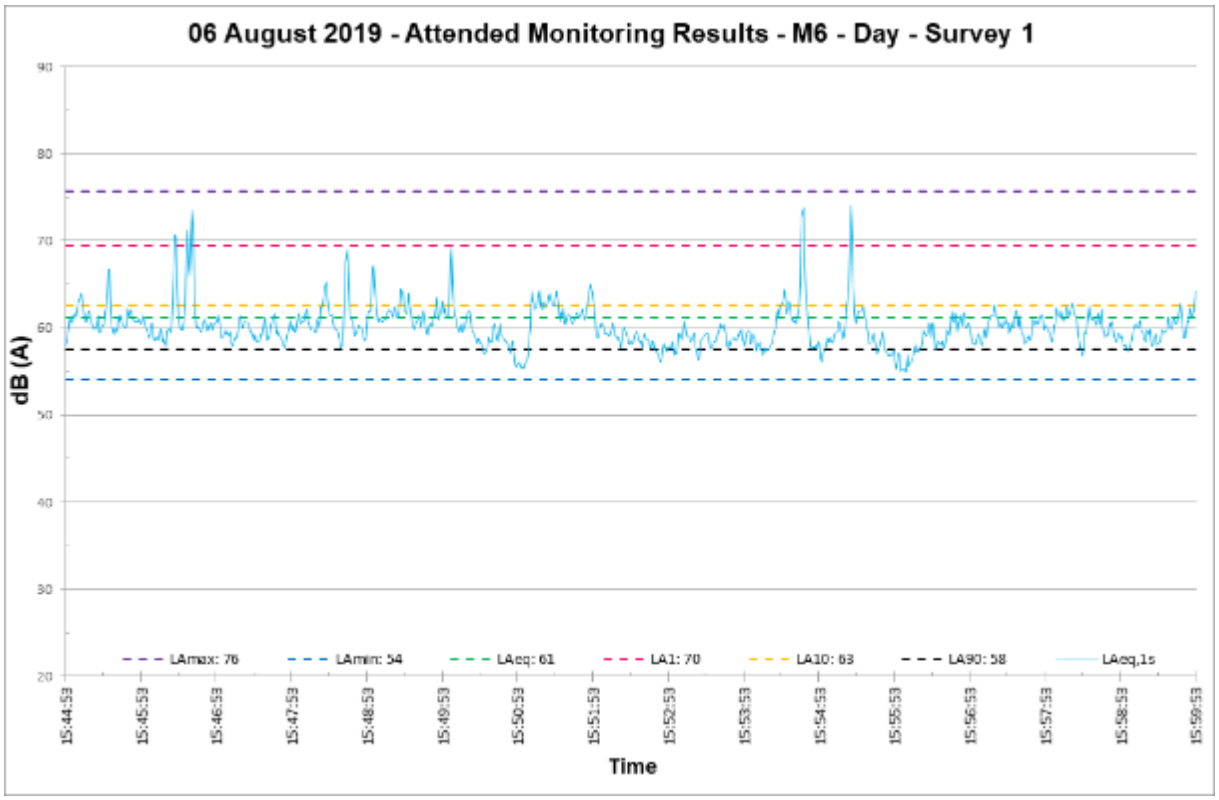


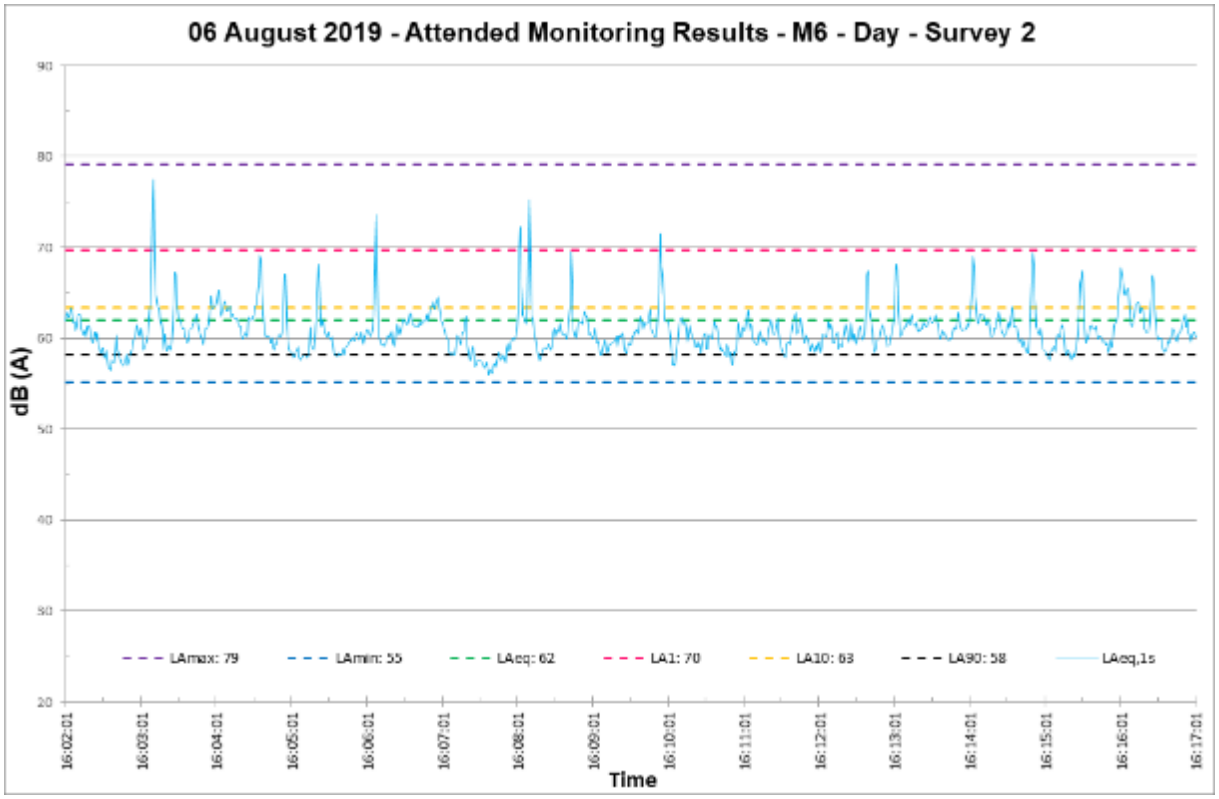


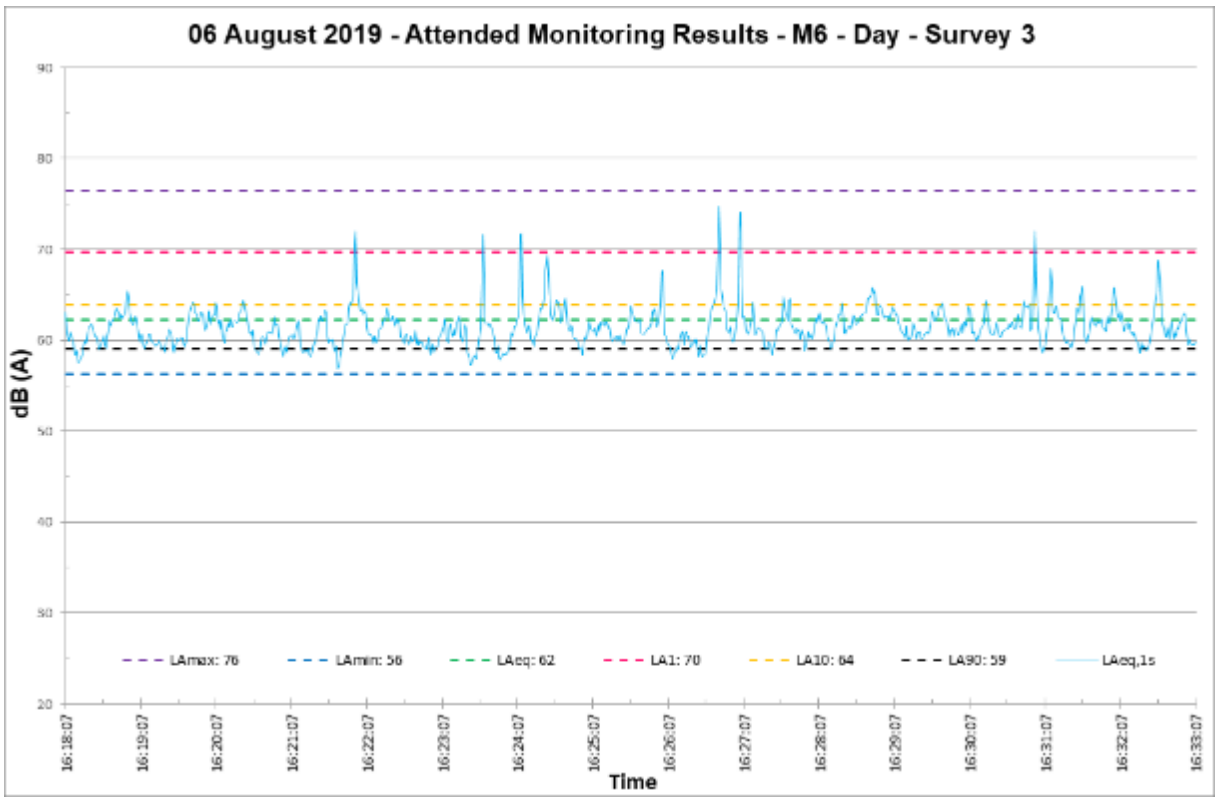

05 August 2019 - Attended Monitoring Results - M6 - Night - Survey 3
dB (A)
Time
LAmax: 67
LAmin: 50
LAeq: 58
LA1: 64
LA10: 62
LA90: 53
LAeq,1s

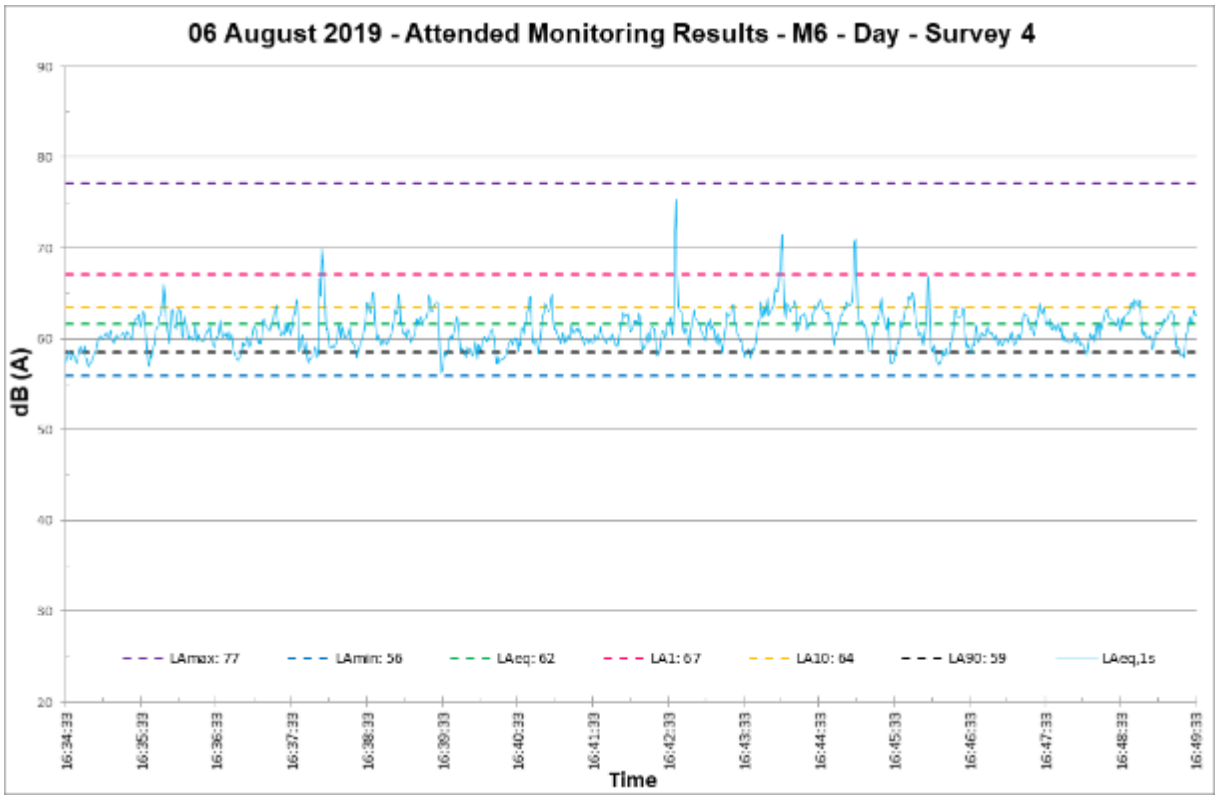

05 August 2019 - Attended Monitoring Results - M6 - Night - Survey 4
dB (A)
Time
LAmax: 70
LAmin: 50
LAeq: 59
LA1: 64
LA10: 61
LA90: 54
LAeq,1s

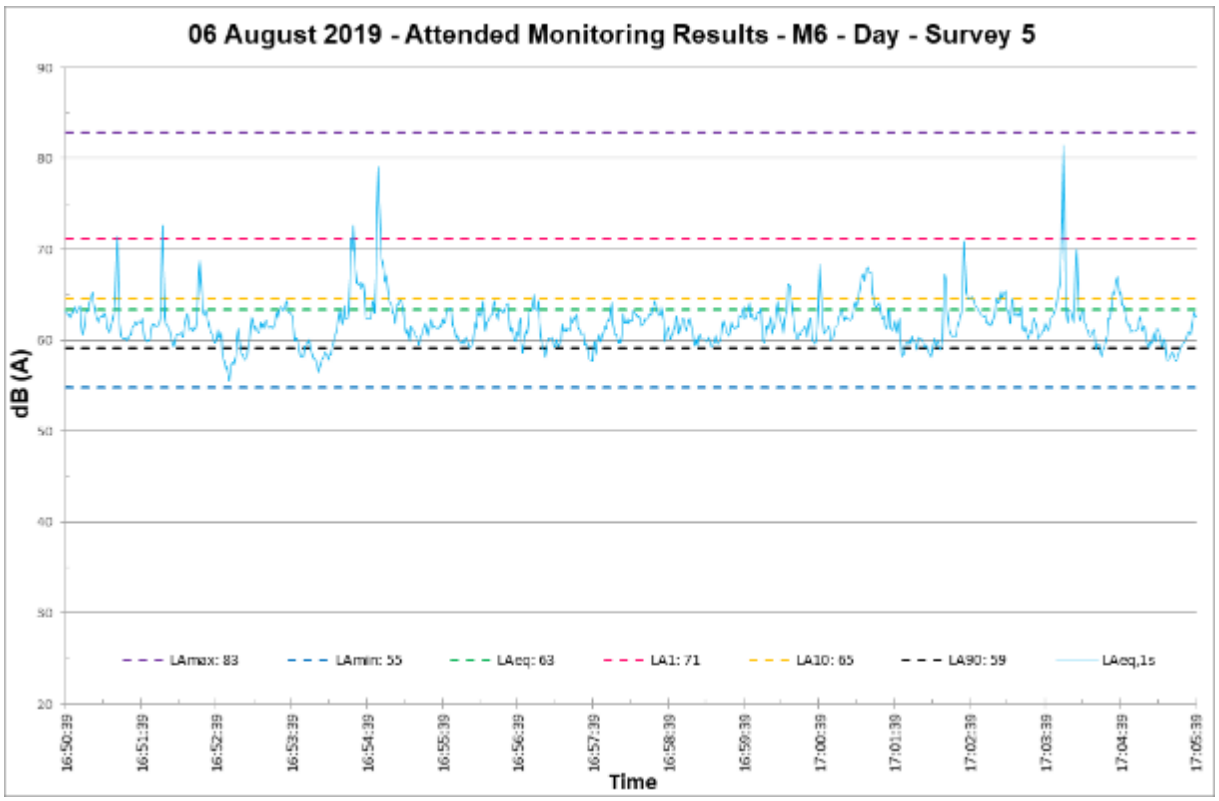
Day – 06/08/2019

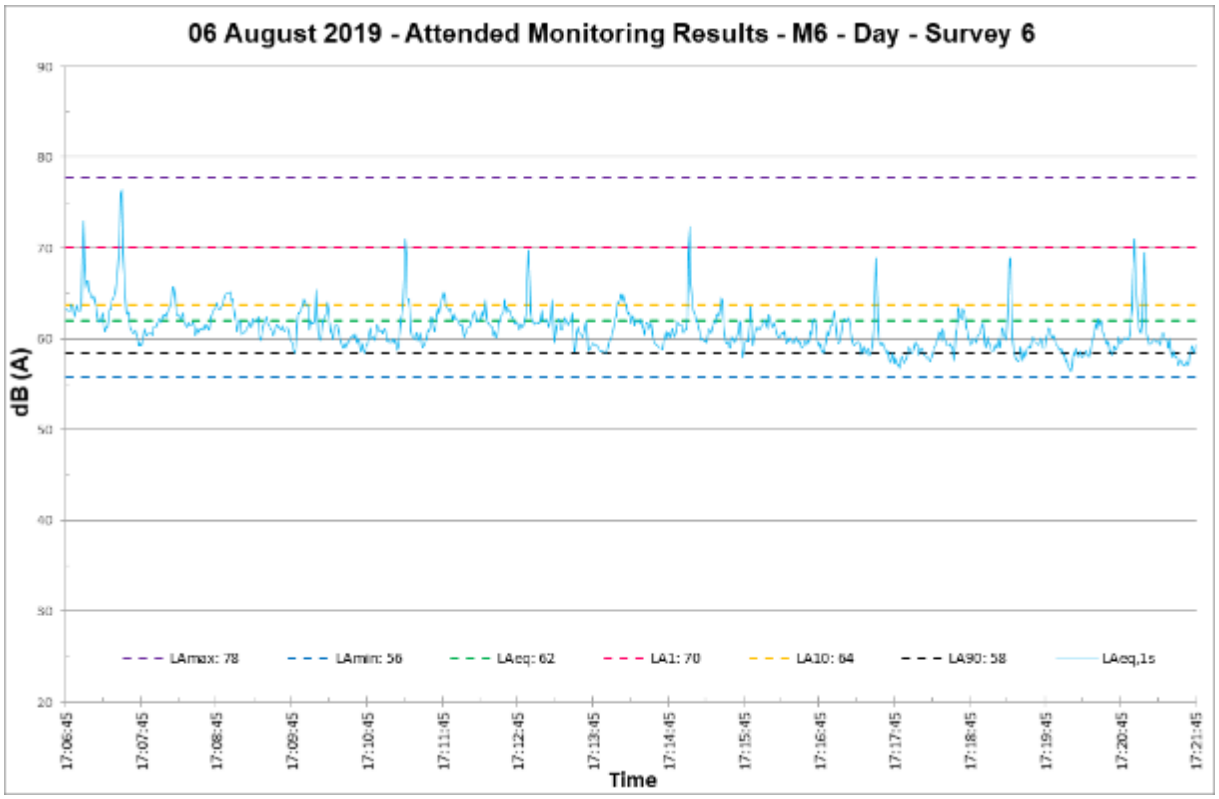




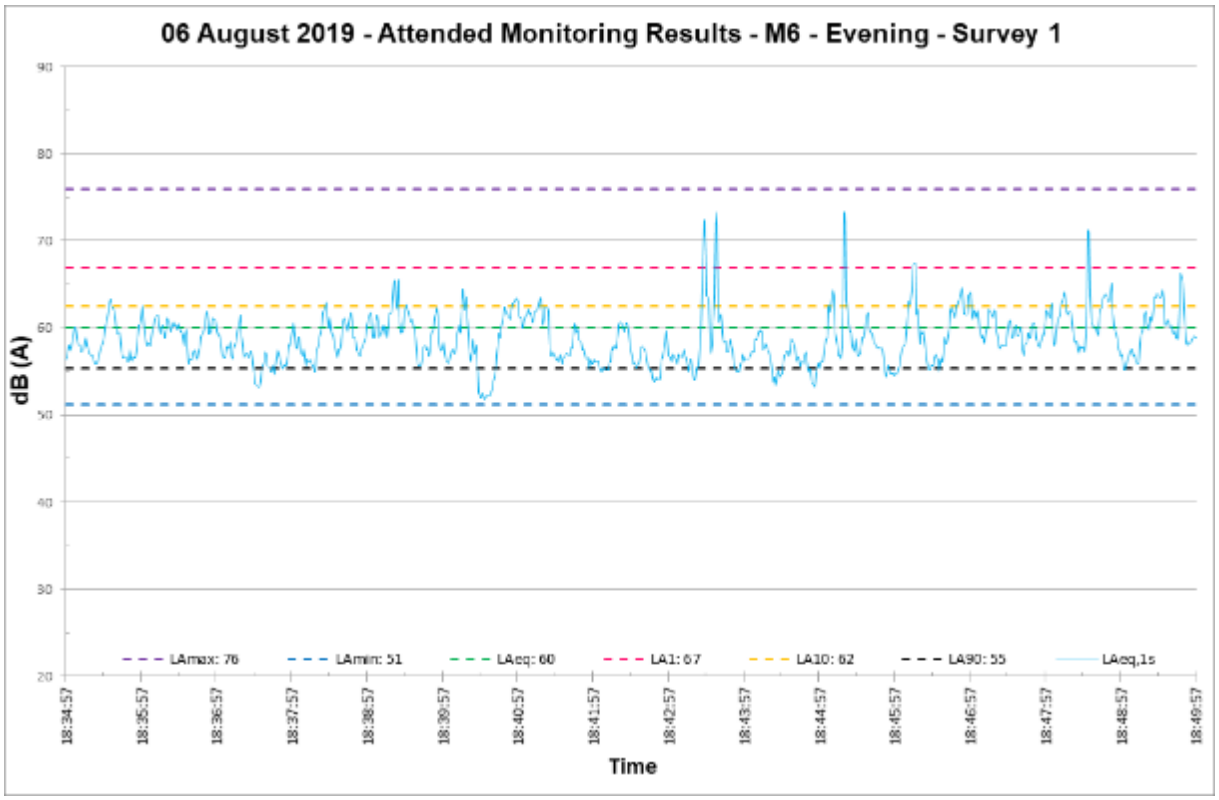

06 August 2019 - Attended Monitoring Results - M6 - Day - Survey 3
dB (A)
Time
LAmax: 76
LAmin: 56
LAeq: 62
LA1: 70
LA10: 64
LA90: 59
LAeq,1s

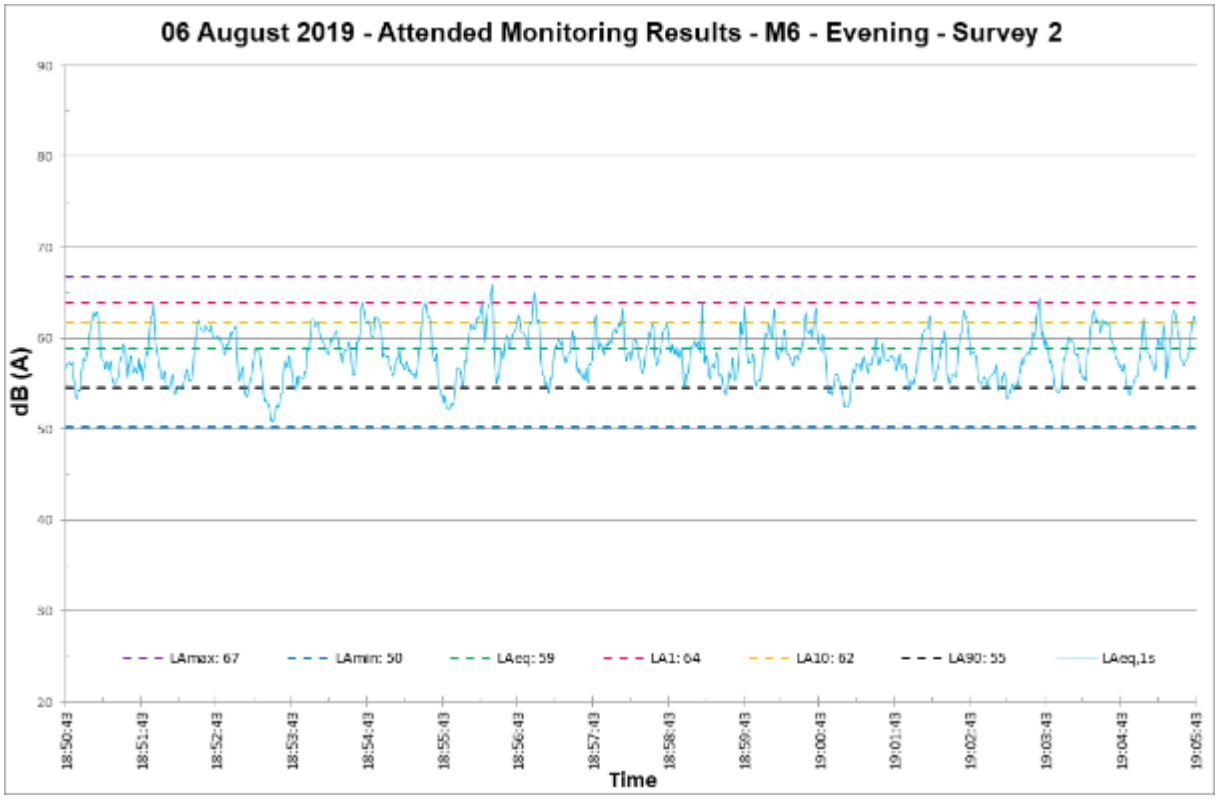

06 August 2019 - Attended Monitoring Results - M6 - Day - Survey 4
dB (A)
Time
LAmax: 77
LAmin: 56
LAeq: 62
LA1: 67
LA10: 64
LA90: 59
LAeq,1s


06 August 2019 - Attended Monitoring Results - M6 - Day - Survey 5
dB (A)
Time
LAmax: 83
LAmin: 55
LAeq: 63
LA1: 71
LA10: 65
LA90: 59
LAeq,1s

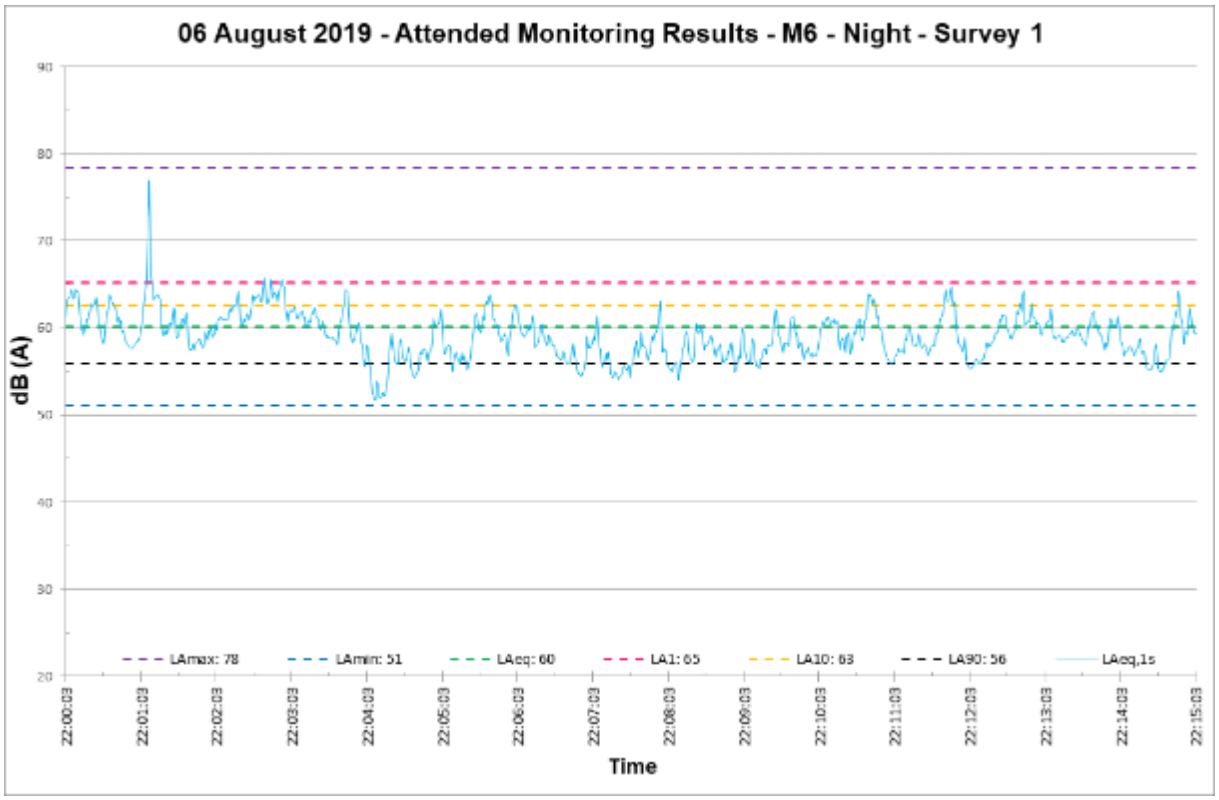

06 August 2019 - Attended Monitoring Results - M6 - Day - Survey 6
dB (A)
Time
LAmax: 78
LAmin: 56
LAeq: 62
LA1: 70
LA10: 64
LA90: 58
LAeq,1s

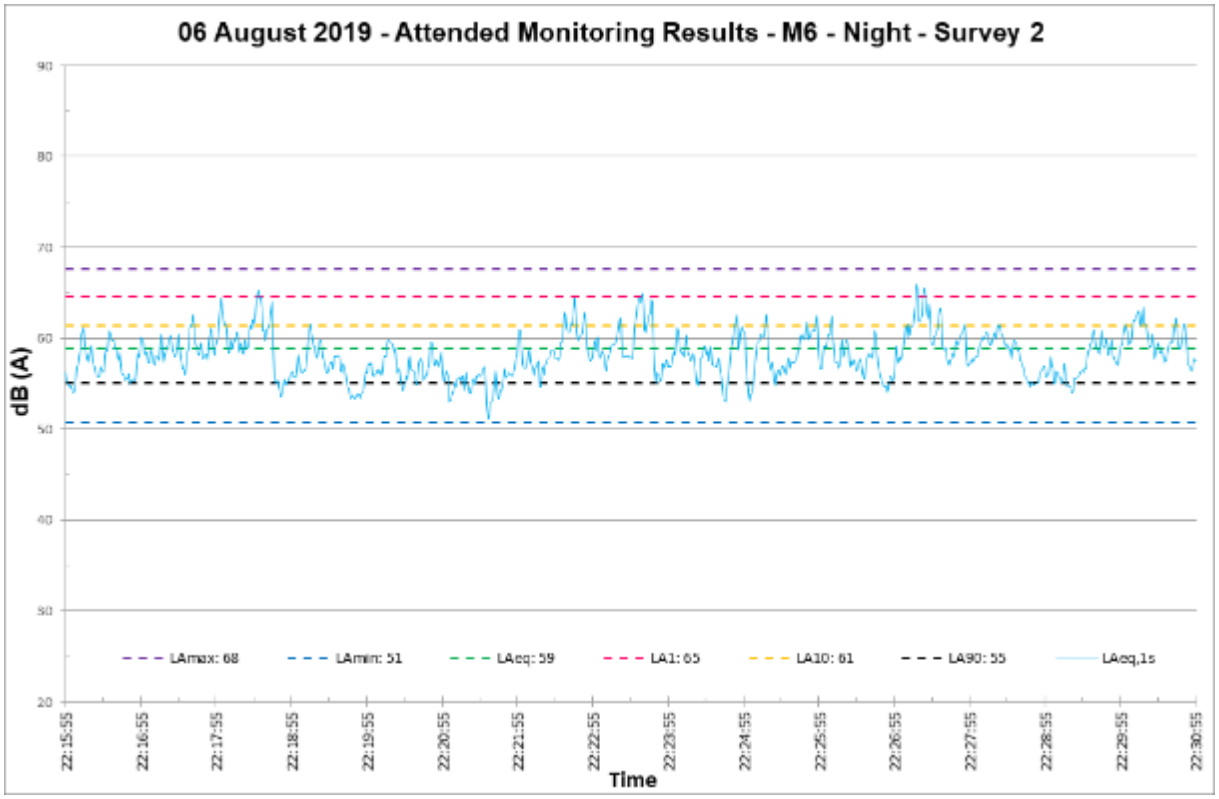
Evening – 06/08/2019

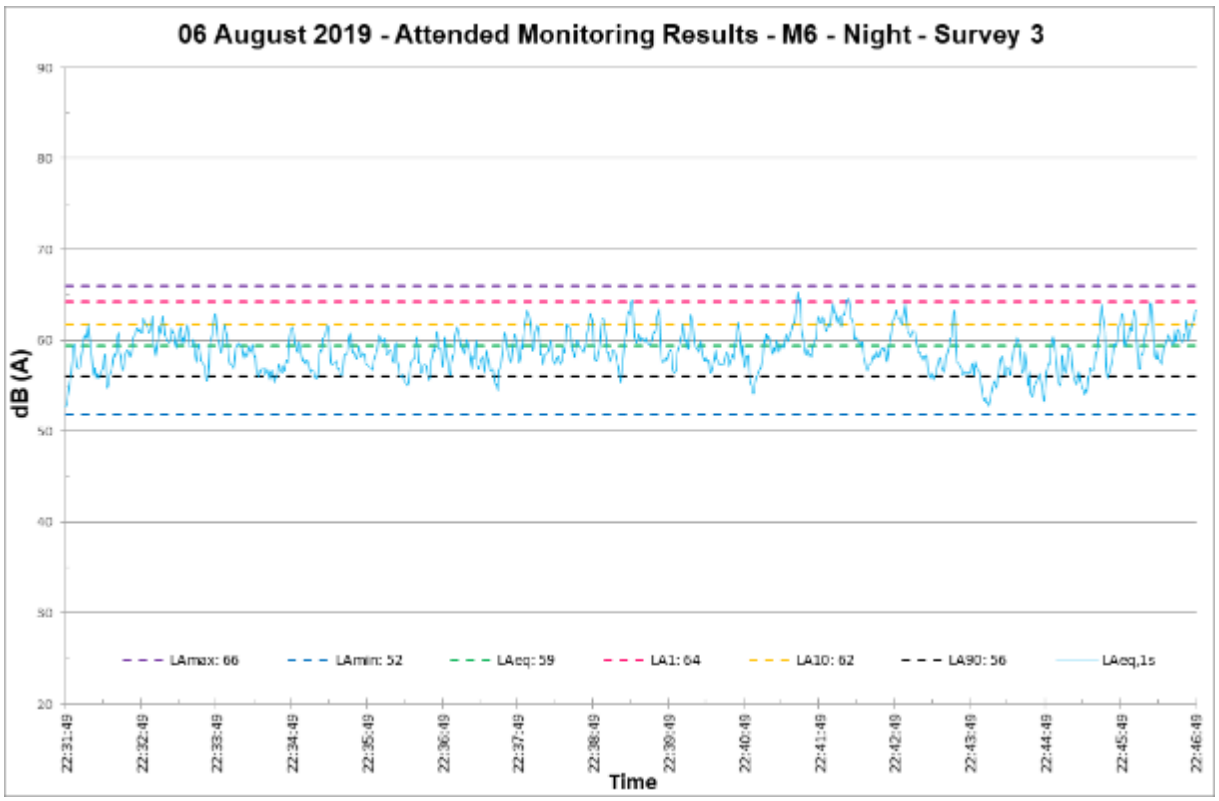


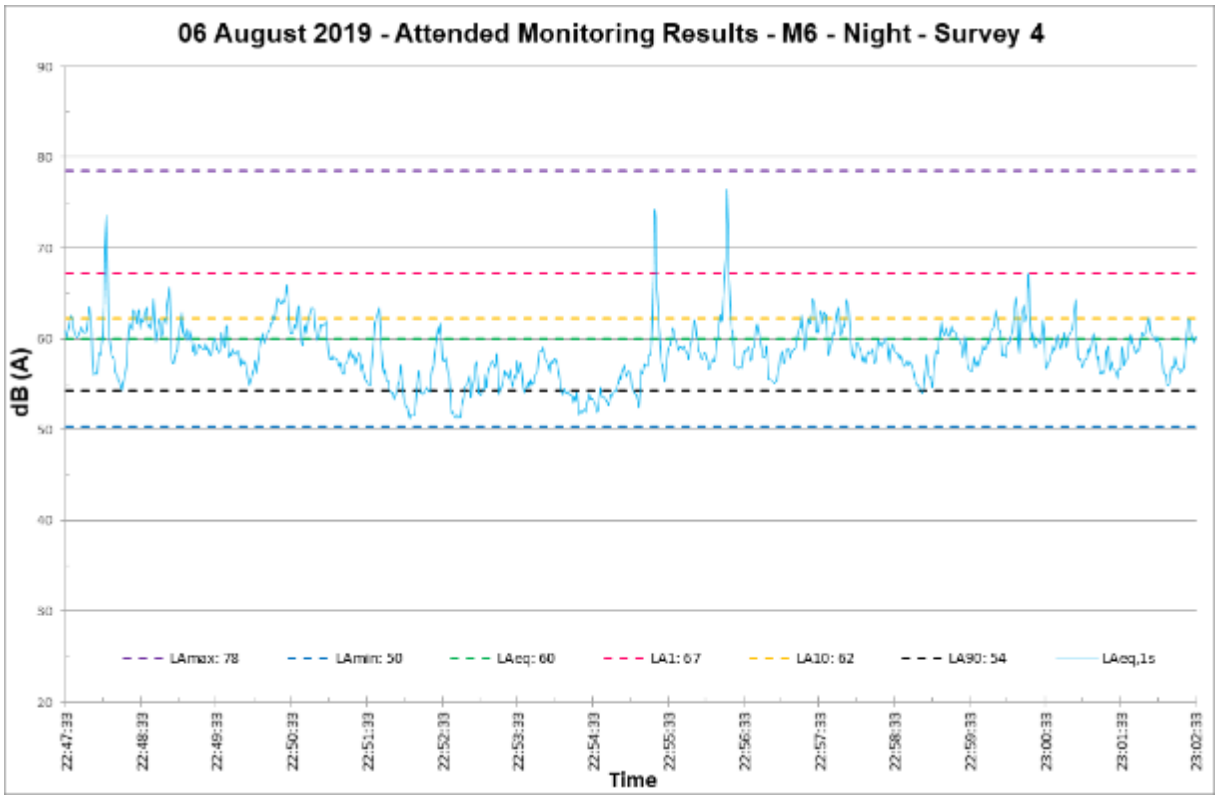


Night – 06/08/2019

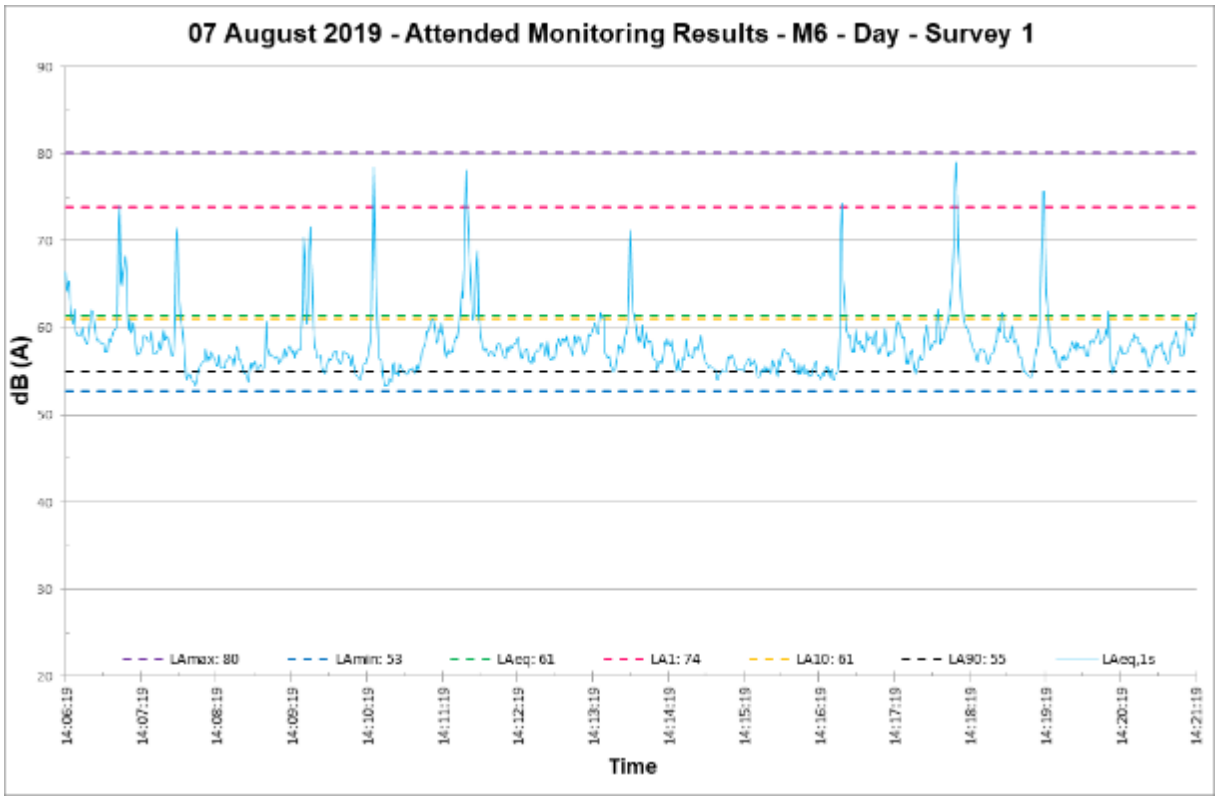


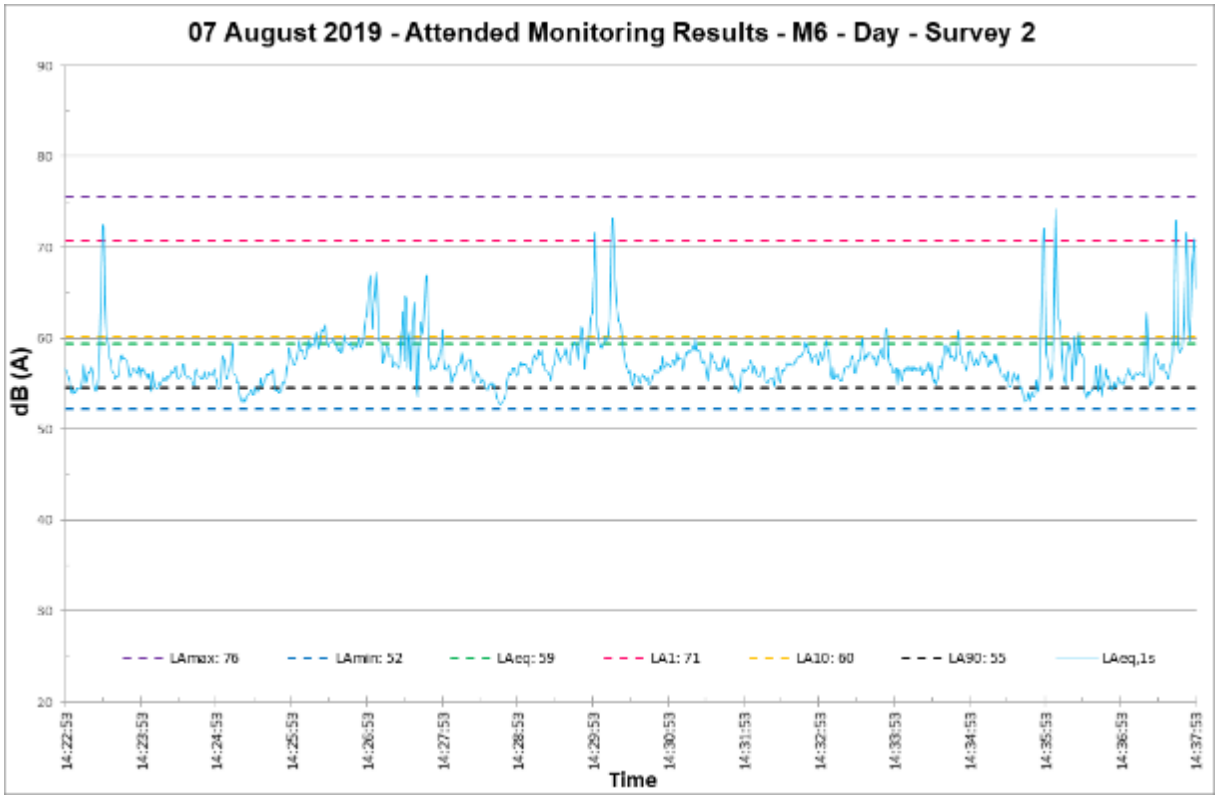


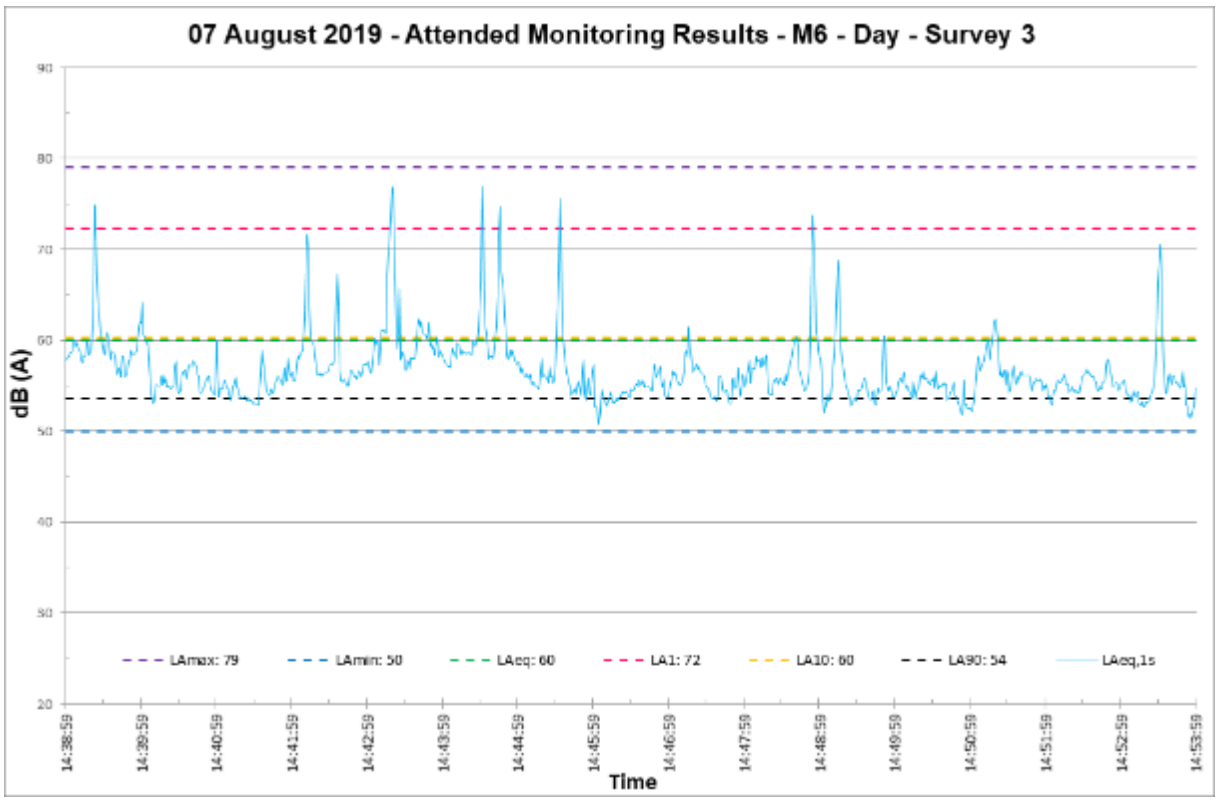

06 August 2019 - Attended Monitoring Results - M6 - Night - Survey 3
dB (A)
Time
LAmax: 66
LAmin: 52
LAeq: 59
LA1: 64
LA10: 62
LA90: 56
LAeq,1s

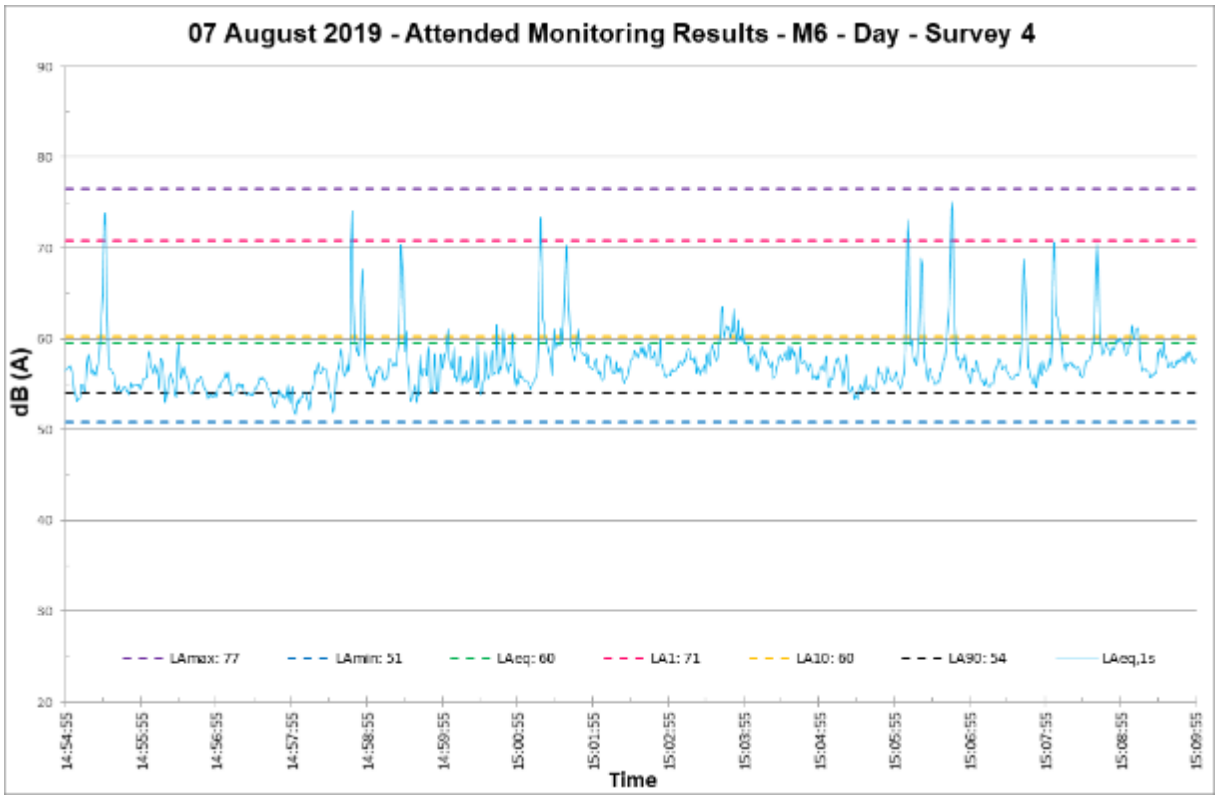

06 August 2019 - Attended Monitoring Results - M6 - Night - Survey 4
dB (A)
Time
LAmax: 78
LAmin: 50
LAeq: 60
LA1: 67
LA10: 62
LA90: 54
LAeq,1s

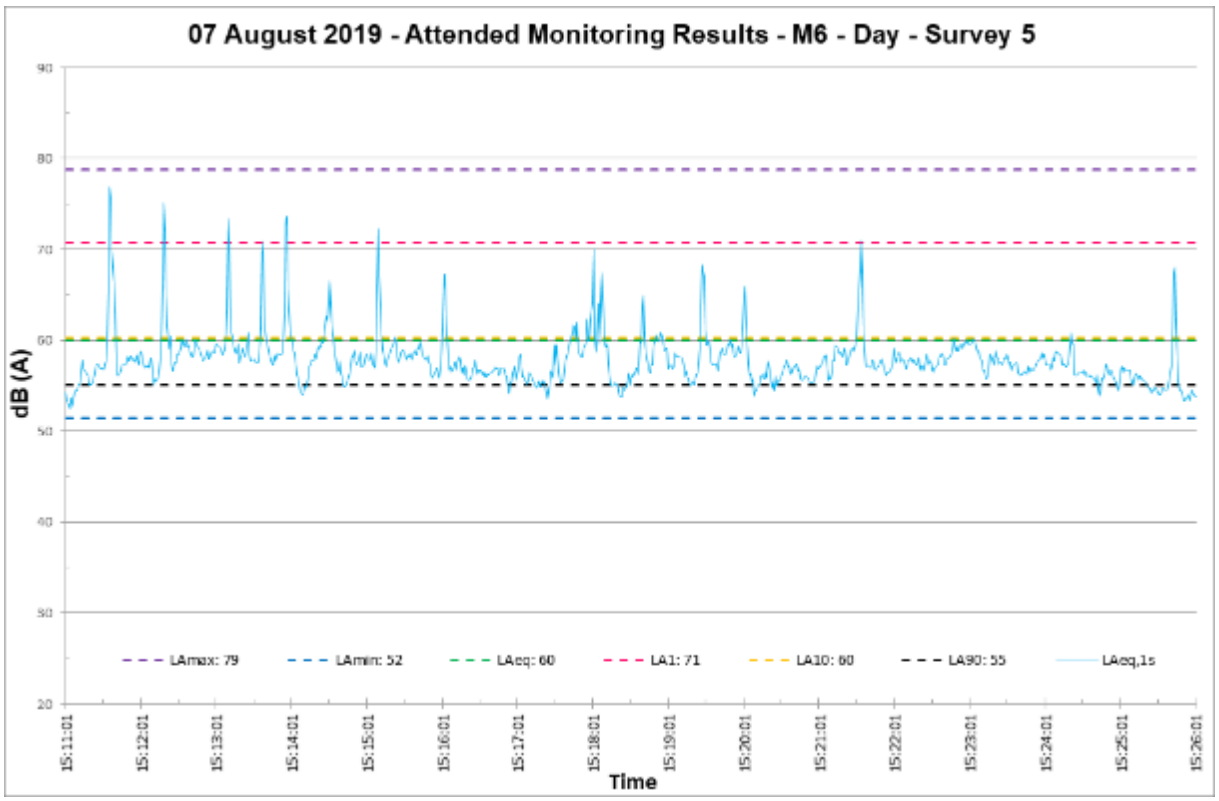
Day – 07/08/2019

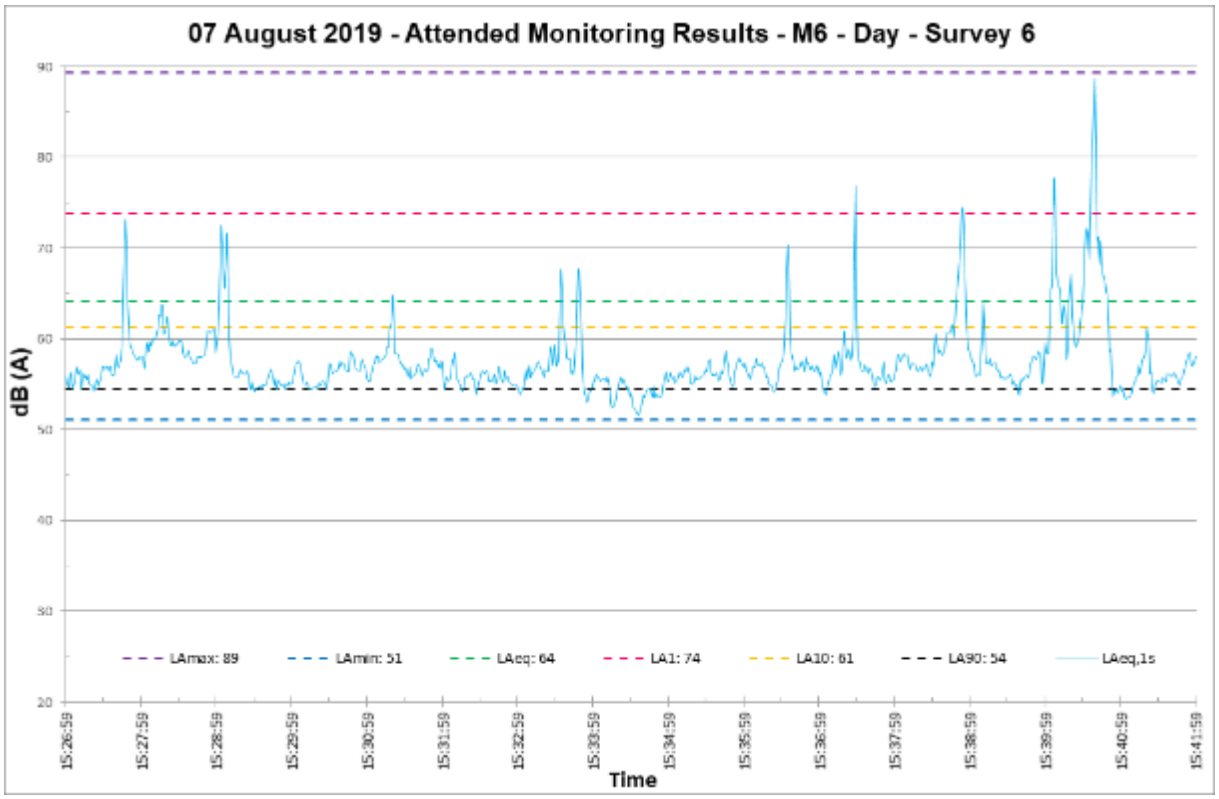




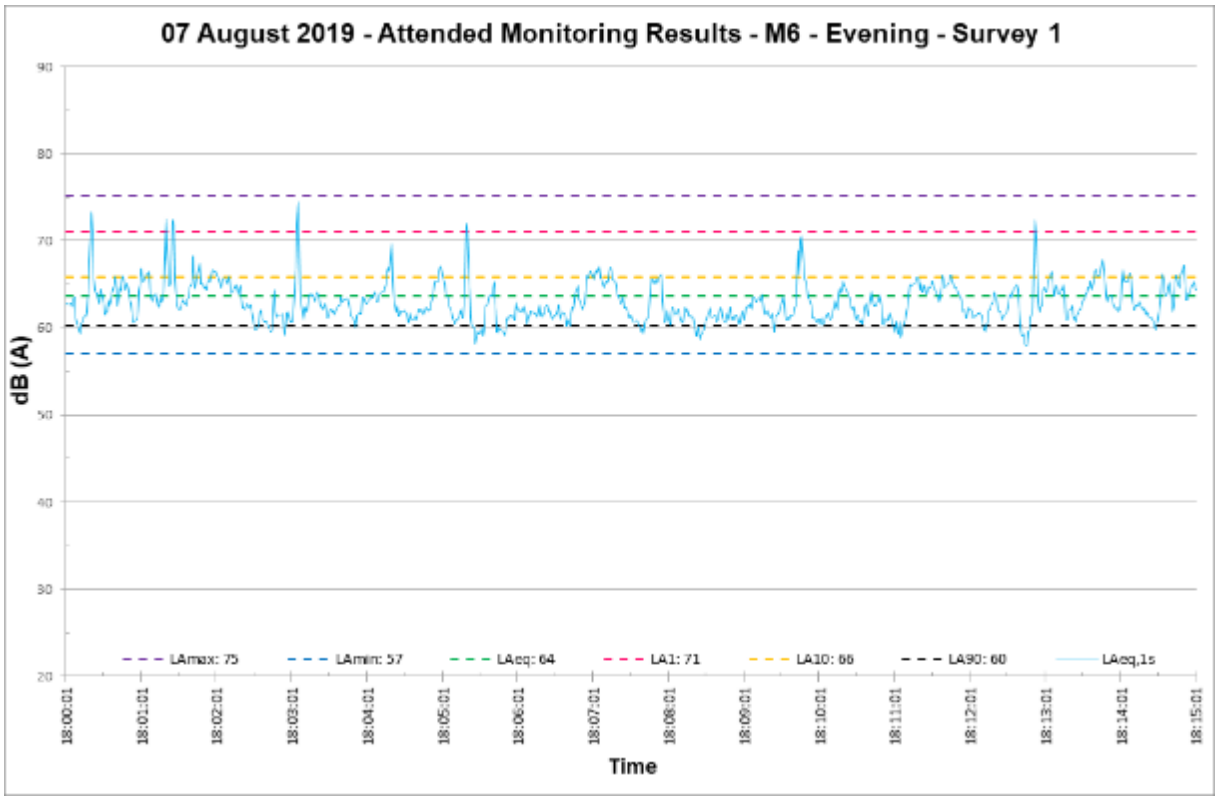

07 August 2019 - Attended Monitoring Results - M6 - Day - Survey 3
dB (A)
Time
LAmax: 79
LAmin: 50
LAeq: 60
LA1: 72
LA10: 60
LA90: 54
LAeq,1s

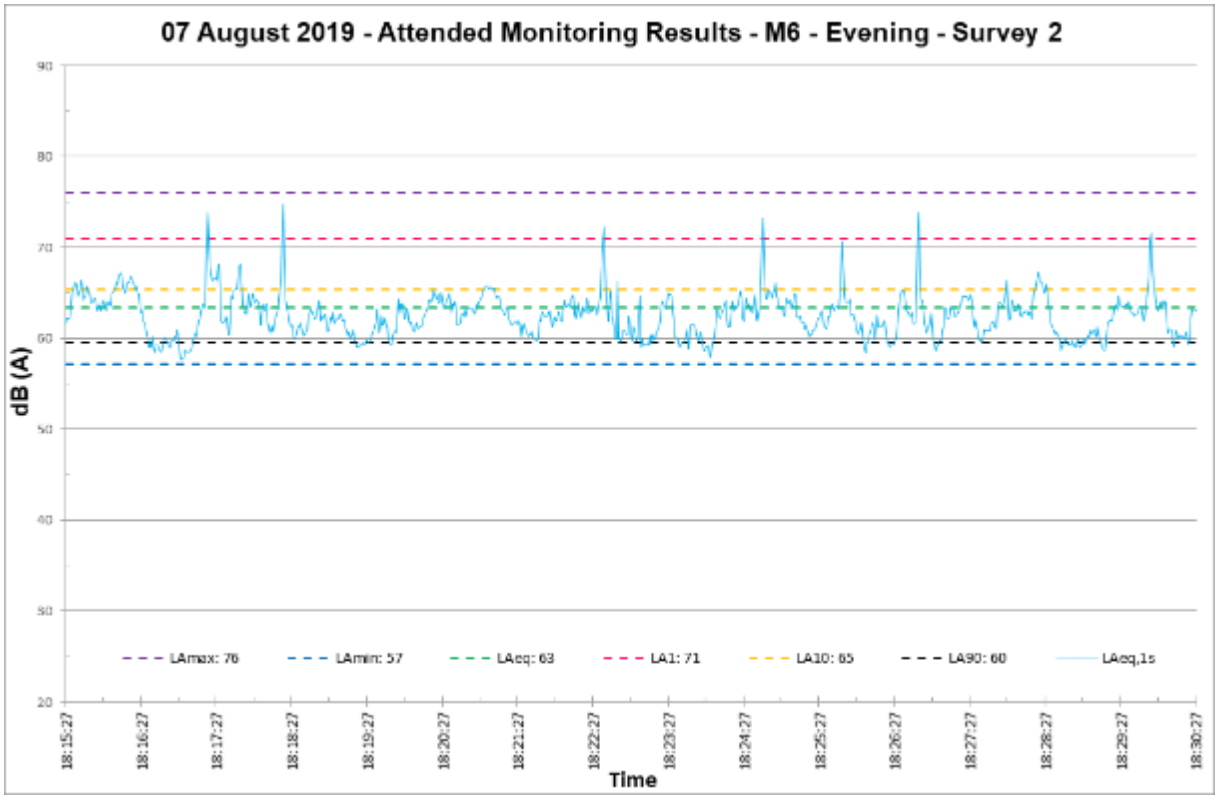

07 August 2019 - Attended Monitoring Results - M6 - Day - Survey 4
dB (A)
Time
LAmax: 77
LAmin: 51
LAeq: 60
LA1: 71
LA10: 60
LA90: 54
LAeq,1s


07 August 2019 - Attended Monitoring Results - M6 - Day - Survey 5
dB (A)
Time
LAmax: 79
LAmin: 52
LAeq: 60
LA1: 71
LA10: 60
LA90: 55
LAeq,1s

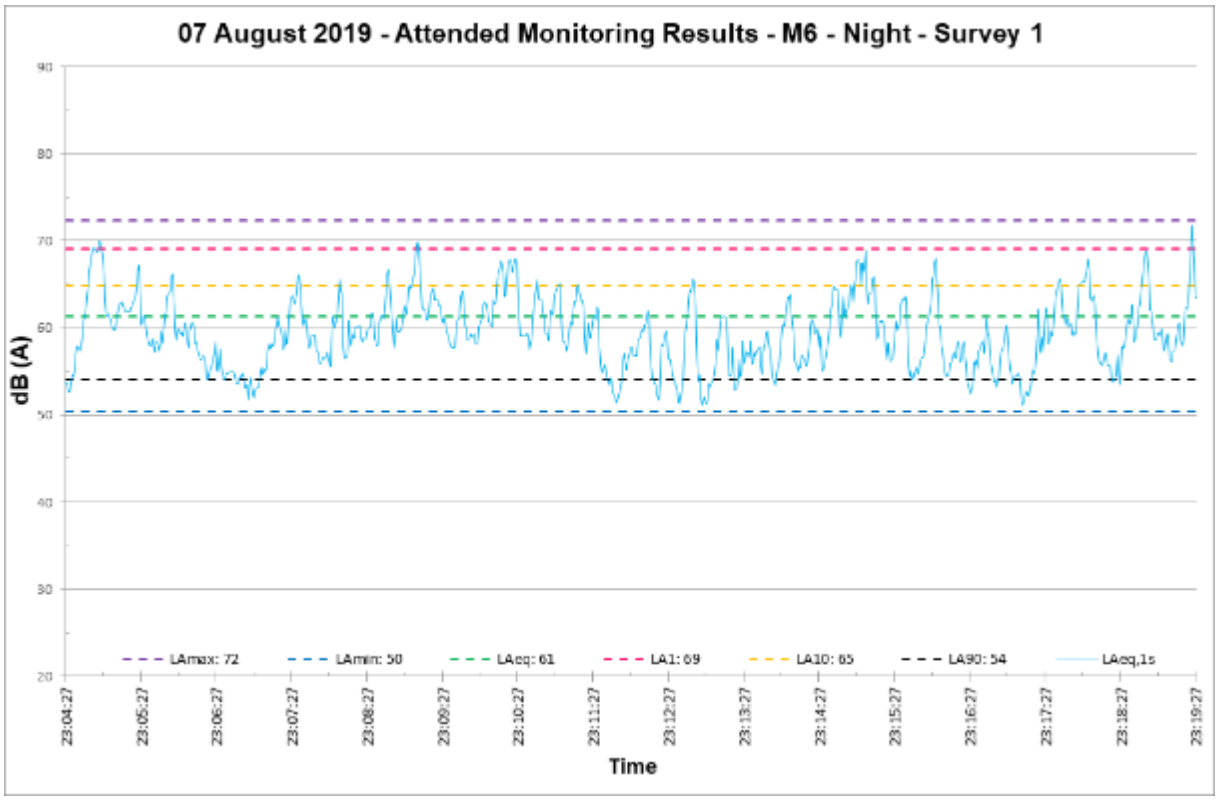

07 August 2019 - Attended Monitoring Results - M6 - Day - Survey 6
dB (A)
Time
LAmax: 89
LAmin: 51
LAeq: 64
LA1: 74
LA10: 61
LA90: 54
LAeq,1s

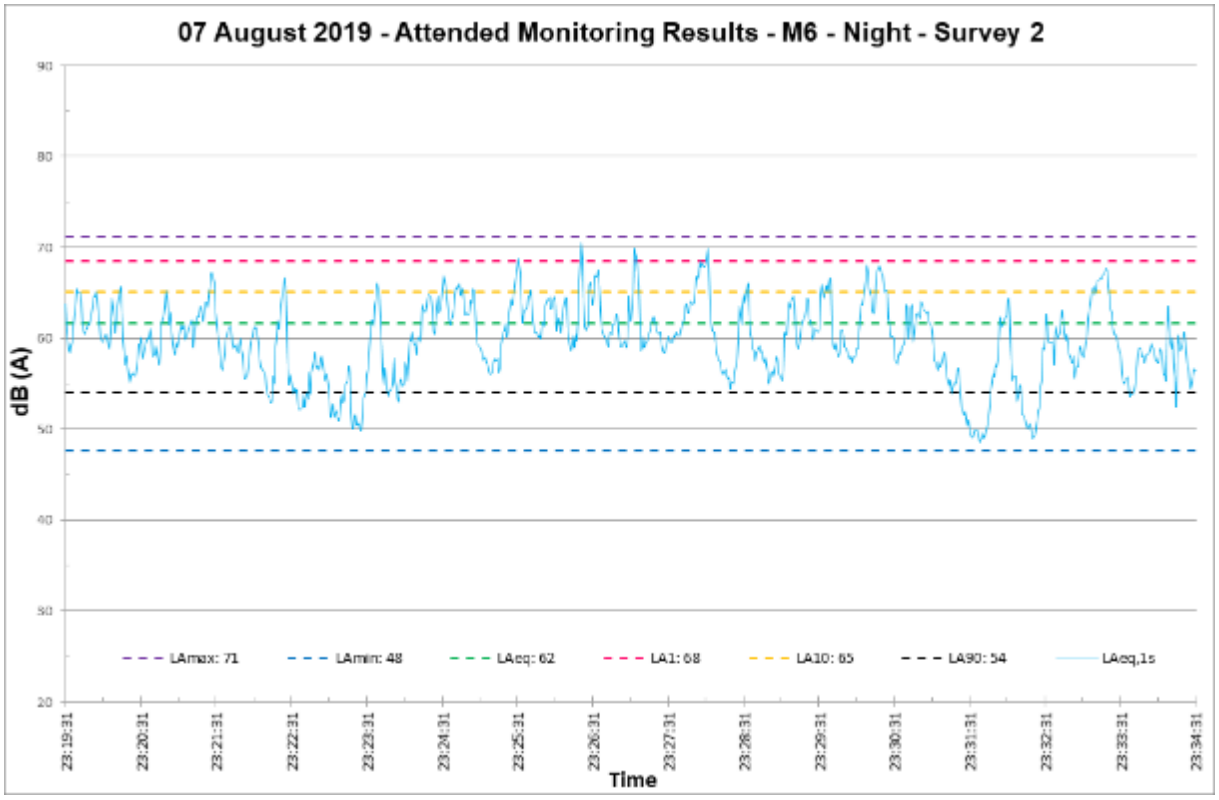
Evening – 07/08/2019

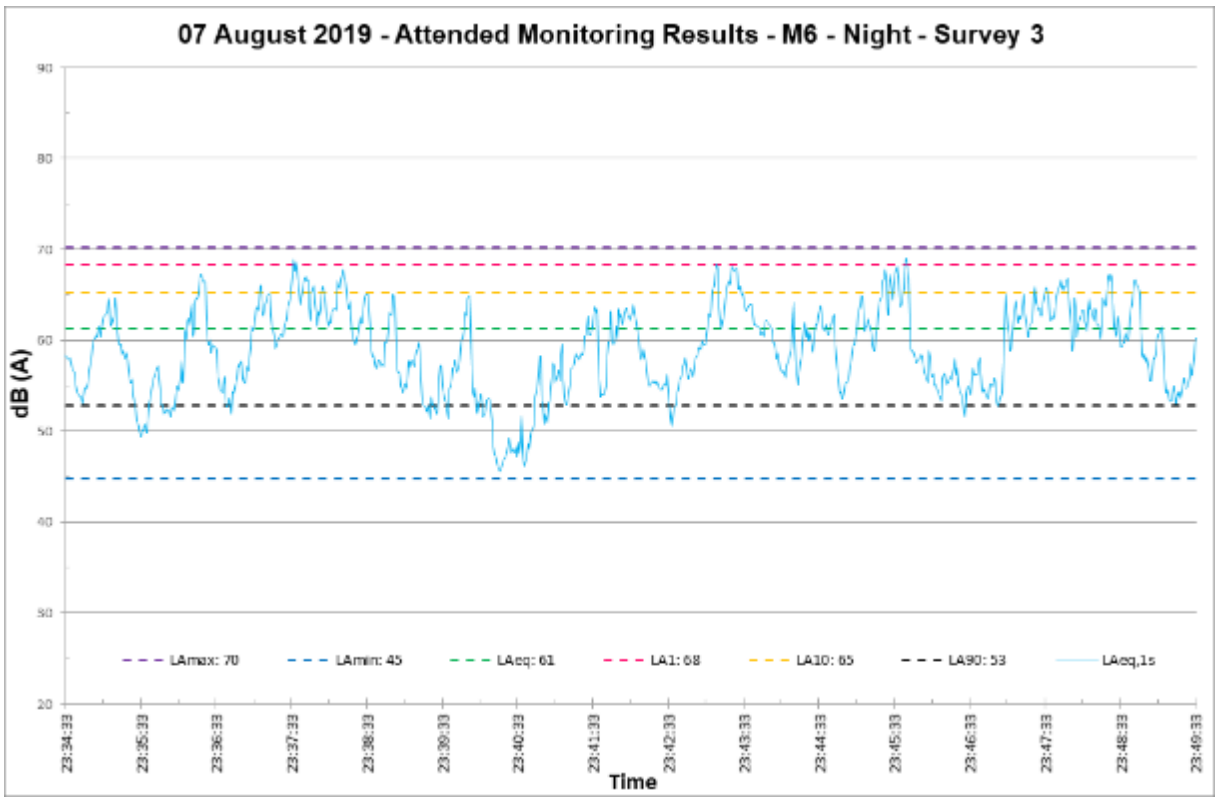


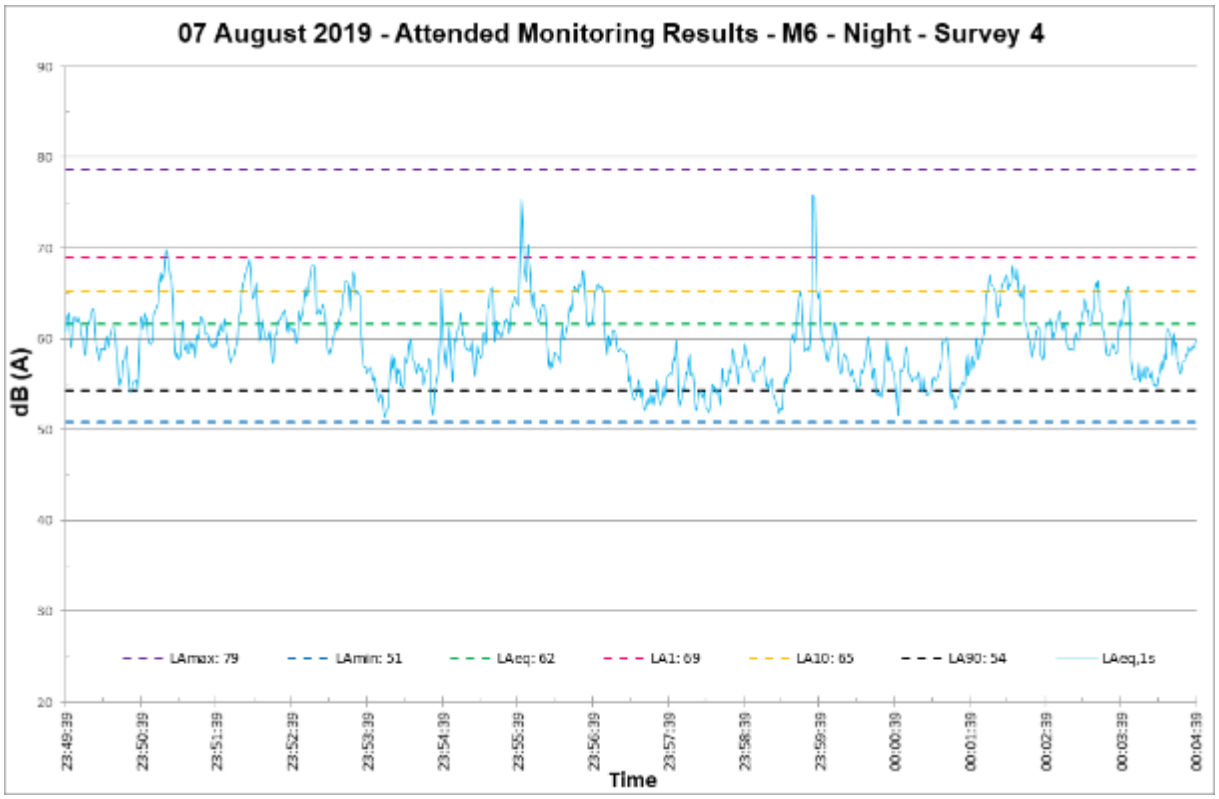


Night – 07/08/2019



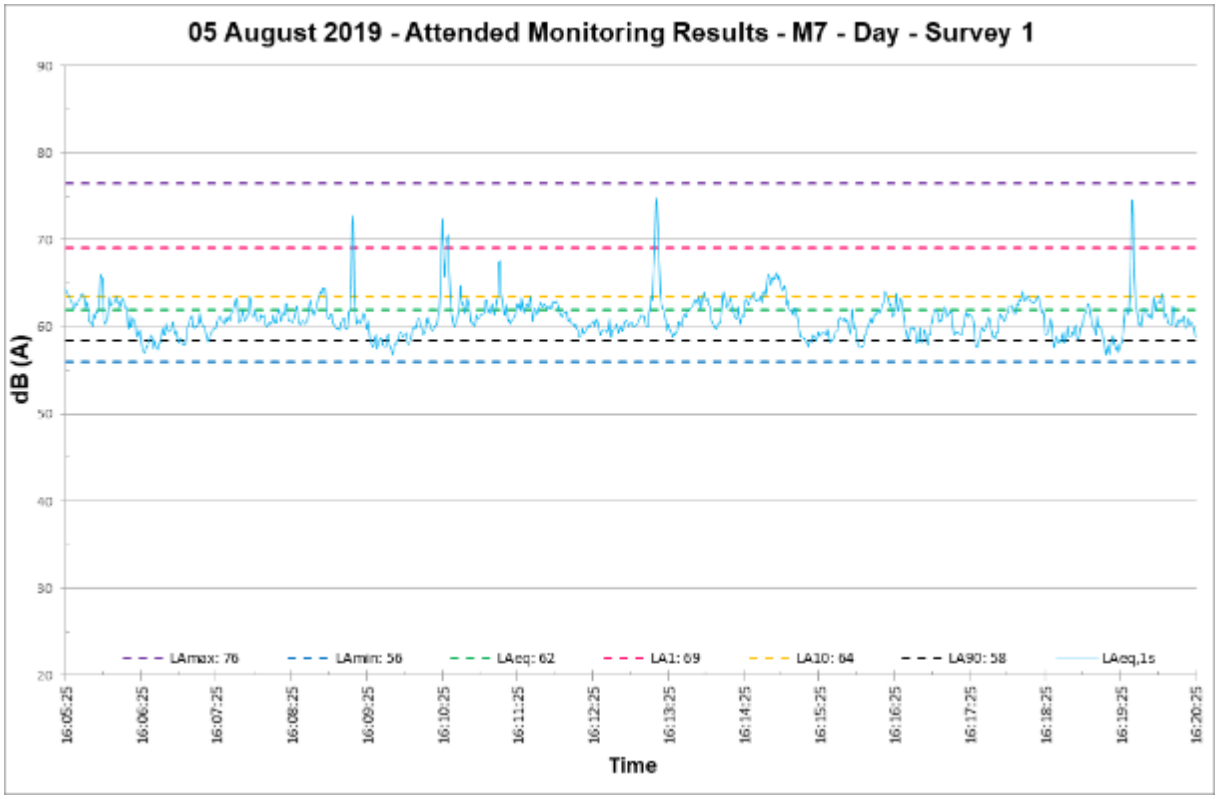


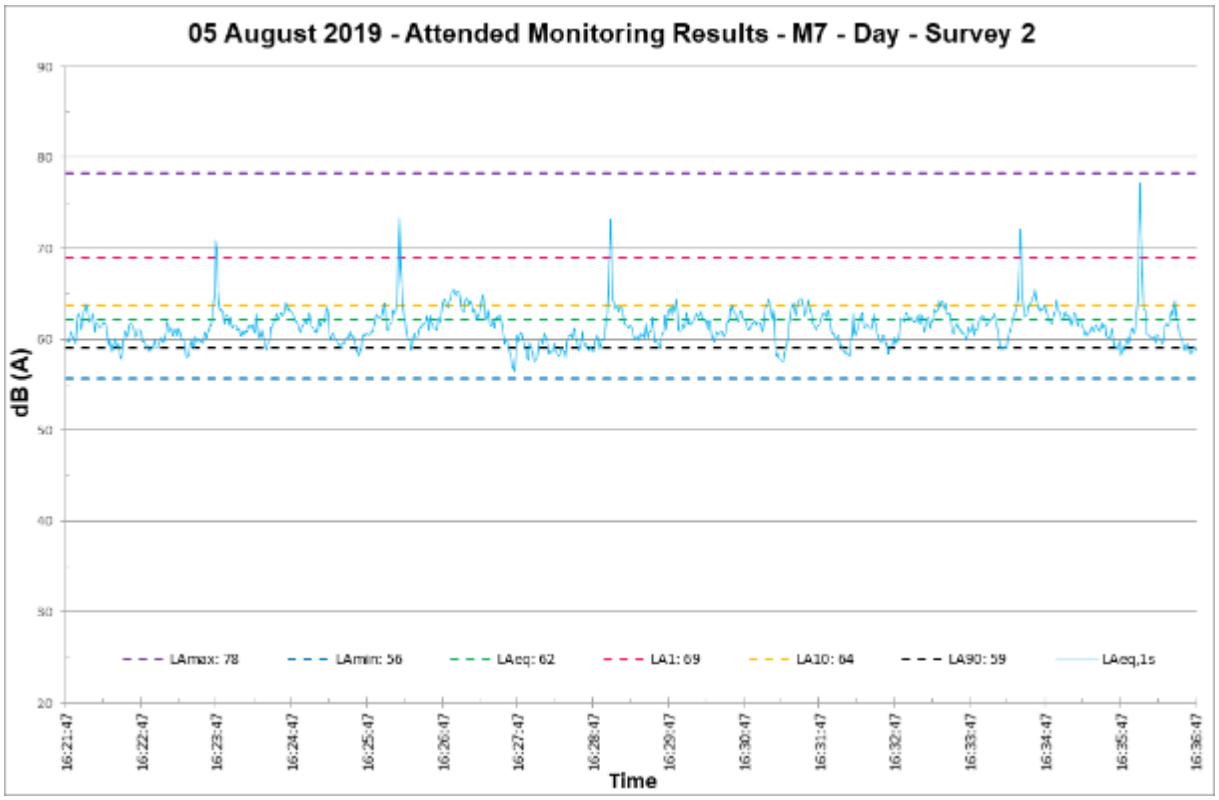

07 August 2019 - Attended Monitoring Results - M6 - Night - Survey 3
dB (A)
Time
LAmax: 70
LAmin: 45
LAeq: 61
LA1: 68
LA10: 65
LA90: 53
LAeq,1s

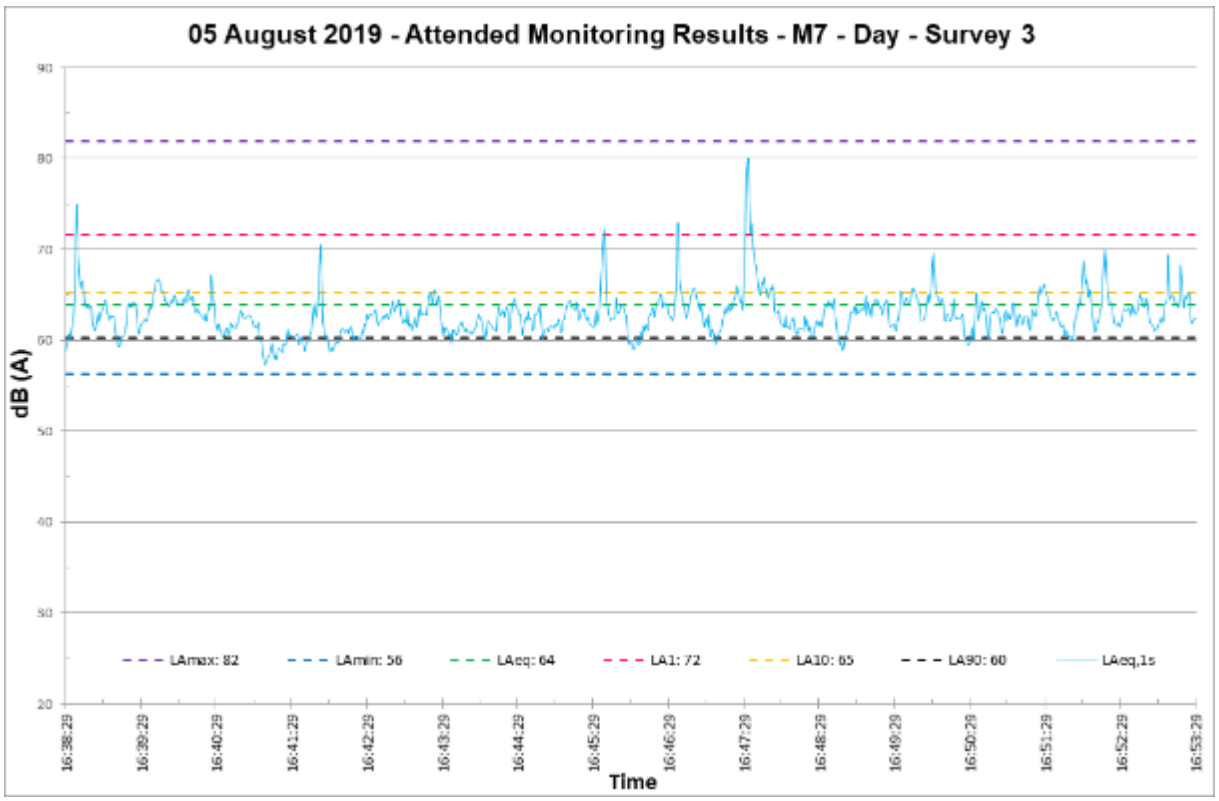

07 August 2019 - Attended Monitoring Results - M6 - Night - Survey 4
dB (A)
Time
LAmax: 79
LAmin: 51
LAeq: 62
LA1: 69
LA10: 65
LA90: 54
LAeq,1s

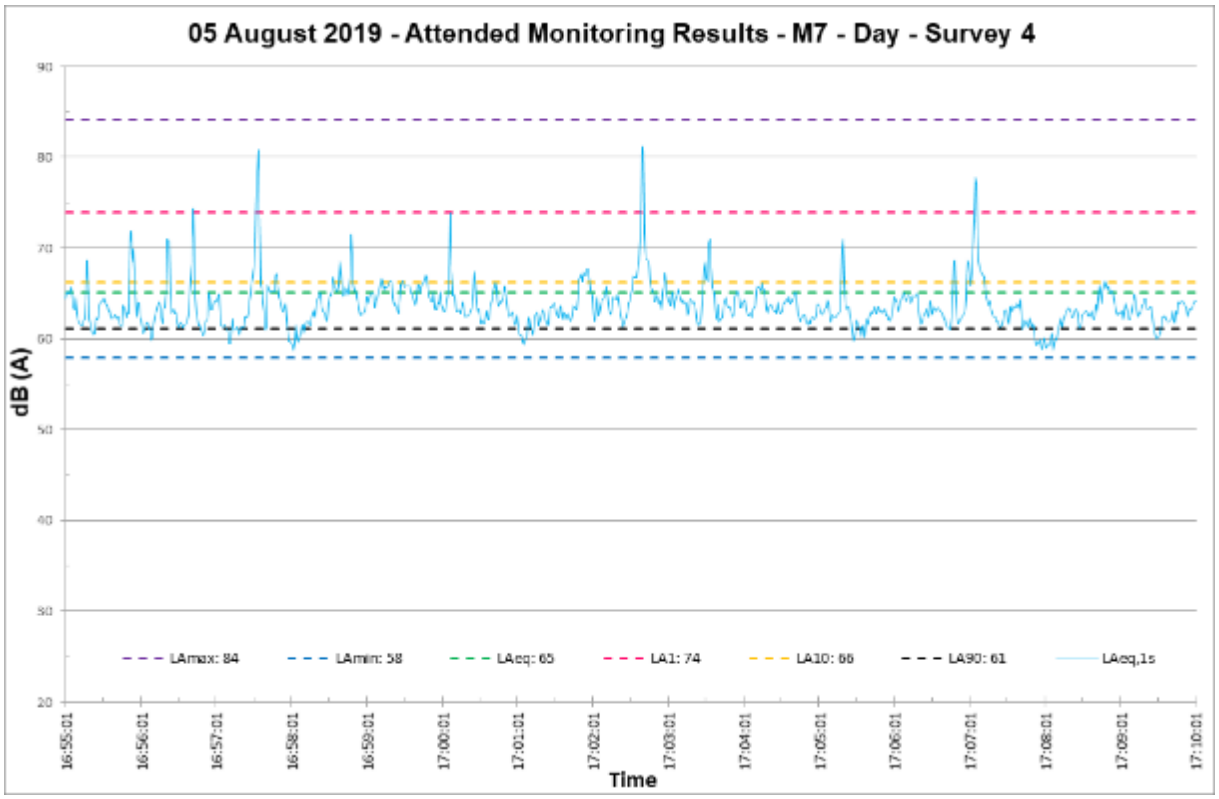
Appendix E – Operator attended noise monitoring results – Location M7

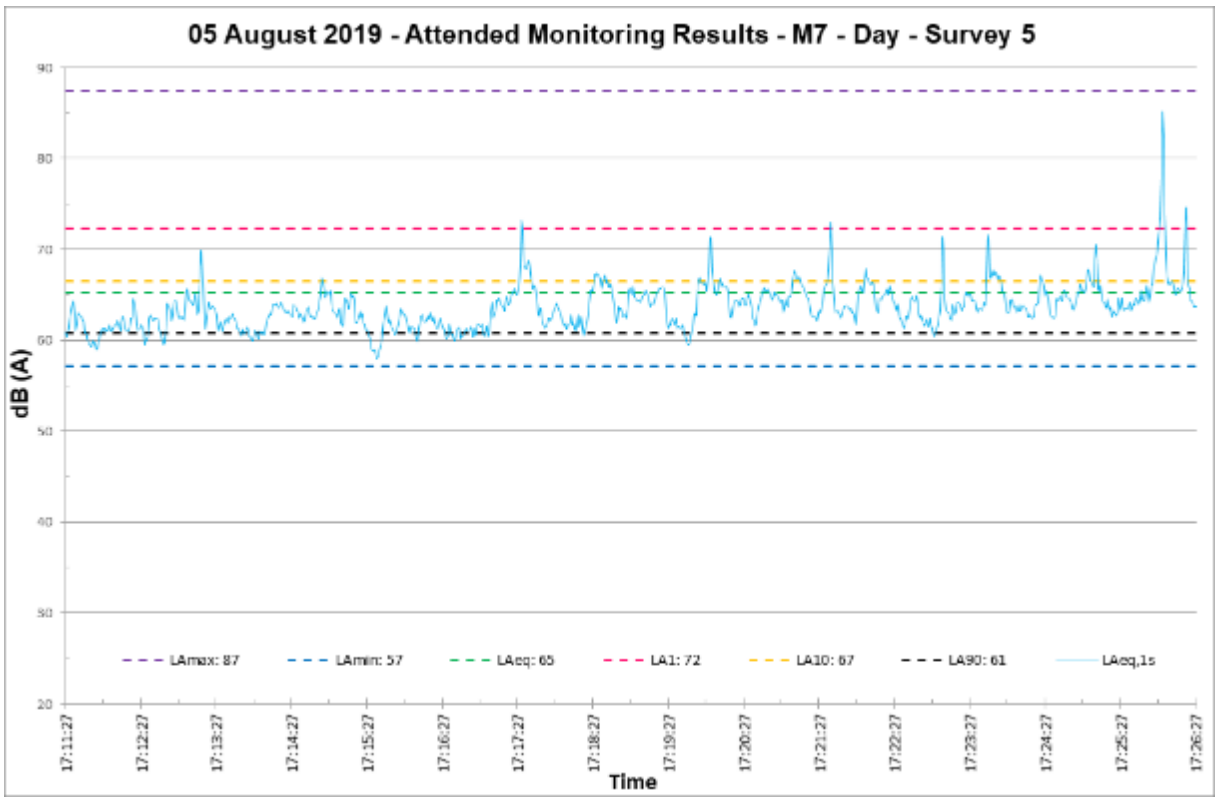
Day – 05/08/2019

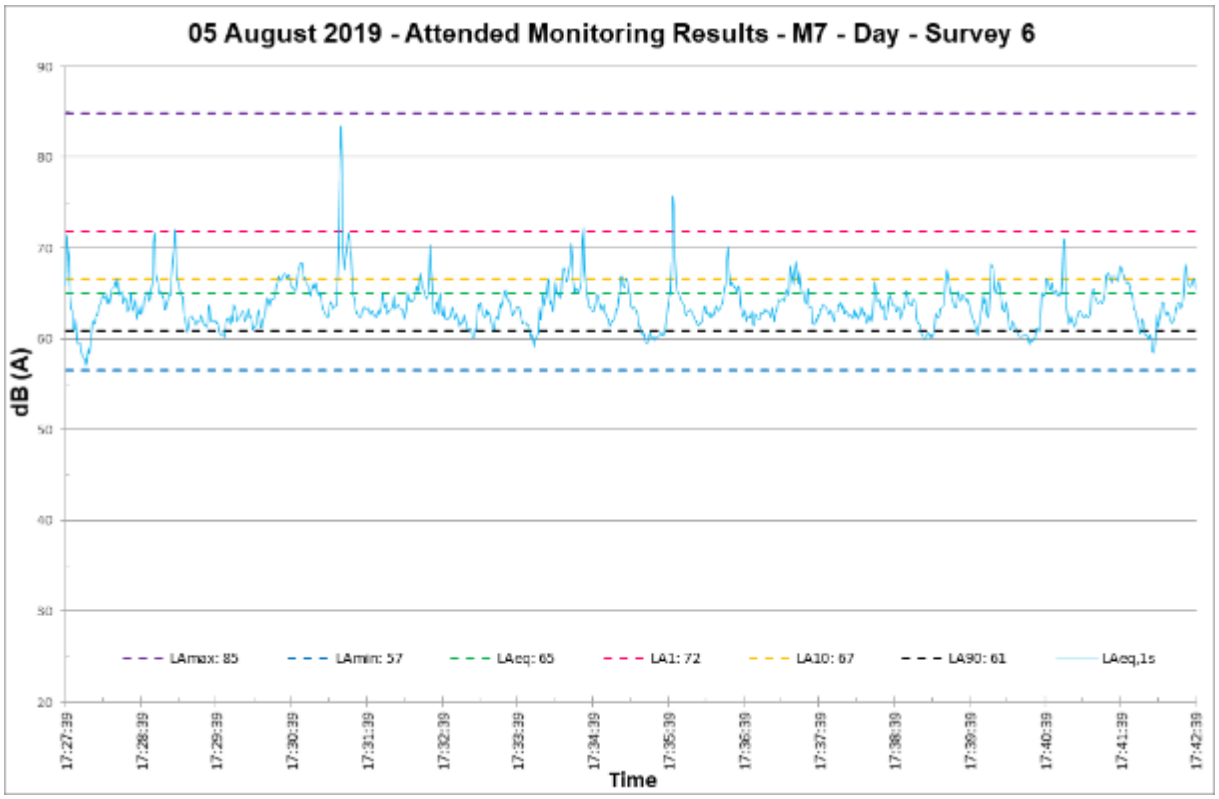




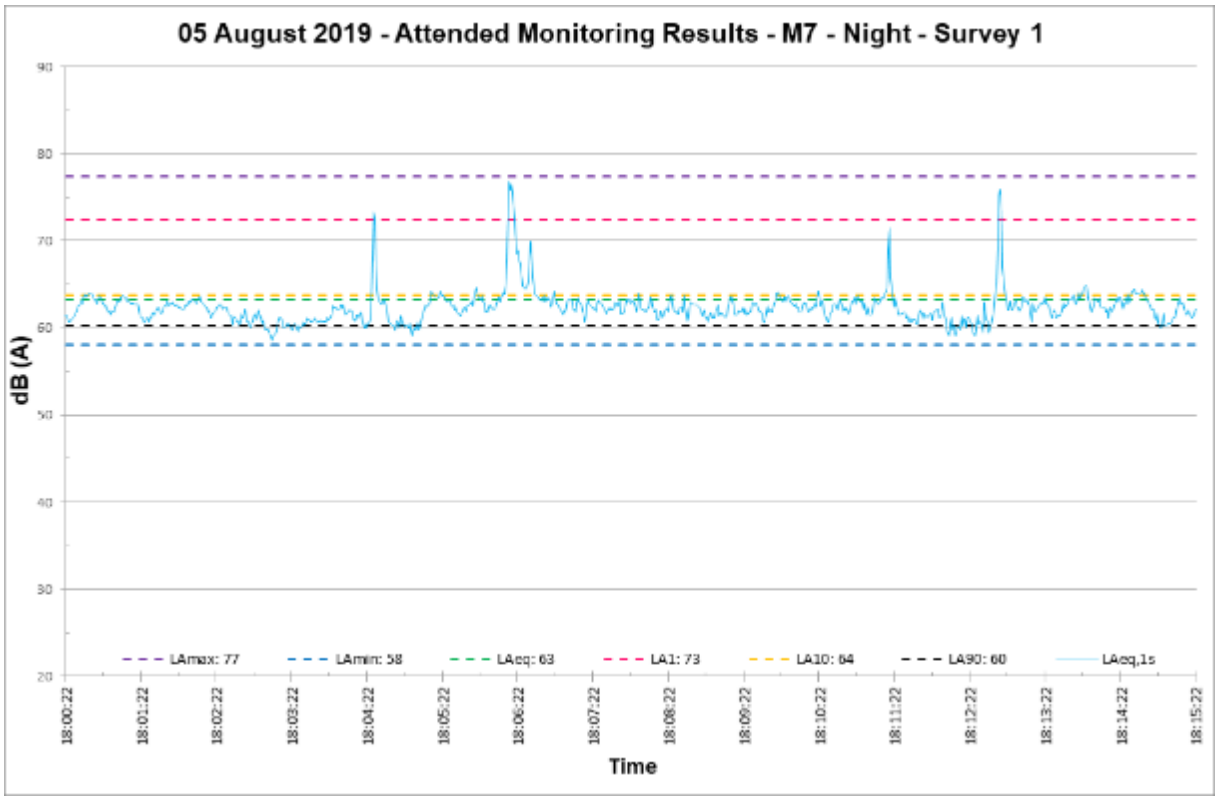

05 August 2019 - Attended Monitoring Results - M7 - Day - Survey 3
dB (A)
Time
LAmax: 82
LAmin: 56
LAeq: 64
LA1: 72
LA10: 65
LA90: 60
LAeq,1s

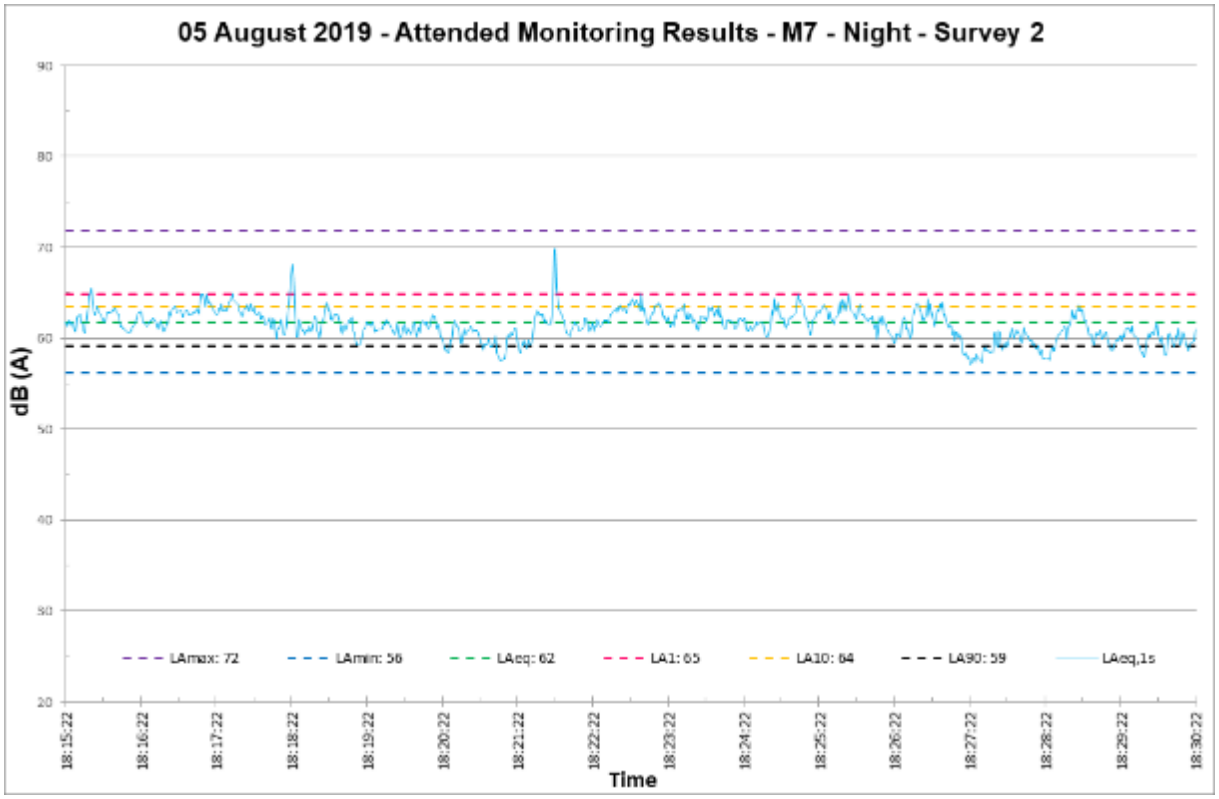

05 August 2019 - Attended Monitoring Results - M7 - Day - Survey 4
dB (A)
Time
LAmax: 84
LAmin: 58
LAeq: 65
LA1: 74
LA10: 66
LA90: 61
LAeq,1s


05 August 2019 - Attended Monitoring Results - M7 - Day - Survey 5
dB (A)
Time
LAmax: 87
LAmin: 57
LAeq: 65
LA1: 72
LA10: 67
LA90: 61
LAeq,1s

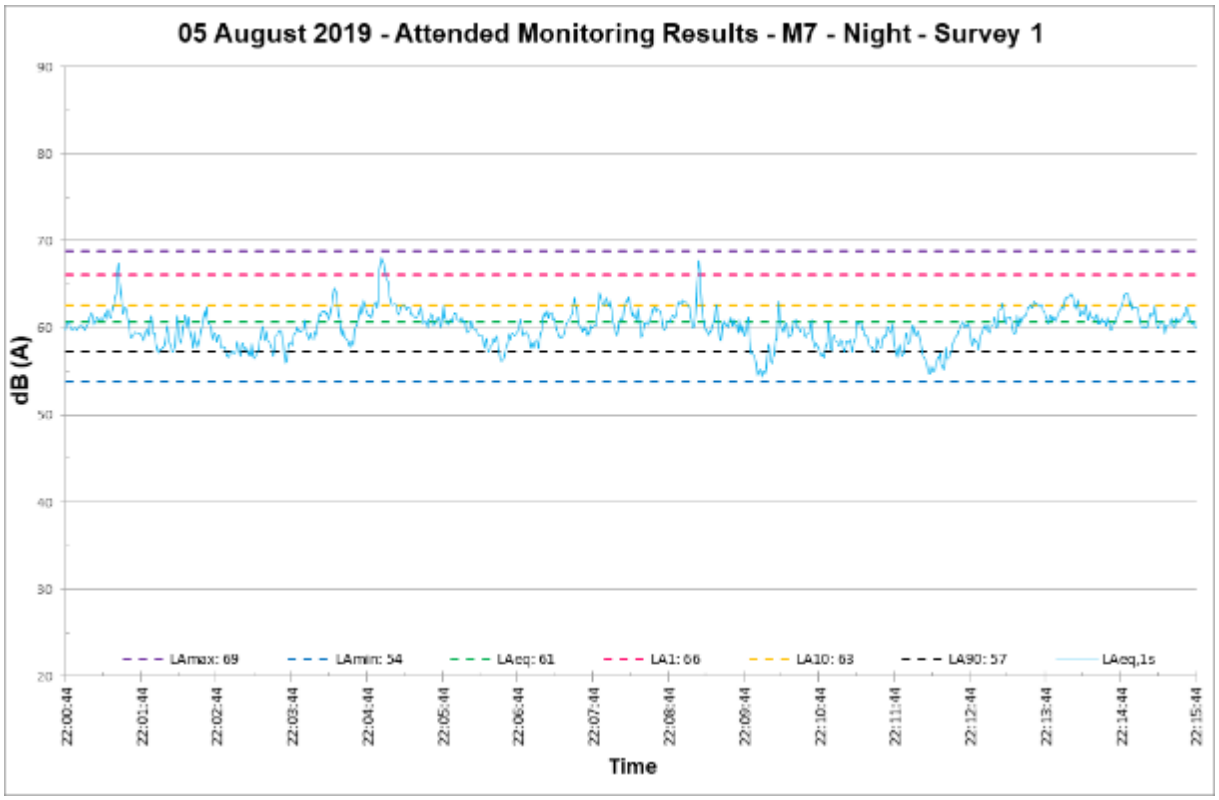

05 August 2019 - Attended Monitoring Results - M7 - Day - Survey 6
dB (A)
Time
LAmax: 85
LAmin: 57
LAeq: 65
LA1: 72
LA10: 67
LA90: 61
LAeq,1s

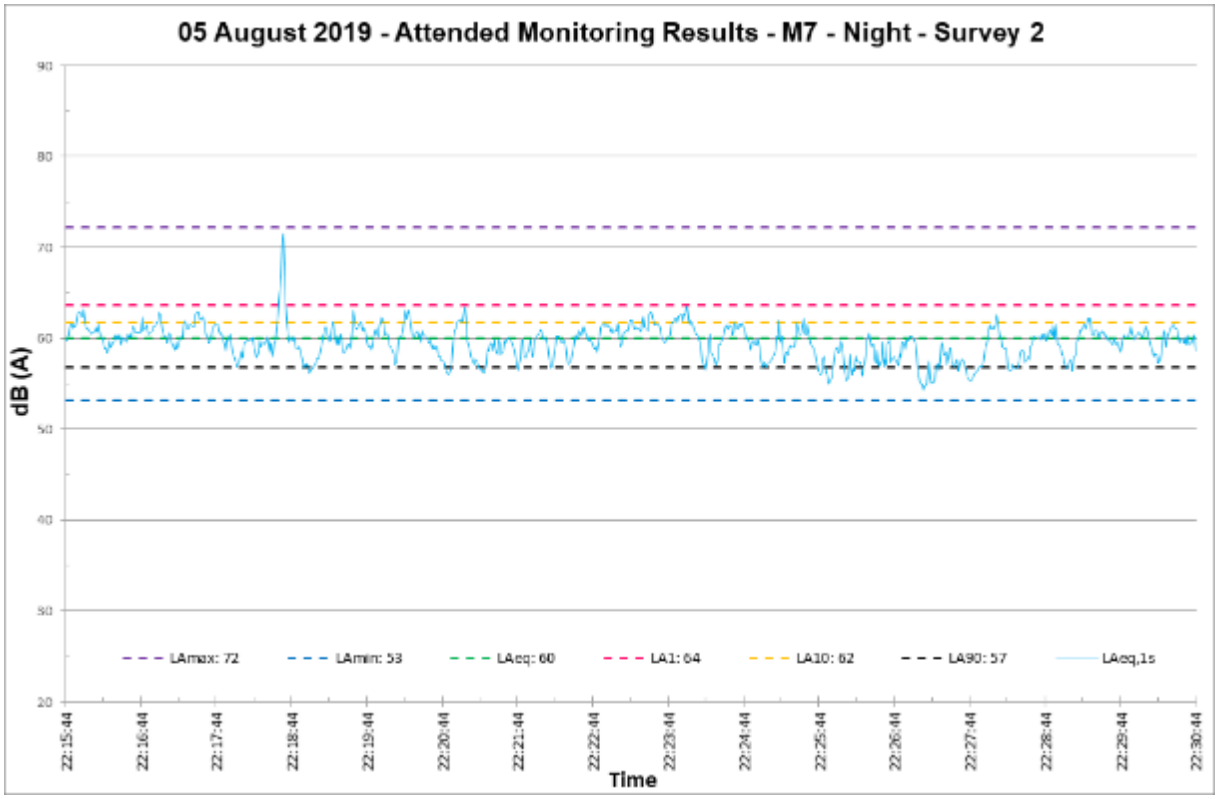
Evening – 05/08/2019

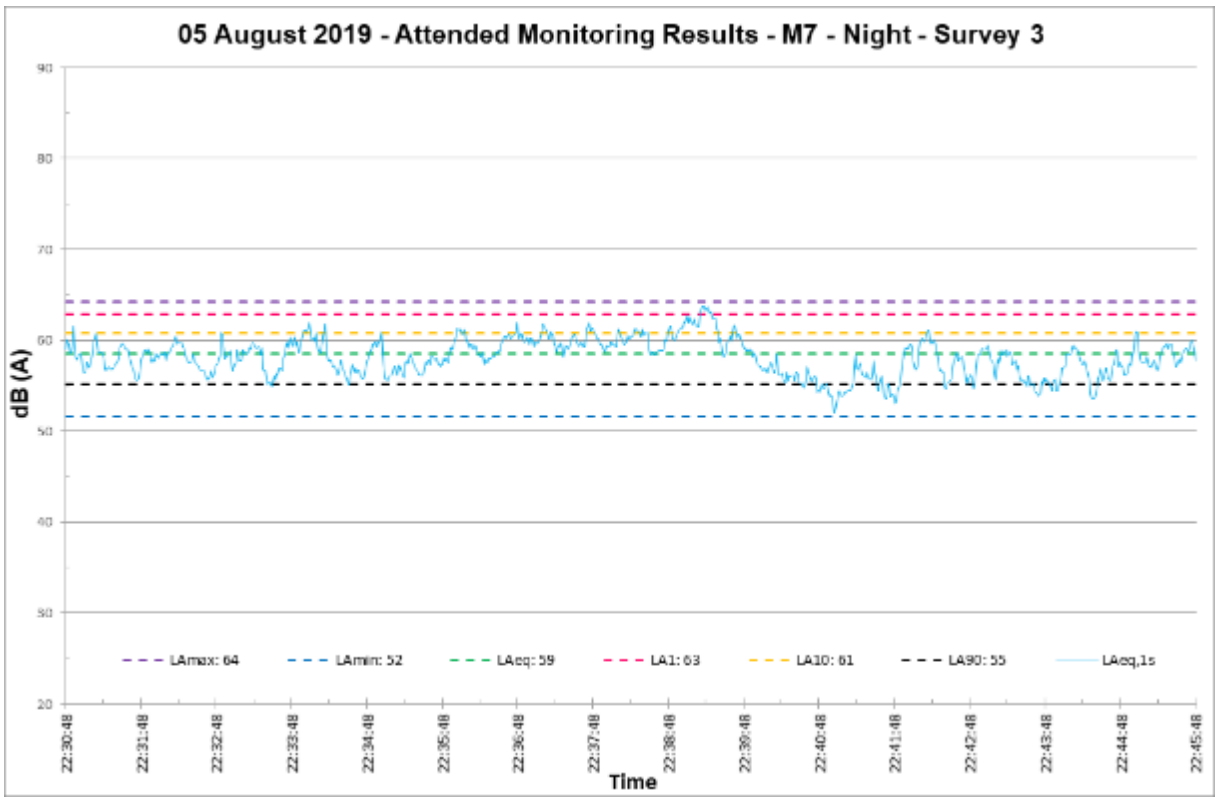


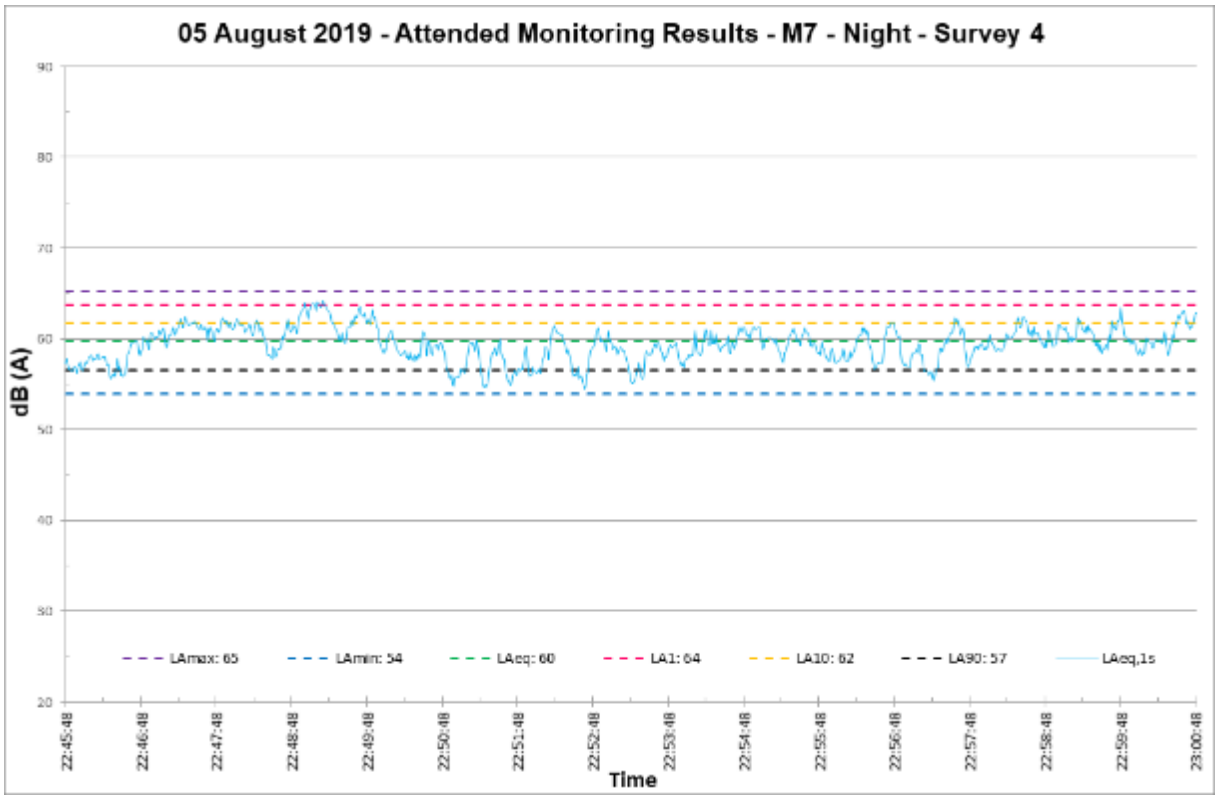


Night – 05/08/2019

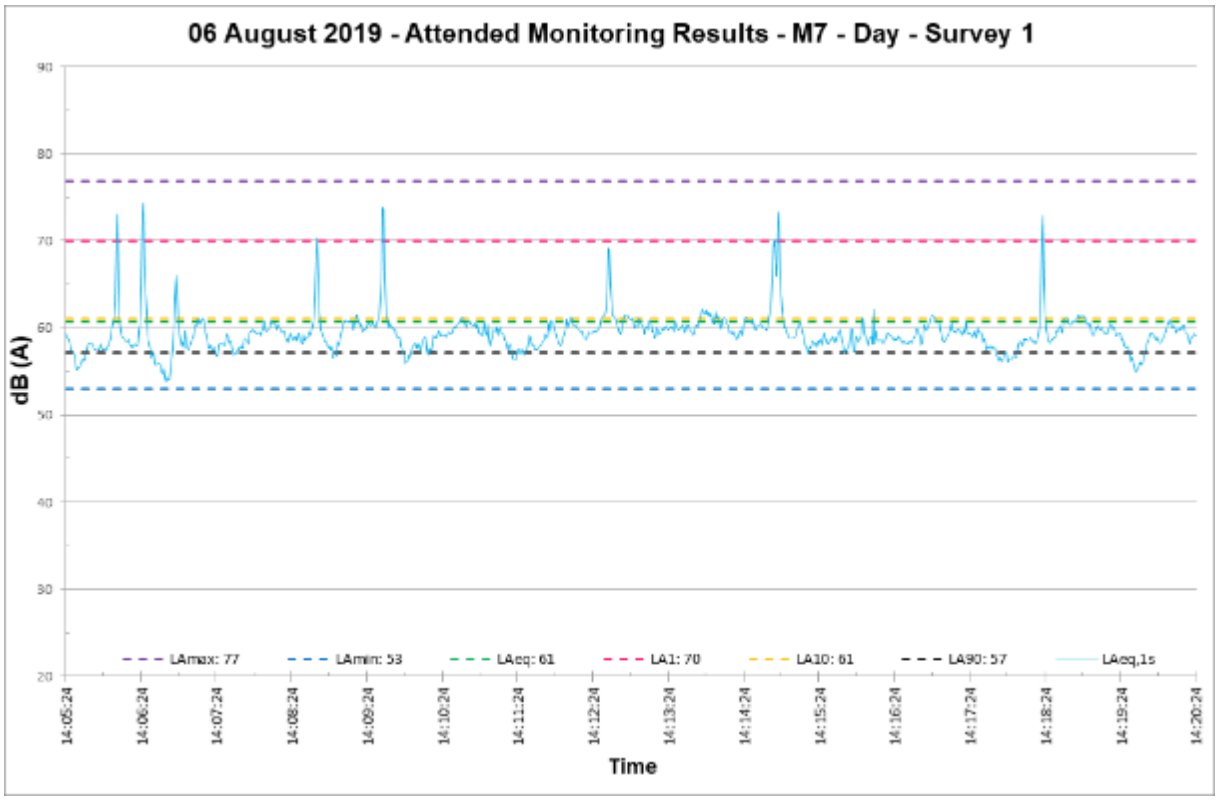


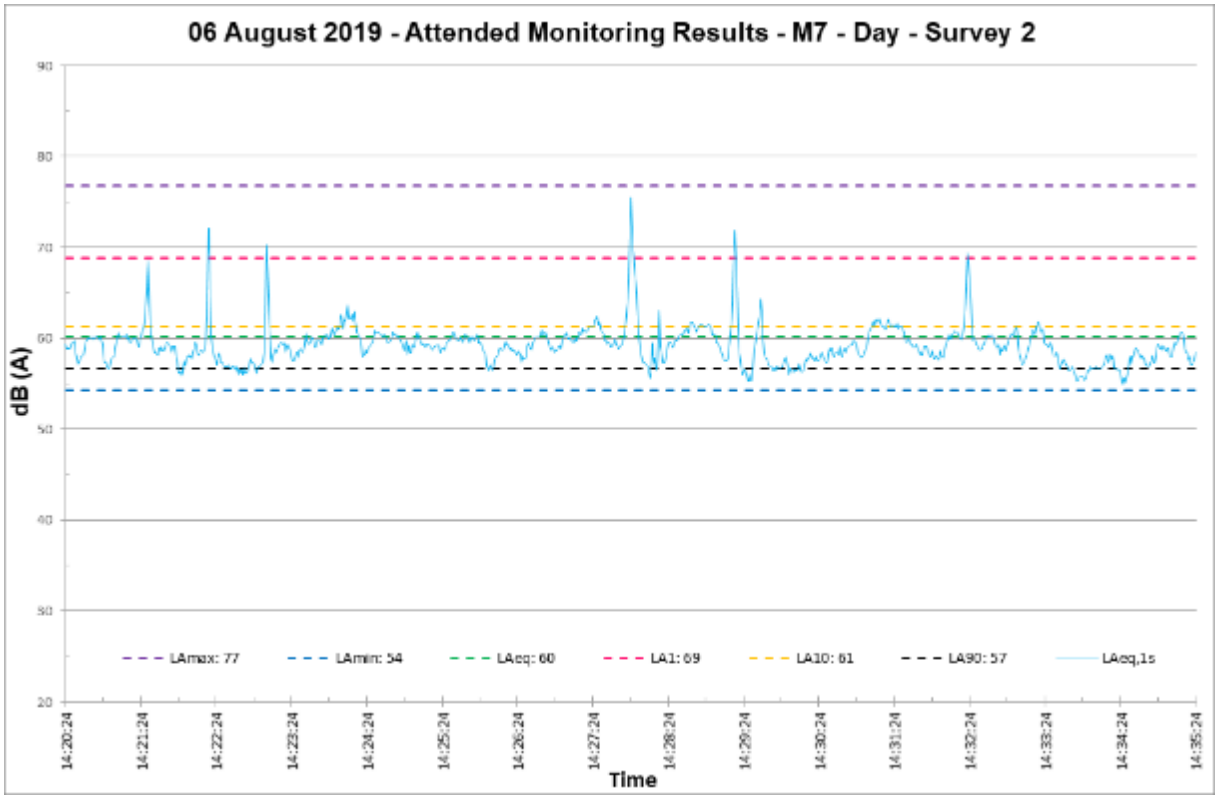


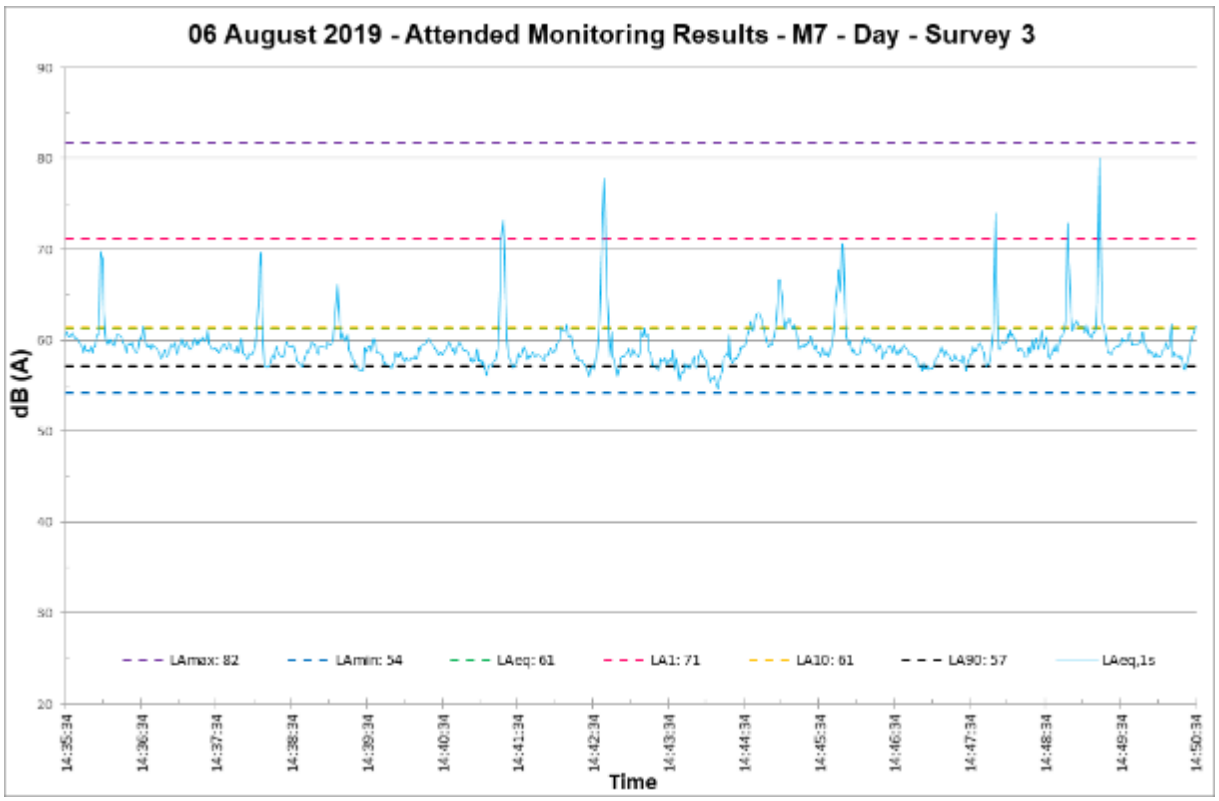

05 August 2019 - Attended Monitoring Results - M7 - Night - Survey 3
dB (A)
Time
LAmax: 64
LAmin: 52
LAeq: 59
LA1: 63
LA10: 61
LA90: 55
LAeq,1s

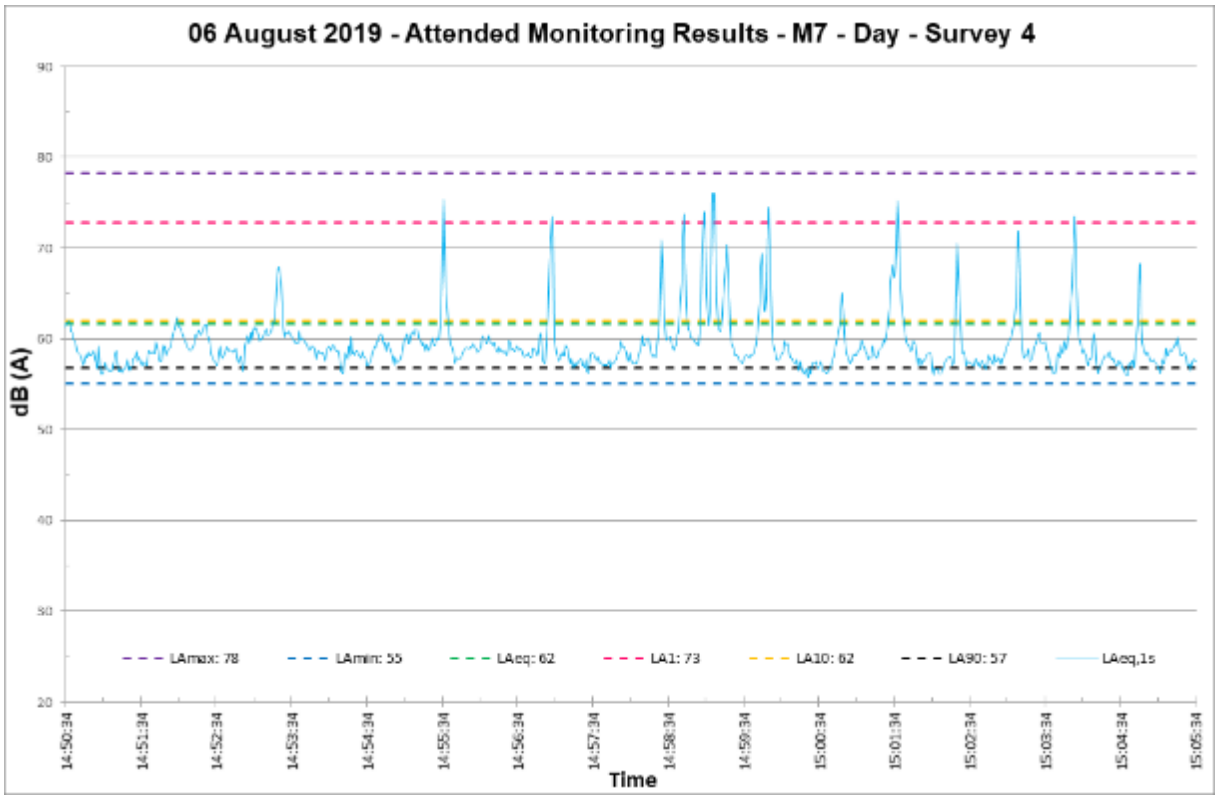

05 August 2019 - Attended Monitoring Results - M7 - Night - Survey 4
dB (A)
Time
LAmax: 65
LAmin: 54
LAeq: 60
LA1: 64
LA10: 62
LA90: 57
LAeq,1s

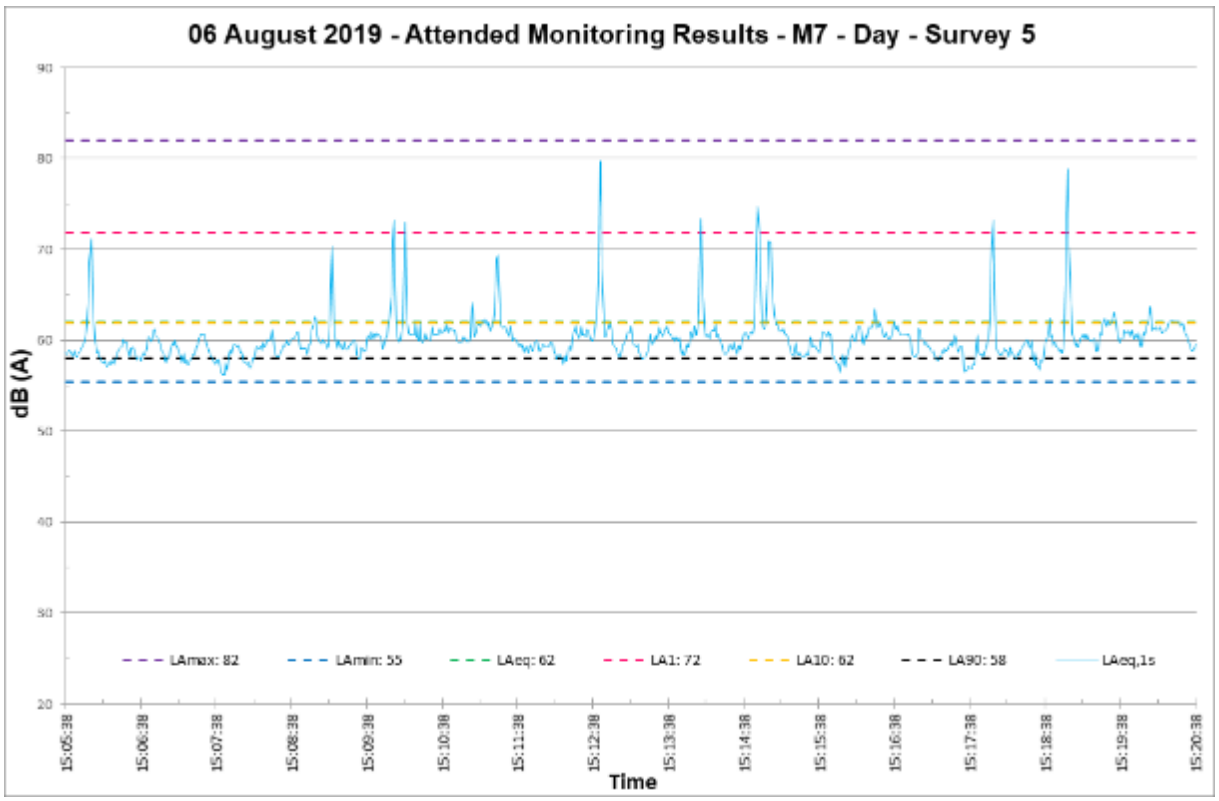
Day – 06/08/2019

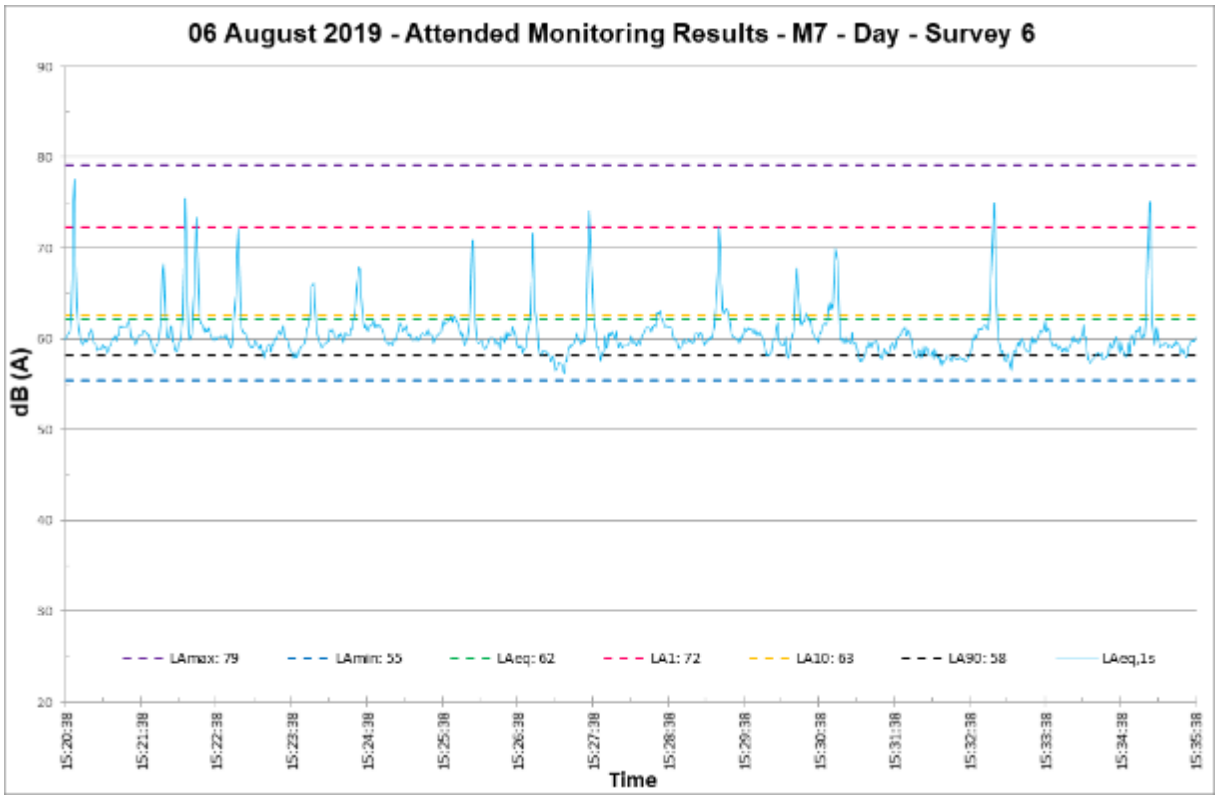




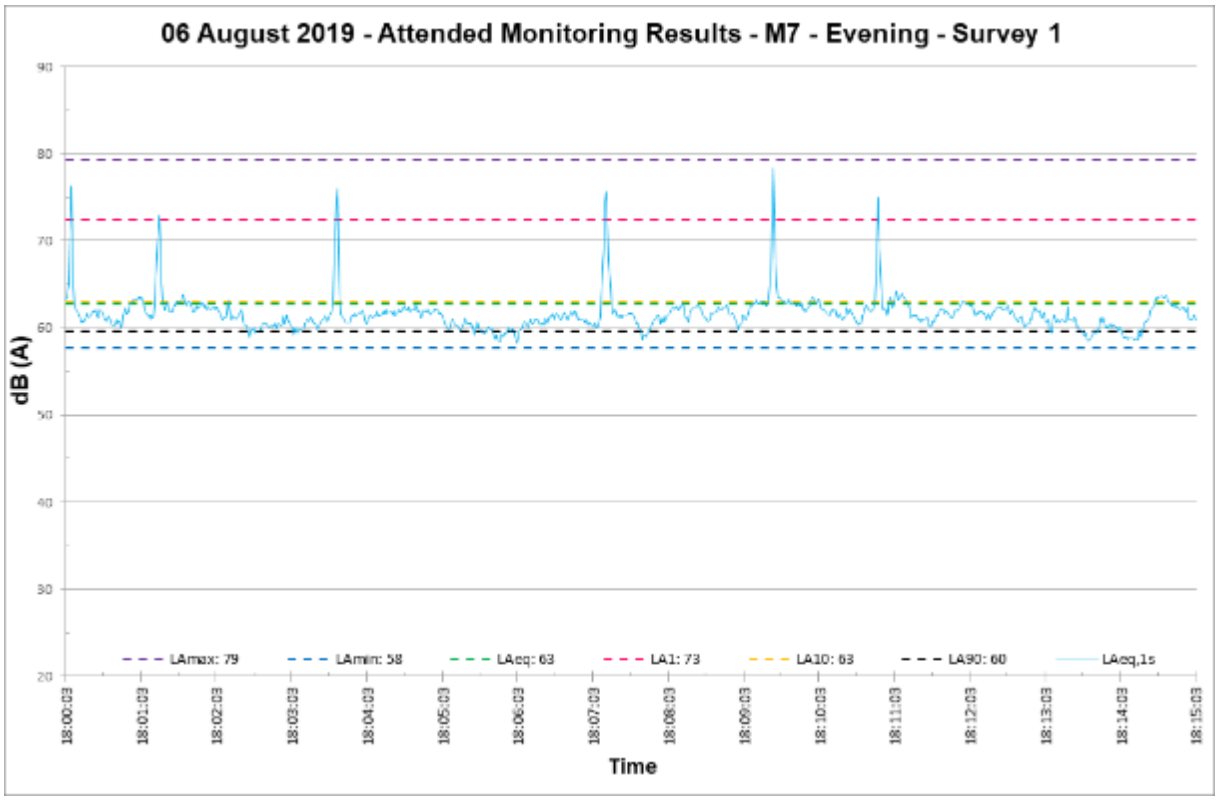

06 August 2019 - Attended Monitoring Results - M7 - Day - Survey 3
dB (A)
Time
LAmax: 82
LAmin: 54
LAeq: 61
LA1: 71
LA10: 61
LA90: 57
LAeq,1s

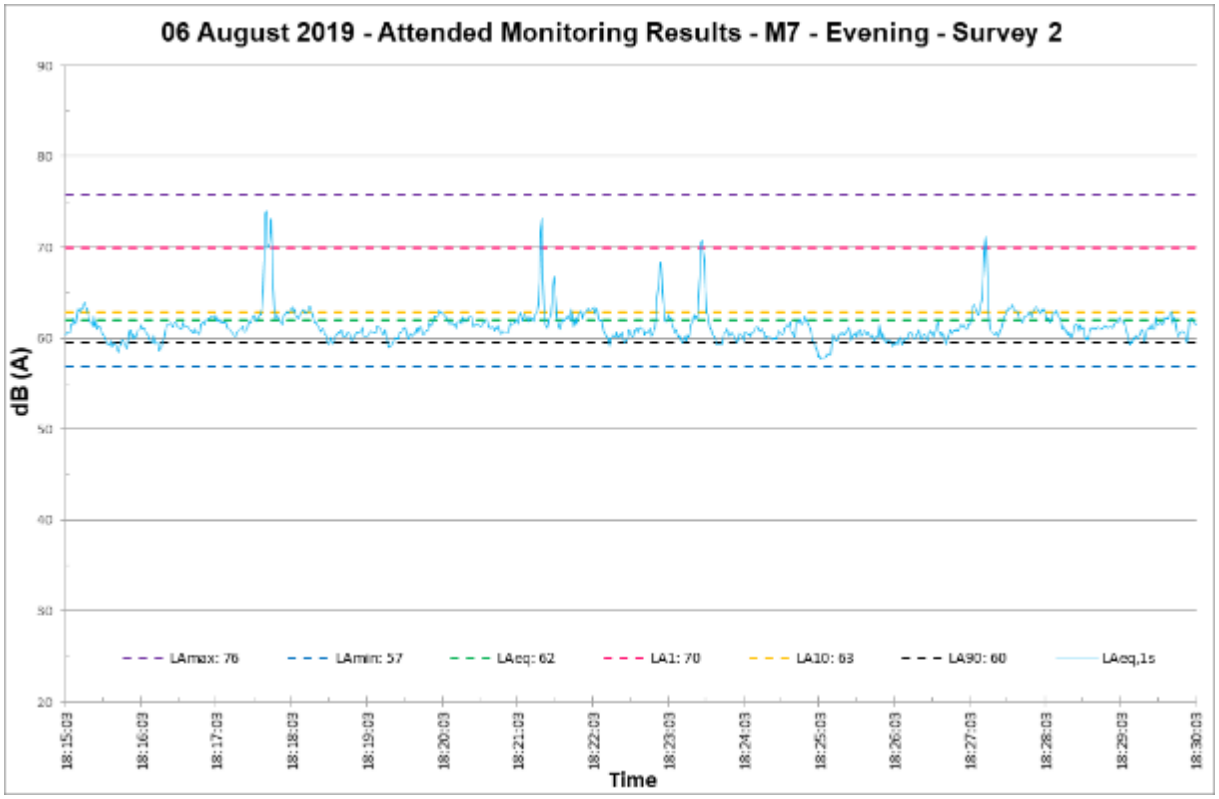

06 August 2019 - Attended Monitoring Results - M7 - Day - Survey 4
dB (A)
Time
LAmax: 78
LAmin: 55
LAeq: 62
LA1: 73
LA10: 62
LA90: 57
LAeq,1s


06 August 2019 - Attended Monitoring Results - M7 - Day - Survey 5
dB (A)
Time
LAmax: 82
LAmin: 55
LAeq: 62
LA1: 72
LA10: 62
LA90: 58
LAeq,1s

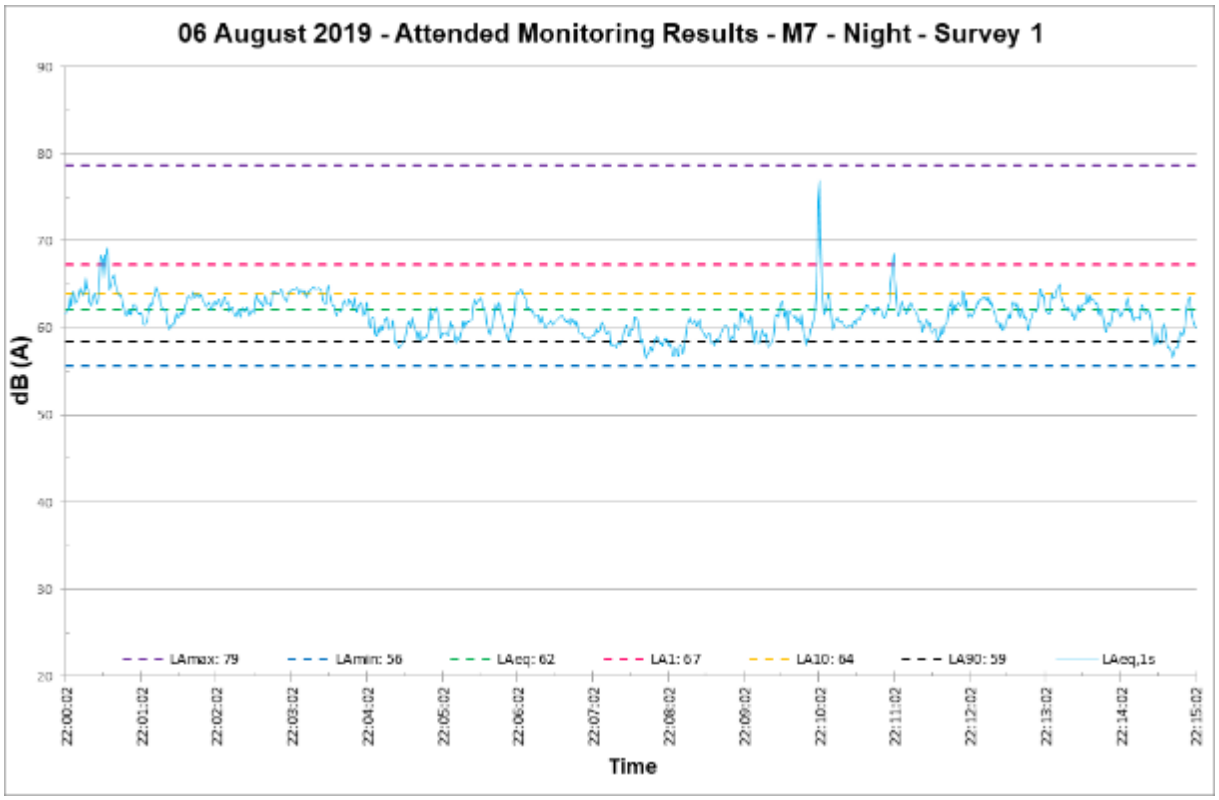

06 August 2019 - Attended Monitoring Results - M7 - Day - Survey 6
dB (A)
Time
LAmax: 79
LAmin: 55
LAeq: 62
LA1: 72
LA10: 63
LA90: 58
LAeq,1s

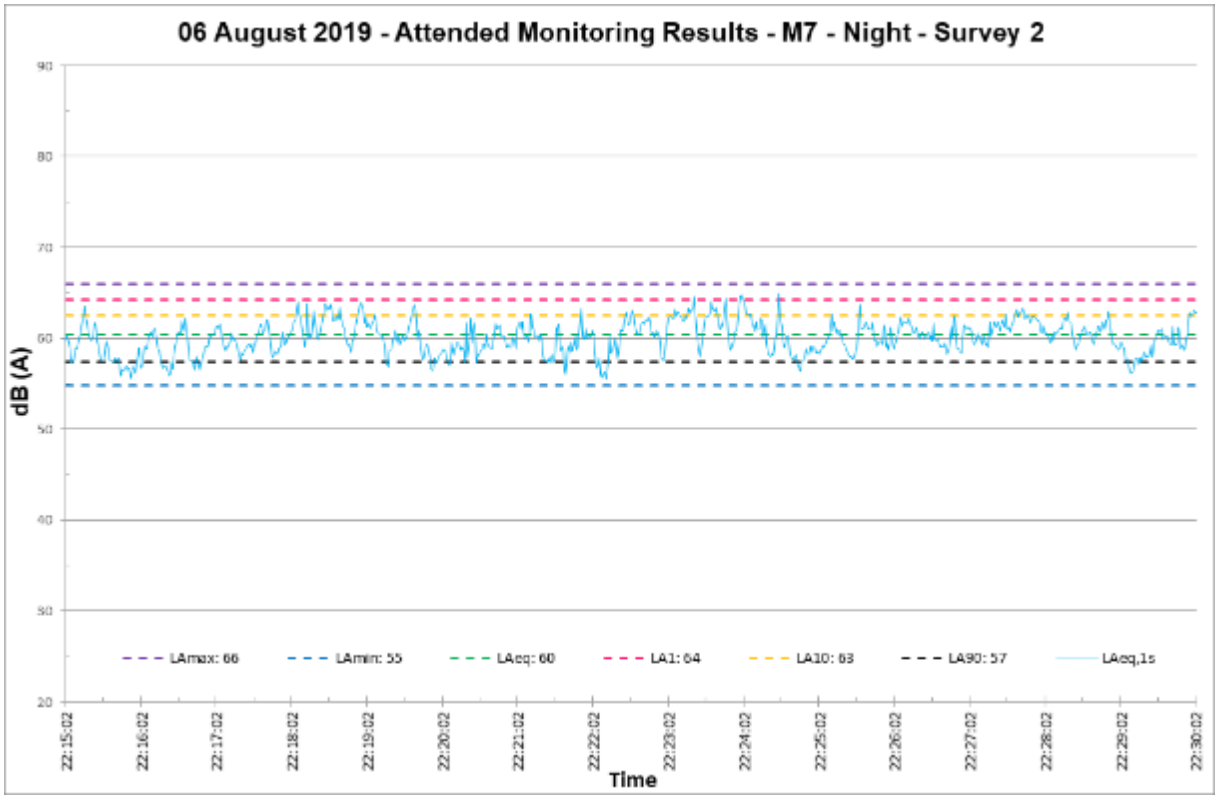
Evening – 06/08/2019

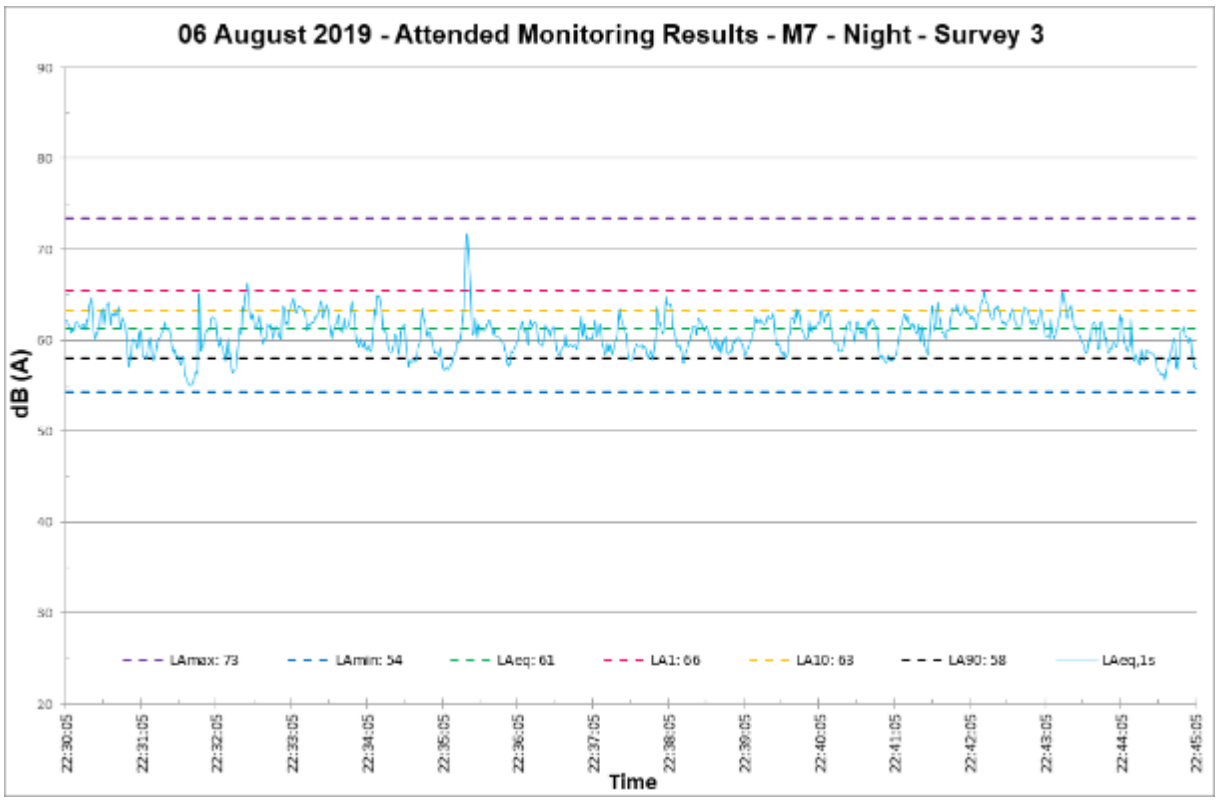


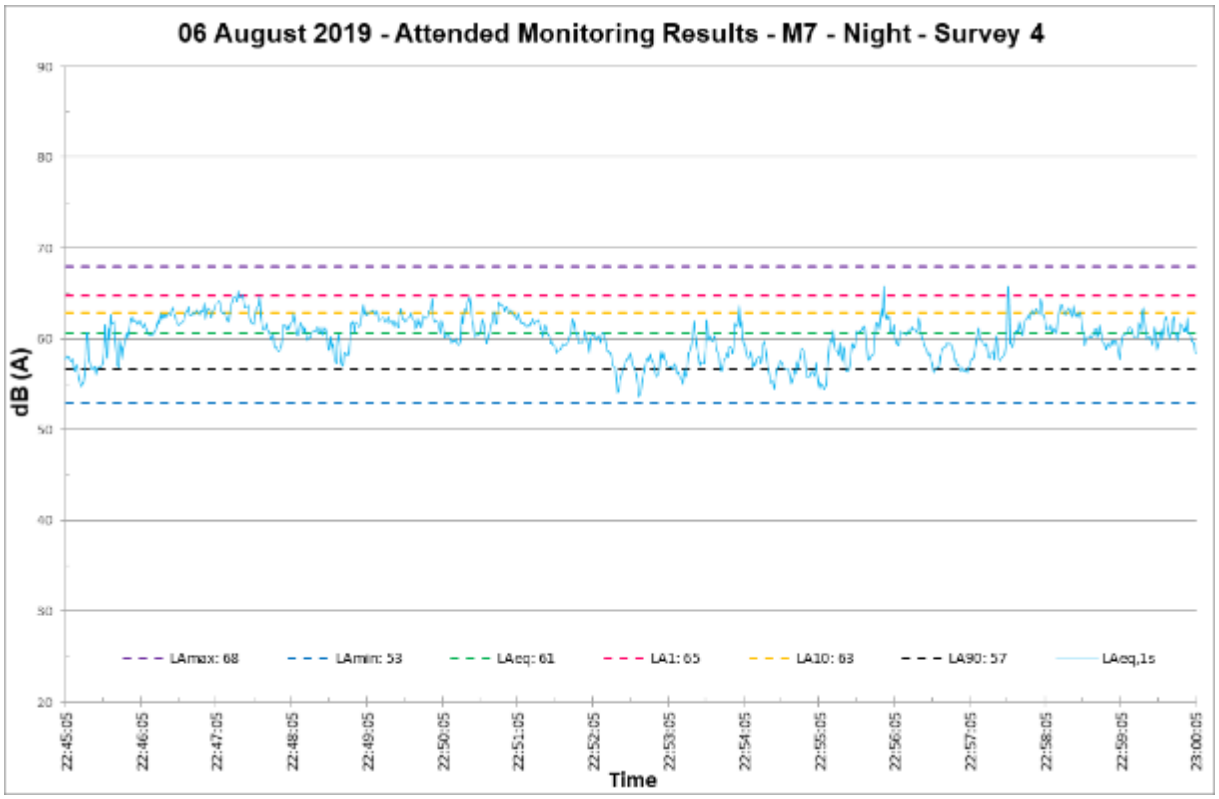


Night – 06/08/2019

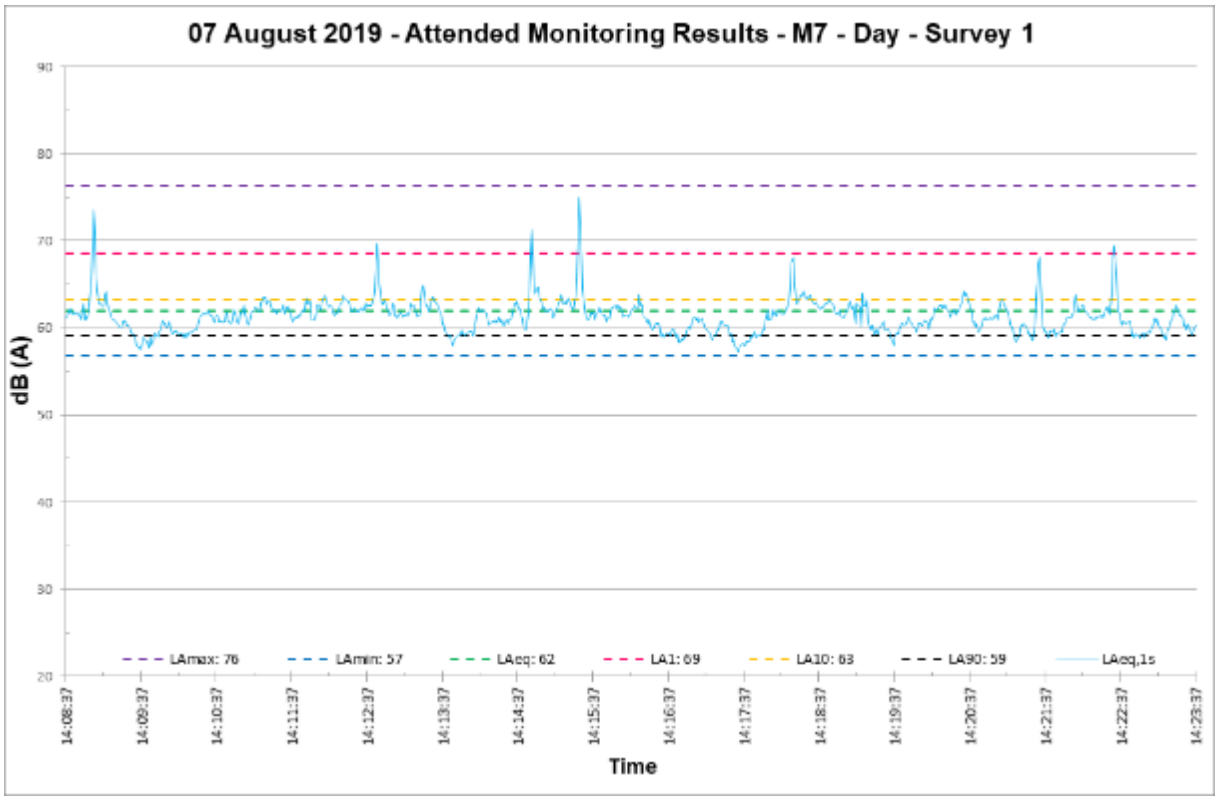


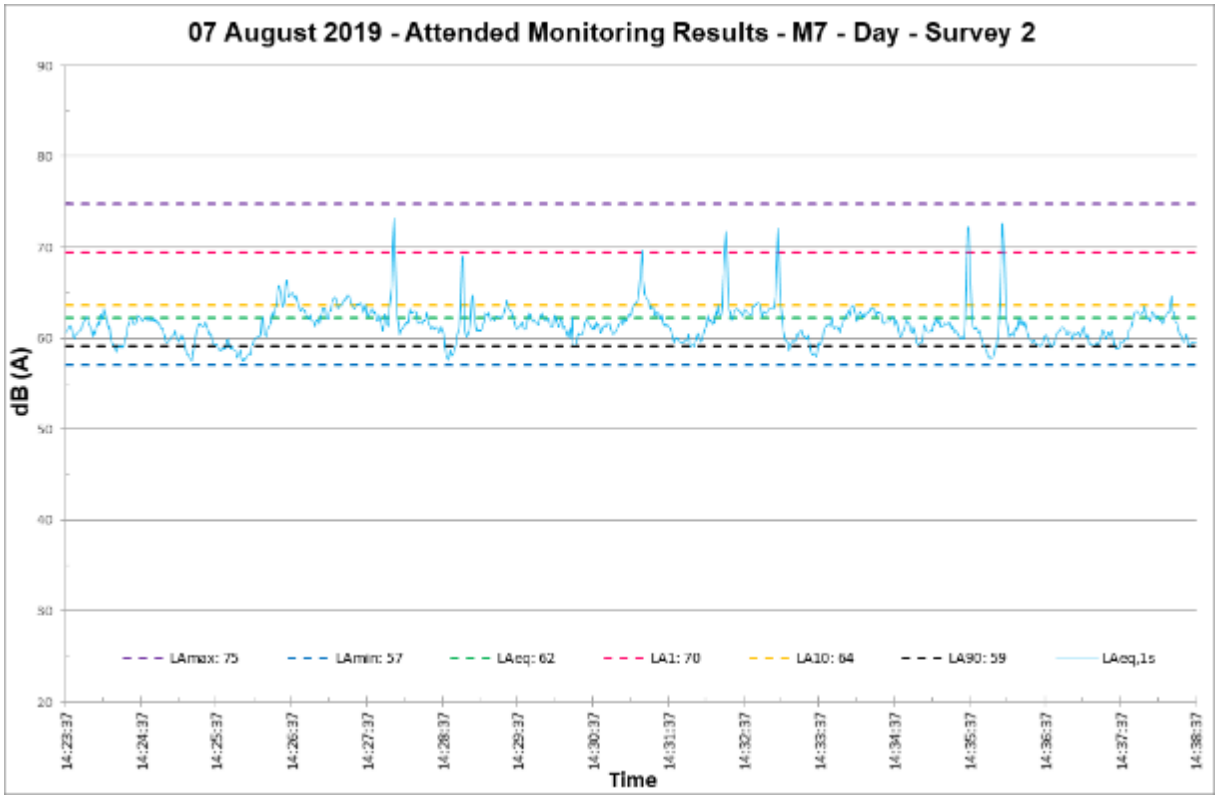


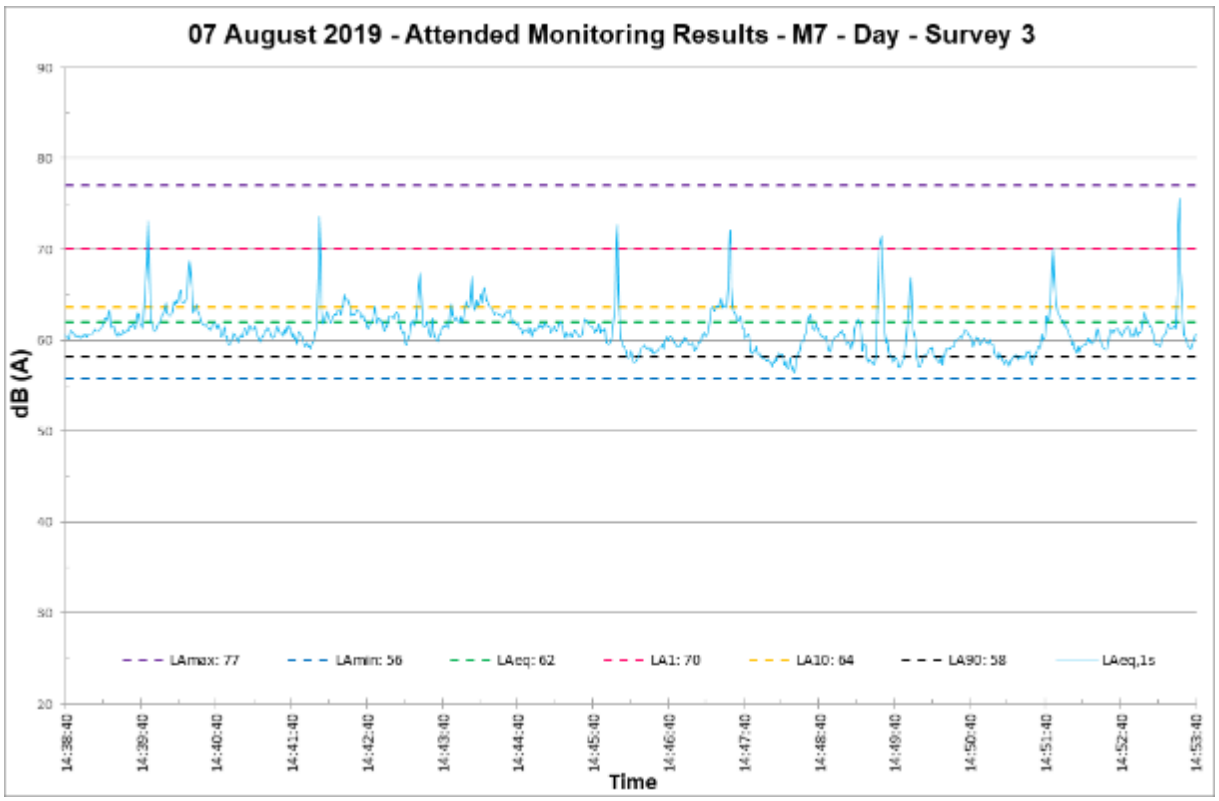

06 August 2019 - Attended Monitoring Results - M7 - Night - Survey 3
dB (A)
Time
LAmax: 73
LAmin: 54
LAeq: 61
LA1: 66
LA10: 63
LA90: 58
LAeq,1s

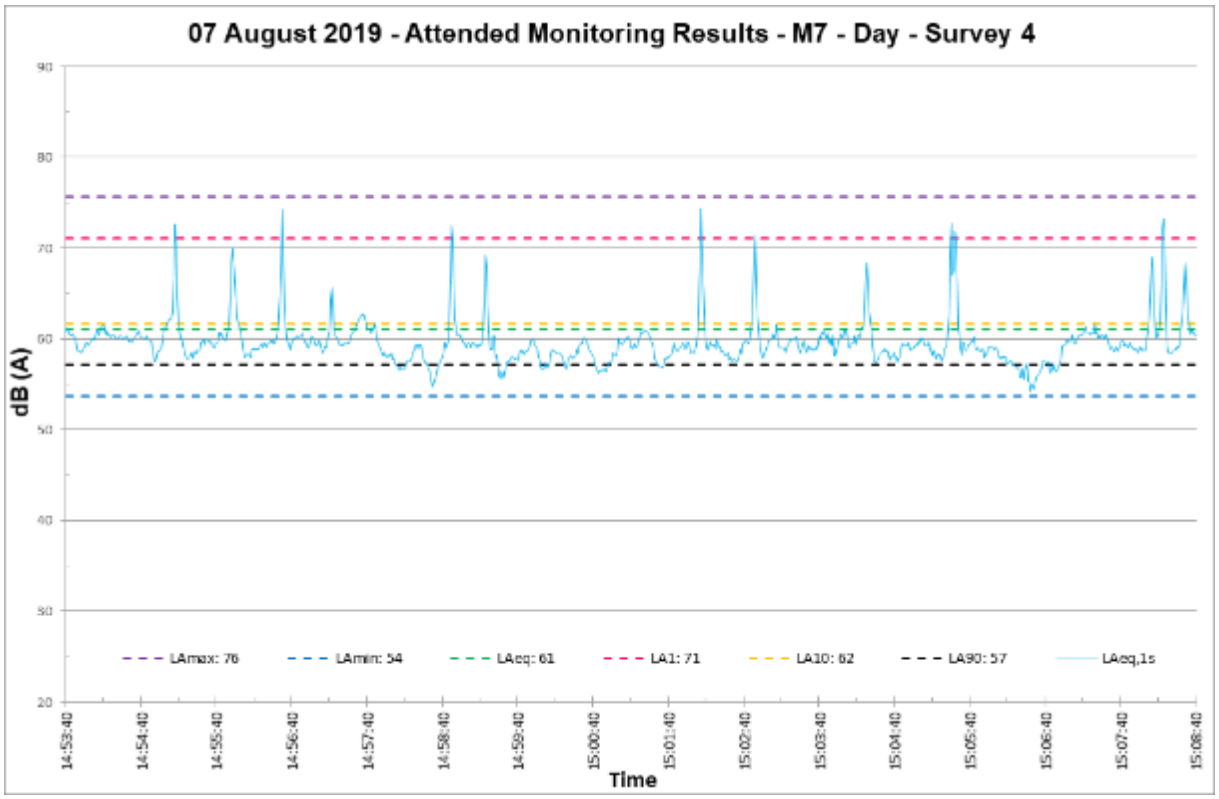

06 August 2019 - Attended Monitoring Results - M7 - Night - Survey 4
dB (A)
Time
LAmax: 68
LAmin: 53
LAeq: 61
LA1: 65
LA10: 63
LA90: 57
LAeq,1s

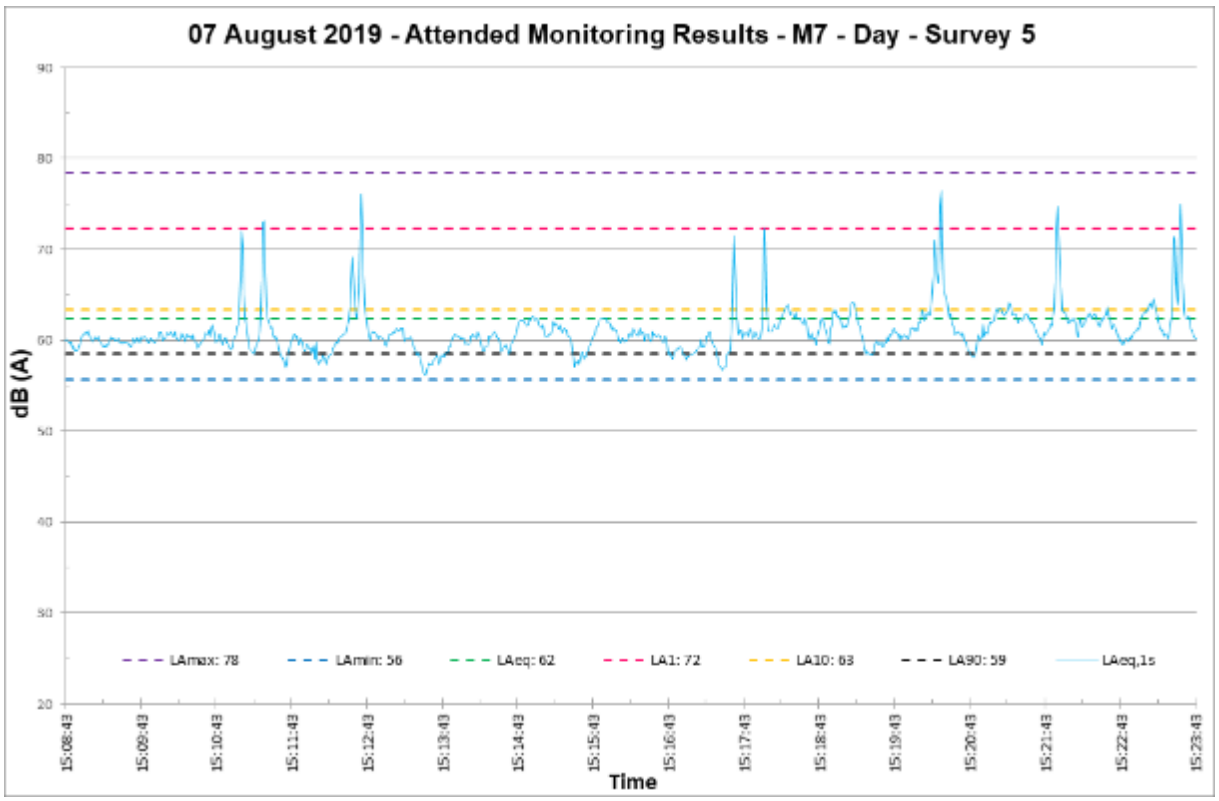
Day – 07/05/2019

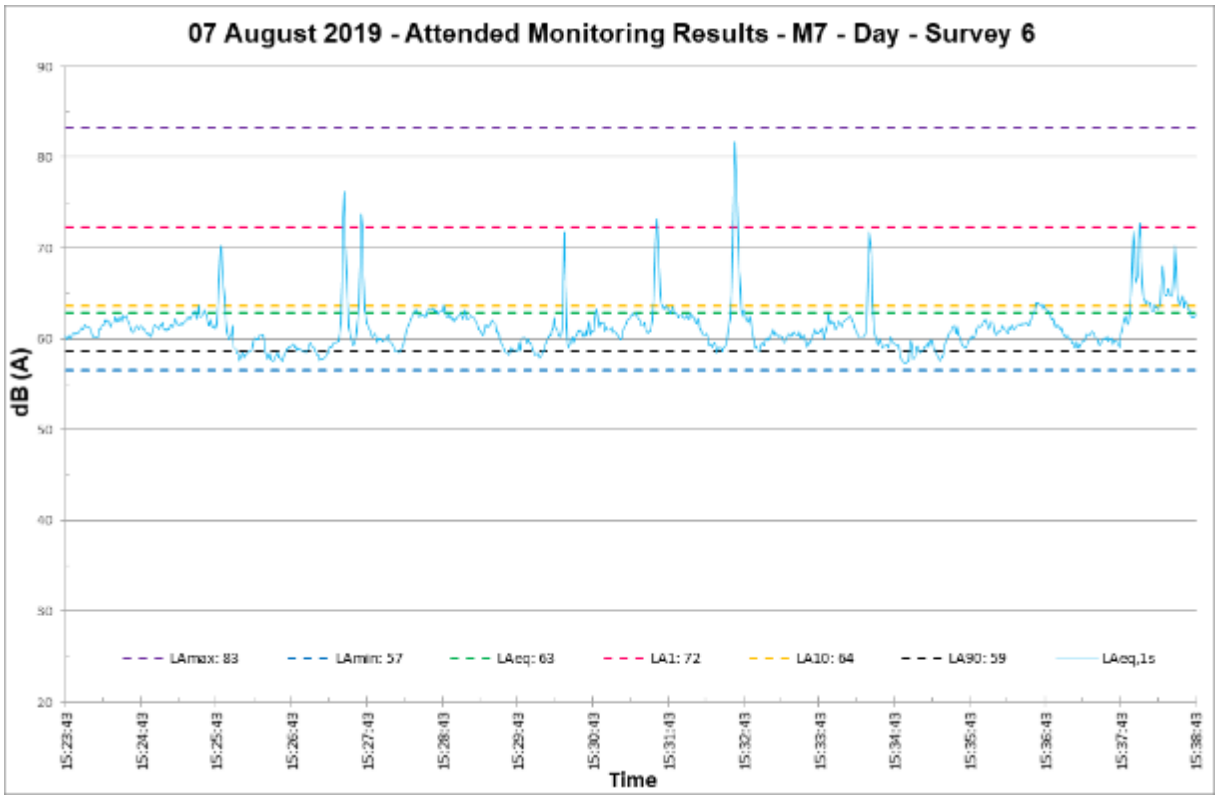




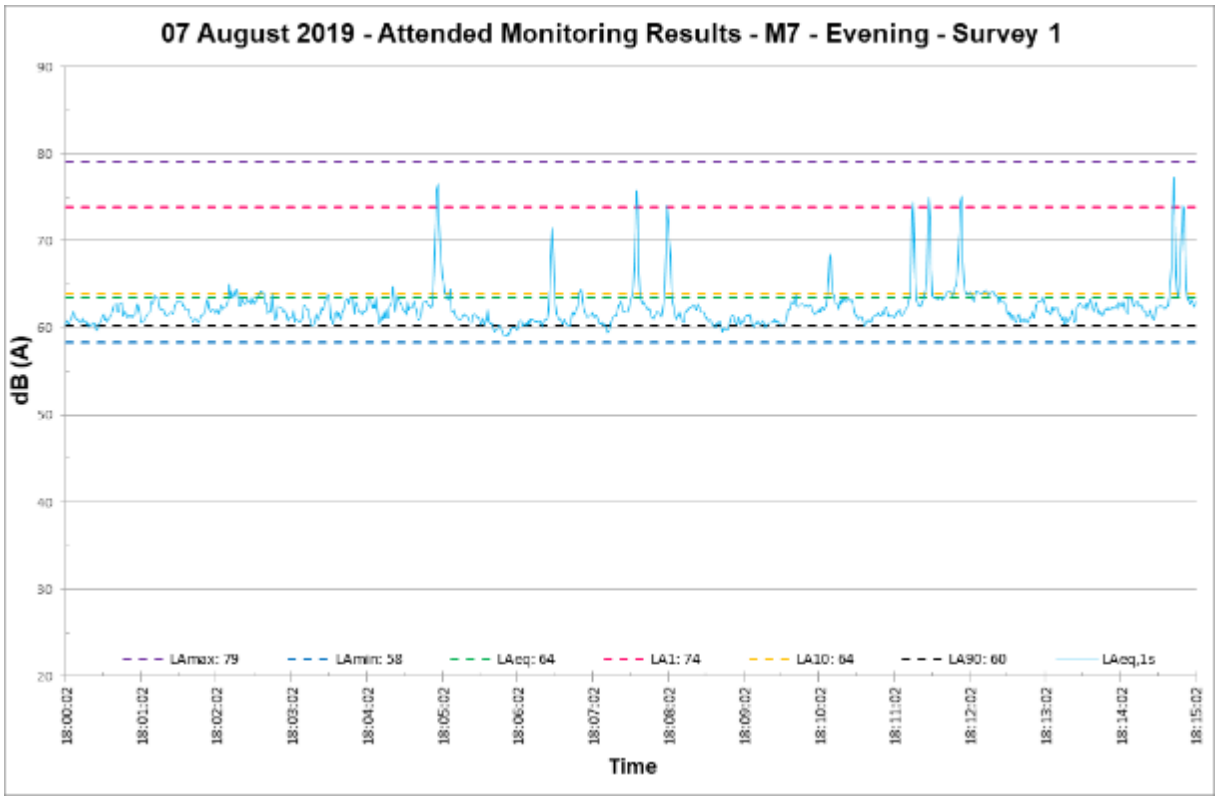

07 August 2019 - Attended Monitoring Results - M7 - Day - Survey 3
dB (A)
Time
LAmax: 77
LAmin: 56
LAeq: 62
LA1: 70
LA10: 64
LA90: 58
LAeq,1s

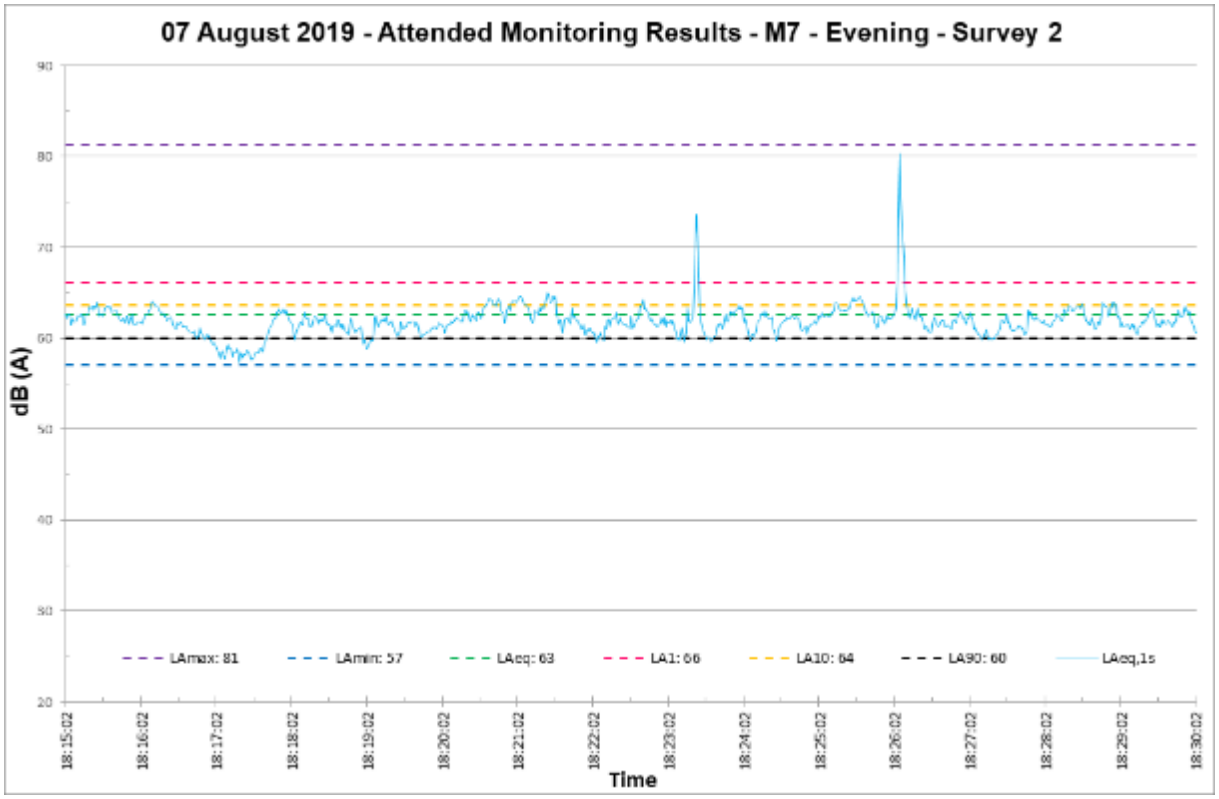

07 August 2019 - Attended Monitoring Results - M7 - Day - Survey 4
dB (A)
Time
LAmax: 76
LAmin: 54
LAeq: 61
LA1: 71
LA10: 62
LA90: 57
LAeq,1s


07 August 2019 - Attended Monitoring Results - M7 - Day - Survey 5
dB (A)
Time
LAmax: 78
LAmin: 56
LAeq: 62
LA1: 72
LA10: 63
LA90: 59
LAeq,1s

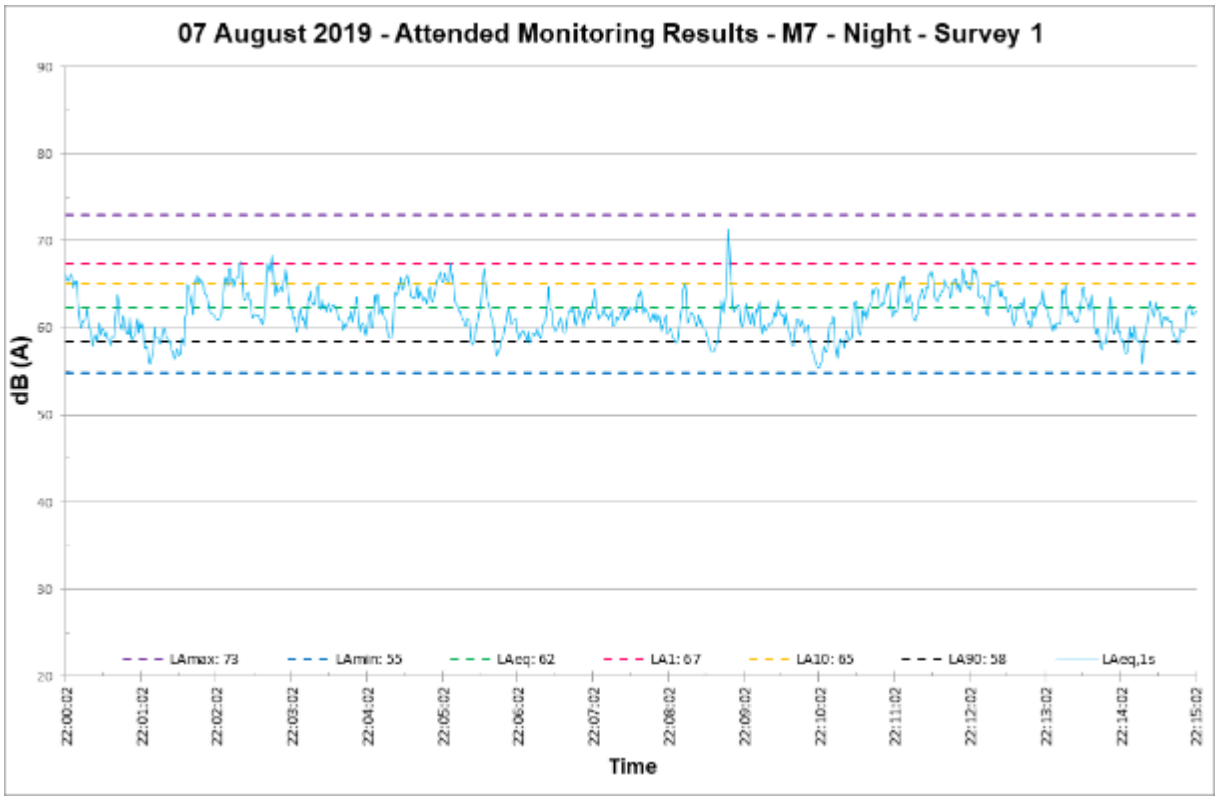

07 August 2019 - Attended Monitoring Results - M7 - Day - Survey 6
dB (A)
Time
LAmax: 83
LAmin: 57
LAeq: 63
LA1: 72
LA10: 64
LA90: 59
LAeq,1s

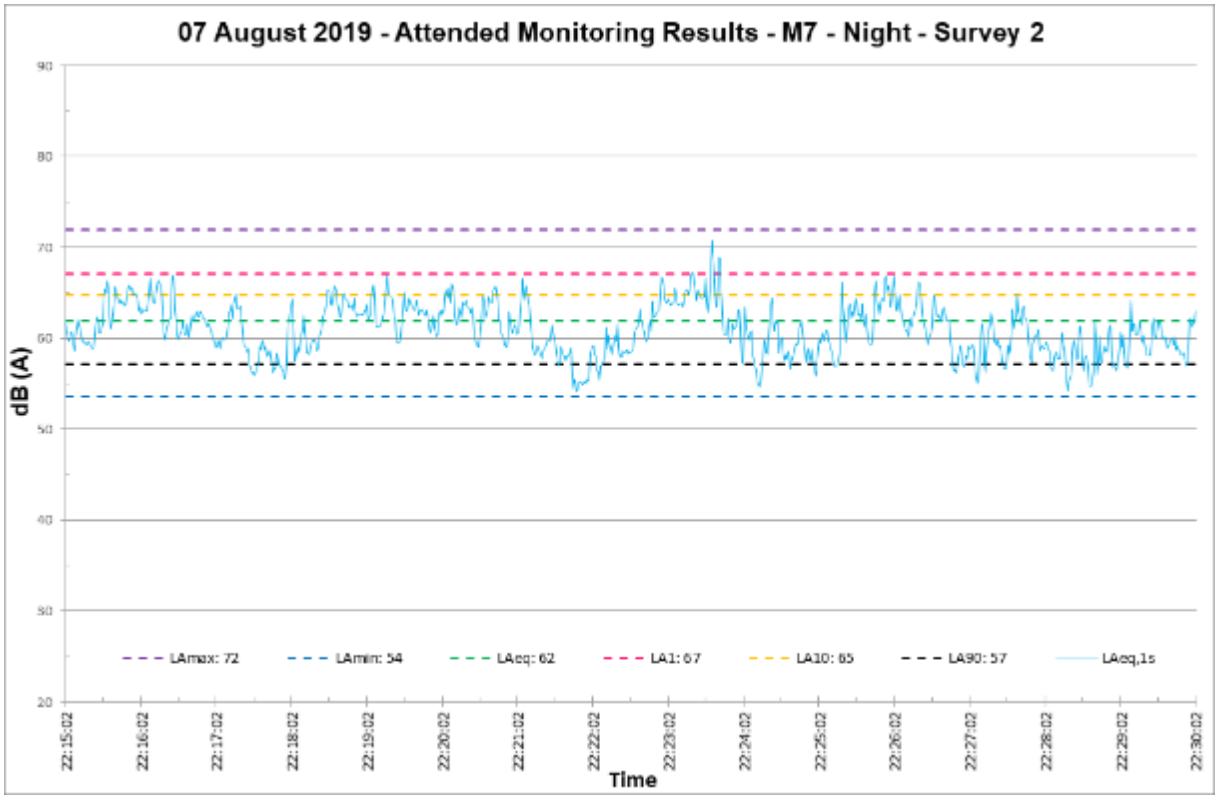
Evening – 07/08/2019

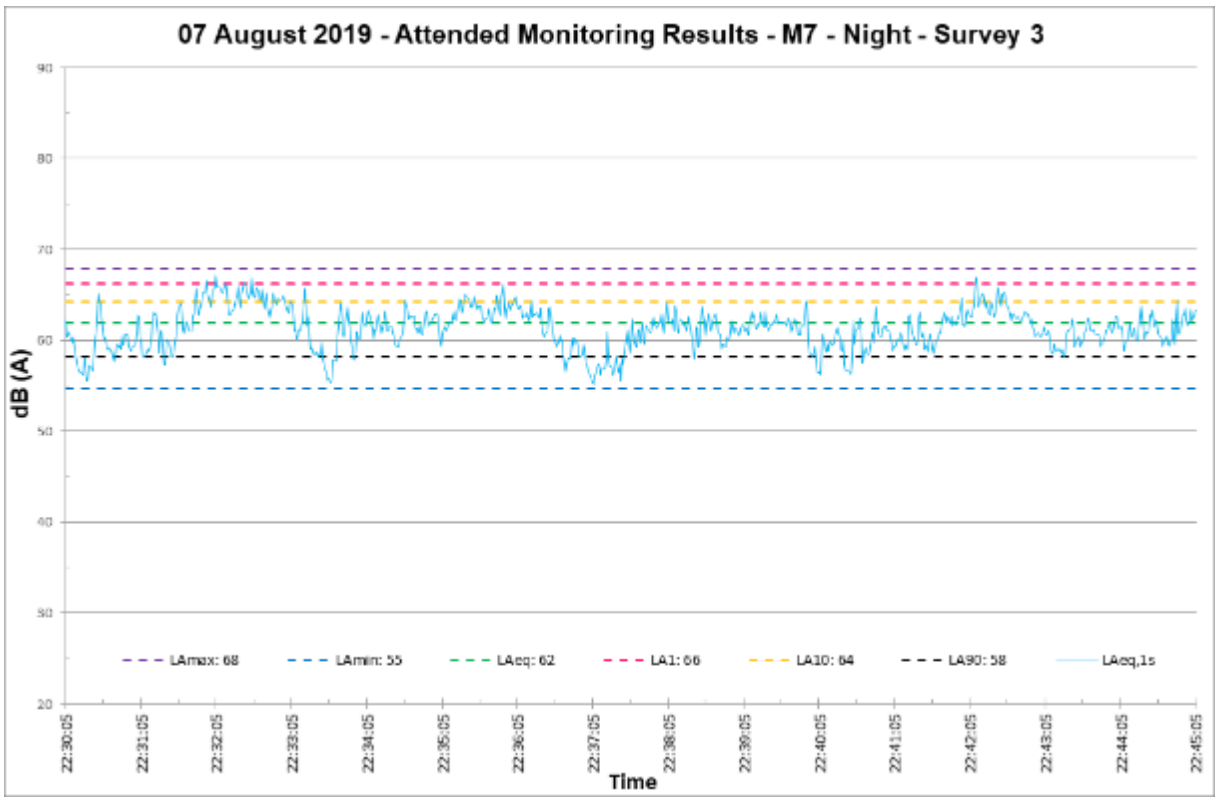


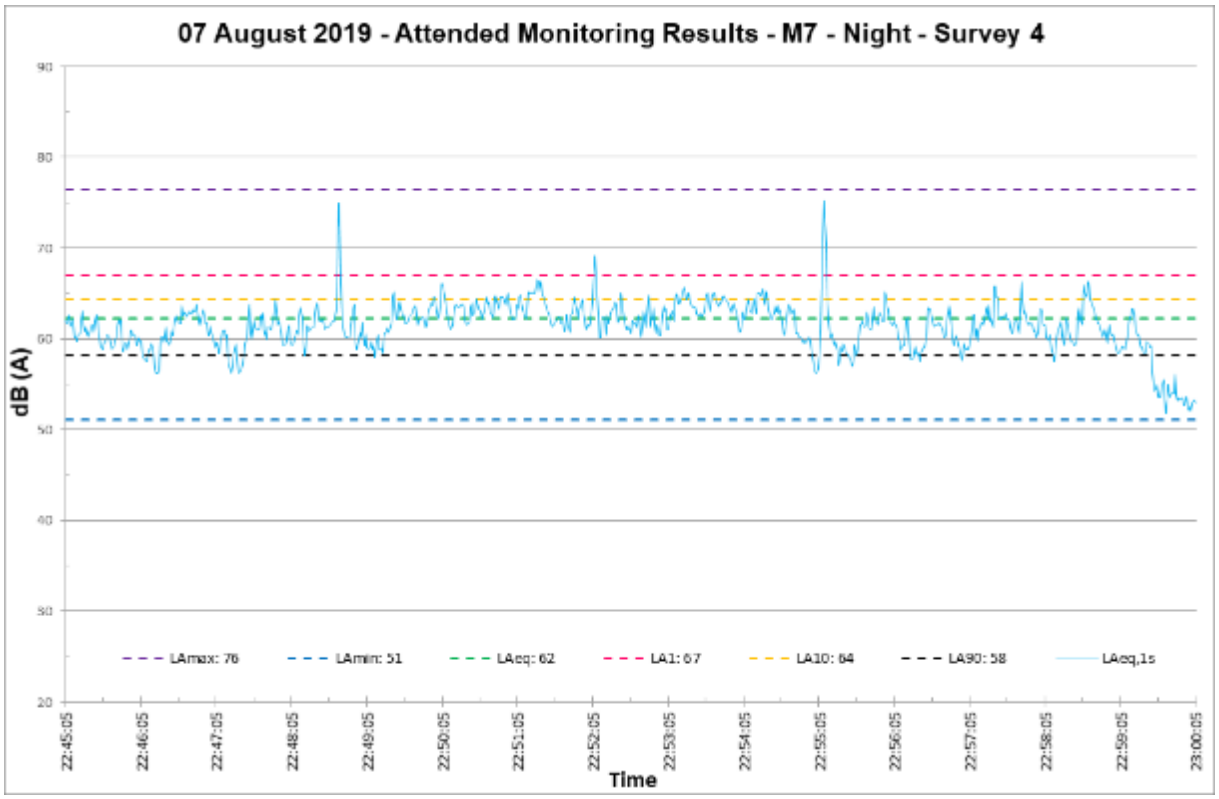


Night – 07/08/2019



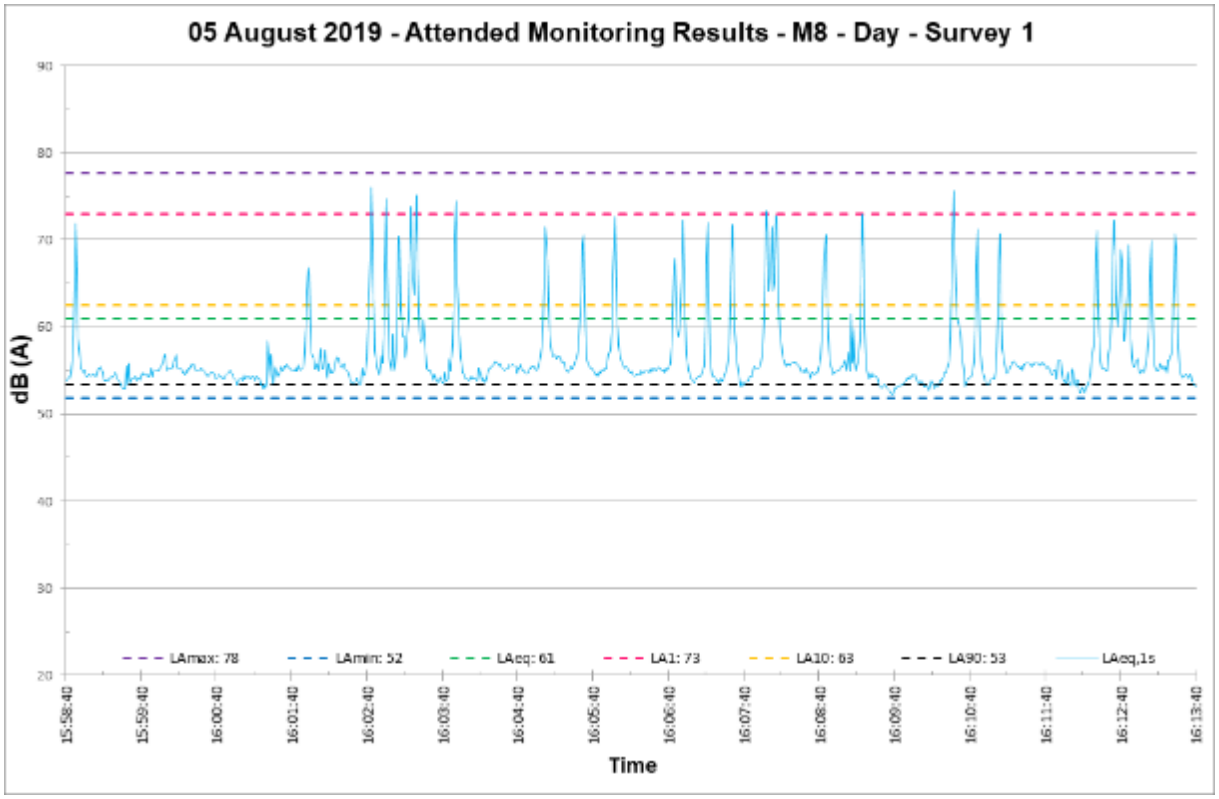


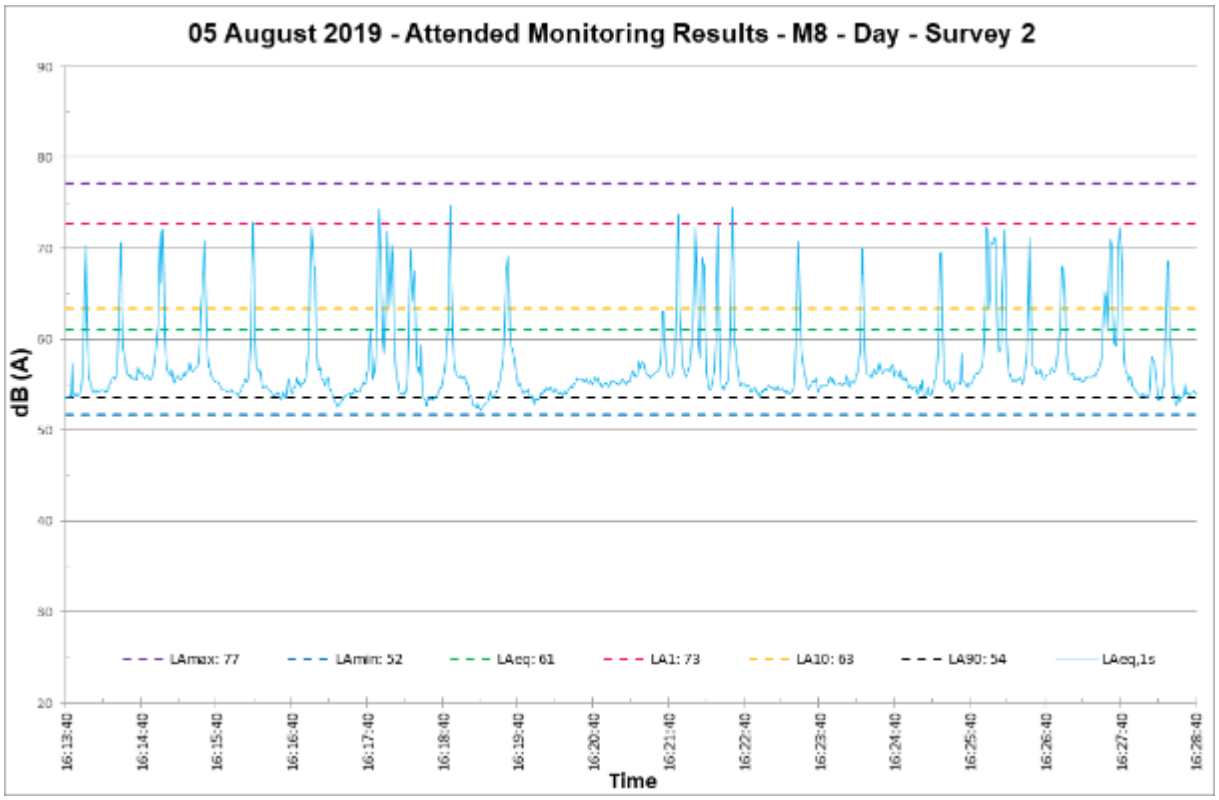

07 August 2019 - Attended Monitoring Results - M7 - Night - Survey 3
dB (A)
Time
LAmax: 68
LAmin: 55
LAeq: 62
LA1: 66
LA10: 64
LA90: 58
LAeq,1s

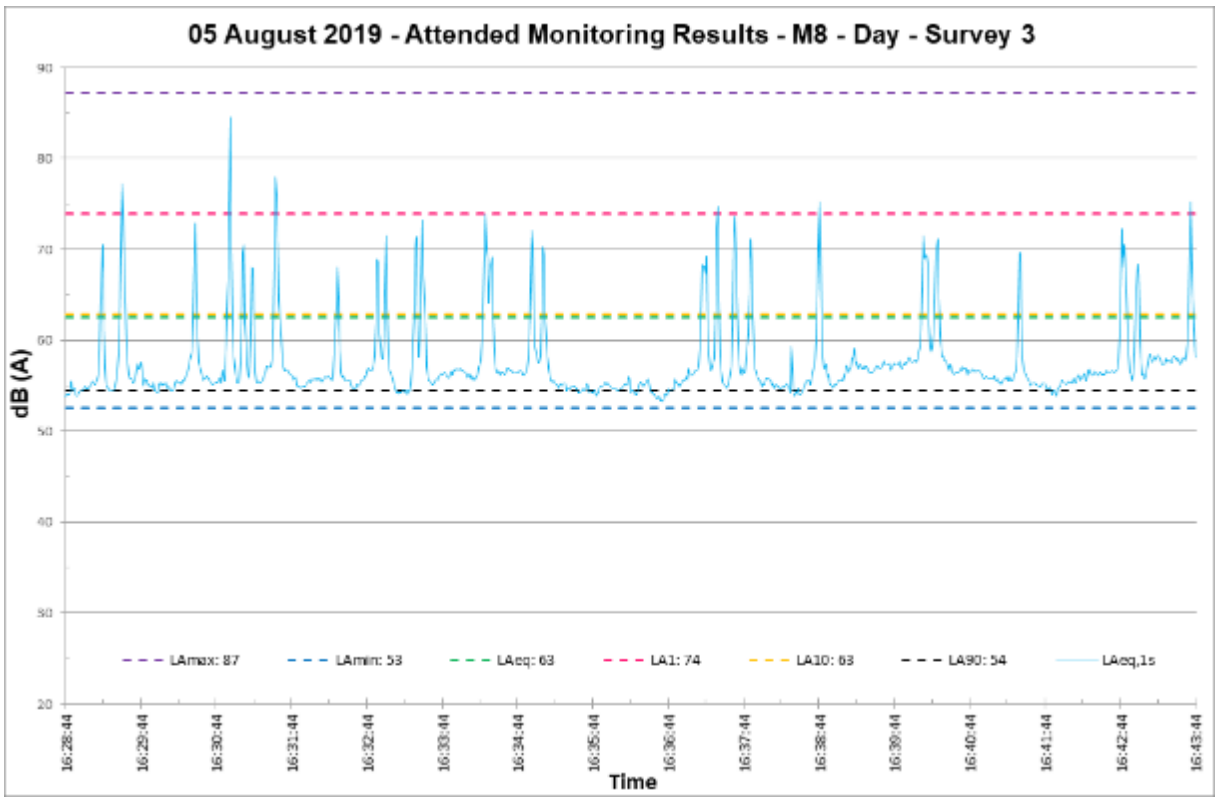

07 August 2019 - Attended Monitoring Results - M7 - Night - Survey 4
dB (A)
Time
LAmax: 76
LAmin: 51
LAeq: 62
LA1: 67
LA10: 64
LA90: 58
LAeq,1s

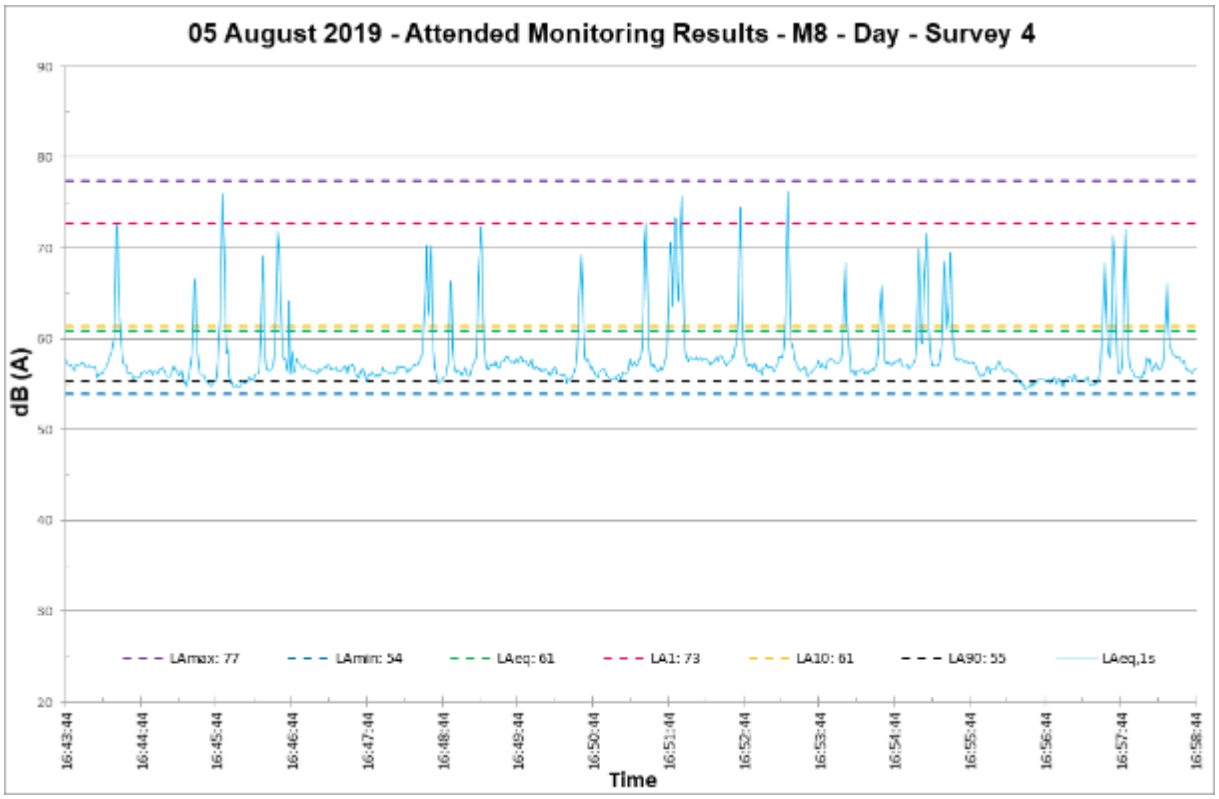
Appendix F – Operator attended noise monitoring results – Location M8

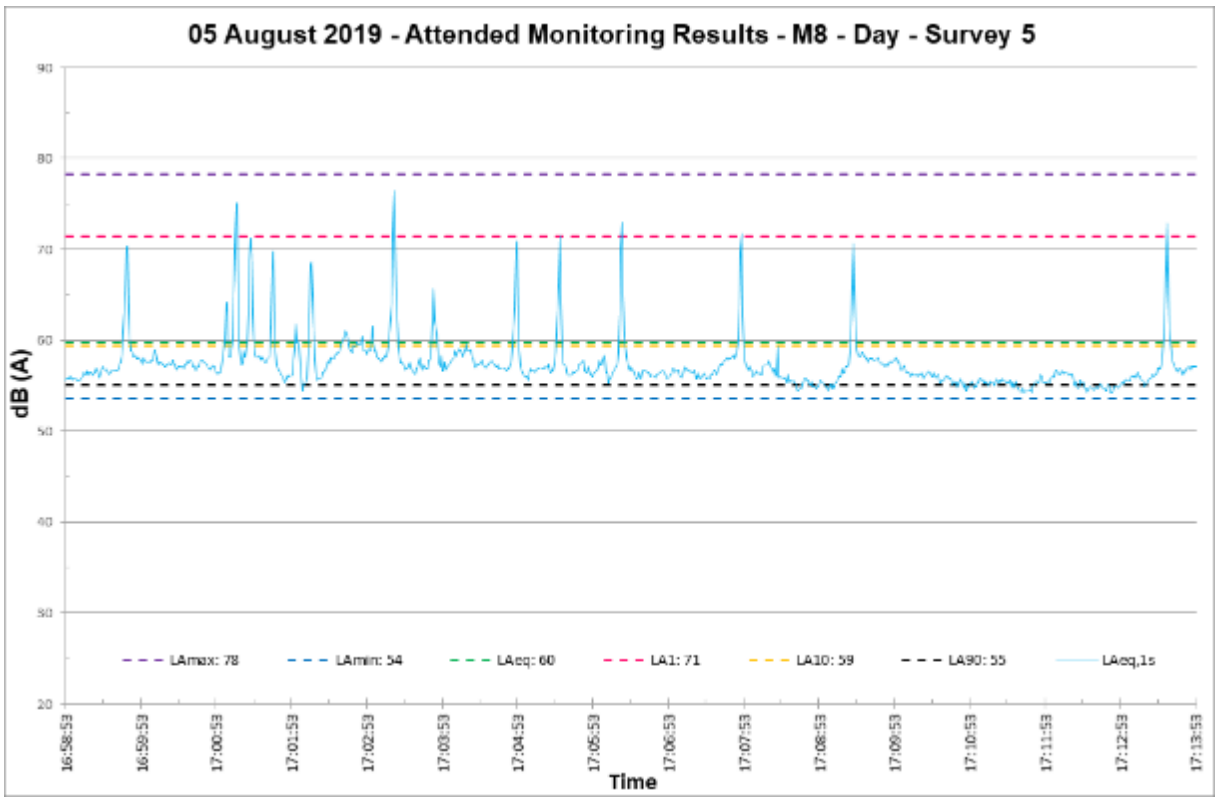
Day – 05/08/2019

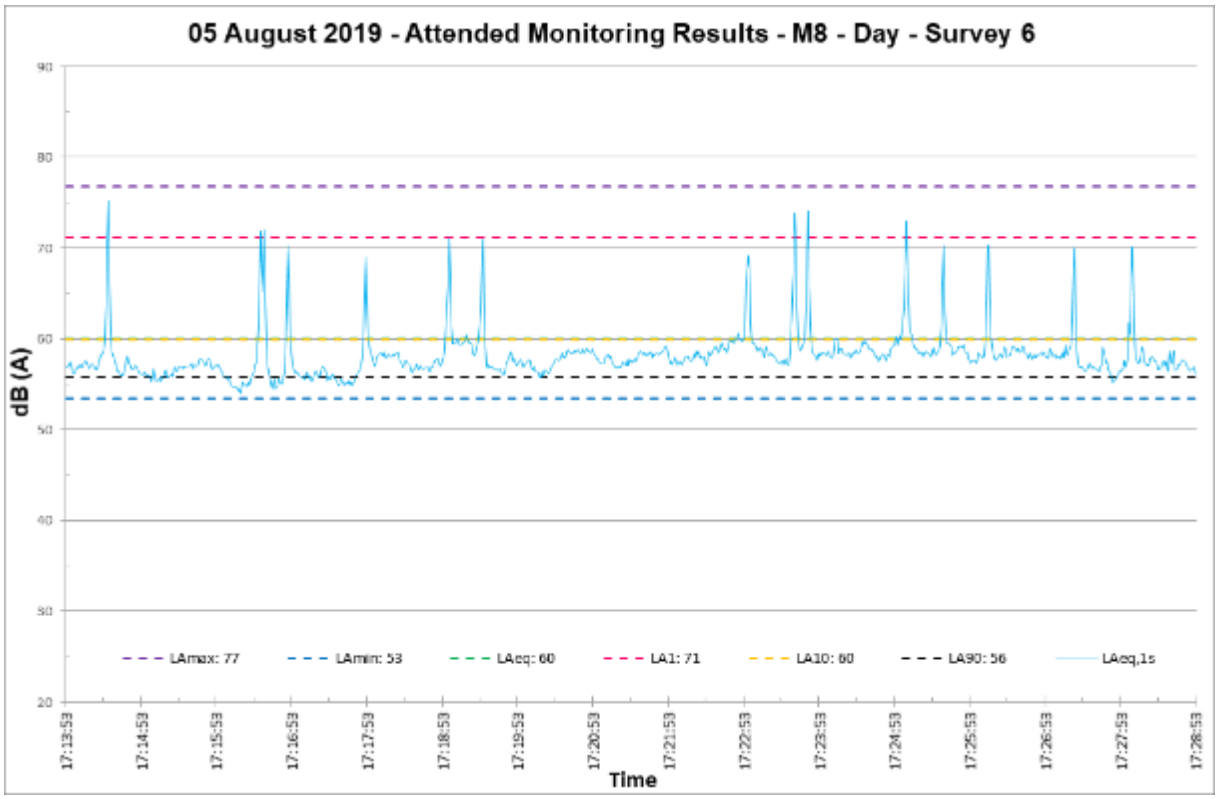




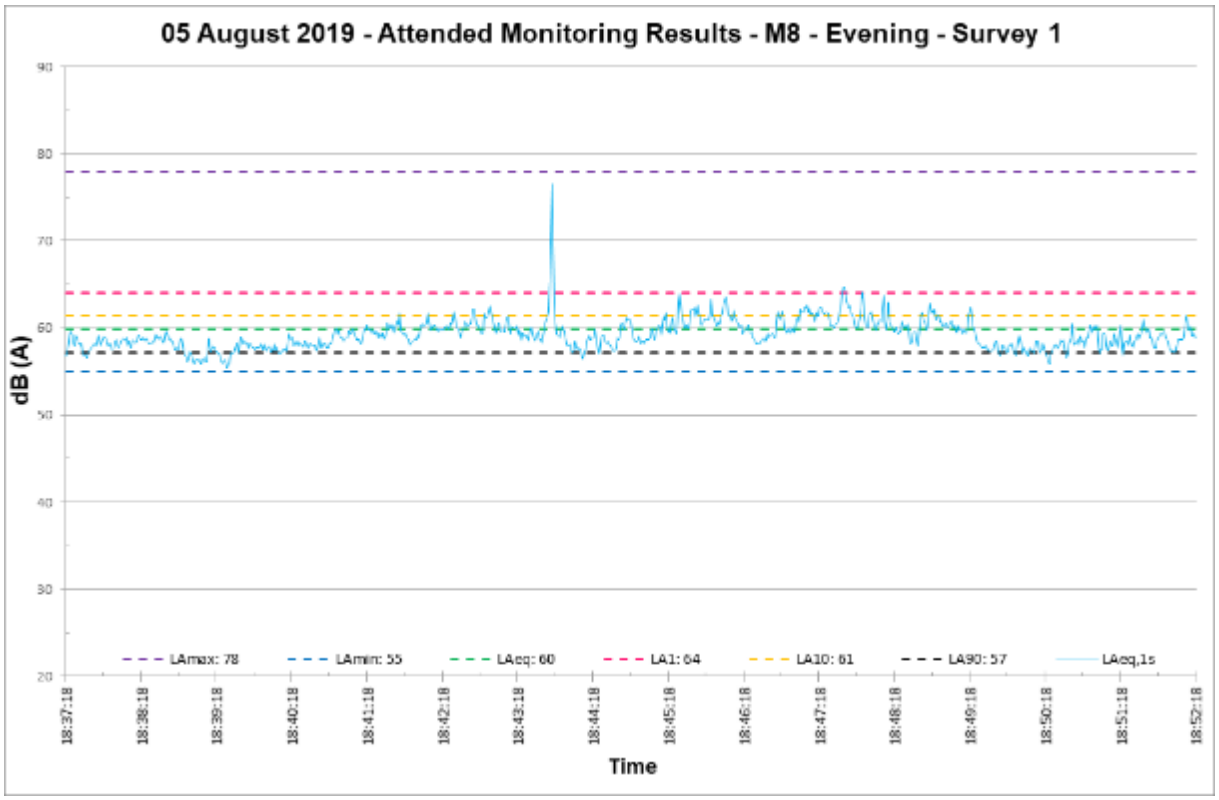

05 August 2019 - Attended Monitoring Results - M8 - Day - Survey 3
dB (A)
Time
LAmax: 87
LAmin: 53
LAeq: 63
LA1: 74
LA10: 63
LA90: 54
LAeq,1s

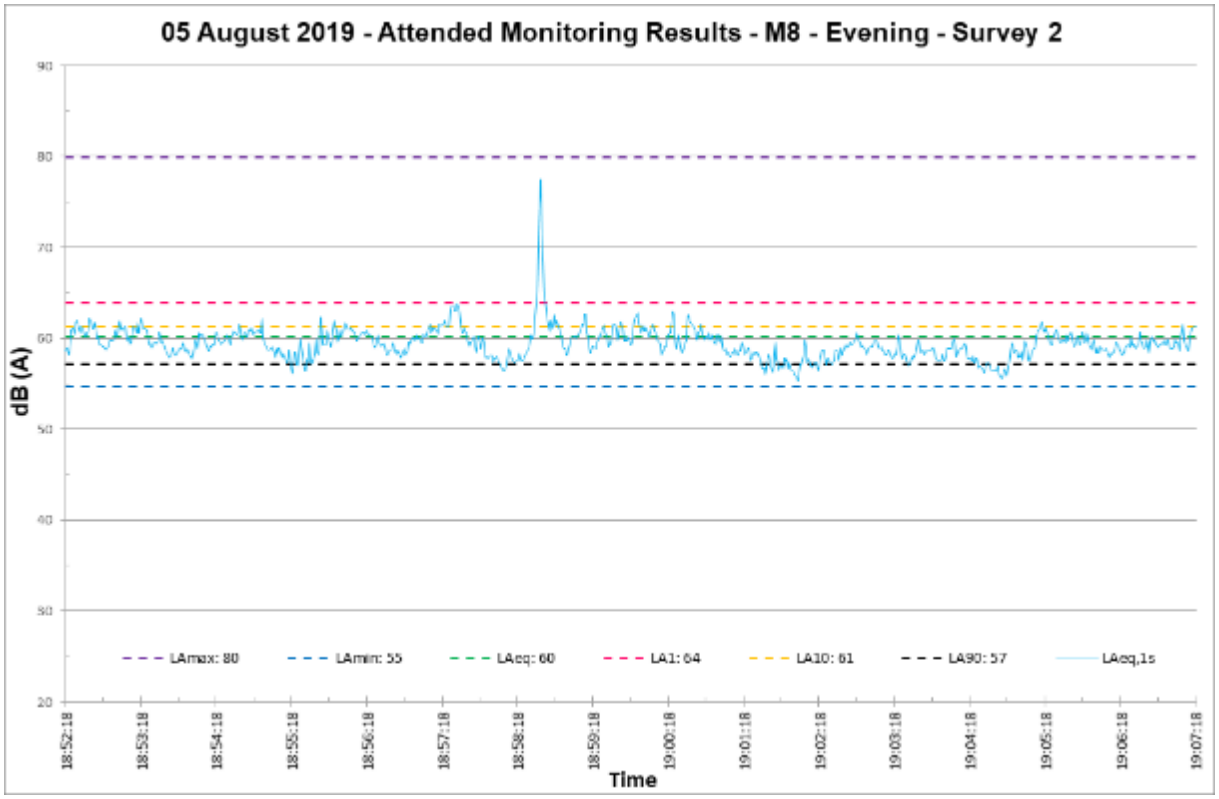

05 August 2019 - Attended Monitoring Results - M8 - Day - Survey 4
dB (A)
Time
LAmax: 77
LAmin: 54
LAeq: 61
LA1: 73
LA10: 61
LA90: 55
LAeq,1s


05 August 2019 - Attended Monitoring Results - M8 - Day - Survey 5
dB (A)
Time
LAmax: 78
LAmin: 54
LAeq: 60
LA1: 71
LA10: 59
LA90: 55
LAeq,1s

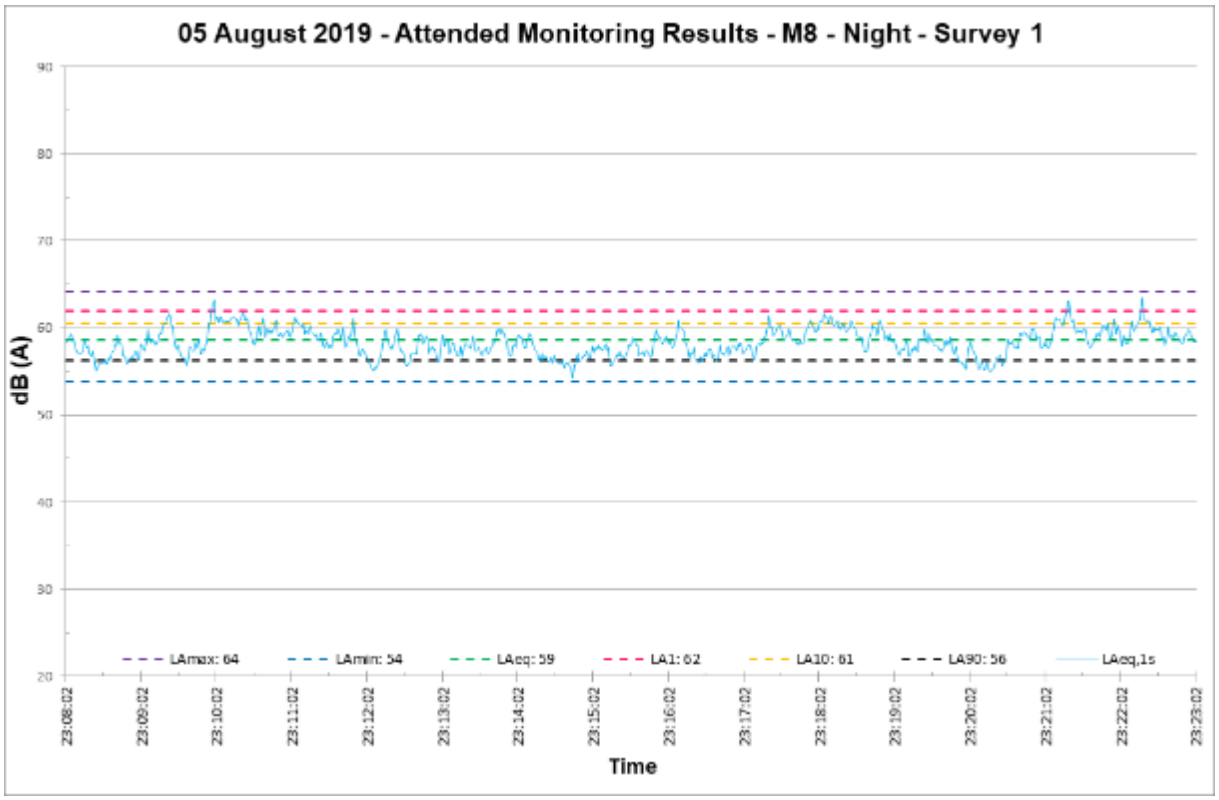

05 August 2019 - Attended Monitoring Results - M8 - Day - Survey 6
dB (A)
Time
LAmax: 77
LAmin: 53
LAeq: 60
LA1: 71
LA10: 60
LA90: 56
LAeq,1s

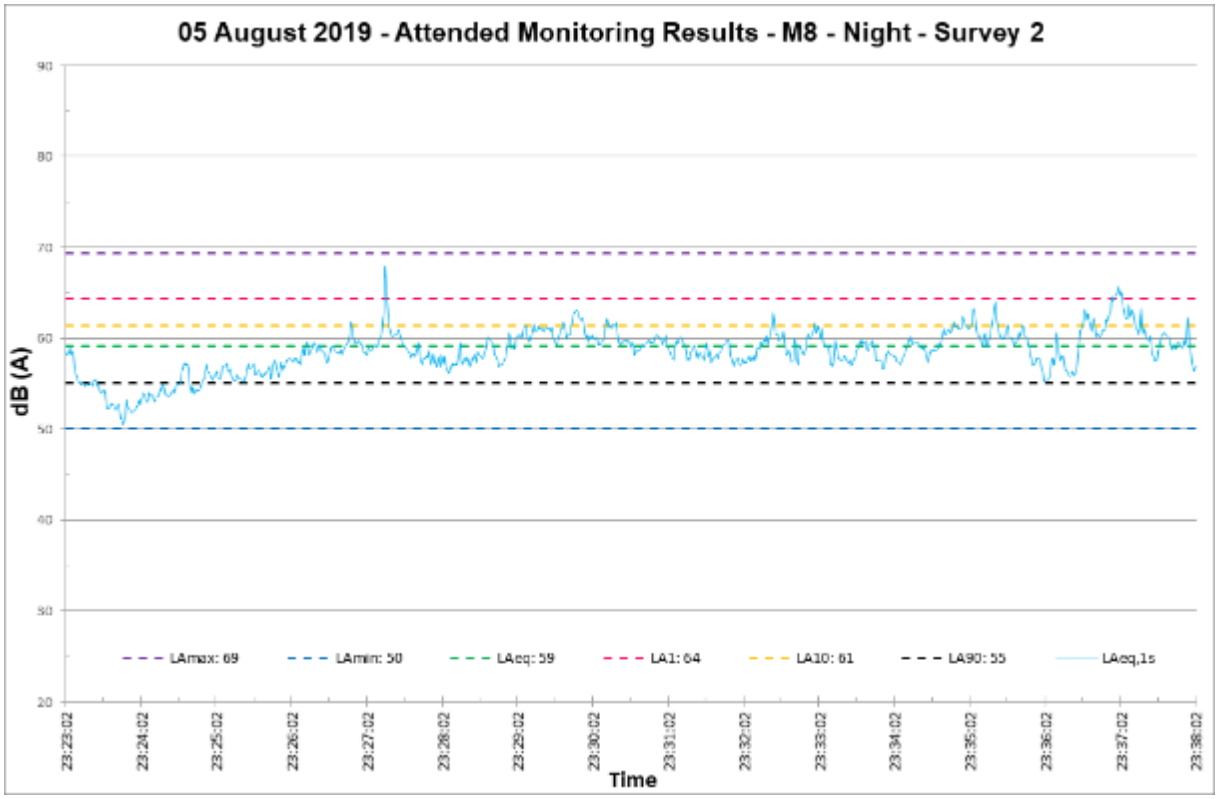
Evening – 05/08/2019

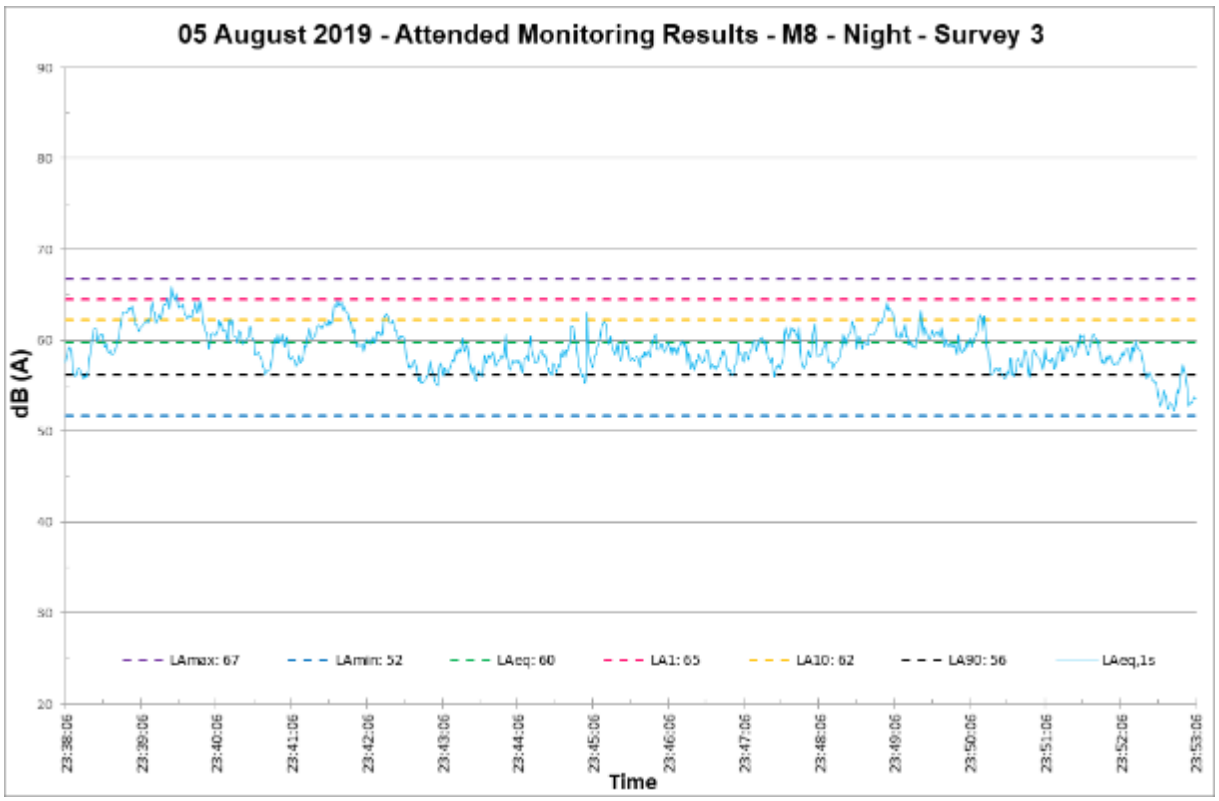


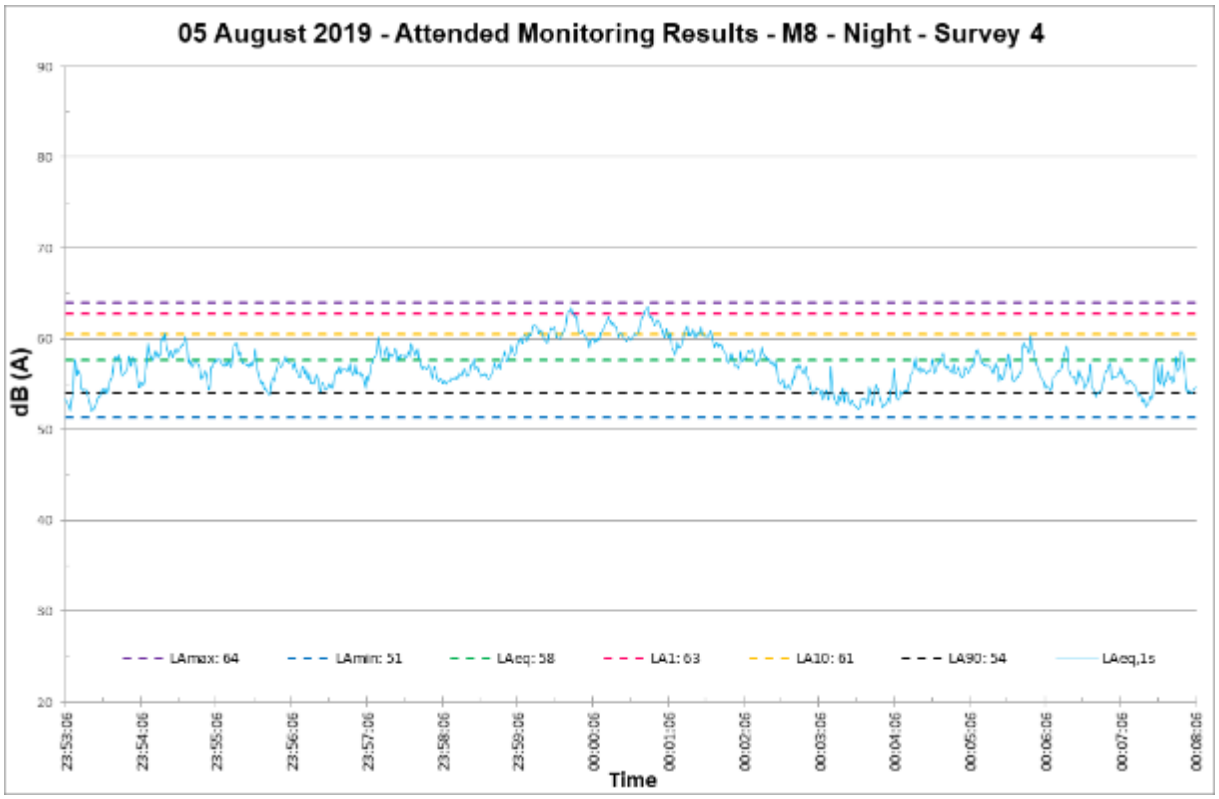


Night – 05/08/2019

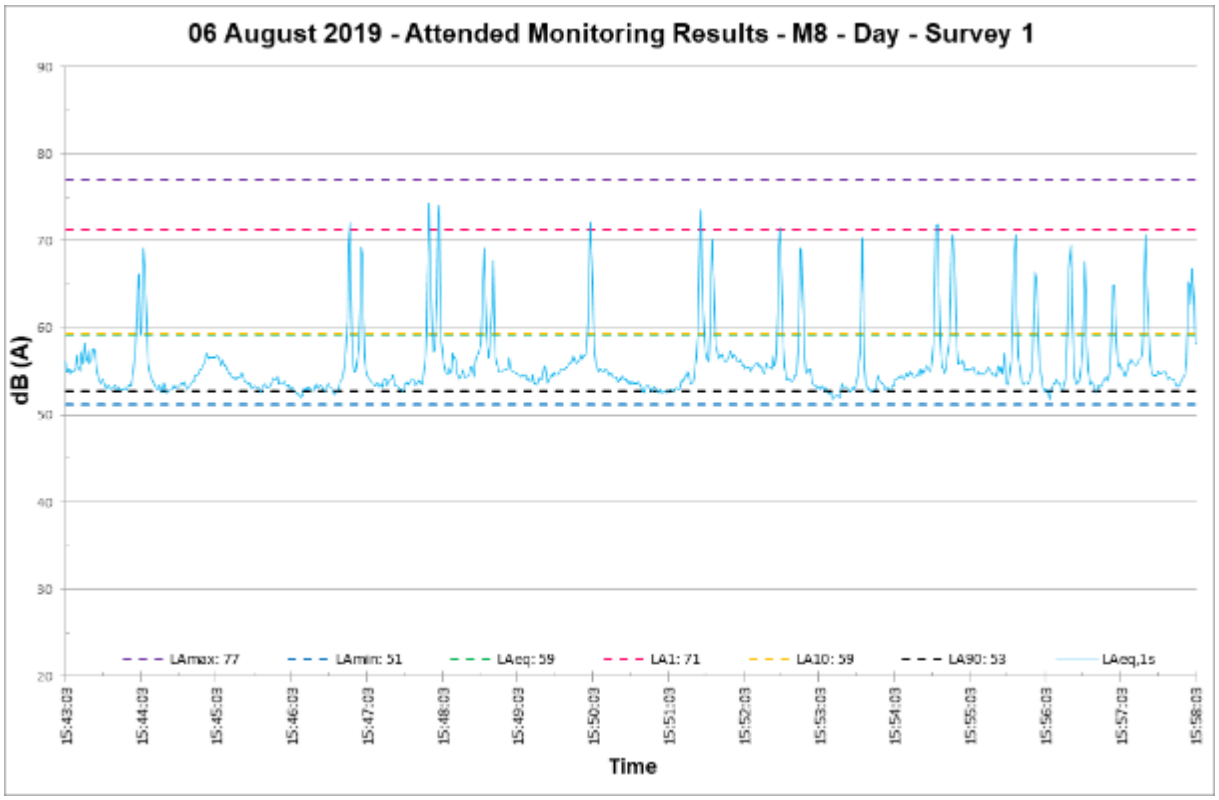


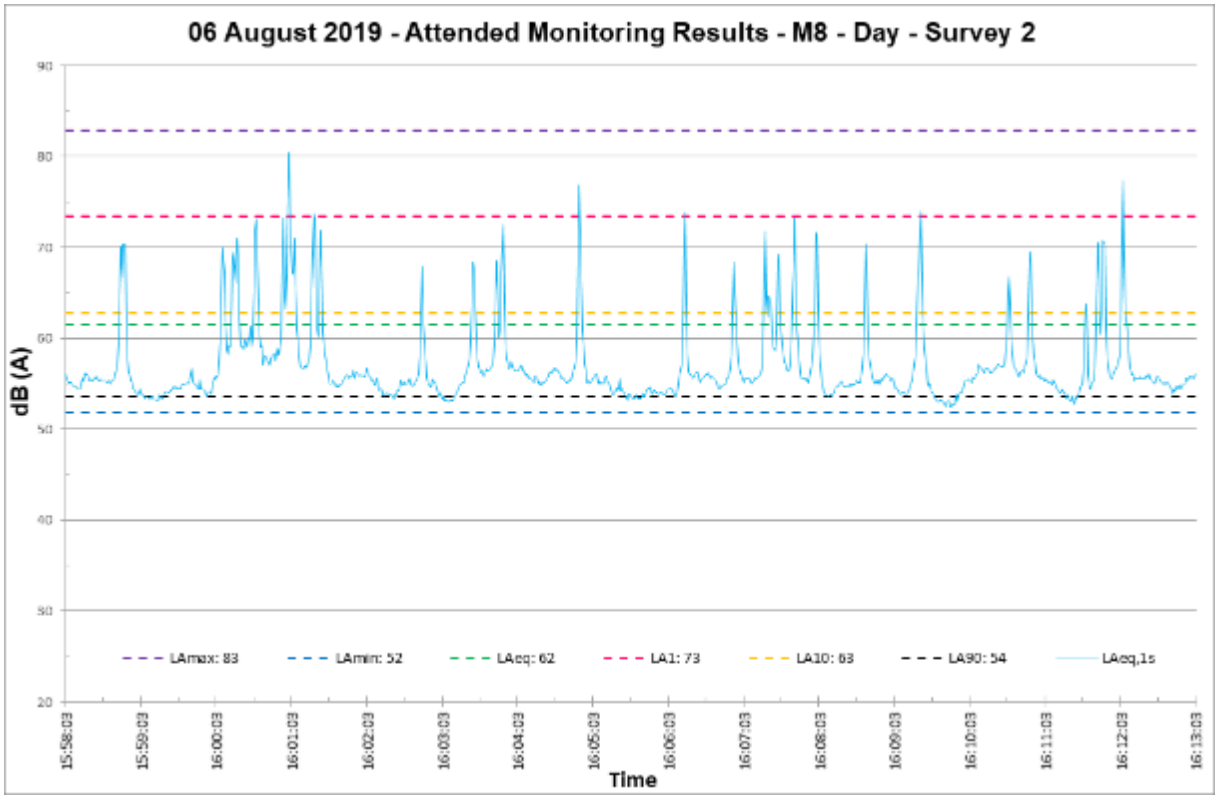


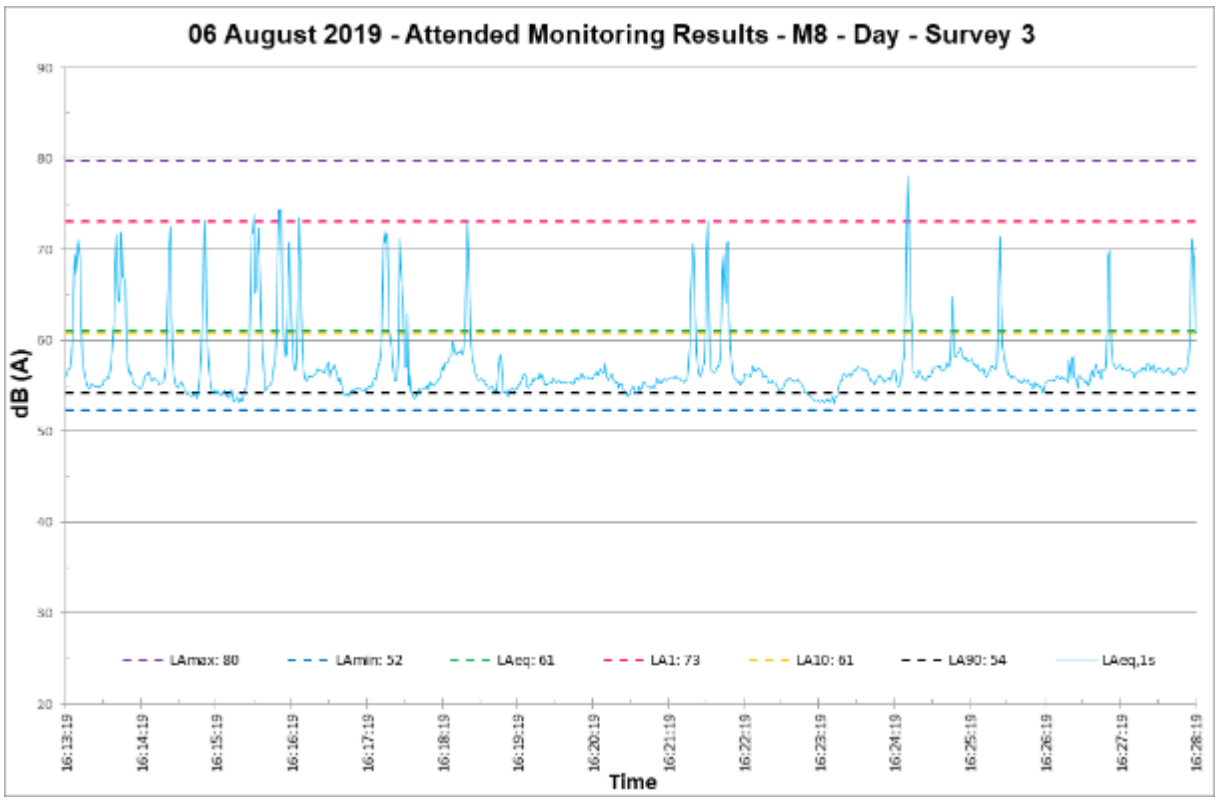

05 August 2019 - Attended Monitoring Results - M8 - Night - Survey 3
dB (A)
Time
LAmax: 67
LAmin: 52
LAeq: 60
LA1: 65
LA10: 62
LA90: 56
LAeq,1s

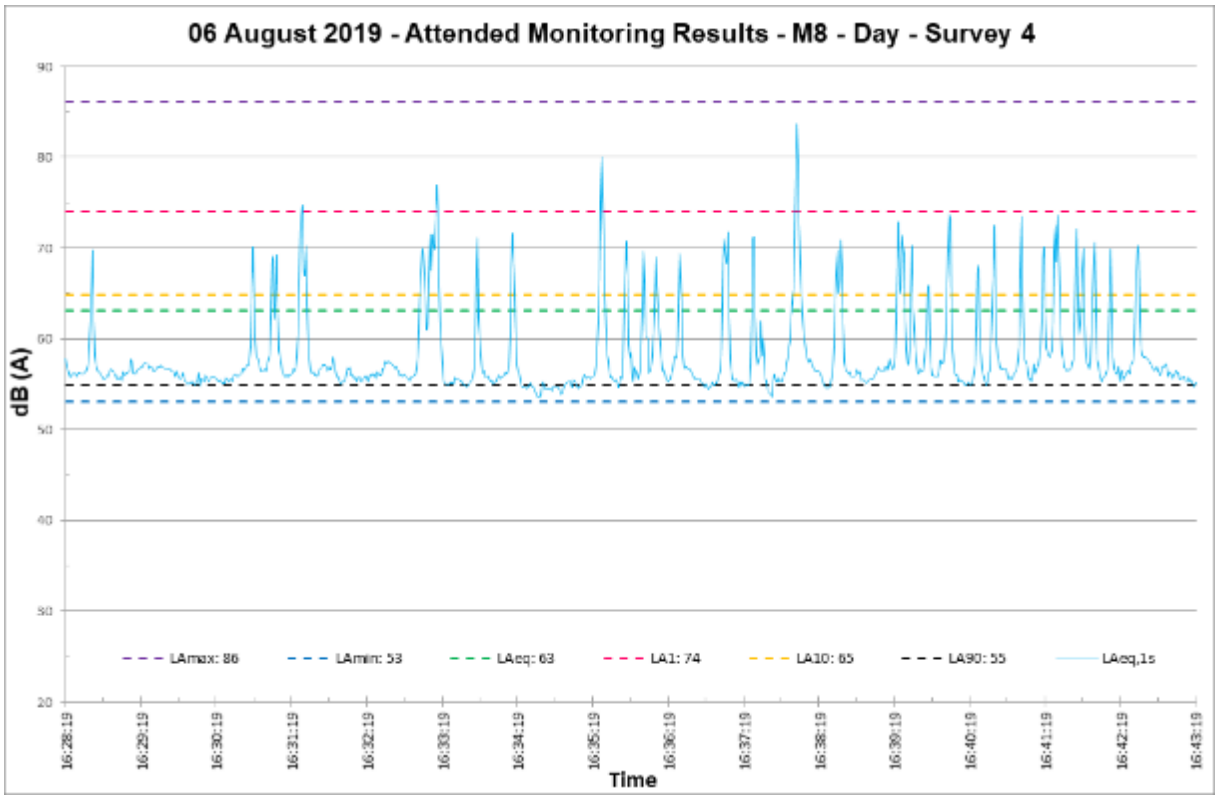

05 August 2019 - Attended Monitoring Results - M8 - Night - Survey 4
dB (A)
Time
LAmax: 64
LAmin: 51
LAeq: 58
LA1: 63
LA10: 61
LA90: 54
LAeq,1s

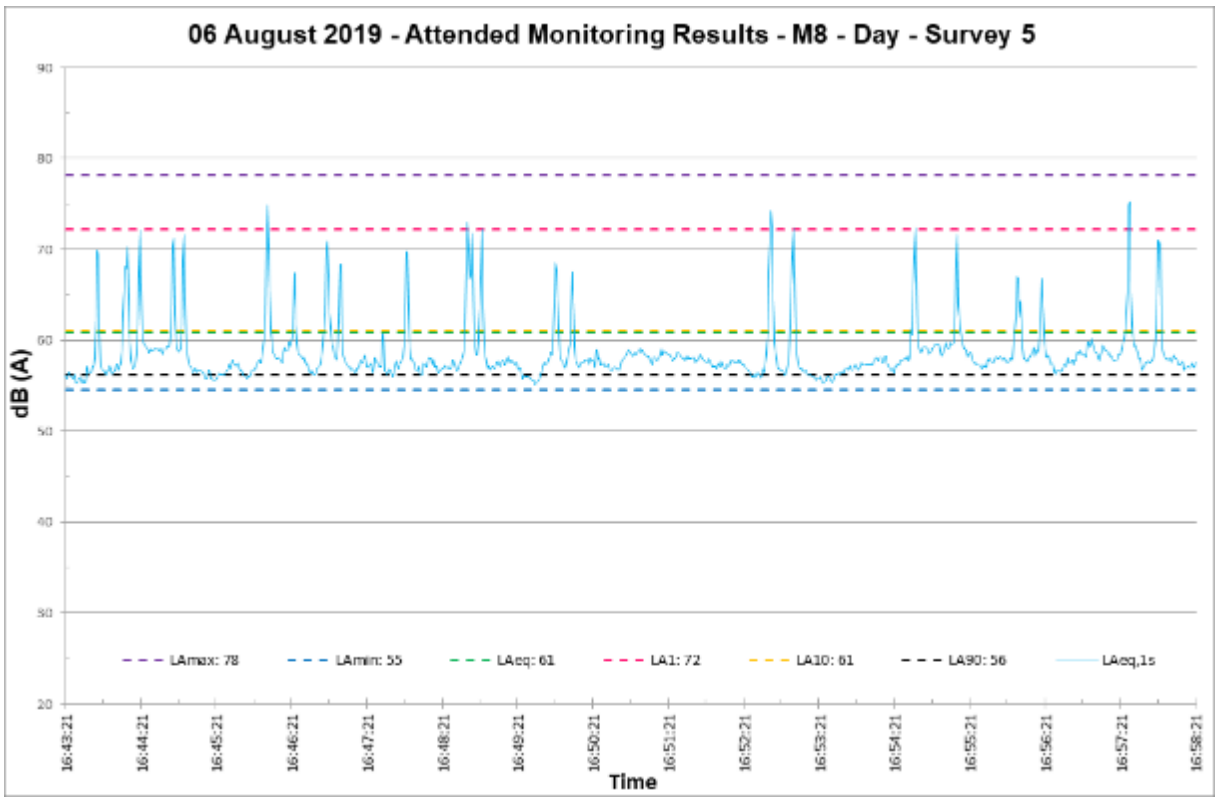
Day – 06/08/2019

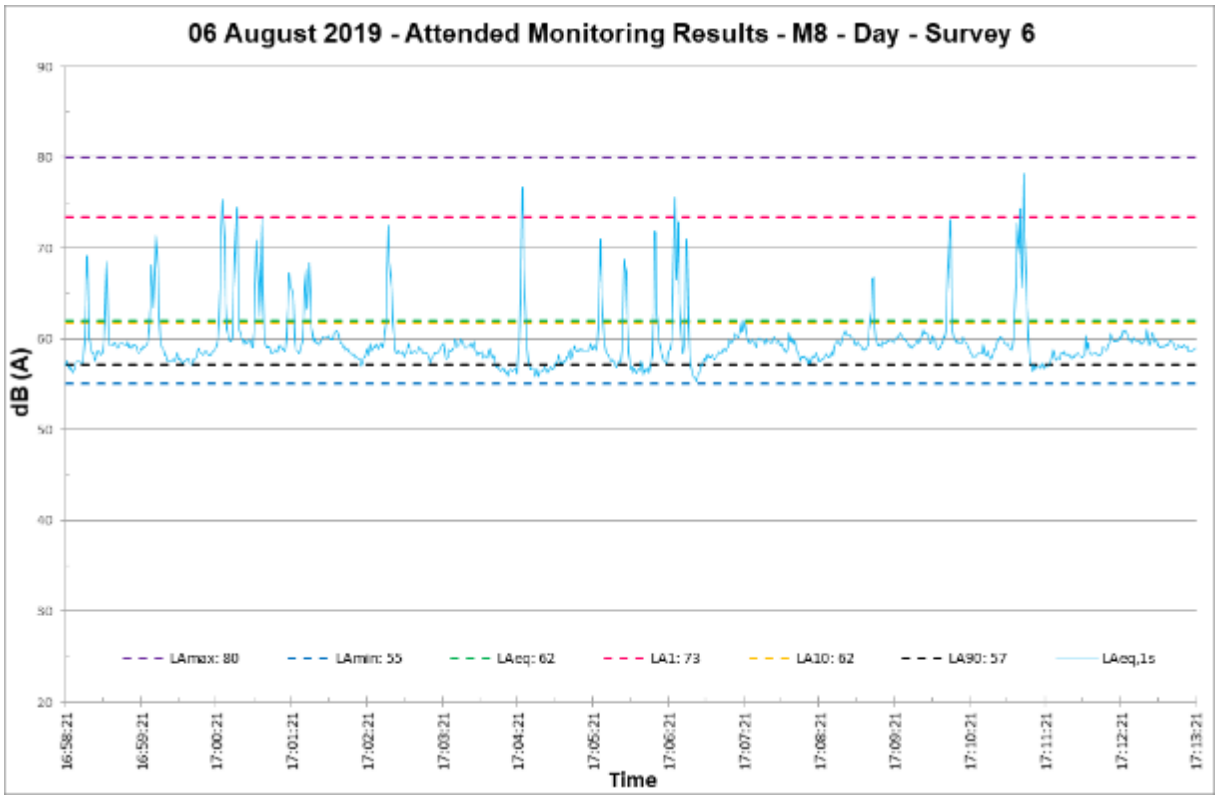




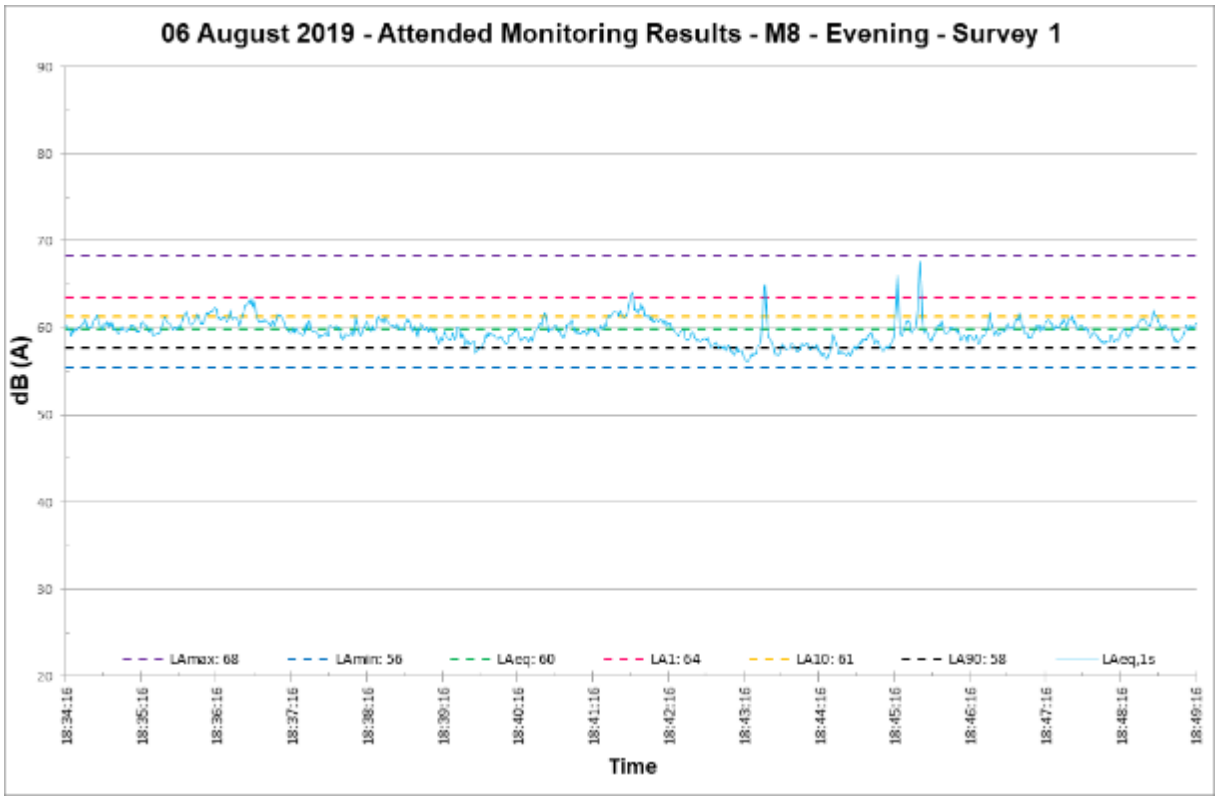

06 August 2019 - Attended Monitoring Results - M8 - Day - Survey 3
dB (A)
Time
LAmax: 80
LAmin: 52
LAeq: 61
LA1: 73
LA10: 61
LA90: 54
LAeq,1s

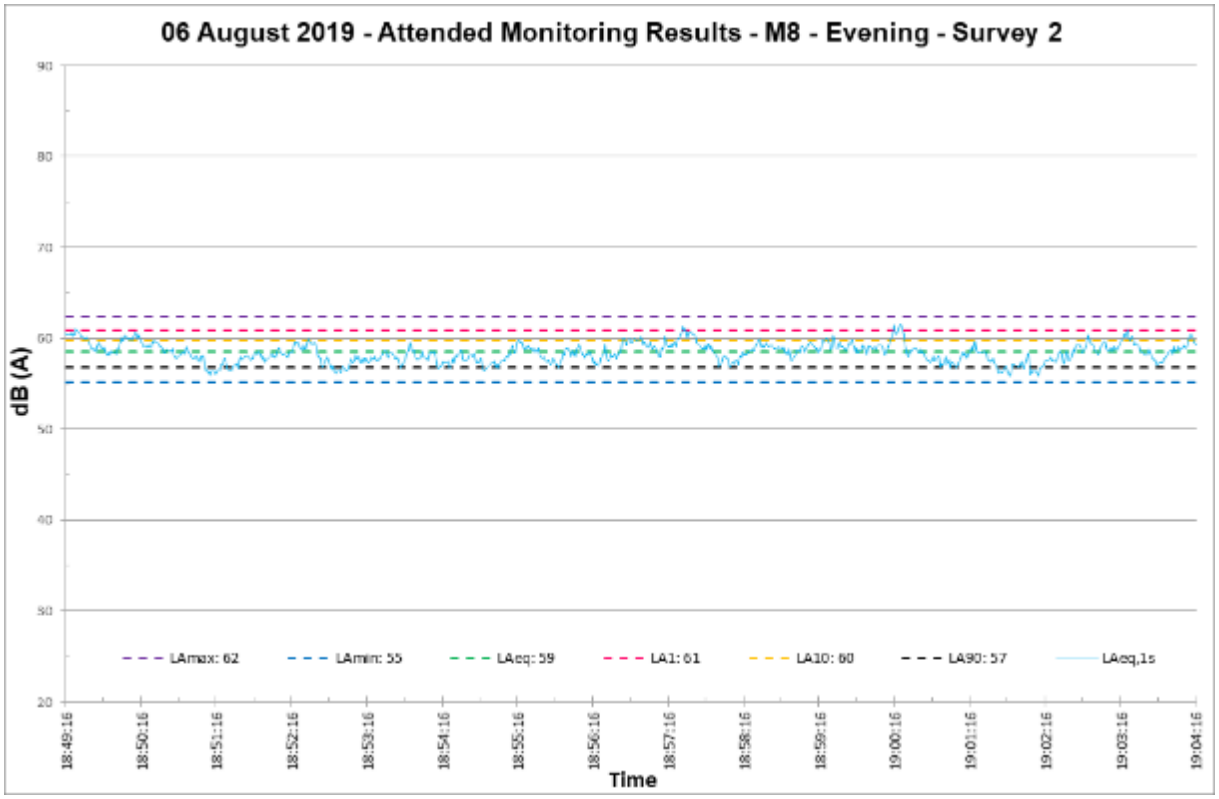

06 August 2019 - Attended Monitoring Results - M8 - Day - Survey 4
dB (A)
Time
LAmax: 86
LAmin: 53
LAeq: 63
LA1: 74
LA10: 65
LA90: 55
LAeq,1s


06 August 2019 - Attended Monitoring Results - M8 - Day - Survey 5
dB (A)
Time
LAmax: 78
LAmin: 55
LAeq: 61
LA1: 72
LA10: 61
LA90: 56
LAeq,1s

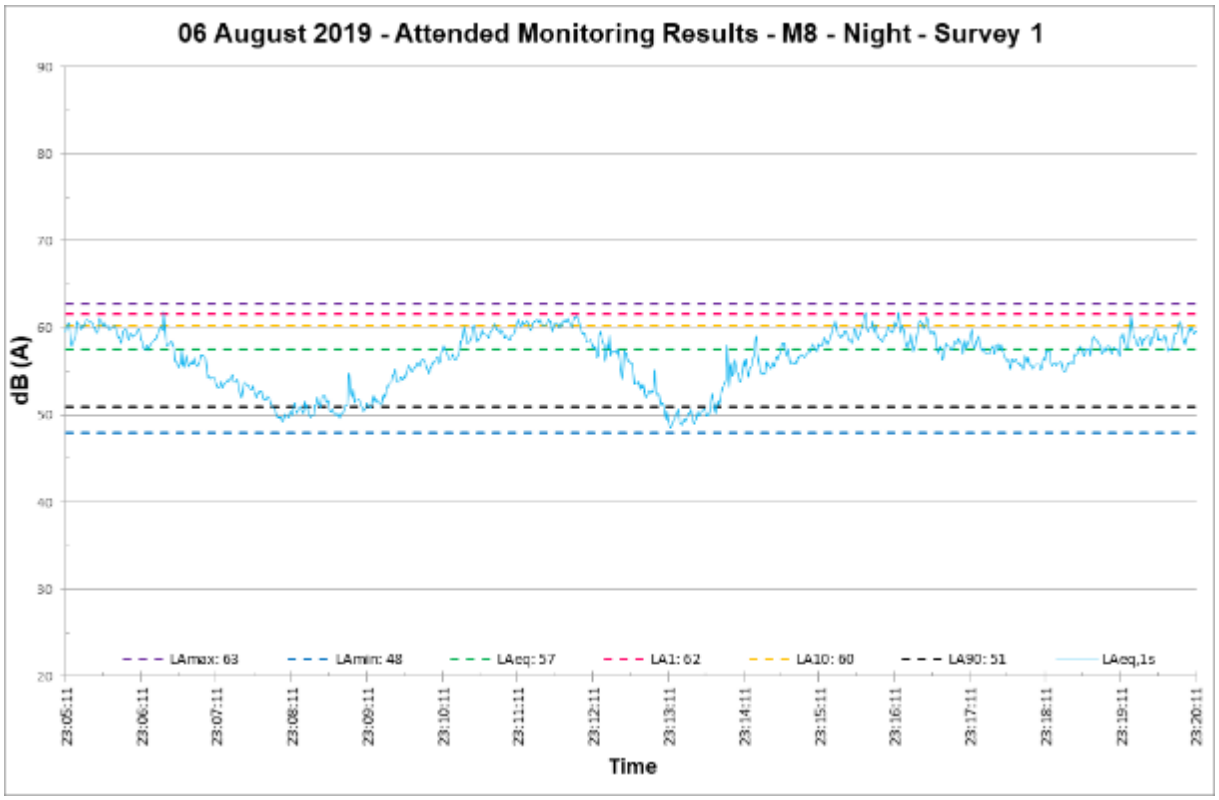

06 August 2019 - Attended Monitoring Results - M8 - Day - Survey 6
dB (A)
Time
LAmax: 80
LAmin: 55
LAeq: 62
LA1: 73
LA10: 62
LA90: 57
LAeq,1s

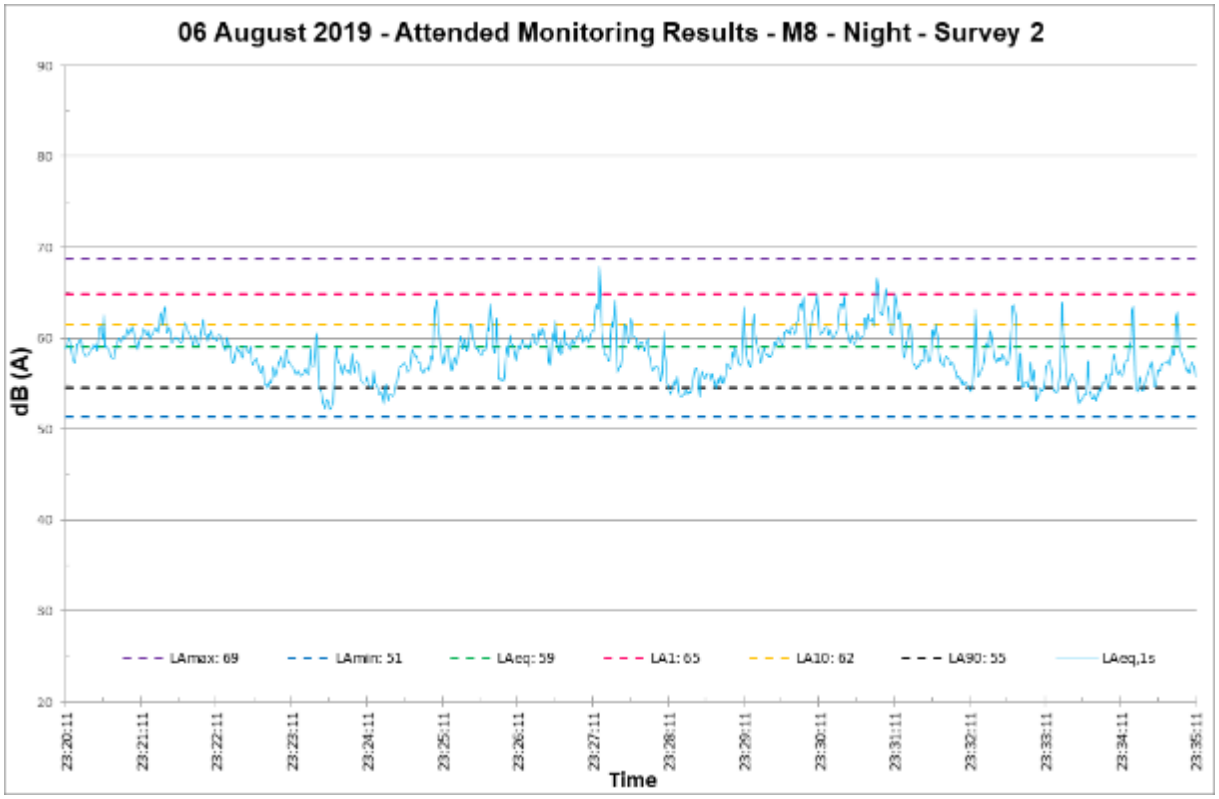
Evening – 06/08/2019

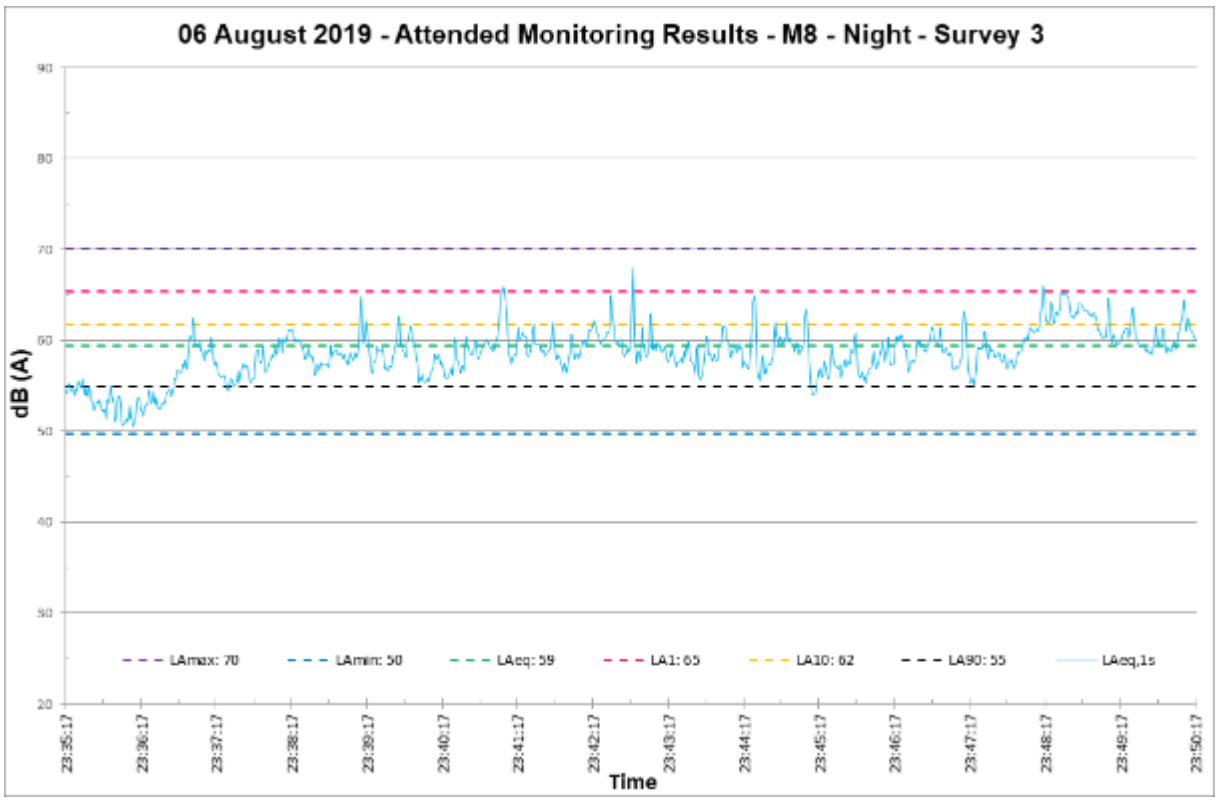


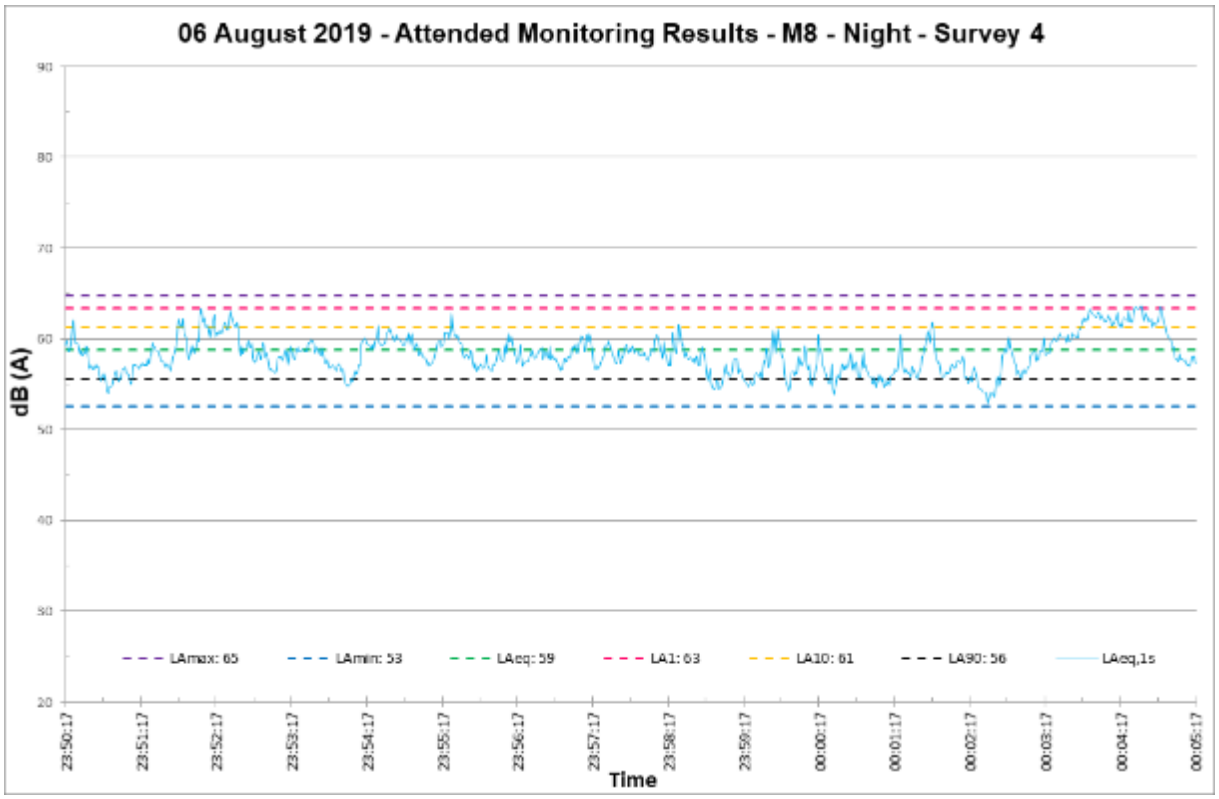


Night – 06/08/2019

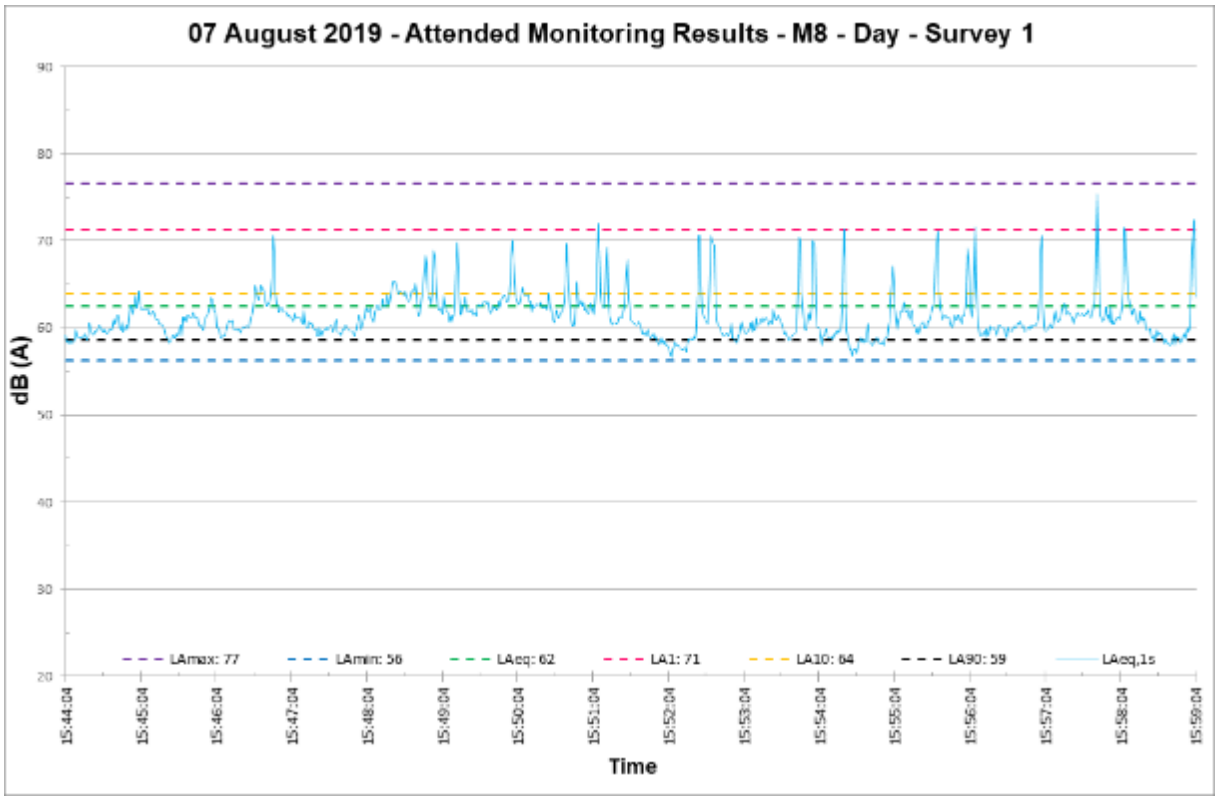


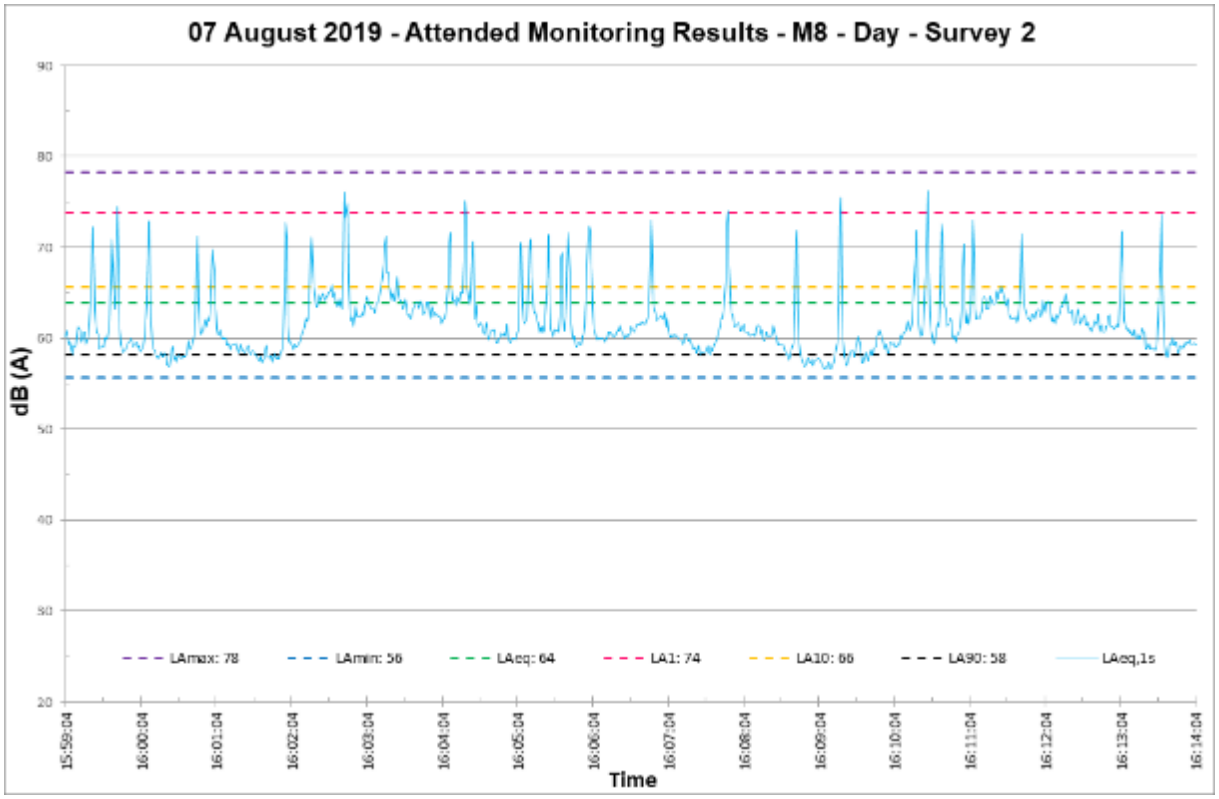


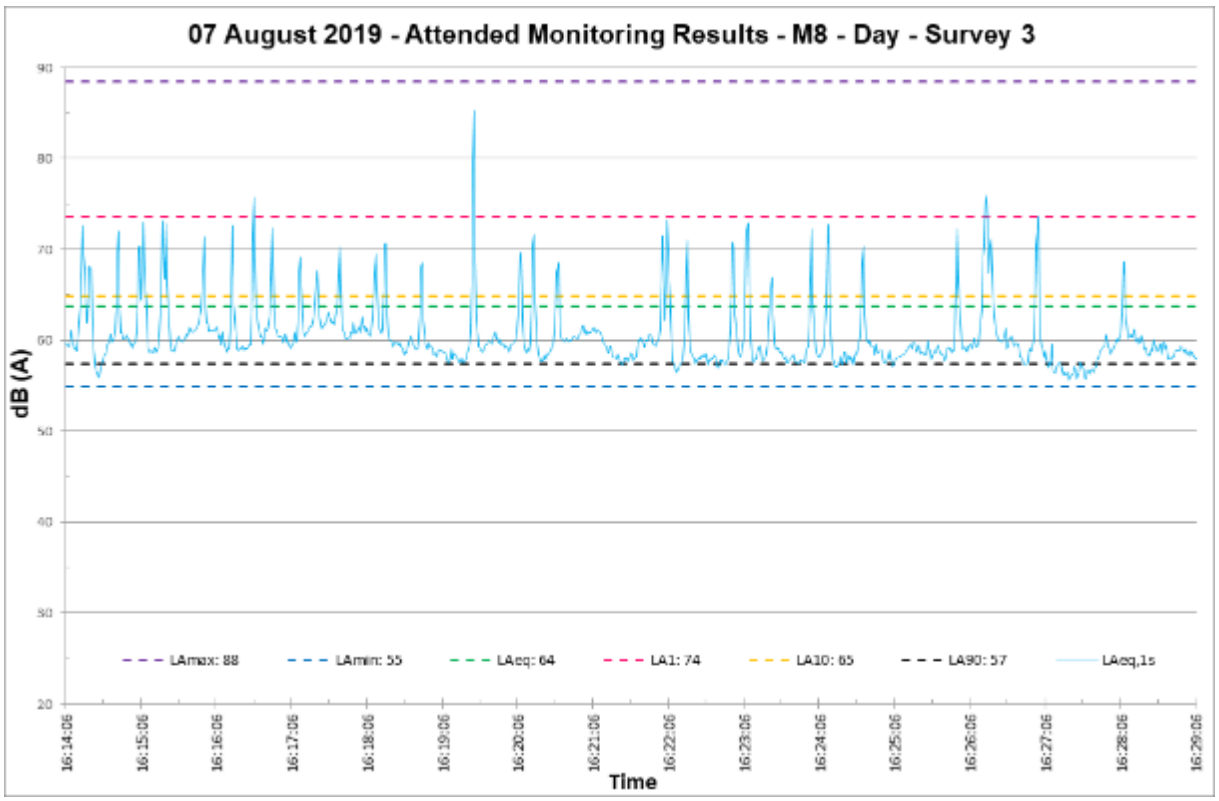

06 August 2019 - Attended Monitoring Results - M8 - Night - Survey 3
dB (A)
Time
LAmax: 70
LAmin: 50
LAeq: 59
LA1: 65
LA10: 62
LA90: 55
LAeq,1s

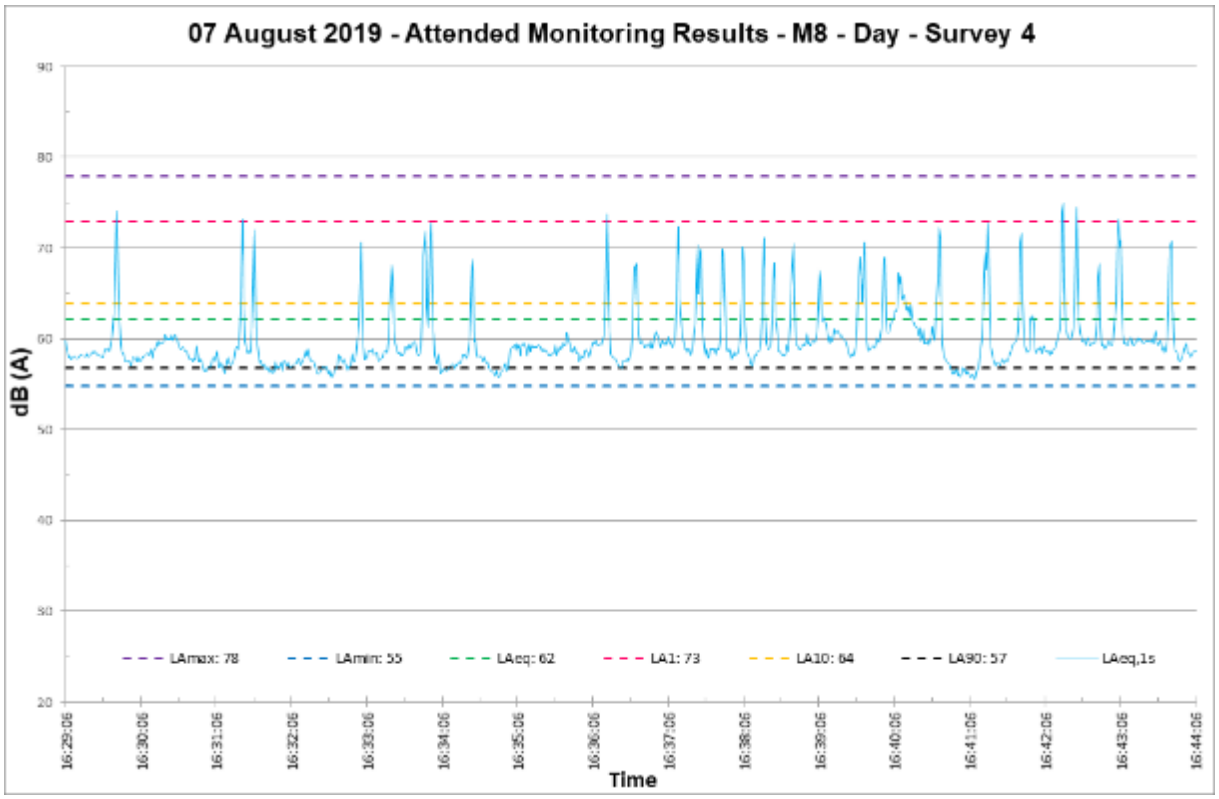

06 August 2019 - Attended Monitoring Results - M8 - Night - Survey 4
dB (A)
Time
LAmax: 65
LAmin: 53
LAeq: 59
LA1: 63
LA10: 61
LA90: 56
LAeq,1s

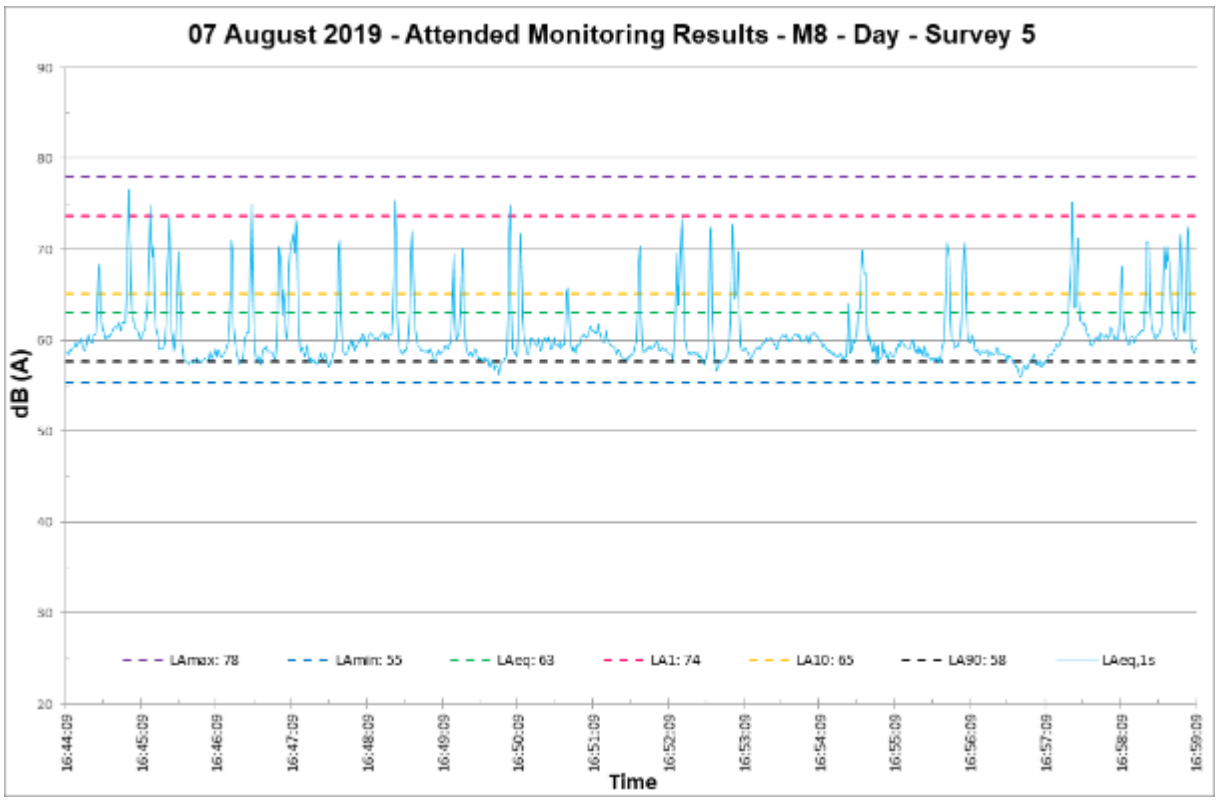
Day – 07/08/2019

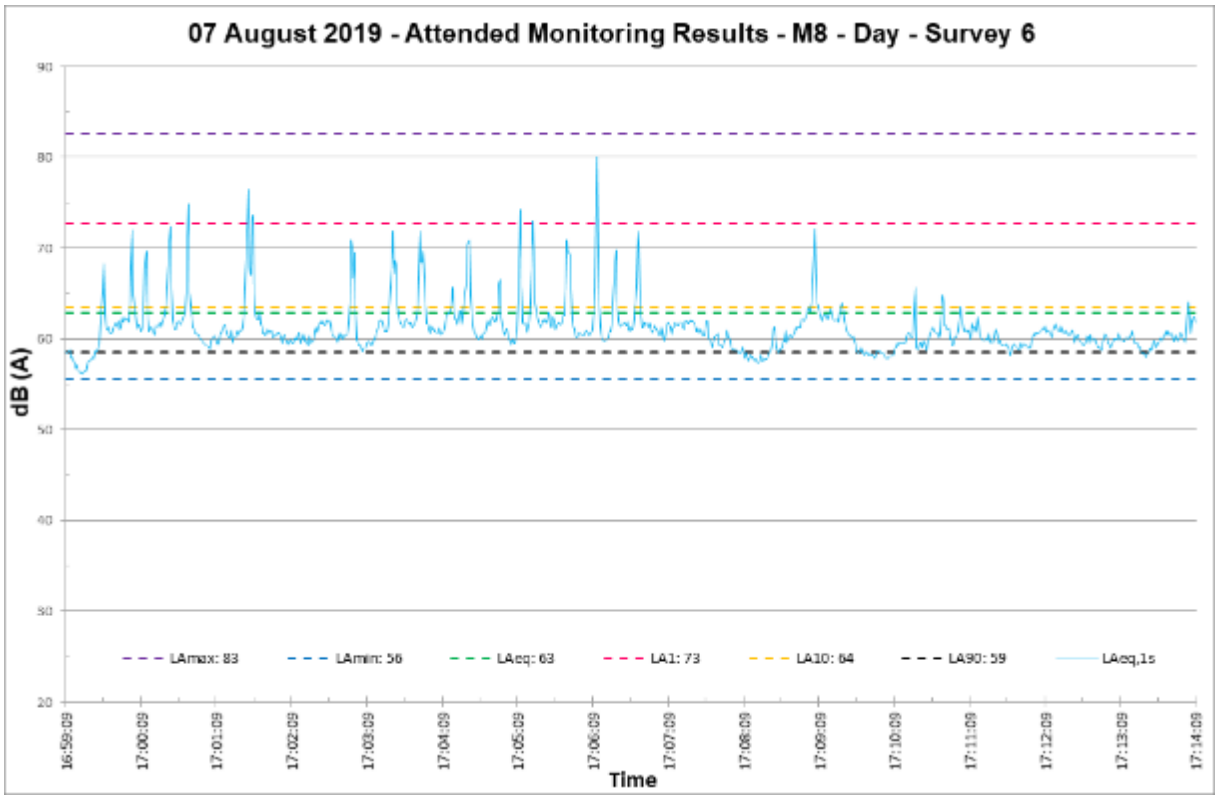




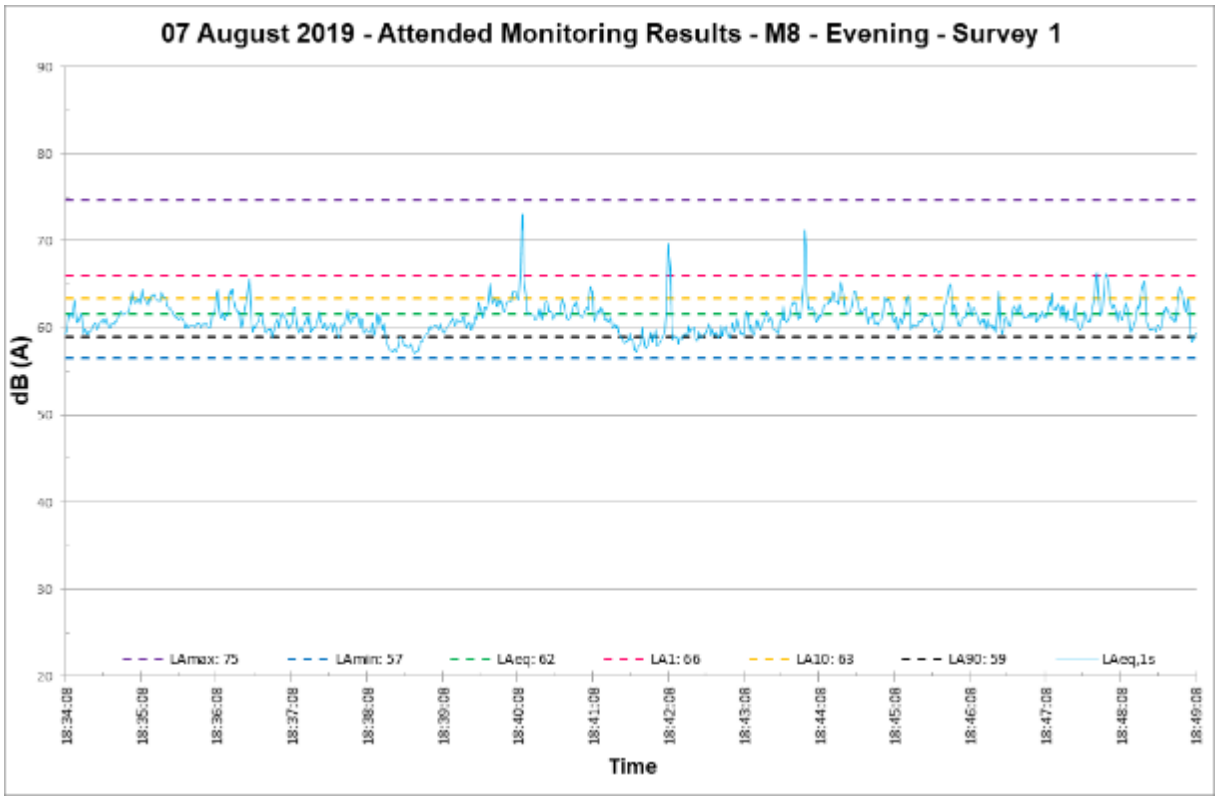

07 August 2019 - Attended Monitoring Results - M8 - Day - Survey 3
dB (A)
Time
LAmax: 88
LAmin: 55
LAeq: 64
LA1: 74
LA10: 65
LA90: 57
LAeq,1s

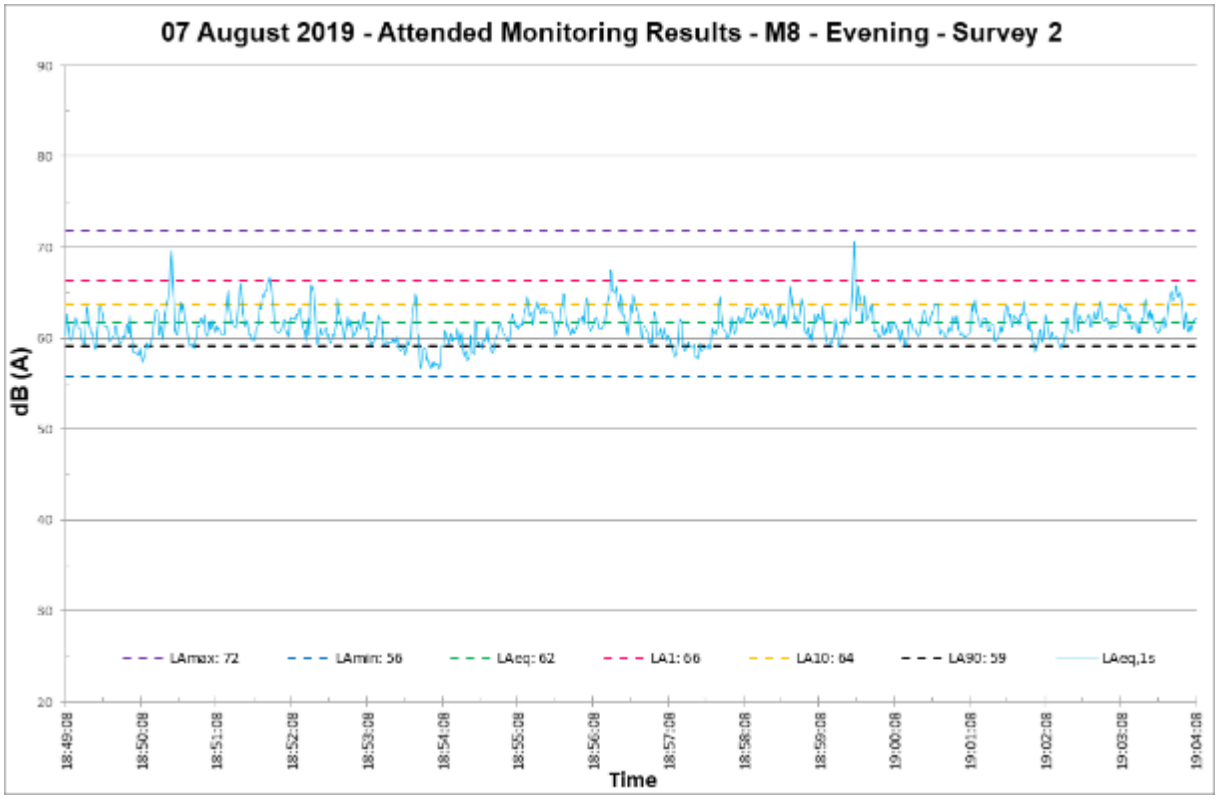

07 August 2019 - Attended Monitoring Results - M8 - Day - Survey 4
dB (A)
Time
LAmax: 78
LAmin: 55
LAeq: 62
LA1: 73
LA10: 64
LA90: 57
LAeq,1s


07 August 2019 - Attended Monitoring Results - M8 - Day - Survey 5
dB (A)
Time
LAmax: 78
LAmin: 55
LAeq: 63
LA1: 74
LA10: 65
LA90: 58
LAeq,1s

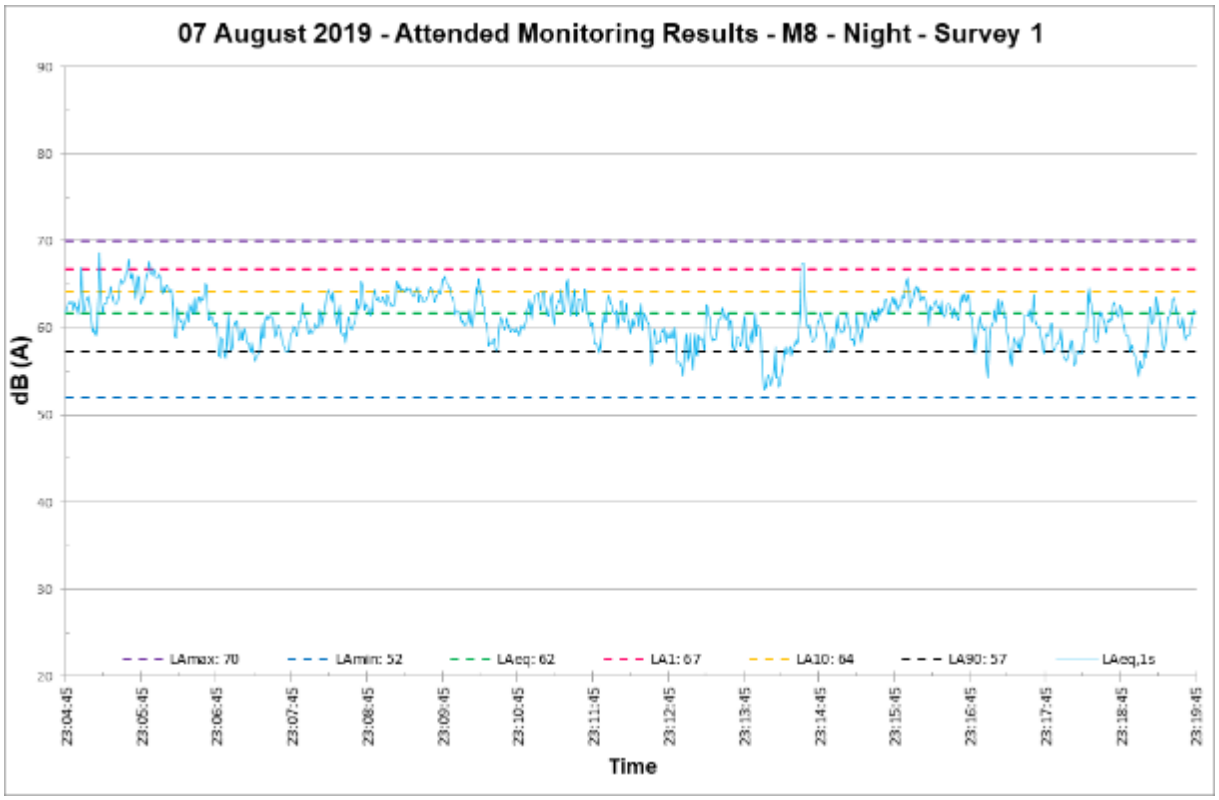

07 August 2019 - Attended Monitoring Results - M8 - Day - Survey 6
dB (A)
Time
LAmax: 83
LAmin: 56
LAeq: 63
LA1: 73
LA10: 64
LA90: 59
LAeq,1s

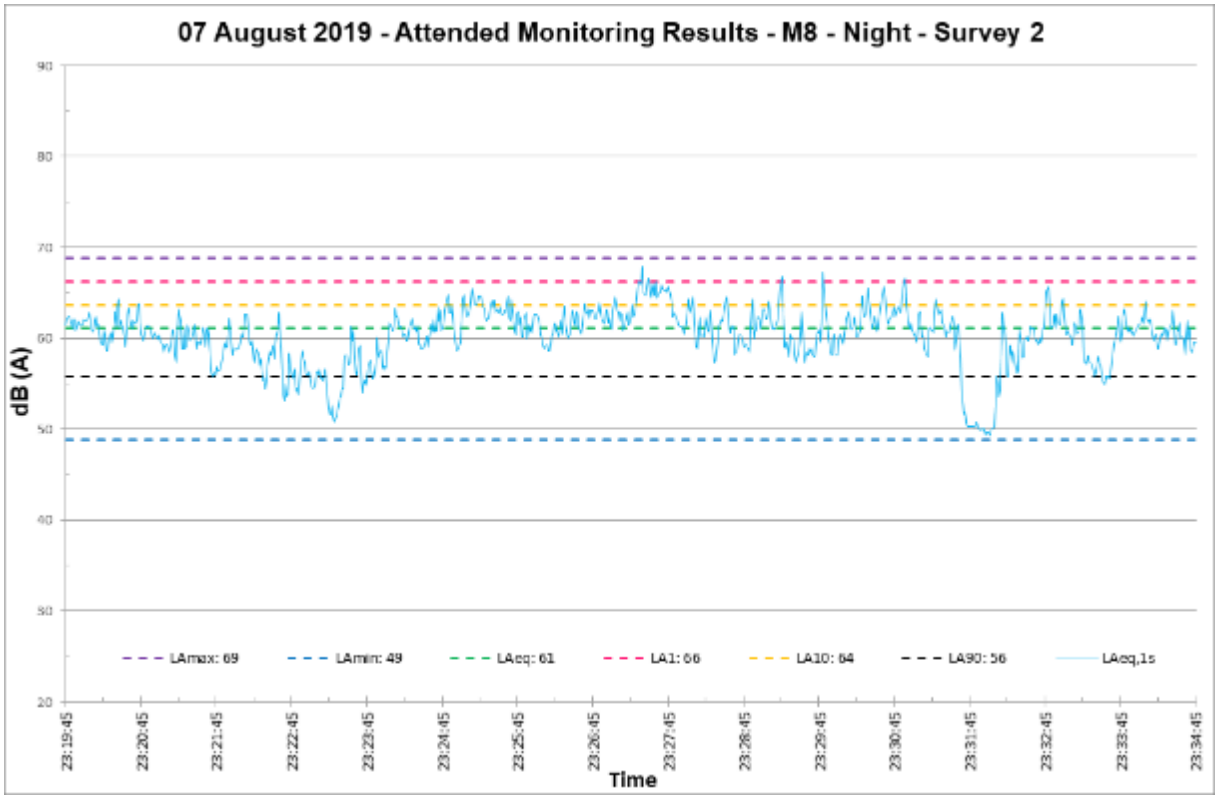
Evening – 07/08/2019

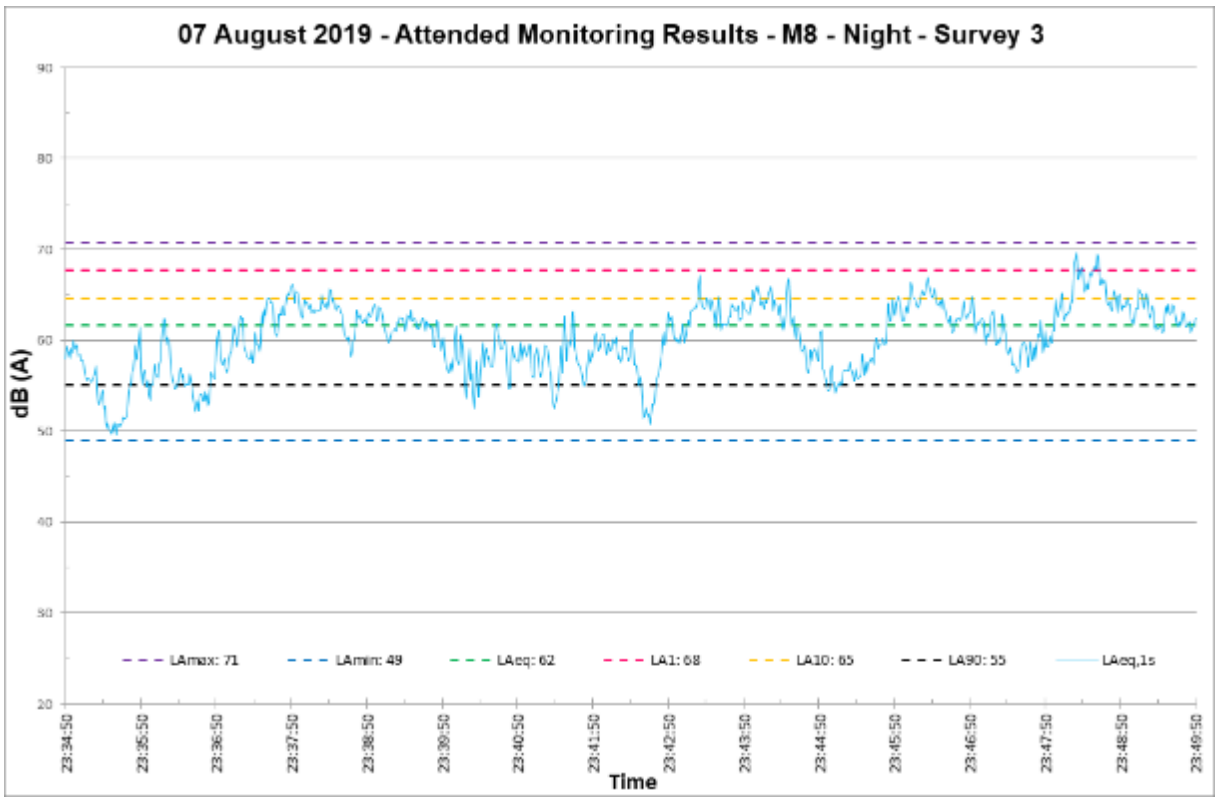


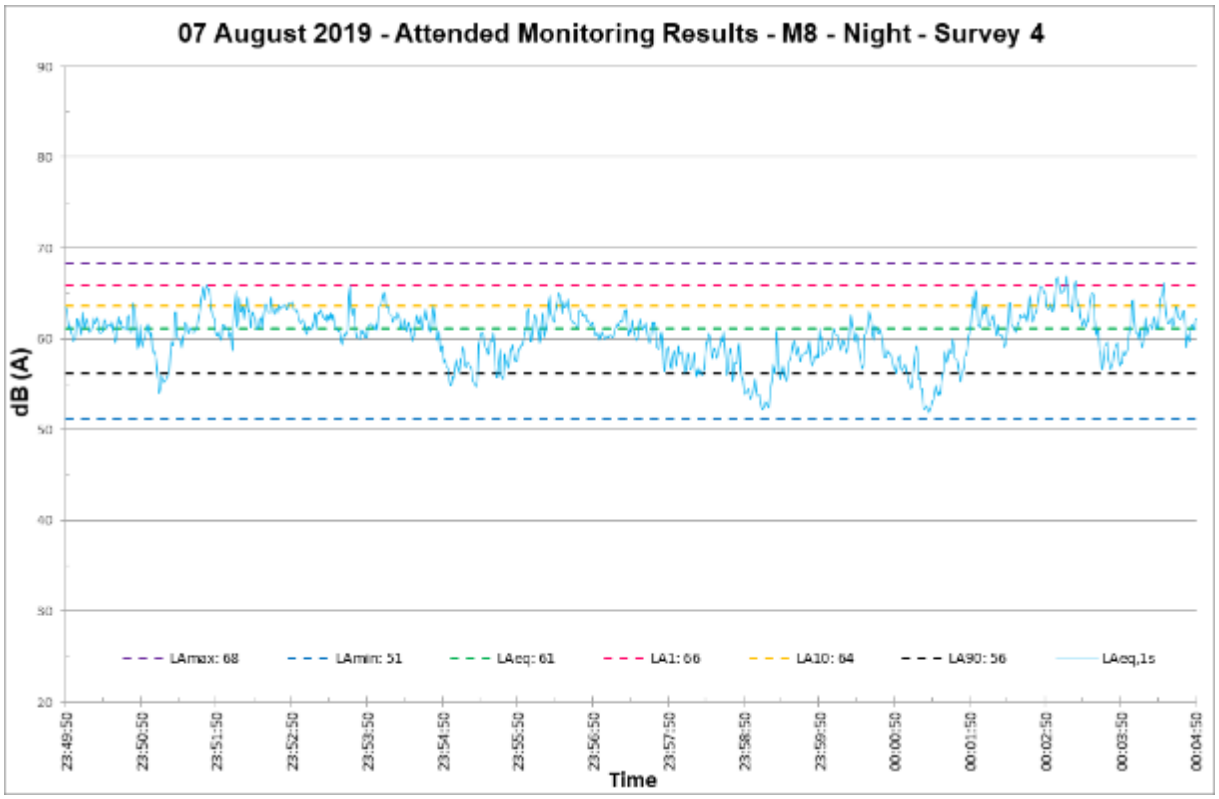


Night – 07/08/2019



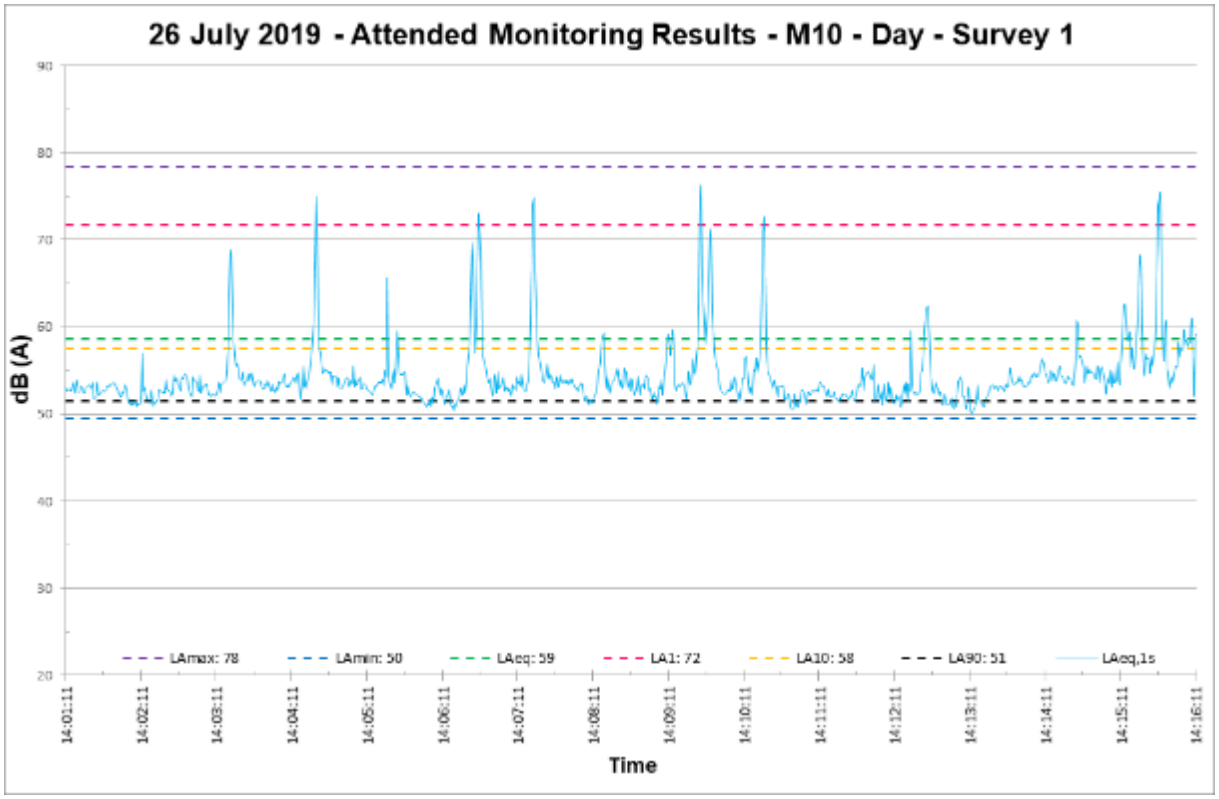


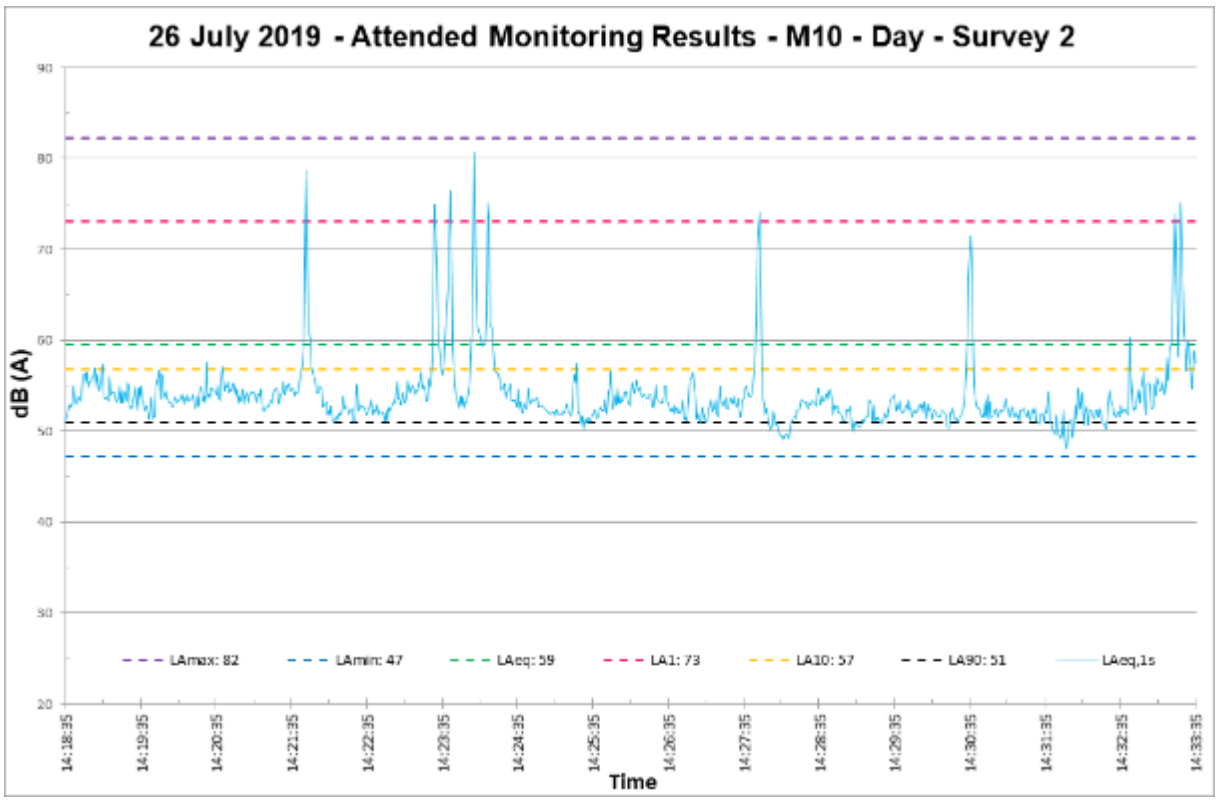

07 August 2019 - Attended Monitoring Results - M8 - Night - Survey 3
dB (A)
Time
LAmax: 71
LAmin: 49
LAeq: 62
LA1: 68
LA10: 65
LA90: 55
LAeq,1s

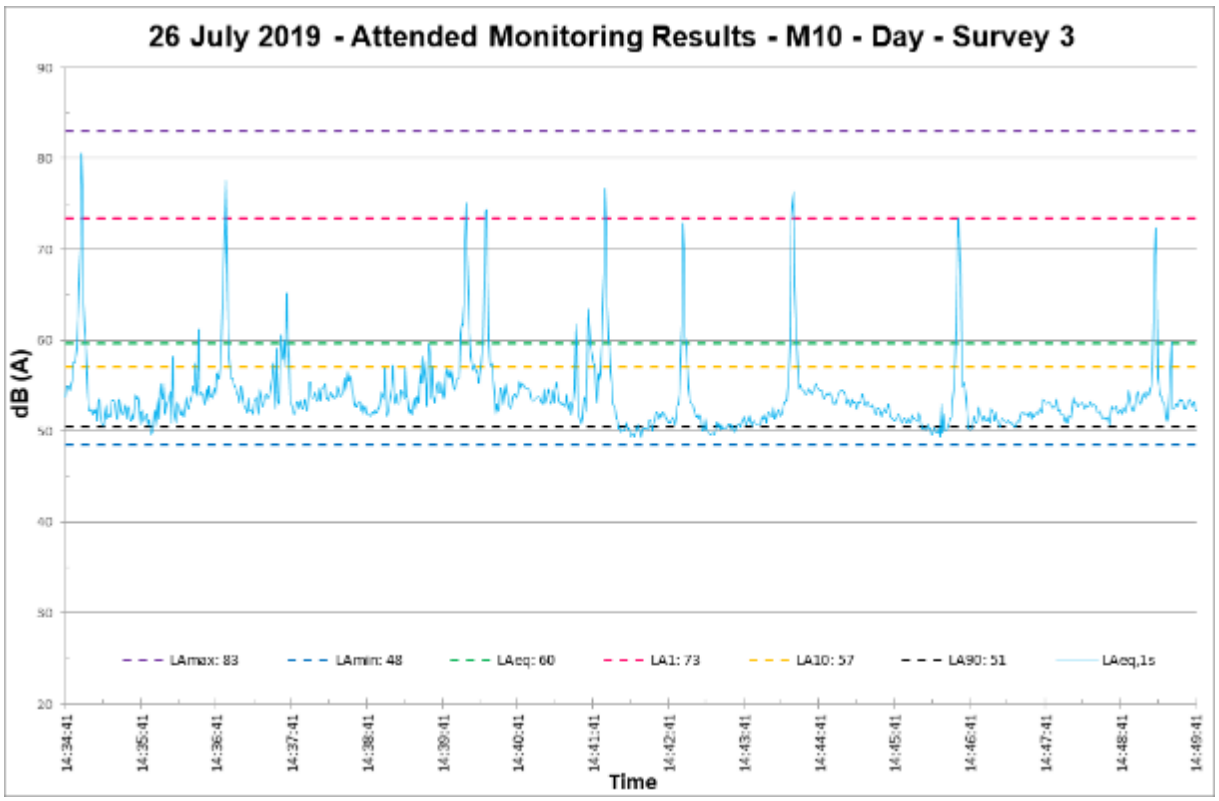

07 August 2019 - Attended Monitoring Results - M8 - Night - Survey 4
dB (A)
Time
LAmax: 68
LAmin: 51
LAeq: 61
LA1: 66
LA10: 64
LA90: 56
LAeq,1s

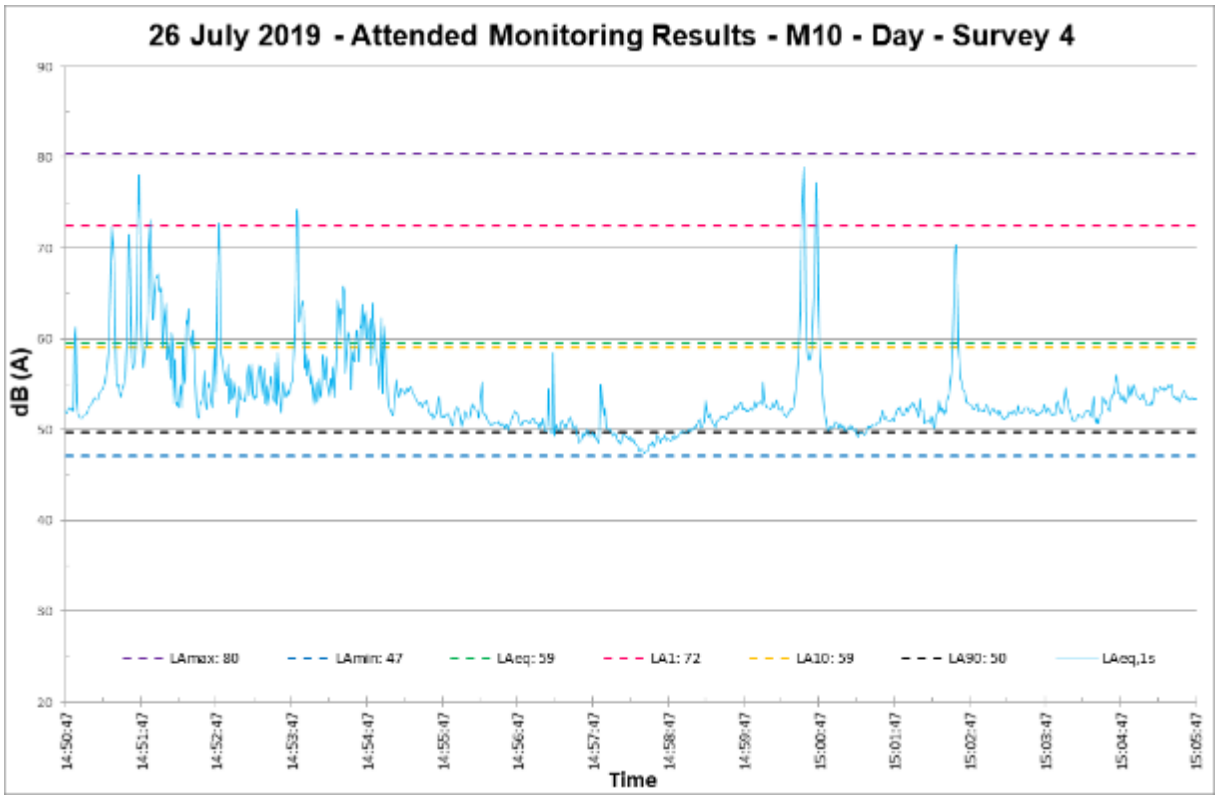
Appendix G – Operator attended noise monitoring results – Location M10

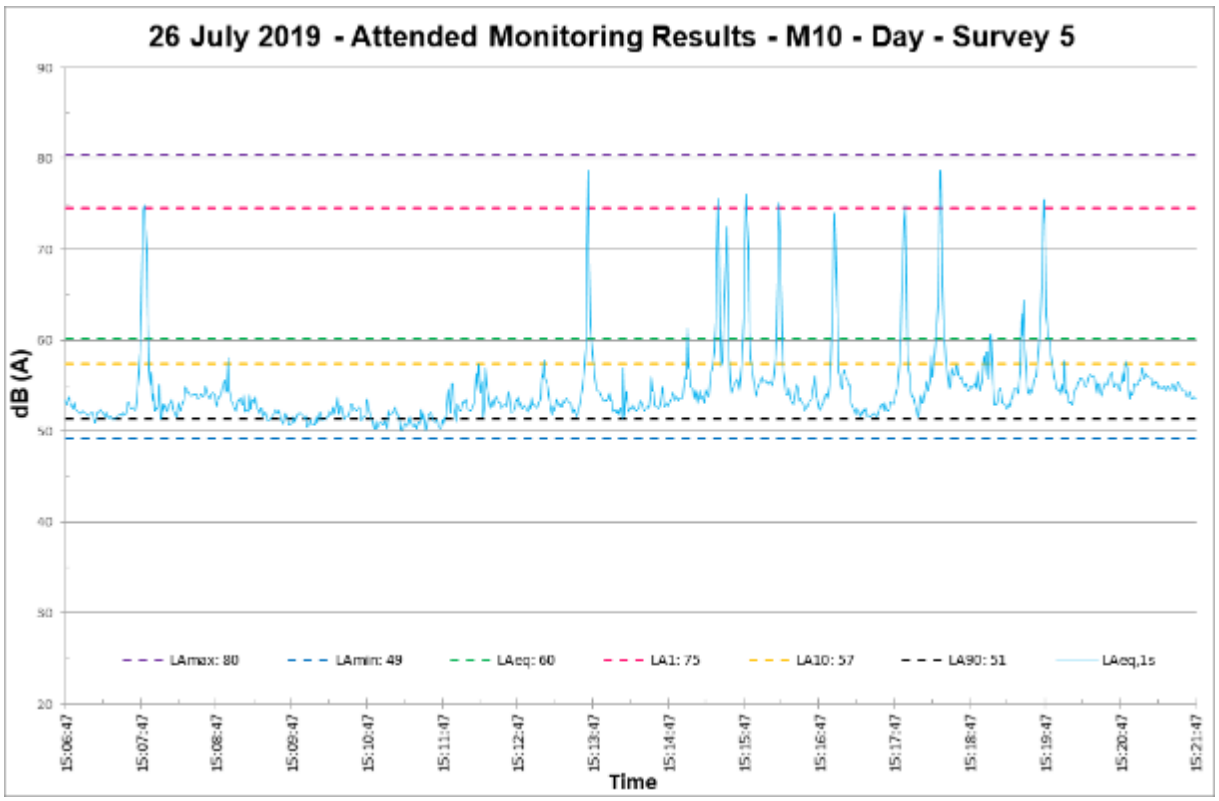
Day – 26/07/2019

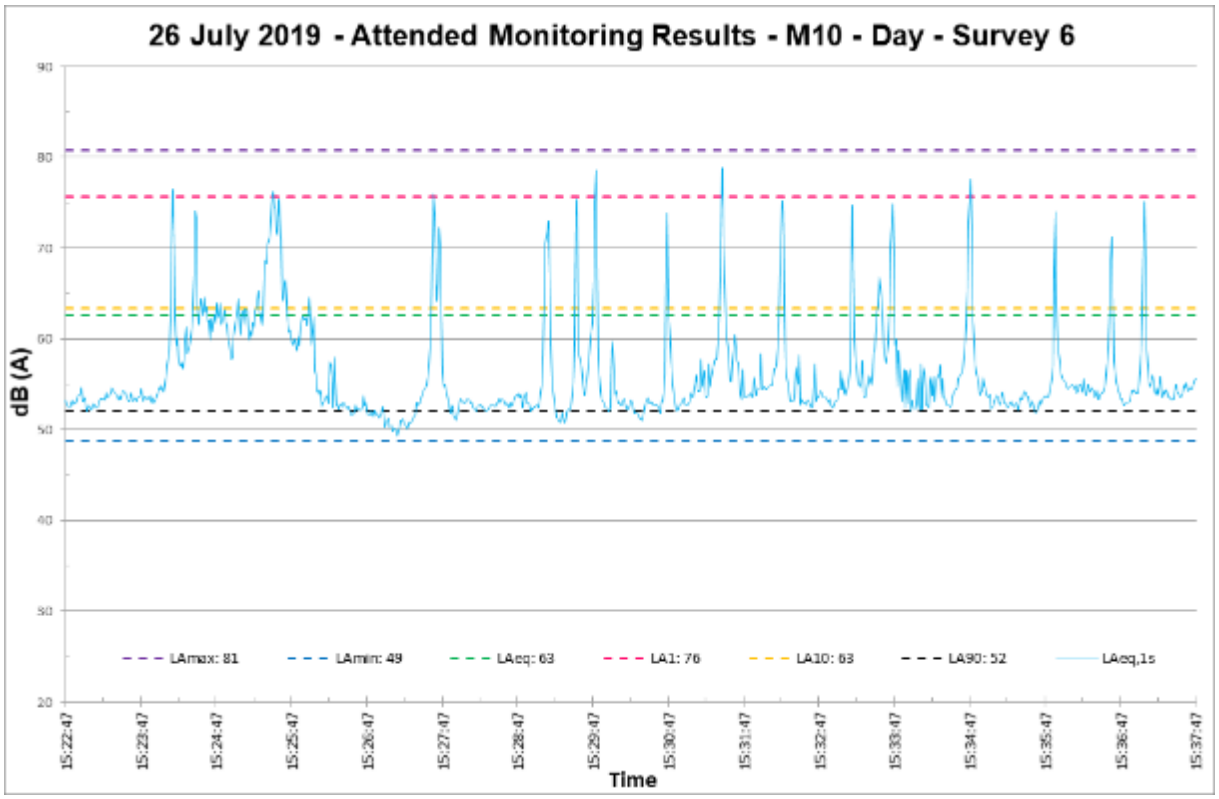




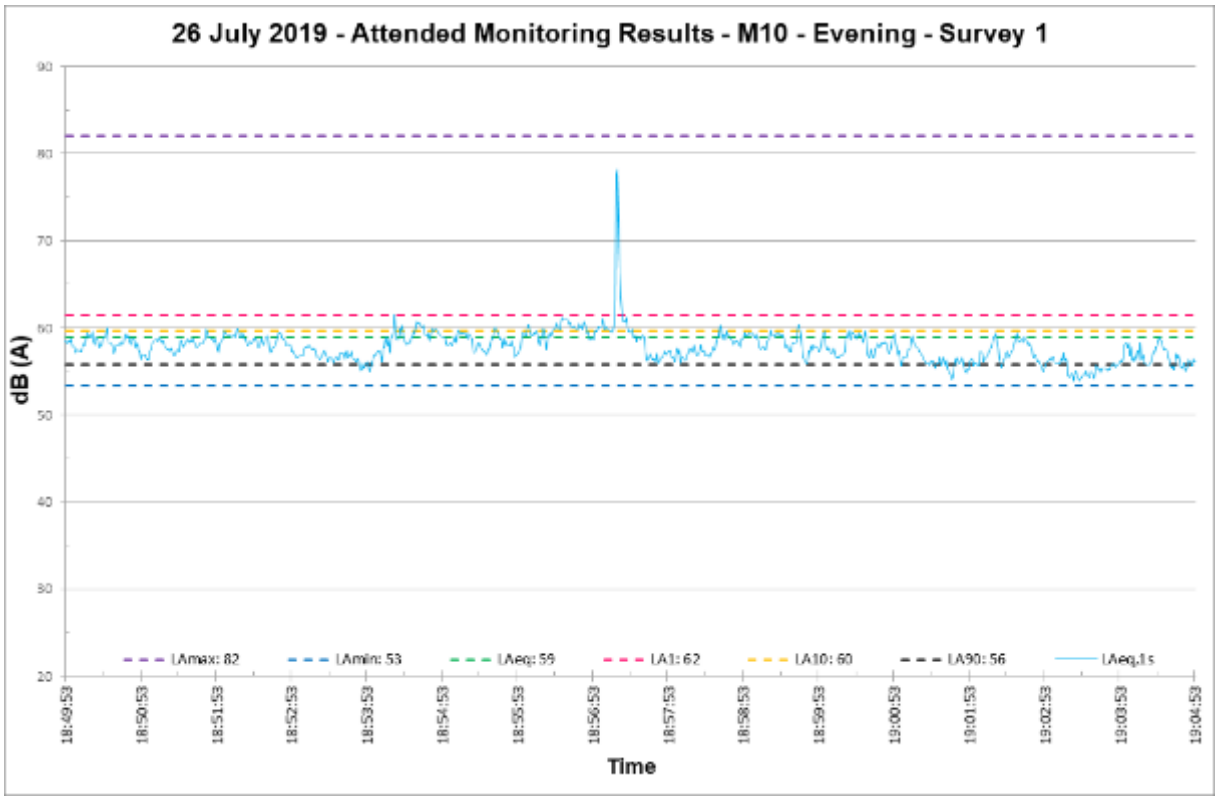

26 July 2019 - Attended Monitoring Results - M10 - Day - Survey 3
dB (A)
Time
LAmax: 83
LAmin: 48
LAeq: 60
LA1: 73
LA10: 57
LA90: 51
LAeq,1s

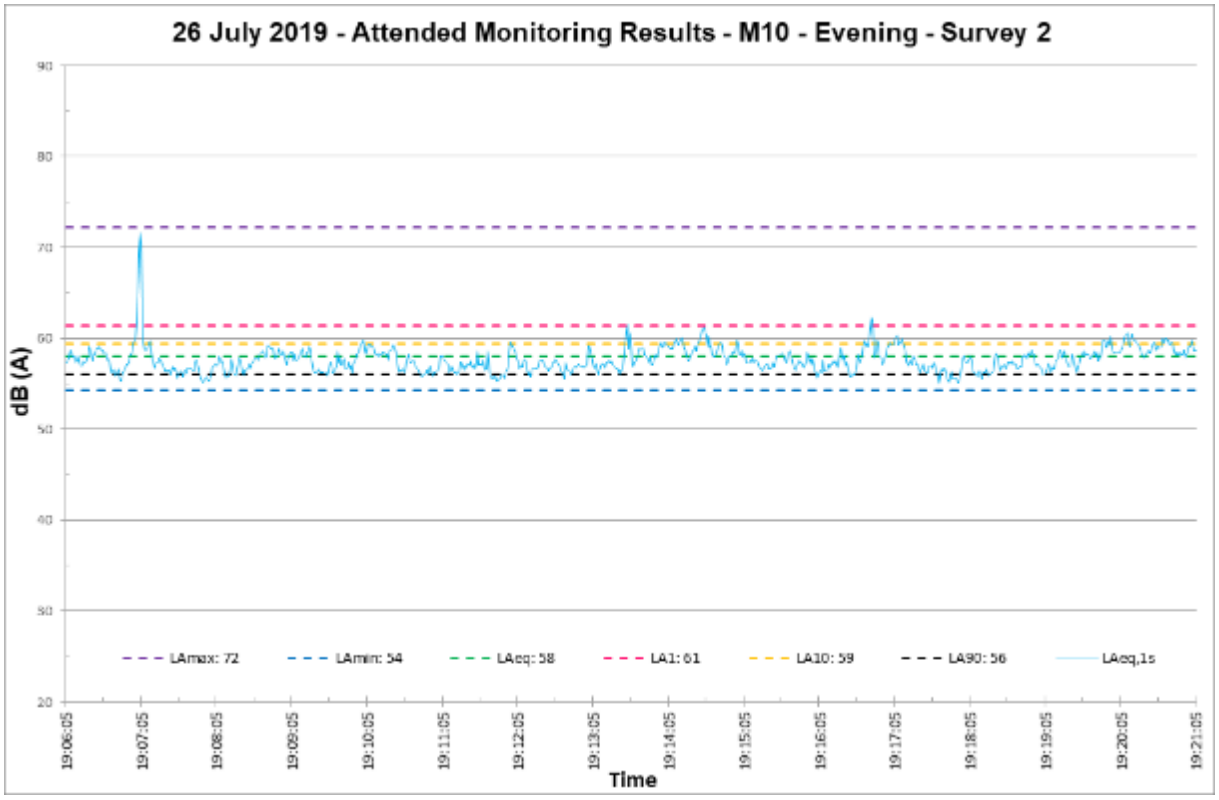

26 July 2019 - Attended Monitoring Results - M10 - Day - Survey 4
dB (A)
Time
LAmax: 80
LAmin: 47
LAeq: 59
LA1: 72
LA10: 59
LA90: 50
LAeq,1s


26 July 2019 - Attended Monitoring Results - M10 - Day - Survey 5
dB (A)
Time
LAmax: 80
LAmin: 49
LAeq: 60
LA1: 75
LA10: 57
LA90: 51
LAeq,1s

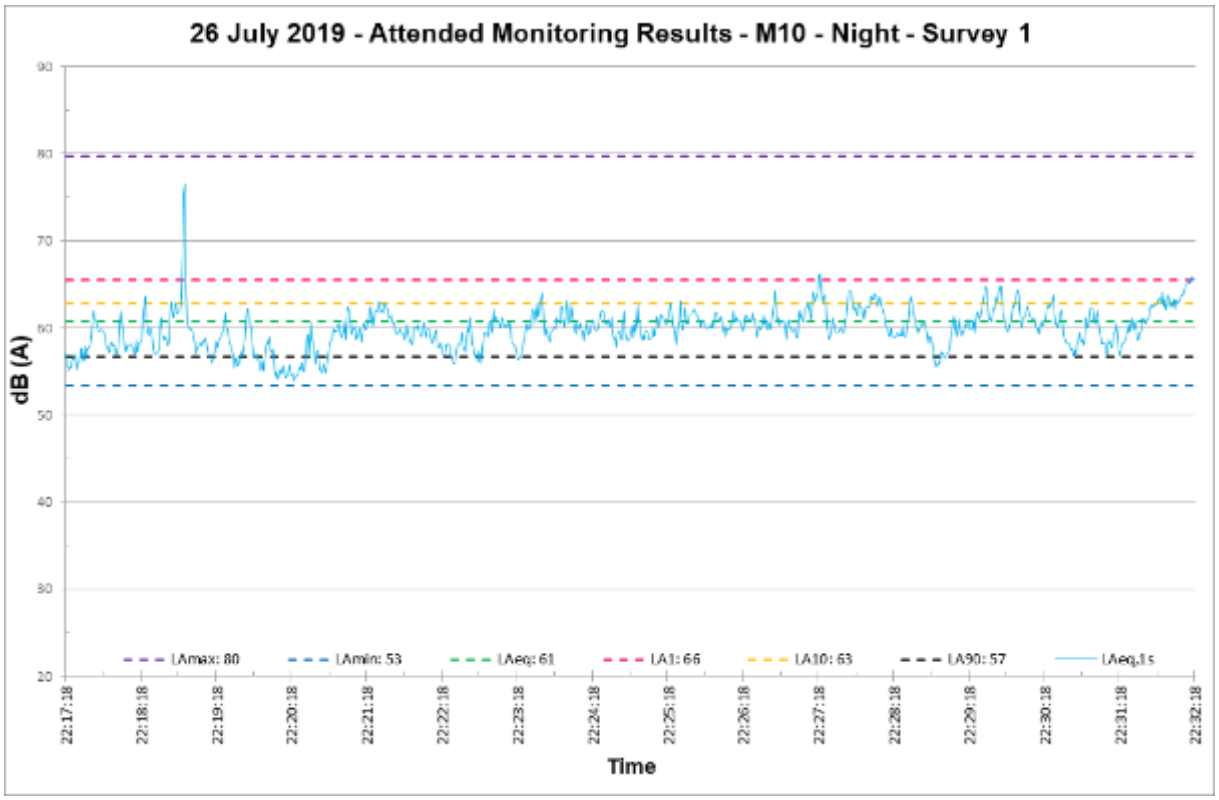

26 July 2019 - Attended Monitoring Results - M10 - Day - Survey 6
dB (A)
Time
LAmax: 81
LAmin: 49
LAeq: 63
LA1: 76
LA10: 63
LA90: 52
LAeq,1s

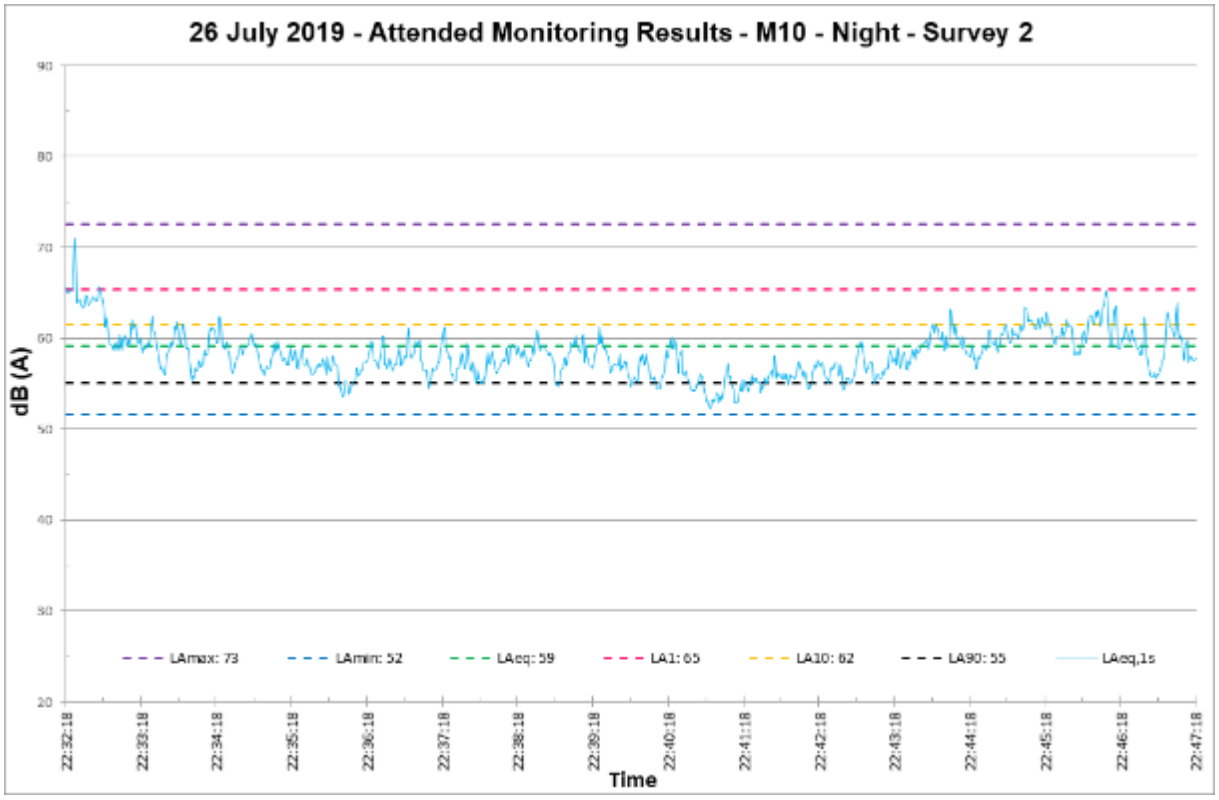
Evening – 26/07/2019

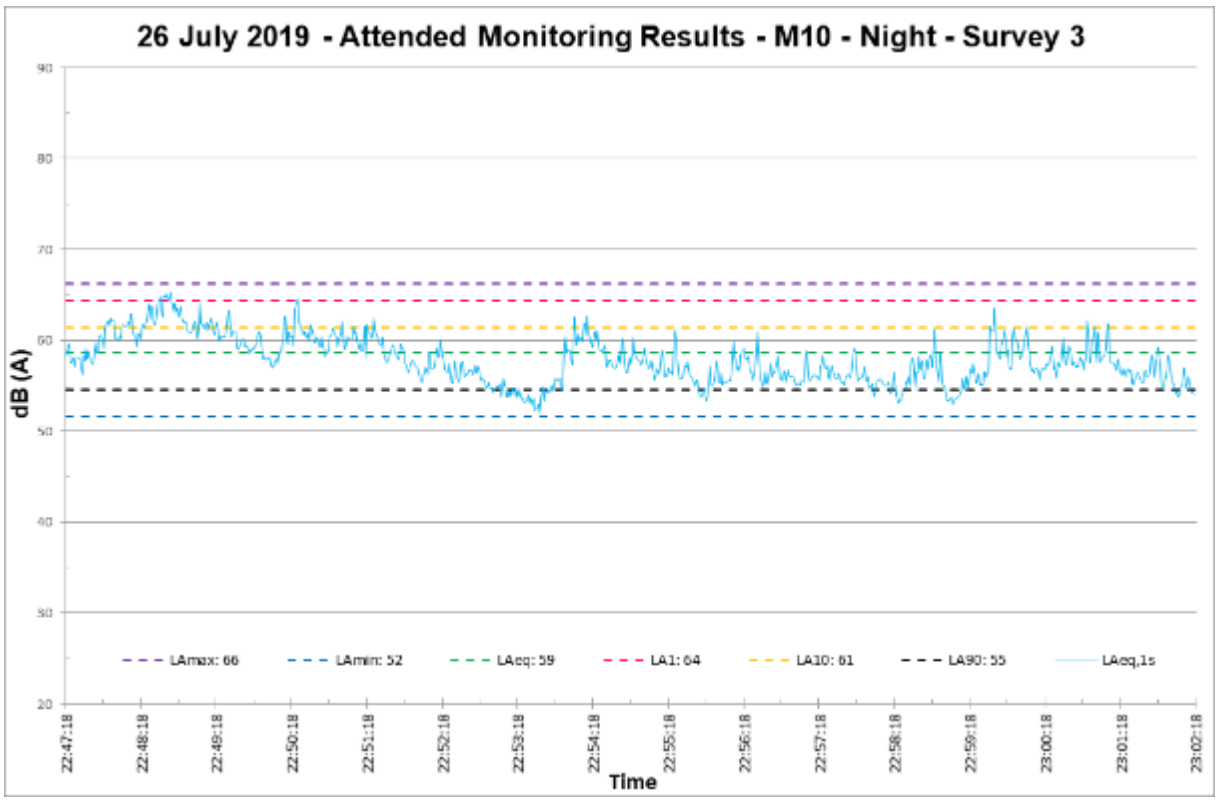


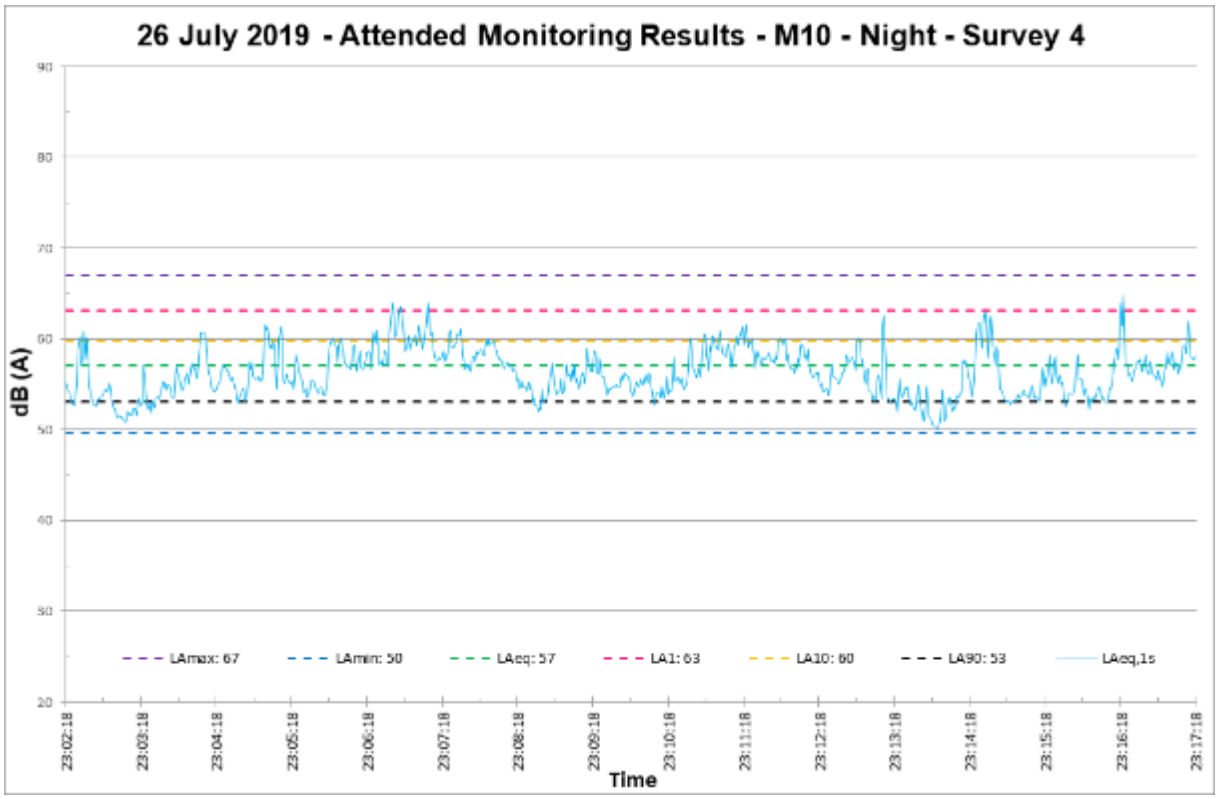


Night – 26/07/2019

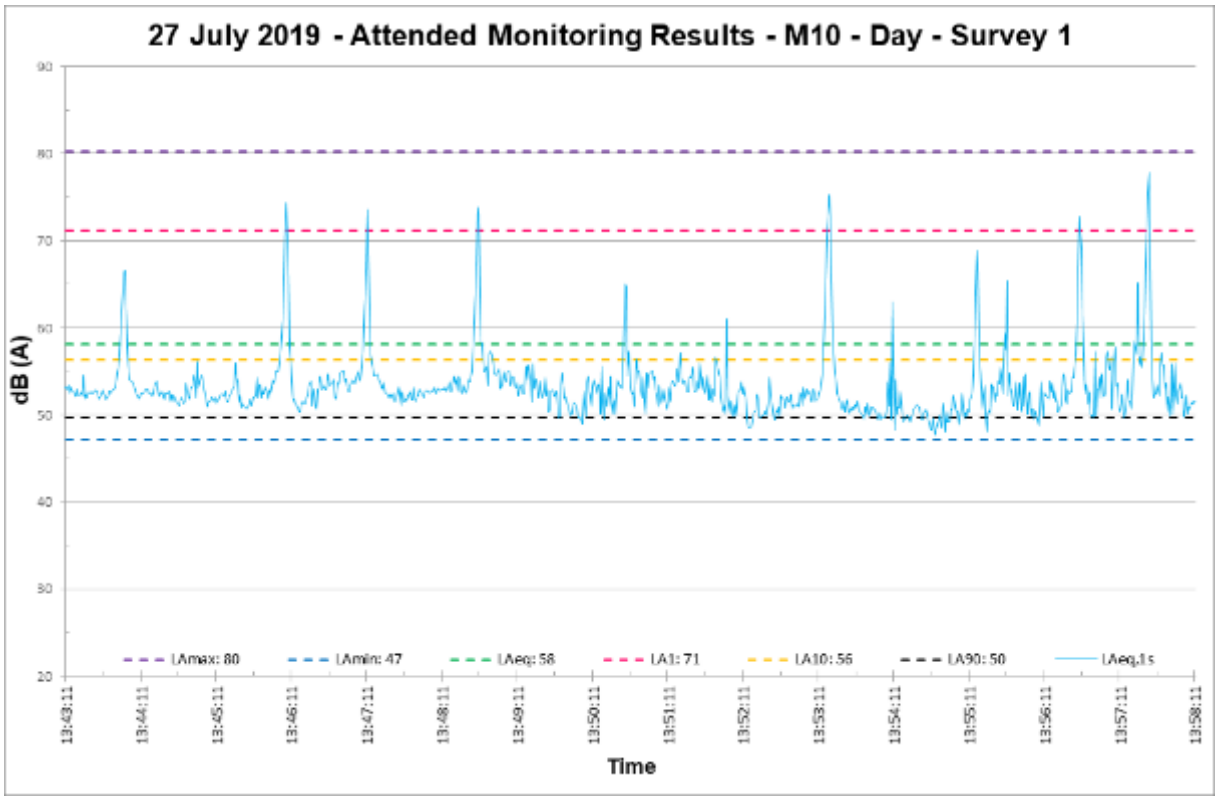


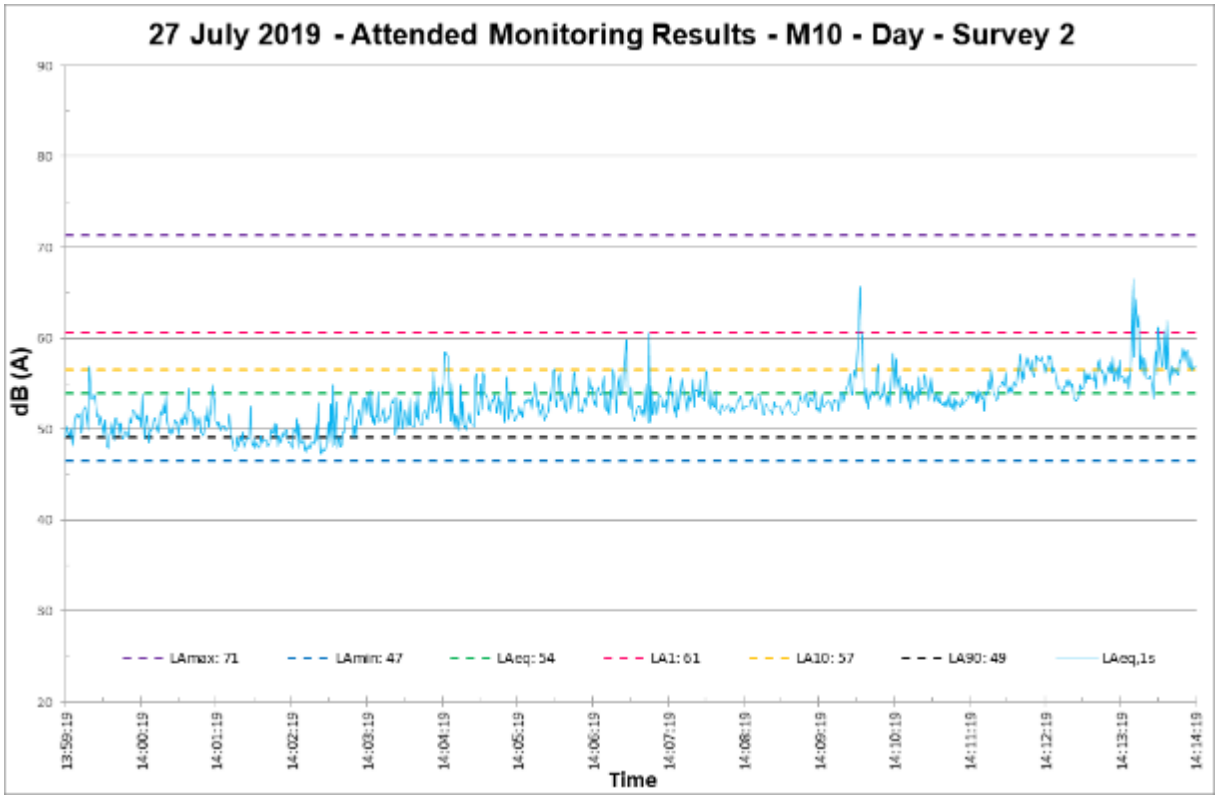


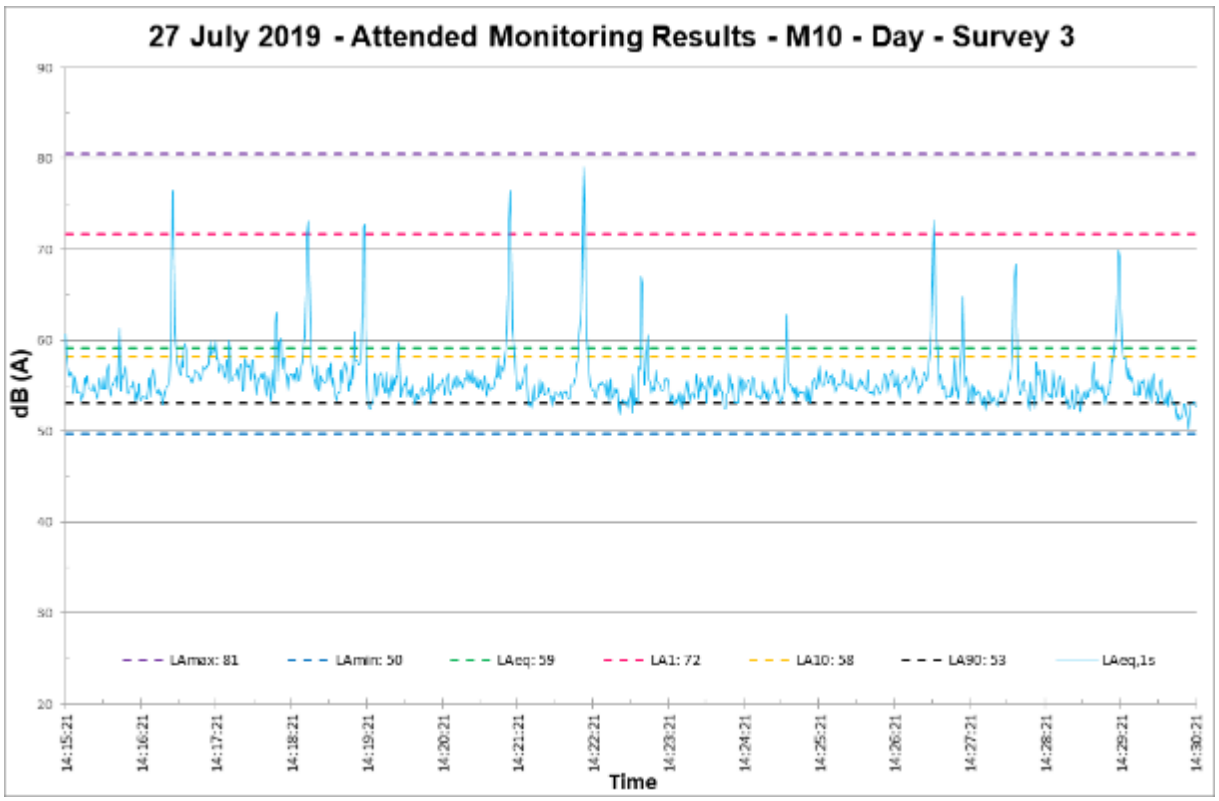

26 July 2019 - Attended Monitoring Results - M10 - Night - Survey 3
dB (A)
Time
LAmax: 66
LAmin: 52
LAeq: 59
LA1: 64
LA10: 61
LA90: 55
LAeq,1s

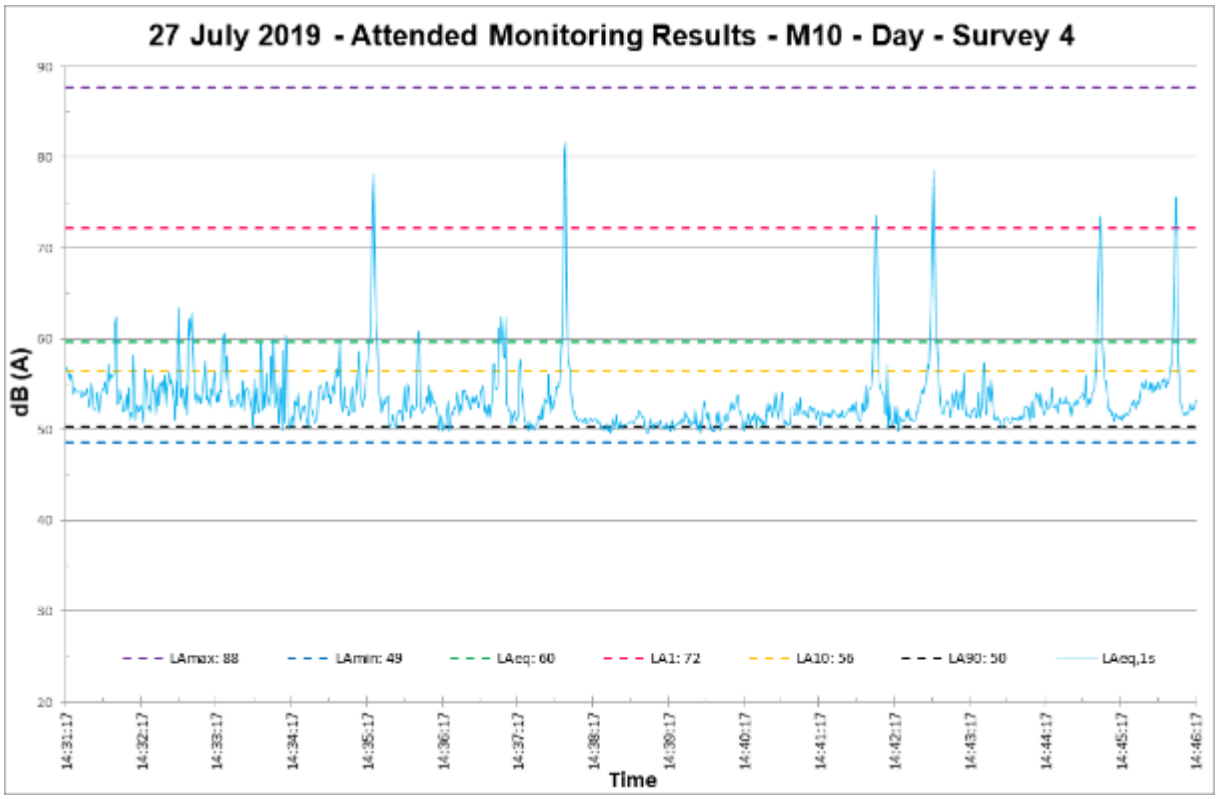

26 July 2019 - Attended Monitoring Results - M10 - Night - Survey 4
dB (A)
Time
LAmax: 67
LAmin: 50
LAeq: 57
LA1: 63
LA10: 60
LA90: 53
LAeq,1s

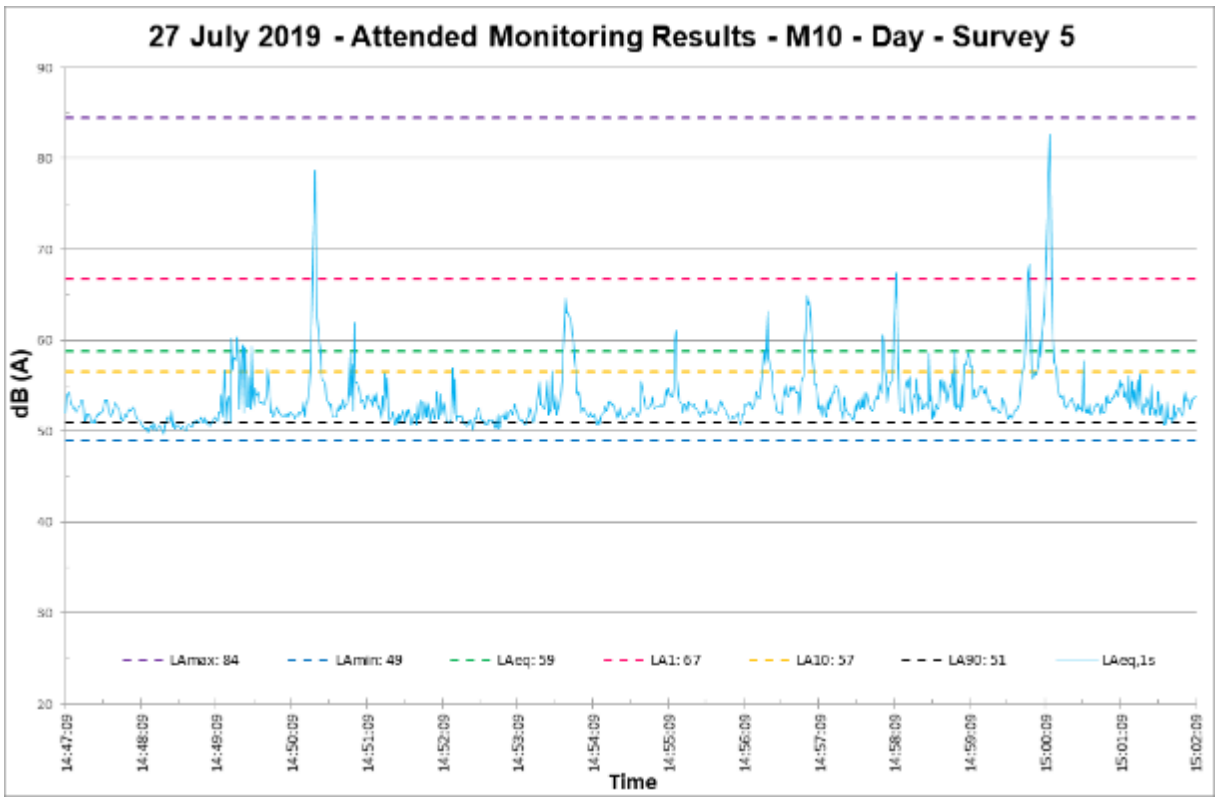
Day – 27/07/2019

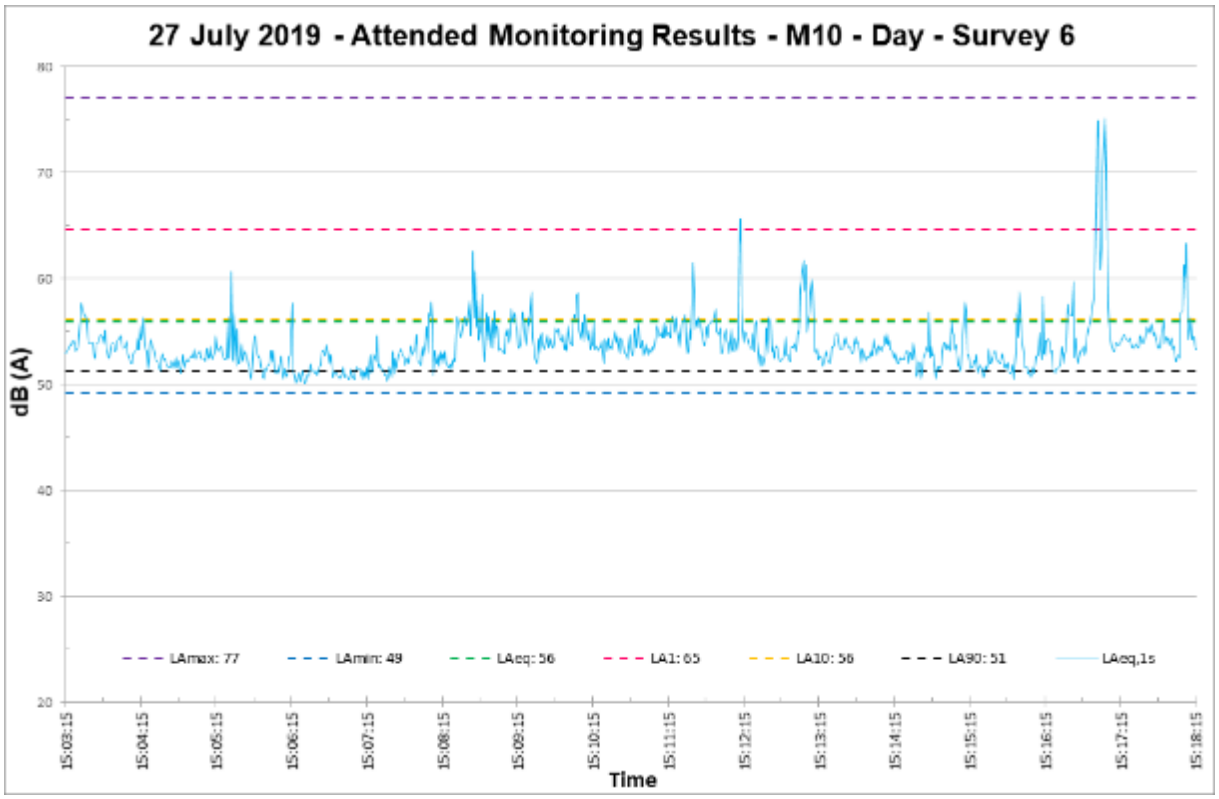




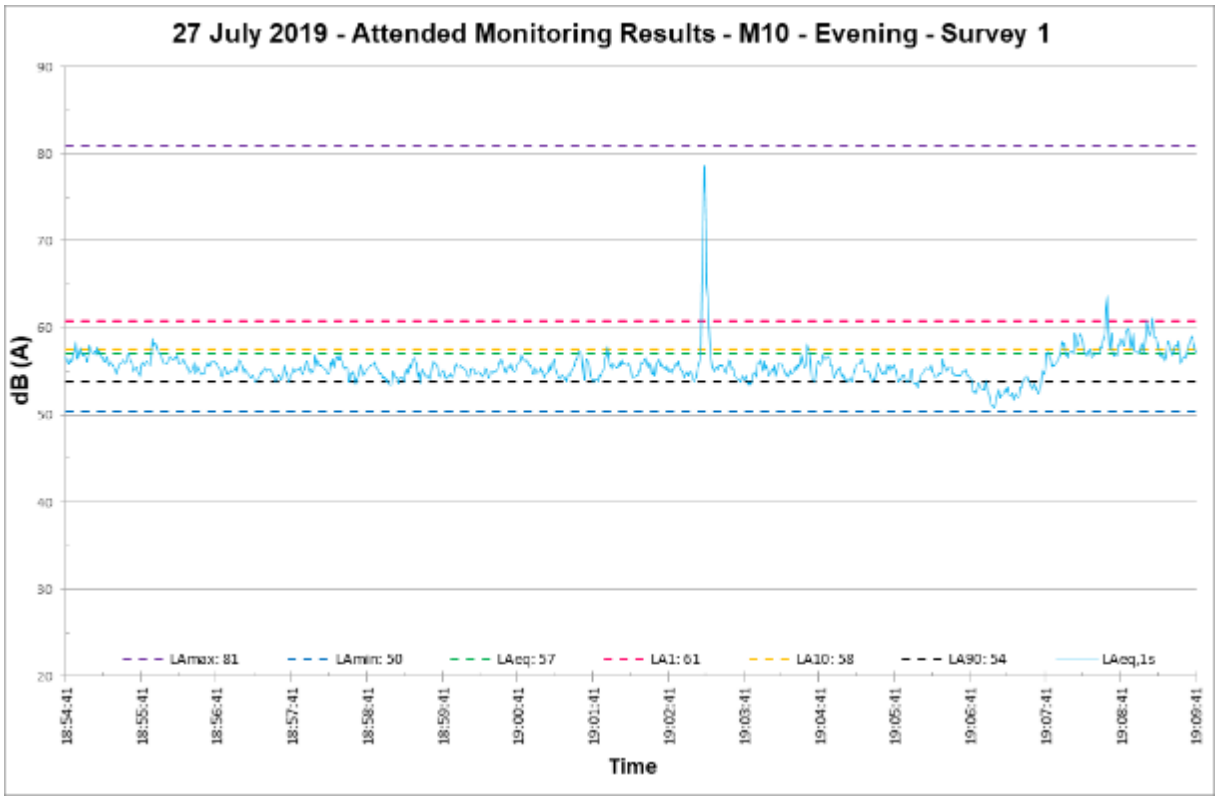

27 July 2019 - Attended Monitoring Results - M10 - Day - Survey 3
dB (A)
Time
LAmax: 81
LAmin: 50
LAeq: 59
LA1: 72
LA10: 58
LA90: 53
LAeq,1s

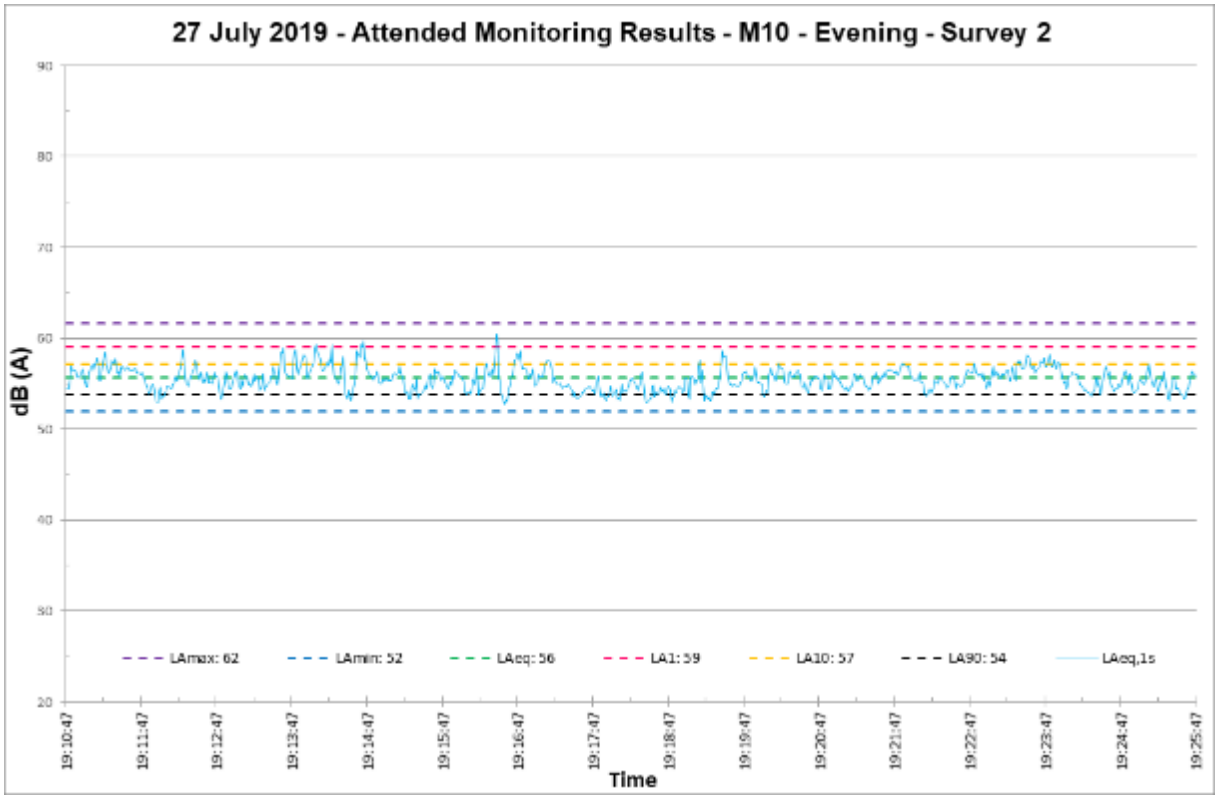

27 July 2019 - Attended Monitoring Results - M10 - Day - Survey 4
dB (A)
Time
LAmax: 88
LAmin: 49
LAeq: 60
LA1: 72
LA10: 56
LA90: 50
LAeq,1s


27 July 2019 - Attended Monitoring Results - M10 - Day - Survey 5
dB (A)
Time
LAmax: 84
LAmin: 49
LAeq: 59
LA1: 67
LA10: 57
LA90: 51
LAeq,1s

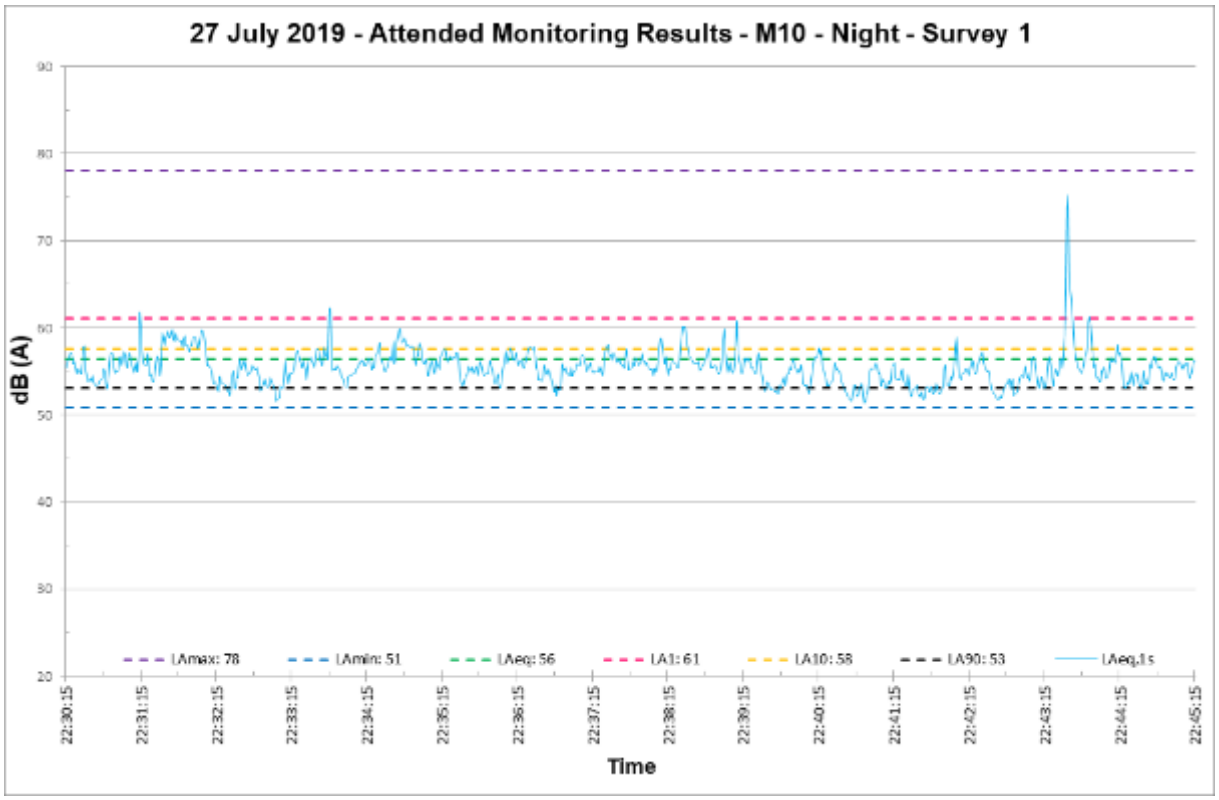

27 July 2019 - Attended Monitoring Results - M10 - Day - Survey 6
dB (A)
Time
LAmax: 77
LAmin: 49
LAeq: 56
LA1: 65
LA10: 56
LA90: 51
LAeq,1s

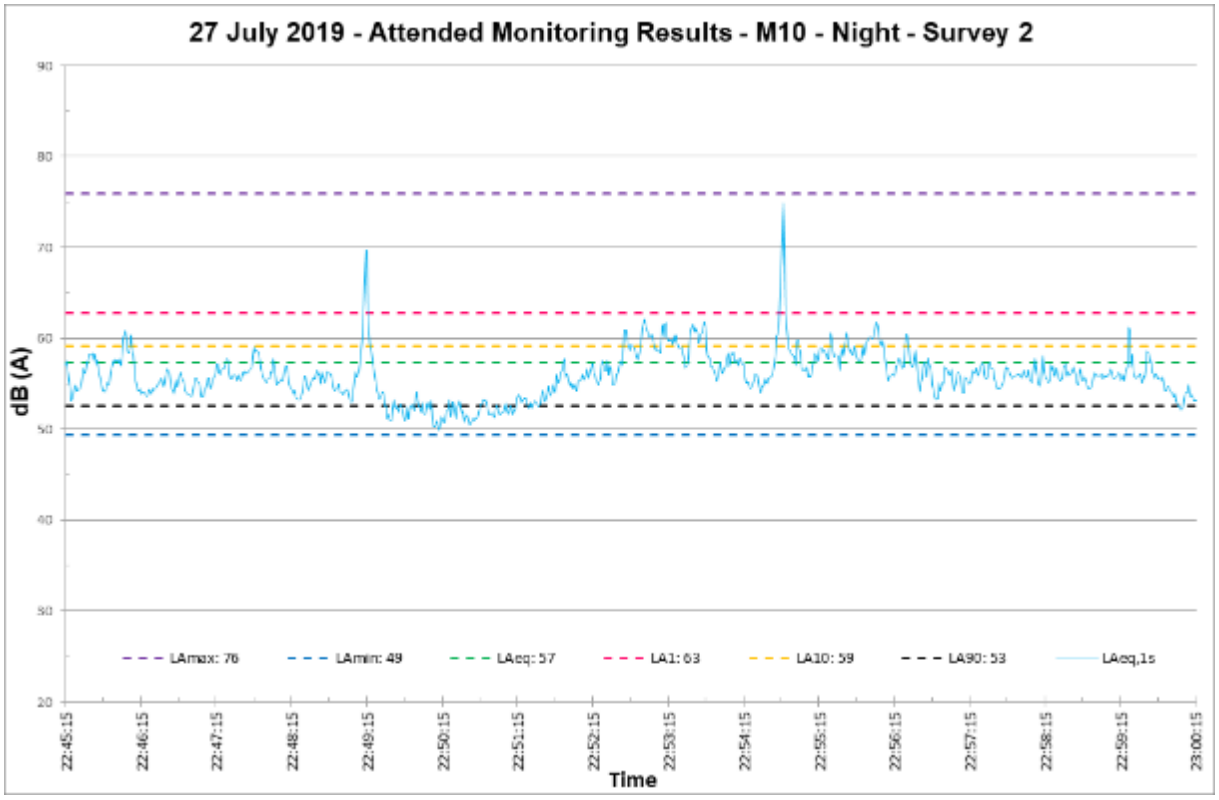
Evening – 27/07/2019

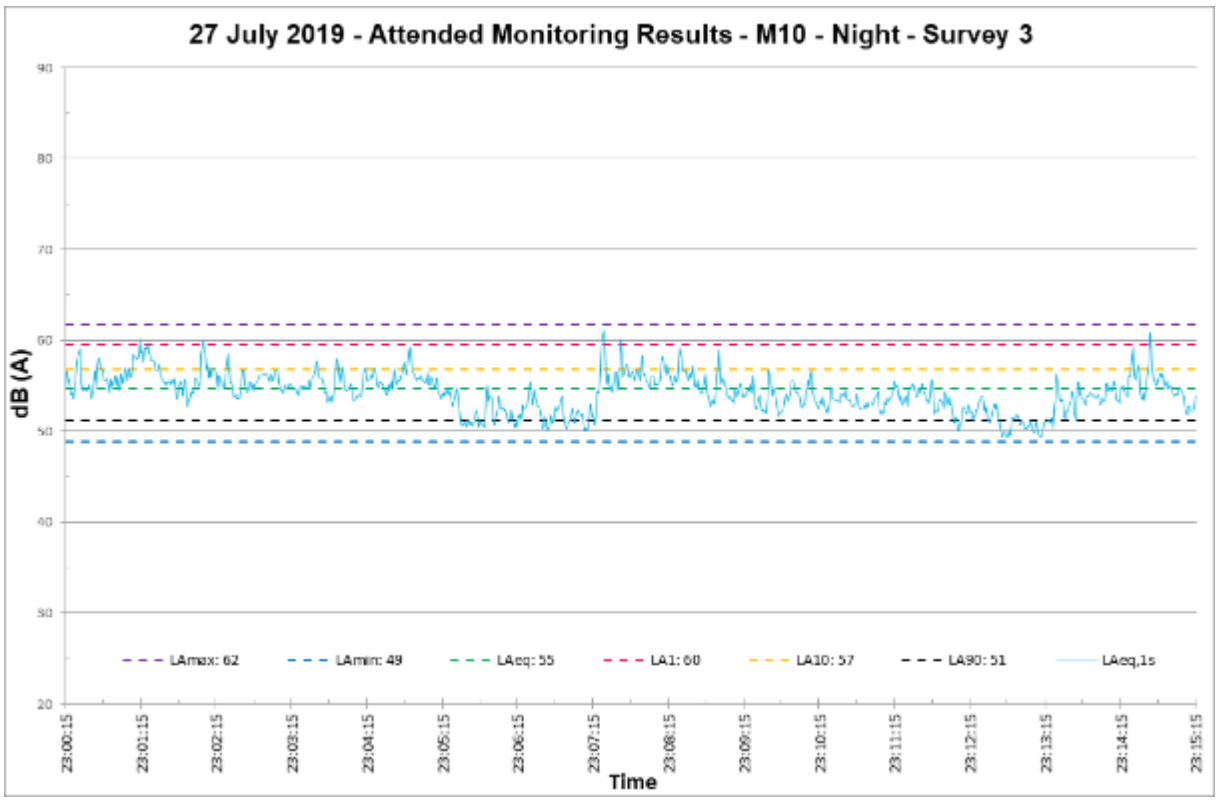


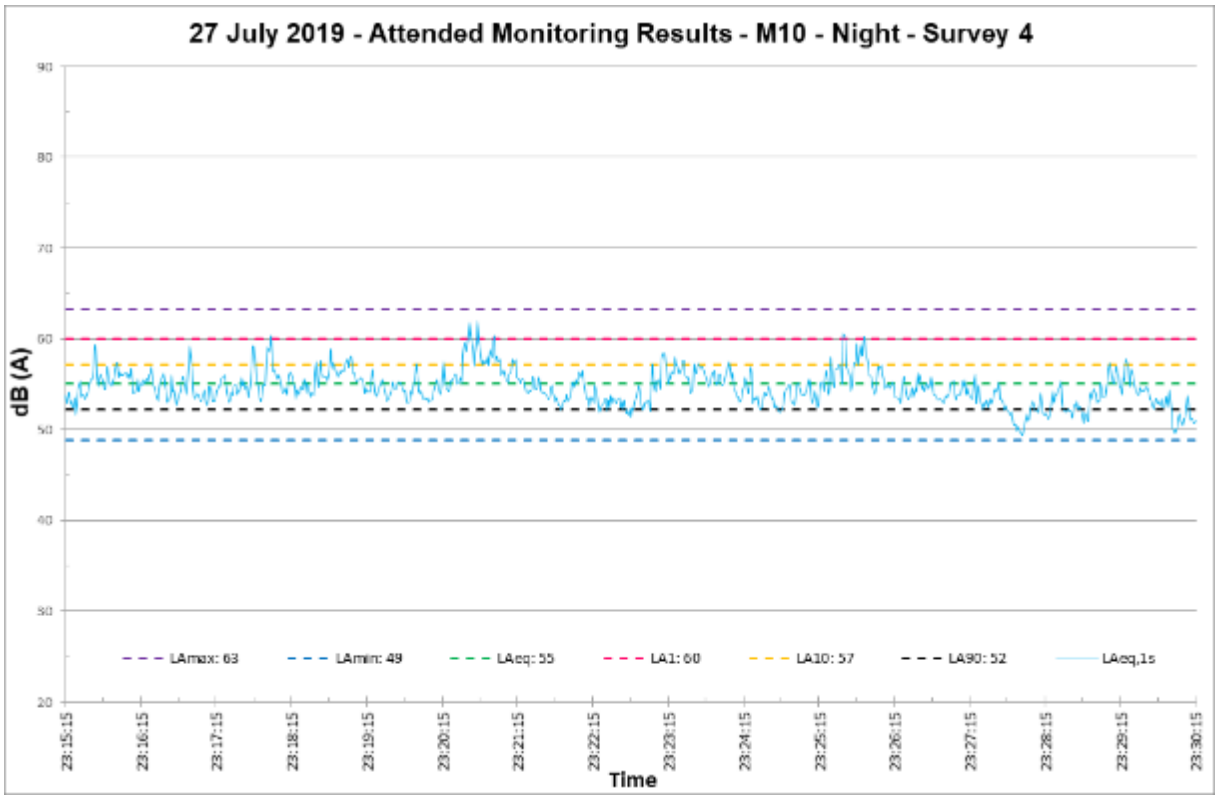


Night – 27/07/2019

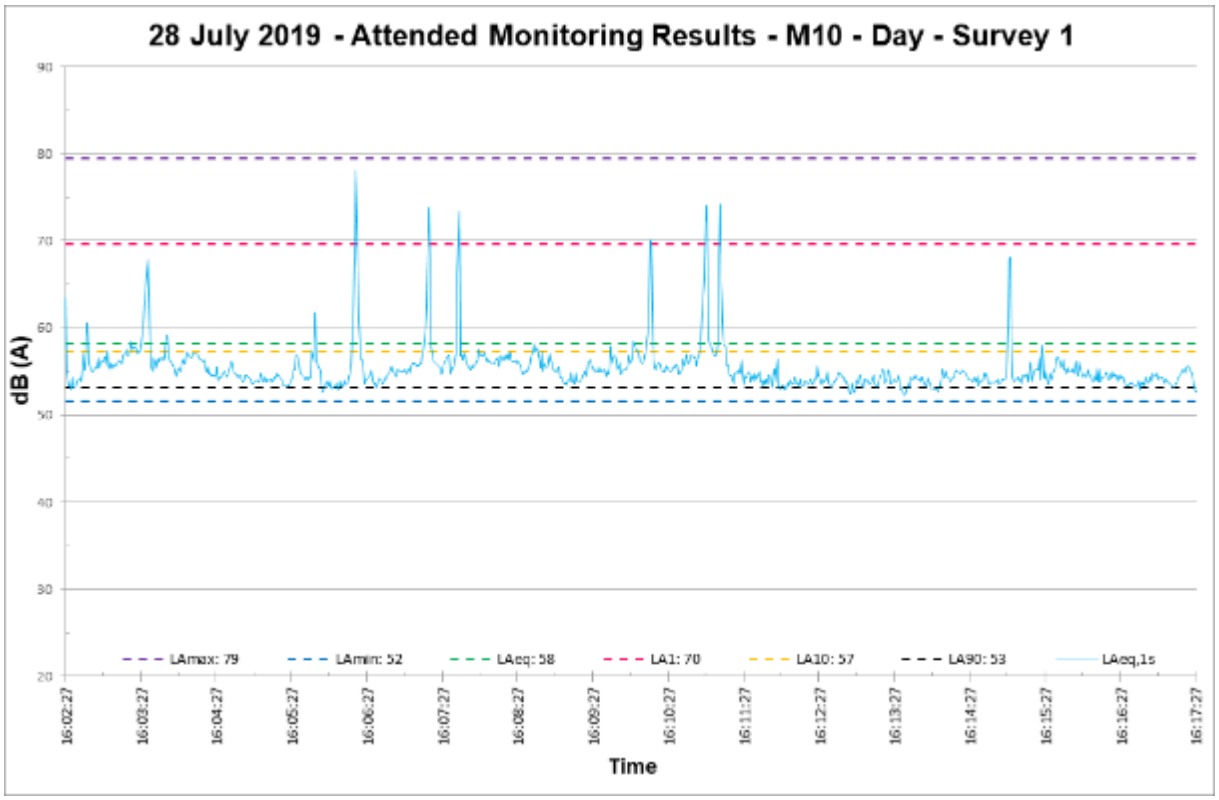


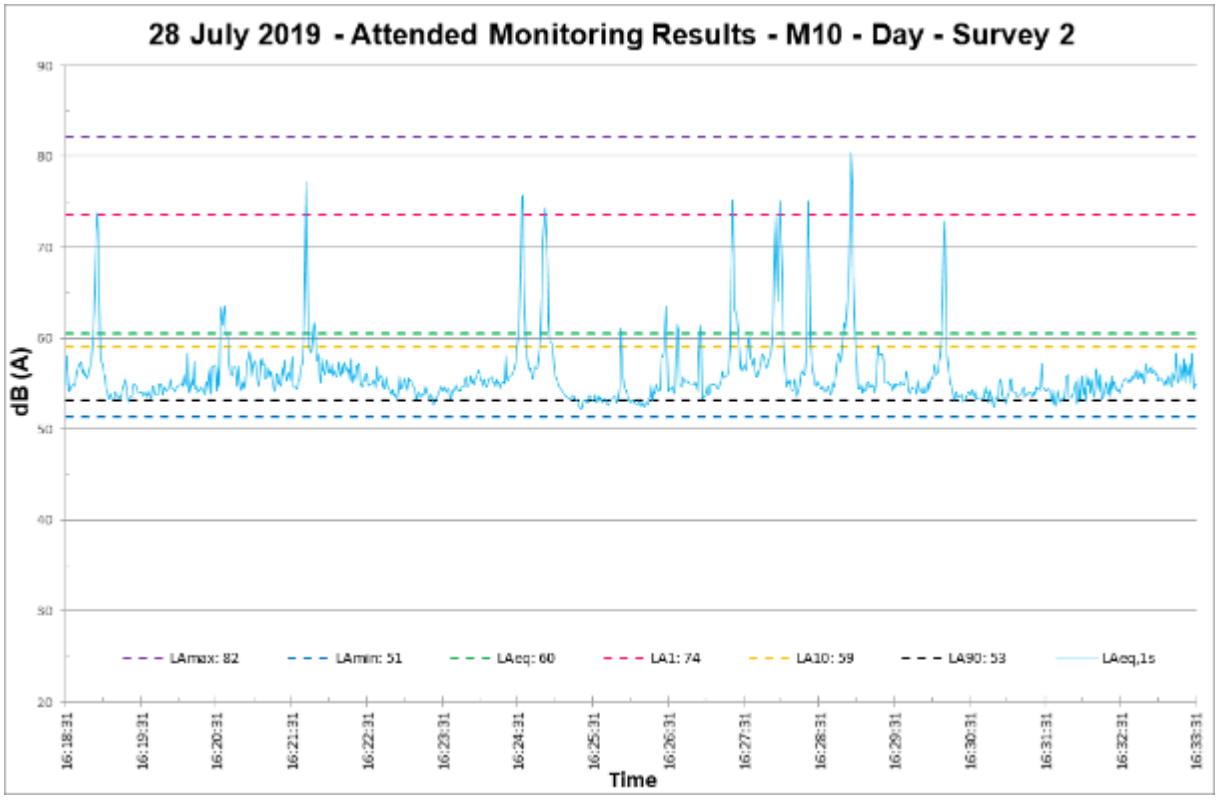


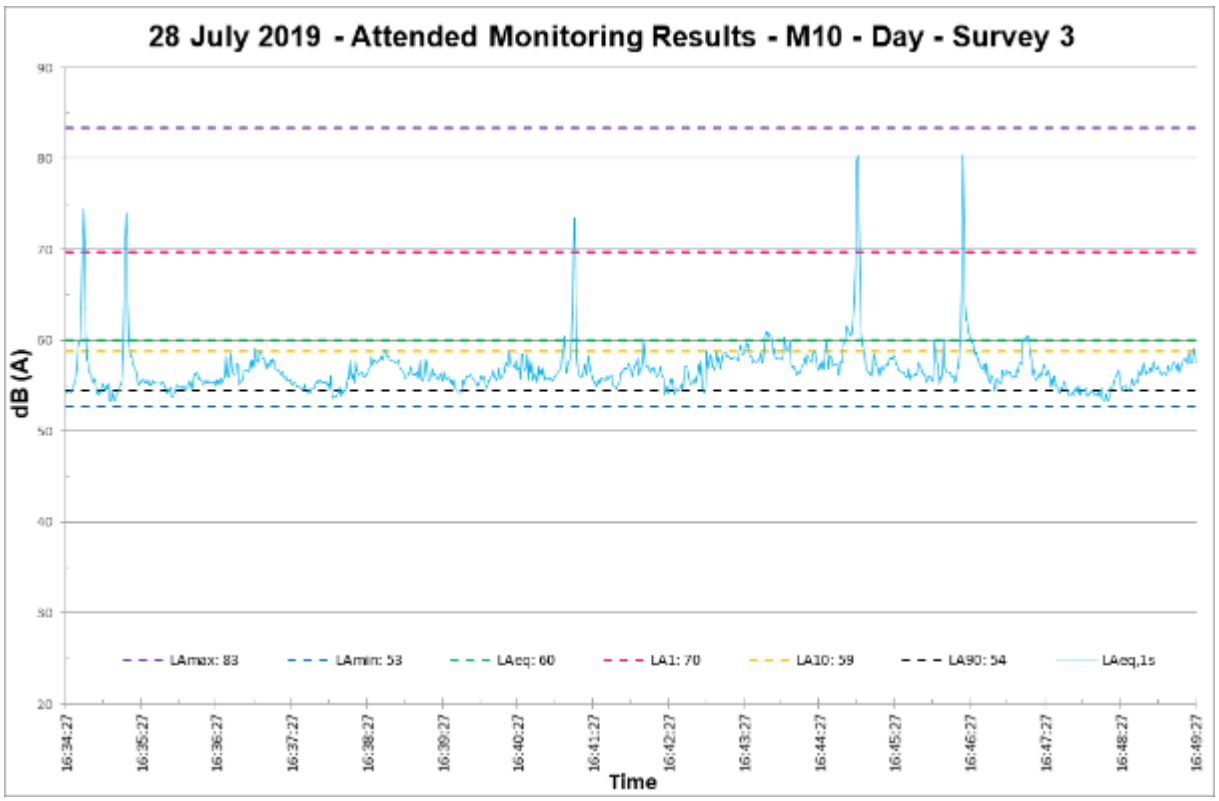

27 July 2019 - Attended Monitoring Results - M10 - Night - Survey 3
dB (A)
Time
LAmax: 62
LAmin: 49
LAeq: 55
LA1: 60
LA10: 57
LA90: 51
LAeq,1s

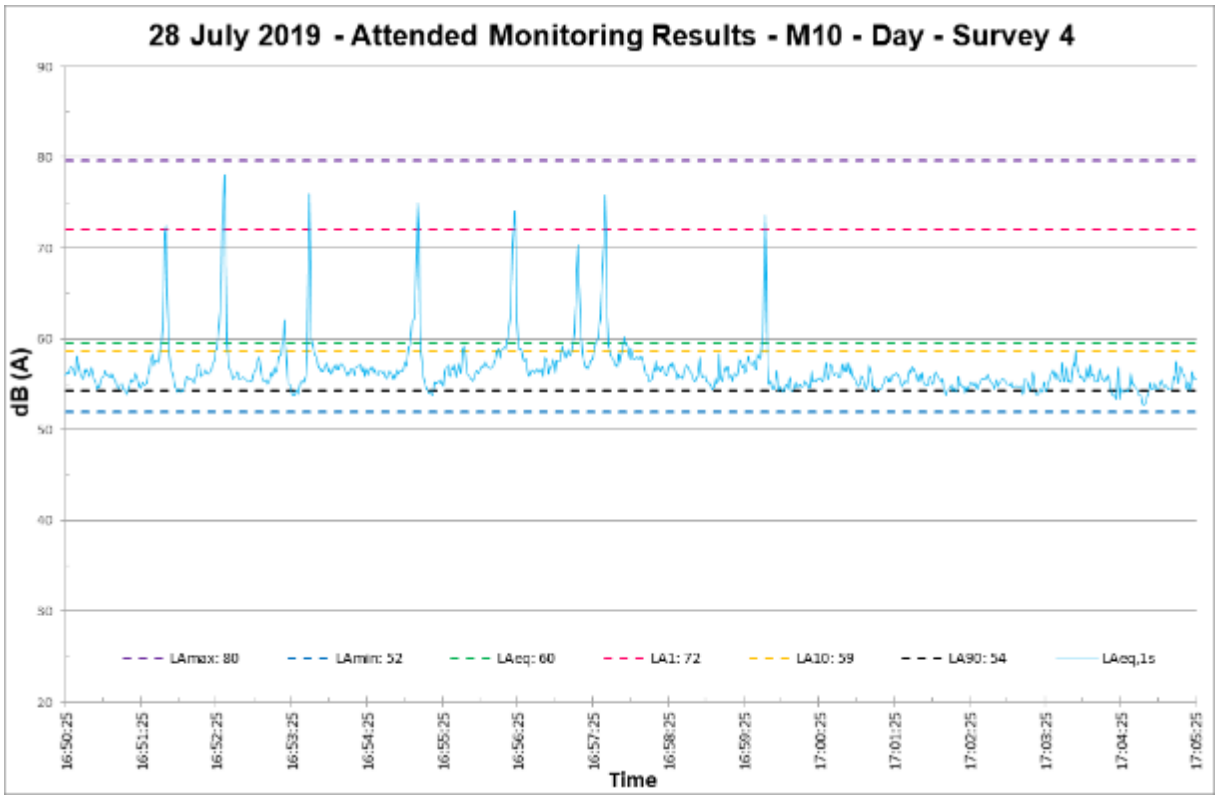

27 July 2019 - Attended Monitoring Results - M10 - Night - Survey 4
dB (A)
Time
LAmax: 63
LAmin: 49
LAeq: 55
LA1: 60
LA10: 57
LA90: 52
LAeq,1s

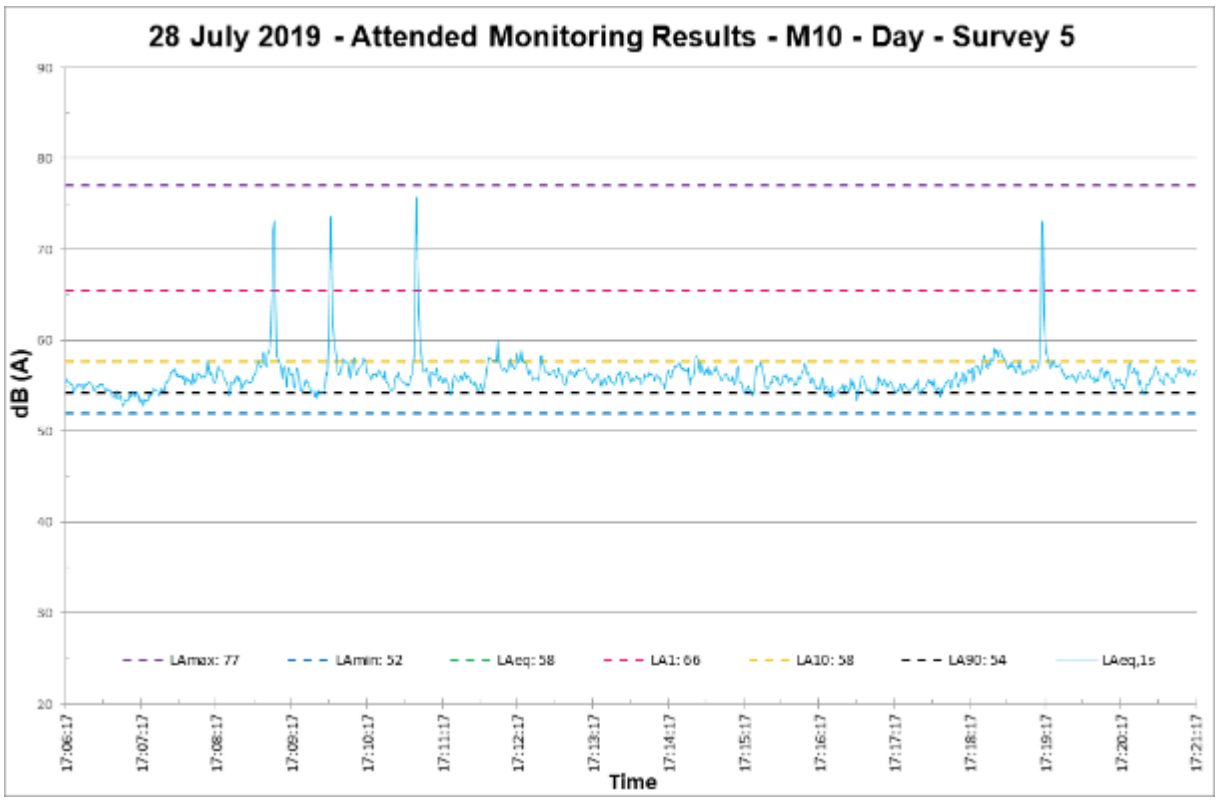
Day – 28/07/2019

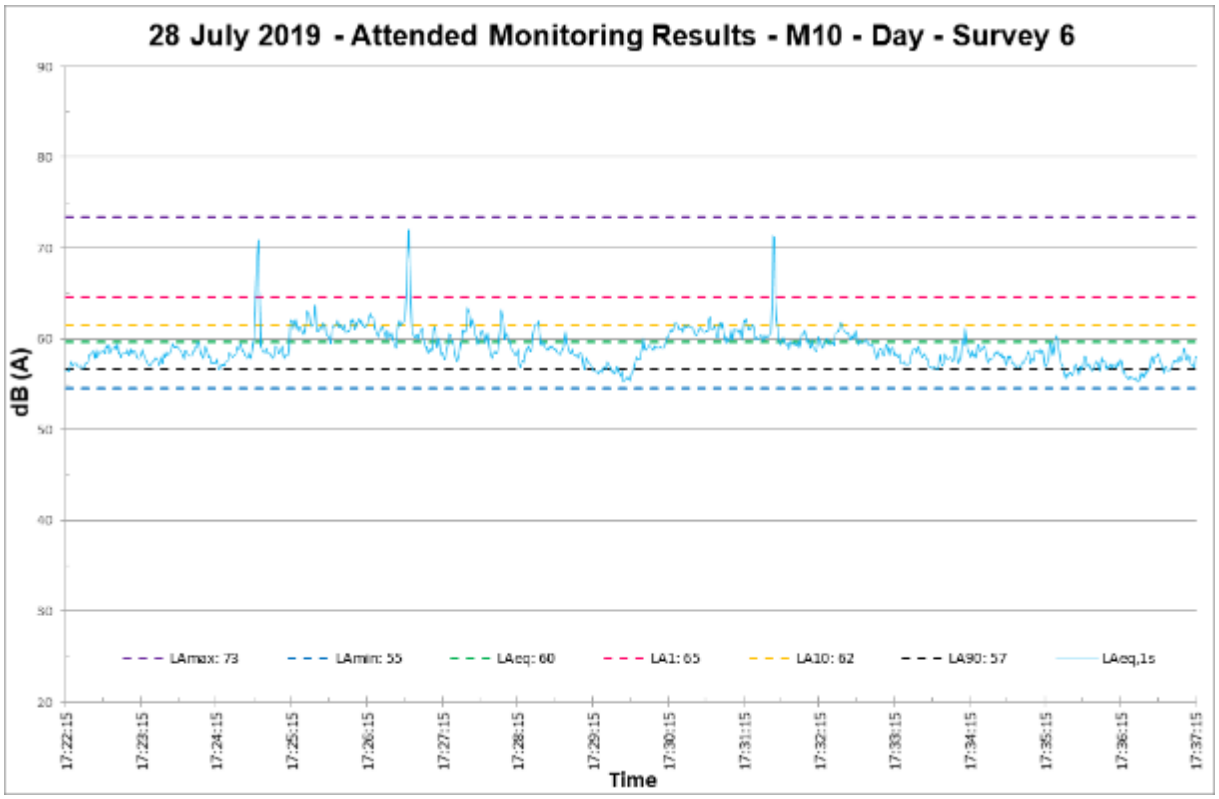




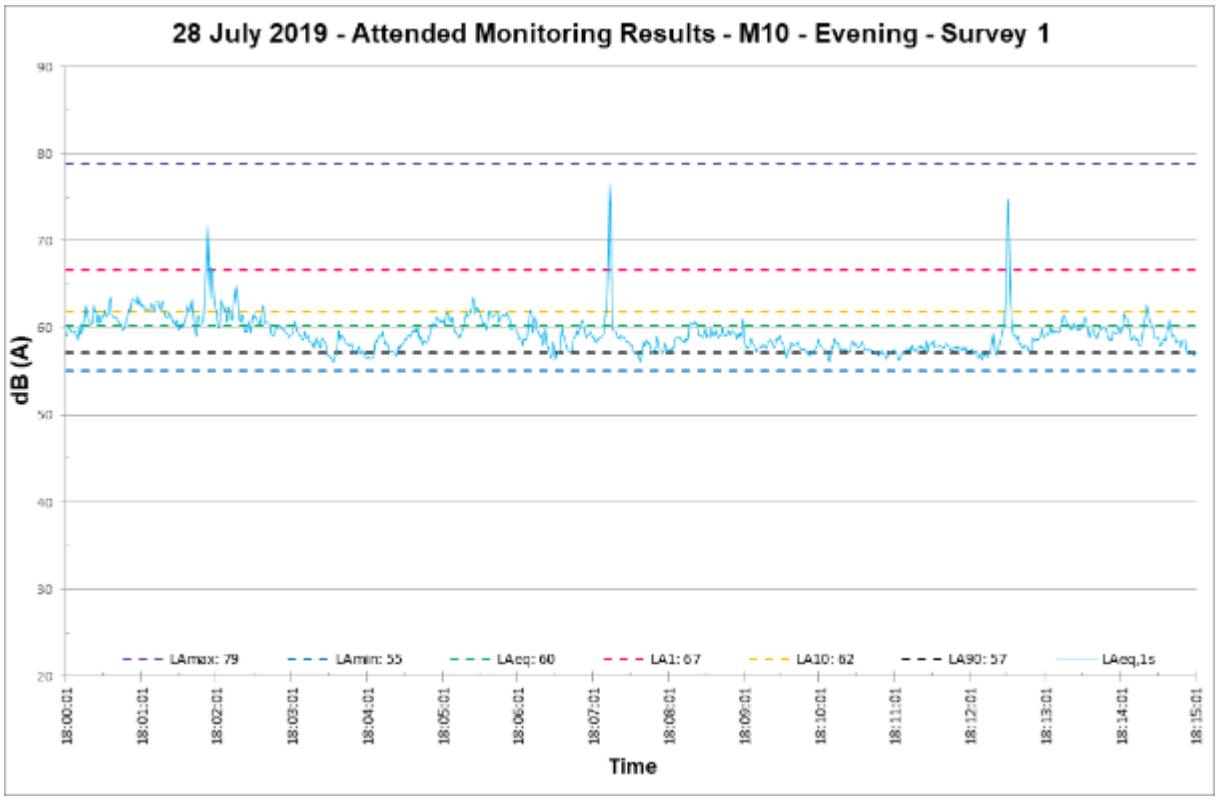

28 July 2019 - Attended Monitoring Results - M10 - Day - Survey 3
dB (A)
Time
LAmax: 83
LAmin: 53
LAeq: 60
LA1: 70
LA10: 59
LA90: 54
LAeq,1s

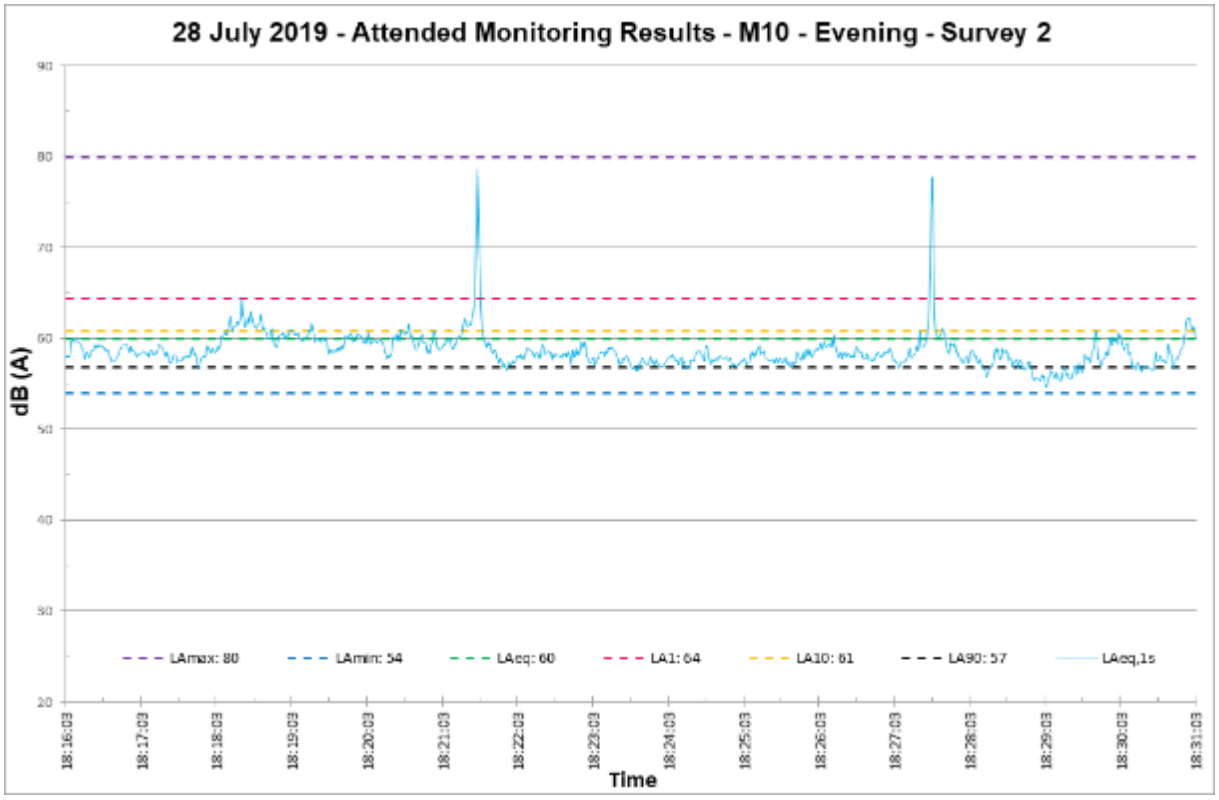

28 July 2019 - Attended Monitoring Results - M10 - Day - Survey 4
dB (A)
Time
LAmax: 80
LAmin: 52
LAeq: 60
LA1: 72
LA10: 59
LA90: 54
LAeq,1s


28 July 2019 - Attended Monitoring Results - M10 - Day - Survey 5
dB (A)
Time
LAmax: 77
LAmin: 52
LAeq: 58
LA1: 66
LA10: 58
LA90: 54
LAeq,1s

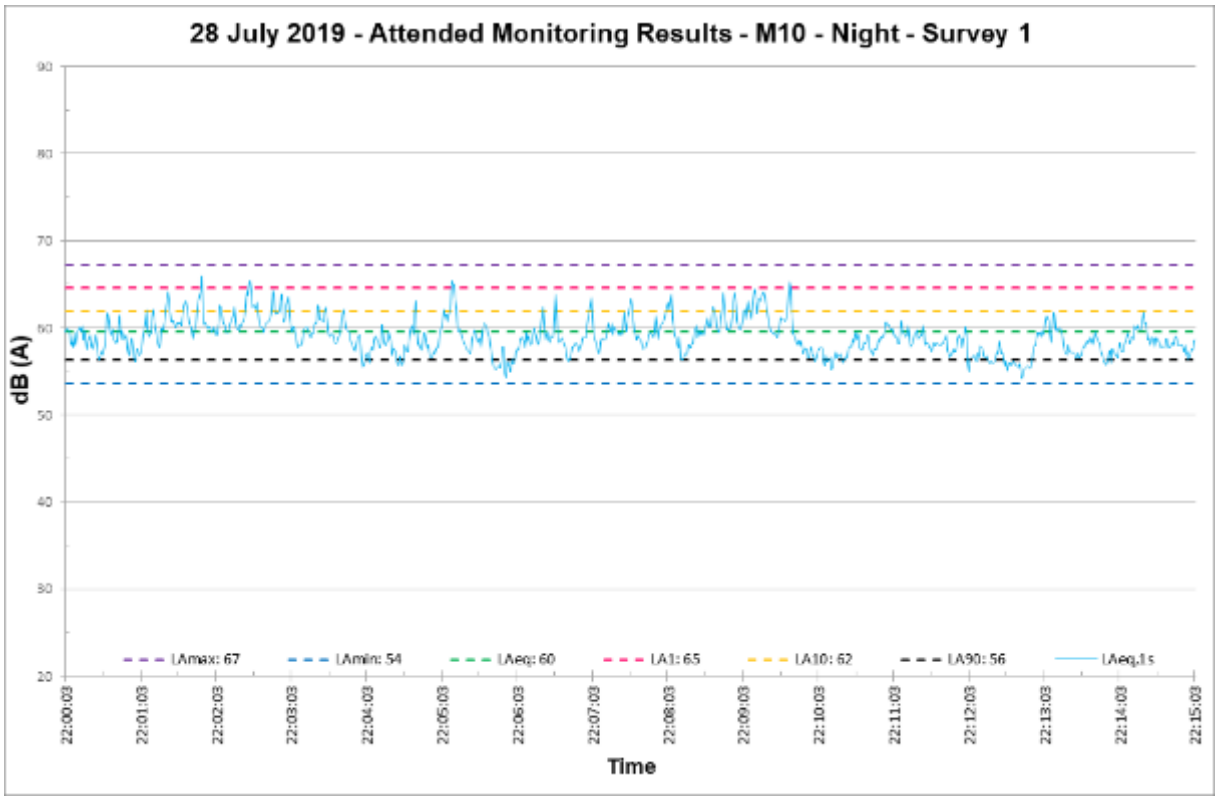

28 July 2019 - Attended Monitoring Results - M10 - Day - Survey 6
dB (A)
Time
LAmax: 73
LAmin: 55
LAeq: 60
LA1: 65
LA10: 62
LA90: 57
LAeq,1s

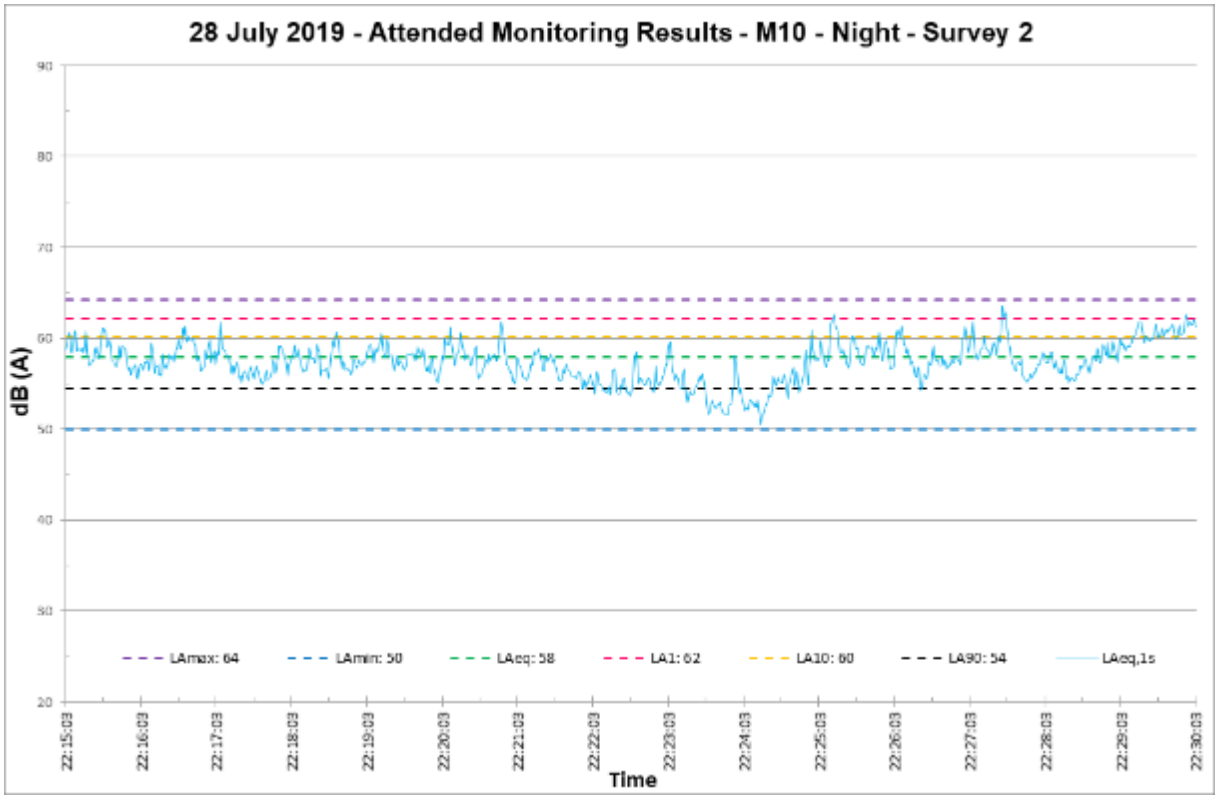
Evening – 28/07/2019

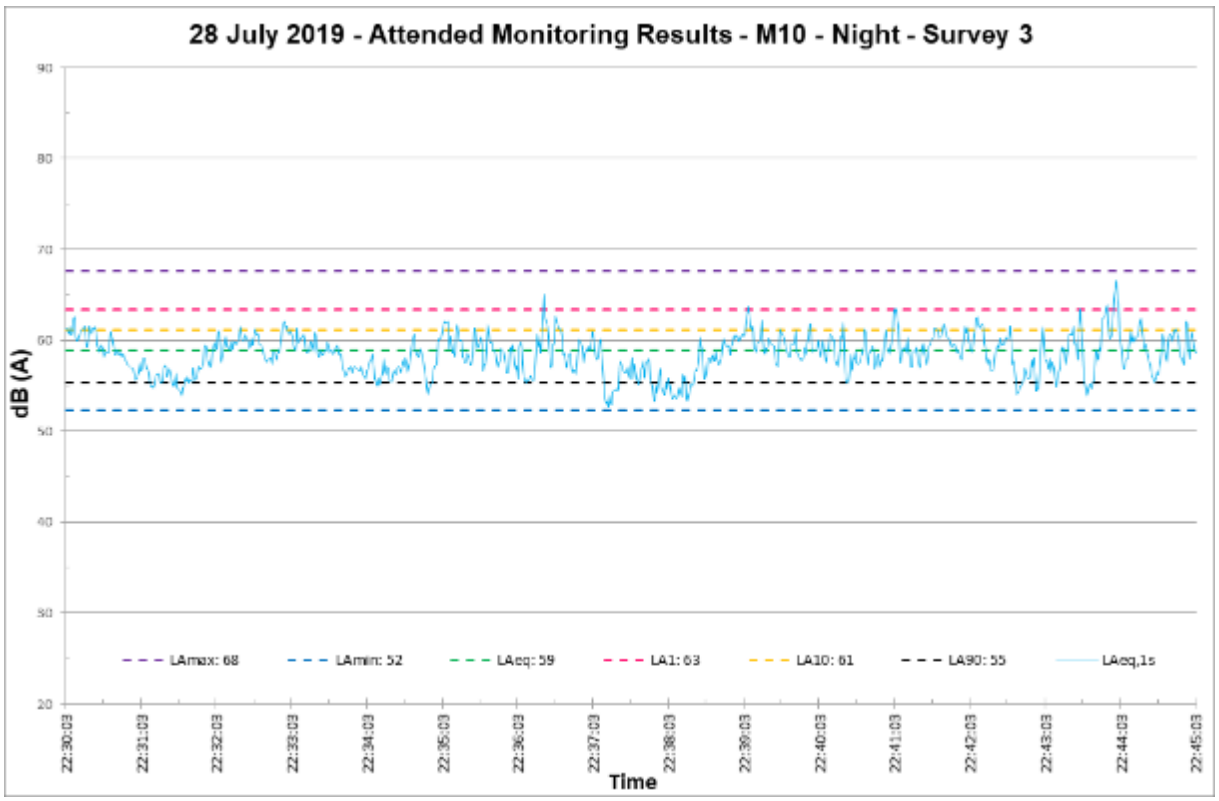


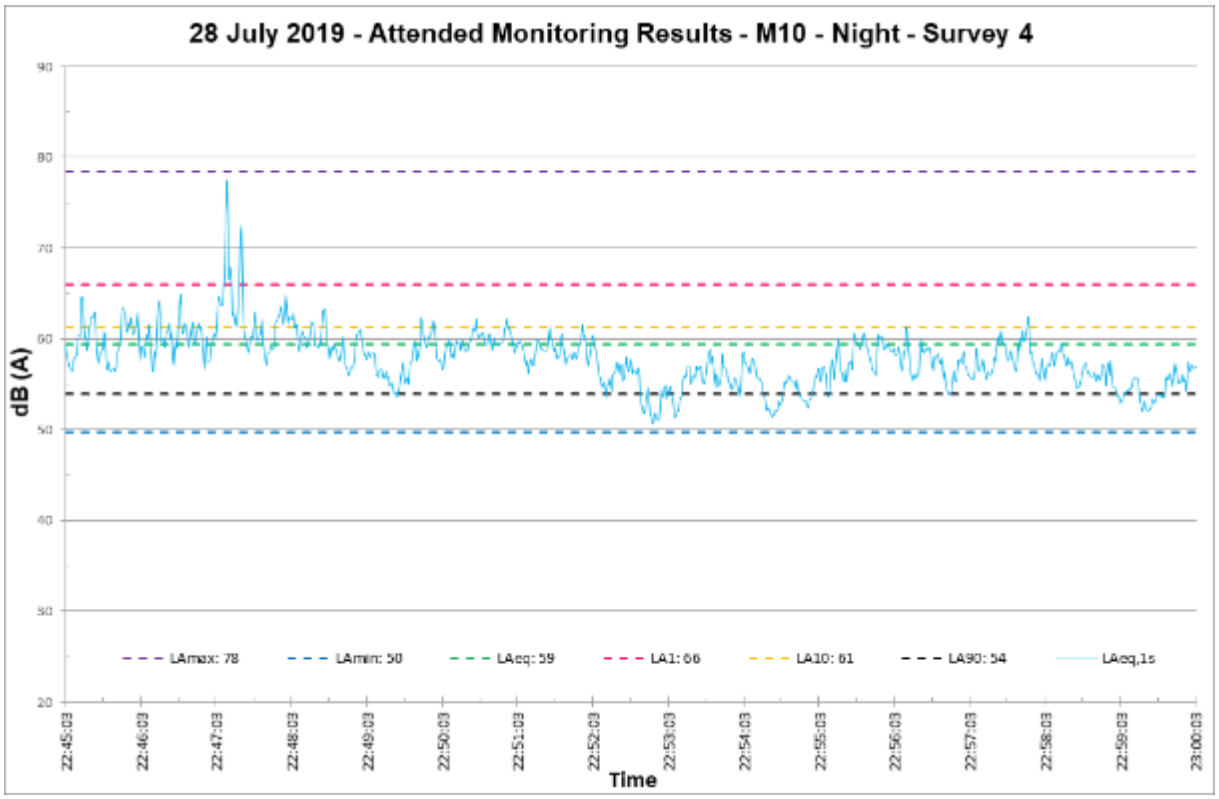


Night – 28/08/2019

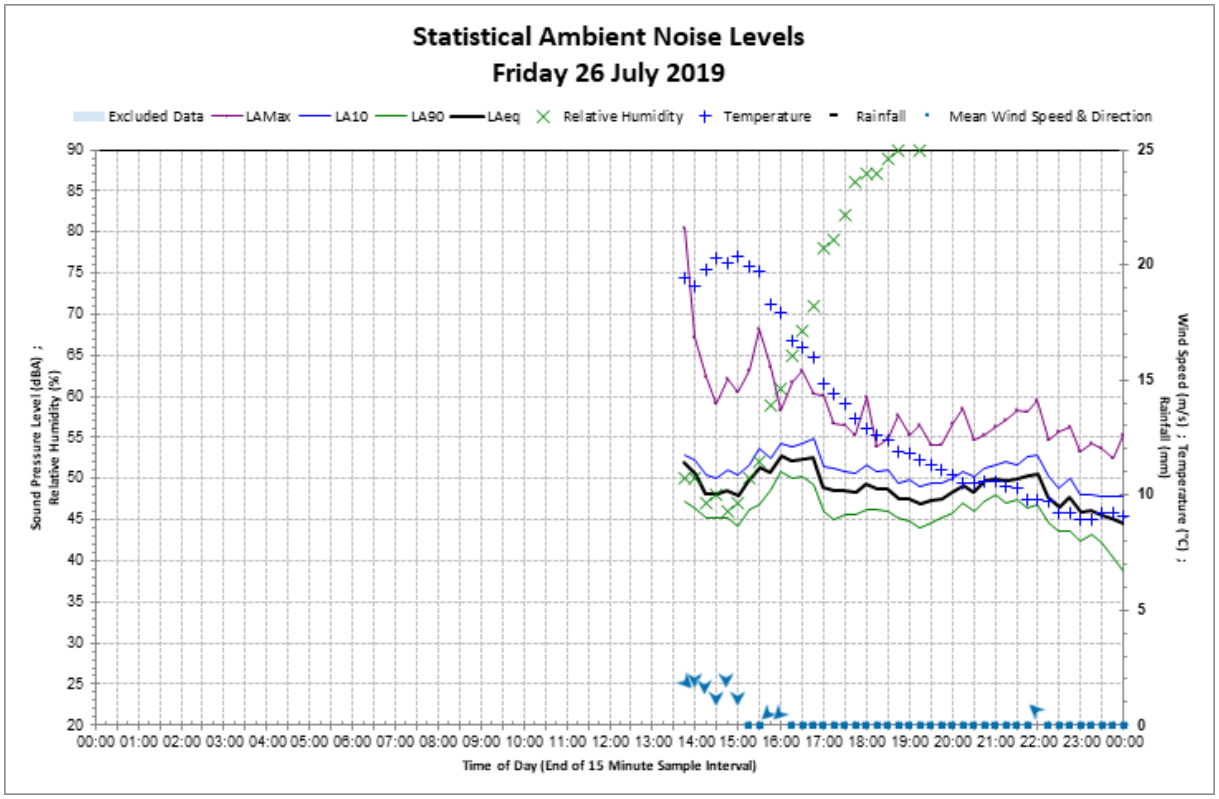


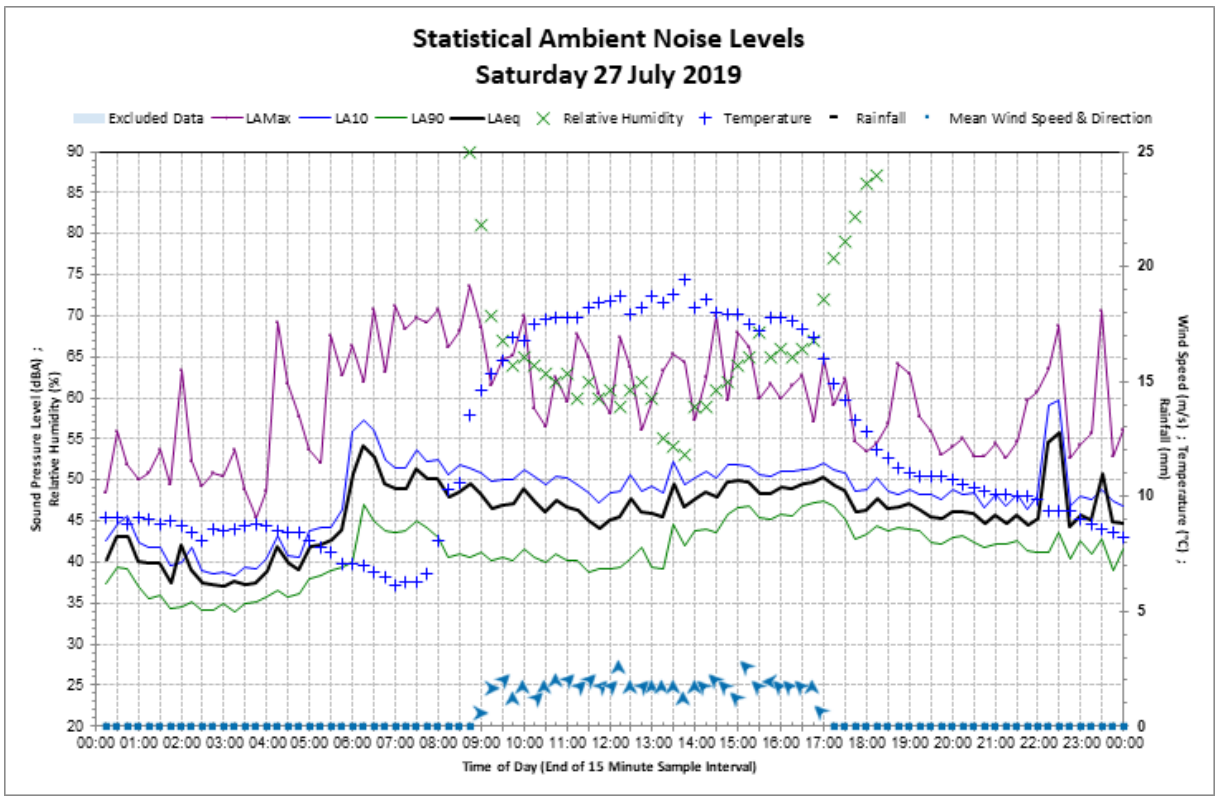


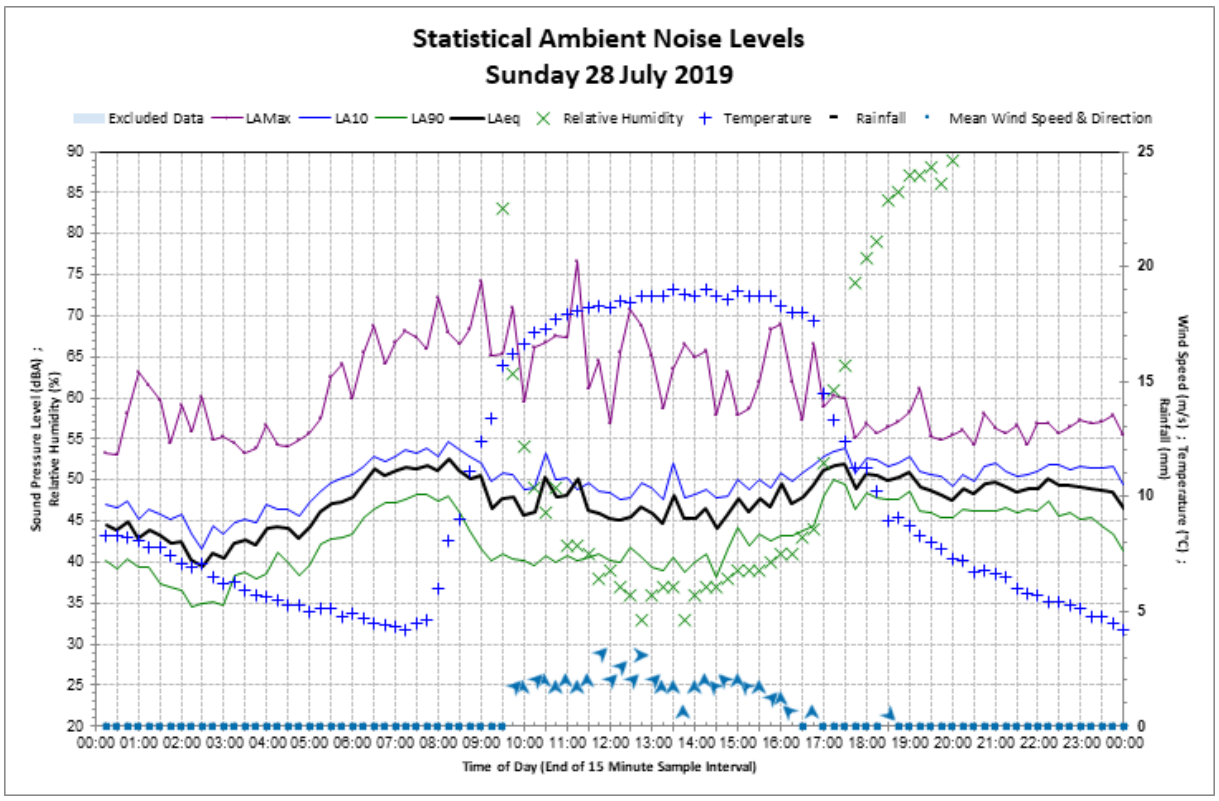

28 July 2019 - Attended Monitoring Results - M10 - Night - Survey 3
dB (A)
Time
LAmax: 68
LAmin: 52
LAeq: 59
LA1: 63
LA10: 61
LA90: 55
LAeq,1s

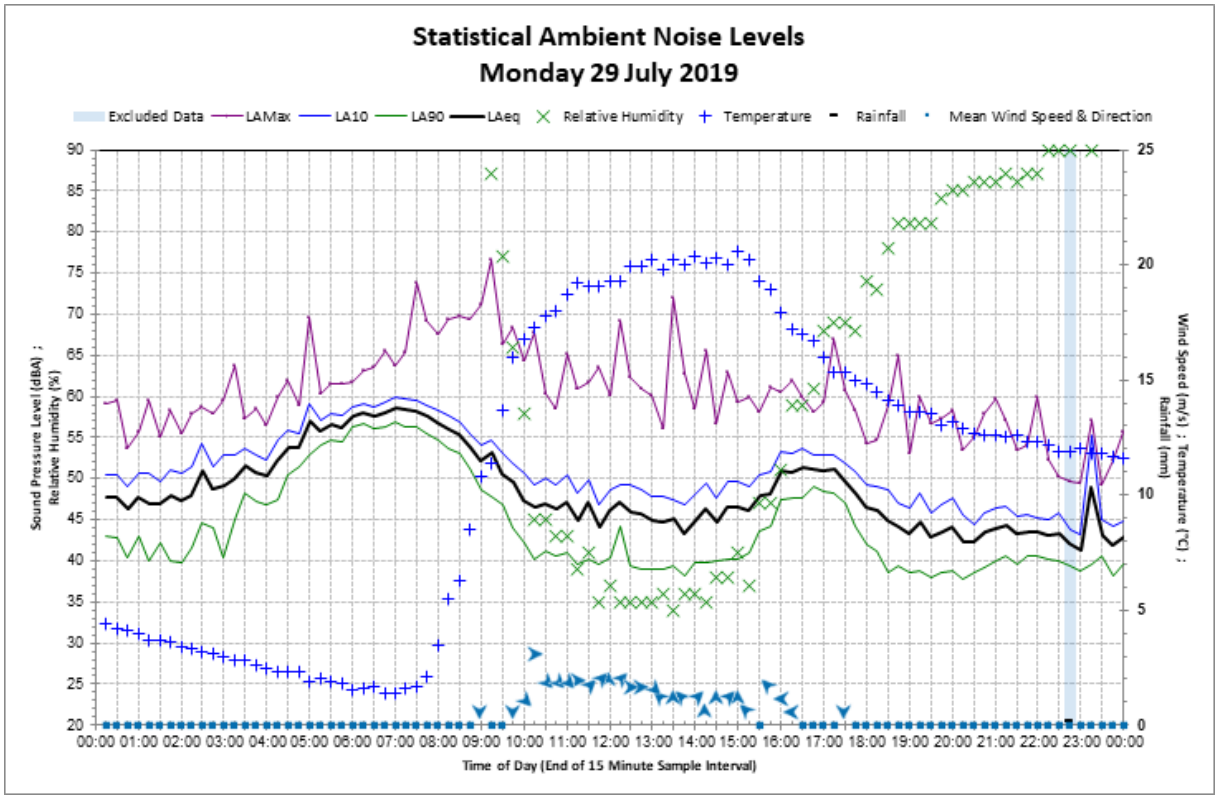

28 July 2019 - Attended Monitoring Results - M10 - Night - Survey 4
dB (A)
Time
LAmax: 78
LAmin: 50
LAeq: 59
LA1: 66
LA10: 61
LA90: 54
LAeq,1s

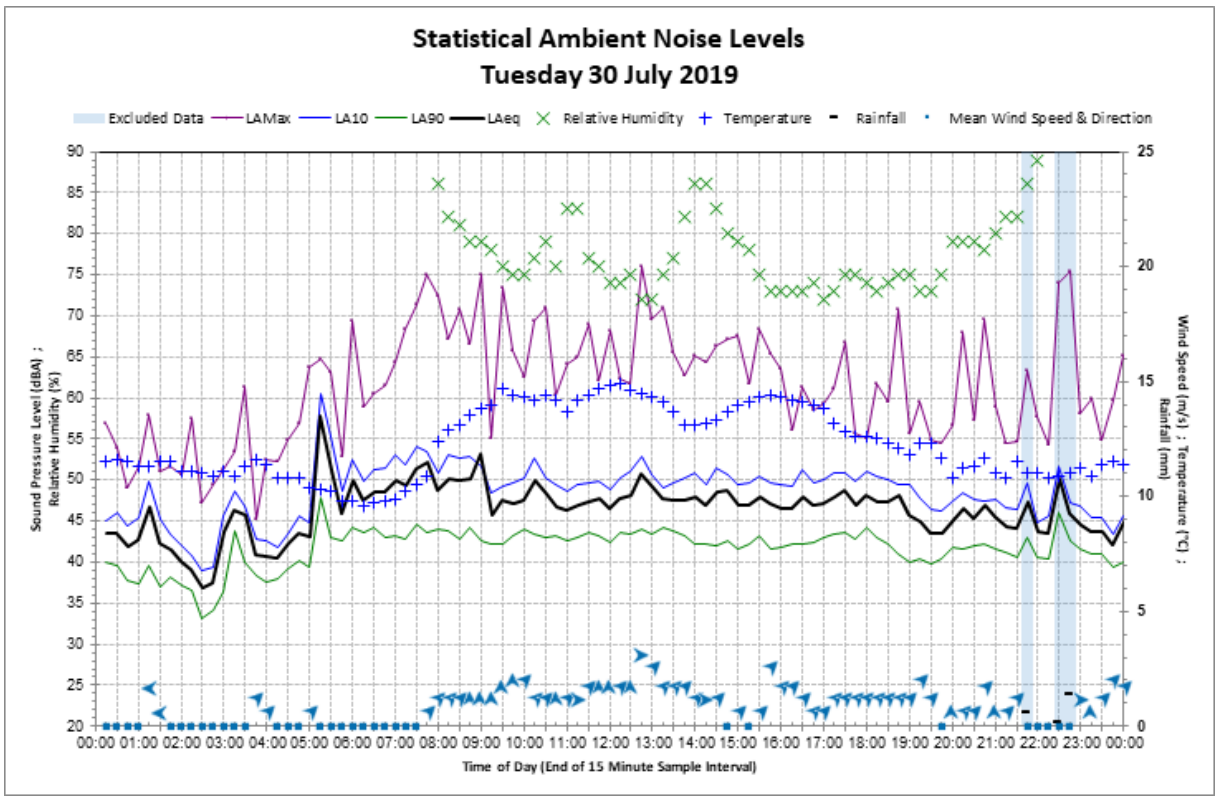
Appendix H – Unattended statistical ambient noise levels charts

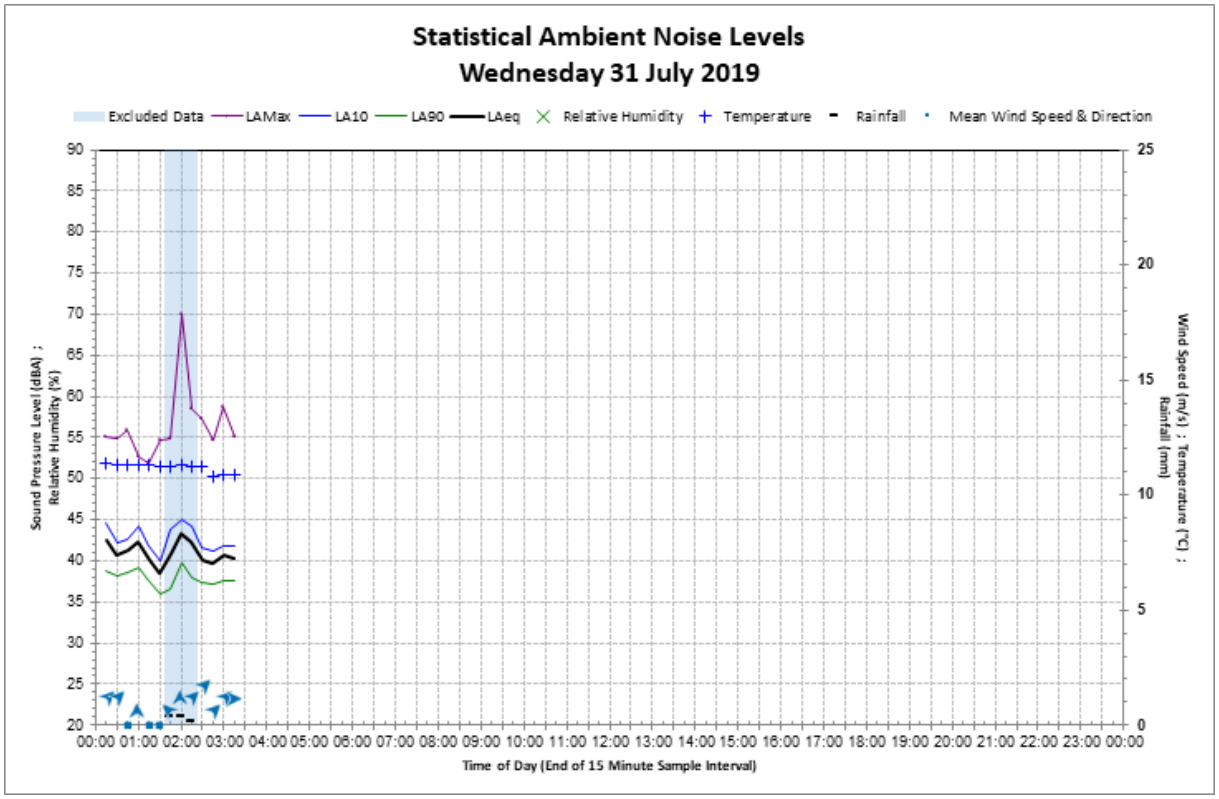


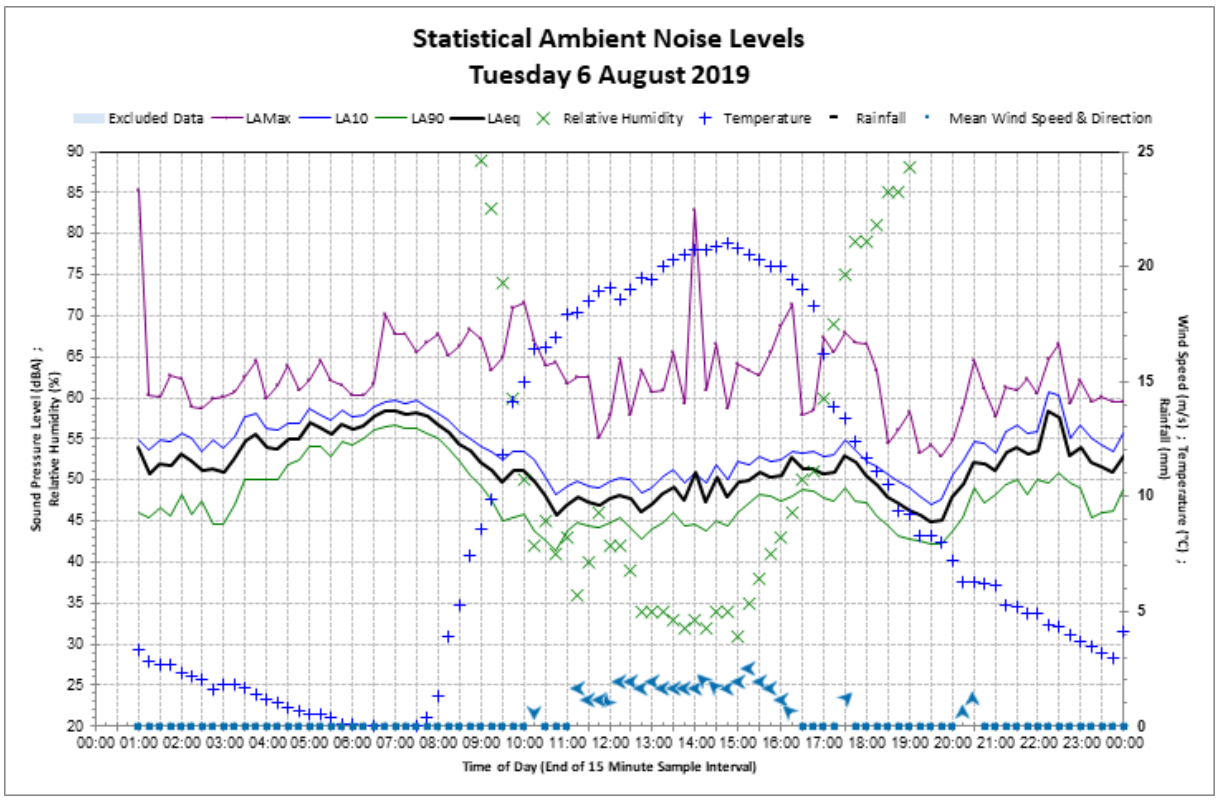


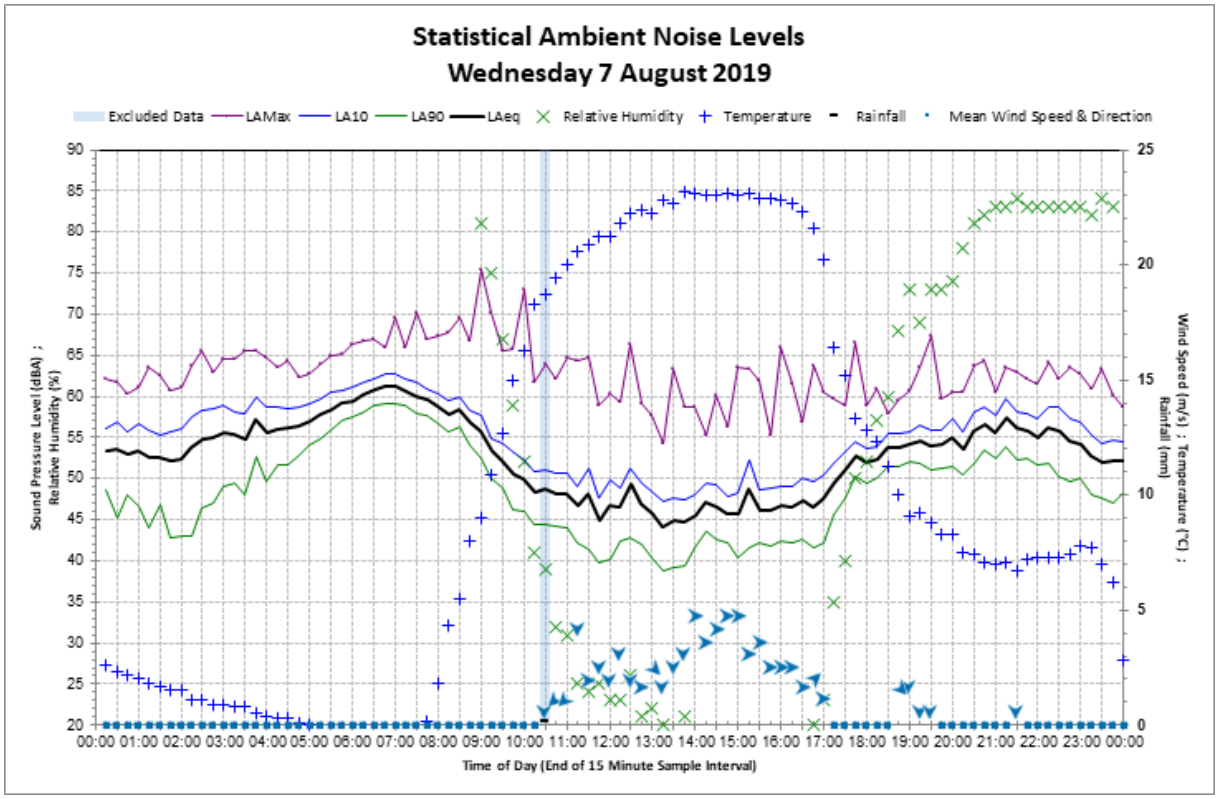

Statistical Ambient Noise Levels
Sunday 28 July 2019
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

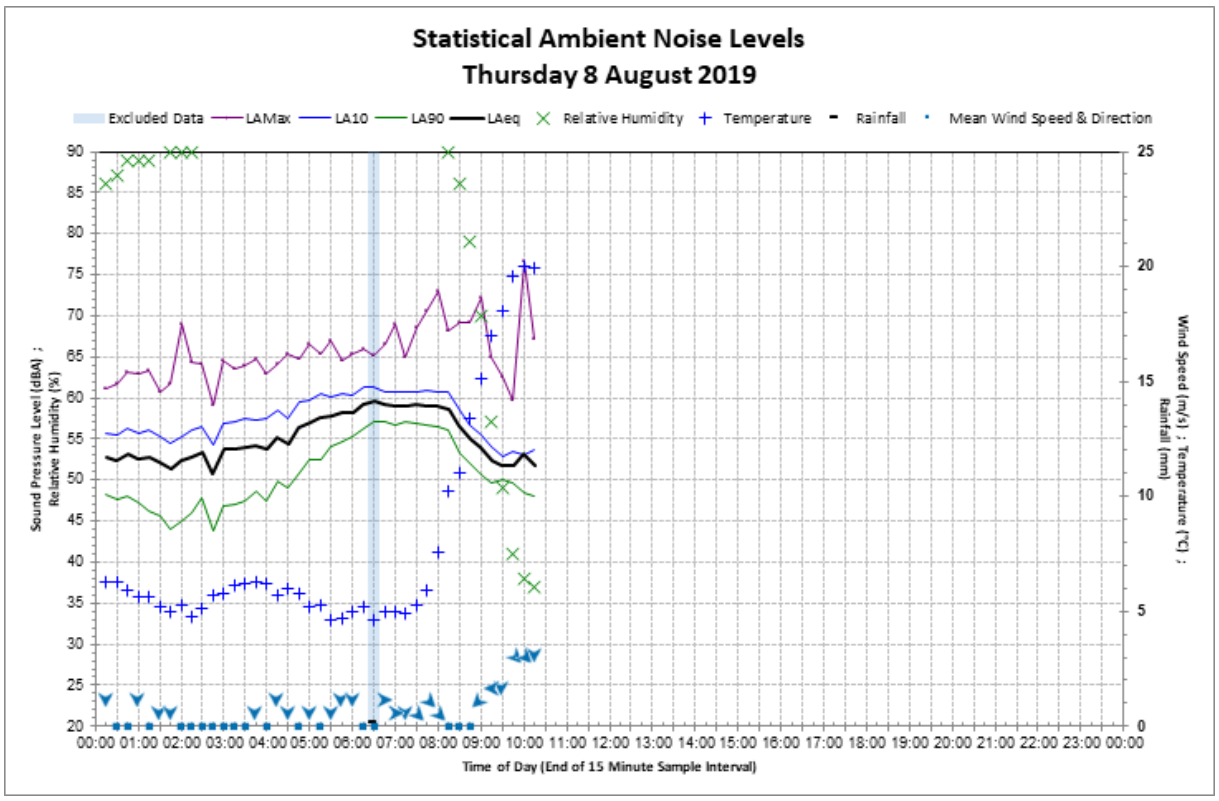

Statistical Ambient Noise Levels
Monday 29 July 2019
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Tuesday 30 July 2019
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Wednesday 31 July 2019
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Tuesday 6 August 2019
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Wednesday 7 August 2019
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Thursday 8 August 2019
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

Appendix I – Mandalong AWS & BOM Lake Macquarie AWS

Table I-1 Mandalong AWS (26/07/2019 to 28/07/2019)

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 0:00	3.8	99.3	0.0	2.5	258.0	0.0
26/07/2019 0:05	3.7	99.2	0.0	2.4	259.9	0.0
26/07/2019 0:10	3.7	99.2	0.0	2.4	253.7	0.0
26/07/2019 0:15	3.6	99.2	0.0	2.4	247.1	0.0
26/07/2019 0:20	3.5	99.2	0.0	2.4	247.4	0.0
26/07/2019 0:25	3.4	99.2	0.0	2.4	247.7	0.1
26/07/2019 0:30	3.4	99.2	0.0	2.4	245.2	0.0
26/07/2019 0:35	3.4	99.3	0.0	2.4	242.6	0.0
26/07/2019 0:40	3.3	99.3	0.0	2.4	246.9	0.0
26/07/2019 0:45	3.2	99.3	0.0	2.4	251.3	0.0
26/07/2019 0:50	3.1	99.2	0.0	2.4	244.9	0.0
26/07/2019 0:55	3.0	99.2	0.0	2.4	239.0	0.0
26/07/2019 1:00	3.1	99.2	0.0	5.5	239.9	0.0
26/07/2019 1:05	3.1	99.3	0.0	8.6	240.9	0.1
26/07/2019 1:10	3.1	99.3	0.0	8.6	246.8	0.1
26/07/2019 1:15	3.2	99.4	0.0	8.6	253.2	0.0
26/07/2019 1:20	3.1	99.4	0.0	8.6	261.2	0.0
26/07/2019 1:25	3.1	99.4	0.0	8.6	268.8	0.0
26/07/2019 1:30	3.1	99.4	0.0	8.6	273.5	0.1
26/07/2019 1:35	3.1	99.4	0.0	8.6	278.7	0.1
26/07/2019 1:40	3.1	99.4	0.0	8.6	266.5	0.1
26/07/2019 1:45	3.1	99.4	0.0	8.6	252.4	0.0
26/07/2019 1:50	3.0	99.4	0.0	8.6	269.0	0.0
26/07/2019 1:55	2.9	99.4	0.0	8.6	283.7	0.0
26/07/2019 2:00	2.9	99.4	0.0	8.9	278.9	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 2:05	2.8	99.4	0.0	9.2	273.6	0.1
26/07/2019 2:10	2.8	99.4	0.0	9.2	272.9	0.0
26/07/2019 2:15	2.7	99.4	0.0	9.2	272.0	0.0
26/07/2019 2:20	2.8	99.5	0.0	9.2	275.5	0.0
26/07/2019 2:25	2.9	99.5	0.0	9.2	278.7	0.0
26/07/2019 2:30	2.8	99.5	0.0	9.2	283.2	0.0
26/07/2019 2:35	2.7	99.4	0.0	9.2	288.2	0.0
26/07/2019 2:40	2.7	99.4	0.0	9.2	258.6	0.0
26/07/2019 2:45	2.7	99.5	0.0	9.2	226.8	0.0
26/07/2019 2:50	2.6	99.4	0.0	9.2	246.7	0.0
26/07/2019 2:55	2.6	99.4	0.0	9.2	263.7	0.0
26/07/2019 3:00	2.6	99.4	0.0	4.6	275.8	0.0
26/07/2019 3:05	2.6	99.5	0.0	0.0	289.9	0.0
26/07/2019 3:10	2.5	99.5	0.0	0.0	296.1	0.0
26/07/2019 3:15	2.4	99.4	0.0	0.0	302.8	0.0
26/07/2019 3:20	2.4	99.5	0.0	0.0	296.9	0.0
26/07/2019 3:25	2.5	99.5	0.0	0.0	291.4	0.0
26/07/2019 3:30	2.5	99.5	0.0	0.0	275.2	0.0
26/07/2019 3:35	2.5	99.5	0.0	0.0	257.1	0.0
26/07/2019 3:40	2.4	99.5	0.0	0.0	278.2	0.0
26/07/2019 3:45	2.3	99.5	0.0	0.0	300.8	0.0
26/07/2019 3:50	2.4	99.5	0.0	0.0	283.9	0.0
26/07/2019 3:55	2.4	99.5	0.0	0.0	268.8	0.0
26/07/2019 4:00	2.3	99.5	0.0	2.5	209.9	0.0
26/07/2019 4:05	2.2	99.5	0.0	5.0	144.3	0.0
26/07/2019 4:10	2.3	99.5	0.0	5.0	106.8	0.0
26/07/2019 4:15	2.3	99.6	0.0	5.0	66.5	0.0
26/07/2019 4:20	2.4	99.6	0.0	5.0	176.7	0.1
26/07/2019 4:25	2.5	99.6	0.0	5.0	274.7	0.2

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 4:30	2.4	99.6	0.0	5.0	293.1	0.1
26/07/2019 4:35	2.3	99.6	0.0	5.0	313.6	0.0
26/07/2019 4:40	2.4	99.6	0.0	5.0	268.7	0.0
26/07/2019 4:45	2.4	99.6	0.0	5.0	220.4	0.0
26/07/2019 4:50	2.4	99.5	0.0	5.0	175.6	0.0
26/07/2019 4:55	2.3	99.5	0.0	5.0	132.6	0.0
26/07/2019 5:00	2.2	99.5	0.0	8.5	192.5	0.0
26/07/2019 5:05	2.1	99.6	0.0	12.0	259.4	0.1
26/07/2019 5:10	2.2	99.6	0.0	12.0	260.3	0.1
26/07/2019 5:15	2.3	99.6	0.0	12.0	261.3	0.0
26/07/2019 5:20	2.3	99.6	0.0	12.0	257.4	0.0
26/07/2019 5:25	2.4	99.6	0.0	12.0	254.0	0.0
26/07/2019 5:30	2.3	99.6	0.0	12.0	261.6	0.0
26/07/2019 5:35	2.3	99.6	0.0	12.0	269.5	0.0
26/07/2019 5:40	2.2	99.6	0.0	12.0	274.9	0.0
26/07/2019 5:45	2.2	99.6	0.0	12.0	280.8	0.1
26/07/2019 5:50	2.3	99.7	0.0	12.0	275.7	0.1
26/07/2019 5:55	2.4	99.7	0.0	12.0	271.2	0.1
26/07/2019 6:00	2.4	99.7	0.0	14.6	248.9	0.1
26/07/2019 6:05	2.4	99.6	0.0	17.1	224.9	0.1
26/07/2019 6:10	2.3	99.6	0.0	17.1	228.6	0.1
26/07/2019 6:15	2.1	99.6	0.0	17.1	232.8	0.0
26/07/2019 6:20	2.0	99.6	0.0	17.1	259.2	0.0
26/07/2019 6:25	1.9	99.6	0.0	17.1	284.5	0.0
26/07/2019 6:30	1.9	99.6	0.0	17.1	283.8	0.0
26/07/2019 6:35	2.0	99.7	0.0	17.1	283.0	0.0
26/07/2019 6:40	1.9	99.7	0.0	17.1	283.8	0.0
26/07/2019 6:45	1.9	99.6	0.0	17.1	284.8	0.0
26/07/2019 6:50	2.0	99.7	0.0	17.1	248.8	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 6:55	2.0	99.7	0.0	17.1	214.2	0.0
26/07/2019 7:00	2.0	99.7	0.0	22.7	153.6	0.0
26/07/2019 7:05	2.1	99.7	0.0	28.4	90.8	0.0
26/07/2019 7:10	2.1	99.7	0.0	28.4	83.1	0.0
26/07/2019 7:15	2.1	99.7	0.0	28.4	75.0	0.0
26/07/2019 7:20	2.2	99.7	0.0	28.4	69.4	0.0
26/07/2019 7:25	2.2	99.7	0.0	28.4	63.8	0.0
26/07/2019 7:30	2.5	99.7	0.0	28.4	149.7	0.1
26/07/2019 7:35	2.7	99.8	0.0	28.4	245.4	0.1
26/07/2019 7:40	2.9	99.8	0.0	28.4	253.0	0.1
26/07/2019 7:45	3.1	99.8	0.0	28.4	261.7	0.0
26/07/2019 7:50	3.4	99.8	0.0	28.4	233.8	0.0
26/07/2019 7:55	3.6	99.8	0.0	28.4	206.9	0.0
26/07/2019 8:00	4.0	99.8	0.0	16.3	261.4	0.0
26/07/2019 8:05	4.5	99.9	0.0	4.2	322.2	0.0
26/07/2019 8:10	4.8	99.9	0.0	4.2	305.0	0.0
26/07/2019 8:15	5.1	99.9	0.0	4.2	286.5	0.0
26/07/2019 8:20	5.6	99.9	0.0	4.2	289.4	0.1
26/07/2019 8:25	6.1	99.9	0.0	4.2	292.0	0.1
26/07/2019 8:30	6.5	99.9	0.0	4.2	265.0	0.0
26/07/2019 8:35	7.0	99.9	0.0	4.2	234.8	0.0
26/07/2019 8:40	7.2	99.8	0.0	4.2	232.5	0.1
26/07/2019 8:45	7.4	99.7	0.0	4.2	230.1	0.1
26/07/2019 8:50	7.8	99.8	0.0	4.2	243.5	0.1
26/07/2019 8:55	8.1	99.8	0.0	4.2	256.3	0.0
26/07/2019 9:00	8.2	99.7	0.0	13.9	249.6	0.1
26/07/2019 9:05	8.2	99.5	0.0	23.7	242.2	0.1
26/07/2019 9:10	8.7	99.6	0.0	23.7	263.1	0.1
26/07/2019 9:15	9.2	99.7	0.0	23.7	284.8	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 9:20	9.9	99.3	0.0	23.7	272.8	0.0
26/07/2019 9:25	10.6	98.9	0.0	23.7	260.8	0.0
26/07/2019 9:30	11.1	96.8	0.0	23.7	241.9	0.0
26/07/2019 9:35	11.6	94.6	0.0	23.7	222.3	0.1
26/07/2019 9:40	12.2	90.4	0.0	23.7	252.4	0.1
26/07/2019 9:45	12.7	86.1	0.0	23.7	283.6	0.2
26/07/2019 9:50	13.3	81.8	0.0	23.7	178.8	0.2
26/07/2019 9:55	13.8	77.5	0.0	23.7	74.0	0.3
26/07/2019 10:00	14.0	76.2	0.0	39.9	60.7	0.3
26/07/2019 10:05	14.1	74.8	0.0	56.1	46.3	0.3
26/07/2019 10:10	14.2	74.1	0.0	56.1	46.6	0.3
26/07/2019 10:15	14.3	73.3	0.0	56.1	46.8	0.3
26/07/2019 10:20	14.7	72.4	0.0	56.1	53.4	0.3
26/07/2019 10:25	15.1	71.6	0.0	56.1	60.0	0.2
26/07/2019 10:30	15.6	70.0	0.0	56.1	71.1	0.2
26/07/2019 10:35	16.1	68.3	0.0	56.1	83.0	0.2
26/07/2019 10:40	16.3	68.0	0.0	56.1	163.8	0.3
26/07/2019 10:45	16.5	67.6	0.0	56.1	257.0	0.3
26/07/2019 10:50	16.6	67.1	0.0	56.1	265.6	0.3
26/07/2019 10:55	16.7	66.6	0.0	56.1	273.8	0.3
26/07/2019 11:00	16.7	67.0	0.0	66.4	269.0	0.3
26/07/2019 11:05	16.7	67.4	0.0	76.7	263.6	0.3
26/07/2019 11:10	16.9	66.6	0.0	76.7	278.5	0.3
26/07/2019 11:15	17.1	65.8	0.0	76.7	294.6	0.3
26/07/2019 11:20	17.2	64.8	0.0	76.7	300.3	0.2
26/07/2019 11:25	17.2	63.9	0.0	76.7	305.7	0.2
26/07/2019 11:30	17.4	63.7	0.0	76.7	287.7	0.2
26/07/2019 11:35	17.6	63.4	0.0	76.7	267.7	0.2
26/07/2019 11:40	17.6	63.3	0.0	76.7	262.2	0.2

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 11:45	17.6	63.2	0.0	76.7	256.8	0.2
26/07/2019 11:50	17.8	62.5	0.0	76.7	282.6	0.2
26/07/2019 11:55	17.9	61.9	0.0	76.7	307.4	0.1
26/07/2019 12:00	18.1	60.8	0.0	54.4	302.7	0.2
26/07/2019 12:05	18.3	59.7	0.0	32.2	297.5	0.3
26/07/2019 12:10	18.4	59.7	0.0	32.2	271.0	0.2
26/07/2019 12:15	18.5	59.7	0.0	32.2	242.5	0.2
26/07/2019 12:20	18.8	58.4	0.0	32.2	232.9	0.2
26/07/2019 12:25	19.1	57.1	0.0	32.2	223.2	0.3
26/07/2019 12:30	19.2	56.8	0.0	32.2	258.9	0.3
26/07/2019 12:35	19.4	56.6	0.0	32.2	297.2	0.3
26/07/2019 12:40	19.4	56.9	0.0	32.2	190.8	0.3
26/07/2019 12:45	19.5	57.3	0.0	32.2	76.6	0.3
26/07/2019 12:50	19.3	57.5	0.0	32.2	61.0	0.4
26/07/2019 12:55	19.1	57.8	0.0	32.2	46.0	0.4
26/07/2019 13:00	19.2	57.1	0.0	38.3	45.2	0.4
26/07/2019 13:05	19.3	56.3	0.0	44.4	44.2	0.3
26/07/2019 13:10	19.2	56.4	0.0	44.4	65.1	0.3
26/07/2019 13:15	19.2	56.6	0.0	44.4	88.4	0.2
26/07/2019 13:20	19.3	56.3	0.0	44.4	61.0	0.3
26/07/2019 13:25	19.4	56.0	0.0	44.4	31.2	0.3
26/07/2019 13:30	19.4	54.7	0.0	44.4	117.9	0.3
26/07/2019 13:35	19.5	53.4	0.0	44.4	207.8	0.4
26/07/2019 13:40	19.6	52.2	0.0	44.4	246.4	0.4
26/07/2019 13:45	19.8	51.0	0.0	44.4	289.4	0.4
26/07/2019 13:50	19.7	51.2	0.0	44.4	300.3	0.4
26/07/2019 13:55	19.6	51.4	0.0	44.4	311.2	0.4
26/07/2019 14:00	19.6	51.7	0.0	40.3	287.7	0.3
26/07/2019 14:05	19.6	52.2	0.0	36.2	261.5	0.3

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 14:10	19.7	51.9	0.0	36.2	268.3	0.3
26/07/2019 14:15	19.7	51.6	0.0	36.2	275.6	0.4
26/07/2019 14:20	19.8	51.0	0.0	36.2	292.2	0.4
26/07/2019 14:25	19.9	50.4	0.0	36.2	308.2	0.4
26/07/2019 14:30	20.0	49.9	0.0	36.2	250.5	0.4
26/07/2019 14:35	20.1	49.5	0.0	36.2	186.2	0.4
26/07/2019 14:40	20.2	48.8	0.0	36.2	206.9	0.4
26/07/2019 14:45	20.4	48.0	0.0	36.2	229.9	0.4
26/07/2019 14:50	20.3	48.2	0.0	36.2	241.8	0.4
26/07/2019 14:55	20.2	48.3	0.0	36.2	253.6	0.3
26/07/2019 15:00	20.4	47.4	0.0	36.3	247.0	0.3
26/07/2019 15:05	20.6	46.5	0.0	36.5	239.7	0.2
26/07/2019 15:10	20.7	46.0	0.0	36.5	194.9	0.3
26/07/2019 15:15	20.8	45.5	0.0	36.5	146.7	0.3
26/07/2019 15:20	20.2	46.9	0.0	36.5	121.0	0.3
26/07/2019 15:25	19.7	48.0	0.0	36.5	99.2	0.3
26/07/2019 15:30	19.8	47.7	0.0	36.5	162.6	0.3
26/07/2019 15:35	20.0	47.3	0.0	36.5	228.3	0.2
26/07/2019 15:40	19.9	47.4	0.0	36.5	211.3	0.2
26/07/2019 15:45	19.8	47.5	0.0	36.5	193.6	0.2
26/07/2019 15:50	19.5	50.6	0.0	36.5	245.5	0.2
26/07/2019 15:55	19.2	53.7	0.0	36.5	297.4	0.2
26/07/2019 16:00	18.8	56.0	0.0	30.1	166.4	0.2
26/07/2019 16:05	18.5	58.3	0.0	23.7	30.5	0.2
26/07/2019 16:10	18.3	59.6	0.0	23.7	75.1	0.1
26/07/2019 16:15	18.2	61.0	0.0	23.7	123.1	0.1
26/07/2019 16:20	17.7	63.4	0.0	23.7	193.5	0.1
26/07/2019 16:25	17.2	65.7	0.0	23.7	261.1	0.1
26/07/2019 16:30	16.8	68.5	0.0	23.7	251.9	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 16:35	16.4	71.6	0.0	23.7	241.7	0.1
26/07/2019 16:40	16.2	73.3	0.0	23.7	222.4	0.1
26/07/2019 16:45	15.9	75.2	0.0	23.7	200.8	0.2
26/07/2019 16:50	15.5	77.6	0.0	23.7	225.4	0.2
26/07/2019 16:55	15.2	80.0	0.0	23.7	249.0	0.2
26/07/2019 17:00	15.0	81.5	0.0	39.2	240.6	0.1
26/07/2019 17:05	14.7	83.1	0.0	54.7	231.3	0.1
26/07/2019 17:10	14.5	83.7	0.0	54.7	215.9	0.1
26/07/2019 17:15	14.2	84.4	0.0	54.7	199.4	0.1
26/07/2019 17:20	14.0	85.7	0.0	54.7	239.2	0.1
26/07/2019 17:25	13.9	86.8	0.0	54.7	273.1	0.1
26/07/2019 17:30	13.6	87.4	0.0	54.7	263.4	0.1
26/07/2019 17:35	13.4	88.1	0.0	54.7	253.4	0.2
26/07/2019 17:40	13.1	88.5	0.0	54.7	248.5	0.1
26/07/2019 17:45	12.9	88.8	0.0	54.7	243.6	0.1
26/07/2019 17:50	12.8	90.1	0.0	54.7	250.3	0.1
26/07/2019 17:55	12.7	91.2	0.0	54.7	256.0	0.0
26/07/2019 18:00	12.4	91.5	0.0	45.2	253.5	0.0
26/07/2019 18:05	12.1	91.9	0.0	35.8	250.8	0.0
26/07/2019 18:10	12.0	93.0	0.0	35.8	256.9	0.0
26/07/2019 18:15	11.9	94.3	0.0	35.8	263.6	0.0
26/07/2019 18:20	11.7	94.4	0.0	35.8	258.1	0.1
26/07/2019 18:25	11.6	94.5	0.0	35.8	252.8	0.1
26/07/2019 18:30	11.3	94.4	0.0	35.8	255.1	0.1
26/07/2019 18:35	11.1	94.3	0.0	35.8	257.6	0.1
26/07/2019 18:40	11.0	94.7	0.0	35.8	256.5	0.1
26/07/2019 18:45	11.0	95.2	0.0	35.8	255.4	0.0
26/07/2019 18:50	10.9	95.3	0.0	35.8	225.4	0.0
26/07/2019 18:55	10.9	95.4	0.0	35.8	196.5	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 19:00	10.7	95.6	0.0	28.3	231.1	0.0
26/07/2019 19:05	10.5	95.8	0.0	20.8	269.6	0.0
26/07/2019 19:10	10.5	96.2	0.0	20.8	268.0	0.0
26/07/2019 19:15	10.6	96.6	0.0	20.8	266.3	0.1
26/07/2019 19:20	10.4	96.4	0.0	20.8	251.3	0.1
26/07/2019 19:25	10.2	96.3	0.0	20.8	237.9	0.2
26/07/2019 19:30	10.2	96.6	0.0	20.8	237.6	0.1
26/07/2019 19:35	10.1	96.9	0.0	20.8	237.2	0.1
26/07/2019 19:40	10.1	97.0	0.0	20.8	233.1	0.1
26/07/2019 19:45	10.1	97.2	0.0	20.8	228.4	0.2
26/07/2019 19:50	10.0	97.3	0.0	20.8	246.9	0.1
26/07/2019 19:55	10.0	97.3	0.0	20.8	265.4	0.1
26/07/2019 20:00	9.8	97.3	0.0	26.4	259.4	0.1
26/07/2019 20:05	9.5	97.3	0.0	32.0	252.7	0.1
26/07/2019 20:10	9.6	97.5	0.0	32.0	262.5	0.1
26/07/2019 20:15	9.7	97.7	0.0	32.0	273.0	0.0
26/07/2019 20:20	9.7	97.8	0.0	32.0	284.5	0.1
26/07/2019 20:25	9.7	97.9	0.0	32.0	294.3	0.1
26/07/2019 20:30	9.7	97.9	0.0	32.0	295.3	0.1
26/07/2019 20:35	9.6	97.8	0.0	32.0	296.3	0.0
26/07/2019 20:40	9.4	97.9	0.0	32.0	263.9	0.0
26/07/2019 20:45	9.2	98.1	0.0	32.0	227.7	0.0
26/07/2019 20:50	9.4	98.3	0.0	32.0	275.2	0.0
26/07/2019 20:55	9.6	98.5	0.0	32.0	322.6	0.1
26/07/2019 21:00	9.5	98.4	0.0	28.0	287.9	0.1
26/07/2019 21:05	9.4	98.2	0.0	23.9	249.2	0.1
26/07/2019 21:10	9.3	98.3	0.0	23.9	244.1	0.1
26/07/2019 21:15	9.3	98.4	0.0	23.9	238.6	0.1
26/07/2019 21:20	9.2	98.4	0.0	23.9	188.2	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 21:25	9.1	98.4	0.0	23.9	141.6	0.1
26/07/2019 21:30	9.2	98.4	0.0	23.9	183.8	0.1
26/07/2019 21:35	9.2	98.5	0.0	23.9	232.5	0.1
26/07/2019 21:40	9.0	98.5	0.0	23.9	234.2	0.2
26/07/2019 21:45	8.8	98.4	0.0	23.9	236.2	0.2
26/07/2019 21:50	8.8	98.5	0.0	23.9	225.2	0.2
26/07/2019 21:55	8.8	98.5	0.0	23.9	214.3	0.2
26/07/2019 22:00	8.7	98.4	0.0	33.6	228.6	0.2
26/07/2019 22:05	8.5	98.3	0.0	43.2	244.5	0.3
26/07/2019 22:10	8.5	98.5	0.0	43.2	235.6	0.2
26/07/2019 22:15	8.5	98.7	0.0	43.2	226.1	0.2
26/07/2019 22:20	8.5	98.6	0.0	43.2	225.8	0.2
26/07/2019 22:25	8.6	98.6	0.0	43.2	225.5	0.1
26/07/2019 22:30	8.5	98.6	0.0	43.2	234.5	0.2
26/07/2019 22:35	8.4	98.5	0.0	43.2	244.2	0.2
26/07/2019 22:40	8.3	98.6	0.0	43.2	233.3	0.2
26/07/2019 22:45	8.2	98.7	0.0	43.2	220.7	0.2
26/07/2019 22:50	8.2	98.6	0.0	43.2	239.7	0.1
26/07/2019 22:55	8.1	98.6	0.0	43.2	258.7	0.1
26/07/2019 23:00	7.9	98.6	0.0	33.4	272.6	0.1
26/07/2019 23:05	7.7	98.7	0.0	23.5	287.1	0.1
26/07/2019 23:10	7.8	98.7	0.0	23.5	288.4	0.1
26/07/2019 23:15	8.0	98.8	0.0	23.5	289.8	0.2
26/07/2019 23:20	8.0	98.9	0.0	23.5	292.2	0.1
26/07/2019 23:25	7.9	98.9	0.0	23.5	294.6	0.1
26/07/2019 23:30	7.9	98.9	0.0	23.5	287.3	0.1
26/07/2019 23:35	7.9	98.8	0.0	23.5	279.1	0.1
26/07/2019 23:40	8.0	98.8	0.0	23.5	256.7	0.1
26/07/2019 23:45	8.1	98.9	0.0	23.5	231.7	0.2

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 23:50	8.1	98.9	0.0	23.5	230.8	0.1
26/07/2019 23:55	8.0	98.8	0.0	23.5	229.8	0.1
27/07/2019 0:00	8.0	98.8	0.0	28.0	236.1	0.2
27/07/2019 0:05	8.0	98.8	0.0	32.5	243.2	0.3
27/07/2019 0:10	8.2	98.9	0.0	32.5	220.9	0.3
27/07/2019 0:15	8.5	99.0	0.0	32.5	196.9	0.4
27/07/2019 0:20	8.6	98.8	0.0	32.5	221.2	0.3
27/07/2019 0:25	8.7	98.7	0.0	32.5	244.6	0.2
27/07/2019 0:30	8.6	98.6	0.0	32.5	230.8	0.2
27/07/2019 0:35	8.6	98.5	0.0	32.5	214.8	0.2
27/07/2019 0:40	8.6	98.5	0.0	32.5	232.6	0.2
27/07/2019 0:45	8.7	98.5	0.0	32.5	251.7	0.1
27/07/2019 0:50	8.8	98.4	0.0	32.5	248.5	0.1
27/07/2019 0:55	8.8	98.3	0.0	32.5	245.4	0.1
27/07/2019 1:00	8.9	98.2	0.0	32.3	252.9	0.1
27/07/2019 1:05	8.9	98.1	0.0	32.0	261.3	0.1
27/07/2019 1:10	9.0	97.9	0.0	32.0	240.2	0.1
27/07/2019 1:15	9.1	97.6	0.0	32.0	217.6	0.1
27/07/2019 1:20	9.2	97.3	0.0	32.0	213.0	0.2
27/07/2019 1:25	9.2	97.1	0.0	32.0	208.5	0.2
27/07/2019 1:30	9.2	96.8	0.0	32.0	223.2	0.2
27/07/2019 1:35	9.1	96.5	0.0	32.0	239.6	0.2
27/07/2019 1:40	9.1	96.4	0.0	32.0	226.1	0.2
27/07/2019 1:45	9.1	96.3	0.0	32.0	211.7	0.1
27/07/2019 1:50	9.3	96.2	0.0	32.0	202.4	0.1
27/07/2019 1:55	9.4	96.1	0.0	32.0	194.1	0.2
27/07/2019 2:00	9.6	95.4	0.0	28.9	198.4	0.2
27/07/2019 2:05	9.8	94.6	0.0	25.8	203.4	0.1
27/07/2019 2:10	9.9	93.5	0.0	25.8	210.0	0.2

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 2:15	10.1	92.3	0.0	25.8	216.8	0.2
27/07/2019 2:20	9.8	92.2	0.0	25.8	212.2	0.2
27/07/2019 2:25	9.4	92.0	0.0	25.8	207.6	0.2
27/07/2019 2:30	9.4	92.5	0.0	25.8	192.0	0.2
27/07/2019 2:35	9.4	93.1	0.0	25.8	174.6	0.3
27/07/2019 2:40	9.7	90.8	0.0	25.8	180.5	0.3
27/07/2019 2:45	10.2	88.2	0.0	25.8	187.1	0.3
27/07/2019 2:50	10.3	87.1	0.0	25.8	185.2	0.3
27/07/2019 2:55	10.5	85.9	0.0	25.8	183.4	0.3
27/07/2019 3:00	10.5	85.7	0.0	24.7	186.6	0.3
27/07/2019 3:05	10.5	85.5	0.0	23.6	190.4	0.3
27/07/2019 3:10	10.5	85.2	0.0	23.6	192.0	0.3
27/07/2019 3:15	10.5	84.8	0.0	23.6	193.8	0.3
27/07/2019 3:20	10.2	85.9	0.0	23.6	185.6	0.3
27/07/2019 3:25	9.9	86.9	0.0	23.6	177.4	0.3
27/07/2019 3:30	10.3	85.1	0.0	23.6	185.0	0.3
27/07/2019 3:35	10.7	83.1	0.0	23.6	193.4	0.3
27/07/2019 3:40	10.6	83.0	0.0	23.6	193.5	0.3
27/07/2019 3:45	10.6	82.9	0.0	23.6	193.7	0.3
27/07/2019 3:50	10.3	84.3	0.0	23.6	192.0	0.3
27/07/2019 3:55	10.1	85.5	0.0	23.6	190.5	0.2
27/07/2019 4:00	10.1	85.7	0.0	22.5	196.8	0.2
27/07/2019 4:05	10.0	86.0	0.0	21.5	204.2	0.3
27/07/2019 4:10	10.1	85.6	0.0	21.5	203.0	0.3
27/07/2019 4:15	10.2	85.1	0.0	21.5	201.7	0.3
27/07/2019 4:20	10.4	83.4	0.0	21.5	196.2	0.3
27/07/2019 4:25	10.6	81.8	0.0	21.5	191.0	0.2
27/07/2019 4:30	10.3	83.2	0.0	21.5	187.7	0.3
27/07/2019 4:35	10.0	84.6	0.0	21.5	184.3	0.3

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 4:40	9.9	84.8	0.0	21.5	193.1	0.3
27/07/2019 4:45	9.9	85.0	0.0	21.5	202.3	0.3
27/07/2019 4:50	9.5	86.3	0.0	21.5	197.0	0.3
27/07/2019 4:55	9.1	87.5	0.0	21.5	191.9	0.2
27/07/2019 5:00	9.1	87.0	0.0	20.2	191.6	0.3
27/07/2019 5:05	9.1	86.4	0.0	18.9	191.3	0.3
27/07/2019 5:10	9.0	87.2	0.0	18.9	193.9	0.3
27/07/2019 5:15	8.8	88.1	0.0	18.9	196.7	0.2
27/07/2019 5:20	8.5	89.4	0.0	18.9	194.1	0.2
27/07/2019 5:25	8.2	90.6	0.0	18.9	191.7	0.2
27/07/2019 5:30	8.1	91.1	0.0	18.9	193.1	0.2
27/07/2019 5:35	8.0	91.7	0.0	18.9	194.7	0.3
27/07/2019 5:40	7.8	91.7	0.0	18.9	199.6	0.2
27/07/2019 5:45	7.7	91.8	0.0	18.9	204.8	0.2
27/07/2019 5:50	7.4	92.3	0.0	18.9	195.3	0.2
27/07/2019 5:55	7.2	92.8	0.0	18.9	185.8	0.2
27/07/2019 6:00	7.3	93.5	0.0	18.5	190.1	0.2
27/07/2019 6:05	7.4	94.2	0.0	18.2	194.9	0.3
27/07/2019 6:10	7.4	94.1	0.0	18.2	196.9	0.2
27/07/2019 6:15	7.4	93.9	0.0	18.2	199.0	0.2
27/07/2019 6:20	7.3	93.7	0.0	18.2	191.5	0.2
27/07/2019 6:25	7.2	93.6	0.0	18.2	184.8	0.2
27/07/2019 6:30	7.0	94.1	0.0	18.2	196.0	0.2
27/07/2019 6:35	6.8	94.7	0.0	18.2	208.4	0.2
27/07/2019 6:40	6.6	95.1	0.0	18.2	217.1	0.1
27/07/2019 6:45	6.4	95.5	0.0	18.2	226.9	0.1
27/07/2019 6:50	6.4	95.7	0.0	18.2	221.5	0.1
27/07/2019 6:55	6.4	95.9	0.0	18.2	216.1	0.1
27/07/2019 7:00	6.2	95.9	0.0	22.7	210.0	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 7:05	6.1	95.8	0.0	27.2	203.0	0.1
27/07/2019 7:10	6.1	96.1	0.0	27.2	209.2	0.1
27/07/2019 7:15	6.1	96.5	0.0	27.2	216.2	0.1
27/07/2019 7:20	6.1	96.6	0.0	27.2	237.9	0.1
27/07/2019 7:25	6.1	96.7	0.0	27.2	259.7	0.2
27/07/2019 7:30	6.2	96.8	0.0	27.2	262.3	0.2
27/07/2019 7:35	6.3	96.9	0.0	27.2	265.1	0.1
27/07/2019 7:40	6.6	96.9	0.0	27.2	271.3	0.2
27/07/2019 7:45	6.9	97.0	0.0	27.2	277.7	0.2
27/07/2019 7:50	7.3	96.6	0.0	27.2	267.1	0.1
27/07/2019 7:55	7.8	96.2	0.0	27.2	257.3	0.1
27/07/2019 8:00	8.4	95.2	0.0	29.0	233.4	0.1
27/07/2019 8:05	9.0	94.1	0.0	30.9	206.8	0.1
27/07/2019 8:10	9.8	91.7	0.0	30.9	206.1	0.1
27/07/2019 8:15	10.6	89.1	0.0	30.9	205.3	0.1
27/07/2019 8:20	11.5	85.5	0.0	30.9	209.4	0.1
27/07/2019 8:25	12.3	82.0	0.0	30.9	213.4	0.2
27/07/2019 8:30	12.8	79.2	0.0	30.9	206.7	0.2
27/07/2019 8:35	13.2	76.0	0.0	30.9	199.2	0.3
27/07/2019 8:40	13.6	74.6	0.0	30.9	207.9	0.3
27/07/2019 8:45	13.9	73.2	0.0	30.9	217.0	0.3
27/07/2019 8:50	14.2	72.1	0.0	30.9	214.7	0.3
27/07/2019 8:55	14.6	71.2	0.0	30.9	212.7	0.3
27/07/2019 9:00	14.9	70.0	0.0	29.3	213.9	0.3
27/07/2019 9:05	15.2	68.7	0.0	27.7	215.3	0.3
27/07/2019 9:10	15.5	68.0	0.0	27.7	216.3	0.3
27/07/2019 9:15	15.7	67.3	0.0	27.7	217.4	0.4
27/07/2019 9:20	15.9	66.3	0.0	27.7	213.9	0.4
27/07/2019 9:25	16.1	65.4	0.0	27.7	210.6	0.4

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 9:30	16.1	64.8	0.0	27.7	206.9	0.5
27/07/2019 9:35	16.1	64.0	0.0	27.7	202.8	0.6
27/07/2019 9:40	16.3	63.7	0.0	27.7	207.6	0.6
27/07/2019 9:45	16.5	63.4	0.0	27.7	212.9	0.5
27/07/2019 9:50	16.5	63.4	0.0	27.7	213.6	0.4
27/07/2019 9:55	16.6	63.5	0.0	27.7	214.2	0.4
27/07/2019 10:00	16.7	63.5	0.0	29.5	214.0	0.5
27/07/2019 10:05	16.7	63.5	0.0	31.3	213.7	0.6
27/07/2019 10:10	17.0	62.9	0.0	31.3	216.6	0.5
27/07/2019 10:15	17.3	62.3	0.0	31.3	219.7	0.5
27/07/2019 10:20	17.3	62.5	0.0	31.3	222.9	0.4
27/07/2019 10:25	17.4	62.6	0.0	31.3	226.0	0.4
27/07/2019 10:30	17.5	62.7	0.0	31.3	210.9	0.4
27/07/2019 10:35	17.5	62.8	0.0	31.3	195.2	0.4
27/07/2019 10:40	17.6	62.5	0.0	31.3	207.3	0.4
27/07/2019 10:45	17.7	62.2	0.0	31.3	220.3	0.5
27/07/2019 10:50	17.7	62.5	0.0	31.3	221.7	0.5
27/07/2019 10:55	17.6	62.7	0.0	31.3	223.0	0.5
27/07/2019 11:00	17.4	63.4	0.0	33.0	222.7	0.4
27/07/2019 11:05	17.3	64.1	0.0	34.7	222.4	0.4
27/07/2019 11:10	17.9	62.5	0.0	34.7	213.3	0.4
27/07/2019 11:15	18.6	60.7	0.0	34.7	203.8	0.4
27/07/2019 11:20	18.4	61.4	0.0	34.7	197.5	0.4
27/07/2019 11:25	18.1	62.0	0.0	34.7	191.6	0.4
27/07/2019 11:30	18.2	61.9	0.0	34.7	198.7	0.4
27/07/2019 11:35	18.4	61.7	0.0	34.7	206.7	0.5
27/07/2019 11:40	18.5	61.1	0.0	34.7	205.8	0.6
27/07/2019 11:45	18.7	60.4	0.0	34.7	204.8	0.7
27/07/2019 11:50	18.9	59.8	0.0	34.7	216.6	0.6

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 11:55	19.1	59.1	0.0	34.7	227.9	0.6
27/07/2019 12:00	18.9	60.1	0.0	37.7	201.0	0.5
27/07/2019 12:05	18.6	61.2	0.0	40.6	173.1	0.4
27/07/2019 12:10	18.9	60.3	0.0	40.6	180.2	0.5
27/07/2019 12:15	19.2	59.3	0.0	40.6	188.1	0.6
27/07/2019 12:20	19.1	59.7	0.0	40.6	181.9	0.6
27/07/2019 12:25	19.0	60.1	0.0	40.6	176.1	0.6
27/07/2019 12:30	18.7	61.0	0.0	40.6	195.6	0.4
27/07/2019 12:35	18.5	62.0	0.0	40.6	215.9	0.3
27/07/2019 12:40	18.4	61.8	0.0	40.6	221.5	0.4
27/07/2019 12:45	18.4	61.7	0.0	40.6	227.6	0.5
27/07/2019 12:50	18.2	62.4	0.0	40.6	233.1	0.4
27/07/2019 12:55	18.1	63.0	0.0	40.6	238.1	0.3
27/07/2019 13:00	18.6	61.3	0.0	41.1	214.2	0.4
27/07/2019 13:05	19.2	59.4	0.0	41.5	187.6	0.6
27/07/2019 13:10	19.1	59.2	0.0	41.5	179.6	0.6
27/07/2019 13:15	19.0	59.0	0.0	41.5	171.1	0.6
27/07/2019 13:20	18.7	59.3	0.0	41.5	168.0	0.5
27/07/2019 13:25	18.5	59.7	0.0	41.5	164.8	0.5
27/07/2019 13:30	18.5	57.6	0.0	41.5	164.3	0.4
27/07/2019 13:35	18.6	55.4	0.0	41.5	163.8	0.3
27/07/2019 13:40	19.0	55.9	0.0	41.5	165.9	0.4
27/07/2019 13:45	19.3	56.4	0.0	41.5	168.2	0.5
27/07/2019 13:50	19.0	58.0	0.0	41.5	165.0	0.5
27/07/2019 13:55	18.6	59.5	0.0	41.5	162.1	0.4
27/07/2019 14:00	18.7	58.5	0.0	35.2	164.3	0.4
27/07/2019 14:05	18.8	57.5	0.0	28.9	166.6	0.4
27/07/2019 14:10	19.1	56.9	0.0	28.9	145.6	0.4
27/07/2019 14:15	19.5	56.3	0.0	28.9	123.1	0.4

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 14:20	18.9	59.2	0.0	28.9	135.0	0.4
27/07/2019 14:25	18.4	61.9	0.0	28.9	146.5	0.4
27/07/2019 14:30	18.1	63.0	0.0	28.9	158.9	0.4
27/07/2019 14:35	17.8	64.0	0.0	28.9	171.7	0.4
27/07/2019 14:40	17.8	64.0	0.0	28.9	164.4	0.4
27/07/2019 14:45	17.7	64.1	0.0	28.9	155.9	0.4
27/07/2019 14:50	17.8	64.0	0.0	28.9	160.6	0.3
27/07/2019 14:55	17.9	64.0	0.0	28.9	165.3	0.3
27/07/2019 15:00	18.0	63.9	0.0	32.4	140.0	0.4
27/07/2019 15:05	18.2	63.8	0.0	35.8	111.8	0.6
27/07/2019 15:10	18.3	63.8	0.0	35.8	116.3	0.7
27/07/2019 15:15	18.4	63.8	0.0	35.8	121.5	0.8
27/07/2019 15:20	17.9	64.9	0.0	35.8	128.6	0.8
27/07/2019 15:25	17.4	66.0	0.0	35.8	135.7	0.8
27/07/2019 15:30	17.5	66.6	0.0	35.8	124.6	0.6
27/07/2019 15:35	17.6	67.2	0.0	35.8	113.0	0.5
27/07/2019 15:40	17.8	65.4	0.0	35.8	132.8	0.5
27/07/2019 15:45	18.1	63.5	0.0	35.8	154.1	0.6
27/07/2019 15:50	18.1	64.2	0.0	35.8	152.4	0.5
27/07/2019 15:55	18.1	64.7	0.0	35.8	150.9	0.5
27/07/2019 16:00	18.1	65.2	0.0	32.0	138.6	0.4
27/07/2019 16:05	18.1	65.7	0.0	28.2	125.9	0.4
27/07/2019 16:10	18.0	65.7	0.0	28.2	136.9	0.5
27/07/2019 16:15	17.9	65.8	0.0	28.2	148.8	0.5
27/07/2019 16:20	17.5	66.8	0.0	28.2	154.7	0.5
27/07/2019 16:25	17.1	67.7	0.0	28.2	160.2	0.5
27/07/2019 16:30	17.0	68.5	0.0	28.2	159.4	0.5
27/07/2019 16:35	16.9	69.3	0.0	28.2	158.6	0.6
27/07/2019 16:40	16.8	70.1	0.0	28.2	155.5	0.5

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 16:45	16.7	70.9	0.0	28.2	152.1	0.4
27/07/2019 16:50	16.5	71.9	0.0	28.2	152.6	0.3
27/07/2019 16:55	16.3	72.9	0.0	28.2	153.1	0.2
27/07/2019 17:00	16.0	73.7	0.0	27.4	160.1	0.2
27/07/2019 17:05	15.8	74.7	0.0	26.7	167.9	0.3
27/07/2019 17:10	15.6	75.9	0.0	26.7	181.8	0.3
27/07/2019 17:15	15.4	77.1	0.0	26.7	195.6	0.4
27/07/2019 17:20	15.0	78.3	0.0	26.7	215.6	0.3
27/07/2019 17:25	14.5	79.5	0.0	26.7	236.5	0.2
27/07/2019 17:30	14.1	81.6	0.0	26.7	241.1	0.1
27/07/2019 17:35	13.7	83.9	0.0	26.7	246.2	0.1
27/07/2019 17:40	13.3	84.9	0.0	26.7	245.2	0.1
27/07/2019 17:45	12.8	86.1	0.0	26.7	244.1	0.1
27/07/2019 17:50	12.5	87.7	0.0	26.7	219.7	0.1
27/07/2019 17:55	12.2	89.1	0.0	26.7	198.8	0.0
27/07/2019 18:00	11.9	90.1	0.0	27.5	200.5	0.1
27/07/2019 18:05	11.6	91.1	0.0	28.2	202.2	0.1
27/07/2019 18:10	11.4	91.6	0.0	28.2	215.0	0.1
27/07/2019 18:15	11.1	92.1	0.0	28.2	229.3	0.2
27/07/2019 18:20	10.9	92.4	0.0	28.2	226.2	0.2
27/07/2019 18:25	10.6	92.6	0.0	28.2	223.4	0.2
27/07/2019 18:30	10.4	93.5	0.0	28.2	233.7	0.2
27/07/2019 18:35	10.2	94.4	0.0	28.2	245.2	0.1
27/07/2019 18:40	10.2	94.8	0.0	28.2	266.5	0.1
27/07/2019 18:45	10.1	95.3	0.0	28.2	289.4	0.0
27/07/2019 18:50	10.0	95.8	0.0	28.2	297.2	0.1
27/07/2019 18:55	9.9	96.3	0.0	28.2	304.1	0.1
27/07/2019 19:00	9.9	96.6	0.0	31.1	306.4	0.1
27/07/2019 19:05	9.9	96.9	0.0	33.9	309.0	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 19:10	9.7	96.9	0.0	33.9	288.1	0.1
27/07/2019 19:15	9.5	96.9	0.0	33.9	264.8	0.0
27/07/2019 19:20	9.2	97.2	0.0	33.9	259.6	0.0
27/07/2019 19:25	9.0	97.4	0.0	33.9	254.8	0.1
27/07/2019 19:30	9.1	97.6	0.0	33.9	262.2	0.1
27/07/2019 19:35	9.2	97.8	0.0	33.9	270.8	0.1
27/07/2019 19:40	9.2	97.8	0.0	33.9	272.9	0.1
27/07/2019 19:45	9.3	97.8	0.0	33.9	275.0	0.1
27/07/2019 19:50	9.1	97.8	0.0	33.9	277.4	0.1
27/07/2019 19:55	9.0	97.8	0.0	33.9	279.7	0.1
27/07/2019 20:00	9.2	98.0	0.0	21.7	286.4	0.1
27/07/2019 20:05	9.3	98.2	0.0	9.5	293.8	0.1
27/07/2019 20:10	9.3	98.2	0.0	9.5	296.5	0.1
27/07/2019 20:15	9.3	98.3	0.0	9.5	299.6	0.0
27/07/2019 20:20	9.2	98.2	0.0	9.5	276.4	0.0
27/07/2019 20:25	9.1	98.1	0.0	9.5	253.3	0.0
27/07/2019 20:30	9.1	98.2	0.0	9.5	256.4	0.0
27/07/2019 20:35	9.1	98.4	0.0	9.5	259.9	0.0
27/07/2019 20:40	9.1	98.4	0.0	9.5	269.5	0.0
27/07/2019 20:45	9.1	98.4	0.0	9.5	280.3	0.0
27/07/2019 20:50	9.1	98.5	0.0	9.5	272.5	0.0
27/07/2019 20:55	9.1	98.5	0.0	9.5	265.3	0.0
27/07/2019 21:00	9.1	98.5	0.0	10.8	266.5	0.0
27/07/2019 21:05	9.1	98.5	0.0	12.2	267.8	0.0
27/07/2019 21:10	9.1	98.5	0.0	12.2	267.8	0.1
27/07/2019 21:15	9.2	98.6	0.0	12.2	267.9	0.1
27/07/2019 21:20	9.0	98.5	0.0	12.2	270.8	0.1
27/07/2019 21:25	8.9	98.5	0.0	12.2	273.7	0.1
27/07/2019 21:30	8.9	98.6	0.0	12.2	265.3	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 21:35	9.0	98.7	0.0	12.2	255.9	0.0
27/07/2019 21:40	9.0	98.7	0.0	12.2	263.4	0.0
27/07/2019 21:45	9.1	98.8	0.0	12.2	271.1	0.0
27/07/2019 21:50	9.1	98.8	0.0	12.2	263.0	0.0
27/07/2019 21:55	9.1	98.8	0.0	12.2	255.8	0.0
27/07/2019 22:00	9.0	98.7	0.0	10.8	253.9	0.1
27/07/2019 22:05	8.9	98.6	0.0	9.4	251.7	0.1
27/07/2019 22:10	8.8	98.7	0.0	9.4	254.7	0.1
27/07/2019 22:15	8.8	98.8	0.0	9.4	258.1	0.0
27/07/2019 22:20	8.7	98.8	0.0	9.4	261.2	0.0
27/07/2019 22:25	8.7	98.8	0.0	9.4	264.5	0.0
27/07/2019 22:30	8.6	98.8	0.0	9.4	276.6	0.0
27/07/2019 22:35	8.6	98.8	0.0	9.4	290.2	0.0
27/07/2019 22:40	8.5	98.8	0.0	9.4	270.3	0.0
27/07/2019 22:45	8.5	98.9	0.0	9.4	248.8	0.1
27/07/2019 22:50	8.4	98.9	0.0	9.4	259.5	0.1
27/07/2019 22:55	8.3	98.9	0.0	9.4	270.7	0.1
27/07/2019 23:00	8.1	98.9	0.0	11.1	253.1	0.1
27/07/2019 23:05	7.9	98.8	0.0	12.7	234.9	0.1
27/07/2019 23:10	7.9	98.9	0.0	12.7	243.4	0.0
27/07/2019 23:15	8.0	99.0	0.0	12.7	252.0	0.0
27/07/2019 23:20	8.0	99.1	0.0	12.7	261.9	0.0
27/07/2019 23:25	8.0	99.1	0.0	12.7	271.4	0.0
27/07/2019 23:30	8.0	99.1	0.0	12.7	265.8	0.1
27/07/2019 23:35	7.9	99.1	0.0	12.7	259.4	0.1
27/07/2019 23:40	7.8	99.1	0.0	12.7	266.3	0.1
27/07/2019 23:45	7.7	99.0	0.0	12.7	273.8	0.1
27/07/2019 23:50	7.5	99.0	0.0	12.7	279.8	0.1
27/07/2019 23:55	7.4	99.0	0.0	12.7	285.1	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 0:00	7.5	99.1	0.0	11.5	289.0	0.1
28/07/2019 0:05	7.6	99.2	0.0	10.2	293.3	0.0
28/07/2019 0:10	7.4	99.2	0.0	10.2	284.1	0.0
28/07/2019 0:15	7.2	99.1	0.0	10.2	273.8	0.0
28/07/2019 0:20	7.3	99.2	0.0	10.2	278.3	0.0
28/07/2019 0:25	7.4	99.3	0.0	10.2	282.9	0.0
28/07/2019 0:30	7.4	99.3	0.0	10.2	282.1	0.0
28/07/2019 0:35	7.4	99.3	0.0	10.2	281.3	0.0
28/07/2019 0:40	7.3	99.3	0.0	10.2	281.2	0.0
28/07/2019 0:45	7.2	99.2	0.0	10.2	281.1	0.0
28/07/2019 0:50	7.1	99.3	0.0	10.2	287.9	0.0
28/07/2019 0:55	7.1	99.3	0.0	10.2	294.7	0.1
28/07/2019 1:00	7.2	99.4	0.0	9.2	287.0	0.1
28/07/2019 1:05	7.4	99.4	0.0	8.2	279.3	0.1
28/07/2019 1:10	7.3	99.4	0.0	8.2	253.9	0.1
28/07/2019 1:15	7.2	99.3	0.0	8.2	226.7	0.1
28/07/2019 1:20	7.0	99.3	0.0	8.2	238.7	0.0
28/07/2019 1:25	6.9	99.3	0.0	8.2	250.6	0.0
28/07/2019 1:30	6.9	99.3	0.0	8.2	253.1	0.0
28/07/2019 1:35	6.9	99.4	0.0	8.2	255.8	0.0
28/07/2019 1:40	6.8	99.4	0.0	8.2	255.7	0.0
28/07/2019 1:45	6.7	99.3	0.0	8.2	255.6	0.0
28/07/2019 1:50	6.7	99.4	0.0	8.2	257.6	0.0
28/07/2019 1:55	6.8	99.4	0.0	8.2	259.6	0.1
28/07/2019 2:00	6.6	99.4	0.0	9.6	259.1	0.1
28/07/2019 2:05	6.5	99.3	0.0	10.9	258.6	0.1
28/07/2019 2:10	6.3	99.3	0.0	10.9	260.4	0.1
28/07/2019 2:15	5.9	99.2	0.0	10.9	262.5	0.1
28/07/2019 2:20	5.9	99.3	0.0	10.9	258.0	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 2:25	5.9	99.4	0.0	10.9	253.9	0.1
28/07/2019 2:30	5.9	99.4	0.0	10.9	248.5	0.1
28/07/2019 2:35	5.9	99.4	0.0	10.9	242.8	0.1
28/07/2019 2:40	5.9	99.4	0.0	10.9	245.6	0.1
28/07/2019 2:45	5.9	99.5	0.0	10.9	248.7	0.1
28/07/2019 2:50	5.9	99.5	0.0	10.9	253.9	0.1
28/07/2019 2:55	5.9	99.5	0.0	10.9	258.5	0.1
28/07/2019 3:00	5.7	99.5	0.0	13.3	268.9	0.1
28/07/2019 3:05	5.5	99.4	0.0	15.6	280.4	0.2
28/07/2019 3:10	5.5	99.5	0.0	15.6	274.0	0.1
28/07/2019 3:15	5.5	99.6	0.0	15.6	267.1	0.1
28/07/2019 3:20	5.5	99.5	0.0	15.6	283.7	0.1
28/07/2019 3:25	5.5	99.5	0.0	15.6	297.9	0.1
28/07/2019 3:30	5.4	99.5	0.0	15.6	275.7	0.0
28/07/2019 3:35	5.2	99.4	0.0	15.6	250.9	0.0
28/07/2019 3:40	5.1	99.4	0.0	15.6	260.4	0.0
28/07/2019 3:45	5.0	99.5	0.0	15.6	271.5	0.0
28/07/2019 3:50	5.2	99.6	0.0	15.6	256.2	0.0
28/07/2019 3:55	5.3	99.6	0.0	15.6	243.2	0.0
28/07/2019 4:00	5.2	99.6	0.0	16.0	234.3	0.0
28/07/2019 4:05	5.2	99.5	0.0	16.4	225.4	0.0
28/07/2019 4:10	5.1	99.5	0.0	16.4	239.6	0.0
28/07/2019 4:15	5.0	99.5	0.0	16.4	254.3	0.1
28/07/2019 4:20	4.9	99.5	0.0	16.4	249.7	0.1
28/07/2019 4:25	4.9	99.5	0.0	16.4	245.5	0.1
28/07/2019 4:30	4.9	99.5	0.0	16.4	239.8	0.1
28/07/2019 4:35	5.0	99.6	0.0	16.4	233.7	0.1
28/07/2019 4:40	4.8	99.6	0.0	16.4	240.1	0.2
28/07/2019 4:45	4.6	99.5	0.0	16.4	246.7	0.2

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 4:50	4.6	99.6	0.0	16.4	250.2	0.2
28/07/2019 4:55	4.6	99.6	0.0	16.4	253.4	0.1
28/07/2019 5:00	4.5	99.6	0.0	16.9	266.1	0.1
28/07/2019 5:05	4.5	99.6	0.0	17.5	280.9	0.1
28/07/2019 5:10	4.5	99.6	0.0	17.5	288.1	0.1
28/07/2019 5:15	4.5	99.6	0.0	17.5	295.8	0.1
28/07/2019 5:20	4.4	99.6	0.0	17.5	290.2	0.1
28/07/2019 5:25	4.3	99.6	0.0	17.5	285.3	0.1
28/07/2019 5:30	4.2	99.6	0.0	17.5	281.2	0.0
28/07/2019 5:35	4.1	99.6	0.0	17.5	276.7	0.0
28/07/2019 5:40	4.3	99.6	0.0	17.5	258.1	0.1
28/07/2019 5:45	4.4	99.7	0.0	17.5	238.0	0.1
28/07/2019 5:50	4.3	99.6	0.0	17.5	236.0	0.1
28/07/2019 5:55	4.2	99.6	0.0	17.5	234.1	0.1
28/07/2019 6:00	4.2	99.6	0.0	19.4	244.9	0.0
28/07/2019 6:05	4.2	99.6	0.0	21.3	255.8	0.0
28/07/2019 6:10	4.2	99.6	0.0	21.3	263.7	0.1
28/07/2019 6:15	4.2	99.7	0.0	21.3	272.2	0.1
28/07/2019 6:20	4.3	99.7	0.0	21.3	268.5	0.1
28/07/2019 6:25	4.4	99.7	0.0	21.3	264.9	0.1
28/07/2019 6:30	4.4	99.7	0.0	21.3	269.2	0.1
28/07/2019 6:35	4.5	99.7	0.0	21.3	274.0	0.0
28/07/2019 6:40	4.3	99.7	0.0	21.3	286.7	0.0
28/07/2019 6:45	4.2	99.6	0.0	21.3	301.5	0.0
28/07/2019 6:50	4.1	99.7	0.0	21.3	298.4	0.0
28/07/2019 6:55	4.0	99.7	0.0	21.3	295.4	0.0
28/07/2019 7:00	3.9	99.7	0.0	15.5	294.8	0.0
28/07/2019 7:05	3.9	99.6	0.0	9.8	294.1	0.0
28/07/2019 7:10	3.9	99.6	0.0	9.8	276.2	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 7:15	4.0	99.7	0.0	9.8	257.0	0.0
28/07/2019 7:20	4.0	99.7	0.0	9.8	250.8	0.1
28/07/2019 7:25	4.0	99.7	0.0	9.8	245.1	0.1
28/07/2019 7:30	4.4	99.8	0.0	9.8	261.5	0.1
28/07/2019 7:35	4.7	99.9	0.0	9.8	279.8	0.1
28/07/2019 7:40	5.1	99.9	0.0	9.8	276.8	0.1
28/07/2019 7:45	5.6	99.9	0.0	9.8	273.4	0.1
28/07/2019 7:50	6.0	99.9	0.0	9.8	273.3	0.0
28/07/2019 7:55	6.4	99.9	0.0	9.8	273.3	0.0
28/07/2019 8:00	6.6	99.9	0.0	11.3	275.3	0.0
28/07/2019 8:05	6.9	99.8	0.0	12.7	277.6	0.0
28/07/2019 8:10	7.3	99.8	0.0	12.7	282.1	0.0
28/07/2019 8:15	7.6	99.8	0.0	12.7	286.9	0.0
28/07/2019 8:20	8.1	99.9	0.0	12.7	280.7	0.0
28/07/2019 8:25	8.6	99.9	0.0	12.7	275.0	0.0
28/07/2019 8:30	9.2	99.9	0.0	12.7	275.6	0.0
28/07/2019 8:35	9.9	99.9	0.0	12.7	276.2	0.0
28/07/2019 8:40	10.1	99.8	0.0	12.7	273.3	0.0
28/07/2019 8:45	10.4	99.7	0.0	12.7	270.0	0.1
28/07/2019 8:50	10.8	99.6	0.0	12.7	286.6	0.1
28/07/2019 8:55	11.2	99.6	0.0	12.7	303.2	0.1
28/07/2019 9:00	11.9	99.1	0.0	16.3	295.2	0.1
28/07/2019 9:05	12.6	98.5	0.0	19.8	286.9	0.1
28/07/2019 9:10	13.2	96.3	0.0	19.8	276.9	0.1
28/07/2019 9:15	13.8	93.8	0.0	19.8	265.8	0.1
28/07/2019 9:20	14.1	90.3	0.0	19.8	243.8	0.2
28/07/2019 9:25	14.5	87.0	0.0	19.8	222.7	0.3
28/07/2019 9:30	15.1	83.0	0.0	19.8	221.3	0.3
28/07/2019 9:35	15.7	78.4	0.0	19.8	219.6	0.2

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 9:40	16.1	73.6	0.0	19.8	217.3	0.3
28/07/2019 9:45	16.5	68.3	0.0	19.8	214.8	0.3
28/07/2019 9:50	16.7	64.3	0.0	19.8	211.1	0.3
28/07/2019 9:55	16.9	60.4	0.0	19.8	207.5	0.4
28/07/2019 10:00	17.0	57.3	0.0	29.9	212.4	0.4
28/07/2019 10:05	17.1	53.9	0.0	40.0	217.9	0.4
28/07/2019 10:10	17.3	52.7	0.0	40.0	219.2	0.4
28/07/2019 10:15	17.5	51.4	0.0	40.0	220.6	0.4
28/07/2019 10:20	17.5	50.5	0.0	40.0	208.4	0.5
28/07/2019 10:25	17.5	49.6	0.0	40.0	196.1	0.5
28/07/2019 10:30	17.9	48.2	0.0	40.0	191.9	0.4
28/07/2019 10:35	18.3	46.7	0.0	40.0	187.3	0.3
28/07/2019 10:40	18.2	46.5	0.0	40.0	200.4	0.4
28/07/2019 10:45	18.1	46.3	0.0	40.0	213.9	0.5
28/07/2019 10:50	18.1	44.8	0.0	40.0	203.2	0.5
28/07/2019 10:55	18.0	43.6	0.0	40.0	194.1	0.5
28/07/2019 11:00	18.2	42.9	0.0	41.8	202.4	0.5
28/07/2019 11:05	18.3	42.1	0.0	43.6	211.4	0.5
28/07/2019 11:10	18.3	41.6	0.0	43.6	221.8	0.6
28/07/2019 11:15	18.2	41.0	0.0	43.6	233.9	0.7
28/07/2019 11:20	18.2	41.0	0.0	43.6	227.7	0.6
28/07/2019 11:25	18.2	41.0	0.0	43.6	222.0	0.5
28/07/2019 11:30	18.3	40.3	0.0	43.6	223.5	0.6
28/07/2019 11:35	18.3	39.6	0.0	43.6	225.1	0.7
28/07/2019 11:40	18.3	39.0	0.0	43.6	213.4	0.6
28/07/2019 11:45	18.4	38.5	0.0	43.6	201.2	0.6
28/07/2019 11:50	18.4	39.4	0.0	43.6	200.9	0.5
28/07/2019 11:55	18.5	40.1	0.0	43.6	200.7	0.5
28/07/2019 12:00	18.7	40.6	0.0	41.0	205.1	0.5

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 12:05	18.9	41.2	0.0	38.5	210.1	0.4
28/07/2019 12:10	18.8	40.1	0.0	38.5	201.7	0.4
28/07/2019 12:15	18.7	38.9	0.0	38.5	192.4	0.4
28/07/2019 12:20	18.6	38.7	0.0	38.5	191.1	0.6
28/07/2019 12:25	18.6	38.5	0.0	38.5	189.9	0.7
28/07/2019 12:30	18.7	37.5	0.0	38.5	207.5	0.6
28/07/2019 12:35	18.9	36.3	0.0	38.5	227.2	0.6
28/07/2019 12:40	19.0	36.6	0.0	38.5	219.1	0.6
28/07/2019 12:45	19.2	37.0	0.0	38.5	210.4	0.5
28/07/2019 12:50	19.1	36.3	0.0	38.5	210.7	0.5
28/07/2019 12:55	19.0	35.6	0.0	38.5	210.9	0.6
28/07/2019 13:00	19.1	35.0	0.0	37.6	213.0	0.6
28/07/2019 13:05	19.2	34.3	0.0	36.8	215.2	0.6
28/07/2019 13:10	19.1	34.3	0.0	36.8	207.6	0.5
28/07/2019 13:15	19.0	34.3	0.0	36.8	199.8	0.5
28/07/2019 13:20	19.1	34.2	0.0	36.8	203.1	0.5
28/07/2019 13:25	19.1	34.1	0.0	36.8	206.2	0.5
28/07/2019 13:30	19.0	34.9	0.0	36.8	201.3	0.5
28/07/2019 13:35	18.9	35.7	0.0	36.8	195.9	0.5
28/07/2019 13:40	18.9	36.1	0.0	36.8	206.0	0.5
28/07/2019 13:45	18.9	36.6	0.0	36.8	217.6	0.4
28/07/2019 13:50	19.0	36.9	0.0	36.8	224.7	0.5
28/07/2019 13:55	19.0	37.1	0.0	36.8	231.3	0.5
28/07/2019 14:00	18.9	37.3	0.0	38.9	213.3	0.6
28/07/2019 14:05	18.9	37.6	0.0	41.0	193.3	0.7
28/07/2019 14:10	18.9	37.7	0.0	41.0	201.1	0.6
28/07/2019 14:15	19.0	37.8	0.0	41.0	209.5	0.4
28/07/2019 14:20	19.0	37.8	0.0	41.0	210.7	0.4
28/07/2019 14:25	19.0	37.8	0.0	41.0	211.4	0.4

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 14:30	19.0	37.9	0.0	41.0	214.5	0.5
28/07/2019 14:35	19.1	38.0	0.0	41.0	218.0	0.5
28/07/2019 14:40	19.0	38.4	0.0	41.0	209.3	0.5
28/07/2019 14:45	18.8	38.8	0.0	41.0	200.0	0.5
28/07/2019 14:50	18.8	39.2	0.0	41.0	203.5	0.5
28/07/2019 14:55	18.8	39.5	0.0	41.0	206.8	0.4
28/07/2019 15:00	18.7	39.7	0.0	40.3	189.3	0.5
28/07/2019 15:05	18.7	39.9	0.0	39.5	169.8	0.5
28/07/2019 15:10	18.7	40.1	0.0	39.5	169.9	0.5
28/07/2019 15:15	18.7	40.3	0.0	39.5	170.1	0.4
28/07/2019 15:20	18.7	40.3	0.0	39.5	181.3	0.4
28/07/2019 15:25	18.8	40.3	0.0	39.5	192.1	0.3
28/07/2019 15:30	18.7	40.3	0.0	39.5	187.3	0.3
28/07/2019 15:35	18.6	40.4	0.0	39.5	182.0	0.3
28/07/2019 15:40	18.5	40.6	0.0	39.5	177.7	0.4
28/07/2019 15:45	18.5	40.9	0.0	39.5	173.1	0.5
28/07/2019 15:50	18.4	41.1	0.0	39.5	174.0	0.4
28/07/2019 15:55	18.3	41.4	0.0	39.5	174.8	0.4
28/07/2019 16:00	18.3	41.3	0.0	36.0	181.0	0.4
28/07/2019 16:05	18.3	41.1	0.0	32.5	188.1	0.3
28/07/2019 16:10	18.2	40.9	0.0	32.5	186.9	0.3
28/07/2019 16:15	18.1	40.6	0.0	32.5	185.6	0.4
28/07/2019 16:20	17.9	40.9	0.0	32.5	180.3	0.4
28/07/2019 16:25	17.8	41.1	0.0	32.5	174.8	0.4
28/07/2019 16:30	17.8	41.2	0.0	32.5	177.2	0.3
28/07/2019 16:35	17.7	41.2	0.0	32.5	179.7	0.2
28/07/2019 16:40	17.7	41.8	0.0	32.5	190.5	0.2
28/07/2019 16:45	17.6	42.5	0.0	32.5	202.0	0.1
28/07/2019 16:50	17.0	45.8	0.0	32.5	210.2	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 16:55	16.4	48.7	0.0	32.5	217.4	0.2
28/07/2019 17:00	15.8	51.3	0.0	31.0	217.1	0.1
28/07/2019 17:05	15.2	54.1	0.0	29.5	216.7	0.1
28/07/2019 17:10	14.3	58.4	0.0	29.5	247.7	0.1
28/07/2019 17:15	13.4	63.1	0.0	29.5	282.3	0.1
28/07/2019 17:20	12.9	67.2	0.0	29.5	278.5	0.1
28/07/2019 17:25	12.4	71.2	0.0	29.5	274.9	0.1
28/07/2019 17:30	11.9	72.9	0.0	29.5	275.2	0.1
28/07/2019 17:35	11.4	74.9	0.0	29.5	275.5	0.1
28/07/2019 17:40	11.2	76.2	0.0	29.5	279.1	0.0
28/07/2019 17:45	10.9	77.5	0.0	29.5	282.9	0.0
28/07/2019 17:50	10.4	78.6	0.0	29.5	282.0	0.1
28/07/2019 17:55	10.0	79.7	0.0	29.5	281.2	0.1
28/07/2019 18:00	9.6	81.6	0.0	29.2	262.3	0.1
28/07/2019 18:05	9.3	83.8	0.0	29.0	241.2	0.1
28/07/2019 18:10	9.3	83.8	0.0	29.0	226.1	0.1
28/07/2019 18:15	9.5	83.8	0.0	29.0	209.2	0.1
28/07/2019 18:20	9.2	84.3	0.0	29.0	224.2	0.2
28/07/2019 18:25	8.9	84.8	0.0	29.0	238.0	0.2
28/07/2019 18:30	8.7	85.6	0.0	29.0	236.6	0.1
28/07/2019 18:35	8.4	86.5	0.0	29.0	235.1	0.1
28/07/2019 18:40	8.1	87.3	0.0	29.0	271.0	0.1
28/07/2019 18:45	7.9	88.2	0.0	29.0	309.6	0.2
28/07/2019 18:50	7.7	89.2	0.0	29.0	294.8	0.1
28/07/2019 18:55	7.5	90.1	0.0	29.0	281.0	0.1
28/07/2019 19:00	7.5	90.2	0.0	32.6	257.9	0.1
28/07/2019 19:05	7.4	90.4	0.0	36.3	232.1	0.1
28/07/2019 19:10	7.2	91.0	0.0	36.3	245.1	0.1
28/07/2019 19:15	7.0	91.7	0.0	36.3	258.1	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 19:20	6.9	92.6	0.0	36.3	252.7	0.1
28/07/2019 19:25	6.9	93.4	0.0	36.3	247.6	0.2
28/07/2019 19:30	6.8	93.5	0.0	36.3	234.9	0.1
28/07/2019 19:35	6.7	93.6	0.0	36.3	221.7	0.1
28/07/2019 19:40	6.7	93.9	0.0	36.3	247.2	0.1
28/07/2019 19:45	6.6	94.2	0.0	36.3	273.7	0.2
28/07/2019 19:50	6.3	94.6	0.0	36.3	293.8	0.2
28/07/2019 19:55	6.1	95.0	0.0	36.3	312.5	0.2
28/07/2019 20:00	6.1	95.4	0.0	36.3	302.4	0.1
28/07/2019 20:05	6.1	95.9	0.0	36.2	291.1	0.1
28/07/2019 20:10	5.9	95.9	0.0	36.2	268.0	0.1
28/07/2019 20:15	5.8	95.9	0.0	36.2	241.3	0.1
28/07/2019 20:20	5.8	96.2	0.0	36.2	235.7	0.1
28/07/2019 20:25	5.8	96.5	0.0	36.2	230.3	0.1
28/07/2019 20:30	5.7	96.6	0.0	36.2	227.4	0.1
28/07/2019 20:35	5.7	96.8	0.0	36.2	224.1	0.1
28/07/2019 20:40	5.6	96.8	0.0	36.2	251.9	0.1
28/07/2019 20:45	5.4	96.8	0.0	36.2	283.9	0.1
28/07/2019 20:50	5.4	97.3	0.0	36.2	289.0	0.1
28/07/2019 20:55	5.4	97.7	0.0	36.2	293.5	0.2
28/07/2019 21:00	5.3	97.5	0.0	33.5	285.7	0.1
28/07/2019 21:05	5.2	97.2	0.0	30.8	277.0	0.1
28/07/2019 21:10	5.2	97.4	0.0	30.8	254.4	0.1
28/07/2019 21:15	5.2	97.6	0.0	30.8	231.8	0.1
28/07/2019 21:20	5.1	97.7	0.0	30.8	239.6	0.1
28/07/2019 21:25	5.1	97.7	0.0	30.8	246.8	0.1
28/07/2019 21:30	5.1	97.8	0.0	30.8	256.4	0.1
28/07/2019 21:35	5.1	97.9	0.0	30.8	267.5	0.0
28/07/2019 21:40	5.0	97.9	0.0	30.8	267.6	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 21:45	5.0	98.0	0.0	30.8	267.8	0.1
28/07/2019 21:50	4.9	98.1	0.0	30.8	261.9	0.1
28/07/2019 21:55	4.7	98.1	0.0	30.8	256.3	0.0
28/07/2019 22:00	4.7	98.2	0.0	23.4	259.7	0.0
28/07/2019 22:05	4.8	98.3	0.0	16.0	263.5	0.0
28/07/2019 22:10	4.8	98.3	0.0	16.0	272.7	0.0
28/07/2019 22:15	4.7	98.4	0.0	16.0	283.0	0.0
28/07/2019 22:20	4.7	98.4	0.0	16.0	266.6	0.0
28/07/2019 22:25	4.7	98.4	0.0	16.0	251.4	0.0
28/07/2019 22:30	4.5	98.4	0.0	16.0	247.2	0.1
28/07/2019 22:35	4.3	98.4	0.0	16.0	242.8	0.1
28/07/2019 22:40	4.3	98.5	0.0	16.0	247.7	0.1
28/07/2019 22:45	4.3	98.6	0.0	16.0	253.4	0.1
28/07/2019 22:50	4.3	98.6	0.0	16.0	250.3	0.1
28/07/2019 22:55	4.3	98.6	0.0	16.0	247.6	0.1
28/07/2019 23:00	4.2	98.6	0.0	10.4	258.2	0.0
28/07/2019 23:05	4.2	98.7	0.0	4.7	270.1	0.0
28/07/2019 23:10	4.2	98.7	0.0	4.7	279.3	0.0
28/07/2019 23:15	4.1	98.8	0.0	4.7	289.2	0.0
28/07/2019 23:20	4.0	98.7	0.0	4.7	291.0	0.1
28/07/2019 23:25	3.9	98.7	0.0	4.7	292.8	0.1
28/07/2019 23:30	3.9	98.8	0.0	4.7	293.7	0.1
28/07/2019 23:35	3.9	98.9	0.0	4.7	294.7	0.2
28/07/2019 23:40	3.9	98.9	0.0	4.7	265.2	0.1
28/07/2019 23:45	3.8	98.8	0.0	4.7	233.6	0.1
28/07/2019 23:50	3.6	98.8	0.0	4.7	232.9	0.1
28/07/2019 23:55	3.4	98.8	0.0	4.7	232.2	0.1

Table I.2 – Mandalong AWS (05/08/2019 to 07/08/2019)

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
5/08/2019 0:00	5.9	99.2	0.0	37.6	253.2	0.1
5/08/2019 0:05	5.7	99.2	0.0	43.6	263.9	0.1
5/08/2019 0:10	5.8	99.3	0.0	43.6	266.1	0.1
5/08/2019 0:15	5.9	99.3	0.0	43.6	268.2	0.0
5/08/2019 0:20	5.9	99.4	0.0	43.6	255.4	0.0
5/08/2019 0:25	5.8	99.4	0.0	43.6	244.0	0.1
5/08/2019 0:30	5.8	99.4	0.0	43.6	262.3	0.1
5/08/2019 0:35	5.8	99.3	0.0	43.6	281.2	0.1
5/08/2019 0:40	5.7	99.3	0.0	43.6	282.5	0.1
5/08/2019 0:45	5.5	99.3	0.0	43.6	283.9	0.0
5/08/2019 0:50	5.6	99.4	0.0	43.6	249.8	0.0
5/08/2019 0:55	5.6	99.4	0.0	43.6	218.3	0.0
5/08/2019 1:00	5.4	99.4	0.0	31.5	245.7	0.0
5/08/2019 1:05	5.1	99.3	0.0	19.4	274.1	0.1
5/08/2019 1:10	5.3	99.4	0.0	19.4	270.5	0.1
5/08/2019 1:15	5.6	99.6	0.0	19.4	266.6	0.1
5/08/2019 1:20	5.5	99.5	0.0	19.4	248.5	0.1
5/08/2019 1:25	5.4	99.4	0.0	19.4	232.4	0.1
5/08/2019 1:30	5.3	99.4	0.0	19.4	243.9	0.1
5/08/2019 1:35	5.3	99.4	0.0	19.4	255.8	0.0
5/08/2019 1:40	5.2	99.4	0.0	19.4	273.7	0.0
5/08/2019 1:45	5.2	99.4	0.0	19.4	292.2	0.1
5/08/2019 1:50	5.3	99.5	0.0	19.4	277.9	0.1
5/08/2019 1:55	5.3	99.5	0.0	19.4	265.8	0.1
5/08/2019 2:00	5.3	99.5	0.0	18.8	251.6	0.1
5/08/2019 2:05	5.2	99.5	0.0	18.2	235.8	0.1
5/08/2019 2:10	5.0	99.5	0.0	18.2	271.5	0.1
5/08/2019 2:15	4.9	99.4	0.0	18.2	307.2	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
5/08/2019 2:20	4.8	99.4	0.0	18.2	289.0	0.1
5/08/2019 2:25	4.8	99.4	0.0	18.2	273.5	0.0
5/08/2019 2:30	4.7	99.5	0.0	18.2	299.8	0.0
5/08/2019 2:35	4.7	99.6	0.0	18.2	328.1	0.0
5/08/2019 2:40	4.7	99.6	0.0	18.2	328.0	0.0
5/08/2019 2:45	4.7	99.5	0.0	18.2	327.8	0.0
5/08/2019 2:50	4.8	99.6	0.0	18.2	279.2	0.1
5/08/2019 2:55	4.9	99.6	0.0	18.2	237.5	0.1
5/08/2019 3:00	4.8	99.6	0.0	20.6	237.0	0.1
5/08/2019 3:05	4.7	99.5	0.0	22.9	236.4	0.0
5/08/2019 3:10	4.6	99.5	0.0	22.9	269.0	0.0
5/08/2019 3:15	4.5	99.4	0.0	22.9	301.6	0.0
5/08/2019 3:20	4.4	99.5	0.0	22.9	303.1	0.0
5/08/2019 3:25	4.4	99.6	0.0	22.9	304.4	0.0
5/08/2019 3:30	4.4	99.6	0.0	22.9	293.4	0.0
5/08/2019 3:35	4.4	99.6	0.0	22.9	282.0	0.1
5/08/2019 3:40	4.2	99.6	0.0	22.9	281.8	0.1
5/08/2019 3:45	4.1	99.5	0.0	22.9	281.5	0.1
5/08/2019 3:50	4.0	99.6	0.0	22.9	255.1	0.1
5/08/2019 3:55	3.9	99.6	0.0	22.9	231.7	0.0
5/08/2019 4:00	4.2	99.6	0.0	29.6	172.2	0.0
5/08/2019 4:05	4.4	99.7	0.0	36.3	105.8	0.0
5/08/2019 4:10	4.4	99.7	0.0	36.3	105.9	0.0
5/08/2019 4:15	4.4	99.6	0.0	36.3	106.0	0.0
5/08/2019 4:20	4.3	99.6	0.0	36.3	129.5	0.0
5/08/2019 4:25	4.3	99.6	0.0	36.3	150.4	0.0
5/08/2019 4:30	4.2	99.6	0.0	36.3	224.0	0.0
5/08/2019 4:35	4.2	99.6	0.0	36.3	300.4	0.1
5/08/2019 4:40	4.2	99.6	0.0	36.3	278.1	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
5/08/2019 4:45	4.3	99.7	0.0	36.3	255.8	0.1
5/08/2019 4:50	4.4	99.7	0.0	36.3	249.9	0.1
5/08/2019 4:55	4.6	99.7	0.0	36.3	244.9	0.1
5/08/2019 5:00	4.6	99.7	0.0	35.1	227.6	0.1
5/08/2019 5:05	4.7	99.7	0.0	33.9	211.6	0.1
5/08/2019 5:10	4.6	99.7	0.0	33.9	234.5	0.1
5/08/2019 5:15	4.6	99.7	0.0	33.9	259.1	0.1
5/08/2019 5:20	4.5	99.6	0.0	33.9	237.9	0.1
5/08/2019 5:25	4.4	99.6	0.0	33.9	219.0	0.1
5/08/2019 5:30	4.4	99.6	0.0	33.9	241.0	0.1
5/08/2019 5:35	4.3	99.7	0.0	33.9	264.7	0.1
5/08/2019 5:40	4.3	99.7	0.0	33.9	270.1	0.1
5/08/2019 5:45	4.3	99.7	0.0	33.9	275.9	0.1
5/08/2019 5:50	4.4	99.7	0.0	33.9	273.9	0.0
5/08/2019 5:55	4.5	99.7	0.0	33.9	272.2	0.0
5/08/2019 6:00	4.4	99.7	0.0	28.9	262.0	0.0
5/08/2019 6:05	4.2	99.6	0.0	23.8	251.8	0.1
5/08/2019 6:10	4.2	99.7	0.0	23.8	236.9	0.0
5/08/2019 6:15	4.2	99.7	0.0	23.8	222.6	0.0
5/08/2019 6:20	4.2	99.7	0.0	23.8	239.4	0.0
5/08/2019 6:25	4.3	99.7	0.0	23.8	253.8	0.0
5/08/2019 6:30	4.2	99.7	0.0	23.8	262.5	0.0
5/08/2019 6:35	4.2	99.7	0.0	23.8	271.8	0.0
5/08/2019 6:40	4.3	99.7	0.0	23.8	279.3	0.0
5/08/2019 6:45	4.4	99.8	0.0	23.8	287.0	0.0
5/08/2019 6:50	4.3	99.7	0.0	23.8	279.4	0.0
5/08/2019 6:55	4.3	99.7	0.0	23.8	272.6	0.0
5/08/2019 7:00	4.4	99.7	0.0	17.6	213.9	0.0
5/08/2019 7:05	4.5	99.8	0.0	11.4	153.1	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
5/08/2019 7:10	4.6	99.8	0.0	11.4	216.6	0.1
5/08/2019 7:15	4.7	99.7	0.0	11.4	282.4	0.1
5/08/2019 7:20	4.7	99.8	0.0	11.4	283.5	0.0
5/08/2019 7:25	4.8	99.8	0.0	11.4	284.5	0.0
5/08/2019 7:30	4.9	99.8	0.0	11.4	281.1	0.0
5/08/2019 7:35	5.0	99.8	0.0	11.4	277.5	0.0
5/08/2019 7:40	5.1	99.8	0.0	11.4	260.1	0.0
5/08/2019 7:45	5.2	99.8	0.0	11.4	243.3	0.1
5/08/2019 7:50	5.4	99.8	0.0	11.4	229.0	0.1
5/08/2019 7:55	5.5	99.8	0.0	11.4	217.2	0.0
5/08/2019 8:00	5.8	99.8	0.0	13.5	245.7	0.0
5/08/2019 8:05	6.0	99.8	0.0	15.5	275.3	0.0
5/08/2019 8:10	6.0	99.8	0.0	15.5	258.1	0.0
5/08/2019 8:15	6.0	99.8	0.0	15.5	240.2	0.0
5/08/2019 8:20	6.2	99.8	0.0	15.5	287.0	0.0
5/08/2019 8:25	6.4	99.8	0.0	15.5	328.6	0.0
5/08/2019 8:30	6.6	99.8	0.0	15.5	306.5	0.0
5/08/2019 8:35	6.9	99.9	0.0	15.5	282.8	0.0
5/08/2019 8:40	7.8	100.0	0.0	15.5	289.2	0.0
5/08/2019 8:45	8.6	100.0	0.0	15.5	295.5	0.0
5/08/2019 8:50	9.3	100.0	0.0	15.5	254.0	0.0
5/08/2019 8:55	9.9	100.0	0.0	15.5	218.6	0.0
5/08/2019 9:00	10.6	100.0	0.0	18.9	229.6	0.0
5/08/2019 9:05	11.3	99.9	0.0	22.4	241.0	0.0
5/08/2019 9:10	11.6	99.9	0.0	22.4	243.8	0.1
5/08/2019 9:15	11.9	99.9	0.0	22.4	246.7	0.1
5/08/2019 9:20	12.3	99.7	0.0	22.4	254.1	0.1
5/08/2019 9:25	12.6	99.6	0.0	22.4	261.0	0.0
5/08/2019 9:30	13.2	98.6	0.0	22.4	241.9	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
5/08/2019 9:35	13.8	97.5	0.0	22.4	220.6	0.0
5/08/2019 9:40	14.4	92.1	0.0	22.4	190.6	0.1
5/08/2019 9:45	15.1	86.5	0.0	22.4	159.4	0.1
5/08/2019 9:50	15.7	81.4	0.0	22.4	193.7	0.1
5/08/2019 9:55	16.2	77.0	0.0	22.4	222.9	0.1
5/08/2019 10:00	16.5	74.3	0.0	34.5	227.7	0.1
5/08/2019 10:05	16.9	71.4	0.0	46.7	232.8	0.1
5/08/2019 10:10	17.2	70.0	0.0	46.7	212.1	0.2
5/08/2019 10:15	17.4	68.7	0.0	46.7	191.4	0.2
5/08/2019 10:20	17.3	69.9	0.0	46.7	223.2	0.3
5/08/2019 10:25	17.2	71.1	0.0	46.7	252.5	0.3
5/08/2019 10:30	17.4	70.5	0.0	46.7	182.0	0.3
5/08/2019 10:35	17.6	69.9	0.0	46.7	106.1	0.3
5/08/2019 10:40	17.7	68.8	0.0	46.7	98.0	0.3
5/08/2019 10:45	17.9	67.7	0.0	46.7	89.5	0.4
5/08/2019 10:50	18.1	67.2	0.0	46.7	111.0	0.4
5/08/2019 10:55	18.2	66.8	0.0	46.7	131.0	0.4
5/08/2019 11:00	18.1	66.9	0.0	60.9	99.5	0.5
5/08/2019 11:05	18.0	66.9	0.0	75.0	66.9	0.6
5/08/2019 11:10	18.3	66.1	0.0	75.0	64.7	0.5
5/08/2019 11:15	18.6	65.3	0.0	75.0	62.6	0.4
5/08/2019 11:20	18.6	64.9	0.0	75.0	63.0	0.5
5/08/2019 11:25	18.6	64.5	0.0	75.0	63.3	0.6
5/08/2019 11:30	18.7	64.1	0.0	75.0	62.0	0.6
5/08/2019 11:35	18.7	63.7	0.0	75.0	60.7	0.6
5/08/2019 11:40	18.7	64.0	0.0	75.0	61.9	0.6
5/08/2019 11:45	18.7	64.2	0.0	75.0	63.0	0.6
5/08/2019 11:50	18.9	63.4	0.0	75.0	58.4	0.5
5/08/2019 11:55	19.1	62.7	0.0	75.0	54.5	0.5

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
5/08/2019 12:00	19.1	62.6	0.0	50.3	63.0	0.5
5/08/2019 12:05	19.2	62.5	0.0	25.7	72.2	0.6
5/08/2019 12:10	19.1	62.5	0.0	25.7	74.0	0.6
5/08/2019 12:15	19.0	62.6	0.0	25.7	75.9	0.6
5/08/2019 12:20	19.1	62.6	0.0	25.7	65.1	0.7
5/08/2019 12:25	19.1	62.6	0.0	25.7	55.9	0.7
5/08/2019 12:30	19.2	62.5	0.0	25.7	60.1	0.7
5/08/2019 12:35	19.3	62.4	0.0	25.7	64.4	0.6
5/08/2019 12:40	19.4	61.5	0.0	25.7	68.5	0.6
5/08/2019 12:45	19.5	60.6	0.0	25.7	72.7	0.7
5/08/2019 12:50	19.5	60.8	0.0	25.7	78.1	0.7
5/08/2019 12:55	19.6	61.0	0.0	25.7	82.6	0.7
5/08/2019 13:00	19.6	60.5	0.0	30.1	79.5	0.7
5/08/2019 13:05	19.7	60.1	0.0	34.6	76.3	0.7
5/08/2019 13:10	19.7	59.6	0.0	34.6	65.9	0.7
5/08/2019 13:15	19.7	59.1	0.0	34.6	54.7	0.7
5/08/2019 13:20	19.7	59.3	0.0	34.6	67.3	0.8
5/08/2019 13:25	19.6	59.6	0.0	34.6	78.9	0.8
5/08/2019 13:30	19.6	59.5	0.0	34.6	63.7	0.8
5/08/2019 13:35	19.6	59.4	0.0	34.6	47.8	0.8
5/08/2019 13:40	19.6	59.5	0.0	34.6	55.8	0.8
5/08/2019 13:45	19.6	59.5	0.0	34.6	64.3	0.7
5/08/2019 13:50	19.8	59.2	0.0	34.6	70.9	0.7
5/08/2019 13:55	19.9	58.9	0.0	34.6	77.0	0.7
5/08/2019 14:00	19.8	59.1	0.0	30.1	67.5	0.8
5/08/2019 14:05	19.7	59.3	0.0	25.5	57.6	0.8
5/08/2019 14:10	19.7	59.4	0.0	25.5	65.0	0.7
5/08/2019 14:15	19.8	59.5	0.0	25.5	72.7	0.7
5/08/2019 14:20	19.6	60.4	0.0	25.5	73.2	0.8

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
5/08/2019 14:25	19.4	61.1	0.0	25.5	73.6	0.9
5/08/2019 14:30	19.4	61.9	0.0	25.5	69.8	0.9
5/08/2019 14:35	19.4	62.7	0.0	25.5	65.8	0.8
5/08/2019 14:40	19.3	63.3	0.0	25.5	68.2	0.8
5/08/2019 14:45	19.2	64.0	0.0	25.5	70.8	0.8
5/08/2019 14:50	19.1	64.4	0.0	25.5	67.2	0.8
5/08/2019 14:55	19.0	64.7	0.0	25.5	63.9	0.7
5/08/2019 15:00	19.1	64.4	0.0	22.9	67.7	0.7
5/08/2019 15:05	19.3	64.0	0.0	20.4	71.4	0.7
5/08/2019 15:10	19.1	64.1	0.0	20.4	69.7	0.7
5/08/2019 15:15	19.0	64.2	0.0	20.4	67.8	0.6
5/08/2019 15:20	19.0	64.1	0.0	20.4	60.1	0.6
5/08/2019 15:25	19.0	63.9	0.0	20.4	52.9	0.6
5/08/2019 15:30	19.1	63.3	0.0	20.4	62.4	0.7
5/08/2019 15:35	19.1	62.7	0.0	20.4	71.5	0.7
5/08/2019 15:40	19.1	62.3	0.0	20.4	65.5	0.6
5/08/2019 15:45	19.1	61.8	0.0	20.4	59.3	0.6
5/08/2019 15:50	19.2	61.4	0.0	20.4	53.5	0.6
5/08/2019 15:55	19.2	61.1	0.0	20.4	48.3	0.5
5/08/2019 16:00	19.3	60.5	0.0	21.2	53.2	0.4
5/08/2019 16:05	19.4	59.9	0.0	22.1	58.5	0.4
5/08/2019 16:10	19.4	59.2	0.0	22.1	58.9	0.4
5/08/2019 16:15	19.4	58.5	0.0	22.1	59.4	0.4
5/08/2019 16:20	19.4	57.4	0.0	22.1	60.4	0.4
5/08/2019 16:25	19.4	56.4	0.0	22.1	61.3	0.4
5/08/2019 16:30	19.3	55.8	0.0	22.1	61.3	0.4
5/08/2019 16:35	19.3	55.2	0.0	22.1	61.2	0.4
5/08/2019 16:40	19.1	56.1	0.0	22.1	53.7	0.3
5/08/2019 16:45	18.9	57.0	0.0	22.1	45.7	0.3

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
5/08/2019 16:50	18.7	56.9	0.0	22.1	40.5	0.3
5/08/2019 16:55	18.5	56.7	0.0	22.1	35.9	0.3
5/08/2019 17:00	18.0	58.9	0.0	21.4	35.3	0.2
5/08/2019 17:05	17.5	61.2	0.0	20.8	34.7	0.1
5/08/2019 17:10	16.6	67.2	0.0	20.8	153.7	0.1
5/08/2019 17:15	15.6	73.4	0.0	20.8	277.2	0.1
5/08/2019 17:20	14.9	78.1	0.0	20.8	286.1	0.1
5/08/2019 17:25	14.3	82.4	0.0	20.8	294.3	0.1
5/08/2019 17:30	13.9	83.7	0.0	20.8	288.2	0.0
5/08/2019 17:35	13.4	85.1	0.0	20.8	281.9	0.0
5/08/2019 17:40	13.0	87.0	0.0	20.8	256.1	0.1
5/08/2019 17:45	12.6	89.1	0.0	20.8	228.4	0.1
5/08/2019 17:50	12.3	90.1	0.0	20.8	234.6	0.1
5/08/2019 17:55	12.0	90.9	0.0	20.8	240.1	0.0
5/08/2019 18:00	11.6	92.2	0.0	22.0	258.7	0.0
5/08/2019 18:05	11.3	93.5	0.0	23.3	278.0	0.1
5/08/2019 18:10	11.1	94.4	0.0	23.3	280.0	0.1
5/08/2019 18:15	10.9	95.4	0.0	23.3	282.1	0.1
5/08/2019 18:20	10.7	95.7	0.0	23.3	260.1	0.1
5/08/2019 18:25	10.5	96.0	0.0	23.3	242.1	0.1
5/08/2019 18:30	10.2	96.1	0.0	23.3	265.8	0.1
5/08/2019 18:35	9.9	96.3	0.0	23.3	290.4	0.0
5/08/2019 18:40	9.9	96.7	0.0	23.3	292.5	0.0
5/08/2019 18:45	9.8	97.2	0.0	23.3	294.8	0.0
5/08/2019 18:50	9.5	97.2	0.0	23.3	290.1	0.0
5/08/2019 18:55	9.3	97.2	0.0	23.3	285.7	0.1
5/08/2019 19:00	9.1	97.4	0.0	27.1	284.1	0.1
5/08/2019 19:05	8.9	97.6	0.0	30.9	282.4	0.1
5/08/2019 19:10	8.8	97.8	0.0	30.9	255.2	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
5/08/2019 19:15	8.7	98.0	0.0	30.9	228.0	0.2
5/08/2019 19:20	8.5	97.9	0.0	30.9	251.1	0.1
5/08/2019 19:25	8.4	97.8	0.0	30.9	270.1	0.0
5/08/2019 19:30	8.4	98.0	0.0	30.9	142.3	0.0
5/08/2019 19:35	8.3	98.3	0.0	30.9	4.6	0.0
5/08/2019 19:40	8.0	98.2	0.0	30.9	114.4	0.0
5/08/2019 19:45	7.7	98.0	0.0	30.9	228.3	0.0
5/08/2019 19:50	7.5	98.1	0.0	30.9	264.2	0.1
5/08/2019 19:55	7.3	98.2	0.0	30.9	297.5	0.1
5/08/2019 20:00	7.2	98.3	0.0	28.8	282.4	0.1
5/08/2019 20:05	7.2	98.5	0.0	26.6	266.8	0.1
5/08/2019 20:10	7.0	98.5	0.0	26.6	258.7	0.1
5/08/2019 20:15	6.9	98.5	0.0	26.6	250.2	0.1
5/08/2019 20:20	6.9	98.7	0.0	26.6	232.2	0.1
5/08/2019 20:25	6.8	98.8	0.0	26.6	215.6	0.0
5/08/2019 20:30	6.9	98.8	0.0	26.6	223.2	0.0
5/08/2019 20:35	6.9	98.8	0.0	26.6	231.1	0.0
5/08/2019 20:40	6.5	98.7	0.0	26.6	259.2	0.1
5/08/2019 20:45	6.2	98.6	0.0	26.6	288.4	0.1
5/08/2019 20:50	6.2	98.8	0.0	26.6	262.9	0.0
5/08/2019 20:55	6.2	98.9	0.0	26.6	241.1	0.0
5/08/2019 21:00	6.2	98.9	0.0	26.0	265.3	0.0
5/08/2019 21:05	6.2	98.9	0.0	25.5	289.5	0.0
5/08/2019 21:10	6.1	98.9	0.0	25.5	298.0	0.0
5/08/2019 21:15	6.0	99.0	0.0	25.5	307.2	0.0
5/08/2019 21:20	5.8	98.9	0.0	25.5	307.3	0.0
5/08/2019 21:25	5.7	98.9	0.0	25.5	307.4	0.0
5/08/2019 21:30	5.7	99.0	0.0	25.5	306.8	0.0
5/08/2019 21:35	5.7	99.1	0.0	25.5	306.1	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
5/08/2019 21:40	5.6	99.0	0.0	25.5	285.4	0.0
5/08/2019 21:45	5.4	98.9	0.0	25.5	263.1	0.0
5/08/2019 21:50	5.2	99.0	0.0	25.5	283.4	0.0
5/08/2019 21:55	5.1	99.1	0.0	25.5	300.1	0.0
5/08/2019 22:00	5.2	99.1	0.0	12.7	267.1	0.0
5/08/2019 22:05	5.3	99.2	0.0	0.0	232.9	0.0
5/08/2019 22:10	5.1	99.2	0.0	0.0	225.9	0.0
5/08/2019 22:15	5.0	99.1	0.0	0.0	218.6	0.0
5/08/2019 22:20	4.7	99.0	0.0	0.0	239.5	0.0
5/08/2019 22:25	4.5	99.0	0.0	0.0	258.8	0.0
5/08/2019 22:30	4.5	99.0	0.0	0.0	268.7	0.0
5/08/2019 22:35	4.4	99.1	0.0	0.0	279.3	0.0
5/08/2019 22:40	4.2	99.2	0.0	0.0	307.8	0.0
5/08/2019 22:45	4.1	99.2	0.0	0.0	334.2	0.0
5/08/2019 22:50	4.1	99.3	0.0	0.0	304.2	0.0
5/08/2019 22:55	4.2	99.3	0.0	0.0	277.5	0.1
5/08/2019 23:00	4.1	99.3	0.0	4.7	257.4	0.1
5/08/2019 23:05	3.9	99.2	0.0	9.4	236.5	0.0
5/08/2019 23:10	3.7	99.2	0.0	9.4	243.0	0.0
5/08/2019 23:15	3.4	99.1	0.0	9.4	249.5	0.0
5/08/2019 23:20	3.5	99.2	0.0	9.4	249.8	0.0
5/08/2019 23:25	3.5	99.3	0.0	9.4	250.1	0.1
5/08/2019 23:30	3.5	99.3	0.0	9.4	247.4	0.0
5/08/2019 23:35	3.4	99.3	0.0	9.4	244.7	0.0
5/08/2019 23:40	3.4	99.3	0.0	9.4	248.2	0.0
5/08/2019 23:45	3.3	99.3	0.0	9.4	251.7	0.1
5/08/2019 23:50	3.3	99.3	0.0	9.4	250.8	0.1
5/08/2019 23:55	3.2	99.3	0.0	9.4	250.0	0.1
6/08/2019 0:00	3.2	99.3	0.0	8.6	253.3	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
6/08/2019 0:05	3.1	99.3	0.0	7.8	256.8	0.0
6/08/2019 0:10	3.0	99.3	0.0	7.8	257.2	0.0
6/08/2019 0:15	2.9	99.3	0.0	7.8	257.6	0.0
6/08/2019 0:20	2.7	99.3	0.0	7.8	267.2	0.0
6/08/2019 0:25	2.5	99.3	0.0	7.8	275.7	0.0
6/08/2019 0:30	2.4	99.3	0.0	7.8	276.8	0.0
6/08/2019 0:35	2.3	99.4	0.0	7.8	278.0	0.0
6/08/2019 0:40	2.3	99.4	0.0	7.8	267.5	0.0
6/08/2019 0:45	2.2	99.4	0.0	7.8	257.7	0.0
6/08/2019 0:50	2.2	99.4	0.0	7.8	278.8	0.0
6/08/2019 0:55	2.1	99.4	0.0	7.8	296.8	0.1
6/08/2019 1:00	2.0	99.4	0.0	14.1	250.4	0.1
6/08/2019 1:05	1.9	99.4	0.0	20.4	202.2	0.0
6/08/2019 1:10	2.0	99.5	0.0	20.4	154.1	0.1
6/08/2019 1:15	2.1	99.6	0.0	20.4	104.2	0.1
6/08/2019 1:20	2.0	99.5	0.0	20.4	142.3	0.1
6/08/2019 1:25	1.9	99.5	0.0	20.4	177.5	0.1
6/08/2019 1:30	1.8	99.5	0.0	20.4	207.2	0.1
6/08/2019 1:35	1.7	99.5	0.0	20.4	238.0	0.1
6/08/2019 1:40	1.5	99.5	0.0	20.4	237.9	0.1
6/08/2019 1:45	1.4	99.5	0.0	20.4	237.9	0.1
6/08/2019 1:50	1.3	99.5	0.0	20.4	228.8	0.1
6/08/2019 1:55	1.3	99.5	0.0	20.4	220.7	0.0
6/08/2019 2:00	1.1	99.5	0.0	37.5	245.7	0.1
6/08/2019 2:05	0.8	99.5	0.0	54.6	273.5	0.1
6/08/2019 2:10	0.7	99.5	0.0	54.6	286.0	0.1
6/08/2019 2:15	0.6	99.6	0.0	54.6	299.0	0.0
6/08/2019 2:20	0.6	99.6	0.0	54.6	308.1	0.0
6/08/2019 2:25	0.6	99.6	0.0	54.6	316.2	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
6/08/2019 2:30	0.7	99.6	0.0	54.6	290.5	0.0
6/08/2019 2:35	0.8	99.6	0.0	54.6	262.8	0.0
6/08/2019 2:40	0.7	99.6	0.0	54.6	244.3	0.0
6/08/2019 2:45	0.7	99.6	0.0	54.6	227.1	0.0
6/08/2019 2:50	0.5	99.5	0.0	54.6	264.2	0.0
6/08/2019 2:55	0.3	99.5	0.0	54.6	298.6	0.0
6/08/2019 3:00	0.3	99.5	0.0	32.7	272.9	0.0
6/08/2019 3:05	0.3	99.6	0.0	10.8	244.3	0.0
6/08/2019 3:10	0.4	99.6	0.0	10.8	234.1	0.1
6/08/2019 3:15	0.5	99.6	0.0	10.8	223.5	0.1
6/08/2019 3:20	0.4	99.6	0.0	10.8	206.6	0.1
6/08/2019 3:25	0.3	99.6	0.0	10.8	190.9	0.0
6/08/2019 3:30	0.1	99.6	0.0	10.8	188.0	0.0
6/08/2019 3:35	-0.1	99.6	0.0	10.8	184.6	0.0
6/08/2019 3:40	0.0	99.6	0.0	10.8	213.6	0.1
6/08/2019 3:45	0.2	99.7	0.0	10.8	245.9	0.1
6/08/2019 3:50	0.0	99.6	0.0	10.8	234.1	0.1
6/08/2019 3:55	0.0	99.6	0.0	10.8	224.0	0.1
6/08/2019 4:00	0.0	99.6	0.0	17.2	235.6	0.1
6/08/2019 4:05	0.1	99.7	0.0	23.6	248.1	0.1
6/08/2019 4:10	0.0	99.7	0.0	23.6	264.9	0.1
6/08/2019 4:15	-0.2	99.6	0.0	23.6	282.4	0.2
6/08/2019 4:20	-0.1	99.7	0.0	23.6	277.3	0.1
6/08/2019 4:25	0.0	99.7	0.0	23.6	273.0	0.1
6/08/2019 4:30	-0.1	99.7	0.0	23.6	271.9	0.1
6/08/2019 4:35	-0.2	99.6	0.0	23.6	270.8	0.1
6/08/2019 4:40	-0.3	99.6	0.0	23.6	282.8	0.1
6/08/2019 4:45	-0.4	99.7	0.0	23.6	294.7	0.1
6/08/2019 4:50	-0.4	99.7	0.0	23.6	272.4	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
6/08/2019 4:55	-0.3	99.7	0.0	23.6	251.7	0.1
6/08/2019 5:00	-0.4	99.7	0.0	24.3	224.8	0.1
6/08/2019 5:05	-0.5	99.7	0.0	25.1	193.7	0.0
6/08/2019 5:10	-0.5	99.7	0.0	25.1	236.8	0.0
6/08/2019 5:15	-0.6	99.8	0.0	25.1	283.2	0.0
6/08/2019 5:20	-0.6	99.7	0.0	25.1	267.1	0.0
6/08/2019 5:25	-0.6	99.7	0.0	25.1	252.2	0.0
6/08/2019 5:30	-0.7	99.7	0.0	25.1	246.8	0.0
6/08/2019 5:35	-0.7	99.7	0.0	25.1	241.0	0.1
6/08/2019 5:40	-0.8	99.7	0.0	25.1	237.1	0.1
6/08/2019 5:45	-0.8	99.7	0.0	25.1	233.1	0.1
6/08/2019 5:50	-0.9	99.7	0.0	25.1	255.4	0.1
6/08/2019 5:55	-1.0	99.7	0.0	25.1	277.7	0.1
6/08/2019 6:00	-1.0	99.7	0.0	23.6	252.4	0.1
6/08/2019 6:05	-1.0	99.7	0.0	22.1	225.1	0.1
6/08/2019 6:10	-1.0	99.7	0.0	22.1	166.9	0.1
6/08/2019 6:15	-1.1	99.8	0.0	22.1	104.4	0.1
6/08/2019 6:20	-0.9	99.8	0.0	22.1	125.4	0.1
6/08/2019 6:25	-0.8	99.8	0.0	22.1	144.9	0.0
6/08/2019 6:30	-0.9	99.7	0.0	22.1	195.0	0.1
6/08/2019 6:35	-1.1	99.7	0.0	22.1	243.4	0.1
6/08/2019 6:40	-1.1	99.7	0.0	22.1	235.8	0.1
6/08/2019 6:45	-1.2	99.7	0.0	22.1	227.4	0.1
6/08/2019 6:50	-1.2	99.7	0.0	22.1	236.8	0.1
6/08/2019 6:55	-1.3	99.7	0.0	22.1	245.5	0.1
6/08/2019 7:00	-1.3	99.7	0.0	31.4	259.0	0.1
6/08/2019 7:05	-1.3	99.8	0.0	40.7	272.9	0.1
6/08/2019 7:10	-1.2	99.8	0.0	40.7	270.1	0.1
6/08/2019 7:15	-1.0	99.8	0.0	40.7	267.0	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
6/08/2019 7:20	-0.8	99.9	0.0	40.7	263.8	0.1
6/08/2019 7:25	-0.7	99.9	0.0	40.7	260.9	0.0
6/08/2019 7:30	-0.5	99.9	0.0	40.7	264.4	0.0
6/08/2019 7:35	-0.3	99.9	0.0	40.7	267.9	0.0
6/08/2019 7:40	-0.2	99.9	0.0	40.7	279.7	0.0
6/08/2019 7:45	0.0	99.8	0.0	40.7	291.9	0.0
6/08/2019 7:50	0.5	99.9	0.0	40.7	286.7	0.1
6/08/2019 7:55	1.0	100.0	0.0	40.7	282.0	0.1
6/08/2019 8:00	1.7	100.0	0.0	27.3	256.5	0.1
6/08/2019 8:05	2.3	100.0	0.0	14.0	230.1	0.0
6/08/2019 8:10	3.0	100.0	0.0	14.0	245.6	0.0
6/08/2019 8:15	3.6	100.0	0.0	14.0	261.7	0.0
6/08/2019 8:20	4.0	99.9	0.0	14.0	286.9	0.0
6/08/2019 8:25	4.4	99.8	0.0	14.0	308.4	0.0
6/08/2019 8:30	5.0	99.8	0.0	14.0	281.3	0.0
6/08/2019 8:35	5.6	99.9	0.0	14.0	253.2	0.0
6/08/2019 8:40	5.7	99.8	0.0	14.0	273.4	0.1
6/08/2019 8:45	5.8	99.7	0.0	14.0	296.0	0.1
6/08/2019 8:50	6.1	99.7	0.0	14.0	281.7	0.1
6/08/2019 8:55	6.4	99.7	0.0	14.0	269.5	0.1
6/08/2019 9:00	6.8	99.5	0.0	19.6	257.8	0.1
6/08/2019 9:05	7.1	99.2	0.0	25.1	245.7	0.1
6/08/2019 9:10	7.7	98.3	0.0	25.1	252.3	0.1
6/08/2019 9:15	8.2	97.4	0.0	25.1	258.9	0.1
6/08/2019 9:20	8.7	95.5	0.0	25.1	258.3	0.1
6/08/2019 9:25	9.1	93.9	0.0	25.1	257.7	0.1
6/08/2019 9:30	10.2	89.5	0.0	25.1	261.2	0.1
6/08/2019 9:35	11.2	85.2	0.0	25.1	264.6	0.1
6/08/2019 9:40	12.1	75.0	0.0	25.1	243.4	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
6/08/2019 9:45	13.0	64.4	0.0	25.1	221.4	0.1
6/08/2019 9:50	13.5	58.7	0.0	25.1	205.3	0.2
6/08/2019 9:55	13.9	53.1	0.0	25.1	189.2	0.3
6/08/2019 10:00	14.4	51.0	0.0	35.5	231.2	0.2
6/08/2019 10:05	15.0	48.7	0.0	45.9	278.1	0.2
6/08/2019 10:10	15.6	47.0	0.0	45.9	185.9	0.2
6/08/2019 10:15	16.2	45.2	0.0	45.9	93.6	0.2
6/08/2019 10:20	16.3	42.8	0.0	45.9	122.7	0.2
6/08/2019 10:25	16.4	40.8	0.0	45.9	146.4	0.2
6/08/2019 10:30	16.7	38.7	0.0	45.9	184.3	0.2
6/08/2019 10:35	17.0	36.2	0.0	45.9	226.5	0.2
6/08/2019 10:40	17.3	37.2	0.0	45.9	194.0	0.2
6/08/2019 10:45	17.6	38.4	0.0	45.9	156.4	0.2
6/08/2019 10:50	17.9	37.8	0.0	45.9	105.5	0.2
6/08/2019 10:55	18.2	37.2	0.0	45.9	62.1	0.2
6/08/2019 11:00	18.2	35.4	0.0	48.2	137.5	0.3
6/08/2019 11:05	18.3	33.6	0.0	50.6	212.8	0.3
6/08/2019 11:10	18.6	33.8	0.0	50.6	187.0	0.3
6/08/2019 11:15	18.8	34.1	0.0	50.6	159.3	0.3
6/08/2019 11:20	18.9	32.3	0.0	50.6	119.0	0.4
6/08/2019 11:25	19.0	30.9	0.0	50.6	84.4	0.4
6/08/2019 11:30	19.0	31.1	0.0	50.6	99.4	0.4
6/08/2019 11:35	18.9	31.4	0.0	50.6	115.0	0.4
6/08/2019 11:40	19.1	30.3	0.0	50.6	96.3	0.4
6/08/2019 11:45	19.2	29.2	0.0	50.6	76.2	0.4
6/08/2019 11:50	19.3	30.7	0.0	50.6	70.6	0.4
6/08/2019 11:55	19.3	32.0	0.0	50.6	65.7	0.4
6/08/2019 12:00	19.4	32.7	0.0	46.1	71.9	0.4
6/08/2019 12:05	19.4	33.4	0.0	41.7	78.8	0.4

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
6/08/2019 12:10	19.7	33.9	0.0	41.7	103.0	0.4
6/08/2019 12:15	20.0	34.4	0.0	41.7	129.0	0.3
6/08/2019 12:20	19.9	36.5	0.0	41.7	92.3	0.4
6/08/2019 12:25	19.8	38.2	0.0	41.7	61.1	0.5
6/08/2019 12:30	19.8	37.0	0.0	41.7	68.4	0.5
6/08/2019 12:35	19.8	35.8	0.0	41.7	76.4	0.4
6/08/2019 12:40	20.0	34.9	0.0	41.7	75.7	0.5
6/08/2019 12:45	20.2	33.9	0.0	41.7	74.9	0.5
6/08/2019 12:50	20.3	33.4	0.0	41.7	87.6	0.5
6/08/2019 12:55	20.4	33.0	0.0	41.7	98.9	0.4
6/08/2019 13:00	20.5	32.8	0.0	42.1	84.5	0.4
6/08/2019 13:05	20.6	32.5	0.0	42.6	69.1	0.5
6/08/2019 13:10	20.6	32.5	0.0	42.6	72.6	0.6
6/08/2019 13:15	20.5	32.5	0.0	42.6	76.2	0.7
6/08/2019 13:20	20.5	31.8	0.0	42.6	86.9	0.7
6/08/2019 13:25	20.5	31.1	0.0	42.6	96.9	0.7
6/08/2019 13:30	20.4	31.1	0.0	42.6	106.0	0.7
6/08/2019 13:35	20.3	31.1	0.0	42.6	114.8	0.7
6/08/2019 13:40	20.3	31.6	0.0	42.6	108.1	0.7
6/08/2019 13:45	20.4	32.0	0.0	42.6	101.1	0.7
6/08/2019 13:50	20.6	31.9	0.0	42.6	97.7	0.6
6/08/2019 13:55	20.8	31.8	0.0	42.6	94.5	0.5
6/08/2019 14:00	20.8	32.2	0.0	33.0	102.4	0.6
6/08/2019 14:05	20.7	32.5	0.0	23.5	110.6	0.6
6/08/2019 14:10	20.8	32.4	0.0	23.5	94.4	0.5
6/08/2019 14:15	21.0	32.2	0.0	23.5	77.7	0.5
6/08/2019 14:20	21.2	31.8	0.0	23.5	84.6	0.5
6/08/2019 14:25	21.4	31.5	0.0	23.5	91.0	0.4
6/08/2019 14:30	21.3	31.5	0.0	23.5	84.7	0.4

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
6/08/2019 14:35	21.3	31.6	0.0	23.5	78.2	0.4
6/08/2019 14:40	21.2	31.1	0.0	23.5	75.8	0.4
6/08/2019 14:45	21.1	30.6	0.0	23.5	73.3	0.4
6/08/2019 14:50	21.1	31.4	0.0	23.5	90.6	0.5
6/08/2019 14:55	21.0	32.2	0.0	23.5	105.9	0.5
6/08/2019 15:00	21.0	32.3	0.0	25.1	104.3	0.6
6/08/2019 15:05	21.1	32.5	0.0	26.7	102.7	0.6
6/08/2019 15:10	21.0	33.6	0.0	26.7	94.7	0.6
6/08/2019 15:15	20.9	34.8	0.0	26.7	86.5	0.7
6/08/2019 15:20	20.8	36.3	0.0	26.7	89.1	0.7
6/08/2019 15:25	20.8	37.7	0.0	26.7	91.4	0.7
6/08/2019 15:30	20.7	39.2	0.0	26.7	92.6	0.6
6/08/2019 15:35	20.5	40.9	0.0	26.7	93.9	0.6
6/08/2019 15:40	20.3	40.9	0.0	26.7	100.2	0.6
6/08/2019 15:45	20.2	40.9	0.0	26.7	107.0	0.6
6/08/2019 15:50	20.0	41.3	0.0	26.7	100.0	0.6
6/08/2019 15:55	19.9	41.7	0.0	26.7	93.7	0.6
6/08/2019 16:00	19.8	42.6	0.0	21.9	99.3	0.5
6/08/2019 16:05	19.7	43.4	0.0	17.1	105.2	0.4
6/08/2019 16:10	19.5	44.3	0.0	17.1	105.9	0.4
6/08/2019 16:15	19.4	45.1	0.0	17.1	106.5	0.5
6/08/2019 16:20	19.4	45.3	0.0	17.1	97.1	0.4
6/08/2019 16:25	19.4	45.4	0.0	17.1	89.1	0.4
6/08/2019 16:30	19.2	46.5	0.0	17.1	107.4	0.3
6/08/2019 16:35	19.1	47.7	0.0	17.1	126.4	0.3
6/08/2019 16:40	18.8	48.8	0.0	17.1	123.1	0.3
6/08/2019 16:45	18.5	49.9	0.0	17.1	119.8	0.4
6/08/2019 16:50	18.2	51.5	0.0	17.1	131.2	0.3
6/08/2019 16:55	17.9	52.8	0.0	17.1	140.6	0.2

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
6/08/2019 17:00	16.9	57.4	0.0	29.5	174.1	0.2
6/08/2019 17:05	15.8	62.1	0.0	41.9	208.9	0.2
6/08/2019 17:10	15.1	66.1	0.0	41.9	215.4	0.2
6/08/2019 17:15	14.3	70.3	0.0	41.9	222.2	0.2
6/08/2019 17:20	13.7	71.9	0.0	41.9	215.3	0.2
6/08/2019 17:25	13.3	73.3	0.0	41.9	209.3	0.2
6/08/2019 17:30	12.9	75.2	0.0	41.9	218.1	0.2
6/08/2019 17:35	12.4	77.0	0.0	41.9	226.6	0.2
6/08/2019 17:40	12.1	79.4	0.0	41.9	220.7	0.2
6/08/2019 17:45	11.8	81.9	0.0	41.9	214.4	0.2
6/08/2019 17:50	11.5	82.6	0.0	41.9	217.6	0.2
6/08/2019 17:55	11.3	83.2	0.0	41.9	220.5	0.2
6/08/2019 18:00	11.0	84.3	0.0	29.1	216.0	0.2
6/08/2019 18:05	10.8	85.5	0.0	16.2	211.3	0.2
6/08/2019 18:10	10.4	86.2	0.0	16.2	206.7	0.2
6/08/2019 18:15	9.9	87.0	0.0	16.2	202.0	0.2
6/08/2019 18:20	9.7	87.9	0.0	16.2	199.6	0.2
6/08/2019 18:25	9.6	88.8	0.0	16.2	197.2	0.3
6/08/2019 18:30	9.6	88.1	0.0	16.2	195.3	0.3
6/08/2019 18:35	9.7	87.4	0.0	16.2	193.5	0.4
6/08/2019 18:40	9.6	87.5	0.0	16.2	192.2	0.4
6/08/2019 18:45	9.6	87.6	0.0	16.2	190.9	0.4
6/08/2019 18:50	9.4	87.0	0.0	16.2	187.0	0.3
6/08/2019 18:55	9.3	86.4	0.0	16.2	183.4	0.3
6/08/2019 19:00	9.0	88.0	0.0	15.7	179.8	0.3
6/08/2019 19:05	8.7	89.6	0.0	15.1	176.1	0.3
6/08/2019 19:10	8.5	89.8	0.0	15.1	183.7	0.3
6/08/2019 19:15	8.2	89.9	0.0	15.1	191.4	0.2
6/08/2019 19:20	8.0	91.0	0.0	15.1	189.3	0.3

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
6/08/2019 19:25	7.8	92.0	0.0	15.1	187.4	0.3
6/08/2019 19:30	7.8	92.6	0.0	15.1	187.0	0.3
6/08/2019 19:35	7.7	93.1	0.0	15.1	186.6	0.3
6/08/2019 19:40	7.7	93.3	0.0	15.1	183.4	0.3
6/08/2019 19:45	7.7	93.6	0.0	15.1	180.1	0.3
6/08/2019 19:50	7.5	93.5	0.0	15.1	186.1	0.2
6/08/2019 19:55	7.4	93.5	0.0	15.1	191.4	0.2
6/08/2019 20:00	7.2	93.4	0.0	16.0	196.8	0.2
6/08/2019 20:05	7.0	93.3	0.0	16.9	202.3	0.2
6/08/2019 20:10	6.9	93.7	0.0	16.9	207.5	0.2
6/08/2019 20:15	6.7	94.2	0.0	16.9	213.0	0.2
6/08/2019 20:20	6.2	94.0	0.0	16.9	226.5	0.2
6/08/2019 20:25	5.7	93.9	0.0	16.9	238.5	0.2
6/08/2019 20:30	5.8	94.9	0.0	16.9	246.1	0.3
6/08/2019 20:35	5.8	95.9	0.0	16.9	253.9	0.3
6/08/2019 20:40	5.7	96.2	0.0	16.9	246.1	0.2
6/08/2019 20:45	5.6	96.5	0.0	16.9	238.4	0.1
6/08/2019 20:50	5.6	96.8	0.0	16.9	135.3	0.1
6/08/2019 20:55	5.6	97.1	0.0	16.9	43.7	0.1
6/08/2019 21:00	5.5	97.2	0.0	37.4	79.8	0.1
6/08/2019 21:05	5.3	97.3	0.0	57.9	117.2	0.0
6/08/2019 21:10	5.3	97.5	0.0	57.9	146.5	0.1
6/08/2019 21:15	5.2	97.7	0.0	57.9	175.9	0.1
6/08/2019 21:20	4.9	97.6	0.0	57.9	210.8	0.1
6/08/2019 21:25	4.7	97.6	0.0	57.9	240.5	0.1
6/08/2019 21:30	4.6	97.8	0.0	57.9	233.9	0.1
6/08/2019 21:35	4.5	98.0	0.0	57.9	227.3	0.2
6/08/2019 21:40	4.3	97.9	0.0	57.9	237.7	0.1
6/08/2019 21:45	4.1	97.8	0.0	57.9	248.9	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
6/08/2019 21:50	4.0	98.0	0.0	57.9	270.0	0.1
6/08/2019 21:55	3.9	98.1	0.0	57.9	289.6	0.1
6/08/2019 22:00	3.8	98.2	0.0	41.6	288.8	0.1
6/08/2019 22:05	3.8	98.3	0.0	25.2	288.0	0.1
6/08/2019 22:10	3.8	98.4	0.0	25.2	288.3	0.1
6/08/2019 22:15	3.7	98.5	0.0	25.2	288.5	0.1
6/08/2019 22:20	3.6	98.5	0.0	25.2	280.1	0.1
6/08/2019 22:25	3.6	98.5	0.0	25.2	272.7	0.1
6/08/2019 22:30	3.3	98.5	0.0	25.2	262.9	0.1
6/08/2019 22:35	3.0	98.5	0.0	25.2	252.7	0.1
6/08/2019 22:40	3.1	98.6	0.0	25.2	251.9	0.1
6/08/2019 22:45	3.2	98.7	0.0	25.2	251.2	0.0
6/08/2019 22:50	3.0	98.6	0.0	25.2	262.2	0.1
6/08/2019 22:55	2.8	98.5	0.0	25.2	271.9	0.1
6/08/2019 23:00	2.8	98.7	0.0	20.7	276.2	0.1
6/08/2019 23:05	2.9	98.9	0.0	16.3	280.7	0.1
6/08/2019 23:10	2.7	98.8	0.0	16.3	292.0	0.0
6/08/2019 23:15	2.4	98.7	0.0	16.3	303.7	0.0
6/08/2019 23:20	2.5	98.8	0.0	16.3	301.7	0.0
6/08/2019 23:25	2.5	98.9	0.0	16.3	299.9	0.0
6/08/2019 23:30	2.4	98.9	0.0	16.3	293.4	0.1
6/08/2019 23:35	2.3	98.9	0.0	16.3	286.6	0.1
6/08/2019 23:40	2.2	98.9	0.0	16.3	291.4	0.1
6/08/2019 23:45	2.1	98.9	0.0	16.3	296.4	0.0
6/08/2019 23:50	2.0	99.0	0.0	16.3	286.8	0.0
6/08/2019 23:55	1.9	99.1	0.0	16.3	277.6	0.0
7/08/2019 0:00	1.9	99.0	0.0	16.9	246.8	0.0
7/08/2019 0:05	1.8	99.0	0.0	17.4	216.0	0.0
7/08/2019 0:10	1.8	99.0	0.0	17.4	238.6	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
7/08/2019 0:15	1.7	99.1	0.0	17.4	262.1	0.1
7/08/2019 0:20	1.6	99.1	0.0	17.4	258.3	0.1
7/08/2019 0:25	1.5	99.1	0.0	17.4	255.1	0.1
7/08/2019 0:30	1.5	99.1	0.0	17.4	250.8	0.1
7/08/2019 0:35	1.5	99.2	0.0	17.4	246.4	0.0
7/08/2019 0:40	1.4	99.2	0.0	17.4	247.8	0.1
7/08/2019 0:45	1.2	99.1	0.0	17.4	249.2	0.1
7/08/2019 0:50	1.1	99.2	0.0	17.4	270.7	0.0
7/08/2019 0:55	1.0	99.2	0.0	17.4	289.1	0.0
7/08/2019 1:00	0.9	99.2	0.0	14.8	280.6	0.0
7/08/2019 1:05	0.8	99.2	0.0	12.2	272.4	0.0
7/08/2019 1:10	0.8	99.2	0.0	12.2	276.9	0.0
7/08/2019 1:15	0.8	99.3	0.0	12.2	281.5	0.0
7/08/2019 1:20	0.8	99.3	0.0	12.2	276.1	0.0
7/08/2019 1:25	0.7	99.3	0.0	12.2	271.2	0.0
7/08/2019 1:30	0.7	99.3	0.0	12.2	266.7	0.0
7/08/2019 1:35	0.7	99.3	0.0	12.2	261.6	0.0
7/08/2019 1:40	0.7	99.4	0.0	12.2	283.9	0.0
7/08/2019 1:45	0.7	99.4	0.0	12.2	306.3	0.0
7/08/2019 1:50	0.6	99.4	0.0	12.2	309.6	0.0
7/08/2019 1:55	0.6	99.4	0.0	12.2	312.4	0.0
7/08/2019 2:00	0.6	99.4	0.0	19.7	198.4	0.0
7/08/2019 2:05	0.6	99.5	0.0	27.2	75.9	0.0
7/08/2019 2:10	0.7	99.5	0.0	27.2	89.1	0.0
7/08/2019 2:15	0.8	99.5	0.0	27.2	102.9	0.1
7/08/2019 2:20	0.7	99.4	0.0	27.2	155.0	0.0
7/08/2019 2:25	0.6	99.4	0.0	27.2	199.4	0.0
7/08/2019 2:30	0.6	99.4	0.0	27.2	226.7	0.0
7/08/2019 2:35	0.5	99.4	0.0	27.2	253.1	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
7/08/2019 2:40	0.4	99.3	0.0	27.2	254.7	0.0
7/08/2019 2:45	0.2	99.2	0.0	27.2	256.4	0.0
7/08/2019 2:50	0.2	99.3	0.0	27.2	260.3	0.0
7/08/2019 2:55	0.1	99.4	0.0	27.2	264.0	0.0
7/08/2019 3:00	0.1	99.4	0.0	27.6	264.2	0.0
7/08/2019 3:05	0.2	99.5	0.0	27.9	264.4	0.0
7/08/2019 3:10	0.0	99.5	0.0	27.9	259.0	0.0
7/08/2019 3:15	0.0	99.4	0.0	27.9	253.3	0.0
7/08/2019 3:20	0.0	99.4	0.0	27.9	253.6	0.0
7/08/2019 3:25	0.0	99.4	0.0	27.9	253.8	0.0
7/08/2019 3:30	-0.1	99.4	0.0	27.9	247.8	0.0
7/08/2019 3:35	-0.2	99.4	0.0	27.9	241.5	0.0
7/08/2019 3:40	-0.3	99.4	0.0	27.9	252.7	0.0
7/08/2019 3:45	-0.4	99.4	0.0	27.9	264.0	0.0
7/08/2019 3:50	-0.4	99.5	0.0	27.9	276.3	0.0
7/08/2019 3:55	-0.4	99.5	0.0	27.9	287.2	0.0
7/08/2019 4:00	-0.4	99.5	0.0	15.3	279.8	0.0
7/08/2019 4:05	-0.4	99.4	0.0	2.6	271.9	0.0
7/08/2019 4:10	-0.4	99.4	0.0	2.6	260.6	0.0
7/08/2019 4:15	-0.5	99.5	0.0	2.6	248.5	0.0
7/08/2019 4:20	-0.5	99.5	0.0	2.6	263.9	0.0
7/08/2019 4:25	-0.5	99.5	0.0	2.6	278.6	0.0
7/08/2019 4:30	-0.5	99.5	0.0	2.6	280.5	0.0
7/08/2019 4:35	-0.5	99.6	0.0	2.6	282.5	0.0
7/08/2019 4:40	-0.6	99.6	0.0	2.6	282.5	0.0
7/08/2019 4:45	-0.7	99.5	0.0	2.6	282.5	0.0
7/08/2019 4:50	-0.7	99.5	0.0	2.6	279.2	0.0
7/08/2019 4:55	-0.7	99.5	0.0	2.6	276.4	0.0
7/08/2019 5:00	-0.7	99.5	0.0	3.3	265.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
7/08/2019 5:05	-0.8	99.6	0.0	4.0	253.2	0.0
7/08/2019 5:10	-0.8	99.6	0.0	4.0	247.2	0.0
7/08/2019 5:15	-0.8	99.5	0.0	4.0	240.9	0.0
7/08/2019 5:20	-0.9	99.6	0.0	4.0	244.6	0.0
7/08/2019 5:25	-1.0	99.6	0.0	4.0	248.2	0.0
7/08/2019 5:30	-1.0	99.6	0.0	4.0	242.2	0.0
7/08/2019 5:35	-1.0	99.6	0.0	4.0	236.1	0.1
7/08/2019 5:40	-1.1	99.5	0.0	4.0	254.0	0.0
7/08/2019 5:45	-1.2	99.5	0.0	4.0	271.9	0.0
7/08/2019 5:50	-1.2	99.5	0.0	4.0	269.9	0.0
7/08/2019 5:55	-1.3	99.5	0.0	4.0	268.2	0.0
7/08/2019 6:00	-1.2	99.5	0.0	3.2	251.4	0.0
7/08/2019 6:05	-1.1	99.6	0.0	2.4	234.6	0.1
7/08/2019 6:10	-1.3	99.6	0.0	2.4	250.4	0.0
7/08/2019 6:15	-1.5	99.5	0.0	2.4	267.4	0.0
7/08/2019 6:20	-1.5	99.6	0.0	2.4	268.4	0.0
7/08/2019 6:25	-1.5	99.6	0.0	2.4	269.2	0.0
7/08/2019 6:30	-1.4	99.6	0.0	2.4	254.6	0.0
7/08/2019 6:35	-1.3	99.7	0.0	2.4	239.4	0.0
7/08/2019 6:40	-1.3	99.7	0.0	2.4	237.4	0.0
7/08/2019 6:45	-1.4	99.6	0.0	2.4	235.3	0.0
7/08/2019 6:50	-1.4	99.6	0.0	2.4	230.9	0.1
7/08/2019 6:55	-1.4	99.6	0.0	2.4	227.0	0.1
7/08/2019 7:00	-1.4	99.6	0.0	2.5	232.4	0.1
7/08/2019 7:05	-1.4	99.6	0.0	2.6	238.2	0.0
7/08/2019 7:10	-1.3	99.7	0.0	2.6	247.8	0.1
7/08/2019 7:15	-1.2	99.8	0.0	2.6	257.8	0.1
7/08/2019 7:20	-0.9	99.8	0.0	2.6	262.4	0.0
7/08/2019 7:25	-0.6	99.8	0.0	2.6	266.1	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
7/08/2019 7:30	-0.2	99.8	0.0	2.6	247.1	0.0
7/08/2019 7:35	0.3	99.9	0.0	2.6	227.3	0.0
7/08/2019 7:40	0.6	99.9	0.0	2.6	242.7	0.0
7/08/2019 7:45	0.8	99.9	0.0	2.6	258.0	0.0
7/08/2019 7:50	0.9	99.8	0.0	2.6	263.2	0.0
7/08/2019 7:55	0.9	99.8	0.0	2.6	267.8	0.1
7/08/2019 8:00	1.5	99.9	0.0	4.9	271.8	0.0
7/08/2019 8:05	2.2	100.0	0.0	7.3	276.2	0.0
7/08/2019 8:10	2.7	100.0	0.0	7.3	262.2	0.0
7/08/2019 8:15	3.2	99.9	0.0	7.3	247.1	0.0
7/08/2019 8:20	3.7	99.8	0.0	7.3	246.8	0.0
7/08/2019 8:25	4.1	99.8	0.0	7.3	246.5	0.0
7/08/2019 8:30	4.9	99.8	0.0	7.3	251.5	0.0
7/08/2019 8:35	5.7	99.9	0.0	7.3	256.8	0.0
7/08/2019 8:40	5.9	99.8	0.0	7.3	239.3	0.0
7/08/2019 8:45	6.2	99.7	0.0	7.3	220.6	0.1
7/08/2019 8:50	6.6	99.5	0.0	7.3	229.9	0.1
7/08/2019 8:55	7.0	99.3	0.0	7.3	237.6	0.1
7/08/2019 9:00	7.5	98.7	0.0	14.0	236.4	0.1
7/08/2019 9:05	7.9	98.0	0.0	20.8	235.2	0.0
7/08/2019 9:10	8.8	93.2	0.0	20.8	244.1	0.1
7/08/2019 9:15	9.7	88.3	0.0	20.8	253.4	0.1
7/08/2019 9:20	10.8	79.1	0.0	20.8	244.8	0.1
7/08/2019 9:25	11.7	71.0	0.0	20.8	237.2	0.1
7/08/2019 9:30	12.1	68.2	0.0	20.8	204.9	0.1
7/08/2019 9:35	12.5	65.6	0.0	20.8	173.7	0.1
7/08/2019 9:40	13.0	64.0	0.0	20.8	181.8	0.1
7/08/2019 9:45	13.5	62.4	0.0	20.8	189.8	0.2
7/08/2019 9:50	13.9	60.9	0.0	20.8	188.1	0.2

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
7/08/2019 9:55	14.3	59.5	0.0	20.8	186.5	0.2
7/08/2019 10:00	14.9	57.3	0.0	37.5	210.0	0.2
7/08/2019 10:05	15.5	55.0	0.0	54.1	234.4	0.2
7/08/2019 10:10	16.4	51.9	0.0	54.1	217.8	0.1
7/08/2019 10:15	17.3	48.7	0.0	54.1	200.6	0.1
7/08/2019 10:20	17.9	44.8	0.0	54.1	161.7	0.2
7/08/2019 10:25	18.4	41.1	0.0	54.1	125.7	0.3
7/08/2019 10:30	18.6	38.9	0.0	54.1	111.9	0.3
7/08/2019 10:35	18.9	36.7	0.0	54.1	97.6	0.3
7/08/2019 10:40	19.0	35.2	0.0	54.1	122.0	0.3
7/08/2019 10:45	19.1	33.8	0.0	54.1	146.4	0.4
7/08/2019 10:50	19.4	33.6	0.0	54.1	188.2	0.3
7/08/2019 10:55	19.6	33.4	0.0	54.1	223.8	0.2
7/08/2019 11:00	19.8	32.6	0.0	47.3	228.1	0.3
7/08/2019 11:05	20.1	31.7	0.0	40.4	232.6	0.3
7/08/2019 11:10	20.3	31.5	0.0	40.4	221.2	0.3
7/08/2019 11:15	20.4	31.2	0.0	40.4	209.9	0.3
7/08/2019 11:20	20.5	30.5	0.0	40.4	211.6	0.3
7/08/2019 11:25	20.5	29.9	0.0	40.4	212.9	0.3
7/08/2019 11:30	20.8	28.8	0.0	40.4	239.3	0.4
7/08/2019 11:35	21.1	27.7	0.0	40.4	266.7	0.5
7/08/2019 11:40	21.4	25.8	0.0	40.4	265.6	0.5
7/08/2019 11:45	21.7	23.9	0.0	40.4	264.5	0.5
7/08/2019 11:50	21.9	23.2	0.0	40.4	264.5	0.5
7/08/2019 11:55	22.1	22.5	0.0	40.4	264.5	0.5
7/08/2019 12:00	22.1	22.5	0.0	44.7	271.6	0.6
7/08/2019 12:05	22.2	22.5	0.0	49.0	278.4	0.6
7/08/2019 12:10	22.2	22.3	0.0	49.0	273.6	0.7
7/08/2019 12:15	22.2	22.1	0.0	49.0	268.7	0.8

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
7/08/2019 12:20	22.3	22.1	0.0	49.0	273.8	0.7
7/08/2019 12:25	22.5	22.0	0.0	49.0	278.3	0.6
7/08/2019 12:30	22.4	21.8	0.0	49.0	280.9	0.8
7/08/2019 12:35	22.4	21.6	0.0	49.0	283.5	0.8
7/08/2019 12:40	22.4	21.7	0.0	49.0	267.4	0.8
7/08/2019 12:45	22.5	21.7	0.0	49.0	250.2	0.8
7/08/2019 12:50	22.7	21.5	0.0	49.0	260.7	0.7
7/08/2019 12:55	22.9	21.3	0.0	49.0	269.7	0.6
7/08/2019 13:00	22.8	21.0	0.0	44.3	280.1	0.8
7/08/2019 13:05	22.6	20.7	0.0	39.6	291.2	1.0
7/08/2019 13:10	22.6	20.8	0.0	39.6	253.3	0.7
7/08/2019 13:15	22.5	21.0	0.0	39.6	213.9	0.4
7/08/2019 13:20	22.7	21.3	0.0	39.6	223.4	0.5
7/08/2019 13:25	22.9	21.5	0.0	39.6	232.1	0.6
7/08/2019 13:30	23.0	21.3	0.0	39.6	239.1	0.6
7/08/2019 13:35	23.2	21.0	0.0	39.6	246.4	0.6
7/08/2019 13:40	23.3	20.7	0.0	39.6	257.8	0.7
7/08/2019 13:45	23.3	20.4	0.0	39.6	269.1	0.8
7/08/2019 13:50	23.5	20.2	0.0	39.6	279.6	0.8
7/08/2019 13:55	23.7	20.0	0.0	39.6	288.5	0.9
7/08/2019 14:00	23.5	19.6	0.0	40.6	282.4	1.0
7/08/2019 14:05	23.3	19.1	0.0	41.5	276.0	1.2
7/08/2019 14:10	23.2	18.7	0.0	41.5	272.3	1.1
7/08/2019 14:15	23.2	18.4	0.0	41.5	268.6	1.0
7/08/2019 14:20	23.2	18.3	0.0	41.5	261.3	0.9
7/08/2019 14:25	23.2	18.2	0.0	41.5	254.9	0.8
7/08/2019 14:30	23.3	18.0	0.0	41.5	255.1	0.8
7/08/2019 14:35	23.4	17.9	0.0	41.5	255.3	0.8
7/08/2019 14:40	23.3	17.9	0.0	41.5	262.0	0.9

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
7/08/2019 14:45	23.3	17.9	0.0	41.5	269.2	0.9
7/08/2019 14:50	23.1	17.9	0.0	41.5	260.6	0.9
7/08/2019 14:55	23.0	17.9	0.0	41.5	253.2	0.9
7/08/2019 15:00	23.2	18.1	0.0	36.1	258.4	0.7
7/08/2019 15:05	23.3	18.3	0.0	30.7	263.6	0.5
7/08/2019 15:10	23.4	18.4	0.0	30.7	272.2	0.5
7/08/2019 15:15	23.6	18.6	0.0	30.7	281.4	0.5
7/08/2019 15:20	23.5	18.9	0.0	30.7	269.9	0.5
7/08/2019 15:25	23.4	19.1	0.0	30.7	259.3	0.5
7/08/2019 15:30	23.2	18.9	0.0	30.7	262.6	0.6
7/08/2019 15:35	23.0	18.7	0.0	30.7	266.1	0.7
7/08/2019 15:40	23.0	18.9	0.0	30.7	262.1	0.6
7/08/2019 15:45	23.0	19.0	0.0	30.7	257.9	0.5
7/08/2019 15:50	22.8	19.2	0.0	30.7	253.7	0.6
7/08/2019 15:55	22.7	19.4	0.0	30.7	250.0	0.8
7/08/2019 16:00	22.6	19.2	0.0	31.7	257.4	0.7
7/08/2019 16:05	22.6	19.0	0.0	32.6	264.5	0.6
7/08/2019 16:10	22.5	19.1	0.0	32.6	260.0	0.6
7/08/2019 16:15	22.5	19.2	0.0	32.6	254.9	0.6
7/08/2019 16:20	22.3	19.6	0.0	32.6	263.6	0.5
7/08/2019 16:25	22.2	20.0	0.0	32.6	271.3	0.4
7/08/2019 16:30	22.2	20.2	0.0	32.6	263.0	0.4
7/08/2019 16:35	22.1	20.4	0.0	32.6	254.0	0.3
7/08/2019 16:40	21.9	20.7	0.0	32.6	252.6	0.4
7/08/2019 16:45	21.7	21.0	0.0	32.6	251.1	0.4
7/08/2019 16:50	21.2	22.5	0.0	32.6	247.7	0.3
7/08/2019 16:55	20.8	23.7	0.0	32.6	244.8	0.3
7/08/2019 17:00	20.1	25.3	0.0	30.5	247.9	0.2
7/08/2019 17:05	19.4	26.7	0.0	28.3	250.9	0.2

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
7/08/2019 17:10	18.7	28.8	0.0	28.3	251.1	0.2
7/08/2019 17:15	18.0	31.1	0.0	28.3	251.3	0.2
7/08/2019 17:20	17.3	34.7	0.0	28.3	241.0	0.1
7/08/2019 17:25	16.5	38.1	0.0	28.3	231.5	0.1
7/08/2019 17:30	15.5	41.6	0.0	28.3	222.4	0.1
7/08/2019 17:35	14.3	45.3	0.0	28.3	212.6	0.2
7/08/2019 17:40	13.8	47.9	0.0	28.3	216.9	0.2
7/08/2019 17:45	13.3	50.5	0.0	28.3	221.3	0.2
7/08/2019 17:50	12.9	52.7	0.0	28.3	220.3	0.2
7/08/2019 17:55	12.5	54.5	0.0	28.3	219.5	0.2
7/08/2019 18:00	12.0	56.7	0.0	33.3	262.5	0.2
7/08/2019 18:05	11.6	58.9	0.0	38.4	305.5	0.2
7/08/2019 18:10	11.3	60.8	0.0	38.4	280.7	0.1
7/08/2019 18:15	10.9	62.6	0.0	38.4	257.7	0.1
7/08/2019 18:20	10.3	64.7	0.0	38.4	260.6	0.1
7/08/2019 18:25	9.6	66.6	0.0	38.4	263.1	0.2
7/08/2019 18:30	9.6	68.7	0.0	38.4	257.7	0.1
7/08/2019 18:35	9.5	70.8	0.0	38.4	252.0	0.1
7/08/2019 18:40	9.3	71.6	0.0	38.4	259.8	0.1
7/08/2019 18:45	9.0	72.5	0.0	38.4	268.2	0.1
7/08/2019 18:50	8.7	74.2	0.0	38.4	242.5	0.0
7/08/2019 18:55	8.4	75.7	0.0	38.4	219.7	0.0
7/08/2019 19:00	8.4	76.1	0.0	33.3	227.9	0.1
7/08/2019 19:05	8.5	76.5	0.0	28.2	236.8	0.1
7/08/2019 19:10	8.1	77.5	0.0	28.2	261.4	0.1
7/08/2019 19:15	7.8	78.4	0.0	28.2	286.0	0.1
7/08/2019 19:20	7.6	79.6	0.0	28.2	214.9	0.1
7/08/2019 19:25	7.5	80.6	0.0	28.2	152.0	0.1
7/08/2019 19:30	7.4	80.8	0.0	28.2	139.9	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
7/08/2019 19:35	7.4	81.0	0.0	28.2	128.2	0.1
7/08/2019 19:40	7.1	81.2	0.0	28.2	179.3	0.1
7/08/2019 19:45	6.9	81.4	0.0	28.2	234.4	0.1
7/08/2019 19:50	6.6	82.5	0.0	28.2	241.7	0.2
7/08/2019 19:55	6.3	83.4	0.0	28.2	247.7	0.2
7/08/2019 20:00	6.2	85.0	0.0	43.1	246.0	0.2
7/08/2019 20:05	6.2	86.6	0.0	58.1	244.2	0.2
7/08/2019 20:10	6.1	86.0	0.0	58.1	228.4	0.1
7/08/2019 20:15	6.0	85.3	0.0	58.1	212.6	0.1
7/08/2019 20:20	5.8	86.4	0.0	58.1	220.5	0.1
7/08/2019 20:25	5.6	87.5	0.0	58.1	227.8	0.1
7/08/2019 20:30	5.6	88.2	0.0	58.1	264.0	0.1
7/08/2019 20:35	5.6	89.0	0.0	58.1	300.2	0.1
7/08/2019 20:40	5.5	89.8	0.0	58.1	280.6	0.1
7/08/2019 20:45	5.4	90.6	0.0	58.1	261.7	0.1
7/08/2019 20:50	5.3	90.2	0.0	58.1	270.8	0.1
7/08/2019 20:55	5.2	89.9	0.0	58.1	279.2	0.0
7/08/2019 21:00	5.1	90.4	0.0	50.4	241.6	0.1
7/08/2019 21:05	5.0	90.9	0.0	42.7	201.3	0.1
7/08/2019 21:10	5.0	91.5	0.0	42.7	191.3	0.1
7/08/2019 21:15	4.9	92.2	0.0	42.7	180.6	0.0
7/08/2019 21:20	5.2	91.7	0.0	42.7	102.7	0.0
7/08/2019 21:25	5.4	91.2	0.0	42.7	36.4	0.0
7/08/2019 21:30	5.4	90.6	0.0	42.7	130.0	0.1
7/08/2019 21:35	5.5	90.0	0.0	42.7	227.0	0.1
7/08/2019 21:40	5.3	89.7	0.0	42.7	227.0	0.1
7/08/2019 21:45	5.2	89.4	0.0	42.7	226.9	0.1
7/08/2019 21:50	5.2	89.5	0.0	42.7	252.9	0.1
7/08/2019 21:55	5.1	89.6	0.0	42.7	276.1	0.1

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
7/08/2019 22:00	5.2	90.0	0.0	35.5	221.8	0.1
7/08/2019 22:05	5.3	90.5	0.0	28.3	163.5	0.1
7/08/2019 22:10	5.4	90.4	0.0	28.3	204.5	0.1
7/08/2019 22:15	5.5	90.2	0.0	28.3	250.3	0.1
7/08/2019 22:20	5.5	90.0	0.0	28.3	259.6	0.0
7/08/2019 22:25	5.4	89.8	0.0	28.3	268.2	0.0
7/08/2019 22:30	5.4	90.4	0.0	28.3	240.0	0.0
7/08/2019 22:35	5.4	91.0	0.0	28.3	210.8	0.0
7/08/2019 22:40	5.5	91.1	0.0	28.3	213.2	0.0
7/08/2019 22:45	5.5	91.3	0.0	28.3	215.6	0.1
7/08/2019 22:50	5.5	91.2	0.0	28.3	229.5	0.1
7/08/2019 22:55	5.5	91.1	0.0	28.3	242.4	0.1
7/08/2019 23:00	5.5	91.1	0.0	22.8	261.5	0.0
7/08/2019 23:05	5.6	91.1	0.0	17.3	282.0	0.0
7/08/2019 23:10	5.6	90.9	0.0	17.3	263.6	0.0
7/08/2019 23:15	5.7	90.8	0.0	17.3	246.6	0.0
7/08/2019 23:20	5.8	90.5	0.0	17.3	228.5	0.0
7/08/2019 23:25	5.8	90.2	0.0	17.3	213.6	0.1
7/08/2019 23:30	5.8	90.1	0.0	17.3	258.4	0.0
7/08/2019 23:35	5.8	90.0	0.0	17.3	304.8	0.0
7/08/2019 23:40	5.7	90.2	0.0	17.3	266.0	0.0
7/08/2019 23:45	5.7	90.5	0.0	17.3	224.3	0.1
7/08/2019 23:50	5.4	91.3	0.0	17.3	156.5	0.0
7/08/2019 23:55	5.2	91.9	0.0	17.3	98.4	0.0
8/08/2019 0:00	5.1	92.6	0.0	21.8	158.8	0.0
8/08/2019 0:05	5.0	93.3	0.0	26.4	219.2	0.0
8/08/2019 0:10	4.9	93.4	0.0	26.4	236.2	0.0
8/08/2019 0:15	4.8	93.6	0.0	26.4	253.2	0.0
8/08/2019 0:20	4.7	94.0	0.0	26.4	279.3	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
8/08/2019 0:25	4.6	94.3	0.0	26.4	301.6	0.0
8/08/2019 0:30	4.5	94.6	0.0	26.4	267.0	0.0
8/08/2019 0:35	4.4	95.0	0.0	26.4	231.1	0.0
8/08/2019 0:40	4.3	95.3	0.0	26.4	235.7	0.0
8/08/2019 0:45	4.2	95.5	0.0	26.4	240.3	0.0
8/08/2019 0:50	4.1	95.8	0.0	26.4	234.9	0.0
8/08/2019 0:55	4.0	96.0	0.0	26.4	230.2	0.0
8/08/2019 1:00	3.9	96.2	0.0	20.1	254.4	0.0
8/08/2019 1:05	3.8	96.5	0.0	13.8	279.4	0.0
8/08/2019 1:10	3.8	96.7	0.0	13.8	291.3	0.0
8/08/2019 1:15	3.7	96.9	0.0	13.8	303.7	0.0
8/08/2019 1:20	3.6	97.2	0.0	13.8	308.9	0.0
8/08/2019 1:25	3.6	97.4	0.0	13.8	314.0	0.0
8/08/2019 1:30	3.6	97.6	0.0	13.8	202.1	0.0
8/08/2019 1:35	3.7	97.8	0.0	13.8	90.2	0.0
8/08/2019 1:40	3.7	97.8	0.0	13.8	149.8	0.0
8/08/2019 1:45	3.7	97.7	0.0	13.8	213.8	0.0
8/08/2019 1:50	3.5	97.7	0.0	13.8	243.8	0.0
8/08/2019 1:55	3.3	97.7	0.0	13.8	271.5	0.0
8/08/2019 2:00	3.3	97.9	0.0	12.8	250.4	0.1

Table I.3 – Lake Macquarie AWS (26/07/2019 to 28/07/2019)

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 16:00	17.9	61.0	0.0	0.0	56.0	0.0
26/07/2019 16:01	17.8	62.0	0.0	0.0	56.0	0.0
26/07/2019 16:02	17.8	62.0	0.0	0.0	56.0	0.0
26/07/2019 16:03	17.7	62.0	0.0	0.0	56.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 16:04	17.8	62.0	0.0	0.0	56.0	0.0
26/07/2019 16:05	17.8	62.0	0.0	0.0	56.0	0.0
26/07/2019 16:06	17.7	62.0	0.0	0.0	56.0	0.0
26/07/2019 16:07	17.6	64.0	0.0	0.0	56.0	0.0
26/07/2019 16:08	17.5	63.0	0.0	0.0	56.0	0.0
26/07/2019 16:09	17.5	63.0	0.0	0.0	56.0	0.0
26/07/2019 16:10	17.5	62.0	0.0	0.0	56.0	0.0
26/07/2019 16:11	17.5	62.0	0.0	0.0	56.0	0.0
26/07/2019 16:12	17.5	63.0	0.0	0.0	56.0	0.0
26/07/2019 16:13	17.4	63.0	0.0	0.0	56.0	0.0
26/07/2019 16:14	17.4	63.0	0.0	0.0	56.0	0.0
26/07/2019 16:15	17.4	63.0	0.0	0.0	56.0	0.0
26/07/2019 16:16	17.3	64.0	0.0	0.0	56.0	0.0
26/07/2019 16:17	17.2	64.0	0.0	0.0	56.0	0.0
26/07/2019 16:18	17.1	64.0	0.0	0.0	56.0	0.0
26/07/2019 16:19	16.9	66.0	0.0	0.0	56.0	0.0
26/07/2019 16:20	16.7	65.0	0.0	0.0	56.0	0.0
26/07/2019 16:21	16.7	66.0	0.0	0.0	56.0	0.0
26/07/2019 16:22	16.6	67.0	0.0	0.0	56.0	0.0
26/07/2019 16:23	16.6	68.0	0.0	0.0	56.0	0.0
26/07/2019 16:24	16.6	68.0	0.0	0.0	56.0	0.0
26/07/2019 16:25	16.6	68.0	0.0	0.0	56.0	0.0
26/07/2019 16:26	16.5	68.0	0.0	0.0	56.0	0.0
26/07/2019 16:27	16.5	68.0	0.0	0.0	56.0	0.0
26/07/2019 16:28	16.4	68.0	0.0	0.0	56.0	0.0
26/07/2019 16:29	16.4	68.0	0.0	0.0	56.0	0.0
26/07/2019 16:30	16.4	68.0	0.0	0.0	56.0	0.0
26/07/2019 16:31	16.4	68.0	0.0	0.0	56.0	0.0
26/07/2019 16:32	16.3	69.0	0.0	0.0	56.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 16:33	16.3	69.0	0.0	0.0	56.0	0.0
26/07/2019 16:34	16.3	69.0	0.0	0.0	56.0	0.0
26/07/2019 16:35	16.3	70.0	0.0	0.0	56.0	0.0
26/07/2019 16:36	16.2	71.0	0.0	0.0	56.0	0.0
26/07/2019 16:37	16.2	71.0	0.0	0.0	56.0	0.0
26/07/2019 16:38	16.1	72.0	0.0	0.0	56.0	0.0
26/07/2019 16:39	16.0	72.0	0.0	0.0	56.0	0.0
26/07/2019 16:40	16.0	71.0	0.0	0.0	56.0	0.0
26/07/2019 16:41	15.9	71.0	0.0	0.0	56.0	0.0
26/07/2019 16:42	15.9	70.0	0.0	0.0	56.0	0.0
26/07/2019 16:43	15.9	71.0	0.0	0.0	56.0	0.0
26/07/2019 16:44	16.0	71.0	0.0	0.0	56.0	0.0
26/07/2019 16:45	16.0	71.0	0.0	0.0	56.0	0.0
26/07/2019 16:46	15.9	71.0	0.0	0.0	56.0	0.0
26/07/2019 16:47	15.8	71.0	0.0	0.0	56.0	0.0
26/07/2019 16:48	15.8	71.0	0.0	0.0	56.0	0.0
26/07/2019 16:49	15.8	71.0	0.0	0.0	56.0	0.0
26/07/2019 16:50	15.7	71.0	0.0	0.0	56.0	0.0
26/07/2019 16:51	15.6	72.0	0.0	0.0	56.0	0.0
26/07/2019 16:52	15.4	73.0	0.0	0.0	56.0	0.0
26/07/2019 16:53	15.3	73.0	0.0	0.0	56.0	0.0
26/07/2019 16:54	15.3	73.0	0.0	0.0	56.0	0.0
26/07/2019 16:55	15.3	73.0	0.0	0.0	56.0	0.0
26/07/2019 16:56	15.2	74.0	0.0	0.0	56.0	0.0
26/07/2019 16:57	15.1	75.0	0.0	0.0	56.0	0.0
26/07/2019 16:58	15.0	76.0	0.0	0.0	56.0	0.0
26/07/2019 16:59	14.9	77.0	0.0	0.0	56.0	0.0
26/07/2019 17:00	14.8	78.0	0.0	0.0	56.0	0.0
26/07/2019 17:01	14.7	79.0	0.0	0.0	56.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 17:02	14.6	79.0	0.0	0.0	56.0	0.0
26/07/2019 17:03	14.7	79.0	0.0	0.0	56.0	0.0
26/07/2019 17:04	14.7	79.0	0.0	0.0	56.0	0.0
26/07/2019 17:05	14.7	79.0	0.0	0.0	56.0	0.0
26/07/2019 17:06	14.8	80.0	0.0	0.0	56.0	0.0
26/07/2019 17:07	14.7	80.0	0.0	0.0	56.0	0.0
26/07/2019 17:08	14.6	79.0	0.0	0.0	56.0	0.0
26/07/2019 17:09	14.4	79.0	0.0	0.0	56.0	0.0
26/07/2019 17:10	14.4	79.0	0.0	0.0	56.0	0.0
26/07/2019 17:11	14.4	80.0	0.0	0.0	56.0	0.0
26/07/2019 17:12	14.4	80.0	0.0	0.0	56.0	0.0
26/07/2019 17:13	14.4	79.0	0.0	0.0	56.0	0.0
26/07/2019 17:14	14.4	79.0	0.0	0.0	56.0	0.0
26/07/2019 17:15	14.4	79.0	0.0	0.0	56.0	0.0
26/07/2019 17:16	14.4	79.0	0.0	0.0	56.0	0.0
26/07/2019 17:17	14.4	78.0	0.0	0.0	56.0	0.0
26/07/2019 17:18	14.4	79.0	0.0	0.0	56.0	0.0
26/07/2019 17:19	14.4	79.0	0.0	0.0	56.0	0.0
26/07/2019 17:20	14.4	79.0	0.0	0.0	56.0	0.0
26/07/2019 17:21	14.4	80.0	0.0	0.0	56.0	0.0
26/07/2019 17:22	14.3	80.0	0.0	0.0	56.0	0.0
26/07/2019 17:23	14.3	79.0	0.0	0.0	56.0	0.0
26/07/2019 17:24	14.3	79.0	0.0	0.0	56.0	0.0
26/07/2019 17:25	14.3	80.0	0.0	0.0	56.0	0.0
26/07/2019 17:26	14.2	80.0	0.0	0.0	56.0	0.0
26/07/2019 17:27	14.2	81.0	0.0	0.0	56.0	0.0
26/07/2019 17:28	14.2	81.0	0.0	0.0	56.0	0.0
26/07/2019 17:29	14.1	81.0	0.0	0.0	56.0	0.0
26/07/2019 17:30	14.0	82.0	0.0	0.0	56.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 17:31	13.9	82.0	0.0	0.0	56.0	0.0
26/07/2019 17:32	13.9	82.0	0.0	0.0	56.0	0.0
26/07/2019 17:33	13.8	82.0	0.0	0.0	56.0	0.0
26/07/2019 17:34	13.8	82.0	0.0	0.0	56.0	0.0
26/07/2019 17:35	13.7	83.0	0.0	0.0	56.0	0.0
26/07/2019 17:36	13.7	83.0	0.0	0.0	56.0	0.0
26/07/2019 17:37	13.6	84.0	0.0	0.0	56.0	0.0
26/07/2019 17:38	13.5	84.0	0.0	0.0	56.0	0.0
26/07/2019 17:39	13.5	85.0	0.0	0.0	56.0	0.0
26/07/2019 17:40	13.4	85.0	0.0	0.0	56.0	0.0
26/07/2019 17:41	13.4	85.0	0.0	0.0	56.0	0.0
26/07/2019 17:42	13.2	85.0	0.0	0.0	56.0	0.0
26/07/2019 17:43	13.2	86.0	0.0	0.0	56.0	0.0
26/07/2019 17:44	13.2	86.0	0.0	0.0	56.0	0.0
26/07/2019 17:45	13.1	86.0	0.0	0.0	56.0	0.0
26/07/2019 17:46	13.2	86.0	0.0	0.0	56.0	0.0
26/07/2019 17:47	13.3	87.0	0.0	0.0	56.0	0.0
26/07/2019 17:48	13.3	87.0	0.0	0.0	56.0	0.0
26/07/2019 17:49	13.3	86.0	0.0	0.0	56.0	0.0
26/07/2019 17:50	13.3	87.0	0.0	0.0	56.0	0.0
26/07/2019 17:51	13.3	87.0	0.0	0.0	56.0	0.0
26/07/2019 17:52	13.3	87.0	0.0	0.0	56.0	0.0
26/07/2019 17:53	13.3	87.0	0.0	0.0	56.0	0.0
26/07/2019 17:54	13.3	87.0	0.0	0.0	56.0	0.0
26/07/2019 17:55	13.3	86.0	0.0	0.0	56.0	0.0
26/07/2019 17:56	13.2	86.0	0.0	0.0	56.0	0.0
26/07/2019 17:57	13.1	87.0	0.0	0.0	56.0	0.0
26/07/2019 17:58	12.9	87.0	0.0	0.0	56.0	0.0
26/07/2019 17:59	12.9	87.0	0.0	0.0	56.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 18:00	12.9	87.0	0.0	0.0	56.0	0.0
26/07/2019 18:01	12.9	88.0	0.0	0.0	56.0	0.0
26/07/2019 18:02	12.8	88.0	0.0	0.0	56.0	0.0
26/07/2019 18:03	12.8	88.0	0.0	0.0	56.0	0.0
26/07/2019 18:04	12.8	88.0	0.0	0.0	56.0	0.0
26/07/2019 18:05	12.8	88.0	0.0	0.0	56.0	0.0
26/07/2019 18:06	12.7	88.0	0.0	0.0	56.0	0.0
26/07/2019 18:07	12.7	88.0	0.0	0.0	56.0	0.0
26/07/2019 18:08	12.6	87.0	0.0	0.0	56.0	0.0
26/07/2019 18:09	12.6	87.0	0.0	0.0	56.0	0.0
26/07/2019 18:10	12.6	87.0	0.0	0.0	56.0	0.0
26/07/2019 18:11	12.5	87.0	0.0	0.0	56.0	0.0
26/07/2019 18:12	12.5	87.0	0.0	0.0	56.0	0.0
26/07/2019 18:13	12.5	87.0	0.0	0.0	56.0	0.0
26/07/2019 18:14	12.5	88.0	0.0	0.0	56.0	0.0
26/07/2019 18:15	12.5	88.0	0.0	0.0	56.0	0.0
26/07/2019 18:16	12.5	88.0	0.0	0.0	56.0	0.0
26/07/2019 18:17	12.5	88.0	0.0	0.0	56.0	0.0
26/07/2019 18:18	12.5	87.0	0.0	0.0	56.0	0.0
26/07/2019 18:19	12.4	88.0	0.0	0.0	56.0	0.0
26/07/2019 18:20	12.4	88.0	0.0	0.0	56.0	0.0
26/07/2019 18:21	12.4	87.0	0.0	0.0	56.0	0.0
26/07/2019 18:22	12.4	87.0	0.0	0.0	56.0	0.0
26/07/2019 18:23	12.4	87.0	0.0	0.0	56.0	0.0
26/07/2019 18:24	12.4	88.0	0.0	0.0	56.0	0.0
26/07/2019 18:25	12.4	88.0	0.0	0.0	56.0	0.0
26/07/2019 18:26	12.4	87.0	0.0	0.0	56.0	0.0
26/07/2019 18:27	12.4	87.0	0.0	0.0	56.0	0.0
26/07/2019 18:28	12.4	87.0	0.0	0.0	56.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 18:29	12.3	88.0	0.0	0.0	56.0	0.0
26/07/2019 18:30	12.4	89.0	0.0	0.0	56.0	0.0
26/07/2019 18:31	12.4	89.0	0.0	0.0	56.0	0.0
26/07/2019 18:32	12.4	89.0	0.0	0.0	56.0	0.0
26/07/2019 18:33	12.4	89.0	0.0	0.0	56.0	0.0
26/07/2019 18:34	12.4	89.0	0.0	0.0	56.0	0.0
26/07/2019 18:35	12.4	89.0	0.0	0.0	56.0	0.0
26/07/2019 18:36	12.3	89.0	0.0	0.0	56.0	0.0
26/07/2019 18:37	12.3	90.0	0.0	0.0	56.0	0.0
26/07/2019 18:38	12.2	89.0	0.0	0.0	56.0	0.0
26/07/2019 18:39	12.2	89.0	0.0	0.0	56.0	0.0
26/07/2019 18:40	12.1	89.0	0.0	0.0	56.0	0.0
26/07/2019 18:41	12.2	89.0	0.0	0.0	56.0	0.0
26/07/2019 18:42	12.2	89.0	0.0	0.0	56.0	0.0
26/07/2019 18:43	12.2	90.0	0.0	0.0	56.0	0.0
26/07/2019 18:44	12.2	90.0	0.0	0.0	56.0	0.0
26/07/2019 18:45	12.1	89.0	0.0	0.0	56.0	0.0
26/07/2019 18:46	12.1	89.0	0.0	0.0	56.0	0.0
26/07/2019 18:47	12.1	90.0	0.0	0.0	56.0	0.0
26/07/2019 18:48	12.0	91.0	0.0	0.0	56.0	0.0
26/07/2019 18:49	12.0	91.0	0.0	0.0	56.0	0.0
26/07/2019 18:50	11.9	91.0	0.0	0.0	56.0	0.0
26/07/2019 18:51	11.9	91.0	0.0	0.0	56.0	0.0
26/07/2019 18:52	11.9	91.0	0.0	0.0	56.0	0.0
26/07/2019 18:53	11.9	91.0	0.0	0.0	56.0	0.0
26/07/2019 18:54	11.9	91.0	0.0	0.0	56.0	0.0
26/07/2019 18:55	11.8	91.0	0.0	0.0	56.0	0.0
26/07/2019 18:56	11.8	91.0	0.0	0.0	56.0	0.0
26/07/2019 18:57	11.8	91.0	0.0	0.0	56.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 18:58	11.8	91.0	0.0	0.0	56.0	0.0
26/07/2019 18:59	11.8	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:00	11.8	91.0	0.0	0.0	56.0	0.0
26/07/2019 19:01	11.9	91.0	0.0	0.0	56.0	0.0
26/07/2019 19:02	11.8	91.0	0.0	0.0	56.0	0.0
26/07/2019 19:03	11.8	91.0	0.0	0.0	56.0	0.0
26/07/2019 19:04	11.8	91.0	0.0	0.0	56.0	0.0
26/07/2019 19:05	11.8	91.0	0.0	0.0	56.0	0.0
26/07/2019 19:06	11.8	91.0	0.0	0.0	56.0	0.0
26/07/2019 19:07	11.8	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:08	11.8	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:09	11.8	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:10	11.7	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:11	11.6	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:12	11.6	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:13	11.6	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:14	11.5	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:15	11.5	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:16	11.5	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:17	11.5	91.0	0.0	0.0	56.0	0.0
26/07/2019 19:18	11.5	91.0	0.0	0.0	56.0	0.0
26/07/2019 19:19	11.5	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:20	11.5	91.0	0.0	0.0	56.0	0.0
26/07/2019 19:21	11.5	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:22	11.5	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:23	11.4	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:24	11.5	91.0	0.0	0.0	56.0	0.0
26/07/2019 19:25	11.5	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:26	11.5	92.0	0.0	0.0	56.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 19:27	11.4	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:28	11.4	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:29	11.4	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:30	11.3	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:31	11.3	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:32	11.3	92.0	0.0	0.0	56.0	0.0
26/07/2019 19:33	11.2	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:34	11.2	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:35	11.2	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:36	11.2	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:37	11.2	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:38	11.2	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:39	11.2	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:40	11.1	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:41	11.1	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:42	11.1	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:43	11.1	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:44	11.1	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:45	11.0	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:46	11.0	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:47	11.0	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:48	11.0	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:49	11.0	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:50	11.0	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:51	11.0	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:52	11.0	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:53	11.0	94.0	0.0	0.0	56.0	0.0
26/07/2019 19:54	11.0	94.0	0.0	0.0	56.0	0.0
26/07/2019 19:55	11.0	93.0	0.0	0.0	56.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 19:56	10.9	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:57	10.9	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:58	10.9	93.0	0.0	0.0	56.0	0.0
26/07/2019 19:59	10.9	93.0	0.0	0.0	56.0	0.0
26/07/2019 20:00	10.9	93.0	0.0	0.0	56.0	0.0
26/07/2019 20:01	10.9	93.0	0.0	0.0	56.0	0.0
26/07/2019 20:02	10.9	93.0	0.0	0.0	56.0	0.0
26/07/2019 20:03	10.9	93.0	0.0	0.0	56.0	0.0
26/07/2019 20:04	10.9	93.0	0.0	0.0	56.0	0.0
26/07/2019 20:05	10.9	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:06	10.9	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:07	10.9	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:08	10.9	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:09	10.8	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:10	10.8	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:11	10.8	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:12	10.8	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:13	10.8	95.0	0.0	0.0	56.0	0.0
26/07/2019 20:14	10.8	95.0	0.0	0.0	56.0	0.0
26/07/2019 20:15	10.8	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:16	10.7	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:17	10.7	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:18	10.7	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:19	10.6	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:20	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:21	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:22	10.6	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:23	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:24	10.5	94.0	0.0	0.0	56.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 20:25	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:26	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:27	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:28	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:29	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:30	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:31	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:32	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:33	10.4	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:34	10.4	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:35	10.4	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:36	10.4	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:37	10.3	93.0	0.0	0.0	56.0	0.0
26/07/2019 20:38	10.3	93.0	0.0	0.0	56.0	0.0
26/07/2019 20:39	10.3	93.0	0.0	0.0	56.0	0.0
26/07/2019 20:40	10.4	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:41	10.4	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:42	10.4	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:43	10.4	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:44	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:45	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:46	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:47	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:48	10.6	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:49	10.6	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:50	10.6	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:51	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:52	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:53	10.6	94.0	0.0	0.0	56.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 20:54	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:55	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:56	10.5	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:57	10.6	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:58	10.6	94.0	0.0	0.0	56.0	0.0
26/07/2019 20:59	10.6	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:00	10.6	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:01	10.6	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:02	10.6	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:03	10.6	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:04	10.6	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:05	10.6	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:06	10.6	93.0	0.0	0.0	56.0	0.0
26/07/2019 21:07	10.5	93.0	0.0	0.0	56.0	0.0
26/07/2019 21:08	10.5	93.0	0.0	0.0	56.0	0.0
26/07/2019 21:09	10.4	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:10	10.4	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:11	10.4	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:12	10.3	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:13	10.3	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:14	10.3	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:15	10.3	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:16	10.2	93.0	0.0	0.0	56.0	0.0
26/07/2019 21:17	10.2	93.0	0.0	0.0	56.0	0.0
26/07/2019 21:18	10.2	93.0	0.0	0.0	56.0	0.0
26/07/2019 21:19	10.2	93.0	0.0	0.0	56.0	0.0
26/07/2019 21:20	10.2	93.0	0.0	0.0	56.0	0.0
26/07/2019 21:21	10.2	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:22	10.2	94.0	0.0	0.0	56.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 21:23	10.2	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:24	10.1	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:25	10.2	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:26	10.2	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:27	10.2	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:28	10.2	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:29	10.2	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:30	10.3	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:31	10.3	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:32	10.2	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:33	10.2	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:34	10.2	93.0	0.0	0.0	56.0	0.0
26/07/2019 21:35	10.2	93.0	0.0	0.0	56.0	0.0
26/07/2019 21:36	10.2	93.0	0.0	0.0	56.0	0.0
26/07/2019 21:37	10.2	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:38	10.1	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:39	10.1	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:40	10.0	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:41	10.0	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:42	10.0	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:43	10.0	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:44	10.0	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:45	10.0	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:46	10.0	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:47	9.9	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:48	9.9	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:49	9.8	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:50	9.8	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:51	9.9	94.0	0.0	0.0	56.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 21:52	9.9	94.0	0.0	0.0	56.0	0.0
26/07/2019 21:53	9.9	94.0	0.0	33.0	150.0	1.3
26/07/2019 21:54	9.8	94.0	0.0	1.0	161.0	1.1
26/07/2019 21:55	9.8	94.0	0.0	1.0	160.0	0.3
26/07/2019 21:56	9.8	94.0	0.0	0.0	160.0	0.0
26/07/2019 21:57	9.8	94.0	0.0	1.0	160.0	0.0
26/07/2019 21:58	9.8	94.0	0.0	1.0	160.0	0.0
26/07/2019 21:59	9.8	94.0	0.0	0.0	160.0	0.0
26/07/2019 22:00	9.8	94.0	0.0	1.0	160.0	0.0
26/07/2019 22:01	9.7	94.0	0.0	0.0	160.0	0.0
26/07/2019 22:02	9.8	94.0	0.0	0.0	160.0	0.0
26/07/2019 22:03	9.8	94.0	0.0	0.0	160.0	0.0
26/07/2019 22:04	9.8	95.0	0.0	0.0	160.0	0.5
26/07/2019 22:05	9.7	95.0	0.0	1.0	160.0	0.8
26/07/2019 22:06	9.6	94.0	0.0	0.0	160.0	0.8
26/07/2019 22:07	9.6	94.0	0.0	0.0	160.0	0.4
26/07/2019 22:08	9.6	94.0	0.0	1.0	160.0	0.4
26/07/2019 22:09	9.5	94.0	0.0	1.0	160.0	0.3
26/07/2019 22:10	9.5	94.0	0.0	1.0	160.0	0.2
26/07/2019 22:11	9.5	94.0	0.0	0.0	160.0	0.0
26/07/2019 22:12	9.5	94.0	0.0	0.0	160.0	0.0
26/07/2019 22:13	9.6	94.0	0.0	1.0	160.0	0.0
26/07/2019 22:14	9.6	94.0	0.0	0.0	160.0	0.0
26/07/2019 22:15	9.7	95.0	0.0	0.0	160.0	0.0
26/07/2019 22:16	9.6	95.0	0.0	1.0	160.0	0.0
26/07/2019 22:17	9.6	95.0	0.0	0.0	160.0	0.0
26/07/2019 22:18	9.6	95.0	0.0	1.0	160.0	0.0
26/07/2019 22:19	9.7	95.0	0.0	0.0	160.0	0.0
26/07/2019 22:20	9.7	95.0	0.0	0.0	160.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 22:21	9.8	95.0	0.0	1.0	160.0	0.0
26/07/2019 22:22	9.7	95.0	0.0	0.0	160.0	0.0
26/07/2019 22:23	9.7	95.0	0.0	0.0	160.0	0.0
26/07/2019 22:24	9.7	95.0	0.0	1.0	160.0	0.0
26/07/2019 22:25	9.5	95.0	0.0	0.0	160.0	0.0
26/07/2019 22:26	9.2	94.0	0.0	0.0	160.0	0.0
26/07/2019 22:27	9.2	94.0	0.0	0.0	160.0	0.0
26/07/2019 22:28	9.1	94.0	0.0	1.0	160.0	0.0
26/07/2019 22:29	9.3	95.0	0.0	0.0	160.0	0.0
26/07/2019 22:30	9.2	95.0	0.0	0.0	160.0	0.0
26/07/2019 22:31	9.2	94.0	0.0	0.0	160.0	0.0
26/07/2019 22:32	9.1	94.0	0.0	1.0	160.0	0.0
26/07/2019 22:33	8.9	94.0	0.0	1.0	160.0	0.0
26/07/2019 22:34	8.8	94.0	0.0	1.0	160.0	0.0
26/07/2019 22:35	8.8	94.0	0.0	1.0	160.0	0.0
26/07/2019 22:36	9.0	94.0	0.0	0.0	160.0	0.0
26/07/2019 22:37	9.1	95.0	0.0	0.0	160.0	0.0
26/07/2019 22:38	9.1	95.0	0.0	1.0	160.0	0.0
26/07/2019 22:39	9.1	95.0	0.0	1.0	160.0	0.0
26/07/2019 22:40	9.2	95.0	0.0	1.0	160.0	0.0
26/07/2019 22:41	9.3	95.0	0.0	1.0	160.0	0.0
26/07/2019 22:42	9.3	95.0	0.0	1.0	160.0	0.0
26/07/2019 22:43	9.1	95.0	0.0	1.0	160.0	0.0
26/07/2019 22:44	8.9	94.0	0.0	0.0	160.0	0.0
26/07/2019 22:45	8.8	94.0	0.0	1.0	160.0	0.0
26/07/2019 22:46	8.8	94.0	0.0	0.0	160.0	0.0
26/07/2019 22:47	8.7	94.0	0.0	0.0	160.0	0.0
26/07/2019 22:48	8.5	94.0	0.0	0.0	160.0	0.0
26/07/2019 22:49	8.5	94.0	0.0	1.0	160.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 22:50	8.5	94.0	0.0	0.0	160.0	0.0
26/07/2019 22:51	8.4	94.0	0.0	0.0	160.0	0.0
26/07/2019 22:52	8.5	94.0	0.0	1.0	160.0	0.0
26/07/2019 22:53	8.7	95.0	0.0	1.0	160.0	0.0
26/07/2019 22:54	8.8	95.0	0.0	1.0	160.0	0.0
26/07/2019 22:55	8.8	96.0	0.0	1.0	160.0	0.0
26/07/2019 22:56	8.8	96.0	0.0	1.0	160.0	0.0
26/07/2019 22:57	8.8	96.0	0.0	0.0	160.0	0.0
26/07/2019 22:58	8.8	96.0	0.0	1.0	160.0	0.0
26/07/2019 22:59	8.8	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:00	8.9	96.0	0.0	0.0	160.0	0.0
26/07/2019 23:01	9.0	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:02	9.0	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:03	9.0	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:04	8.9	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:05	8.9	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:06	9.0	96.0	0.0	0.0	160.0	0.0
26/07/2019 23:07	9.0	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:08	9.0	96.0	0.0	0.0	160.0	0.0
26/07/2019 23:09	9.0	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:10	8.9	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:11	8.8	96.0	0.0	0.0	160.0	0.0
26/07/2019 23:12	8.8	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:13	8.7	95.0	0.0	1.0	160.0	0.0
26/07/2019 23:14	8.8	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:15	8.7	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:16	8.8	96.0	0.0	0.0	160.0	0.0
26/07/2019 23:17	8.8	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:18	8.8	95.0	0.0	1.0	160.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
26/07/2019 23:19	8.8	95.0	0.0	1.0	160.0	0.0
26/07/2019 23:20	8.9	95.0	0.0	0.0	160.0	0.0
26/07/2019 23:21	8.9	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:22	9.0	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:23	9.0	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:24	9.0	96.0	0.0	0.0	160.0	0.0
26/07/2019 23:25	9.1	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:26	9.1	96.0	0.0	0.0	160.0	0.0
26/07/2019 23:27	9.1	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:28	9.1	96.0	0.0	0.0	160.0	0.0
26/07/2019 23:29	9.1	96.0	0.0	0.0	160.0	0.0
26/07/2019 23:30	9.2	96.0	0.0	0.0	160.0	0.0
26/07/2019 23:31	9.2	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:32	9.2	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:33	9.2	96.0	0.0	0.0	160.0	0.0
26/07/2019 23:34	9.2	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:35	9.2	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:36	9.2	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:37	9.2	96.0	0.0	1.0	160.0	0.0
26/07/2019 23:38	9.2	96.0	0.0	0.0	160.0	0.0
26/07/2019 23:39	9.2	95.0	0.0	0.0	160.0	0.0
26/07/2019 23:40	9.2	95.0	0.0	1.0	160.0	0.0
26/07/2019 23:41	9.2	95.0	0.0	0.0	160.0	0.0
26/07/2019 23:42	9.2	95.0	0.0	1.0	160.0	0.0
26/07/2019 23:43	9.2	95.0	0.0	1.0	160.0	0.0
26/07/2019 23:44	9.1	95.0	0.0	1.0	160.0	0.0
26/07/2019 23:45	9.1	95.0	0.0	1.0	160.0	0.0
27/07/2019 16:00	17.8	66.0	0.0	4.0	147.0	1.0
27/07/2019 16:01	17.7	66.0	0.0	17.0	137.0	1.7

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 16:02	17.7	66.0	0.0	25.0	156.0	2.3
27/07/2019 16:03	17.7	67.0	0.0	15.0	161.0	1.1
27/07/2019 16:04	17.8	66.0	0.0	23.0	154.0	1.0
27/07/2019 16:05	17.7	66.0	0.0	17.0	141.0	1.0
27/07/2019 16:06	17.7	66.0	0.0	19.0	145.0	1.5
27/07/2019 16:07	17.7	66.0	0.0	11.0	153.0	1.6
27/07/2019 16:08	17.7	67.0	0.0	3.0	148.0	0.9
27/07/2019 16:09	17.7	66.0	0.0	12.0	159.0	1.1
27/07/2019 16:10	17.7	66.0	0.0	6.0	167.0	1.0
27/07/2019 16:11	17.7	65.0	0.0	5.0	147.0	1.5
27/07/2019 16:12	17.7	66.0	0.0	14.0	171.0	1.9
27/07/2019 16:13	17.7	65.0	0.0	26.0	160.0	2.9
27/07/2019 16:14	17.6	65.0	0.0	24.0	167.0	2.6
27/07/2019 16:15	17.6	66.0	0.0	10.0	149.0	1.4
27/07/2019 16:16	17.6	66.0	0.0	9.0	151.0	1.1
27/07/2019 16:17	17.6	66.0	0.0	11.0	187.0	0.7
27/07/2019 16:18	17.7	66.0	0.0	26.0	171.0	1.0
27/07/2019 16:19	17.6	65.0	0.0	14.0	149.0	1.3
27/07/2019 16:20	17.6	66.0	0.0	16.0	165.0	1.3
27/07/2019 16:21	17.6	65.0	0.0	14.0	147.0	2.2
27/07/2019 16:22	17.4	65.0	0.0	21.0	174.0	1.7
27/07/2019 16:23	17.4	65.0	0.0	20.0	178.0	1.7
27/07/2019 16:24	17.4	65.0	0.0	22.0	157.0	2.5
27/07/2019 16:25	17.4	65.0	0.0	28.0	181.0	1.4
27/07/2019 16:26	17.4	65.0	0.0	1.0	169.0	0.9
27/07/2019 16:27	17.3	66.0	0.0	0.0	169.0	0.5
27/07/2019 16:28	17.3	66.0	0.0	9.0	166.0	1.1
27/07/2019 16:29	17.3	66.0	0.0	51.0	116.0	1.0
27/07/2019 16:30	17.3	66.0	0.0	10.0	173.0	1.3

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 16:31	17.2	65.0	0.0	32.0	151.0	1.6
27/07/2019 16:32	17.2	65.0	0.0	21.0	143.0	1.6
27/07/2019 16:33	17.1	66.0	0.0	0.0	124.0	0.6
27/07/2019 16:34	17.0	66.0	0.0	26.0	147.0	1.2
27/07/2019 16:35	17.0	66.0	0.0	22.0	143.0	1.6
27/07/2019 16:36	17.0	67.0	0.0	9.0	171.0	2.1
27/07/2019 16:37	17.0	67.0	0.0	19.0	158.0	2.0
27/07/2019 16:38	16.9	67.0	0.0	16.0	155.0	2.1
27/07/2019 16:39	16.9	68.0	0.0	9.0	155.0	2.3
27/07/2019 16:40	16.9	68.0	0.0	12.0	174.0	1.3
27/07/2019 16:41	16.9	68.0	0.0	3.0	158.0	1.0
27/07/2019 16:42	16.8	68.0	0.0	1.0	160.0	0.8
27/07/2019 16:43	16.7	68.0	0.0	12.0	149.0	1.3
27/07/2019 16:44	16.7	69.0	0.0	1.0	162.0	0.8
27/07/2019 16:45	16.7	69.0	0.0	12.0	156.0	1.1
27/07/2019 16:46	16.6	69.0	0.0	5.0	161.0	1.0
27/07/2019 16:47	16.5	69.0	0.0	6.0	150.0	0.8
27/07/2019 16:48	16.5	70.0	0.0	1.0	147.0	0.6
27/07/2019 16:49	16.4	70.0	0.0	9.0	152.0	0.7
27/07/2019 16:50	16.4	70.0	0.0	8.0	165.0	1.2
27/07/2019 16:51	16.4	70.0	0.0	1.0	175.0	0.9
27/07/2019 16:52	16.4	71.0	0.0	0.0	175.0	0.5
27/07/2019 16:53	16.3	71.0	0.0	23.0	168.0	0.6
27/07/2019 16:54	16.2	71.0	0.0	22.0	141.0	1.1
27/07/2019 16:55	16.2	71.0	0.0	4.0	153.0	0.9
27/07/2019 16:56	16.1	72.0	0.0	1.0	158.0	0.3
27/07/2019 16:57	16.1	72.0	0.0	1.0	158.0	0.3
27/07/2019 16:58	16.1	72.0	0.0	4.0	164.0	0.9
27/07/2019 16:59	16.0	72.0	0.0	1.0	171.0	0.6

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 17:00	16.0	72.0	0.0	0.0	171.0	0.5
27/07/2019 17:01	16.0	73.0	0.0	1.0	171.0	0.1
27/07/2019 17:02	16.0	73.0	0.0	0.0	171.0	0.0
27/07/2019 17:03	16.0	72.0	0.0	1.0	171.0	0.0
27/07/2019 17:04	15.9	72.0	0.0	1.0	171.0	0.0
27/07/2019 17:05	15.9	73.0	0.0	1.0	171.0	0.0
27/07/2019 17:06	15.9	73.0	0.0	1.0	171.0	0.0
27/07/2019 17:07	15.8	73.0	0.0	1.0	171.0	0.0
27/07/2019 17:08	15.7	74.0	0.0	1.0	171.0	0.0
27/07/2019 17:09	15.7	74.0	0.0	0.0	171.0	0.0
27/07/2019 17:10	15.6	74.0	0.0	0.0	171.0	0.0
27/07/2019 17:11	15.5	74.0	0.0	1.0	171.0	0.0
27/07/2019 17:12	15.5	74.0	0.0	1.0	171.0	0.0
27/07/2019 17:13	15.5	73.0	0.0	0.0	171.0	0.0
27/07/2019 17:14	15.4	74.0	0.0	1.0	171.0	0.0
27/07/2019 17:15	15.3	75.0	0.0	0.0	171.0	0.0
27/07/2019 17:16	15.2	75.0	0.0	0.0	171.0	0.0
27/07/2019 17:17	15.1	76.0	0.0	1.0	171.0	0.0
27/07/2019 17:18	15.0	76.0	0.0	1.0	171.0	0.0
27/07/2019 17:19	14.9	77.0	0.0	0.0	171.0	0.0
27/07/2019 17:20	14.9	77.0	0.0	1.0	171.0	0.0
27/07/2019 17:21	14.9	77.0	0.0	1.0	171.0	0.0
27/07/2019 17:22	14.8	76.0	0.0	0.0	171.0	0.0
27/07/2019 17:23	14.7	77.0	0.0	1.0	171.0	0.0
27/07/2019 17:24	14.6	78.0	0.0	0.0	171.0	0.0
27/07/2019 17:25	14.6	78.0	0.0	0.0	171.0	0.0
27/07/2019 17:26	14.6	77.0	0.0	0.0	171.0	0.0
27/07/2019 17:27	14.6	77.0	0.0	0.0	171.0	0.0
27/07/2019 17:28	14.5	78.0	0.0	1.0	171.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 17:29	14.4	78.0	0.0	0.0	171.0	0.0
27/07/2019 17:30	14.2	79.0	0.0	1.0	171.0	0.0
27/07/2019 17:31	14.2	79.0	0.0	0.0	171.0	0.0
27/07/2019 17:32	14.2	79.0	0.0	0.0	171.0	0.0
27/07/2019 17:33	14.1	79.0	0.0	0.0	171.0	0.0
27/07/2019 17:34	14.1	79.0	0.0	1.0	171.0	0.0
27/07/2019 17:35	14.1	80.0	0.0	1.0	171.0	0.0
27/07/2019 17:36	14.0	80.0	0.0	0.0	171.0	0.0
27/07/2019 17:37	13.9	80.0	0.0	1.0	171.0	0.0
27/07/2019 17:38	13.9	81.0	0.0	1.0	171.0	0.0
27/07/2019 17:39	13.9	81.0	0.0	0.0	171.0	0.0
27/07/2019 17:40	13.8	81.0	0.0	1.0	171.0	0.0
27/07/2019 17:41	13.7	81.0	0.0	0.0	171.0	0.0
27/07/2019 17:42	13.6	82.0	0.0	1.0	171.0	0.0
27/07/2019 17:43	13.6	81.0	0.0	0.0	171.0	0.0
27/07/2019 17:44	13.6	82.0	0.0	1.0	171.0	0.0
27/07/2019 17:45	13.5	83.0	0.0	1.0	171.0	0.0
27/07/2019 17:46	13.5	83.0	0.0	1.0	171.0	0.0
27/07/2019 17:47	13.5	83.0	0.0	0.0	171.0	0.0
27/07/2019 17:48	13.4	83.0	0.0	1.0	171.0	0.0
27/07/2019 17:49	13.4	83.0	0.0	0.0	171.0	0.0
27/07/2019 17:50	13.3	82.0	0.0	1.0	171.0	0.0
27/07/2019 17:51	13.3	82.0	0.0	1.0	171.0	0.0
27/07/2019 17:52	13.3	82.0	0.0	1.0	171.0	0.0
27/07/2019 17:53	13.2	82.0	0.0	1.0	171.0	0.0
27/07/2019 17:54	13.2	82.0	0.0	0.0	171.0	0.0
27/07/2019 17:55	13.1	83.0	0.0	0.0	171.0	0.0
27/07/2019 17:56	13.1	84.0	0.0	1.0	171.0	0.0
27/07/2019 17:57	13.0	85.0	0.0	0.0	171.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 17:58	12.9	86.0	0.0	1.0	171.0	0.0
27/07/2019 17:59	12.9	86.0	0.0	0.0	171.0	0.0
27/07/2019 18:00	12.8	86.0	0.0	0.0	171.0	0.0
27/07/2019 18:01	12.7	87.0	0.0	1.0	171.0	0.0
27/07/2019 18:02	12.8	87.0	0.0	1.0	171.0	0.0
27/07/2019 18:03	12.8	87.0	0.0	0.0	171.0	0.0
27/07/2019 18:04	12.7	87.0	0.0	0.0	171.0	0.0
27/07/2019 18:05	12.6	87.0	0.0	0.0	171.0	0.0
27/07/2019 18:06	12.5	87.0	0.0	0.0	171.0	0.0
27/07/2019 18:07	12.3	87.0	0.0	1.0	171.0	0.0
27/07/2019 18:08	12.2	88.0	0.0	1.0	171.0	0.0
27/07/2019 18:09	12.2	88.0	0.0	1.0	171.0	0.0
27/07/2019 18:10	12.0	88.0	0.0	1.0	171.0	0.0
27/07/2019 18:11	12.0	88.0	0.0	1.0	171.0	0.0
27/07/2019 18:12	12.0	89.0	0.0	0.0	171.0	0.0
27/07/2019 18:13	12.0	88.0	0.0	1.0	171.0	0.0
27/07/2019 18:14	11.9	88.0	0.0	0.0	171.0	0.0
27/07/2019 18:15	12.1	89.0	0.0	0.0	171.0	0.0
27/07/2019 18:16	12.2	90.0	0.0	0.0	171.0	0.0
27/07/2019 18:17	12.2	89.0	0.0	1.0	171.0	0.0
27/07/2019 18:18	12.2	89.0	0.0	1.0	171.0	0.0
27/07/2019 18:19	12.1	88.0	0.0	1.0	171.0	0.0
27/07/2019 18:20	12.1	89.0	0.0	0.0	171.0	0.0
27/07/2019 18:21	12.1	89.0	0.0	0.0	171.0	0.0
27/07/2019 18:22	12.1	90.0	0.0	1.0	171.0	0.0
27/07/2019 18:23	12.0	90.0	0.0	0.0	171.0	0.0
27/07/2019 18:24	11.9	89.0	0.0	1.0	171.0	0.0
27/07/2019 18:25	12.0	90.0	0.0	0.0	171.0	0.0
27/07/2019 18:26	12.0	91.0	0.0	0.0	171.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 18:27	12.0	91.0	0.0	0.0	171.0	0.0
27/07/2019 18:28	11.9	91.0	0.0	0.0	171.0	0.0
27/07/2019 18:29	11.8	91.0	0.0	1.0	171.0	0.0
27/07/2019 18:30	11.7	91.0	0.0	1.0	171.0	0.0
27/07/2019 18:31	11.7	91.0	0.0	1.0	171.0	0.0
27/07/2019 18:32	11.8	91.0	0.0	1.0	171.0	0.0
27/07/2019 18:33	11.8	91.0	0.0	0.0	171.0	0.0
27/07/2019 18:34	11.7	91.0	0.0	0.0	171.0	0.0
27/07/2019 18:35	11.5	90.0	0.0	0.0	171.0	0.0
27/07/2019 18:36	11.4	91.0	0.0	1.0	171.0	0.0
27/07/2019 18:37	11.5	92.0	0.0	1.0	171.0	0.0
27/07/2019 18:38	11.5	92.0	0.0	1.0	171.0	0.0
27/07/2019 18:39	11.6	92.0	0.0	0.0	171.0	0.0
27/07/2019 18:40	11.6	92.0	0.0	1.0	171.0	0.0
27/07/2019 18:41	11.5	92.0	0.0	1.0	171.0	0.0
27/07/2019 18:42	11.5	92.0	0.0	0.0	171.0	0.0
27/07/2019 18:43	11.4	92.0	0.0	1.0	171.0	0.0
27/07/2019 18:44	11.4	92.0	0.0	1.0	171.0	0.0
27/07/2019 18:45	11.3	92.0	0.0	0.0	171.0	0.0
27/07/2019 18:46	11.3	92.0	0.0	1.0	171.0	0.0
27/07/2019 18:47	11.2	92.0	0.0	1.0	171.0	0.0
27/07/2019 18:48	11.3	93.0	0.0	0.0	171.0	0.0
27/07/2019 18:49	11.2	93.0	0.0	0.0	171.0	0.0
27/07/2019 18:50	11.2	93.0	0.0	1.0	171.0	0.0
27/07/2019 18:51	11.0	92.0	0.0	1.0	171.0	0.0
27/07/2019 18:52	11.0	93.0	0.0	0.0	171.0	0.0
27/07/2019 18:53	11.0	93.0	0.0	0.0	171.0	0.0
27/07/2019 18:54	11.0	93.0	0.0	1.0	171.0	0.0
27/07/2019 18:55	11.0	93.0	0.0	1.0	171.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 18:56	11.0	93.0	0.0	0.0	171.0	0.0
27/07/2019 18:57	11.0	93.0	0.0	1.0	171.0	0.0
27/07/2019 18:58	11.0	93.0	0.0	1.0	171.0	0.0
27/07/2019 18:59	11.0	94.0	0.0	0.0	171.0	0.0
27/07/2019 19:00	11.0	94.0	0.0	1.0	171.0	0.0
27/07/2019 19:01	11.0	94.0	0.0	1.0	171.0	0.0
27/07/2019 19:02	11.0	94.0	0.0	0.0	171.0	0.0
27/07/2019 19:03	10.9	94.0	0.0	1.0	171.0	0.0
27/07/2019 19:04	10.9	94.0	0.0	0.0	171.0	0.0
27/07/2019 19:05	10.9	94.0	0.0	0.0	171.0	0.0
27/07/2019 19:06	10.9	94.0	0.0	1.0	171.0	0.0
27/07/2019 19:07	10.9	94.0	0.0	0.0	171.0	0.0
27/07/2019 19:08	10.9	94.0	0.0	0.0	171.0	0.0
27/07/2019 19:09	10.9	94.0	0.0	1.0	171.0	0.0
27/07/2019 19:10	10.9	94.0	0.0	1.0	171.0	0.0
27/07/2019 19:11	10.9	94.0	0.0	0.0	171.0	0.0
27/07/2019 19:12	10.9	94.0	0.0	1.0	171.0	0.0
27/07/2019 19:13	10.9	94.0	0.0	0.0	171.0	0.0
27/07/2019 19:14	10.9	94.0	0.0	0.0	171.0	0.0
27/07/2019 19:15	10.9	94.0	0.0	1.0	171.0	0.0
27/07/2019 19:16	10.9	94.0	0.0	1.0	171.0	0.0
27/07/2019 19:17	10.9	94.0	0.0	1.0	171.0	0.0
27/07/2019 19:18	10.9	94.0	0.0	1.0	171.0	0.0
27/07/2019 19:19	10.9	94.0	0.0	1.0	171.0	0.0
27/07/2019 19:20	10.9	93.0	0.0	1.0	171.0	0.0
27/07/2019 19:21	10.9	93.0	0.0	0.0	171.0	0.0
27/07/2019 19:22	10.9	93.0	0.0	1.0	171.0	0.0
27/07/2019 19:23	10.9	93.0	0.0	0.0	171.0	0.0
27/07/2019 19:24	10.9	94.0	0.0	0.0	171.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 19:25	10.9	93.0	0.0	0.0	171.0	0.0
27/07/2019 19:26	10.9	93.0	0.0	1.0	171.0	0.0
27/07/2019 19:27	10.9	93.0	0.0	1.0	171.0	0.0
27/07/2019 19:28	10.9	93.0	0.0	0.0	171.0	0.0
27/07/2019 19:29	10.9	93.0	0.0	0.0	171.0	0.0
27/07/2019 19:30	10.9	93.0	0.0	0.0	171.0	0.0
27/07/2019 19:31	10.9	93.0	0.0	0.0	171.0	0.0
27/07/2019 19:32	10.9	93.0	0.0	1.0	171.0	0.0
27/07/2019 19:33	10.9	93.0	0.0	1.0	171.0	0.0
27/07/2019 19:34	10.9	93.0	0.0	0.0	171.0	0.0
27/07/2019 19:35	10.9	93.0	0.0	1.0	171.0	0.0
27/07/2019 19:36	10.9	93.0	0.0	0.0	171.0	0.0
27/07/2019 19:37	10.9	93.0	0.0	1.0	171.0	0.0
27/07/2019 19:38	10.9	93.0	0.0	1.0	171.0	0.0
27/07/2019 19:39	10.9	93.0	0.0	1.0	171.0	0.0
27/07/2019 19:40	10.9	93.0	0.0	0.0	171.0	0.0
27/07/2019 19:41	10.9	93.0	0.0	1.0	171.0	0.0
27/07/2019 19:42	10.9	93.0	0.0	1.0	171.0	0.0
27/07/2019 19:43	10.9	93.0	0.0	0.0	171.0	0.0
27/07/2019 19:44	10.8	94.0	0.0	1.0	171.0	0.0
27/07/2019 19:45	10.8	94.0	0.0	0.0	171.0	0.0
27/07/2019 19:46	10.8	94.0	0.0	0.0	171.0	0.0
27/07/2019 19:47	10.8	94.0	0.0	0.0	171.0	0.0
27/07/2019 19:48	10.8	94.0	0.0	1.0	171.0	0.0
27/07/2019 19:49	10.8	94.0	0.0	1.0	171.0	0.0
27/07/2019 19:50	10.8	94.0	0.0	0.0	171.0	0.0
27/07/2019 19:51	10.8	94.0	0.0	0.0	171.0	0.0
27/07/2019 19:52	10.8	94.0	0.0	0.0	171.0	0.0
27/07/2019 19:53	10.7	94.0	0.0	0.0	171.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 19:54	10.7	94.0	0.0	0.0	171.0	0.0
27/07/2019 19:55	10.6	94.0	0.0	1.0	171.0	0.0
27/07/2019 19:56	10.6	94.0	0.0	1.0	171.0	0.0
27/07/2019 19:57	10.7	94.0	0.0	0.0	171.0	0.0
27/07/2019 19:58	10.7	94.0	0.0	1.0	171.0	0.0
27/07/2019 19:59	10.8	94.0	0.0	0.0	171.0	0.0
27/07/2019 20:00	10.7	94.0	0.0	1.0	171.0	0.0
27/07/2019 20:01	10.7	94.0	0.0	1.0	171.0	0.0
27/07/2019 20:02	10.7	94.0	0.0	0.0	171.0	0.0
27/07/2019 20:03	10.7	94.0	0.0	0.0	171.0	0.0
27/07/2019 20:04	10.6	94.0	0.0	0.0	171.0	0.0
27/07/2019 20:05	10.6	94.0	0.0	1.0	171.0	0.0
27/07/2019 20:06	10.6	94.0	0.0	0.0	171.0	0.0
27/07/2019 20:07	10.6	94.0	0.0	0.0	171.0	0.0
27/07/2019 20:08	10.6	94.0	0.0	0.0	171.0	0.0
27/07/2019 20:09	10.6	94.0	0.0	1.0	171.0	0.0
27/07/2019 20:10	10.6	94.0	0.0	0.0	171.0	0.0
27/07/2019 20:11	10.6	94.0	0.0	1.0	171.0	0.0
27/07/2019 20:12	10.5	94.0	0.0	0.0	171.0	0.0
27/07/2019 20:13	10.5	94.0	0.0	0.0	171.0	0.0
27/07/2019 20:14	10.5	94.0	0.0	1.0	171.0	0.0
27/07/2019 20:15	10.5	94.0	0.0	1.0	171.0	0.0
27/07/2019 20:16	10.5	94.0	0.0	1.0	171.0	0.0
27/07/2019 20:17	10.5	94.0	0.0	0.0	171.0	0.0
27/07/2019 20:18	10.5	94.0	0.0	0.0	171.0	0.0
27/07/2019 20:19	10.5	94.0	0.0	0.0	171.0	0.0
27/07/2019 20:20	10.5	94.0	0.0	0.0	171.0	0.0
27/07/2019 20:21	10.5	94.0	0.0	1.0	171.0	0.0
27/07/2019 20:22	10.4	94.0	0.0	0.0	171.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 20:23	10.4	94.0	0.0	1.0	171.0	0.0
27/07/2019 20:24	10.4	94.0	0.0	1.0	171.0	0.0
27/07/2019 20:25	10.4	94.0	0.0	1.0	171.0	0.0
27/07/2019 20:26	10.4	94.0	0.0	1.0	171.0	0.0
27/07/2019 20:27	10.4	94.0	0.0	1.0	171.0	0.0
27/07/2019 20:28	10.4	93.0	0.0	1.0	171.0	0.0
27/07/2019 20:29	10.4	94.0	0.0	0.0	171.0	0.0
27/07/2019 20:30	10.4	94.0	0.0	1.0	171.0	0.0
27/07/2019 20:31	10.4	94.0	0.0	0.0	171.0	0.0
27/07/2019 20:32	10.4	94.0	0.0	0.0	171.0	0.0
27/07/2019 20:33	10.4	94.0	0.0	1.0	171.0	0.0
27/07/2019 20:34	10.4	94.0	0.0	1.0	171.0	0.0
27/07/2019 20:35	10.4	94.0	0.0	1.0	171.0	0.0
27/07/2019 20:36	10.5	94.0	0.0	0.0	171.0	0.0
27/07/2019 20:37	10.4	93.0	0.0	1.0	171.0	0.0
27/07/2019 20:38	10.5	93.0	0.0	0.0	171.0	0.0
27/07/2019 20:39	10.4	93.0	0.0	0.0	171.0	0.0
27/07/2019 20:40	10.4	93.0	0.0	0.0	171.0	0.0
27/07/2019 20:41	10.4	93.0	0.0	0.0	171.0	0.0
27/07/2019 20:42	10.3	93.0	0.0	1.0	171.0	0.0
27/07/2019 20:43	10.3	93.0	0.0	1.0	171.0	0.0
27/07/2019 20:44	10.3	93.0	0.0	1.0	171.0	0.0
27/07/2019 20:45	10.3	93.0	0.0	0.0	171.0	0.0
27/07/2019 20:46	10.3	93.0	0.0	0.0	171.0	0.0
27/07/2019 20:47	10.3	93.0	0.0	0.0	171.0	0.0
27/07/2019 20:48	10.2	93.0	0.0	0.0	171.0	0.0
27/07/2019 20:49	10.2	93.0	0.0	0.0	171.0	0.0
27/07/2019 20:50	10.2	93.0	0.0	0.0	171.0	0.0
27/07/2019 20:51	10.2	93.0	0.0	0.0	171.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 20:52	10.2	93.0	0.0	0.0	171.0	0.0
27/07/2019 20:53	10.1	93.0	0.0	0.0	171.0	0.0
27/07/2019 20:54	10.1	93.0	0.0	1.0	171.0	0.0
27/07/2019 20:55	10.1	93.0	0.0	1.0	171.0	0.0
27/07/2019 20:56	10.1	93.0	0.0	0.0	171.0	0.0
27/07/2019 20:57	10.1	93.0	0.0	1.0	171.0	0.0
27/07/2019 20:58	10.1	93.0	0.0	1.0	171.0	0.0
27/07/2019 20:59	10.1	94.0	0.0	0.0	171.0	0.0
27/07/2019 21:00	10.1	94.0	0.0	1.0	171.0	0.0
27/07/2019 21:01	10.1	94.0	0.0	0.0	171.0	0.0
27/07/2019 21:02	10.1	94.0	0.0	0.0	171.0	0.0
27/07/2019 21:03	10.1	94.0	0.0	1.0	171.0	0.0
27/07/2019 21:04	10.1	94.0	0.0	1.0	171.0	0.0
27/07/2019 21:05	10.1	95.0	0.0	0.0	171.0	0.0
27/07/2019 21:06	10.1	95.0	0.0	1.0	171.0	0.0
27/07/2019 21:07	10.1	95.0	0.0	0.0	171.0	0.0
27/07/2019 21:08	10.1	95.0	0.0	0.0	171.0	0.0
27/07/2019 21:09	10.1	95.0	0.0	1.0	171.0	0.0
27/07/2019 21:10	10.1	95.0	0.0	0.0	171.0	0.0
27/07/2019 21:11	10.1	96.0	0.0	1.0	171.0	0.0
27/07/2019 21:12	10.1	96.0	0.0	1.0	171.0	0.0
27/07/2019 21:13	10.1	96.0	0.0	0.0	171.0	0.0
27/07/2019 21:14	10.1	96.0	0.0	1.0	171.0	0.0
27/07/2019 21:15	10.1	96.0	0.0	0.0	171.0	0.0
27/07/2019 21:16	10.1	96.0	0.0	0.0	171.0	0.0
27/07/2019 21:17	10.0	96.0	0.0	0.0	171.0	0.0
27/07/2019 21:18	10.0	96.0	0.0	0.0	171.0	0.0
27/07/2019 21:19	10.0	96.0	0.0	1.0	171.0	0.0
27/07/2019 21:20	10.0	96.0	0.0	1.0	171.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 21:21	10.0	96.0	0.0	1.0	171.0	0.0
27/07/2019 21:22	10.0	96.0	0.0	0.0	171.0	0.0
27/07/2019 21:23	9.9	96.0	0.0	1.0	171.0	0.0
27/07/2019 21:24	9.9	96.0	0.0	0.0	171.0	0.0
27/07/2019 21:25	10.0	96.0	0.0	1.0	171.0	0.0
27/07/2019 21:26	10.0	96.0	0.0	0.0	171.0	0.0
27/07/2019 21:27	10.0	96.0	0.0	0.0	171.0	0.0
27/07/2019 21:28	10.0	96.0	0.0	0.0	171.0	0.0
27/07/2019 21:29	10.0	96.0	0.0	0.0	171.0	0.0
27/07/2019 21:30	10.0	95.0	0.0	1.0	171.0	0.0
27/07/2019 21:31	10.0	95.0	0.0	0.0	171.0	0.0
27/07/2019 21:32	10.0	95.0	0.0	0.0	171.0	0.0
27/07/2019 21:33	10.0	95.0	0.0	0.0	171.0	0.0
27/07/2019 21:34	9.9	95.0	0.0	0.0	171.0	0.0
27/07/2019 21:35	9.9	95.0	0.0	1.0	171.0	0.0
27/07/2019 21:36	9.9	95.0	0.0	0.0	171.0	0.0
27/07/2019 21:37	9.9	95.0	0.0	1.0	171.0	0.0
27/07/2019 21:38	9.9	95.0	0.0	0.0	171.0	0.0
27/07/2019 21:39	9.9	95.0	0.0	1.0	171.0	0.0
27/07/2019 21:40	9.9	95.0	0.0	1.0	171.0	0.0
27/07/2019 21:41	9.9	95.0	0.0	1.0	171.0	0.0
27/07/2019 21:42	9.9	94.0	0.0	0.0	171.0	0.0
27/07/2019 21:43	9.9	94.0	0.0	0.0	171.0	0.0
27/07/2019 21:44	9.8	94.0	0.0	0.0	171.0	0.0
27/07/2019 21:45	9.9	95.0	0.0	1.0	171.0	0.0
27/07/2019 21:46	9.9	95.0	0.0	0.0	171.0	0.0
27/07/2019 21:47	10.0	95.0	0.0	0.0	171.0	0.0
27/07/2019 21:48	10.0	95.0	0.0	0.0	171.0	0.0
27/07/2019 21:49	10.0	96.0	0.0	1.0	171.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 21:50	10.0	96.0	0.0	1.0	171.0	0.0
27/07/2019 21:51	10.1	96.0	0.0	0.0	171.0	0.0
27/07/2019 21:52	10.1	96.0	0.0	0.0	171.0	0.0
27/07/2019 21:53	10.1	96.0	0.0	0.0	171.0	0.0
27/07/2019 21:54	10.0	96.0	0.0	0.0	171.0	0.0
27/07/2019 21:55	10.0	96.0	0.0	1.0	171.0	0.0
27/07/2019 21:56	9.9	96.0	0.0	0.0	171.0	0.0
27/07/2019 21:57	9.9	96.0	0.0	1.0	171.0	0.0
27/07/2019 21:58	9.9	96.0	0.0	0.0	171.0	0.0
27/07/2019 21:59	9.9	96.0	0.0	0.0	171.0	0.0
27/07/2019 22:00	9.9	96.0	0.0	0.0	171.0	0.0
27/07/2019 22:01	9.8	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:02	9.7	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:03	9.7	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:04	9.8	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:05	9.8	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:06	9.7	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:07	9.7	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:08	9.6	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:09	9.6	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:10	9.6	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:11	9.6	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:12	9.6	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:13	9.6	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:14	9.6	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:15	9.5	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:16	9.5	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:17	9.5	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:18	9.5	95.0	0.0	0.0	171.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 22:19	9.5	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:20	9.4	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:21	9.4	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:22	9.4	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:23	9.5	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:24	9.5	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:25	9.5	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:26	9.5	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:27	9.5	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:28	9.5	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:29	9.4	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:30	9.4	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:31	9.4	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:32	9.4	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:33	9.4	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:34	9.4	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:35	9.4	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:36	9.4	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:37	9.4	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:38	9.4	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:39	9.4	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:40	9.4	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:41	9.3	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:42	9.3	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:43	9.2	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:44	9.2	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:45	9.2	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:46	9.2	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:47	9.2	95.0	0.0	0.0	171.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 22:48	9.2	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:49	9.2	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:50	9.2	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:51	9.2	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:52	9.3	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:53	9.3	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:54	9.3	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:55	9.3	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:56	9.3	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:57	9.3	95.0	0.0	1.0	171.0	0.0
27/07/2019 22:58	9.2	95.0	0.0	0.0	171.0	0.0
27/07/2019 22:59	9.1	95.0	0.0	0.0	171.0	0.0
27/07/2019 23:00	9.0	95.0	0.0	0.0	171.0	0.0
27/07/2019 23:01	9.0	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:02	9.0	96.0	0.0	1.0	171.0	0.0
27/07/2019 23:03	8.9	96.0	0.0	1.0	171.0	0.0
27/07/2019 23:04	8.9	96.0	0.0	1.0	171.0	0.0
27/07/2019 23:05	8.9	96.0	0.0	1.0	171.0	0.0
27/07/2019 23:06	8.9	96.0	0.0	1.0	171.0	0.0
27/07/2019 23:07	8.9	96.0	0.0	1.0	171.0	0.0
27/07/2019 23:08	8.9	96.0	0.0	1.0	171.0	0.0
27/07/2019 23:09	8.9	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:10	8.9	96.0	0.0	1.0	171.0	0.0
27/07/2019 23:11	8.9	96.0	0.0	1.0	171.0	0.0
27/07/2019 23:12	8.9	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:13	8.9	96.0	0.0	1.0	171.0	0.0
27/07/2019 23:14	8.9	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:15	8.9	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:16	8.9	96.0	0.0	1.0	171.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/07/2019 23:17	8.9	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:18	8.9	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:19	8.8	96.0	0.0	1.0	171.0	0.0
27/07/2019 23:20	8.8	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:21	8.8	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:22	8.8	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:23	8.7	96.0	0.0	1.0	171.0	0.0
27/07/2019 23:24	8.7	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:25	8.7	96.0	0.0	1.0	171.0	0.0
27/07/2019 23:26	8.7	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:27	8.7	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:28	8.7	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:29	8.6	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:30	8.6	96.0	0.0	1.0	171.0	0.0
27/07/2019 23:31	8.6	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:32	8.6	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:33	8.6	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:34	8.6	96.0	0.0	1.0	171.0	0.0
27/07/2019 23:35	8.6	96.0	0.0	1.0	171.0	0.0
27/07/2019 23:36	8.6	96.0	0.0	1.0	171.0	0.0
27/07/2019 23:37	8.6	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:38	8.7	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:39	8.7	96.0	0.0	0.0	171.0	0.0
27/07/2019 23:40	8.7	97.0	0.0	0.0	171.0	0.0
27/07/2019 23:41	8.7	97.0	0.0	1.0	171.0	0.0
27/07/2019 23:42	8.6	97.0	0.0	1.0	171.0	0.0
27/07/2019 23:43	8.5	97.0	0.0	0.0	171.0	0.0
27/07/2019 23:44	8.5	97.0	0.0	0.0	171.0	0.0
27/07/2019 23:45	8.5	97.0	0.0	1.0	171.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 16:00	18.3	41.0	0.0	7.0	198.0	1.6
28/07/2019 16:01	18.3	40.0	0.0	8.0	173.0	1.1
28/07/2019 16:02	18.3	41.0	0.0	12.0	177.0	1.1
28/07/2019 16:03	18.2	42.0	0.0	6.0	182.0	1.0
28/07/2019 16:04	18.4	41.0	0.0	16.0	197.0	1.3
28/07/2019 16:05	18.6	40.0	0.0	8.0	220.0	1.0
28/07/2019 16:06	18.6	41.0	0.0	11.0	203.0	0.8
28/07/2019 16:07	18.5	42.0	0.0	21.0	170.0	1.1
28/07/2019 16:08	18.3	41.0	0.0	13.0	179.0	1.4
28/07/2019 16:09	18.2	43.0	0.0	1.0	192.0	0.8
28/07/2019 16:10	18.3	42.0	0.0	1.0	192.0	0.7
28/07/2019 16:11	18.2	43.0	0.0	6.0	186.0	0.7
28/07/2019 16:12	18.2	40.0	0.0	48.0	165.0	1.3
28/07/2019 16:13	18.3	40.0	0.0	14.0	184.0	1.0
28/07/2019 16:14	18.3	42.0	0.0	2.0	183.0	0.8
28/07/2019 16:15	18.3	40.0	0.0	17.0	211.0	0.9
28/07/2019 16:16	18.3	41.0	0.0	2.0	220.0	0.3
28/07/2019 16:17	18.2	41.0	0.0	1.0	225.0	0.9
28/07/2019 16:18	18.2	41.0	0.0	1.0	225.0	0.4
28/07/2019 16:19	18.1	41.0	0.0	3.0	224.0	0.1
28/07/2019 16:20	18.0	41.0	0.0	5.0	166.0	0.6
28/07/2019 16:21	17.9	41.0	0.0	1.0	165.0	0.2
28/07/2019 16:22	17.8	42.0	0.0	1.0	165.0	0.0
28/07/2019 16:23	18.0	41.0	0.0	0.0	165.0	0.0
28/07/2019 16:24	18.0	40.0	0.0	1.0	165.0	0.0
28/07/2019 16:25	18.2	42.0	0.0	0.0	165.0	0.0
28/07/2019 16:26	18.3	41.0	0.0	0.0	165.0	0.0
28/07/2019 16:27	18.1	40.0	0.0	1.0	165.0	0.0
28/07/2019 16:28	18.0	42.0	0.0	2.0	165.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 16:29	18.0	43.0	0.0	1.0	191.0	0.5
28/07/2019 16:30	18.0	43.0	0.0	1.0	191.0	0.5
28/07/2019 16:31	17.9	42.0	0.0	0.0	191.0	0.4
28/07/2019 16:32	18.0	41.0	0.0	1.0	191.0	0.4
28/07/2019 16:33	17.9	43.0	0.0	0.0	191.0	0.2
28/07/2019 16:34	17.7	43.0	0.0	0.0	191.0	0.0
28/07/2019 16:35	17.7	44.0	0.0	1.0	191.0	0.0
28/07/2019 16:36	17.5	44.0	0.0	1.0	191.0	0.0
28/07/2019 16:37	17.6	44.0	0.0	1.0	191.0	0.0
28/07/2019 16:38	17.6	45.0	0.0	1.0	191.0	0.0
28/07/2019 16:39	17.6	45.0	0.0	6.0	188.0	0.2
28/07/2019 16:40	17.6	44.0	0.0	0.0	174.0	0.4
28/07/2019 16:41	17.4	46.0	0.0	0.0	174.0	0.1
28/07/2019 16:42	16.8	49.0	0.0	0.0	174.0	0.0
28/07/2019 16:43	16.6	48.0	0.0	0.0	174.0	0.0
28/07/2019 16:44	16.6	47.0	0.0	1.0	174.0	0.0
28/07/2019 16:45	16.4	48.0	0.0	1.0	174.0	0.0
28/07/2019 16:46	16.2	48.0	0.0	1.0	174.0	0.0
28/07/2019 16:47	16.1	49.0	0.0	0.0	174.0	0.0
28/07/2019 16:48	16.0	49.0	0.0	0.0	174.0	0.0
28/07/2019 16:49	15.8	50.0	0.0	0.0	174.0	0.0
28/07/2019 16:50	15.7	52.0	0.0	1.0	174.0	0.0
28/07/2019 16:51	15.6	52.0	0.0	0.0	174.0	0.0
28/07/2019 16:52	15.6	52.0	0.0	0.0	174.0	0.0
28/07/2019 16:53	15.5	52.0	0.0	1.0	174.0	0.0
28/07/2019 16:54	15.4	52.0	0.0	0.0	174.0	0.0
28/07/2019 16:55	15.3	52.0	0.0	1.0	174.0	0.0
28/07/2019 16:56	15.2	51.0	0.0	1.0	174.0	0.0
28/07/2019 16:57	15.0	51.0	0.0	0.0	174.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 16:58	14.8	51.0	0.0	1.0	174.0	0.0
28/07/2019 16:59	14.7	52.0	0.0	0.0	174.0	0.0
28/07/2019 17:00	14.5	52.0	0.0	1.0	174.0	0.0
28/07/2019 17:01	14.4	53.0	0.0	1.0	174.0	0.0
28/07/2019 17:02	14.3	53.0	0.0	1.0	174.0	0.0
28/07/2019 17:03	14.2	54.0	0.0	0.0	174.0	0.0
28/07/2019 17:04	14.2	55.0	0.0	1.0	174.0	0.0
28/07/2019 17:05	14.2	56.0	0.0	1.0	174.0	0.0
28/07/2019 17:06	14.1	57.0	0.0	0.0	174.0	0.0
28/07/2019 17:07	14.0	57.0	0.0	1.0	174.0	0.0
28/07/2019 17:08	14.0	57.0	0.0	1.0	174.0	0.0
28/07/2019 17:09	14.0	57.0	0.0	1.0	174.0	0.0
28/07/2019 17:10	13.9	57.0	0.0	1.0	174.0	0.0
28/07/2019 17:11	13.8	58.0	0.0	0.0	174.0	0.0
28/07/2019 17:12	13.7	59.0	0.0	1.0	174.0	0.0
28/07/2019 17:13	13.6	59.0	0.0	0.0	174.0	0.0
28/07/2019 17:14	13.5	59.0	0.0	1.0	174.0	0.0
28/07/2019 17:15	13.5	59.0	0.0	1.0	174.0	0.0
28/07/2019 17:16	13.4	60.0	0.0	0.0	174.0	0.0
28/07/2019 17:17	13.4	60.0	0.0	0.0	174.0	0.0
28/07/2019 17:18	13.3	60.0	0.0	1.0	174.0	0.0
28/07/2019 17:19	13.3	60.0	0.0	1.0	174.0	0.0
28/07/2019 17:20	13.3	61.0	0.0	1.0	174.0	0.0
28/07/2019 17:21	13.2	61.0	0.0	1.0	174.0	0.0
28/07/2019 17:22	13.2	61.0	0.0	1.0	174.0	0.0
28/07/2019 17:23	13.1	61.0	0.0	0.0	174.0	0.0
28/07/2019 17:24	13.0	61.0	0.0	0.0	174.0	0.0
28/07/2019 17:25	12.9	62.0	0.0	1.0	174.0	0.0
28/07/2019 17:26	12.8	62.0	0.0	1.0	174.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 17:27	12.7	63.0	0.0	1.0	174.0	0.0
28/07/2019 17:28	12.6	63.0	0.0	1.0	174.0	0.0
28/07/2019 17:29	12.5	64.0	0.0	0.0	174.0	0.0
28/07/2019 17:30	12.4	64.0	0.0	1.0	174.0	0.0
28/07/2019 17:31	12.3	65.0	0.0	1.0	174.0	0.0
28/07/2019 17:32	12.3	64.0	0.0	1.0	174.0	0.0
28/07/2019 17:33	12.2	64.0	0.0	0.0	174.0	0.0
28/07/2019 17:34	12.2	65.0	0.0	0.0	174.0	0.0
28/07/2019 17:35	12.2	64.0	0.0	1.0	174.0	0.0
28/07/2019 17:36	12.2	66.0	0.0	1.0	174.0	0.0
28/07/2019 17:37	12.2	67.0	0.0	0.0	174.0	0.0
28/07/2019 17:38	12.1	67.0	0.0	1.0	174.0	0.0
28/07/2019 17:39	12.0	67.0	0.0	1.0	174.0	0.0
28/07/2019 17:40	12.0	68.0	0.0	1.0	174.0	0.0
28/07/2019 17:41	11.9	68.0	0.0	1.0	174.0	0.0
28/07/2019 17:42	11.9	68.0	0.0	1.0	174.0	0.0
28/07/2019 17:43	11.8	68.0	0.0	1.0	174.0	0.0
28/07/2019 17:44	11.7	69.0	0.0	1.0	174.0	0.0
28/07/2019 17:45	11.5	70.0	0.0	0.0	174.0	0.0
28/07/2019 17:46	11.4	70.0	0.0	1.0	174.0	0.0
28/07/2019 17:47	11.4	71.0	0.0	1.0	174.0	0.0
28/07/2019 17:48	11.3	72.0	0.0	0.0	174.0	0.0
28/07/2019 17:49	11.2	73.0	0.0	0.0	174.0	0.0
28/07/2019 17:50	11.2	74.0	0.0	0.0	174.0	0.0
28/07/2019 17:51	11.1	74.0	0.0	1.0	174.0	0.0
28/07/2019 17:52	11.2	74.0	0.0	1.0	174.0	0.0
28/07/2019 17:53	11.2	75.0	0.0	1.0	174.0	0.0
28/07/2019 17:54	11.2	75.0	0.0	1.0	174.0	0.0
28/07/2019 17:55	11.1	75.0	0.0	1.0	174.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 17:56	11.1	75.0	0.0	0.0	174.0	0.0
28/07/2019 17:57	11.1	75.0	0.0	1.0	174.0	0.0
28/07/2019 17:58	11.0	76.0	0.0	0.0	174.0	0.0
28/07/2019 17:59	11.1	77.0	0.0	21.0	201.0	0.3
28/07/2019 18:00	11.2	77.0	0.0	1.0	218.0	0.6
28/07/2019 18:01	11.1	76.0	0.0	1.0	218.0	0.4
28/07/2019 18:02	10.9	75.0	0.0	1.0	218.0	0.3
28/07/2019 18:03	10.8	76.0	0.0	0.0	218.0	0.0
28/07/2019 18:04	10.7	76.0	0.0	1.0	218.0	0.0
28/07/2019 18:05	10.7	77.0	0.0	1.0	218.0	0.0
28/07/2019 18:06	10.6	77.0	0.0	1.0	218.0	0.0
28/07/2019 18:07	10.6	77.0	0.0	0.0	218.0	0.0
28/07/2019 18:08	10.6	77.0	0.0	1.0	218.0	0.0
28/07/2019 18:09	10.5	77.0	0.0	1.0	218.0	0.0
28/07/2019 18:10	10.2	79.0	0.0	1.0	218.0	0.0
28/07/2019 18:11	9.9	79.0	0.0	1.0	218.0	0.0
28/07/2019 18:12	9.8	80.0	0.0	1.0	219.0	0.5
28/07/2019 18:13	9.7	80.0	0.0	29.0	297.0	1.0
28/07/2019 18:14	9.3	80.0	0.0	1.0	310.0	1.0
28/07/2019 18:15	9.1	80.0	0.0	1.0	311.0	0.8
28/07/2019 18:16	8.9	80.0	0.0	1.0	311.0	0.7
28/07/2019 18:17	8.7	80.0	0.0	1.0	311.0	0.6
28/07/2019 18:18	8.7	82.0	0.0	1.0	310.0	0.5
28/07/2019 18:19	9.2	84.0	0.0	1.0	311.0	0.4
28/07/2019 18:20	9.5	84.0	0.0	1.0	311.0	0.3
28/07/2019 18:21	9.5	84.0	0.0	1.0	311.0	0.6
28/07/2019 18:22	9.5	84.0	0.0	1.0	311.0	0.6
28/07/2019 18:23	9.3	84.0	0.0	1.0	311.0	0.6
28/07/2019 18:24	9.4	85.0	0.0	2.0	310.0	0.6

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 18:25	9.4	84.0	0.0	1.0	311.0	0.6
28/07/2019 18:26	9.3	83.0	0.0	1.0	311.0	0.6
28/07/2019 18:27	9.1	84.0	0.0	1.0	311.0	0.6
28/07/2019 18:28	9.1	84.0	0.0	1.0	310.0	0.6
28/07/2019 18:29	9.0	84.0	0.0	1.0	311.0	0.6
28/07/2019 18:30	8.9	84.0	0.0	1.0	311.0	0.5
28/07/2019 18:31	8.8	84.0	0.0	1.0	311.0	0.3
28/07/2019 18:32	8.7	84.0	0.0	1.0	311.0	0.2
28/07/2019 18:33	8.7	84.0	0.0	1.0	311.0	0.1
28/07/2019 18:34	8.7	84.0	0.0	1.0	311.0	0.0
28/07/2019 18:35	8.7	85.0	0.0	1.0	311.0	0.0
28/07/2019 18:36	8.8	85.0	0.0	1.0	311.0	0.0
28/07/2019 18:37	8.8	85.0	0.0	1.0	311.0	0.0
28/07/2019 18:38	8.9	85.0	0.0	1.0	311.0	0.0
28/07/2019 18:39	9.0	86.0	0.0	1.0	311.0	0.0
28/07/2019 18:40	9.1	86.0	0.0	1.0	311.0	0.0
28/07/2019 18:41	9.2	86.0	0.0	1.0	310.0	0.0
28/07/2019 18:42	9.3	86.0	0.0	1.0	311.0	0.0
28/07/2019 18:43	9.3	85.0	0.0	1.0	311.0	0.0
28/07/2019 18:44	9.3	85.0	0.0	1.0	311.0	0.0
28/07/2019 18:45	9.2	85.0	0.0	1.0	310.0	0.0
28/07/2019 18:46	9.1	86.0	0.0	1.0	310.0	0.0
28/07/2019 18:47	9.0	86.0	0.0	1.0	311.0	0.0
28/07/2019 18:48	9.0	85.0	0.0	1.0	311.0	0.0
28/07/2019 18:49	9.0	86.0	0.0	1.0	311.0	0.0
28/07/2019 18:50	9.1	86.0	0.0	1.0	311.0	0.0
28/07/2019 18:51	9.2	85.0	0.0	1.0	311.0	0.0
28/07/2019 18:52	9.2	85.0	0.0	1.0	311.0	0.0
28/07/2019 18:53	9.2	85.0	0.0	1.0	311.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 18:54	9.1	85.0	0.0	0.0	311.0	0.0
28/07/2019 18:55	8.9	85.0	0.0	2.0	311.0	0.0
28/07/2019 18:56	8.8	85.0	0.0	1.0	311.0	0.0
28/07/2019 18:57	8.6	85.0	0.0	1.0	311.0	0.0
28/07/2019 18:58	8.5	85.0	0.0	1.0	310.0	0.0
28/07/2019 18:59	8.6	86.0	0.0	1.0	311.0	0.0
28/07/2019 19:00	8.7	87.0	0.0	1.0	311.0	0.0
28/07/2019 19:01	8.7	87.0	0.0	1.0	310.0	0.0
28/07/2019 19:02	8.7	86.0	0.0	1.0	311.0	0.0
28/07/2019 19:03	8.7	86.0	0.0	1.0	311.0	0.0
28/07/2019 19:04	8.7	86.0	0.0	1.0	311.0	0.0
28/07/2019 19:05	8.6	86.0	0.0	1.0	311.0	0.0
28/07/2019 19:06	8.6	86.0	0.0	1.0	310.0	0.0
28/07/2019 19:07	8.6	86.0	0.0	1.0	310.0	0.0
28/07/2019 19:08	8.6	85.0	0.0	1.0	311.0	0.0
28/07/2019 19:09	8.5	85.0	0.0	1.0	311.0	0.0
28/07/2019 19:10	8.5	85.0	0.0	1.0	311.0	0.0
28/07/2019 19:11	8.4	86.0	0.0	1.0	311.0	0.0
28/07/2019 19:12	8.4	87.0	0.0	1.0	311.0	0.0
28/07/2019 19:13	8.4	87.0	0.0	1.0	311.0	0.0
28/07/2019 19:14	8.4	88.0	0.0	1.0	311.0	0.0
28/07/2019 19:15	8.4	88.0	0.0	1.0	311.0	0.0
28/07/2019 19:16	8.4	88.0	0.0	1.0	310.0	0.0
28/07/2019 19:17	8.4	87.0	0.0	1.0	311.0	0.0
28/07/2019 19:18	8.3	87.0	0.0	1.0	311.0	0.0
28/07/2019 19:19	8.3	87.0	0.0	1.0	311.0	0.0
28/07/2019 19:20	8.3	87.0	0.0	1.0	311.0	0.0
28/07/2019 19:21	8.3	87.0	0.0	1.0	310.0	0.0
28/07/2019 19:22	8.3	87.0	0.0	1.0	311.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 19:23	8.2	87.0	0.0	1.0	310.0	0.0
28/07/2019 19:24	8.2	87.0	0.0	1.0	311.0	0.0
28/07/2019 19:25	8.2	87.0	0.0	1.0	311.0	0.0
28/07/2019 19:26	8.2	88.0	0.0	1.0	311.0	0.0
28/07/2019 19:27	8.2	88.0	0.0	1.0	311.0	0.0
28/07/2019 19:28	8.1	88.0	0.0	1.0	310.0	0.0
28/07/2019 19:29	8.1	88.0	0.0	1.0	311.0	0.0
28/07/2019 19:30	8.0	88.0	0.0	1.0	311.0	0.0
28/07/2019 19:31	8.0	88.0	0.0	1.0	311.0	0.0
28/07/2019 19:32	8.0	88.0	0.0	0.0	310.0	0.0
28/07/2019 19:33	7.9	87.0	0.0	1.0	311.0	0.0
28/07/2019 19:34	7.9	87.0	0.0	1.0	311.0	0.0
28/07/2019 19:35	7.9	87.0	0.0	1.0	311.0	0.0
28/07/2019 19:36	7.8	86.0	0.0	1.0	311.0	0.0
28/07/2019 19:37	7.8	86.0	0.0	1.0	311.0	0.0
28/07/2019 19:38	7.8	86.0	0.0	1.0	311.0	0.0
28/07/2019 19:39	7.7	86.0	0.0	1.0	310.0	0.0
28/07/2019 19:40	7.7	86.0	0.0	1.0	311.0	0.0
28/07/2019 19:41	7.6	86.0	0.0	1.0	311.0	0.0
28/07/2019 19:42	7.6	87.0	0.0	1.0	311.0	0.0
28/07/2019 19:43	7.6	87.0	0.0	1.0	311.0	0.0
28/07/2019 19:44	7.6	88.0	0.0	1.0	311.0	0.0
28/07/2019 19:45	7.6	89.0	0.0	1.0	311.0	0.0
28/07/2019 19:46	7.6	89.0	0.0	1.0	311.0	0.0
28/07/2019 19:47	7.5	88.0	0.0	1.0	311.0	0.0
28/07/2019 19:48	7.5	88.0	0.0	0.0	311.0	0.0
28/07/2019 19:49	7.5	89.0	0.0	1.0	311.0	0.0
28/07/2019 19:50	7.5	88.0	0.0	1.0	311.0	0.0
28/07/2019 19:51	7.5	88.0	0.0	1.0	310.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 19:52	7.4	88.0	0.0	1.0	310.0	0.0
28/07/2019 19:53	7.4	88.0	0.0	1.0	310.0	0.0
28/07/2019 19:54	7.4	89.0	0.0	1.0	311.0	0.0
28/07/2019 19:55	7.5	89.0	0.0	1.0	310.0	0.0
28/07/2019 19:56	7.5	89.0	0.0	1.0	311.0	0.0
28/07/2019 19:57	7.4	89.0	0.0	0.0	311.0	0.0
28/07/2019 19:58	7.3	89.0	0.0	1.0	311.0	0.0
28/07/2019 19:59	7.3	89.0	0.0	1.0	311.0	0.0
28/07/2019 20:00	7.3	89.0	0.0	1.0	311.0	0.0
28/07/2019 20:01	7.2	90.0	0.0	1.0	311.0	0.0
28/07/2019 20:02	7.2	90.0	0.0	1.0	311.0	0.0
28/07/2019 20:03	7.2	90.0	0.0	1.0	311.0	0.0
28/07/2019 20:04	7.2	90.0	0.0	1.0	311.0	0.0
28/07/2019 20:05	7.2	90.0	0.0	1.0	310.0	0.0
28/07/2019 20:06	7.2	91.0	0.0	1.0	310.0	0.0
28/07/2019 20:07	7.3	92.0	0.0	1.0	310.0	0.0
28/07/2019 20:08	7.4	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:09	7.5	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:10	7.4	91.0	0.0	1.0	311.0	0.0
28/07/2019 20:11	7.3	91.0	0.0	1.0	311.0	0.0
28/07/2019 20:12	7.3	90.0	0.0	1.0	311.0	0.0
28/07/2019 20:13	7.2	91.0	0.0	1.0	311.0	0.0
28/07/2019 20:14	7.1	91.0	0.0	1.0	311.0	0.0
28/07/2019 20:15	7.2	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:16	7.2	93.0	0.0	1.0	311.0	0.0
28/07/2019 20:17	7.2	93.0	0.0	1.0	311.0	0.0
28/07/2019 20:18	7.3	93.0	0.0	1.0	311.0	0.0
28/07/2019 20:19	7.3	93.0	0.0	1.0	311.0	0.0
28/07/2019 20:20	7.2	92.0	0.0	1.0	311.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 20:21	7.2	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:22	7.1	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:23	7.1	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:24	7.1	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:25	7.2	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:26	7.1	92.0	0.0	1.0	310.0	0.0
28/07/2019 20:27	6.9	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:28	6.8	92.0	0.0	0.0	310.0	0.0
28/07/2019 20:29	6.8	92.0	0.0	0.0	310.0	0.0
28/07/2019 20:30	6.7	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:31	6.7	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:32	6.7	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:33	6.8	93.0	0.0	1.0	311.0	0.0
28/07/2019 20:34	6.8	92.0	0.0	1.0	310.0	0.0
28/07/2019 20:35	6.8	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:36	6.8	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:37	6.8	92.0	0.0	1.0	310.0	0.0
28/07/2019 20:38	6.7	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:39	6.7	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:40	6.8	92.0	0.0	1.0	310.0	0.0
28/07/2019 20:41	6.8	93.0	0.0	1.0	310.0	0.0
28/07/2019 20:42	6.8	93.0	0.0	1.0	310.0	0.0
28/07/2019 20:43	6.8	93.0	0.0	1.0	311.0	0.0
28/07/2019 20:44	6.7	93.0	0.0	1.0	310.0	0.0
28/07/2019 20:45	6.8	93.0	0.0	1.0	311.0	0.0
28/07/2019 20:46	6.8	93.0	0.0	1.0	310.0	0.0
28/07/2019 20:47	6.8	93.0	0.0	1.0	310.0	0.0
28/07/2019 20:48	6.8	93.0	0.0	1.0	311.0	0.0
28/07/2019 20:49	6.8	92.0	0.0	1.0	311.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 20:50	6.8	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:51	6.8	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:52	6.7	92.0	0.0	1.0	310.0	0.0
28/07/2019 20:53	6.7	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:54	6.6	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:55	6.6	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:56	6.7	92.0	0.0	1.0	311.0	0.0
28/07/2019 20:57	6.7	92.0	0.0	0.0	311.0	0.0
28/07/2019 20:58	6.7	93.0	0.0	1.0	311.0	0.0
28/07/2019 20:59	6.7	93.0	0.0	1.0	311.0	0.0
28/07/2019 21:00	6.6	93.0	0.0	1.0	311.0	0.0
28/07/2019 21:01	6.6	93.0	0.0	1.0	310.0	0.0
28/07/2019 21:02	6.6	93.0	0.0	1.0	311.0	0.0
28/07/2019 21:03	6.6	93.0	0.0	1.0	311.0	0.0
28/07/2019 21:04	6.6	93.0	0.0	1.0	311.0	0.0
28/07/2019 21:05	6.6	93.0	0.0	0.0	311.0	0.0
28/07/2019 21:06	6.6	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:07	6.6	93.0	0.0	1.0	311.0	0.0
28/07/2019 21:08	6.5	93.0	0.0	1.0	311.0	0.0
28/07/2019 21:09	6.5	93.0	0.0	1.0	310.0	0.0
28/07/2019 21:10	6.5	93.0	0.0	1.0	310.0	0.0
28/07/2019 21:11	6.4	93.0	0.0	1.0	311.0	0.0
28/07/2019 21:12	6.4	93.0	0.0	1.0	311.0	0.0
28/07/2019 21:13	6.4	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:14	6.3	93.0	0.0	1.0	311.0	0.0
28/07/2019 21:15	6.3	93.0	0.0	1.0	310.0	0.0
28/07/2019 21:16	6.3	93.0	0.0	1.0	311.0	0.0
28/07/2019 21:17	6.3	93.0	0.0	1.0	311.0	0.0
28/07/2019 21:18	6.3	93.0	0.0	1.0	311.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 21:19	6.3	93.0	0.0	1.0	311.0	0.0
28/07/2019 21:20	6.3	93.0	0.0	1.0	310.0	0.0
28/07/2019 21:21	6.2	93.0	0.0	1.0	311.0	0.0
28/07/2019 21:22	6.2	93.0	0.0	1.0	311.0	0.0
28/07/2019 21:23	6.2	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:24	6.1	94.0	0.0	1.0	310.0	0.0
28/07/2019 21:25	6.1	94.0	0.0	1.0	310.0	0.0
28/07/2019 21:26	6.0	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:27	6.0	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:28	6.0	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:29	6.0	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:30	6.0	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:31	6.0	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:32	6.0	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:33	6.0	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:34	6.0	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:35	6.1	95.0	0.0	1.0	311.0	0.0
28/07/2019 21:36	6.1	95.0	0.0	1.0	311.0	0.0
28/07/2019 21:37	6.1	95.0	0.0	1.0	310.0	0.0
28/07/2019 21:38	6.2	95.0	0.0	1.0	311.0	0.0
28/07/2019 21:39	6.2	95.0	0.0	1.0	311.0	0.0
28/07/2019 21:40	6.1	95.0	0.0	1.0	310.0	0.0
28/07/2019 21:41	6.1	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:42	6.0	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:43	6.0	94.0	0.0	1.0	310.0	0.0
28/07/2019 21:44	6.0	94.0	0.0	1.0	310.0	0.0
28/07/2019 21:45	6.0	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:46	6.0	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:47	5.9	94.0	0.0	1.0	310.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 21:48	5.9	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:49	5.9	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:50	5.8	94.0	0.0	0.0	311.0	0.0
28/07/2019 21:51	5.8	94.0	0.0	0.0	311.0	0.0
28/07/2019 21:52	5.8	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:53	5.8	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:54	5.8	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:55	5.8	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:56	5.8	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:57	5.7	94.0	0.0	1.0	310.0	0.0
28/07/2019 21:58	5.7	94.0	0.0	1.0	311.0	0.0
28/07/2019 21:59	5.7	94.0	0.0	1.0	311.0	0.0
28/07/2019 22:00	5.7	94.0	0.0	1.0	310.0	0.0
28/07/2019 22:01	5.7	94.0	0.0	1.0	311.0	0.0
28/07/2019 22:02	5.7	94.0	0.0	1.0	310.0	0.0
28/07/2019 22:03	5.8	94.0	0.0	1.0	310.0	0.0
28/07/2019 22:04	5.8	94.0	0.0	1.0	311.0	0.0
28/07/2019 22:05	5.8	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:06	5.8	95.0	0.0	2.0	310.0	0.0
28/07/2019 22:07	5.8	95.0	0.0	1.0	310.0	0.0
28/07/2019 22:08	5.7	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:09	5.7	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:10	5.7	95.0	0.0	1.0	310.0	0.0
28/07/2019 22:11	5.7	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:12	5.7	95.0	0.0	1.0	310.0	0.0
28/07/2019 22:13	5.6	95.0	0.0	1.0	310.0	0.0
28/07/2019 22:14	5.6	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:15	5.6	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:16	5.5	95.0	0.0	1.0	311.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 22:17	5.6	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:18	5.5	95.0	0.0	1.0	310.0	0.0
28/07/2019 22:19	5.5	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:20	5.4	95.0	0.0	1.0	310.0	0.0
28/07/2019 22:21	5.4	94.0	0.0	1.0	310.0	0.0
28/07/2019 22:22	5.4	94.0	0.0	1.0	311.0	0.0
28/07/2019 22:23	5.4	94.0	0.0	1.0	311.0	0.0
28/07/2019 22:24	5.4	94.0	0.0	1.0	310.0	0.0
28/07/2019 22:25	5.4	94.0	0.0	1.0	311.0	0.0
28/07/2019 22:26	5.4	94.0	0.0	1.0	311.0	0.0
28/07/2019 22:27	5.4	94.0	0.0	1.0	310.0	0.0
28/07/2019 22:28	5.5	94.0	0.0	2.0	311.0	0.0
28/07/2019 22:29	5.4	94.0	0.0	1.0	311.0	0.0
28/07/2019 22:30	5.4	94.0	0.0	1.0	311.0	0.0
28/07/2019 22:31	5.5	94.0	0.0	1.0	311.0	0.0
28/07/2019 22:32	5.5	94.0	0.0	1.0	311.0	0.0
28/07/2019 22:33	5.5	94.0	0.0	1.0	311.0	0.0
28/07/2019 22:34	5.4	94.0	0.0	1.0	310.0	0.0
28/07/2019 22:35	5.4	94.0	0.0	1.0	311.0	0.0
28/07/2019 22:36	5.4	94.0	0.0	1.0	311.0	0.0
28/07/2019 22:37	5.3	94.0	0.0	1.0	311.0	0.0
28/07/2019 22:38	5.3	94.0	0.0	1.0	311.0	0.0
28/07/2019 22:39	5.3	94.0	0.0	1.0	311.0	0.0
28/07/2019 22:40	5.3	94.0	0.0	1.0	311.0	0.0
28/07/2019 22:41	5.3	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:42	5.3	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:43	5.3	95.0	0.0	1.0	310.0	0.0
28/07/2019 22:44	5.3	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:45	5.3	95.0	0.0	1.0	311.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 22:46	5.3	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:47	5.3	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:48	5.3	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:49	5.2	95.0	0.0	0.0	311.0	0.0
28/07/2019 22:50	5.2	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:51	5.2	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:52	5.1	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:53	5.1	95.0	0.0	1.0	310.0	0.0
28/07/2019 22:54	5.1	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:55	5.1	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:56	5.0	95.0	0.0	1.0	311.0	0.0
28/07/2019 22:57	5.1	95.0	0.0	1.0	310.0	0.0
28/07/2019 22:58	5.2	95.0	0.0	1.0	310.0	0.0
28/07/2019 22:59	5.2	95.0	0.0	1.0	310.0	0.0
28/07/2019 23:00	5.1	95.0	0.0	1.0	310.0	0.0
28/07/2019 23:01	5.1	95.0	0.0	1.0	310.0	0.0
28/07/2019 23:02	5.1	96.0	0.0	2.0	310.0	0.0
28/07/2019 23:03	5.0	95.0	0.0	1.0	311.0	0.0
28/07/2019 23:04	5.0	95.0	0.0	1.0	311.0	0.0
28/07/2019 23:05	5.0	95.0	0.0	1.0	311.0	0.0
28/07/2019 23:06	4.9	95.0	0.0	1.0	311.0	0.0
28/07/2019 23:07	4.9	95.0	0.0	1.0	311.0	0.0
28/07/2019 23:08	4.9	95.0	0.0	1.0	310.0	0.0
28/07/2019 23:09	4.9	95.0	0.0	1.0	311.0	0.0
28/07/2019 23:10	4.8	95.0	0.0	1.0	310.0	0.0
28/07/2019 23:11	4.8	94.0	0.0	1.0	311.0	0.0
28/07/2019 23:12	4.8	94.0	0.0	1.0	311.0	0.0
28/07/2019 23:13	4.7	94.0	0.0	1.0	311.0	0.0
28/07/2019 23:14	4.7	94.0	0.0	1.0	311.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 23:15	4.7	94.0	0.0	1.0	311.0	0.0
28/07/2019 23:16	4.7	94.0	0.0	1.0	311.0	0.0
28/07/2019 23:17	4.7	94.0	0.0	1.0	310.0	0.0
28/07/2019 23:18	4.8	95.0	0.0	1.0	311.0	0.0
28/07/2019 23:19	4.8	95.0	0.0	1.0	311.0	0.0
28/07/2019 23:20	4.8	95.0	0.0	1.0	310.0	0.0
28/07/2019 23:21	4.9	95.0	0.0	1.0	311.0	0.0
28/07/2019 23:22	4.9	96.0	0.0	1.0	310.0	0.0
28/07/2019 23:23	4.9	96.0	0.0	1.0	310.0	0.0
28/07/2019 23:24	4.8	96.0	0.0	1.0	311.0	0.0
28/07/2019 23:25	4.8	96.0	0.0	1.0	310.0	0.0
28/07/2019 23:26	4.8	96.0	0.0	1.0	311.0	0.0
28/07/2019 23:27	4.8	96.0	0.0	1.0	311.0	0.0
28/07/2019 23:28	4.8	96.0	0.0	1.0	311.0	0.0
28/07/2019 23:29	4.8	96.0	0.0	1.0	311.0	0.0
28/07/2019 23:30	4.8	96.0	0.0	1.0	311.0	0.0
28/07/2019 23:31	4.8	96.0	0.0	1.0	311.0	0.0
28/07/2019 23:32	4.8	96.0	0.0	1.0	311.0	0.0
28/07/2019 23:33	4.8	96.0	0.0	1.0	311.0	0.0
28/07/2019 23:34	4.8	96.0	0.0	1.0	311.0	0.0
28/07/2019 23:35	4.7	96.0	0.0	1.0	311.0	0.0
28/07/2019 23:36	4.6	96.0	0.0	1.0	310.0	0.0
28/07/2019 23:37	4.5	96.0	0.0	1.0	311.0	0.0
28/07/2019 23:38	4.5	96.0	0.0	1.0	311.0	0.0
28/07/2019 23:39	4.5	95.0	0.0	1.0	311.0	0.0
28/07/2019 23:40	4.5	95.0	0.0	1.0	311.0	0.0
28/07/2019 23:41	4.5	95.0	0.0	1.0	311.0	0.0
28/07/2019 23:42	4.5	95.0	0.0	1.0	311.0	0.0
28/07/2019 23:43	4.6	95.0	0.0	1.0	311.0	0.0

Date/Time	Temp(°C)	Humidity(%)	Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
28/07/2019 23:44	4.6	95.0	0.0	1.0	311.0	0.0
28/07/2019 23:45	4.6	95.0	0.0	1.0	311.0	0.0

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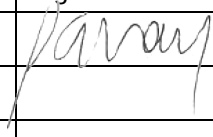
Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	B Elder	C Evenden		S Gray		03/10/2019

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Centennial Mandalong Pty Ltd

2019 Additional Annual Compliance Noise Monitoring

January 2020

WATER | ENERGY & RESOURCES | ENVIRONMENT | PROPERTY & BUILDINGS | TRANSPORTATION

Glossary

Term	Definition
AS	Australian Standard
dB	Decibel is the unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dB(A)	Frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at very low and very high frequencies.
NPI	Noise Policy for Industry
$L_{Aeq(period)}$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
$L_{A10(period)}$	The sound pressure level that is exceeded for 10% of the measurement period.
$L_{A1(period)}$	The sound pressure level that is exceeded for 1% of the measurement period.
$L_{A90(period)}$	The sound pressure level that is exceeded for 90% of the measurement period.
L_{Amax}	The maximum sound level recorded during the measurement period.
Noise Sensitive Receiver	Noise sensitive land use that may be impacted by noise from the development.
PSNG	Project Specific Noise Goals
Rating Background Level (RBL)	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period.

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Appendices

Appendix A – Calibration certificates

Appendix B – Operator attended noise monitoring results – Location M1

Appendix C – Weather Station Data

1. Introduction

1.1 Overview

GHD Pty Ltd (GHD) has been engaged by Centennial Mandalong Pty Ltd (Centennial) to conduct additional operational noise compliance monitoring associated with the Cooranbong Entry Site (Cooranbong) in accordance with the recommendations provided in GHD's previous report *Mandalong Mine 2019 Annual Compliance Noise Monitoring,* dated October 2019.

1.2 Purpose of this report

The purpose of this report is to present the findings of the additional operational noise compliance monitoring surveys and assess this monitoring data against noise criteria set out in Centennial's *Noise Management Plan – Northern Region May 2018,* Environmental Protection Licence EPL 365, Development Consent SSD-5144 and SSD-5145 for this site.

1.3 Scope of work

The scope of work undertaken by GHD for this assessment is summarised below:

- Additional operator attended operational compliance noise monitoring was undertaken at one (1) location M1 during the night-time period. Monitoring was undertaken for 1 hour during the night-time period.
- Monitoring was conducted on public property representative of the nearest sensitive receivers.
- Measured operational noise levels have been assessed against the development consent conditions.
- If measured noise levels indicate that a noise target is exceeded, GHD will consult with Centennial to agree upon the preferred noise control strategy.
- GHD will liaise with Centennial upon completion of the monitoring event to advise of any issues or any instances of potential exceedance and likely source.
- Where noise levels exceed noise goals, in-principle noise mitigation recommendations have been provided.
- All measurements were conducted in accordance with the specifications detailed in the following documents:
  - Development Consent SSD 5144
  - Development Application SSD-5145
  - Environmental Protection Licence (EPL) 365
  - *Noise Management Plan – Northern Region May 2018*
  - NSW Noise Policy for Industry (2017)
  - *Australia Standards AS1055 – 2019. Acoustics – Description and Measurement of Environmental Noise, Part 1 General Procedures*

1.4 Limitations

This report has been prepared by GHD for Centennial Mandalong Pty Ltd and may only be used and relied on by Centennial Mandalong Pty Ltd for the purpose agreed between GHD and Centennial Mandalong Pty Ltd as set out in Sections 1.2 and 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Centennial Mandalong Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The noise monitoring results outlined in this report represent the findings apparent at the date and time of the conducted and the conditions of the area at the time. It is the nature of environmental assessments that all variations in environmental conditions cannot be accessed and all uncertainty concerning the conditions of the ambient noise environment cannot be eliminated. Professional judgement must be exercised in the investigation and interpretation of observations.

In conducting this assessment and preparing the report, current guidelines for noise were referred to. This work has been conducted in good faith with GHD's understanding of the client's brief and the generally accepted consulting practice.

No other warranty, expressed or implied, is made as to the information and professional advice included in this report. It is not intended for other parties or other uses.

2. Additional annual compliance noise monitoring methodology

2.1 Operator attended compliance noise monitoring

2.1.1 General requirements

The additional operational noise monitoring programme was conducted with reference to the *Noise Management Plan Northern Region (May 2018),* Development Consent SSD-5144 and SSD-5145, EPL 365 Conditions L5.3, L5.4, and L5.6 and *AS 1055-2018 Acoustics –Description and Measurement of Environmental Noise.*

Additional operator attended noise surveys were conducted at location M1 during the night-time. Monitoring was undertaken for 1 hour to determine the character and relative contribution of ambient noise sources and mine contributions.

Measurements were conducted during typical worst case operational conditions for the Cooranbong Entry site in order to capture associated typical worst case noise emission levels.

Attended noise measurements were taken using a SVAN 977 Type 1 sound level meter (serial number 36821). This instrument is capable of measuring continuous A-weighted 1/3 octave sound pressure levels and able to record L_{Amin}, L_{A90}, L_{A10}, L_{A1}, L_{Amax} and L_{Aeq} noise descriptors.

The contribution from the site was estimated based on the observations of site equipment sound pressure level and their duration.

Field calibrations were checked by GHD immediately before and after each set of measurements using a Brüel & Kjær 4231 sound level calibrator (serial number 2542101). In all cases, pre and post calibration checks were within the acceptable range of 94 dB +/- 0.5 dB.

All instrumentation used during noise measurements comply with the requirements of AS IEC 61672.1-2019 *Electroacoustics - Sound Level Meters – Specifications*, AS IEC 61672.2-2019, AS IEC 61672.3-2019 and carry current NATA or manufacturer calibration certificates. Calibration Certificates for the sound level meters during the monitoring have been attached in Appendix A.

3. Additional operator attended compliance noise monitoring

3.1 Operator attended noise monitoring results

The results of the additional operator attended noise measurements are given in Table 3-1. Ambient noise levels given in the tables include all noise sources such as traffic, insects, birds, mine operations as well as any other industrial operations.

The tables provide the following information:

- Monitoring location
- Date and start time
- Wind velocity (m/s), temperature (ºC), relative humidity (%) and cloud cover at the measurement location
- Stability category
- Typical maximum (L_{Amax}) and contributed noise levels

Furthermore, the monitoring results are presented graphically in Appendix B.

Table 3-1 Night time operator attended noise survey results

Date/start time Weather (Mandalong AWS) (operator) SLM details	Measurement location/relevant criteria $L_{Aeq(15\text{-}minute)}$		Measurement number	Primary noise descriptor (dBA re 20 µPa)					Description of noise emission and typical maximum levels L_{Amax} (dBA)
	EPL 365	SSD-5144 and SSD-5145		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
27/11/2019 10:07 pm Wind = CALM Temp = 12-14°C Cloud cover 0/8 Stability Category: D & F (Tristan Robertson) SVAN 977 S/N 36821	M1 23 Gradwells Rd L_{Aeq} 37 dBA L_{A1} 45 dBA 26 Gradwells Rd L_{Aeq} 36 dBA L_{A1} 45 dBA	M1 23 Gradwells Rd L_{Aeq} 37 dBA L_{A1} 45 dBA 26 Gradwells Rd L_{Aeq} 36 dBA L_{A1} 45 dBA	1	57	49	45	42	44	Birds 51 to 52 dBA Train passby 47 to 52 dBA Insects audible Local road traffic 79 to 80 dBA Dog barking 50 to 55 dBA Eraring Power Station 43 to 50 dBA Cooranbong Entry Site: Coal loading 50 to 57 dBA Constant hum from rotary crusher and CHPP 36 to 39 dBA
			2	50	48	45	43	44	
			3	55	48	47	44	46	
			4	80	58	48	46	52	

Note 1: Night time is defined as the period between 10:00 pm to 7:00 am.

3.2 Operational compliance noise monitoring discussion of results

It is relevant to note that property access was not possible during the noise monitoring period, the noise monitoring location was at the property boundary fence to obtain the $L_{Aeq(15\text{-minute})}$ and $L_{A1(1\text{-minute})}$ noise contributions. Noise contributions were distance corrected as they were outside of these parameters to conform to the 30 m from the dwelling for $L_{Aeq(15\text{-minute})}$ measurements and 1 m from a dwelling for $L_{A1(1\text{-minute})}$ to represent the noise levels at each dwelling.

3.2.1 Operational noise

A summary of the operational noise compliance results are presented in Table 3-2.

Table 3-2 Operational noise compliance results summary

Location	Period	Number	Measured noise level $L_{Aeq\ (15\text{-minute})}$	Relevant criteria $L_{Aeq(15\ minute)}$		Compliance	
				EPL 365[2]	SSD-5144 & SSD-5145[2]	Mandalong AWS	Lake Macquarie BoM AWS
M1	Night	1	41 dBA[3]	23 Gradwells Rd L_{Aeq} 37 dBA 26 Gradwells Rd L_{Aeq} 36 dBA	23 Gradwells Rd L_{Aeq} 37 dBA 26 Gradwells Rd L_{Aeq} 36 dBA	No	N/A. Stability Category G inversion conditions.
		2	34 dBA[4]			Yes	N/A. Stability Category G inversion conditions.
		3	35 dBA[4]			Yes	N/A. Stability Category G inversion conditions.
		4	37 dBA[4]			N/A. Stability Category F inversion conditions.	N/A. Stability Category G inversion conditions.

Note 1: Night time is defined as 10:00 pm to 7:00 am.

Note 2: *The noise limits apply under all meteorological conditions except for any one of the following:*

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

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

(c) Stability category G temperature inversion conditions.

Note 3: Noise monitoring results have been analysed for annoyance. 5 dBA intermittent correction applied.

Note 4: Noise monitoring results have been analysed for annoyance. No corrections were applied.

The attended operational noise monitoring results presented in Table 3-2 show that the noise contributions from Cooranbong Entry Site complied with the EPL 365, Development Consent SSD-5144 and SSD-5145 noise criteria during measurements 2 and 3 undertaken at the monitoring site. Noise contributions from the site during the 1st and 4th measurement exceeded both sets of noise criteria. The exceedance that was recorded during the 1st measurement was attributed to coal loading activities based on observations made during the measurement.

It is relevant to note that the meteorological conditions, observed at the Mandalong AWS, during the 4th measurement were during stability category F conditions. As specified in condition L5.3, the noise limits do not apply under these conditions. Given the results of the preceding 2 measurements, undertaken in the absence of coal loading activities on site, it is considered unlikely that the noise levels would exceed the noise criteria under normal meteorological conditions given the steady state nature of the acoustically significant noise sources at the Cooranbong Entry Site.

3.2.2 Sleep disturbance

A summary of the sleep disturbance noise compliance results are presented in Table 3-3.

Table 3-3 Sleep disturbance noise compliance results summary

Location	Period	Number	Measured noise level L_{A1} (1-minute)	Relevant criteria $L_{A1(1\text{-minute})}$		Compliance	
				EPL 365[2]	SSD-5144 & SSD-5145[2]	Mandalong AWS	Lake Macquarie BoM AWS
M1	Night	1	59 dBA[3]	23 Gradwells Rd L_{Aeq} 45 dBA 26 Gradwells Rd L_{Aeq} 45 dBA	23 Gradwells Rd L_{Aeq} 45 dBA 26 Gradwells Rd L_{Aeq} 45 dBA	No	N/A. Stability Category G inversion conditions.
		2	33 dBA[4]			Yes	N/A. Stability Category G inversion conditions.
		3	34 dBA[4]			Yes	N/A. Stability Category G inversion conditions.
		4	36 dBA[4]			N/A. Stability Category F inversion conditions.	N/A. Stability Category G inversion conditions.

Note 1: Night time is defined as 10:00 pm to 7:00 am.

Note 2: *The noise limits apply under all meteorological conditions except for any one of the following:*

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

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

(c) Stability category G temperature inversion conditions.

Note 3: Noise monitoring results have been analysed for annoyance. 5 dBA intermittent correction applied.

Note 4: Noise monitoring results have been analysed for annoyance. No corrections were applied.

The operator attended sleep disturbance noise monitoring results summary presented in Table 3-3 show that the noise contributions from Cooranbong Entry Site comply with the EPL 365, Development Consent SSD-5144 and SSD-5145 relevant sleep disturbance noise criteria during 3 of the 4 measurements. The exceedances that were observed during the 1st measurement were due to coal loading activities.

The EPA's current approach to assessing potential sleep disturbance is to apply an initial screening criterion of background plus 15 dB (as described in the NPI) and to undertake further detailed analysis if the screening criterion cannot be achieved. The sleep disturbance screening criterion applies outside bedroom windows during the night-time period.

Where the screening criterion cannot be met, the additional analysis should consider the number of potential sleep disturbance events during the night, the level of exceedance and noise from other events. It may also be appropriate to consider other guidelines including the RNP which contains additional guidance relating to the potential sleep disturbance impacts.

A review of research on sleep disturbance in the RNP indicates that in some circumstances, higher noise levels may occur without significant sleep disturbance. Based on studies into sleep disturbance, the RNP concludes that:

- Maximum internal noise levels below 50 dBA to 55 dBA are unlikely to cause awakening reactions.
- One or two noise events per night, with maximum internal noise levels of 65 dBA to 70 dBA, are not likely to affect health and wellbeing significantly.

It is generally accepted that internal noise levels in a dwelling, with the windows open, are 10 dB lower than external noise levels. Based on a worst case minimum attenuation, with windows open, of 10 dB, the first conclusion above suggests that short term external noises of 60 dBA to 65 dBA are unlikely to cause awakening reactions. The second conclusion suggests that one or two noise events per night with maximum external noise levels of 75 dBA to 80 dBA are not likely to affect health and wellbeing significantly.

Given the preceding, since the short term external noise levels were equal to or below 59 dBA, the measured exceedances are not likely to affect health and wellbeing or cause awakening reactions.

It is also relevant to note that the meteorological conditions during the fourth measurement were during stability category F conditions, as measured at the Mandalong AWS. As specified in condition L5.3, the noise limits do not apply under these conditions. However the measured site contribution did not exceed the relevant criteria.

4. Conclusion

GHD was engaged by Centennial Mandalong Pty Ltd (Centennial) to conduct additional annual operational noise compliance monitoring associated with the Cooranbong Entry Site in accordance with the recommendations in GHD's previous report *Mandalong Mine 2019 Annual Compliance Noise Monitoring* dated October 2019.

Additional operator attended operational compliance noise monitoring was undertaken at one (1) location M1 during the night-time period. Monitoring was undertaken for 1 hour.

The attended operational noise monitoring results presented in Table 3-2 show that the noise contributions from Cooranbong Entry Site complied with the EPL 365, Development Consent SSD-5144 and SSD-5145 noise criteria during measurements 2 and 3 undertaken at the monitoring site. Noise contributions from the site during the 1st and 4th measurement exceeded both sets of noise criteria.

The exceedance that was recorded during the 1st measurement was attributed to coal loading activities based on observations made during the measurement.

Noise contributions from the site during the 4th measurement exceeded both sets of noise criteria. However the 4th measurement occurred during stability Category F weather conditions, as measured at the Mandalong AWS. As specified in condition L5.3 of EPL 365, the noise limits do not apply under these meteorological conditions.

The operator attended sleep disturbance noise monitoring results showed that the noise contributions from Cooranbong Entry Site were compliant with the EPL 365, Development Consent SSD-5144 and SSD-5145 relevant sleep disturbance noise criteria at the monitoring location during 3 of the 4 measurements undertaken at the monitoring site. The exceedance that was recorded during the first measurement was due to impact noises associated with coal loading activities.

As per the discussion presented in Section 3.2.2, since the short term external noise levels were equal to or below 59 dBA, the measured exceedance is not likely to affect health and wellbeing.

It is also relevant to note that the subsequent measurements showed that sleep disturbance noise levels at the nearest receptors, without coal loading activities occurring onsite, were compliant with the relevant criteria.

5. References

Australian Standard AS1055: 2019. *Acoustics – Description and Measurement of Environmental Noise, Part 1 General Procedures.*

Australian Standard AS2436-2010 (R2016). *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*.

AS IEC 61672.1: 2019 *Electroacoustics - Sound level meters – Specifications*.

Centennial Coal Noise Management Plan – Northern Region May 2018.

Development Consent SSD 5144.

Development Consent SSD 5145.

Development Application DA 97/800.

Development Application DA 35-2-2004.

Environmental Protection License (EPL) 365.

NSW Environmental Protection Authority, 2017. New South Wales *Noise Policy for Industry.*

NSW Environmental Protection Authority, 2013. *Noise Guide for Local Government*.

NSW Interim Construction Interim construction noise guideline (ICNG) (DECC, 2009).

Appendices

Appendix A – Calibration certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: SLM 24491 & FILT 5122

Equipment Description:	Sound & Vibration Analyser		
Manufacturer:	Svantek		
Model No:	Svan-977	**Serial No:**	36821
Microphone Type:	7052E	**Serial No:**	52114
Preamplifier Type:	SV12L	**Serial No:**	30276
Filter Type:	1/3 Octave	**Serial No:**	36821
Comments:	All tests passed for class 1. (See over for details)		
Owner:	GHD Pty Ltd Level 3, 24 Honeysuckle Drive Newcastle, NSW 2300		
Ambient Pressure:	1009 hPa ±1.5 hPa		
Temperature:	23 °C ±2° C	**Relative Humidity:**	54% ±5%
Date of Calibration:	15/04/2019	**Issue Date:**	16/04/2019
Acu-Vib Test Procedure:	AVP10 (SLM) & AVP06 (Filters)		

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....
Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

NATA
WORLD RECOGNISED ACCREDITATION

ACU-VIB
ELECTRONICS
HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
web site: www.acu-vib.com.au

Accredited Lab. No. 9262
Acoustic and Vibration Measurements

CERTIFICATE NO.: SLM 24491 & FILT 5122

The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013

Tests Performed:	*Clause*	*Result*
Absolute Calibration	10	Pass
Acoustical Frequency Weighting	12	Pass
Self Generated Noise	11.1	Entered
Electrical Noise	11.2	Entered
Long Term Stability	15	Pass
Electrical Frequency Weightings	13	Pass
Frequency and Time Weightings	14	Pass
Reference Level Linearity	16	Pass
Range Level Linearity	17	Pass
Toneburst	18	Pass
Peak C Sound Level	19	Pass
Overload Indicator	20	Pass
High Level Stability	21	Pass

Statement of Compliance: The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.
A full technical report is available if required.

This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:

1. Relative attenuation clause 5.3

Date of Calibration: 15/04/2019 **Issue Date:** 16/04/2019

Checked by: RKB

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 25473

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: B & K
Type No: 4231 **Serial No:** 2542101
Owner: GHD Pty Ltd
Level 3, 24 Honeysuckle Drive
Newcastle, NSW 2300

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	93.97	999.97	0.56
Level 2:	NA	N	113.97	999.97	0.32
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITION OF TEST:
Ambient Pressure: 1004 hPa ±1.5 hPa **Relative Humidity:** 42% ±5%
Temperature: 23 °C ±2° C
Date of Calibration: 02/09/2019 **Issue Date:** 02/09/2019
Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017
CHECKED BY: NKB **AUTHORISED SIGNATURE:** .....
Jack Rielt

.Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.
The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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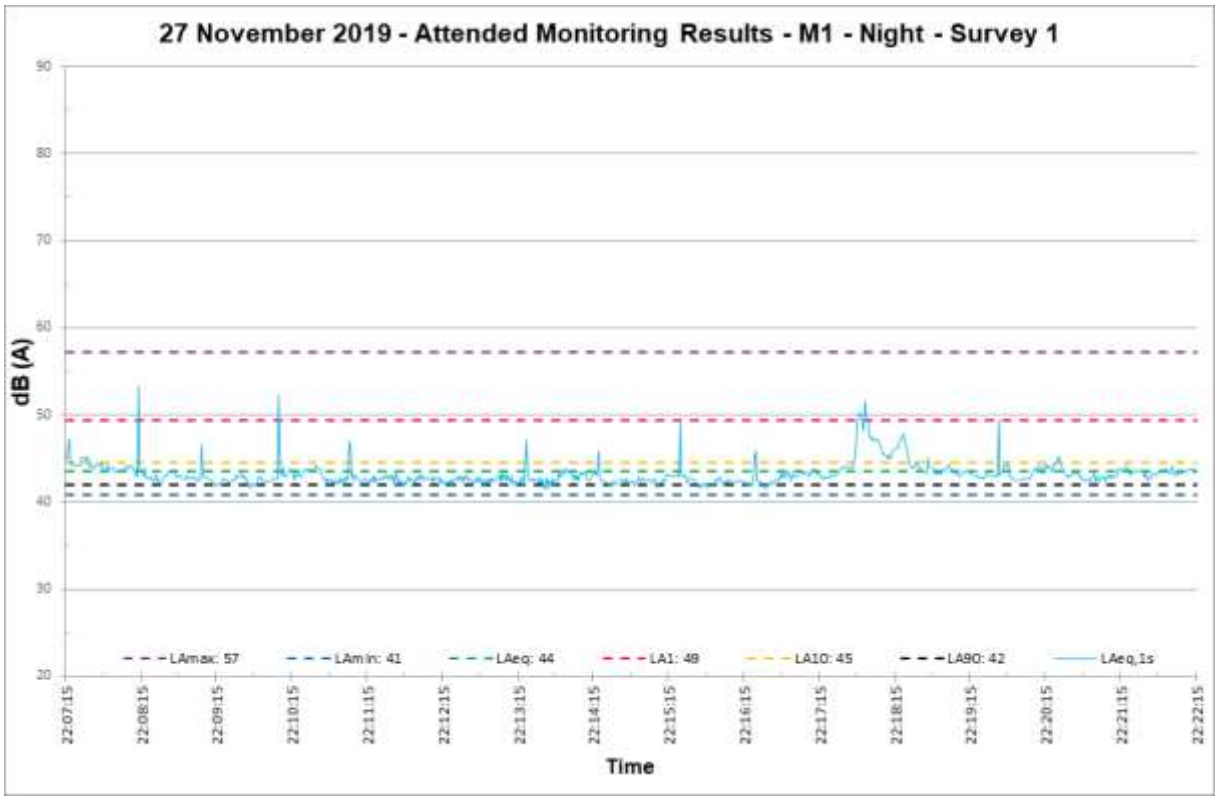
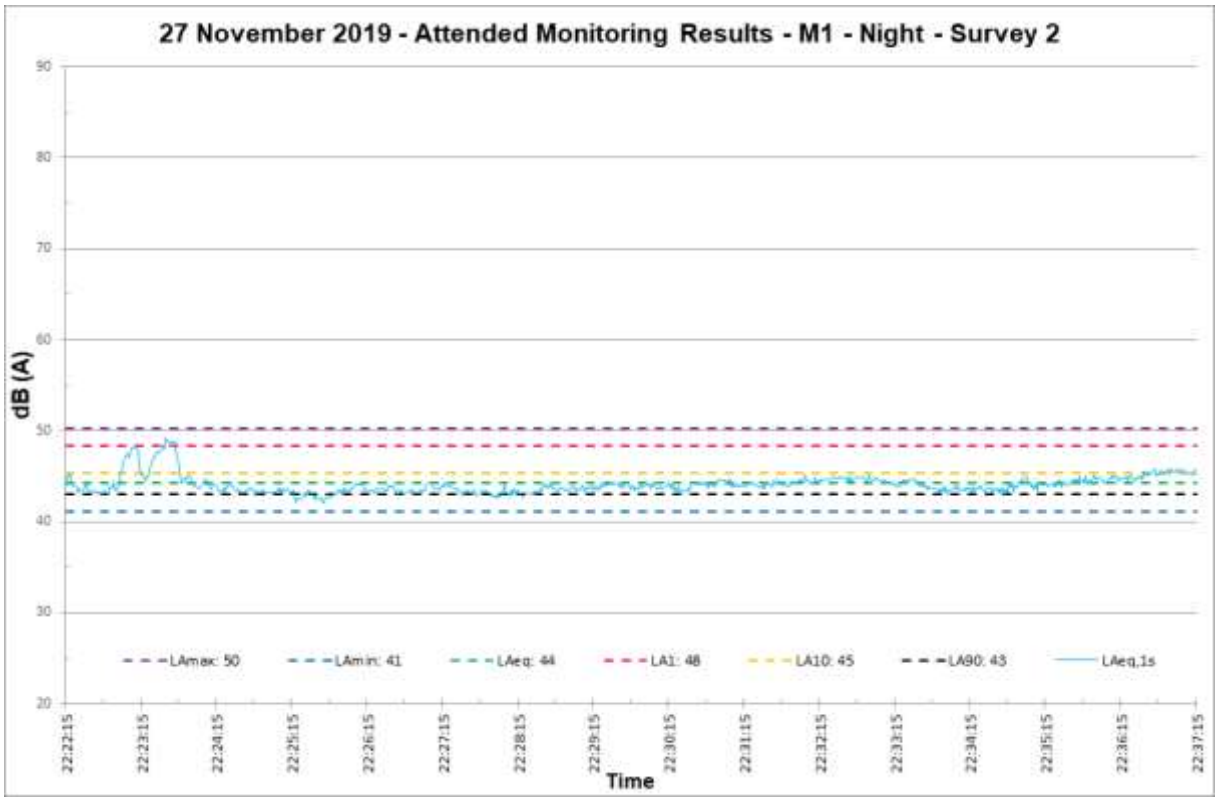
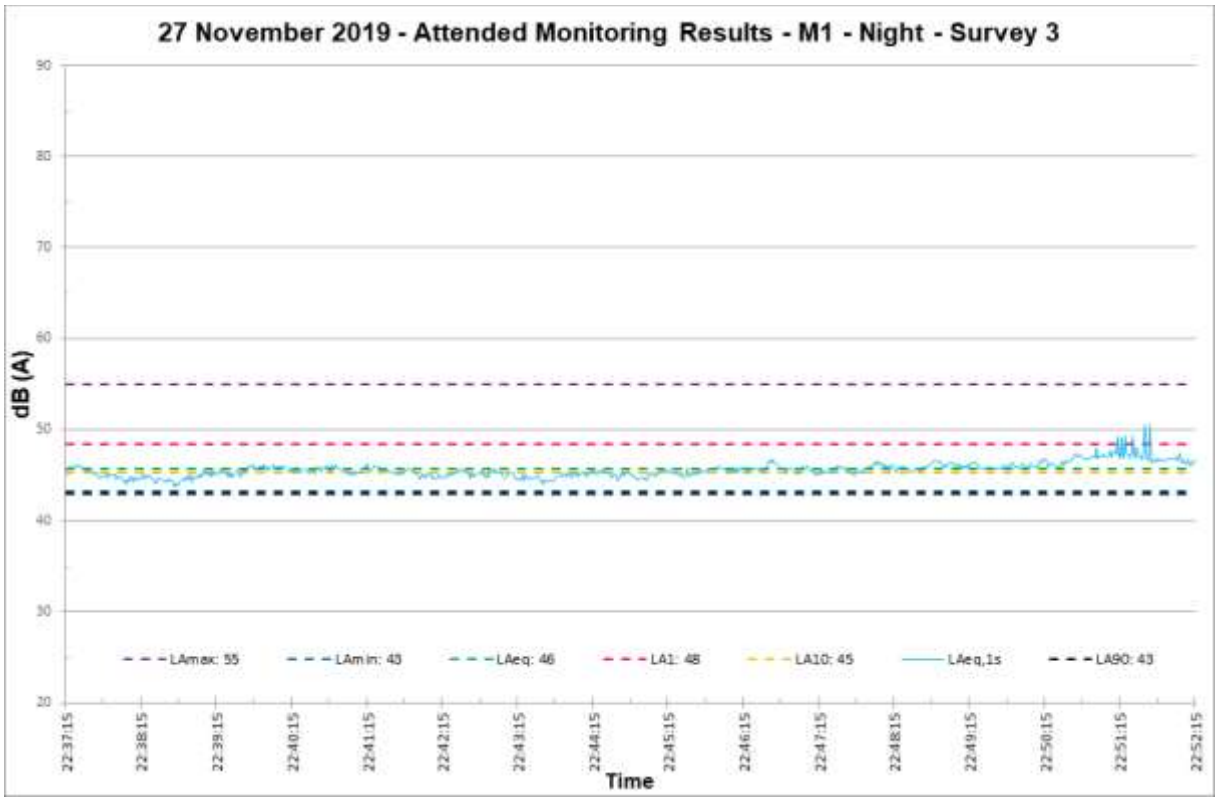
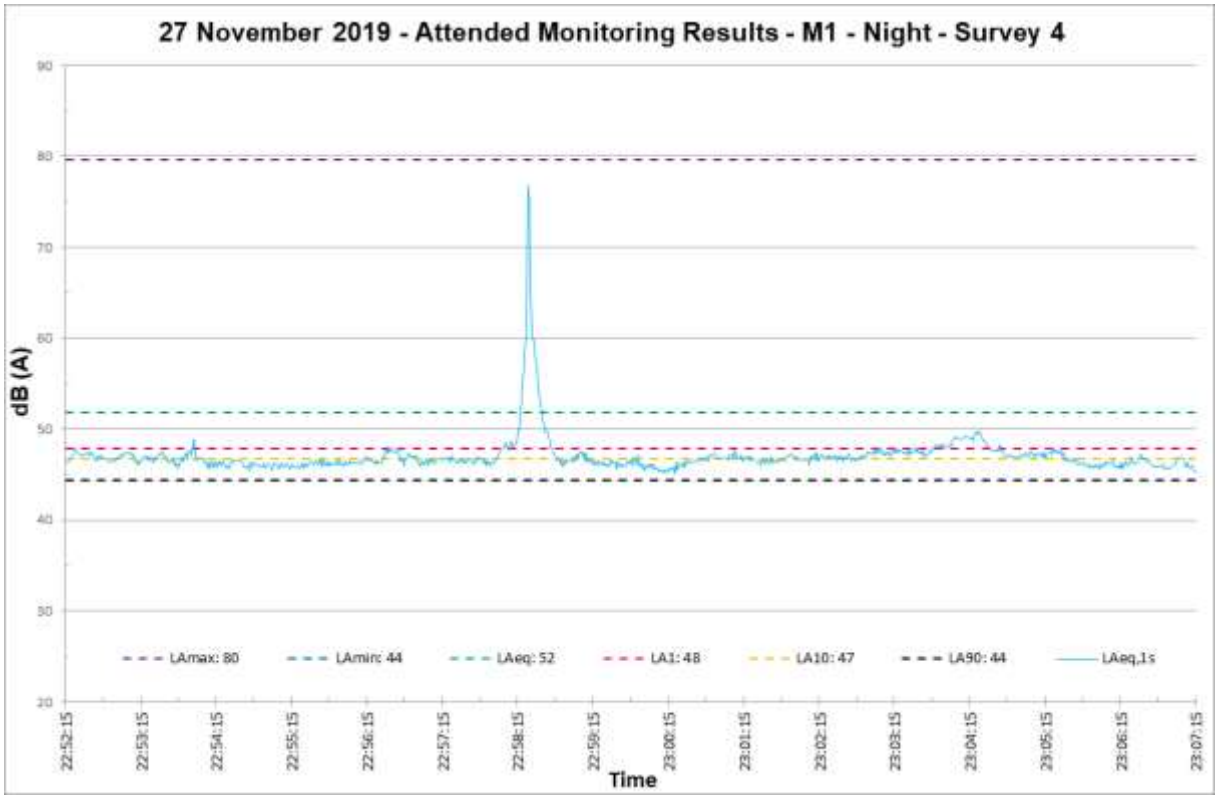
Appendix B – Operator attended noise monitoring results – Location M1






27 November 2019 - Attended Monitoring Results - M1 - Night - Survey 3
dB (A)
Time
LAmax: 55
LAmin: 43
LAeq: 46
LA1: 48
LA10: 45
LAeq,1s
LA90: 43


27 November 2019 - Attended Monitoring Results - M1 - Night - Survey 4
dB (A)
Time
LAmax: 80
LAmin: 44
LAeq: 52
LA1: 48
LA10: 47
LA90: 44
LAeq,1s

Appendix C – Weather Station Data

Table C-1 Mandalong AWS (27/11/2019)

Date/Time	Temp(°C)	Humidity(%)	Daily Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/11/2019 22:00	14.4	81.9	0.6	16.1	193.4	0.1
27/11/2019 22:05	14.4	81.9	0.6	16.1	193.4	0.1
27/11/2019 22:10	13.9	83.9	0.6	16.1	38.4	0.1
27/11/2019 22:15	13.9	83.9	0.6	16.1	38.4	0.1
27/11/2019 22:20	13.5	86.0	0.6	16.1	22.0	0.0
27/11/2019 22:25	13.5	86.0	0.6	16.1	22.0	0.0
27/11/2019 22:30	13.1	87.0	0.6	16.1	63.3	0.0
27/11/2019 22:35	13.1	87.0	0.6	16.1	63.3	0.0
27/11/2019 22:40	12.8	88.8	0.6	16.1	88.8	0.0
27/11/2019 22:45	12.8	88.8	0.6	16.1	88.8	0.0
27/11/2019 22:50	12.9	89.8	0.6	16.1	299.4	0.0
27/11/2019 22:55	12.9	89.8	0.6	16.1	299.4	0.0
27/11/2019 23:00	12.4	90.3	0.6	55.6	240.0	0.1
27/11/2019 23:05	12.4	90.3	0.6	55.6	240.0	0.1
27/11/2019 23:10	12.0	91.3	0.6	55.6	240.0	0.1
27/11/2019 23:15	12.0	91.3	0.6	55.6	240.0	0.1
27/11/2019 23:20	12.0	92.5	0.6	55.6	240.0	0.1
27/11/2019 23:25	12.0	92.5	0.6	55.6	240.0	0.1
27/11/2019 23:30	11.7	92.9	0.6	55.6	240.1	0.1

Table C-2 Lake Macquarie AWS (27/11/2019)

Date/Time	Temp(°C)	Humidity(%)	Daily Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/11/2019 21:56	13.9	83	0	0	22	0
27/11/2019 21:57	13.9	83	0	0	22	0
27/11/2019 21:58	13.9	83	0	0	22	0
27/11/2019 21:59	13.9	83	0	0	22	0
27/11/2019 22:0	13.9	83	0	0	22	0
27/11/2019 22:1	13.9	83	0	0	22	0
27/11/2019 22:2	13.9	83	0	0	22	0
27/11/2019 22:3	13.9	83	0	0	22	0
27/11/2019 22:4	13.8	84	0	0	22	0
27/11/2019 22:5	13.7	84	0	0	22	0
27/11/2019 22:6	13.7	84	0	0	22	0
27/11/2019 22:7	13.7	84	0	0	22	0
27/11/2019 22:8	13.7	84	0	0	22	0
27/11/2019 22:9	13.7	84	0	0	22	0
27/11/2019 22:10	13.6	84	0	0	22	0
27/11/2019 22:11	13.6	84	0	0	22	0
27/11/2019 22:12	13.6	84	0	0	22	0
27/11/2019 22:13	13.6	84	0	0	22	0
27/11/2019 22:14	13.5	85	0	0	22	0
27/11/2019 22:15	13.4	85	0	0	22	0
27/11/2019 22:16	13.4	85	0	0	22	0
27/11/2019 22:17	13.5	85	0	0	22	0
27/11/2019 22:18	13.5	85	0	0	22	0
27/11/2019 22:19	13.5	85	0	0	22	0
27/11/2019 22:20	13.5	84	0	0	22	0
27/11/2019 22:21	13.5	84	0	0	22	0
27/11/2019 22:22	13.5	85	0	0	22	0

Date/Time	Temp(°C)	Humidity(%)	Daily Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/11/2019 22:23	13.5	85	0	0	22	0
27/11/2019 22:24	13.5	85	0	0	22	0
27/11/2019 22:25	13.5	85	0	0	22	0
27/11/2019 22:26	13.5	85	0	0	22	0
27/11/2019 22:27	13.5	86	0	0	22	0
27/11/2019 22:28	13.4	86	0	0	22	0
27/11/2019 22:29	13.3	87	0	0	22	0
27/11/2019 22:30	13.3	87	0	0	22	0
27/11/2019 22:31	13.2	86	0	0	22	0
27/11/2019 22:32	13.2	86	0	0	22	0
27/11/2019 22:33	13.2	87	0	0	22	0
27/11/2019 22:34	13.3	87	0	0	22	0
27/11/2019 22:35	13.2	87	0	0	22	0
27/11/2019 22:36	13.2	87	0	0	22	0
27/11/2019 22:37	13.2	87	0	0	22	0
27/11/2019 22:38	13.2	87	0	0	22	0
27/11/2019 22:39	13.1	87	0	0	22	0
27/11/2019 22:40	13.1	87	0	0	22	0
27/11/2019 22:41	13	87	0	0	22	0
27/11/2019 22:42	13	88	0	0	22	0
27/11/2019 22:43	13.1	88	0	0	22	0
27/11/2019 22:44	12.9	88	0	0	22	0
27/11/2019 22:45	12.9	88	0	0	22	0
27/11/2019 22:46	12.9	88	0	0	22	0
27/11/2019 22:47	12.8	88	0	0	22	0
27/11/2019 22:48	12.8	89	0	0	22	0
27/11/2019 22:49	12.8	89	0	0	22	0
27/11/2019 22:50	12.8	89	0	0	22	0
27/11/2019 22:51	12.7	89	0	0	22	0

Date/Time	Temp(°C)	Humidity(%)	Daily Rain(mm)	10 m Sigma Theta	10 m Wind Direction(°)	10 m Wind Speed (m/s)
27/11/2019 22:52	12.8	89	0	0	22	0
27/11/2019 22:53	12.8	88	0	0	22	0
27/11/2019 22:54	12.7	88	0	0	22	0
27/11/2019 22:55	12.7	89	0	0	22	0
27/11/2019 22:56	12.7	89	0	0	22	0
27/11/2019 22:57	12.7	89	0	0	22	0
27/11/2019 22:58	12.7	89	0	0	22	0
27/11/2019 22:59	12.7	89	0	0	22	0
27/11/2019 23:0	12.7	89	0	0	22	0
27/11/2019 23:1	12.6	89	0	0	22	0
27/11/2019 23:2	12.6	90	0	0	22	0
27/11/2019 23:3	12.6	90	0	0	22	0
27/11/2019 23:4	12.7	90	0	0	22	0
27/11/2019 23:5	12.7	90	0	0	22	0
27/11/2019 23:6	12.6	90	0	0	22	0
27/11/2019 23:7	12.5	89	0	0	22	0
27/11/2019 23:8	12.5	89	0	0	22	0
27/11/2019 23:9	12.5	89	0	0	22	0
27/11/2019 23:10	12.5	90	0	0	22	0

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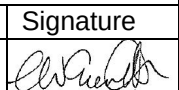
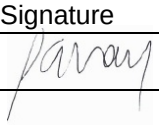
Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	B. Elder	C. Evenden		S. Gray		23/01/2020

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