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Surat Gas Project

Supplementary Noise and Vibration Assessment

Prepared For

Coffey Environments Australia Pty Ltd

on behalf of

Arrow Energy Pty Ltd

S3257C23
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EXECUTIVE SUMMARY

A supplementary assessment has been made of the environmental noise and vibration impact from the Surat Gas Project (the project) proposed by Arrow Energy Pty Ltd (Arrow). The assessment accounts for updates to the project description since the project environmental impact statement (EIS) was finalised and exhibited.

The updates to the project description, which are relevant to the noise and vibration impact assessment include the option of grouping gas wells within multi-well pads; revised central gas processing facility (CGPF) layout and power options; and a revised water treatment facility arrangement.

The assessment has maintained the method and criteria developed in the initial noise and vibration impact assessment. The assessment specifically determines the noise and vibration impact for project components related to the updates to the project description since the initial assessment. For other project components considered in the EIS (such as construction work and abandonment of production wells), the impact assessments and conclusions in the initial assessment remain valid.

The noise modelling assumes flat topography given the generally flat ground in the project development area. The noise model also assumes no noise-attenuating features across the landscape, such as dense trees or buildings. These site conditions correspond to the worst-case topographical conditions and provide the worst-case (highest) modelled noise levels for most locations.

Based on modelling, the proposed operational noise conditions will be achieved at the noise sensitive receptors with appropriate siting and application of a feasible level of acoustic treatment to equipment.

The construction equipment information is consistent with the assumptions considered in the initial assessment and therefore the noise impact and mitigation requirements provided in the initial assessment for construction noise remain valid.

Similarly, as the updates to the project description have not affected the assumptions and considerations in the initial assessment for the abandonment of the production wells, the conclusions in the initial assessment remain valid.

The vibration impact from the project as determined in the initial assessment remains valid as the main factors which control vibration impact, such as the type of vibration source (i.e., type of equipment) and distance from the sensitive receptors, have not varied significantly with the updates to the project description.

As the noise and vibration impact of the project does not change with the updates to the project description, the conclusions for the cumulative impact assessment in the initial assessment remain valid.

GLOSSARY

Acoustic impedance	A physical property of a medium or material which provides a measure of how well the medium absorbs acoustical energy; the higher the acoustic impedance, the lesser the amount of the energy that is absorbed.
Ambient noise level	The noise level with the presence of all noise sources.
A weighting	Frequency adjustment representing the response of the human ear.
Background noise level	The noise level in the absence of intermittent noise sources.
Background creep	The gradual increase in background noise levels in an area as a result of successive developments generating constant noise levels at a particular location.
CGPF	Central Gas Processing Facility.
CONCAWE	The oil companies' international study group for conservation of clean air and water in Europe. "The propagation of noise from petrochemical complexes to neighbouring communities".
CONCAWE noise propagation model	The CONCAWE noise propagation model is a model which takes into account topography, ground absorption, air absorption and meteorological conditions. It is used around the world and is widely accepted as an appropriate model for predicting noise over significant distances. The CONCAWE noise propagation model can be implemented in a noise modelling software such as SoundPlan.
CSGI	Coal seam gas industry.
dB(A)	A weighted noise or sound power level in decibels.
DEHP	Department of Environment and Heritage Protection.
DERM	Department of Environment and Resource Management.
Equivalent noise level	Energy averaged noise level.
EIS	Environmental Impact Statement.
$L_{A1,adj,1hr}$	The A weighted noise level exceeded 1% of the time measured in decibels over a period of 1 hour and adjusted for tonality or impulsiveness, representing the maximum noise level.
$L_{A10,adj,1hr}$	The A weighted noise level exceeded 10% of the time measured in decibels over a period of 1 hour and adjusted for tonality or

	impulsiveness, representing the typical upper noise level.
L_{A10}	The A weighted noise level exceeded 10% of the time measured in decibels.
L_{A10} (18hr)	The arithmetic average of 18 hourly L_{A10} measurements, measured consecutively between 6am and 12 midnight.
L_{A90}	The A weighted noise level exceeded 90% of the time measured in decibels, representing the background noise level.
L_{Aeq}	The A weighted equivalent noise level measured in decibels.
$L_{Aeq, adj, 1 hour}$	The A weighted equivalent noise level measured in decibels over a period of 1 hour and adjusted for tonality.
$L_{Aeq,adj,15mins}$	The A weighted equivalent noise level measured in decibels over a period of 15 minutes and adjusted for tonality.
$L_{pA,LF}$	Indoor low frequency A weighted noise level measured in decibels.
$_{max}\ L_{p,A,15mins}$	The maximum A weighted noise level measured in decibels over a period of 15 minutes.
Long-term noise event	Noise exposure which persists for a period greater than five days, even when there are respite periods when the noise is inaudible within those five days.
Medium-term noise event	Noise exposure which persists for an aggregate period not greater than five days and does not re-occur (for a period of one hour or more) for a period of at least four weeks.
RBL	Rating Background Level.
S3257C17 Report	The Sonus report “Surat Gas Project – Noise and Vibration Impact Assessment”, Ref. No. S3257C17, dated November 2011.
Sensitive receptor	A location in the vicinity of the proposed development, where noise may affect the amenity of the land use. For the proposed development, sensitive receptors are generally dwellings.
Short-term noise event	Noise exposure which persists for an aggregate period not greater than eight hours and does not re-occur (for a period of one hour or more) for a period of at least seven days.
Sound power level	A measure of the sound energy emitted from a source of noise.
VFD	Variable Fan Drive.
WHO	World Health Organisation.
Worst-case	Conditions resulting in the highest noise level at or inside dwellings. Worst-case meteorological conditions can be characterised as no cloud at night with wind from the project site to dwellings.

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1 INTRODUCTION

Sonus Pty Ltd (Sonus) has been engaged to conduct a supplementary noise and vibration assessment of the proposed Surat Gas Project (the project) for Arrow Energy Pty Ltd (Arrow).

The assessment was commissioned to understand the potential for any change to the noise and vibration impact of the project as a result of updates to the project description since the environmental impact statement (EIS) was finalised and exhibited. The assessment specifically addresses project components that have been affected by these updates and supplements the initial assessment conducted for the project.

The initial assessment, conducted by Sonus, is detailed in the report “Surat Gas Project - Noise and Vibration Impact Assessment”, Ref. No. S3257C17, dated November, 2011 (the S3257C17 Report). The S3257C17 Report was included as Appendix N in the EIS for the project, published in March 2012.

The supplementary assessment uses the method and criteria described in the S3257C17 Report to assess the noise and vibration impact of the proposed updates to the project description. This supplementary assessment will form part of the Supplementary Report to the EIS being prepared for the project.

2 PROJECT DESCRIPTION UPDATES

Since preparation of the Surat Gas Project EIS, further knowledge of the gas reserves has been gained resulting in refinement of the field development plan and basis for design of coal seam gas infrastructure. The updates applicable to the noise and vibration impact assessment include the addition of multi-well pads to form a combination of both vertical and deviated well scenarios, the layout of the central gas processing facilities (CGPFs) and water treatment facilities, the number and capacity of production facilities and the equipment associated with these, the power supply options for construction and operation of wells and facilities, and revised flaring scenarios.

Arrow has identified the properties on which four of the eight CGPFs will be located, two of which will have water treatment facilities located adjacent to them. In the EIS this arrangement was referred to as an integrated processing facility. This term will no longer be used and the facilities will be referred to by their function i.e., CGPF and water treatment facility. The exact locations of infrastructure within the properties have not been determined with the final siting of infrastructure to be determined through a constraints analysis.

The CGPF facilities will comprise up to three compressor trains, each with a capacity to process 75 TJ/d of gas. The facilities will typically compress 75 to 225 TJ/d, with a sparing capacity of one train (75 TJ/d) potentially adopted. As such, with an N+1 sparing capacity, compression could be up to 300 TJ/d. This compares to the maximum of 150 TJ/d sized facilities considered in the EIS. A typical layout of the CGPF with an additional compressor train to account for the N+1 sparing scenario is provided in Appendix A.

The number of water treatment facilities and associated storage facilities (dams) has been reduced from the six described in the EIS, to two. The northern water treatment facility is expected to be sized to treat approximately 35 ML/day of coal seam gas water, and the southern water treatment facility is expected to be sized to treat approximately 90 ML/day compared to 60 ML/day assessed in the EIS. The main noise sources associated with the water treatment facility will include those previously considered in the EIS for water treatment, with additional electric motors, steam compressors and pressure control valves.
In addition to single wells, multi-well pads will be drilled, which will comprise an average of 9 wells per pad with the potential for up to 12 wells per pad, approximately spaced 8 m apart. A typical layout of the multi-well pad is provided in Appendix A. Wells will be either supplied

with power from the nearest CGPF or in a few exceptional circumstances may have temporary power generation from a gas engine.

The EIS assessed the potential impacts associated with power being supplied through self-generation at the site of the facilities and wells, with power supplied by the Queensland electricity grid described as the alternate power supply option that Arrow was considering. Refinements to Arrow's basis for design include consideration for their power supply, with the alternate option of grid power, now being favoured. Self-generated power may however, still be necessary until connection to a third party's infrastructure can be made. From a noise perspective, the power requirements for self-generated power at a multi-well pad of up to 12 wells and at a CGPF (with a capacity greater than that assessed in the EIS), has been included in this assessment.

The temporary self-generated power supply option for a CGPF allows for up to 50MW of power to be supplied. A review of available power generation plant found that there are small and medium capacity units e.g., 1.1 MW engines and 5.7 MW gas turbines. As detailed design has not been conducted and the procurement strategy has not been developed, the type of power generation equipment is not known. Consequently configurations using 47 1.1 MW engines and 10 5.7 MW gas turbines were modelled to capture the range of possible scenarios.

A multi-well pad has a power requirement of 720kW, which for the temporary self-generated power supply option, has been assessed through consideration of a 749kW engine.

Ramp-up flaring is expected to result from commissioning of eight CGPFs. Planned and unplanned maintenance flaring at CGPFs includes partial (i.e., one train) and full shutdowns which have changed due to the increased capacity of a CGPF and larger train sizes. Pilot flaring of the CGPF will no longer occur as nitrogen will be used for purging. No gas will be flared at an FCF.

The equipment information associated with the abandonment of wells is consistent with the assumptions considered in the initial assessment, therefore the noise impact and mitigation requirements provided in the initial assessment remain valid.

The updates to the project descriptions above generally relate to the configuration and operation of the project. The construction method and processes associated with the project remain consistent with the assumptions considered in the initial assessment, therefore the conclusions in the initial assessment and EIS for construction remain valid.

3 LEGISLATIVE CONTEXT

Since the EIS was finalised and exhibited, there have been no changes to the relevant noise and vibration related legislation and guidelines. However, there has been a recent guideline release which is relevant to petroleum activities in Queensland. The guideline, discussed below, is consistent with the legislation and other guidelines previously considered for the project. Therefore, the proposed requirements and conditions as outlined in the S3257C17 Report are still appropriate and have been directly adopted in this assessment.

3.1 Legislation and Guidelines

The legislation and guidelines relevant to the establishment of appropriate noise and vibration assessment conditions are listed below.

Noise

- the *Environmental Protection Act 1994;*
- the *Environmental Protection (Noise) Policy 2008;*
- World Health Organization (WHO) Guidelines, 1999;
- former Department of Environment and Resource Management (DERM) "Coal Seam Gas Industry Procedural Guide – Control of Noise from Gasfield Activities", 2011[1] (the Procedural Guide); and,
- DERM "Assessment of Low Frequency Noise" Draft Guideline, 2002.

In March 2013, the Department of Environment and Heritage Protection (DEHP) released the "Noise Assessment Guideline – Prescribing noise conditions for environmental authorities for petroleum activities" (the Noise Assessment Guideline) which is intended:

> *to assist in the assessment of noise impacts and the development of noise conditions for petroleum activities within the general framework provided by the Environmental Protection Act 1994.*

The Noise Assessment Guideline provides recommended noise conditions which are based on the Procedural Guide and are therefore consistent with the proposed conditions in the S3257C17 Report.

[1] A document prepared by Ron Rumble Renzo Tonin, and released by DERM.

Vibration

- Australian Standard AS 2670.2-1990 “Evaluation of human exposure to whole-body vibration – Part 2: Continuous and shock induced vibration in buildings (1 to 80 HZ)”; and
- German Standard DIN 4150.3-1999 “Structural Vibration – Part 3: Effect of vibration on structures”.

Blasting

- the *Environmental Protection Act 1994;*
- DERM “Noise and vibration from blasting” Guideline, 2006.

As there has been no updates in the project description relating to blasting activity, blasting activity has not been considered further in this assessment; and the conclusions and recommendations in the initial assessment remain valid.

3.2 Criteria

3.2.1 Noise

In the EIS, noise criteria were developed for the different activities associated with the project based on the existing acoustic environment (referred to as scenarios) at potential sensitive receptor locations in the vicinity of the project development area.

The activities, scenarios and the resultant noise criteria considered in the initial assessment, (provided in Appendix N of the EIS) have been adopted for this report.

3.2.2 Vibration

The vibration criteria in this assessment have been adopted from the initial assessment, as detailed in the S3257C17 Report and provided in the Appendix N of the EIS.

4 ASSESSMENT METHOD

This report maintains the method developed in the initial noise and vibration impact assessment as detailed in the S3257C17 Report and reconsiders the components in the initial assessment which may have been affected by the updates to the project description.

Specifically, this report has considered the following components:

- Noise impact assessment
- Vibration impact assessment
- Off-site traffic impact assessment
- Cumulative impact assessment
- Analysis of potential impact on livestock

For other components of the assessment, as outlined in Section 4 of the S3257C17 Report, the assessment outcomes and conclusions have been directly adopted in this report as they have not been affected by the updates to the project description

5 NOISE IMPACT ASSESSMENT

The noise impact assessment considers noise from the project components which have the potential to be affected by the updates to the project description, as outlined in Section 2. Specifically, the assessment considers the noise from the operation of the multi-well pads, CGPFs and water treatment facilities.

As the site location and design of the facilities are yet to be finalised, the assessment has been based on an example location with typical site layout and indicative equipment.

5.1 Assessment Locations

The assessment considers noise levels at specific setback distances from the centre of the typical CGPF layout and from the boundary of the multi-well pad fenced area as shown in Appendix A.

The setback distances considered in this assessment are 1km, 1.5km, 2km, 3km and 5km from the CGPF in the north, east, south and west directions; and 200m, 250m, 300m, 350m, 400m, 450m and 500m from the multi-well pad in the same relative directions. As the level of equipment and the number of sites has changed, these locations are different to those considered in the S3257C17 Report. Therefore, the previous designations referred to as Reference Locations (RFs) have not been used in this assessment. Appendix A shows the assumed plant orientation for the purpose of determining the relative directions.

The new setback distances and relative directions above (assessment locations) have been selected to provide a better indication of the noise level variation in proximity of the facilities. Although the locations include distances as close as 1km from the CGPF and 200m from the multi-well pad, a minimum separation distance of approximately 1.5km and 400m has been assumed between the closest sensitive receptor, and the CGPF and multi-well pad, respectively. The provision of such minimum separation distances has been taken into consideration in determining the required mitigation measures.

Notwithstanding, should the sensitive receptors be located within the minimum separation distances, the modelled noise levels at the closer distances will provide an indication of the extent of additional noise reduction required in order to achieve the criterion. The additional noise reduction may need to be provided by acoustic treatment beyond the extent

recommended in this report, which may be determined during the detailed design stage of the project.

5.2 Applicable Criteria

To provide a worst-case assessment and to be consistent with the initial assessment, the assessment assumes an existing low noise environment at the sensitive receptors (i.e., assessment locations) with no noise contribution from any existing Arrow facilities in the area.

On the basis of the above, the resultant noise criteria applicable at all assessment locations for the project are provided in Table 5.1. These criteria correspond to the most stringent criteria in accordance with the Procedural Guide.

Table 5.1: Noise criteria at sensitive receptors.

Time Period	Descriptor	Noise Criteria (dB(A)) at Sensitive Receptors		
		Short Term Noise Event	Medium Term Noise Event	Long Term Noise Event
7:00am - 6:00pm	$L_{Aeq,adj,15mins}$	45	43	40
6:00pm - 10:00pm	$L_{Aeq,adj,15mins}$	40	38	35
10:00pm - 6:00am	$L_{Aeq,adj,15mins}$ $\max L_{p,A,15mins}$	28 55	28 55	28 55
6:00am - 7:00am	$L_{Aeq,adj,15mins}$	40	38	35

5.3 Meteorological Conditions for Noise Modelling

Based on the analysis of meteorological conditions provided in the S3257C17 Report, CONCAWE Categories 5 and 6 meteorological conditions are considered to be a feature of the project development area for sensitive receptors located in all directions of a site, except in the west and northwest directions.

Nevertheless, for the purpose of this assessment, the worst-case (CONCAWE Category 6) meteorological conditions have been considered in the assessment of noise at all assessment locations (i.e., each setback distance and relative direction from the facility).

5.4 Modelled Scenarios

Different modelling scenarios have been considered for the multi-well pad and CGPF based on the power supply options for the sites (i.e., permanent or temporary), and also the water treatment facility co-located with the CGPF and the revised flaring strategy. The modelled scenarios are summarised in Table 5.2.

Table 5.2: Modelled Scenarios.

Scenario	Description
PAD P	Multi-well pad with power supply from the primary power grid
PAD T	Multi-well pad with temporary power – 749kW unit
CGPF P	CGPF with the power supply from the primary power grid
CGPF T1	CGPF with temporary power configuration 1 – 47 x 1.1MW units
CGPF T2	CGPF with temporary power configuration 2 – 10 x 5.7MW units
WTF	Water treatment facility adjacent to the CGPF
FLARE	Noise from the revised flaring strategy

5.5 Typical Equipment

As the equipment selection and configuration at the multi-well pads and CGPFs are yet to be finalised, indicative equipment selections have been considered in the noise modelling.

The main noise sources modelled for the multi-well pad and CGPF arrangements are listed in Table 5.3. Table 5.3 also includes the total sound power levels and the quantity of each type of equipment. The octave band sound power levels and source of the data are provided in Appendix B.

Table 5.3: Main noise sources at the sites.

Noise Source	Sound Power Level (dB(A))	Modelled Quantity	Modelled Scenario
Multi-well Pad			
Well Equipment			
Electric motor – 60kW	81	12	PAD P PAD T
Multi-well Pad Temporary Power – 1 x 749kW Unit			
Mechanical – *enclosed achieving 71 dB(A) at 15m*	102	1	PAD T
Exhaust – *attenuated achieving 71 dB(A) at 15m*	102	1	

Noise Source	Sound Power Level (dB(A))	Modelled Quantity	Modelled Scenario
CGPF			
Compressor Train**			
Electric motor – 12.6MW	110	6	CGPF P, CGPF T1 CGPF T2
Variable speed drive	108	6	
LP Compressor	108	3	
HP Compressor	104	2	
Cooler fan	104	48	
Water Transfer Pump			
Centrifugal pump – 150 kW	98	1	CGPF P, CGPF T1 CGPF T2
Flaring$^{\Psi}$			
Ramp-up maximum – 72 TJ/d	108	1	FLARE
Upset condition – 75 TJ/d	108	1	
Upset condition maximum – 225 TJ/d	113	1	
CGPF Temporary Power Configuration 1 – 47 x 1.1MW Unit			
Mechanical – *enclosed achieving 76 dB(A) at 7m*	101	47	CGPF T1
Exhaust – *attenuated achieving 76 dB(A) at 7m*	101	47	
Cooler fan	104	47	
CGPF Temporary Power Configuration 2 – 10 x 5.7MW Unit			
Air inlet – *with standard silencer and air filter*	108	10	CGPF T2
Mechanical package – *with standard enclosure*	106	10	
Exhaust – *with standard silencer*	109	10	CGPF T2
Lube oil cooler – *standard*	100	10	
Cooler fan	104	40	
CGPF with Water Treatment Facility			
Centrifugal pump	87	44	WTF
Electric motor – 55 kW	87	30	
Electric motor – 450 kW	95	14	
Electric motor – 1.6MW	104	4	
Steam compressor	93	4	
Pressure control valve	93	24	

* All noise sources are long-term noise sources, except for the upset condition flaring which is a medium-term noise event.

** Modelled considered 3 trains operating simultaneously.

Ψ The upset condition flaring rates (TJ/d) will depend on the number of trains affected. The nominal rate for a single train shutdown is 75 TJ/d, whilst a part train shutdown rate is 25TJ/d. A 25 TJ/d flare will produce a lower noise level than a 75 TJ/d flare, and therefore the 75 TJ/d flare has been considered as the worst-case scenario for a single train shutdown. The maximum flare rate for a facility is 225 TJ/d, during a 3 train shutdown, which has therefore also been considered.

5.6 Noise Modelling

The noise from the operation of the multi-well pad and CGPF has been modelled for the various assessment locations using the CONCAWE noise propagation model in the SoundPlan noise modelling software.

The CONCAWE propagation model separates ground attenuation into the categories of hard ground and ground with finite acoustic impedance. CONCAWE states that hard ground should be used for surfaces such as concrete or water and all other surfaces including grass or soil should be considered as finite acoustic impedance. Therefore, the finite acoustic impedance category has been used.

Flat ground topography has been assumed in the model given the generally flat ground in the project development area. The model also assumes no noise-attenuating features across the landscape, such as dense trees or buildings. These site conditions correspond to the worst-case topographical conditions and will provide worst-case (highest) modelled noise levels for most locations[2].

The modelled noise levels at the assessment locations for each of the considered scenarios are provided below.

5.7 Modelled Noise Levels

5.7.1 Multi-well Pads

The modelled noise levels from the operation of the multi-well pad for the permanent and temporary power scenarios (PAD P and PAD T, respectively) are presented in Table 5.4. Noise contours of the modelled noise levels are provided in Appendix C.

[2] An example where the worst-case topographical conditions may occur is at the tree-less Jimbour Plains.

Table 5.4: Modelled noise levels from the multi-well pads.

Setback distance (m) from site boundary	Noise Criterion (dB(A))	Modelled Noise Level (dB(A)) by Relative Direction			
		North	East	South	West
PAD P					
200	28	***35***	***34***	***35***	***34***
250	28	***33***	***31***	***33***	***31***
300	28	***31***	***30***	***31***	***29***
350	28	***29***	28	***29***	28
400	28	27	26	27	26
450	28	25	25	26	25
500	28	24	23	24	23
PAD T					
200	28	***45***	***42***	***45***	***47***
250	28	***42***	***40***	***43***	***44***
300	28	***41***	***39***	***41***	***42***
350	28	***39***	***37***	***40***	***40***
400	28	***37***	***36***	***38***	***38***
450	28	***36***	***34***	***36***	***37***
500	28	***35***	***33***	***35***	***35***

Note: Values in bold italic indicate that the modelled noise level exceeds of the noise criterion.

The modelling indicates that the noise from the multi-well pads with the permanent power supply from the grid will achieve the long term night-time noise criterion of 28 dB(A) with the 400m separation distance (i.e., sensitive receptor located at least 400m from the site boundary). The noise from the multi-well pads with the unattenuated temporary power supply will exceed the noise criterion of 28 dB(A) for all setback distances considered.

In order to achieve the criterion at a setback distance of 400m from the multi-well pad with temporary power, mitigation measures may need to be incorporated, which are considered in Section 5.8.1.

5.7.2 CGPFs

The modelled noise levels from the operation of the CGPFs for the permanent (CGPF P) and temporary power configuration (CGPF T1 and CGPF T2) are presented in Table 5.5. Noise contours of the modelled noise levels are provided in Appendix C.

Table 5.5: Modelled noise levels from the CGPFs.

Setback distance (km) from centre of facility	Noise Criterion (dB(A))	Modelled Noise Level (dB(A)) by Relative Direction			
		North	East	South	West
CGPF P					
1	28	***51***	***49***	***50***	***50***
1.5	28	***45***	***44***	***44***	***44***
2	28	***41***	***40***	***40***	***40***
3	28	***34***	***34***	***34***	***34***
5	28	25	24	25	25
CGPF T1					
1	28	***54***	***52***	***54***	***53***
1.5	28	***48***	***47***	***48***	***47***
2	28	***44***	***43***	***44***	***43***
3	28	***37***	***37***	***37***	***37***
5	28	28	28	28	28
CGPF T2					
1	28	***54***	***53***	***55***	***53***
1.5	28	***48***	***48***	***49***	***48***
2	28	***44***	***44***	***45***	***44***
3	28	***38***	***38***	***38***	***38***
5	28	***29***	***29***	***29***	***29***

Note: Values in bold italic indicate that the modelled noise level exceeds of the noise criterion.

The modelling for the different unattenuated CGPF scenarios indicates that the noise at all sensitive receptors will exceed the long term night-time noise criterion of 28 dB(A), except at those receptors located at least 5km from facilities that utilise the permanent or temporary power configuration 1 (i.e., scenarios CGPF P and CGPF T1).

In order to achieve the criterion at distances within 3km of the facilities, mitigation measures may need to be incorporated, which are considered in Section 5.8.2.

It is noted that the modelled levels in Table 5.5 do not include the noise from water treatment facilities or flaring events (i.e., the ramp-up or upset conditions flaring).

Noise levels associated with the water treatment facilities and flaring are considered separately in the following sections, taking into account the cumulative noise with the CGPF above where relevant.

5.7.3 Water Treatment Facilities

The modelled noise levels from the operation of a water treatment facility located adjacent to a CGPF are presented in Table 5.6.

Table 5.6: Modelled noise levels from the water treatment facilities.

Distance (km) from centre of CGPF	Water Treatment Facility Noise Contribution Limit (dB(A))	Modelled Noise Level (dB(A)) by Relative Direction			
		North	East	South	West
1	18	***39***	***40***	***41***	***39***
1.5	18	***33***	***34***	***35***	***33***
2	18	***29***	***30***	***30***	***29***
3	18	***22***	***23***	***23***	***22***
5	18	12	13	13	12

Note: Values in bold italic indicate that the modelled noise level exceeds of the noise criterion.

As the water treatment facility will be located adjacent to the CGPF, the cumulative noise of both facilities operating continuously will need to achieve the relevant long term night-time criterion. Since the CGPF will be designed to achieve 28 dB(A), the noise contribution from the water treatment facility will need to be designed to achieve 18 dB(A) or less to ensure that it does not increase the total noise above 28 dB(A). This approach is more practicable as treatment to the CGPF is more difficult.

The modelling for the unattenuated water treatment facility indicates that the noise at sensitive receptors at 3km from the facility will exceed the design level of 18 dB(A).

In order to achieve the criterion at distances within 3km of the facilities, mitigation measures may need to be incorporated, which are considered in Section 5.8.3.

5.7.4 Flaring

Modelling of the noise from the flaring events has been conducted based on revisions to the flaring strategy, in particular maximum flow rates for the different ramp-up and upset conditions. The modelled noise levels are presented in Table 5.7

Table 5.7: Modelled noise levels from flaring events.

Distance (km) from centre of CGPF	Noise Criterion (dB(A))	Modelled Noise Level (dB(A)) by Relative Direction			
		North	East	South	West
Ramp-up Flaring - 72 TJ/d					
1	28	***30***	***30***	***29***	28
1.5	28	23	22	23	22
2	28	18	18	18	18
3	28	12	12	12	12
5	28	4	4	4	4
Upset Conditions Flaring – 75TJ/d for 48 hours 4 times a year					
1	28	***30***	***30***	***29***	28
1.5	28	23	22	23	22
2	28	18	18	18	18
3	28	12	12	12	12
5	28	4	4	4	4
Upset Conditions Flaring – 225TJ/d for 24 hours once a year					
1	28	***35***	***35***	***34***	***33***
1.5	28	28	27	28	27
2	28	23	23	23	23
3	28	17	17	17	17
5	28	9	9	9	9

Note: Values in bold italic indicate that the modelled noise level exceeds of the noise criterion.

The modelling for the flaring indicates that the noise at sensitive receptors located at least 1.5km from the CGPF will achieve the night-time noise criterion of 28 dB(A).

The flaring events above are intermittent noise sources and can be considered separately from the long-term continuous operation of other equipment at the CGPF and water treatment facility. Therefore, the noise from these flaring events has been excluded from the CGPF and water treatment facility cumulative noise assessment.

5.8 Mitigation Measures

Where the modelled noise levels from operation of the facilities exceed the established noise criteria, mitigation measures in the form of conceptual acoustic treatment to be developed during the design stage of the project have been considered.

The acoustic treatment that has been considered is summarised in Table 5.8. The acoustic treatment is consistent with that considered for the EIS.

Table 5.8: Feasible acoustic treatment packages.

Treatment	Potential Treatment
Enclosure Treatment Package 1	Sealed steel enclosure with 1mm sheet thickness, and single stage acoustic louvres at inlet and discharge.
Enclosure Treatment Package 2	Sealed steel enclosure with1mm sheet thickness, and two stage (600mm) acoustic louvres at inlet and discharge.
Enclosure Treatment Package 3	Sealed steel enclosure with 1mm sheet thickness having 50mm sound absorbing internal lining, and 900mm long (33%) splitter attenuators at inlet and discharge.
Enclosure Treatment Package 4	Sealed steel enclosure with 1.6mm sheet thickness having 75mm sound absorbing internal lining, and 1500mm long (33%) splitter attenuators at inlet and discharge.
Cooler Treatment Package 1	Medium-grade cooler silencers
Cooler Treatment Package 2	High-grade cooler silencers
Cooler Treatment Package 3	Fan with Variable Fan Drive (VFD), and high-grade cooler silencers
Cooler Treatment Package 4	Ultra low noise fan with VFD, and high-grade cooler silencers
Muffler	Low-grade, medium-grade, high-grade or super critical-grade mufflers
Barrier	Solid barrier of sufficient height around single noise source

5.8.1 Multi-well Pads

An acoustic barrier around the temporary power supply equipment has been considered in order to reduce the noise level at the assessment locations. Based on calculations, the noise level reduction that can be achieved with the application of the barrier is provided in Table 5.9.

Table 5.9: Noise level reduction from the acoustic treatment for multi-well pad.

Noise Source	Noise Level Reduction (dB) at each Octave Band Centre Frequency							Potential Treatment
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	
Multi-well Pad Temporary Power – 1 x 749kW Unit								
Mechanical	4	6	8	10	13	16	18	Insulated barrier – 3.3m high
Exhaust	3	4	6	8	10	13	16	Insulated barrier – 3.3m high

With the barrier incorporated around the temporary power supply equipment, the noise levels from the site have been modelled and are summarised in Table 5.10. A noise contour plan of the modelled noise levels with the barrier is provided in Appendix D.

Table 5.10: Modelled noise levels from the multi-well pads with additional acoustic treatment.

Setback distance (m) from site boundary	Noise Criterion (dB(A))	Modelled Noise Level (dB(A)) by Relative Direction			
		North	East	South	West
PAD T					
200	28	***36***	***35***	***36***	***36***
250	28	***34***	***32***	***34***	***34***
300	28	***32***	***31***	***32***	***32***
350	28	***30***	***29***	***30***	***30***
400	28	28	27	28	28
450	28	27	26	27	27
500	28	26	25	26	26

Note: Values in bold italic indicate that the modelled noise level exceeds of the noise criterion.

Based on the modelled noise levels in Table 5.10, the long term night-time noise criterion of 28 dB(A) can be achieved at the minimum setback distance of 400m from the site with an acoustic barrier around the power generation unit. However, should sensitive receptors be located closer than 400m from the site, additional acoustic treatment may need to be incorporated to achieve the criterion, which may comprise treatment to the individual well equipment.

It is noted that additional acoustic treatment has not been considered for the unattenuated multi-well pad with permanent power supply since the modelled noise levels achieved the long-term night-time noise criterion of 28 dB(A) with a 400m separation distance (refer Table 5.5). Therefore no noise contours "with attenuation" are provided for this scenario. Should sensitive receptors be located closer than 400m from the site, additional acoustic treatment may need to be incorporated to achieve the criterion, which may comprise treatment to the individual well equipment.

5.8.2 CGPFs

The acoustic treatment summarised in Table 5.8 has been considered for the main noise sources at the CGPF in order to achieve the long term night-time noise criterion of 28 dB(A) at setback distances of 1.5km, 2km and 3km from the facilities.

The required noise level reduction with the application of the treatment to the main noise sources and the potential treatment for the different scenarios considered are provided in Tables 5.11 to 5.13.

Table 5.11: Required noise level reduction from acoustic treatment for CGPF (CGPF P scenario).

Noise Source	Required Noise Level Reduction (dB) at each Octave Band Centre Frequency							Potential Treatment
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	
Acoustic treatment to achieve 28 dB(A) at 1.5km								
Compressor Train (3 trains operating)								
Electric motor – 12.6MW	0	10	19	21	26	34	17	Enclosure Treatment Package 2
Variable speed drive	0	10	19	21	26	34	17	Enclosure Treatment Package 2
LP Compressor	0	8	8	11	21	24	16	Enclosure Treatment Package 1
HP Compressor	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Cooler fan	15	18	22	28	30	25	10	Cooler Treatment Package 4
Water Transfer Pump								
Centrifugal pump – 150 kW	0	10	19	21	26	34	17	Enclosure Treatment Package 1
Acoustic treatment to achieve 28 dB(A) at 2km								
Compressor Train (3 trains operating)								
Electric motor – 12.6MW	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Variable speed drive	0	8	8	11	21	24	16	Enclosure Treatment Package 1
LP Compressor	0	8	8	11	21	24	16	Enclosure Treatment Package 1
HP Compressor	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Cooler fan	9	13	15	18	20	11	0	Cooler Treatment Package 3

Noise Source	Required Noise Level Reduction (dB) at each Octave Band Centre Frequency							Potential Treatment
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	
Acoustic treatment to achieve 28 dB(A) at 3km								
Compressor Train (3 trains operating)								
Electric motor – 12.6MW	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Cooler fan	2	8	10	16	14	10	0	Cooler Treatment Package 2

Table 5.12: Required noise level reduction from acoustic treatment for CGPF (CGPF T1 scenario).

Noise Source	Required Noise Level Reduction (dB) at each Octave Band Centre Frequency							Potential Treatment
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	
Acoustic treatment to achieve 28 dB(A) at 1.5km								
Compressor Train (3 trains operating)								
Electric motor – 12.6MW	0	10	19	21	26	34	17	Enclosure Treatment Package 2
Variable speed drive	0	10	19	21	26	34	17	Enclosure Treatment Package 2
LP Compressor	0	8	8	11	21	24	16	Enclosure Treatment Package 1
HP Compressor	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Cooler fan	15	18	22	28	30	25	10	Cooler Treatment Package 4
Water Transfer Pump								
Centrifugal pump – 150 kW	0	10	19	21	26	34	17	Enclosure Treatment Package 1
CGPF Temporary Power Configuration 1 – 47 x 1.1MW Unit								
Mechanical	5	10	21	39	46	41	18	Enclosure Treatment Package 3
Exhaust	10	15	20	20	25	25	25	Super critical-grade muffler
Cooler fan	15	18	22	28	30	25	10	Cooler Treatment Package 4
Acoustic treatment to achieve 28 dB(A) at 2km								
Compressor Train (3 trains operating)								
Electric motor – 12.6MW	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Variable speed drive	0	8	8	11	21	24	16	Enclosure Treatment Package 1
LP Compressor	0	8	8	11	21	24	16	Enclosure Treatment Package 1
HP Compressor	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Cooler fan	9	13	15	18	20	11	0	Cooler Treatment Package 3
Water Transfer Pump								
Centrifugal pump – 150 kW	0	10	19	21	26	34	17	Enclosure Treatment Package 1
CGPF Temporary Power Configuration 1 – 47 x 1.1MW Unit								
Mechanical	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Exhaust	8	10	14	15	20	15	10	High-grade muffler
Cooler fan	15	18	22	28	30	25	10	Cooler Treatment Package 4

Noise Source	Required Noise Level Reduction (dB) at each Octave Band Centre Frequency							Potential Treatment
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	
Acoustic treatment to achieve 28 dB(A) at 3km								
Compressor Train (3 trains operating)								
Electric motor – 12.6MW	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Variable speed drive	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Cooler fan	2	8	10	16	14	10	0	Cooler Treatment Package 2
CGPF Temporary Power Configuration 1 – 47 x 1.1MW Unit								
Exhaust	8	10	14	15	20	15	10	High-grade muffler
Cooler fan	2	8	10	16	14	10	0	Cooler Treatment Package 2

Table 5.13: Required noise level reduction from acoustic treatment for CGPF (CGPF T2 scenario).

Noise Source	Required Noise Level Reduction (dB) at each Octave Band Centre Frequency							Potential Treatment
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	
Acoustic treatment to achieve 28 dB(A) at 1.5km								
Compressor Train (3 trains operating)								
Electric motor – 12.6MW	5	10	21	39	46	41	18	Enclosure Treatment Package 3
Variable speed drive	5	10	21	39	46	41	18	Enclosure Treatment Package 3
LP Compressor	0	8	8	11	21	24	16	Enclosure Treatment Package 1
HP Compressor	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Cooler fan	15	18	22	28	30	25	10	Cooler Treatment Package 4
Water Transfer Pump								
Centrifugal pump – 150 kW	0	10	19	21	26	34	17	Enclosure Treatment Package 1
CGPF Temporary Power Configuration 2 – 10 x 5.7MW Unit								
Air inlet	10	15	20	20	25	25	25	Super critical-grade muffler
Mechanical package	0	10	19	21	26	34	17	Enclosure Treatment Package 2
Exhaust	10	15	20	20	25	25	25	Super critical-grade muffler
Lube oil cooler	15	18	22	28	30	25	10	Cooler Treatment Package 4
Cooler fan	15	18	22	28	30	25	10	Cooler Treatment Package 4
Acoustic treatment to achieve 28 dB(A) at 2km								
Compressor Train (3 trains operating)								
Electric motor – 12.6MW	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Variable speed drive	0	8	8	11	21	24	16	Enclosure Treatment Package 1
LP Compressor	0	8	8	11	21	24	16	Enclosure Treatment Package 1
HP Compressor	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Cooler fan	15	18	22	28	30	25	10	Cooler Treatment Package 4

Noise Source	Required Noise Level Reduction (dB) at each Octave Band Centre Frequency							Potential Treatment
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	
CGPF Temporary Power Configuration 2 – 10 x 5.7MW Unit								
Air inlet	8	10	14	15	20	15	10	High-grade muffler
Mechanical package	0	10	19	21	26	34	17	Enclosure Treatment Package 2
Exhaust	10	15	20	20	25	25	25	Super critical-grade muffler
Lube oil cooler	9	13	15	18	20	11	0	Cooler Treatment Package 3
Cooler fan	15	18	22	28	30	25	10	Cooler Treatment Package 4
Acoustic treatment to achieve 28 dB(A) at 3km								
Compressor Train (3 trains operating)								
Electric motor – 12.6MW	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Variable speed drive	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Cooler fan	2	8	10	16	14	10	0	Cooler Treatment Package 2
CGPF Temporary Power Configuration 2 – 10 x 5.7MW Unit								
Air inlet	0	2	3	5	8	2	0	Medium-grade muffler
Mechanical package	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Exhaust	8	10	14	15	20	15	10	High-grade muffler
Lube oil cooler	0	1	3	8	6	3	0	Cooler Treatment Package 1
Cooler fan	9	13	15	18	20	11	0	Cooler Treatment Package 3

With the acoustic treatment incorporated in the design and the respective noise level reductions achieved (as provided in Tables 5.11 to 5.13), the noise levels at the different locations have been modelled and are summarised in Tables 5.14 to 5.16. Noise contours of the modelled noise levels from the CGPFs with additional acoustic treatment are provided in Appendix D.

Table 5.14: Modelled noise levels from the CGPF with additional acoustic treatment (CGPF P scenario).

Distance (km) from centre of CGPF	Noise Criterion (dB(A))	Modelled Noise Level (dB(A)) by Relative Direction			
		North	East	South	West
Acoustic treatment to achieve 28 dB(A) at 1.5km					
1	28	***31***	***30***	***30***	***30***
1.5	28	25	24	25	24
2	28	21	20	20	20
3	28	15	14	14	14
5	28	7	6	7	6
Acoustic treatment to achieve 28 dB(A) at 2km					
1	28	***37***	***35***	***36***	***36***
1.5	28	***31***	***30***	***30***	***30***

Distance (km) from centre of CGPF	Noise Criterion (dB(A))	Modelled Noise Level (dB(A)) by Relative Direction			
		North	East	South	West
2	28	27	26	26	26
3	28	20	20	20	20
5	28	12	11	12	11
Acoustic treatment to achieve 28 dB(A) at 3km					
1	28	***45***	***43***	***44***	***44***
1.5	28	***39***	***37***	***38***	***38***
2	28	***34***	***33***	***34***	***33***
3	28	27	27	27	27
5	28	18	18	18	18

Table 5.15: Modelled noise levels from the CGPF with additional acoustic treatment (CGPF T1 scenario).

Distance (km) from centre of CGPF	Noise Criterion (dB(A))	Modelled Noise Level (dB(A)) by Relative Direction			
		North	East	South	West
Acoustic treatment to achieve 28 dB(A) at 1.5km					
1	28	***33***	***32***	***34***	***33***
1.5	28	28	27	28	27
2	28	24	23	24	23
3	28	18	17	18	17
5	28	10	10	10	10
Acoustic treatment to achieve 28 dB(A) at 2km					
1	28	***38***	***37***	***38***	***37***
1.5	28	***32***	***31***	***32***	***32***
2	28	28	28	28	28
3	28	22	22	22	22
5	28	15	14	14	14
Acoustic treatment to achieve 28 dB(A) at 3km					
1	28	***45***	***44***	***46***	***45***
1.5	28	***39***	***38***	***39***	***39***
2	28	***34***	***34***	***35***	***34***
3	28	28	27	28	28
5	28	19	19	19	19

Table 5.16: Modelled noise levels from the CGPF with additional acoustic treatment (CGPF T2 scenario).

Distance (km) from centre of CGPF	Noise Criterion (dB(A))	Modelled Noise Level (dB(A)) by Relative Direction			
		North	East	South	West
Acoustic treatment to achieve 28 dB(A) at 1.5km					
1	28	***33***	***32***	***34***	***32***
1.5	28	27	26	27	26
2	28	23	22	23	22
3	28	17	16	17	16
5	28	9	9	9	9
Acoustic treatment to achieve 28 dB(A) at 2km					
1	28	***37***	***36***	***37***	***36***
1.5	28	***31***	***30***	***31***	***30***
2	28	27	26	27	26
3	28	21	20	21	20
5	28	13	12	13	12
Acoustic treatment to achieve 28 dB(A) at 3km					
1	28	***45***	***44***	***46***	***44***
1.5	28	***39***	***38***	***39***	***38***
2	28	***35***	***34***	***35***	***34***
3	28	28	28	28	28
5	28	20	20	20	20

The modelling indicates that the operational noise level at distances of 1.5km or greater can achieve the long term night-time noise criterion of 28 dB(A) with the additional acoustic treatment incorporated.

It is noted that the assessment has assumed that a separation distance of 1.5km between the facility and the closest sensitive receptor can be provided. If sensitive receptors are located closer, further acoustic treatment may be required in order to achieve the 28 dB(A) criterion and may include specially designed measures that provide a higher level of acoustic attenuation.

Low Frequency Noise

The low frequency noise inside dwellings from the CGPF with the application of the recommended treatment has also been considered. The noise inside representative dwellings located at the designated setback distances from the CGPF have been modelled

assuming a noise reduction of 10 dB(A) from outside to inside of the dwelling, and worst-case meteorological conditions. The modelled noise levels are provided in Table 5.17.

Table 5.17: Modelled low frequency noise levels (operation) from CGPFs.

Distance (km) from centre of CGPF	Indoor Noise Criterion, dB(A))	Outdoor Noise Level Target for Applied Treatment	Modelled Noise Level, dB(A)			
			North	East	South	West
CGPF P						
1.5	20	28 dB(A) at 1.5km	13	12	12	12
2	20	28 dB(A) at 2km	11	11	11	11
3	20	28 dB(A) at 3km	11	10	11	10
CGPF T1						
1.5	20	28 dB(A) at 1.5km	16	15	16	15
2	20	28 dB(A) at 2km	15	14	15	14
3	20	28 dB(A) at 3km	13	12	13	12
CGPF T2						
1.5	20	28 dB(A) at 1.5km	14	13	15	14
2	20	28 dB(A) at 2km	13	12	12	13
3	20	28 dB(A) at 3km	14	14	14	14

The modelling indicates that the low frequency noise level inside the dwellings will be no greater than 16 dB(A) with the application of the acoustic treatment, therefore achieving the 20 dB(A) low frequency noise level ($L_{pA,LF}$) criterion of the DERM Low Frequency Noise Draft Guideline.

5.8.3 Water Treatment Facility

The acoustic treatment summarised in Table 5.8 has been considered for the main noise sources at the water treatment facility. The assessment ensures that the cumulative noise from the CGPF and the water treatment facility achieves the long term night-time noise criterion of 28 dB(A) at 1.5km, 2km and 3km from the facilities.

On the basis that the CGPF will be designed to 28 dB(A), the water treatment facility will need to achieve a level of 18 dB(A) with the applied acoustic treatment. The required noise level reduction with the application of the treatment to the main noise sources and the potential treatment are provided in Tables 5.18.

Table 5.18: Required noise level reduction from acoustic treatment for water treatment facility.

Noise Source	Required Noise Level Reduction (dB) at each Octave Band Centre Frequency							Potential Treatment
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	
Acoustic treatment to achieve 18 dB(A) at 1.5km								
Centrifugal pump	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Electric motor – 55 kW	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Electric motor – 450 kW	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Electric motor – 1.6MW	0	10	19	21	26	34	17	Enclosure Treatment Package 2
Steam compressor	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Pressure control valve	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Acoustic treatment to achieve 18 dB(A) at 2km								
Centrifugal pump	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Electric motor – 55 kW	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Electric motor – 450 kW	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Electric motor – 1.6MW	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Steam compressor	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Pressure control valve	0	8	8	11	21	24	16	Enclosure Treatment Package 1
Acoustic treatment to achieve 28 dB(A) at 3km								
Electric motor – 1.6MW	0	8	8	11	21	24	16	Enclosure Treatment Package 1

With the acoustic treatment incorporated in the design and the respective noise level reductions achieved (as provided in Tables 5.18), the noise from the water treatment facility has been modelled and noise levels at the assessment locations are summarised in Table 5.19.

Table 5.19: Modelled noise levels from the water treatment facilities with additional acoustic treatment.

Distance (km) from centre of CGPF	Water Treatment Facility Noise Contribution Limit (dB(A))	Modelled Noise Level (dB(A)) by Relative Direction			
		North	East	South	West
Acoustic treatment to achieve 18 dB(A) at 1.5km					
1	18	***23***	***22***	***24***	***22***
1.5	18	18	17	18	17
2	18	14	14	14	13
3	18	8	8	8	7
5	18	<5	<5	<5	<5
Acoustic treatment to achieve 18 dB(A) at 2km					
1	18	***24***	***24***	***25***	***24***
1.5	18	***19***	***19***	***20***	***19***
2	18	15	15	16	15

Distance (km) from centre of CGPF	Water Treatment Facility Noise Contribution Limit (dB(A))	Modelled Noise Level (dB(A)) by Relative Direction			
		North	East	South	West
3	18	9	9	10	9
5	18	<5	<5	<5	<5
Acoustic treatment to achieve 18 dB(A) at 3km					
1	18	***32***	***33***	***34***	***32***
1.5	18	***27***	***27***	***28***	***26***
2	18	***23***	***23***	***24***	***22***
3	18	16	16	17	16
5	18	6	7	7	6

As noted previously, the assessment has assumed that a separation distance of 1.5km between the facility and the closest sensitive receptor can be provided. If sensitive receptors are located closer, further acoustic treatment may be required in order to achieve the 18 dB(A) criterion and may include enclosure treatment packages that provide a higher level of acoustic attenuation.

6 VIBRATION IMPACT ASSESSMENT

This assessment adopts the vibration criteria which have been considered in the initial assessment, detailed in the S3257C17 Report which is provided in Appendix N of the EIS.

The level of vibration at sensitive receptors is dependent on the equipment operating (i.e., the vibration source), and the separation distance and ground type between the sensitive receptors and the vibration sources. These factors are considered when determining the potential vibration impact on sensitive receptors from the project.

The updates to the project description have not resulted in a significant variation to the proposed type of equipment associated with the project (i.e., vibration source), and the relative location (i.e., distance) of the equipment to the sensitive receptors.

Therefore, the vibration impact at sensitive receptors as determined in the initial impact assessment does not change. That is, the conclusions for the vibration impact assessment in the S3257C17 Report remain valid.

7 OFF-SITE TRAFFIC IMPACT ASSESSMENT

Although not specifically detailed in the updated project description, consideration has been given to the potential change to the noise impact from off-site traffic generated by the project. The assessment has been based on the update to the road traffic impact assessment conducted by Cardno (Qld) Pty Ltd and summarised in the draft report "Road Impact Assessment – Surat Gas Project SREIS", Ref. No. CEB06413, dated 1st of May, 2013 (the RIA Report).

In regard to traffic volumes on the road network in the region, the following has been considered in this assessment:

- a maximum 4% increase in traffic volume generated by the project. This is approximately double the volume considered in the initial assessment; and,
- a 35% cumulative increase in traffic volume generated by all activity in the region by year 2025.

The values above have been based on the information in Section 5 of the RIA Report.

Based on a maximum traffic volume increase of 4%, the noise levels from road traffic will increase by less than 1 dB(A) above the current level. From a noise perspective, an increase of 1 dB(A) is considered negligible[3] and will not result a change in noise impact.

With a 35% cumulative increase in traffic volume generated by all activity in the region, the noise levels will increase by approximately 1 dB(A) above the current level. Such an increment is unlikely to be noticeable and will not result a change in noise impact.

As described in the S3257C17 Report, the impact from the additional vehicles on the road will be similar to the impact from existing vehicles using the road network. Therefore, there will be no change in noise impact as a result of additional vehicles associated with the project.

[3] Subjectively, a 3 dB(A) increase in noise level is just noticeable.

8 CUMULATIVE IMPACT ASSESSMENT

The cumulative noise and vibration impact assessment considers the noise and vibration impact of the project, existing developments and projects with an approved EIS which are located in the Surat Basin.

The noise and vibration impact assessments outlined in Sections 5 and 6, respectively, have determined that the noise and vibration impact of the project remains largely unchanged from that determined in the initial assessment.

Therefore, based on the above and the assumption that all other external factors remain unchanged, the conclusions for the cumulative impact assessment in the S3257C17 Report remain valid.

9 POTENTIAL IMPACT ON LIVESTOCK

The potential impact of noise and vibration on livestock located close to project infrastructure has been reviewed based on the noise modelling and the vibration impact assessment undertaken as a part of this report.

As the findings of this report indicate that the level of noise and vibration from the project (incorporating updates to the project description) is similar to that determined in the initial assessment, the conclusions of the S3257C17 remain valid. That is, the level of noise and vibration experienced by livestock outside of the site boundaries of the multi-well pads and CGPFs will be similar to when grazing near roads or rail.

10 CONCLUSION

This supplementary assessment has considered the potential change to environmental noise and vibration impacts from the project with the proposed project description updates.

The assessment maintained the method and criteria developed in the initial noise and vibration impact assessment, summarised in the S3257C17 Report. The assessment determined the noise and vibration impact for project components which are affected by the updates to the project description. For project components which are unaffected, the impacts and conclusion provided in the S3257C17 Report remain valid.

Based on predictions, the noise conditions will be achieved at the noise sensitive receptors with a feasible level of acoustic treatment applied to equipment at the multi-well pads, CGPFs and water treatment facilities.

The vibration impact from the project as determined in the initial assessment remains valid considering that the main factors which control vibration impact, such as the type of vibration source (i.e., type of equipment) and distance from the sensitive receptors, have not varied significantly with the updates to the project description.

As the noise and vibration impact of the project has remained largely unchanged with the updates to the project description, the conclusions for the cumulative impact assessment in the S3257C17 Report remain valid.

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APPENDIX A: TYPICAL MULTI-WELL PAD AND CGPF LAYOUTS

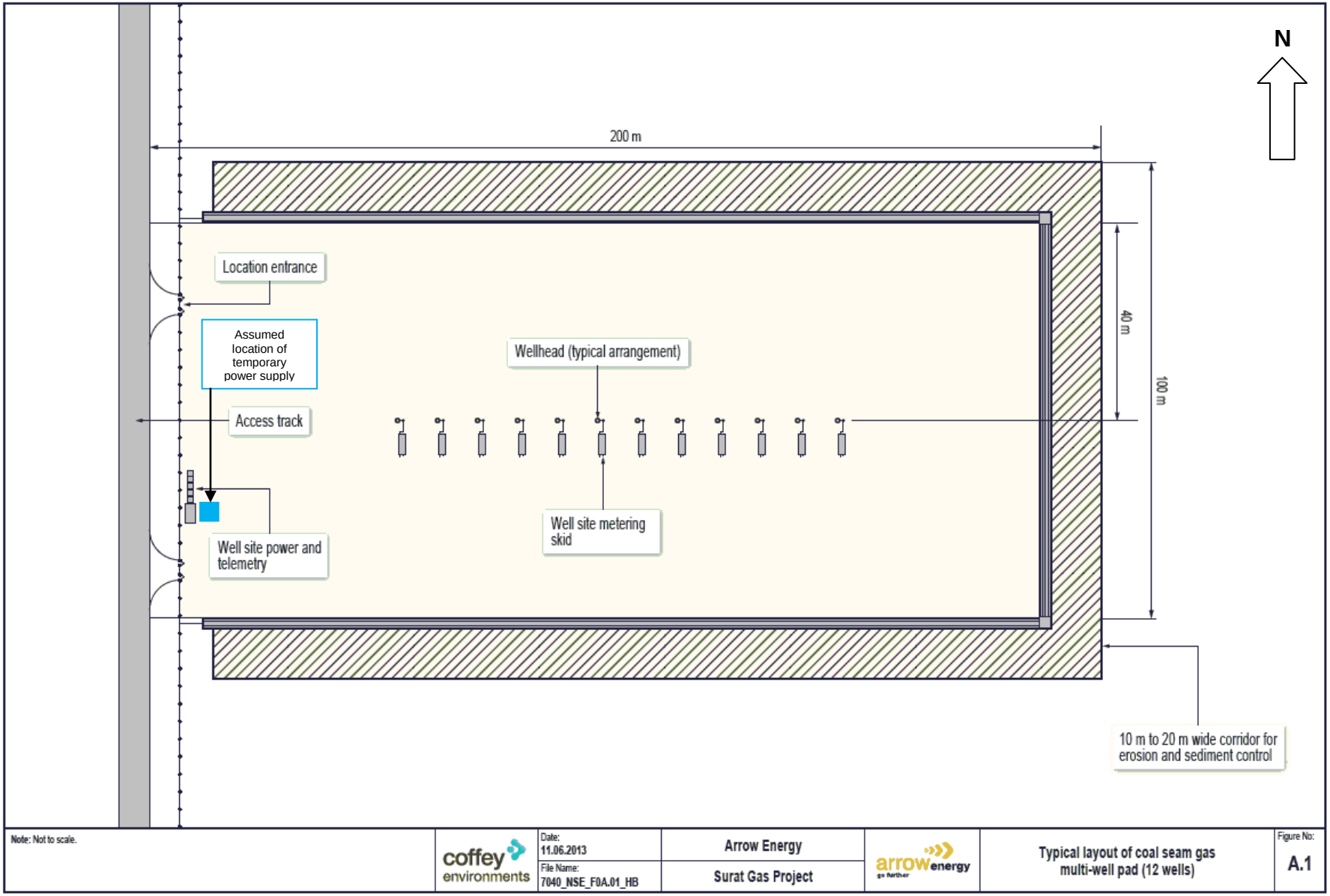


Figure A.1: Coal seam gas multi-well pad (12 wells).

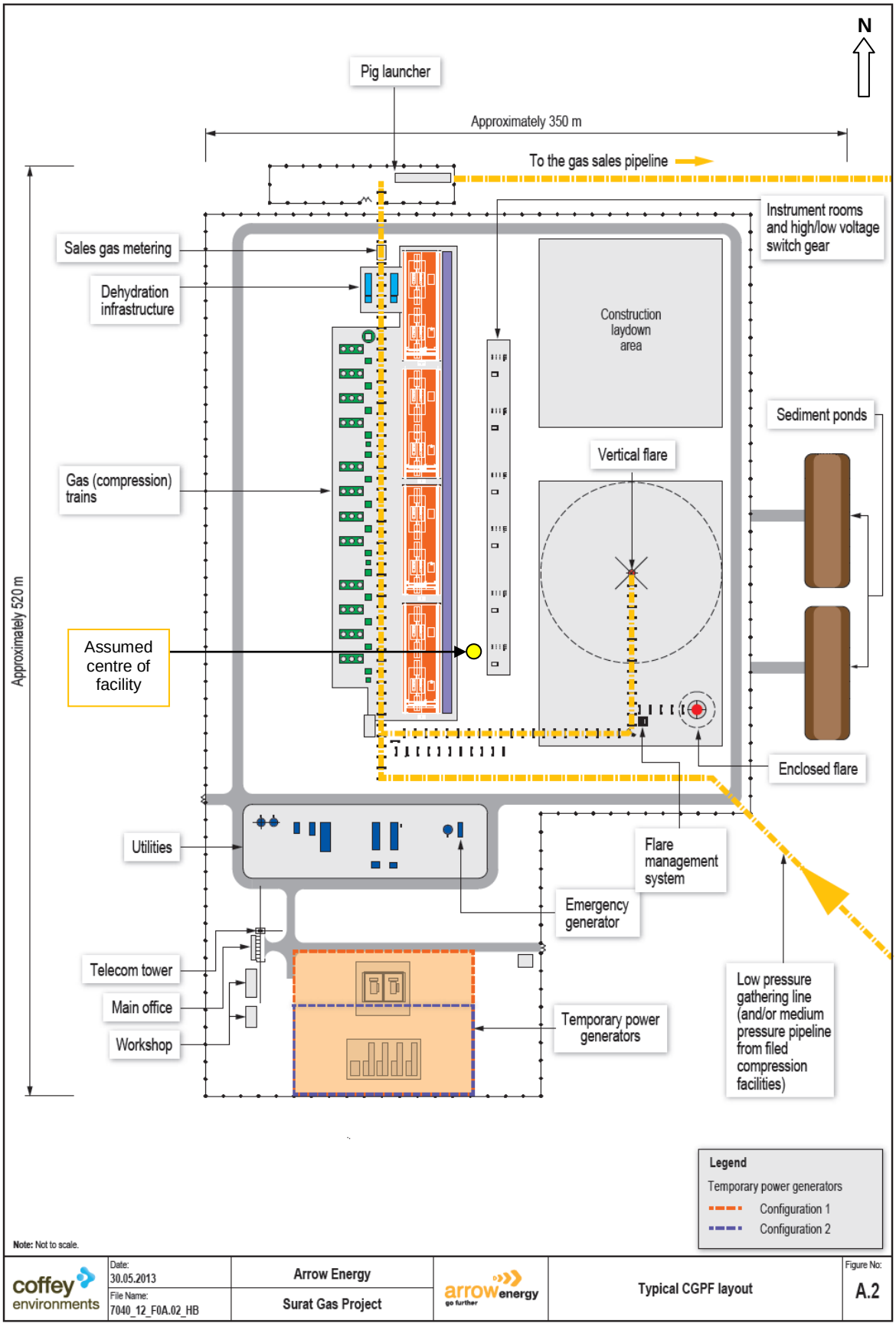


Figure A.2: Typical CGPF layout.

APPENDIX B: MAIN NOISE SOURCES, SOUND POWER LEVELS AND DATA SOURCE

Table B.1: Sound power levels of the main noise sources.

Noise Source	Maximum Sound Power Level (dB(A) re 1 pW) at each Octave Band Frequency									Total (dB(A))	Data Source
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz		
CGPF											
Compressor Train											
Electric motor – 12.6MW	-	76	88	96	101	104	106	102	93	110	SA
Variable speed drive	-	86	95	98	100	100	101	99	96	108	SA
LP Compressor	-	66	79	83	92	101	106	102	93	108	SA
HP Compressor	-	61	74	79	87	96	101	97	89	104	SA
Cooler fan	70	85	94	98	99	99	93	89	81	104	S
Flaring											
Ramp-up maximum – 72 TJ/d	63	79	94	97	92	91	97	107	99	108	S
Upset condition – 75 TJ/d	63	79	94	97	92	91	97	107	99	108	S
Upset condition maximum – 225 TJ/d	68	84	99	102	97	96	102	112	104	113	S
Water Transfer Pump											
Centrifugal pump – 150 kW	75	75	88	93	94	95	89	83	75	98	E
CGPF Temporary Power Configuration 1 – 47 x 1.1MW Unit											
Mechanical – *enclosed achieving 76 dB(A) at 7m*	-	64	75	84	88	92	93	98	87	101	M
Exhaust – *attenuated achieving 76dB(A) at 7m*	-	84	96	95	94	94	89	84	82	101	M
Cooler fan	70	85	94	98	99	99	93	89	81	104	S
CGPF Temporary Power Configuration 2 – 10 x 5.7MW Unit											
Air inlet – *with standard silencer and air filter*	67	83	97	104	97	87	74	103	93	108	M
Mechanical package – *with standard enclosure*	68	75	86	94	101	100	101	97	88	106	M
Exhaust – *with standard silencer*	79	94	97	102	106	98	94	91	84	109	M
Lube oil cooler – *standard*	65	85	92	93	93	94	91	87	79	100	M
Cooler fan	70	85	94	98	99	99	93	89	81	104	S
CGPF with Water Treatment Facility											
Centrifugal pump	35	48	61	70	79	82	82	77	67	87	E
Electric motor – 55 kW	35	48	61	70	79	82	82	77	67	87	E
Electric motor – 450 kW	43	58	70	79	87	90	91	87	80	95	E
Electric motor – 1.6MW	55	70	82	89	95	98	99	96	87	104	S
Steam compressor	-	74	80	82	87	89	86	80	71	93	S
Pressure control valve	-	38	58	73	85	92	86	75	60	93	S
Multi-well Pad											
Well Equipment											
Electric motor – 60kW	50	53	59	71	67	70	75	75	76	81	E

Noise Source	Maximum Sound Power Level (dB(A) re 1 pW) at each Octave Band Frequency									Total (dB(A))	Data Source
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz		
Multi-well Pad Temporary Power – 1 x 750kW Unit											
Mechanical – *enclosed achieving 71 dB(A) at 15m*	-	75	82	84	90	96	99	95	85	102	M
Exhaust – *attenuated achieving 71dB(A) at 15m*	-	67	80	89	90	96	97	97	88	102	M

Data Source Code:

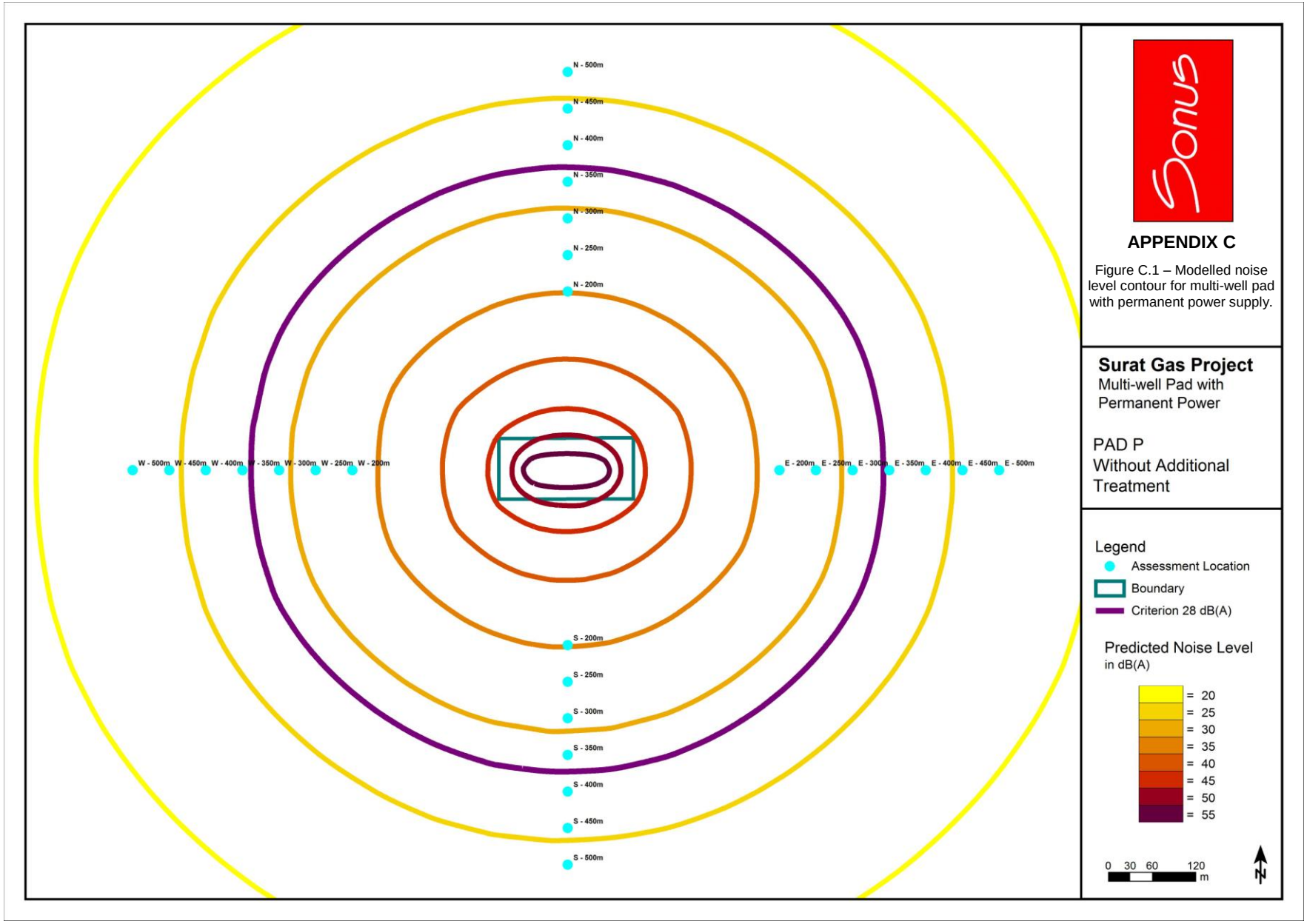
E EIS data

M Manufacturer's data

S Sonus database of noise sources

SA Savery & Associates, 2010. Supplementary information-Noise Assessment Australia Pacific LNG Upstream Project, Doc. No. SP0072.1 Rev 0. Savery & Associates Pty Ltd, Queensland.

APPENDIX C: NOISE CONTOURS – WITHOUT ADDITIONAL ACOUSTIC TREATMENT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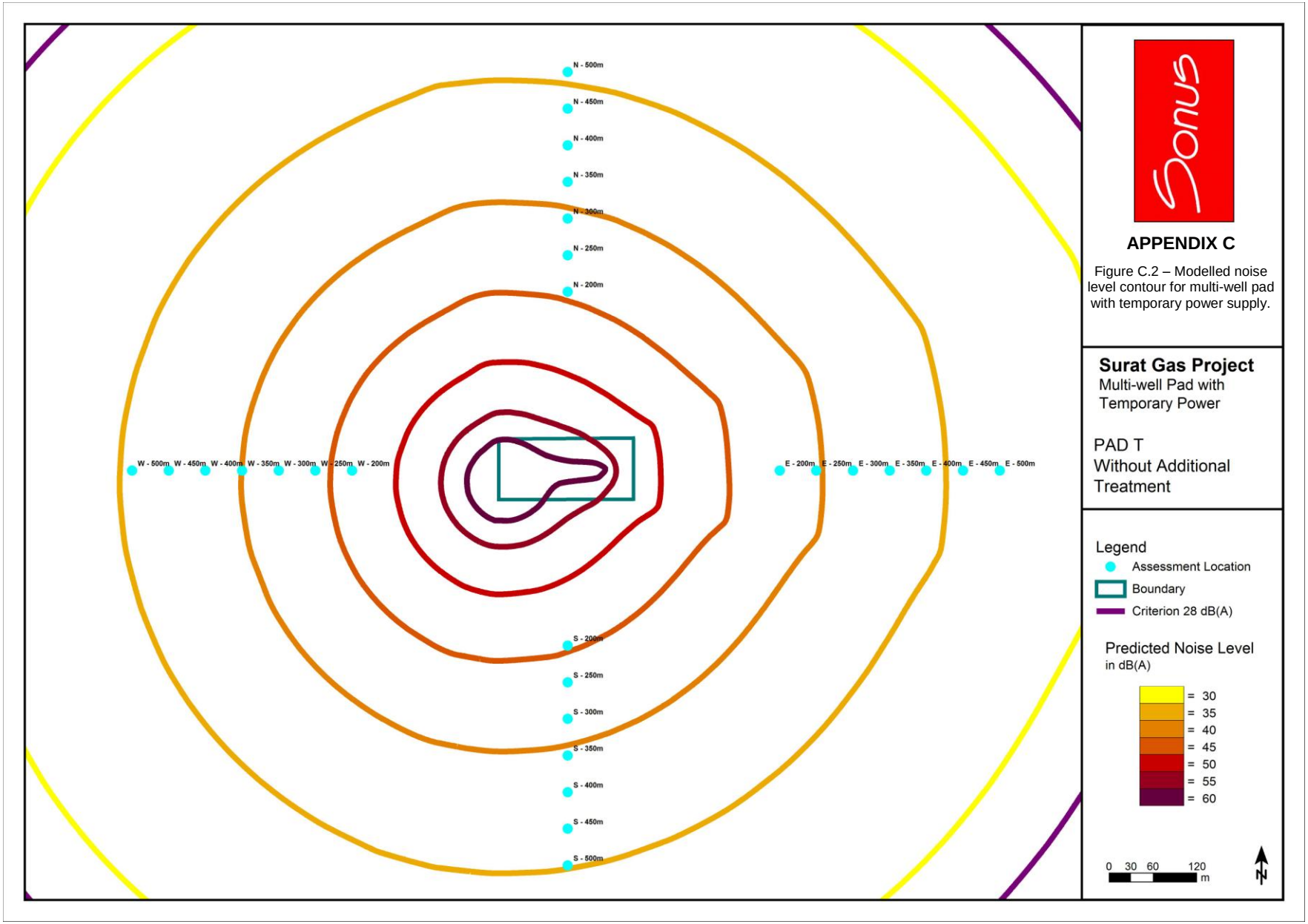
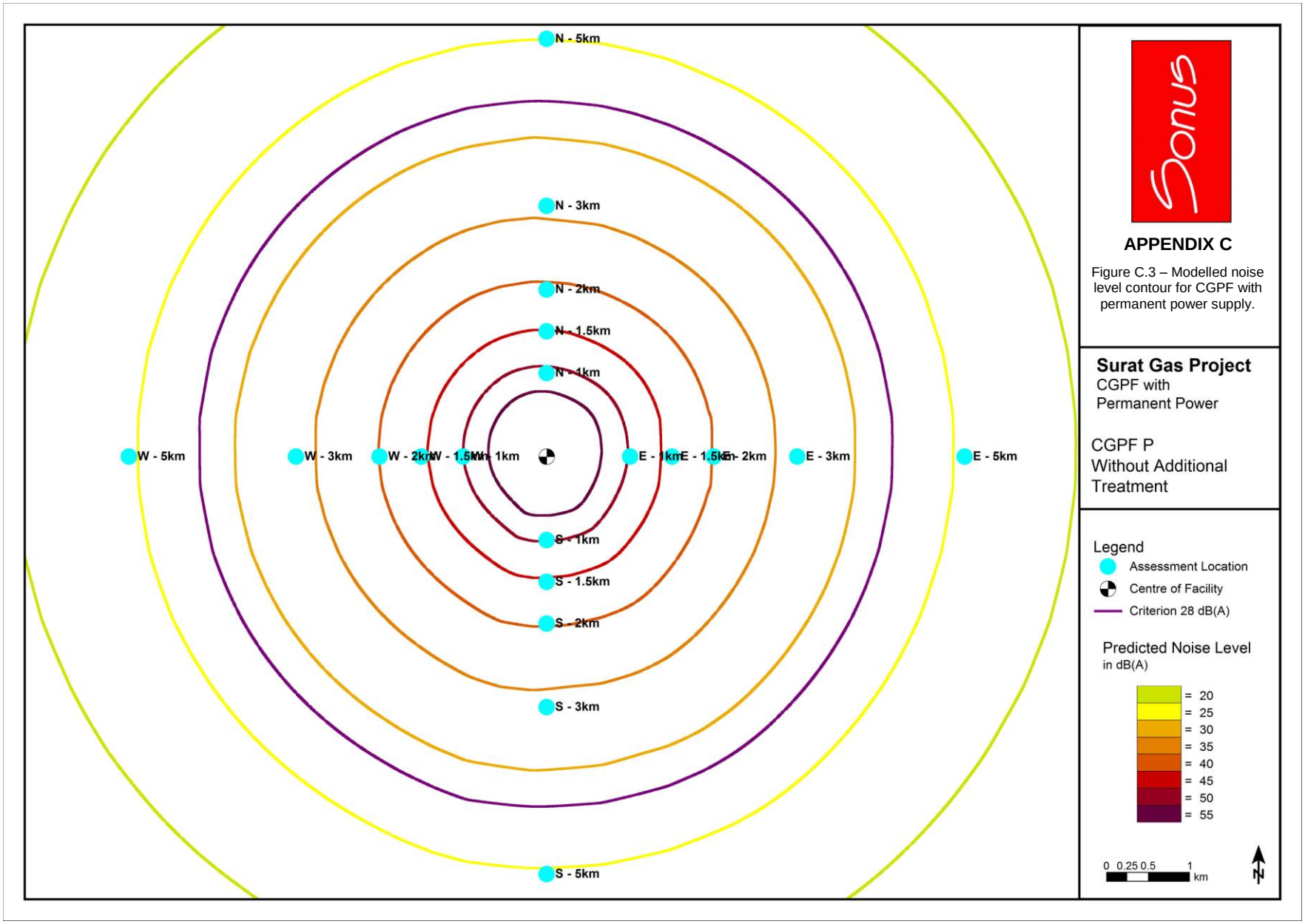
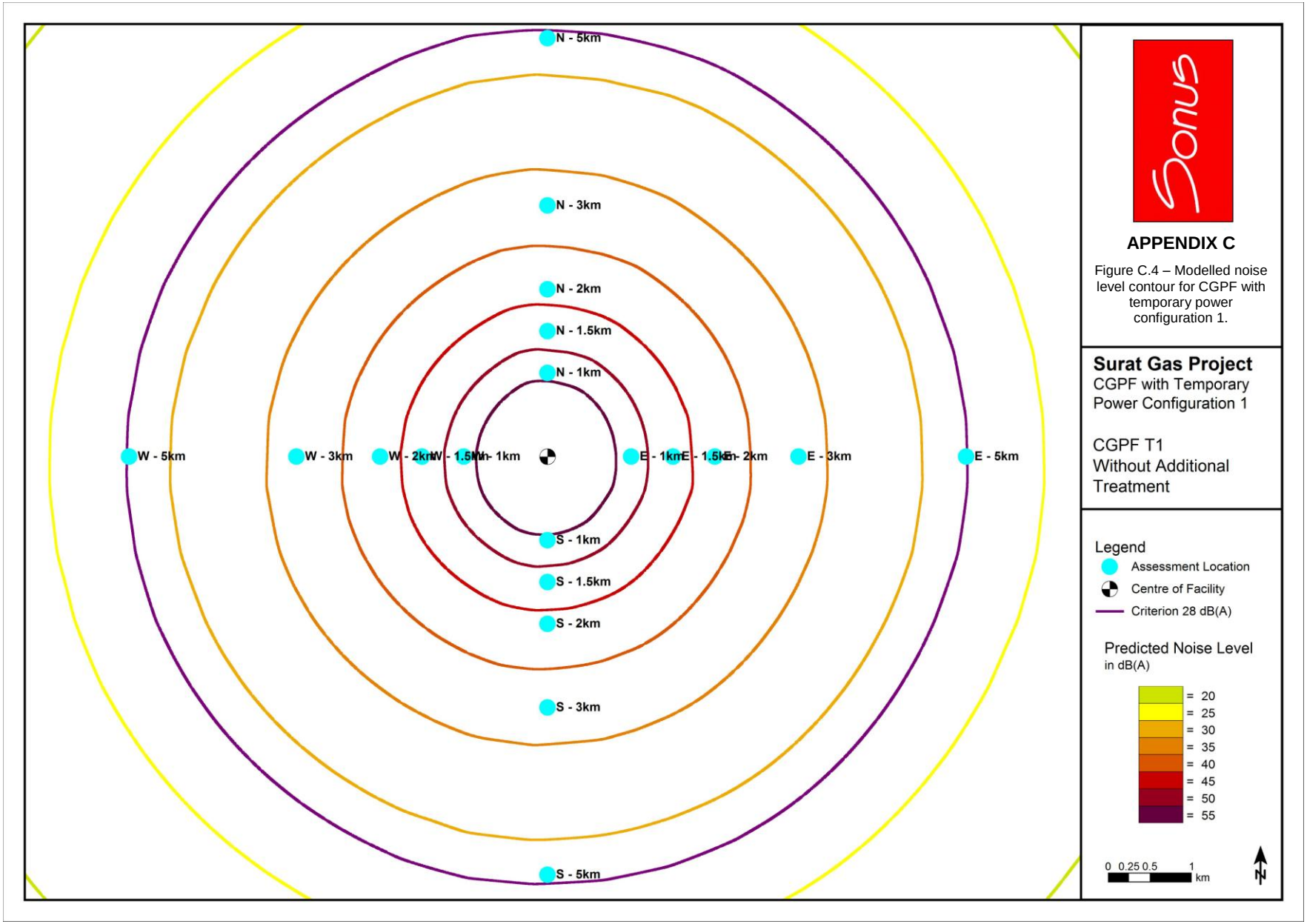
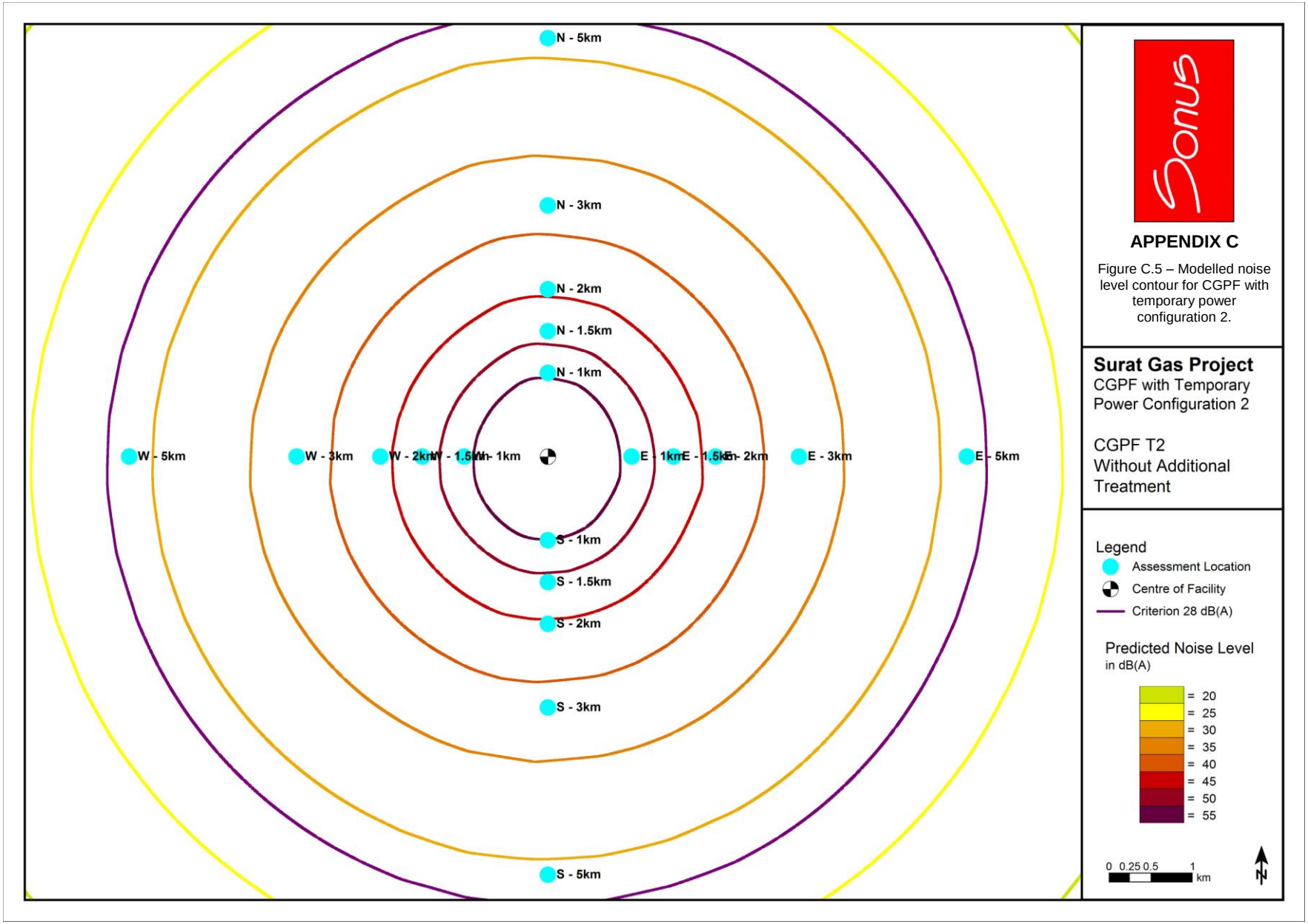
N - 450m
N - 400m
N - 350m
N - 300m
N - 250m
N - 200m
W - 500m W - 450m W - 400m W - 350m W - 300m W - 250m W - 200m
E - 200m E - 250m E - 300m E - 350m E - 400m E - 450m E - 500m
S - 200m
S - 250m
S - 300m
S - 350m
S - 400m
S - 450m
S - 500m
APPENDIX C
Figure C.1 – Modelled noise level contour for multi-well pad with permanent power supply.
Surat Gas Project
Multi-well Pad with Permanent Power
PAD P
Without Additional Treatment
Legend
Assessment Location
Boundary
Criterion 28 dB(A)
Predicted Noise Level in dB(A)
= 20
= 25
= 30
= 35
= 40
= 45
= 50
= 55
0 30 60 120
m
N

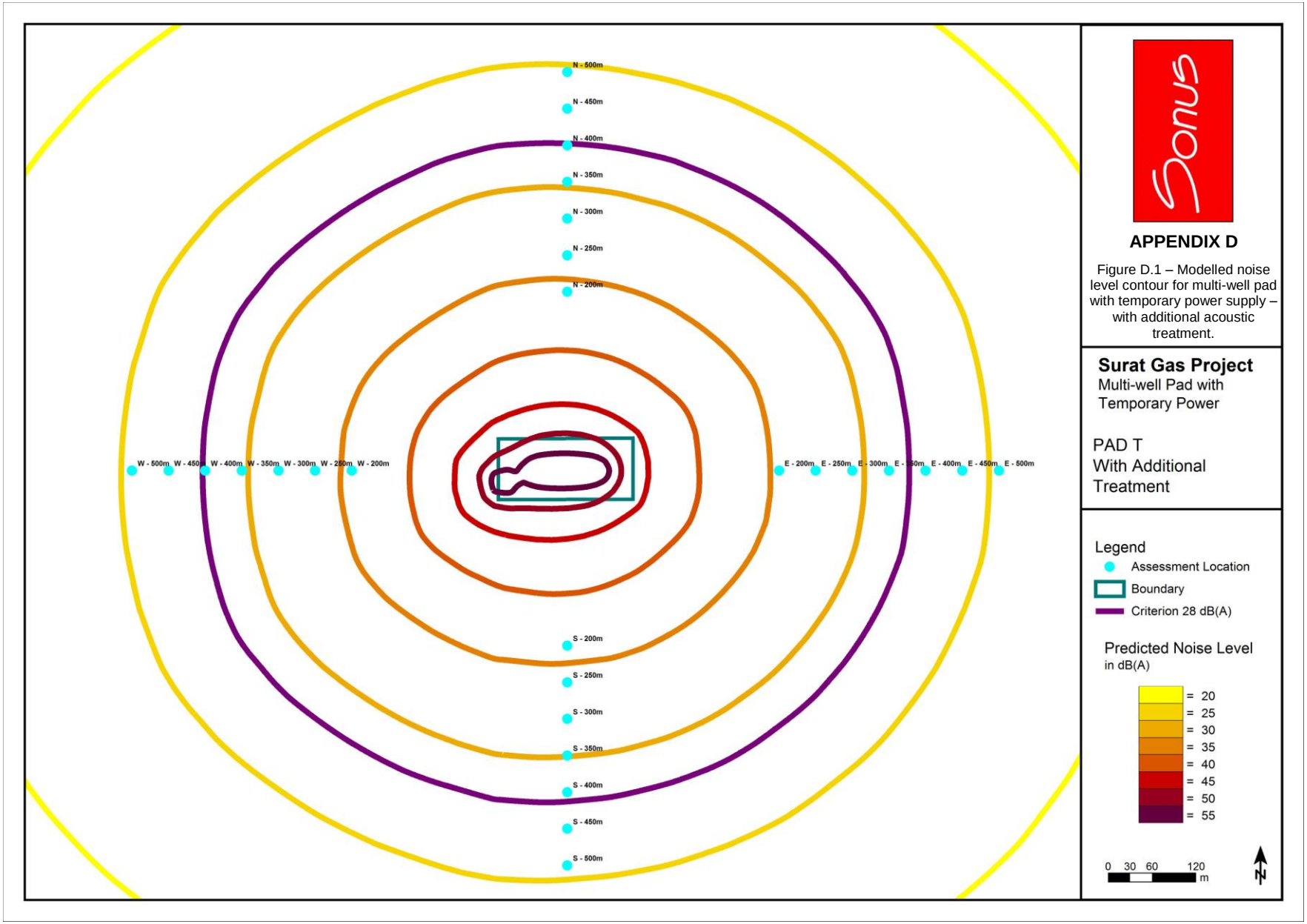

N - 500m
N - 450m
N - 400m
N - 350m
N - 300m
N - 250m
N - 200m
W - 500m
W - 450m
W - 400m
W - 350m
W - 300m
W - 250m
W - 200m
E - 200m
E - 250m
E - 300m
E - 350m
E - 400m
E - 450m
E - 500m
S - 200m
S - 250m
S - 300m
S - 350m
S - 400m
S - 450m
S - 500m
APPENDIX C
Figure C.2 – Modelled noise level contour for multi-well pad with temporary power supply.
Surat Gas Project
Multi-well Pad with Temporary Power
PAD T
Without Additional Treatment
Legend
Assessment Location
Boundary
Criterion 28 dB(A)
Predicted Noise Level in dB(A)
= 30
= 35
= 40
= 45
= 50
= 55
= 60
0 30 60 120 m
N

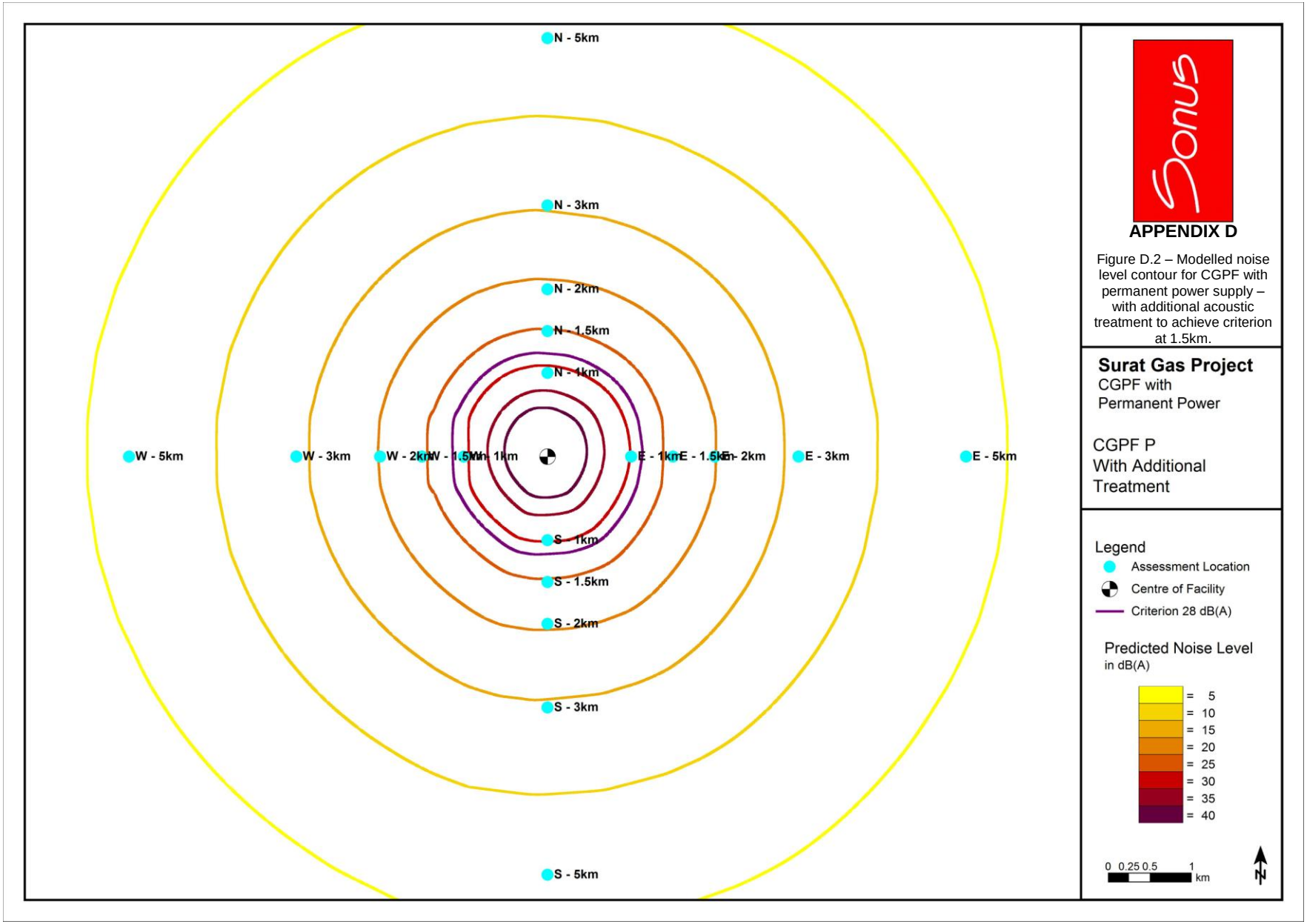

N - 5km
N - 3km
N - 2km
N - 1.5km
N - 1km
W - 5km
W - 3km
W - 2km
W - 1.5km
W - 1km
E - 1km
E - 1.5km
E - 2km
E - 3km
E - 5km
S - 1km
S - 1.5km
S - 2km
S - 3km
S - 5km
APPENDIX C
Figure C.3 – Modelled noise level contour for CGPF with permanent power supply.
Surat Gas Project
CGPF with Permanent Power
CGPF P Without Additional Treatment
Legend
Assessment Location
Centre of Facility
Criterion 28 dB(A)
Predicted Noise Level in dB(A)
= 20
= 25
= 30
= 35
= 40
= 45
= 50
= 55
0 0.25 0.5 1 km
N

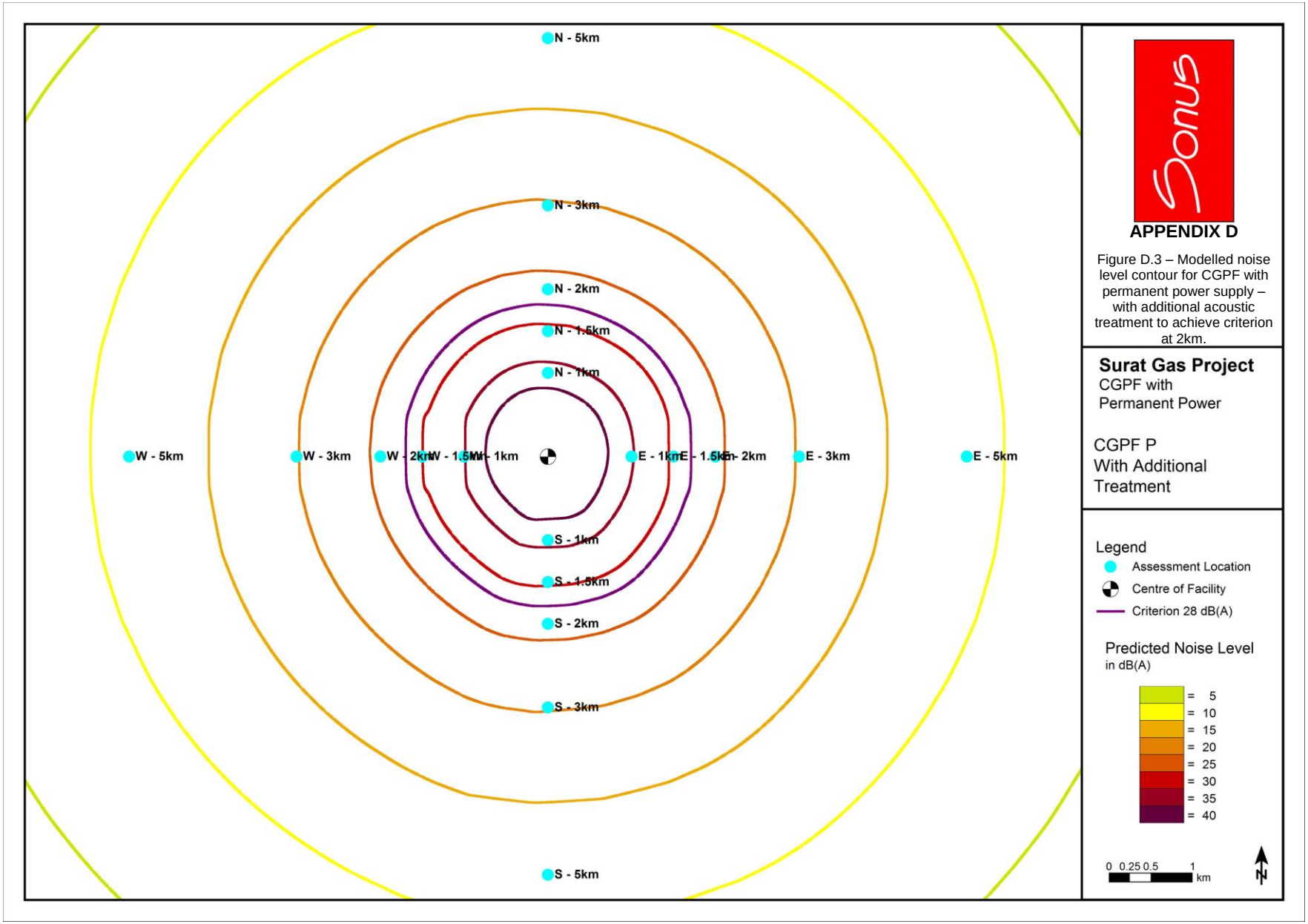

N - 5km
N - 3km
N - 2km
N - 1.5km
N - 1km
W - 5km
W - 3km
W - 2km
W - 1.5km
W - 1km
E - 1km
E - 1.5km
E - 2km
E - 3km
E - 5km
S - 1km
S - 1.5km
S - 2km
S - 3km
S - 5km
APPENDIX C
Figure C.4 – Modelled noise level contour for CGPF with temporary power configuration 1.
Surat Gas Project
CGPF with Temporary Power Configuration 1
CGPF T1
Without Additional Treatment
Legend
Assessment Location
Centre of Facility
Criterion 28 dB(A)
Predicted Noise Level in dB(A)
= 20
= 25
= 30
= 35
= 40
= 45
= 50
= 55
0 0.25 0.5 1 km
N

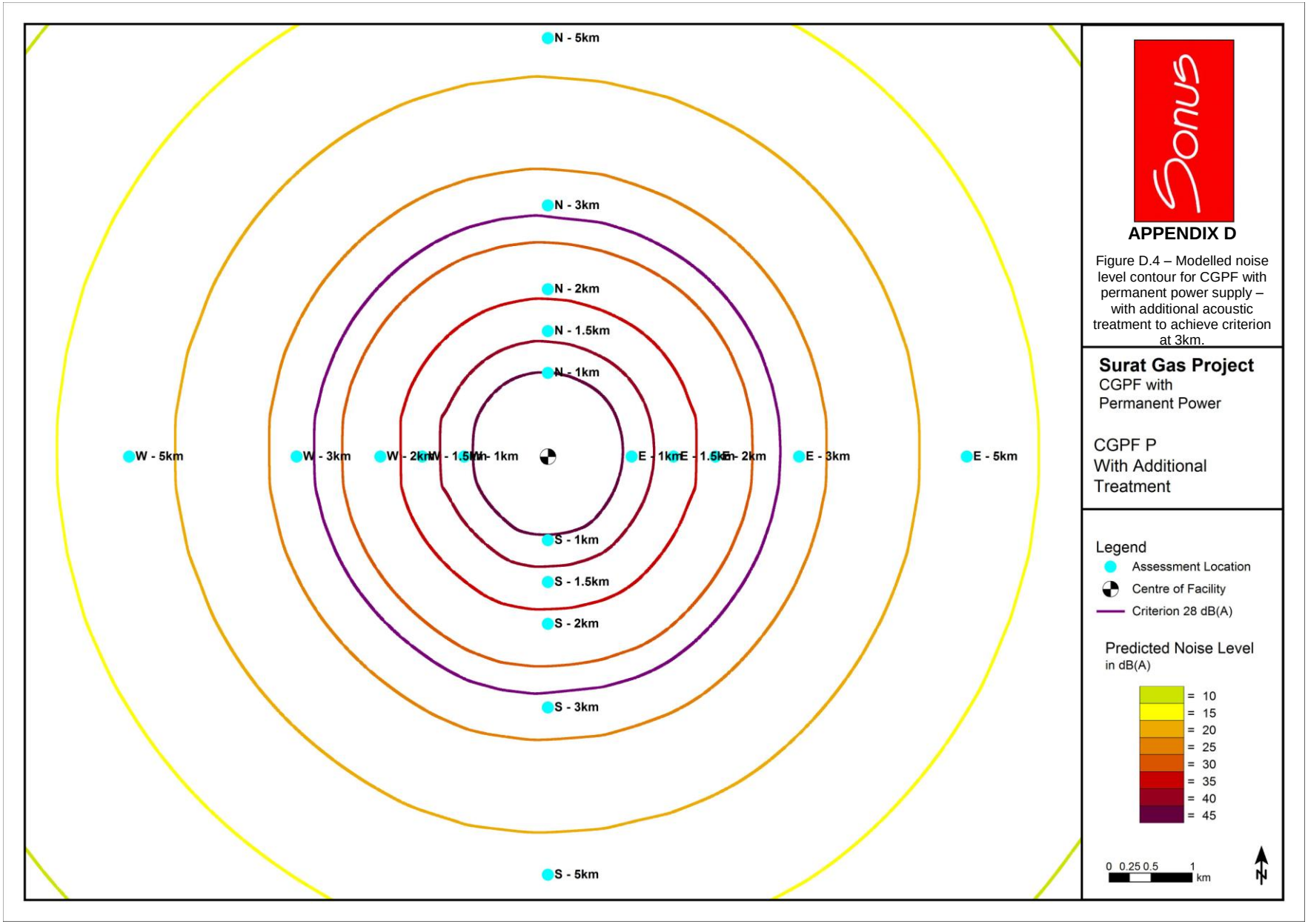

N - 5km
N - 3km
N - 2km
N - 1.5km
N - 1km
W - 5km
W - 3km
W - 2km
W - 1.5km
W - 1km
E - 1km
E - 1.5km
E - 2km
E - 3km
E - 5km
S - 1km
S - 1.5km
S - 2km
S - 3km
S - 5km
APPENDIX C
Figure C.5 – Modelled noise level contour for CGPF with temporary power configuration 2.
Surat Gas Project
CGPF with Temporary Power Configuration 2
CGPF T2
Without Additional Treatment
Legend
Assessment Location
Centre of Facility
Criterion 28 dB(A)
Predicted Noise Level in dB(A)
= 20
= 25
= 30
= 35
= 40
= 45
= 50
= 55
0 0.25 0.5 1 km
N

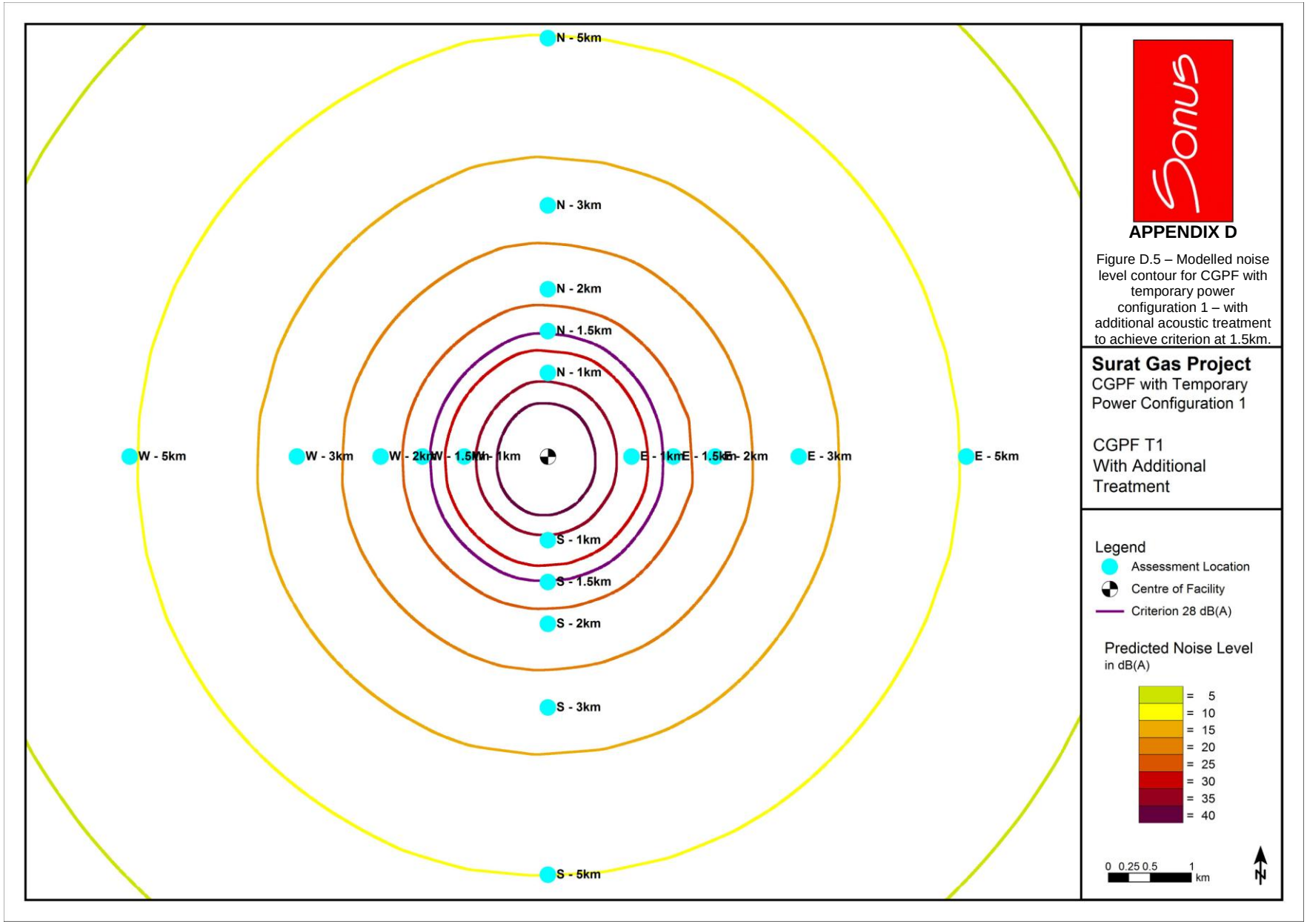
APPENDIX D: NOISE CONTOURS – WITH ADDITIONAL ACOUSTIC TREATMENT

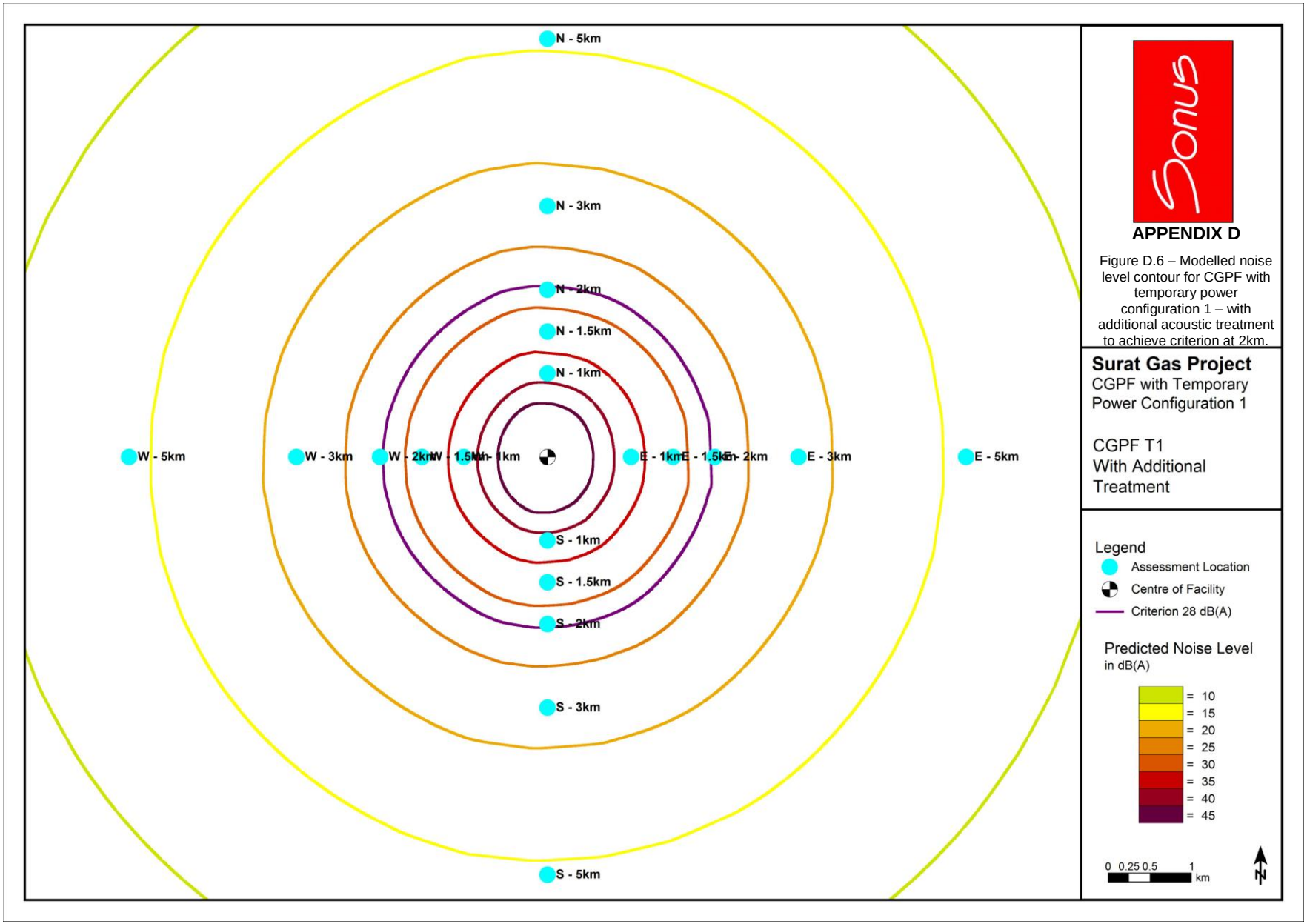

N - 500m
N - 450m
N - 400m
N - 350m
N - 300m
N - 250m
N - 200m
W - 500m
W - 450m
W - 400m
W - 350m
W - 300m
W - 250m
W - 200m
E - 200m
E - 250m
E - 300m
E - 350m
E - 400m
E - 450m
E - 500m
S - 200m
S - 250m
S - 300m
S - 350m
S - 400m
S - 450m
S - 500m
APPENDIX D
Figure D.1 – Modelled noise level contour for multi-well pad with temporary power supply – with additional acoustic treatment.
Surat Gas Project
Multi-well Pad with Temporary Power
PAD T
With Additional Treatment
Legend
Assessment Location
Boundary
Criterion 28 dB(A)
Predicted Noise Level in dB(A)
= 20
= 25
= 30
= 35
= 40
= 45
= 50
= 55
0 30 60 120
m
N

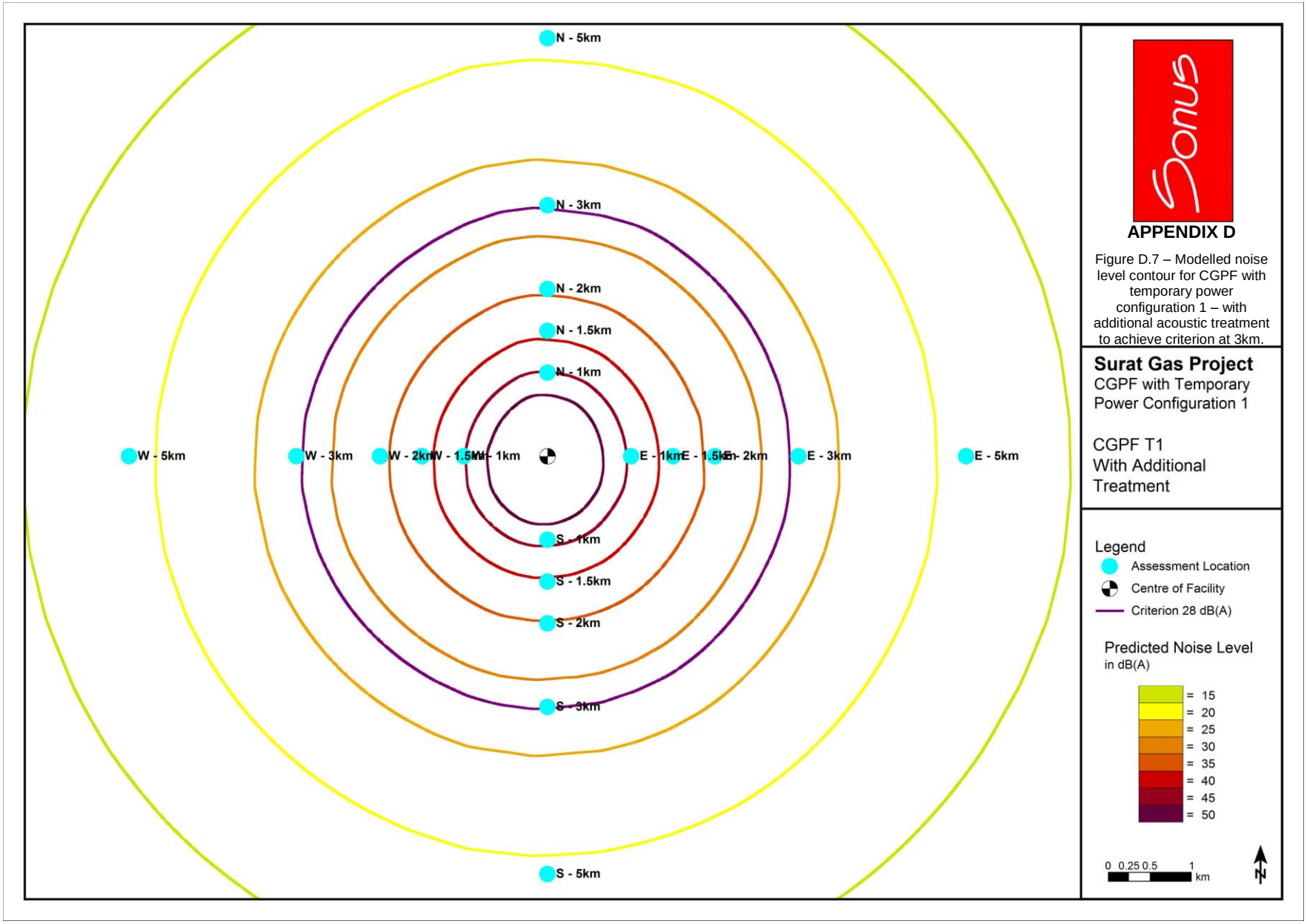

N - 5km
N - 3km
N - 2km
N - 1.5km
N - 1km
W - 5km
W - 3km
W - 2km
W - 1.5km
W - 1km
E - 1km
E - 1.5km
E - 2km
E - 3km
E - 5km
S - 1km
S - 1.5km
S - 2km
S - 3km
S - 5km
APPENDIX D
Figure D.2 – Modelled noise level contour for CGPF with permanent power supply – with additional acoustic treatment to achieve criterion at 1.5km.
Surat Gas Project
CGPF with
Permanent Power
CGPF P
With Additional
Treatment
Legend
Assessment Location
Centre of Facility
Criterion 28 dB(A)
Predicted Noise Level
in dB(A)
= 5
= 10
= 15
= 20
= 25
= 30
= 35
= 40
0 0.25 0.5 1
km
N

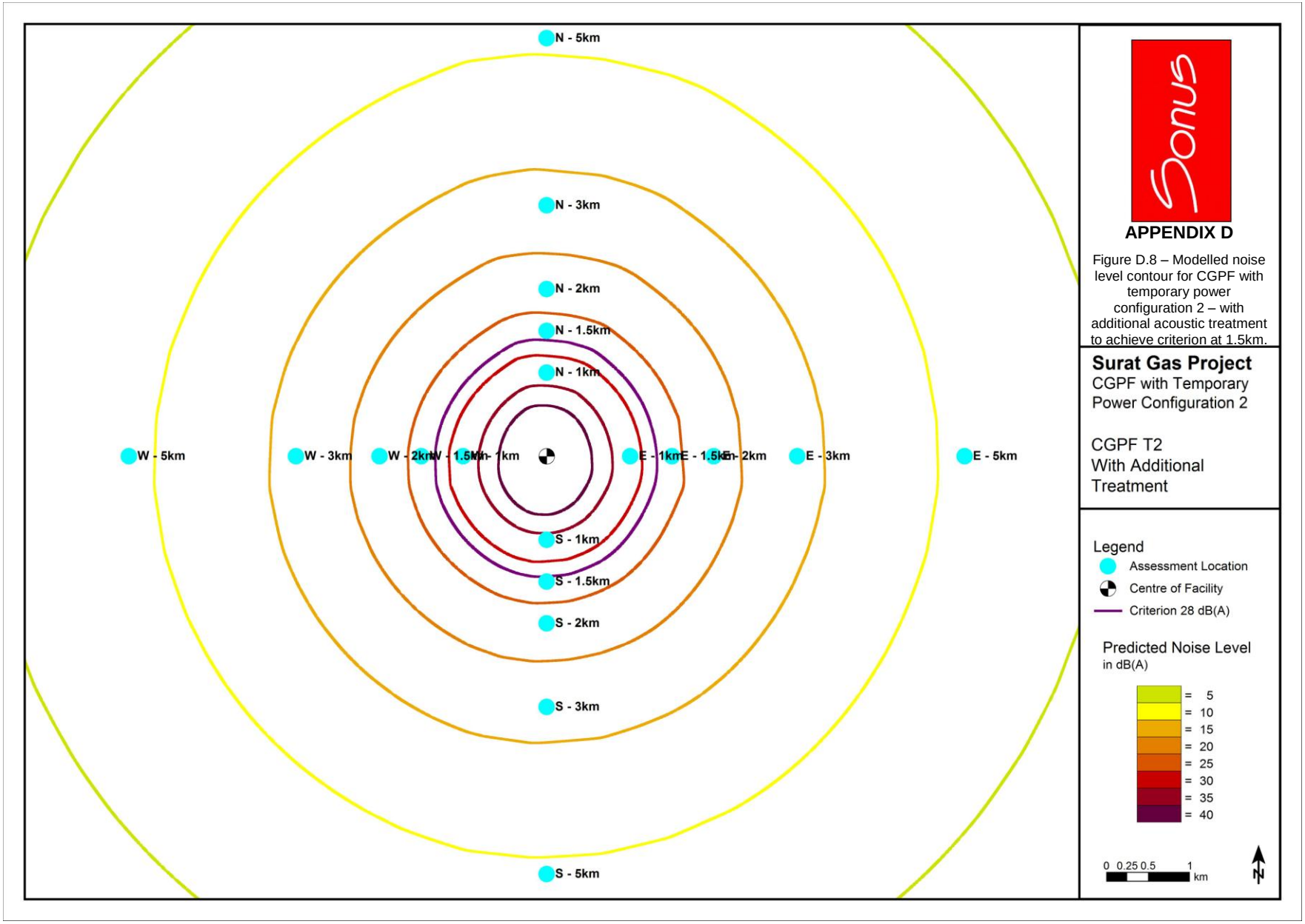

N - 5km
N - 3km
N - 2km
N - 1.5km
N - 1km
W - 5km
W - 3km
W - 2km
W - 1.5km
W - 1km
E - 1km
E - 1.5km
E - 2km
E - 3km
E - 5km
S - 1km
S - 1.5km
S - 2km
S - 3km
S - 5km
APPENDIX D
Figure D.3 – Modelled noise level contour for CGPF with permanent power supply – with additional acoustic treatment to achieve criterion at 2km.
Surat Gas Project
CGPF with
Permanent Power
CGPF P
With Additional
Treatment
Legend
Assessment Location
Centre of Facility
Criterion 28 dB(A)
Predicted Noise Level
in dB(A)
= 5
= 10
= 15
= 20
= 25
= 30
= 35
= 40
0 0.25 0.5 1
km
N

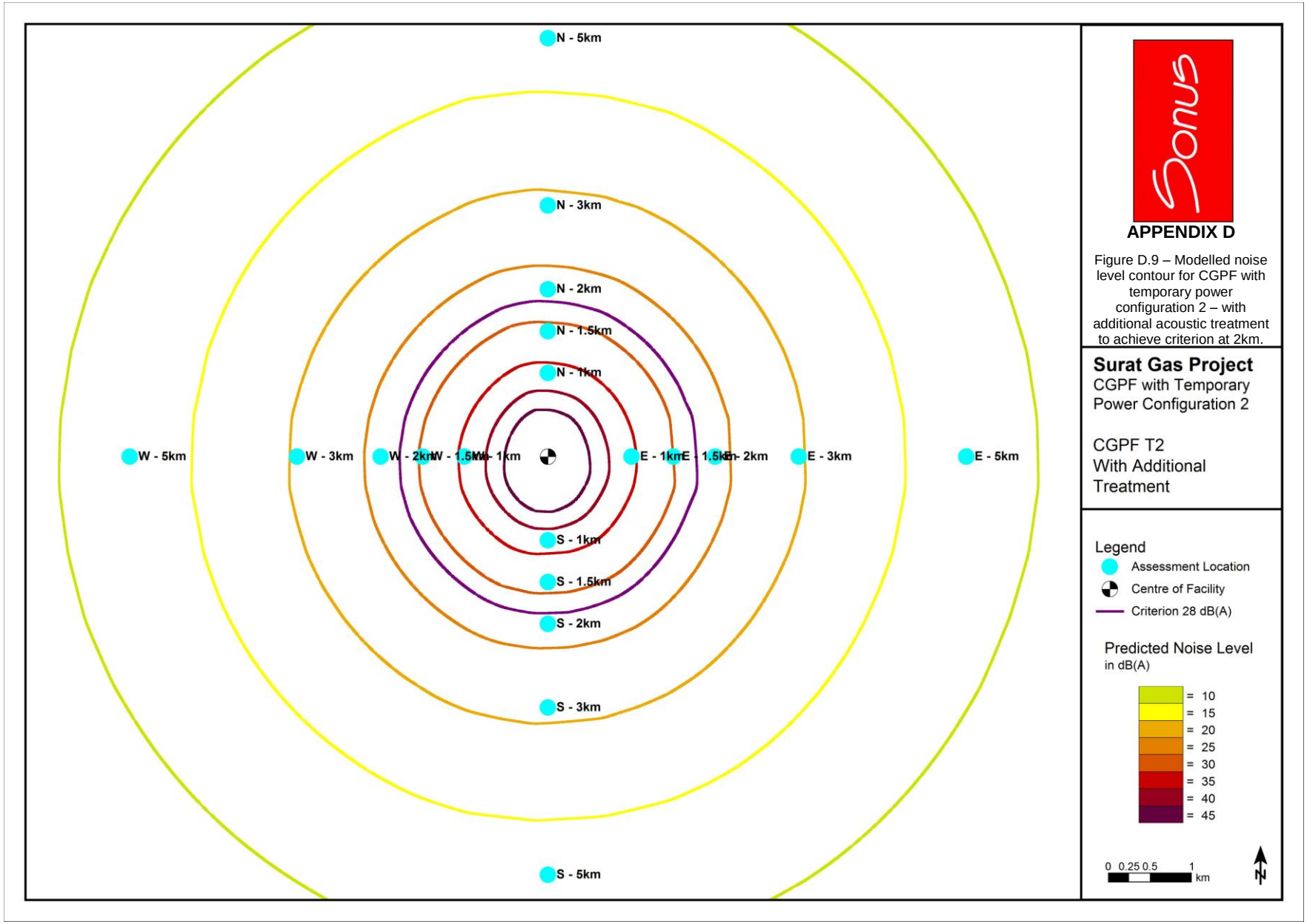

N - 5km
N - 3km
N - 2km
N - 1.5km
N - 1km
W - 5km
W - 3km
W - 2km
W - 1.5km
W - 1km
E - 1km
E - 1.5km
E - 2km
E - 3km
E - 5km
S - 1km
S - 1.5km
S - 2km
S - 3km
S - 5km
APPENDIX D
Figure D.4 – Modelled noise level contour for CGPF with permanent power supply – with additional acoustic treatment to achieve criterion at 3km.
Surat Gas Project
CGPF with Permanent Power
CGPF P With Additional Treatment
Legend
Assessment Location
Centre of Facility
Criterion 28 dB(A)
Predicted Noise Level in dB(A)
= 10
= 15
= 20
= 25
= 30
= 35
= 40
= 45
0 0.25 0.5 1 km
N

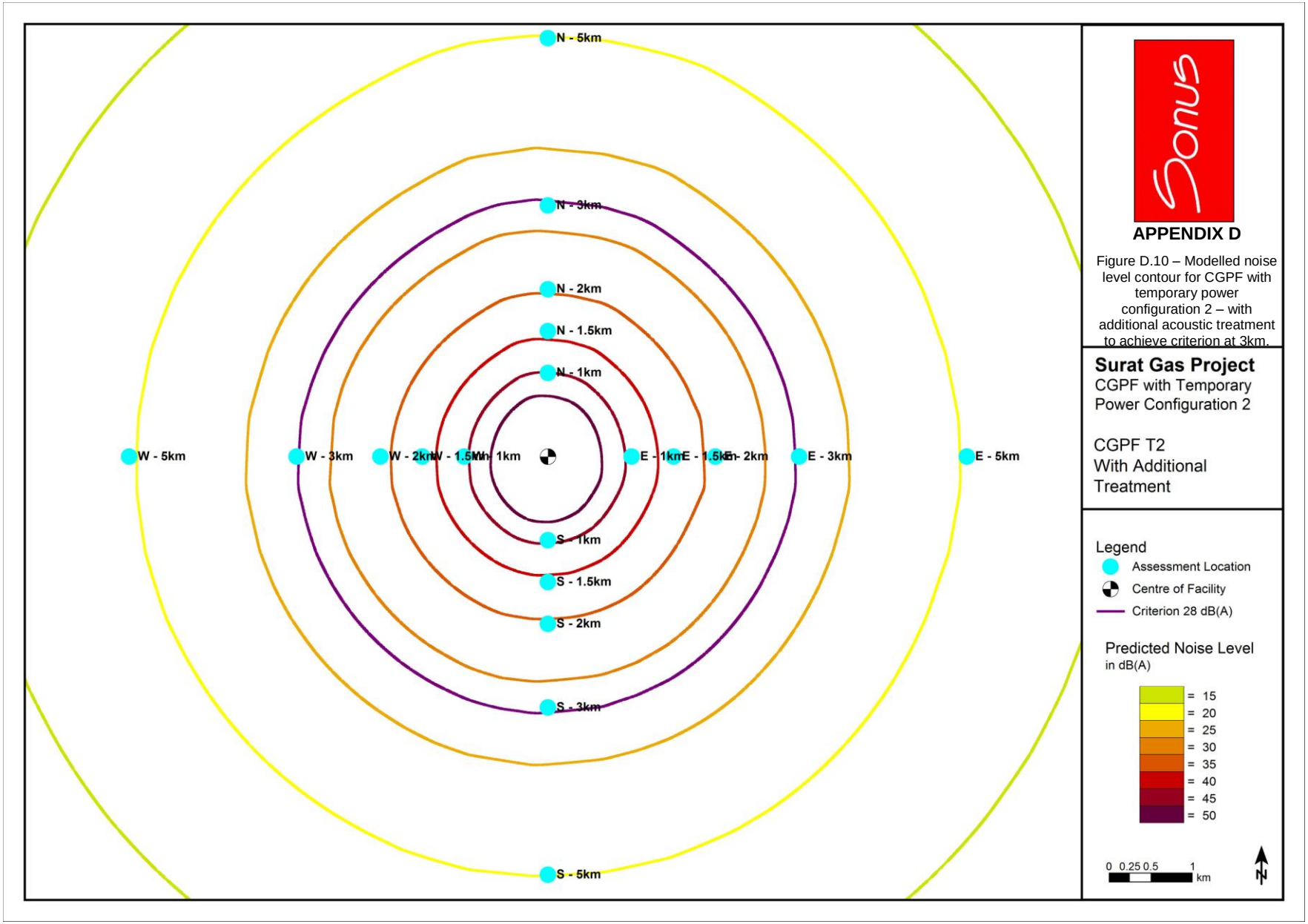

N - 5km
N - 3km
N - 2km
N - 1.5km
N - 1km
W - 5km
W - 3km
W - 2km
W - 1.5km
W - 1km
E - 1km
E - 1.5km
E - 2km
E - 3km
E - 5km
S - 1km
S - 1.5km
S - 2km
S - 3km
S - 5km
APPENDIX D
Figure D.5 – Modelled noise level contour for CGPF with temporary power configuration 1 – with additional acoustic treatment to achieve criterion at 1.5km.
Surat Gas Project
CGPF with Temporary Power Configuration 1
CGPF T1
With Additional Treatment
Legend
Assessment Location
Centre of Facility
Criterion 28 dB(A)
Predicted Noise Level
in dB(A)
= 5
= 10
= 15
= 20
= 25
= 30
= 35
= 40
0 0.25 0.5 1
km
N


N - 5km
N - 3km
N - 2km
N - 1.5km
N - 1km
W - 5km
W - 3km
W - 2km
W - 1.5km
W - 1km
E - 1km
E - 1.5km
E - 2km
E - 3km
E - 5km
S - 1km
S - 1.5km
S - 2km
S - 3km
S - 5km
APPENDIX D
Figure D.6 – Modelled noise level contour for CGPF with temporary power configuration 1 – with additional acoustic treatment to achieve criterion at 2km.
Surat Gas Project
CGPF with Temporary Power Configuration 1
CGPF T1
With Additional Treatment
Legend
Assessment Location
Centre of Facility
Criterion 28 dB(A)
Predicted Noise Level
in dB(A)
= 10
= 15
= 20
= 25
= 30
= 35
= 40
= 45
0 0.25 0.5 1
km
N


N - 5km
N - 3km
N - 2km
N - 1.5km
N - 1km
W - 5km
W - 3km
W - 2km
W - 1.5km
W - 1km
E - 1km
E - 1.5km
E - 2km
E - 3km
E - 5km
S - 1km
S - 1.5km
S - 2km
S - 3km
S - 5km
APPENDIX D
Figure D.7 – Modelled noise level contour for CGPF with temporary power configuration 1 – with additional acoustic treatment to achieve criterion at 3km.
Surat Gas Project
CGPF with Temporary Power Configuration 1
CGPF T1
With Additional Treatment
Legend
Assessment Location
Centre of Facility
Criterion 28 dB(A)
Predicted Noise Level
in dB(A)
= 15
= 20
= 25
= 30
= 35
= 40
= 45
= 50
0 0.25 0.5 1
km
N


N - 5km
N - 3km
N - 2km
N - 1.5km
N - 1km
W - 5km
W - 3km
W - 2km
W - 1.5km
W - 1km
E - 1km
E - 1.5km
E - 2km
E - 3km
E - 5km
S - 1km
S - 1.5km
S - 2km
S - 3km
S - 5km
APPENDIX D
Figure D.8 – Modelled noise level contour for CGPF with temporary power configuration 2 – with additional acoustic treatment to achieve criterion at 1.5km.
Surat Gas Project
CGPF with Temporary Power Configuration 2
CGPF T2
With Additional Treatment
Legend
Assessment Location
Centre of Facility
Criterion 28 dB(A)
Predicted Noise Level
in dB(A)
= 5
= 10
= 15
= 20
= 25
= 30
= 35
= 40
0 0.25 0.5 1
km
N


N - 5km
N - 3km
N - 2km
N - 1.5km
N - 1km
W - 5km
W - 3km
W - 2km
W - 1.5km
W - 1km
E - 1km
E - 1.5km
E - 2km
E - 3km
E - 5km
S - 1km
S - 1.5km
S - 2km
S - 3km
S - 5km
APPENDIX D
Figure D.9 – Modelled noise level contour for CGPF with temporary power configuration 2 – with additional acoustic treatment to achieve criterion at 2km.
Surat Gas Project
CGPF with Temporary Power Configuration 2
CGPF T2
With Additional Treatment
Legend
Assessment Location
Centre of Facility
Criterion 28 dB(A)
Predicted Noise Level
in dB(A)
= 10
= 15
= 20
= 25
= 30
= 35
= 40
= 45
0 0.25 0.5 1
km
N


N - 5km
N - 3km
N - 2km
N - 1.5km
N - 1km
W - 5km
W - 3km
W - 2km
W - 1.5km
W - 1km
E - 1km
E - 1.5km
E - 2km
E - 3km
E - 5km
S - 1km
S - 1.5km
S - 2km
S - 3km
S - 5km
APPENDIX D
Figure D.10 – Modelled noise level contour for CGPF with temporary power configuration 2 – with additional acoustic treatment to achieve criterion at 3km.
Surat Gas Project
CGPF with Temporary Power Configuration 2
CGPF T2
With Additional Treatment
Legend
Assessment Location
Centre of Facility
Criterion 28 dB(A)
Predicted Noise Level
in dB(A)
= 15
= 20
= 25
= 30
= 35
= 40
= 45
= 50
0 0.25 0.5 1
km
N