APPLICATION ON NOTIFICATION – CROWN DEVELOPMENT

Applicant:	Energy Australia C/- Aurecon
Development Number:	422/V005/17
Nature of Development:	Installation of a new aero derivative gas turbine within the existing Hallett Power Station site
Type of development:	Public Infrastructure
Zone / Policy Area:	Primary Production Zone
Subject Land:	29 The Willows Road, Canowie
Contact Officer:	Laura Kerber
Phone Number:	7109 7073
Start Date:	Wednesday 17 January 2018
Close Date:	Thursday 8 February 2018

During the notification period, hard copies of the application documentation can be viewed at the Department of Planning, Transport and Infrastructure, Level 5, 50 Flinders Street, Adelaide during normal business hours. Application documentation may also be viewed during normal business hours at the local Council office (if identified on the public notice).

Written representations must be received by the close date (indicated above) and can either be posted, hand-delivered, faxed or emailed to the State Commission Assessment Panel (SCAP). A representation form is provided as part of this pdf document.

Any representations received after the close date will not be considered.

Postal Address:
The Secretary
State Commission Assessment Panel
GPO Box 1815
ADELAIDE SA 5001

Street Address:
Development Division
Department of Planning, Transport and Infrastructure
Level 5, 50 Flinders Street
ADELAIDE

Email Address: scapadmin@sa.gov.au
Fax Number: (08) 8303 0753

Government of South Australia

Department of Planning, Transport and Infrastructure

DEVELOPMENT ACT 1993

NOTICE OF APPLICATION FOR CONSENT TO DEVELOPMENT

SECTION 49 – PUBLIC INFRASTRUCTURE

Notice is hereby given that an application has been made by **Energy Australia C/- Aurecon** for consent to **install a new aero derivative gas turbine** within the existing Hallett Power Station site (Development Number: **422/V005/17**).

The land is situated at **29 The Willows Road, Canowie** being Certificate of Title: Volume 5965 Folio 72.

The subject land is located within **Primary Production Zone** of the **Goyder Council Development Plan Consolidated 24 November 2016.**

The application may be examined during normal office hours at the office of the State Commission Assessment Panel, Level 5, 50 Flinders Street and at the office of the Regional Council of Goyder (1 Market Square, Burra). Application documentation may also be viewed on the State Commission Assessment Panel (SCAP) website: www.saplanningcommission.sa.gov.au/scap.

Any person or body who desires to do so may make representations concerning the application by notice in writing delivered to the Secretary, State Commission Assessment Panel, GPO Box 1815, Adelaide 5001 **NOT LATER THAN Close of Business Thursday 8 February 2018.**

Each person or body making a representation should state the reason for the representation and whether that person or body wishes to be given the opportunity to appear before the SCAP to further explain the representation.

Submissions may be made available for public inspection. Please indicate in writing if you object to your submission being made available in this way.

Should you wish to discuss the application and the public notification procedure please contact **Laura Kerber** on **7109 7073.**

Alison Gill
SECRETARY
STATE COMMISSION ASSESSMENT PANEL
www.saplanningcommission.sa.gov.au/asap

PN2396

PN2396
18x2 (63mm)
Adelaide Advertiser, Northern Argus
17 January 2018

DEVELOPMENT ACT, 1993
S49/S49A – CROWN DEVELOPMENT
REPRESENTATION ON APPLICATION

Applicant:	Energy Australia C/- Aurecon
Development Number:	422/V005/17
Nature of Development:	Installation of a new aero derivative gas turbine within the existing Hallett Power Station site
Zone / Policy Area:	Primary Production Zone
Subject Land:	29 The Willows Road, Canowie
Contact Officer:	Laura Kerber
Phone Number:	7109 7073
Close Date:	Thursday 8 February 2018

My name:_____

My phone number: _____

PRIMARY METHOD(s) OF CONTACT: Email address: _____

Postal address:_____

_____Postcode_____

You may be contacted via your nominated PRIMARY METHOD(s) OF CONTACT if you indicate below that you wish to be heard by the State Commission Assessment Panel in support of your submission.

My interests are:
[ ] owner of local property
[ ] occupier of local property
[ ] a representative of a company/other organisation affected by the proposal
[ ] a private citizen

The address of the property affected is .....Postcode.....

The specific aspects of the application to which I make comment on are: .....

.....

.....

.....

.....

.....

.....

.....

I
[ ] wish to be heard in support of my submission
[ ] do not wish to be heard in support of my submission
(Please tick one)

by
[ ] appearing personally
[ ] being represented by the following person : .....
(Cross out whichever does not apply)

Date: ..... Signature: .....

Return Address: The Secretary, State Commission Assessment Panel, GPO Box 1815, Adelaide, SA 5001 or scapadmin@sa.gov.au

Aurecon Australasia Pty Ltd
ABN 54 005 139 873
Level 10, 55 Grenfell Street
Adelaide SA 5000
Australia

T +61 8 8237 9777
F +61 8 8237 9778
E adelaide@aurecongroup.com
W aurecongroup.com

1 December 2017

South Australian Planning Commission
GPO Box 1815
Adelaide SA 5001

Email – **scapadmin@sa.gov.au**

To Whom It May Concern

Development Application – New Gas Turbine at the Hallett Power Station

Aurecon is pleased to submit this Crown Sponsored development application on behalf of EnergyAustralia for the installation of a new open cycle aeroderivative gas turbine generator at the existing Hallett Power Station at 29 The Willows Road, Canowie SA.

The new gas turbine will assist in providing additional power supply to the South Australian network and will help to ensure the provision of future generation at the site as existing facilities within the subject site near the end of their lifecycle. Additionally, the proposed installation will improve overall efficiency of the Hallett Power Station, increase capacity and improve environmental outcomes.

If there is any aspect of our submission that you would like to discuss further or seek further clarification do not hesitate to contact me on 8237 9987.

Yours faithfully

Marcus Howard
Manager, Aurecon

DEVELOPMENT APPLICATION FORM

PLEASE USE BLOCK LETTERS

COUNCIL: Regional Council of Goyder

APPLICANT: EnergyAustralia

Postal Address: c/- Aurecon, 55 Grenfell Street Adelaide SA 5000

Owner: EnergyAustralia

Postal Address: Level 33, 385 Bourke Street, Melbourne, VIC 3000

BUILDER: To Be Confirmed

Postal Address: _____

_____

_____ Licence No: _____

CONTACT PERSON FOR FURTHER INFORMATION

Name: Marcus Howard (Aurecon)

Telephone: 82379987 [work] 0417210603 [Ah]

Fax: _____ [work] _____ [Ah]

EXISTING USE: Power Station

FOR OFFICE USE

Development No: _____

Previous Development No: _____

Assessment No: _____

☐ Complying	Application forwarded to DA
☐ Non Complying	Commission/Council on
☐ Notification Cat 2	/ /
☐ Notification Cat 3	Decision: _____
☐ Referrals/Concurrences	Type: _____
☐ DA Commission	Date: / /

	Decision required	Fees	Receipt No	Date
Planning:				
Building:				
Land Division:				
Additional:				
Development Approval				

DESCRIPTION OF PROPOSED DEVELOPMENT: New open cycle gas turbine

LOCATION OF PROPOSED DEVELOPMENT: _____

House No: 29 Lot No: 1 Street: The Willows Road Town/Suburb: Canowie

Section No [full/part] _____ Hundred: _____ Volume: 5965 Folio: 72

Section No [full/part] _____ Hundred: _____ Volume: _____ Folio: _____

LAND DIVISION:

Site Area [m²] _____ Reserve Area [m²] _____ No of existing allotments _____

Number of additional allotments [excluding road and reserve]: _____ Lease: YES ☐ NO ☐

BUILDING RULES CLASSIFICATION SOUGHT: _____ Present classification: _____

If Class 5,6,78 or 9 classification is sought, state the proposed number of employees: Male: _____ Female: _____

If Class 9a classification is sought, state the number o persons for whom accommodation is provided: _____

If Class 9b classification is sought, state the proposed number of occupants of the various spaces at the premises: _____

DOES EITHER SCHEDULE 21 OR 22 OF THE DEVELOPMENT REGULATIONS 2008 APPLY? YES ☐ NO ☐

HAS THE CONSTRUCTION INDUSTRY TRAINING FUND ACT 2008 LEVY BEEN PAID? YES ☐ NO ☐

DEVELOPMENT COST [do not include any fit-out costs]: $ 35 Million (AUD)

I acknowledge that copies of this application and supporting documentation may be provided to interested persons in accordance with the Development Regulations 2008.

SIGNATURE: Marcus Howard Dated: 01 / 12 / 2017

DEVELOPMENT REGULATIONS 2008
Form of Declaration (Schedule 5 clause 2A)

Government of South Australia

To: State Planning Commission

From: Marcus Howard

Date of Application: 1 / 12 / 2017

Location of Proposed Development: 29 The Willows Road, Canowie

House No: 29 Lot No: 1 Street: The Willows Road

Town/Suburb: Canowie

Section No (full/part): _____ Hundred: _____

Volume: 5965 Folio: 72

Nature of Proposed Development:

New open cycle gas turbine at the Hallett Power Station.

I Marcus Howard **being the applicant/ a person acting on behalf of the applicant (delete the inapplicable statement) for the development described above declare that the proposed development will involve the construction of a building which would, if constructed in accordance with the plans submitted, not be contrary to the regulations prescribed for the purposes of section 86 of the Electricity Act 1996. I make this declaration under clause 2A(1) of Schedule 5 of the Development Regulations 2008.**

Signed: _____ **Date:** 1 / 12 / 2017

Government of South Australia
Department of the Premier and Cabinet

D17052280

GPO Box 2343
Adelaide SA 5001
DX 56201
Tel 08 8226 3500
Fax 08 8226 3535
www.dpc.sa.gov.au

22 November 2017

30 NOV 2017

Mr Mark Collette
Energy Executive
EnergyAustralia
Level 33
385 Bourke Street
MELBOURNE VICT 3000

Dear Mr Collette,

HALLETT REPOWER UPGRADE PROJECT

I refer to your letter of 8 November 2017 regarding the request for support and specific endorsement pursuant to Section 49(2)(c) of the *Development Act 1993* for the proposed upgrade of the Hallett Power Station.

Given that the proposed works meet the definition of "public infrastructure" as outlined in Section 49(1)(a) of *Development Act 1993,* and the project will provide additional back-up to the State's existing power generation supply, I am prepared to support and specifically endorse, pursuant to Section 49(2)(c) of the *Development Act 1993,* the works as detailed below:

- Installation of a new General Electric LM2500+G4 SAC aero derivative gas turbine to the existing Hallett Power Station facility.
- To be installed and operated under the existing license and Transmission Connection Access Agreement with ElectraNet, and to be electrically connected through the Canowie substation.
- The new gas turbine would be fully integrated within the existing footprint of the Hallett power station. Proposed location and site plans are provided in Attachment 1.

I note the Technical Regulator's Certificate for Development, dated 2 November 2017, advises that approval is granted for the proposed generator on the understanding that the shortfall in inertia of the new gas turbine will be compensated via the following additional capabilities of the generator:

- Governor response of 0.2MW to 0.7MW for the first 250ms:
- The generator has a nominal output of 27.5MW, but has the capability and headroom to operate up to 32MW output for short periods of time should it be required.

The Department of the Premier and Cabinet makes no representations or gives no warranties in relation to the outcome of the development application or time that it takes to secure a planning outcome for the project.

It is EnergyAustralia's responsibility to obtain all other statutory approvals, licences and permits from relevant authorities, manage community expectations and to fund the project. The State Government makes no commitment to purchase any product or service related to the project.

A development application must be lodged by EnergyAustralia at its cost with the Development Assessment Commission on or prior to 26 November 2018. If this is not achieved by that time, my support under Section 49(2)(c) of the *Development Act 1993* for the Hallett Repower upgrade project works will lapse.

Please contact Mr Chris Lim, Case Manager, Department of State Development, if you have any queries in relation to this advice or require further information. He can be contacted by phone on 8207 8762, by mobile on 0439 873 104 or via e-mail at chris.lim@sa.gov.au.

Yours sincerely,

Dr Don Russell
CHIEF EXECUTIVE

Attachment 1 :

- Figures 1, 2 and 3 from EnergyAustralia's letter 8 November 2017

Figure's 1, 2 and 3

Figure 1 – Location of proposed gas turbine.

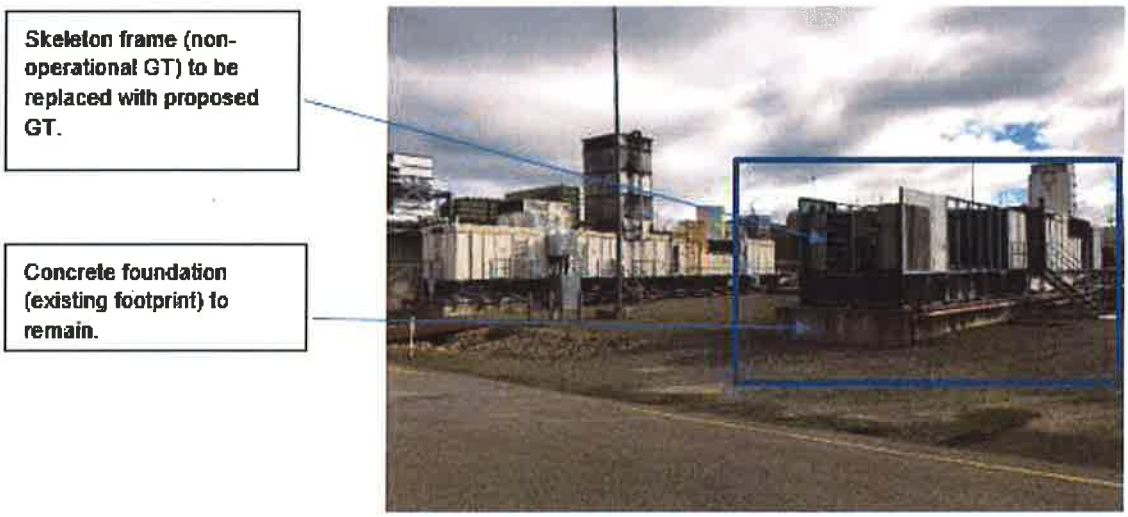


Figure 2 – Location of proposed gas turbine.

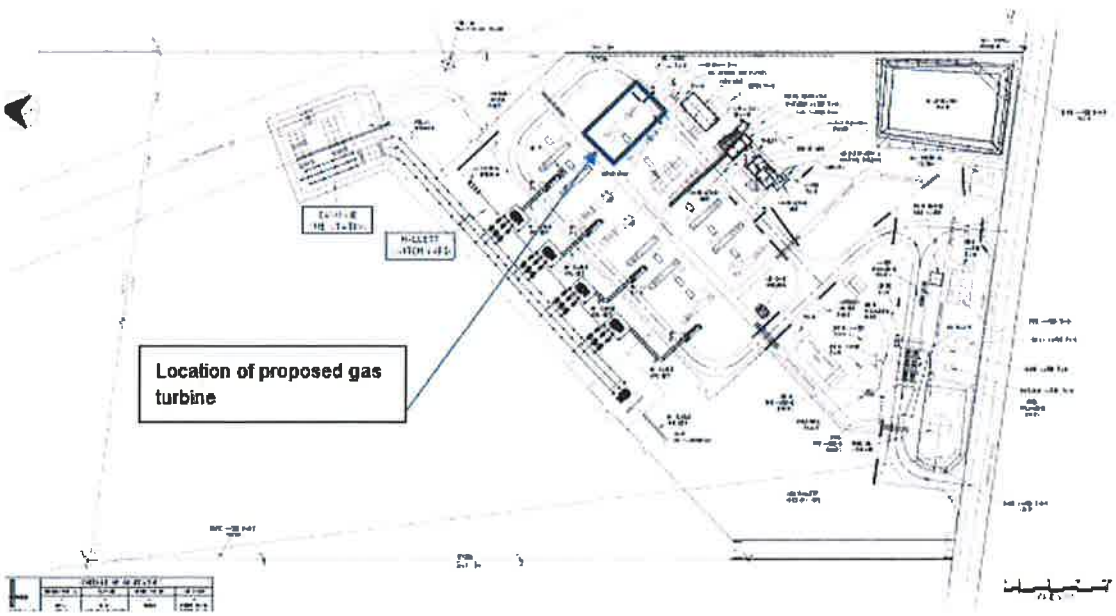


Figure 3 – Site plan of Hallett Power Station showing the location of proposed gas turbine.

Hallett Power Station

Development Application Report

EnergyAustralia

Reference: 500618

1 December 2017

aurecon

Bringing ideas to life

Document control record

Document prepared by:

Aurecon Australasia Pty Ltd
ABN 54 005 139 873
Level 10, 55 Grenfell Street
Adelaide SA 5000 Australia

A person using documents or data accepts the risk of:

a) Using the documents or data in electronic form without requesting and checking them for accuracy against the original hard copy version.
b) Using the documents or data for any purpose not agreed to in writing by .

Document control						aurecon
Report title		Development Application Report				
Document ID		Hallett Power Station - Planning Report - FINAL	**Project number**		**500618**	
Client		EnergyAustralia				
Client contact		Adam Emera	**Client reference**			
Rev	**Date**	**Revision details/status**	**Author**	**Reviewer**	**Verifier** (if required)	**Approver**
R1	2 November 2017	Draft for Client Review	M Johnson	M Howard		M Howard
R2	16 November 2017	Draft for Client Review (2)	M Johnson	M Howard		M Howard
R3	1 December 2017	Final	M Johnson	M Howard		M Howard
Current revision		**R3**				

Approval			
Author signature		Approver signature	
Name	Matthew Johnson	Name	Marcus Howard
Title	Planner	Title	Senior Town Planner / Manager

Contents

Appendices

Figures

1 Executive Summary

Proposal	**EnergyAustralia** are proposing to install a new open cycle aeroderivative gas turbine generator within the existing Hallett Power Station.
Purpose	The proposed facility will assist in providing additional power supply to the South Australian network and will help to ensure the provision of future generation at the site as existing facilities within the subject site near the end of their lifecycle. Additionally, the proposed installation will improve overall efficiency of the Hallett Power Station, increase capacity and improve environmental outcomes.
Property Details	*Plan/Parcel number:* Allotment 1, Deposited Plan 57812 *Street Address:* 29 The Willows Road, Canowie, SA 5419 *Property Owner:* EnergyAustralia
Development Plan	*Council:* Regional Council of Goyder *Zones:* Primary Production Zone *Policy Area:* N/A *Precinct:* N/A *Maps:* Go/1 *Consolidated 24 November 2016*
Application	Installation of one (1) open cycle aeroderivative gas turbine at the Hallett Power Station.
Applicant	**EnergyAustralia** c/- Aurecon Australasia Pty Ltd Level 10, 55 Grenfell Street Adelaide SA 5000 **Contacts:** Marcus Howard (08) 8237 9987 **marcus.howard@aurecongroup.com** Our Ref: *500618 – Hallett Power Station Upgrade*

2 Introduction

This report has been prepared in support of the Development Application by EnergyAustralia for the establishment of a new open cycle aeroderivative gas turbine at the existing Hallett Power Station located in Canowie, South Australia.

The project will provide an additional gas turbine within the Hallett Power Station to help supplement power generation during periods of peak demand.

Approval for the proposed development is being sought under Section 49 of the Development Act 1993 (the Act), which relates Crown Development and Public Infrastructure. The Department of Transport, Planning and Infrastructure (DPTI) (defined as a 'State Agency' within the Act) have provided their formal letter support of the proposed development in accordance with Section 49(2)(c) of the Act. This letter of support is provided with this application.

The Development Application will be lodged with the State Planning Commission (SPC), with recommendation to the Minister for Planning for the final determination. A copy of the Application will also be forwarded to the Regional Council of Goyder for consideration and comment in accordance with Section 49(4a) and Section 49(5) of The Act.

2.1 Pre-lodgement Consultation

Prior to lodgement of this Development Application, EnergyAustralia have undertaken consultation with the following State and Local Government agencies:

- •Department of Planning, Transport and Infrastructure;
- •Environmental Protection Authority (SA);
- Office of the Technical Regulator
- •South Australian Country Fire Service; and
- •Regional Council of Goyder.

All comments and recommendations received from these agencies have been taken into consideration throughout the preparation of this Development Application.

2.2 Background and Need for the Proposed Facility

South Australia forms part of the National Energy Market (NEM), which operates as an interconnected power system that incorporates Queensland, New South Wales, ACT, Victoria, Tasmania and South Australia. The NEM is a wholesale electricity market in which generators sell electricity and retailers buy it to on-sell to customers. This system helps to create an economical and efficient way of maintaining competitive prices in the wholesale market. The existing Hallett Power Station generates and distributes electricity as part of the National Energy Market.

The Hallett Power Station currently houses twelve (12) 'second-hand' open cycle GE Frame 5 Industrial gas turbine generators. These existing generators can be operated with either gas or diesel fuel (mineral diesel only). The Hallett Power station is used to meet periods of high demand for electricity in South Australia (especially in summer months) for some 85,000 customers providing a secure, reliable and efficient source of electricity generation for the State.

As the existing gas turbines located within the site move towards the end of their life cycle, EnergyAustralia are seeking to invest in a new aeroderivative gas turbine at the Hallett Power Station to ensure there is a consistent energy supply from the station during periods of peak demand. In addition, the proposed gas turbine will improve the overall efficiency of the station, increase capacity and will improve environmental outcomes.

2.3 Proposal Details

EnergyAustralia is planning to install and operate a new General Electric LM2500+G4 SAC Aeroderivative Gas Turbine within the existing Hallett Power Station facility. The proposed gas turbine to be installed is more thermally efficient and has a lower environmental footprint than the existing units, thus increasing the overall efficiency of the site.

Furthermore, the proposed technology meets the South Australian Government's requirements for power generation, providing reliable and flexible power electricity infrastructure to support the state with fast start capability, which is ideally suited to support the rapid introduction of transient power generating capacity into the South Australian grid.

The new gas turbine and related equipment would utilise and be fully integrated within the existing footprint of the Hallett Power Station.

The proposed upgrade will not involve any major construction activities on-site as the gas turbine will be installed as a preassembled kit along with all other related equipment for the project. The turbine is to be located on an existing concrete base.

2.4 Project Timeline

The proposed works are anticipated to be completed in time for the 2018/2019 peak summer demand. It is anticipated that the project will follow the timeline below.

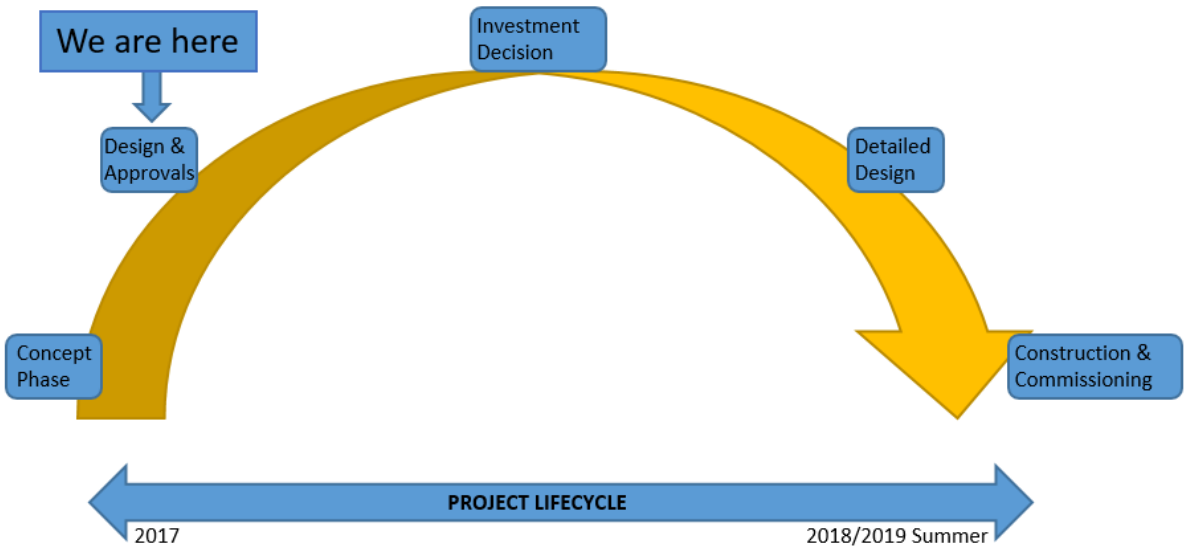


Figure 1 Project Lifecycle

2.5 Estimated Cost of Works

The estimated overall cost of works for the project is AUD$35 million.

3 Locality

3.1 The Subject Site

The existing Hallett Power Station is located at 29 The Willows Road, Canowie, SA 5419. The subject site is formally described as Allotment 1 on Deposited Plan 57812, in the area named Canowie, Hundred of Anne. A copy of the Certificate of Title is attached as **Appendix A.**

The rectangular shaped allotment measures approximately 199,140m² and has one (1) frontage to The Willows Road measuring approximately 330m.

The subject site is currently utilised as a power station which is operated during periods of high demand for electricity in South Australia. The Hallett Power Station provides a secure, reliable and efficient source of electricity generation for the South Australia network. The subject site currently encompasses twelve (12) existing open cycle GE Frame 5 industrial gas turbine generators which can be operated using either gas or diesel fuel. In association with the twelve (12) existing gas turbines, the subject site contains a central administration office located towards the eastern property boundary, a large diesel fuel storage tank and multiple water storage tanks associated with fire prevention located towards the southern property boundary.

The topography of the subject site is relatively flat, with only a minor rise in elevation towards the eastern property boundary. Access to the site is currently granted via two (2) existing crossovers located off The Willows Road.

Figure 2 provides an aerial image which demonstrates the position of the subject land within the immediate locality.

Figure 2 Subject Site – Hallett Power Station

3.1.1 Existing Development on Site

Figure 3 Existing 'second hand' Frame 5 Gas Turbines (turbines3-3 and turbines3-1)

Figure 4 Existing Gas Turbine Generator (turbines2-2)

Figure 5 Existing Gas Turbine Generator (turbines2-3)

Figure 6 Existing Diesel Fuel Storage Tank Located Towards the Southern Property Boundary

Figure 7 Decommissioned Gas Turbine Generator (turbines1-3)

3.2 The Surrounding Locality

The subject site is located within the wider Hallett / Canowie region, located approximately 175km north of Adelaide within the Goyder Council area. The locality surrounding the subject site can be generally classified as agricultural land uses. The large rural allotments that surround the subject site are primarily used for broad scale agriculture uses including cropping and grazing, while similar land uses can be found throughout the wider Canowie and Hallett regions.

There are very few residences located within the region, except where associated with large rural allotments directly associated with agricultural uses. The closest of these residences to the subject site is located approximately 1.65km northeast of the subject site at 4087 Booborowie Road, Hallett. Views to this power station from this property are limited by existing vegetation and the topography of the landscape.

Additionally, there is an existing wind farm situated atop the ridgeline located approximately 2.25km west of the subject site. This wind farm consists of several wind turbines at various elevations extending approximately 13.3km along the ridgeline.

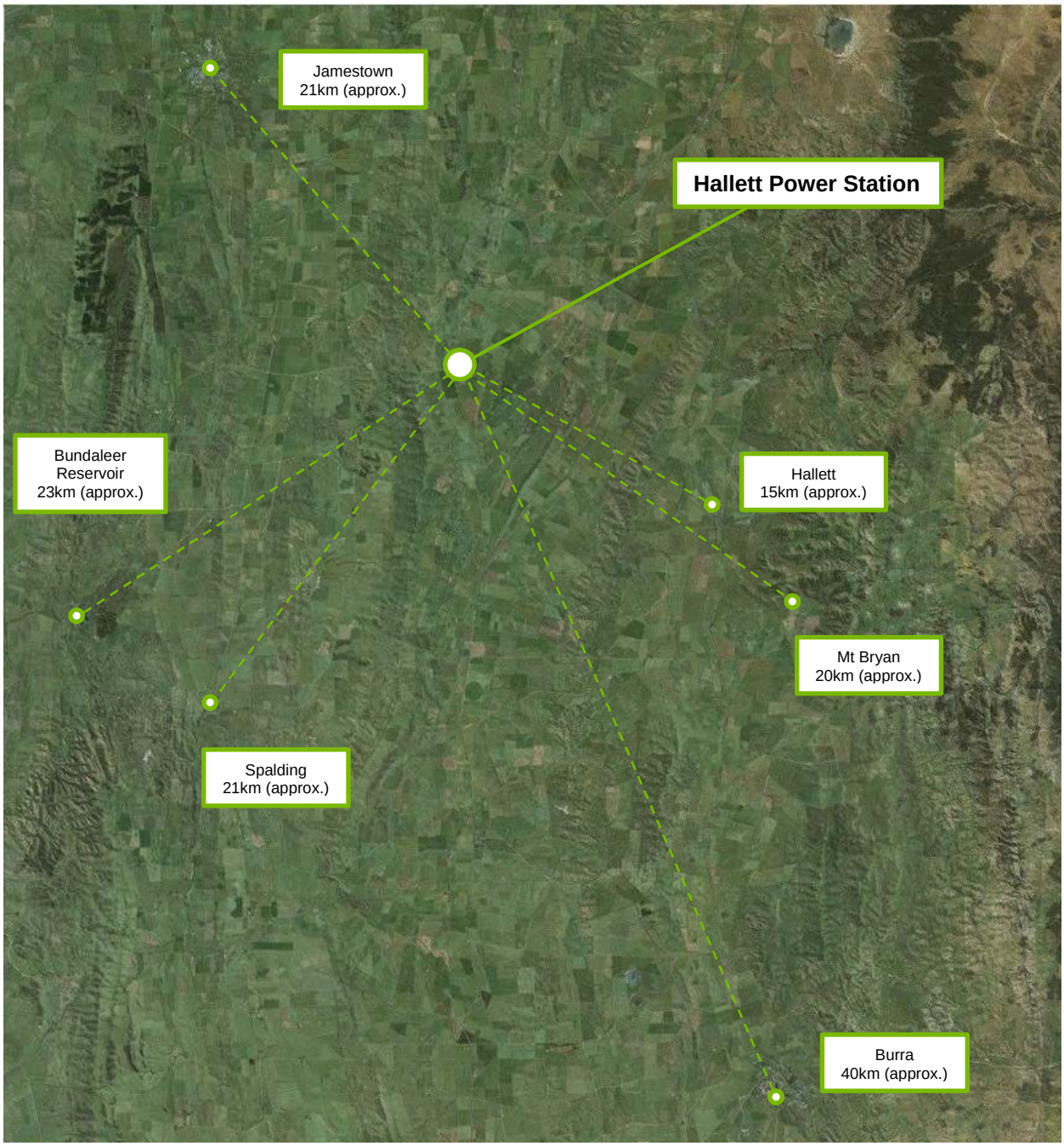


Figure 8 Site Location Map

The wider region is predominately broad-scale agricultural land uses and rural-residential properties associated with large landholdings. The area consists of a number of small townships such as Hallett, Spalding and Whyte Yarcowie as well as larger regional centres such as Jamestown and Burra. These large regional centres contain the necessary infrastructure for the handling, storage and transportation of agricultural and other commodities, which are an integral part of the rural economy within the region.

3.3 Zoning

The subject site is located within the Regional Council of Goyder and is therefore subject to the requirements of the *Goyder Council Development Plan* (Consolidated 24 November 2016).

The site is situated within the Primary Production Zone, in accordance with Zone Map Go/1. The nearest non-rural zone is the 'Township Zone' of Hallett located approximately 14.3km southeast from the existing power station.

Figure 9 Land Use Zoning – Map 01

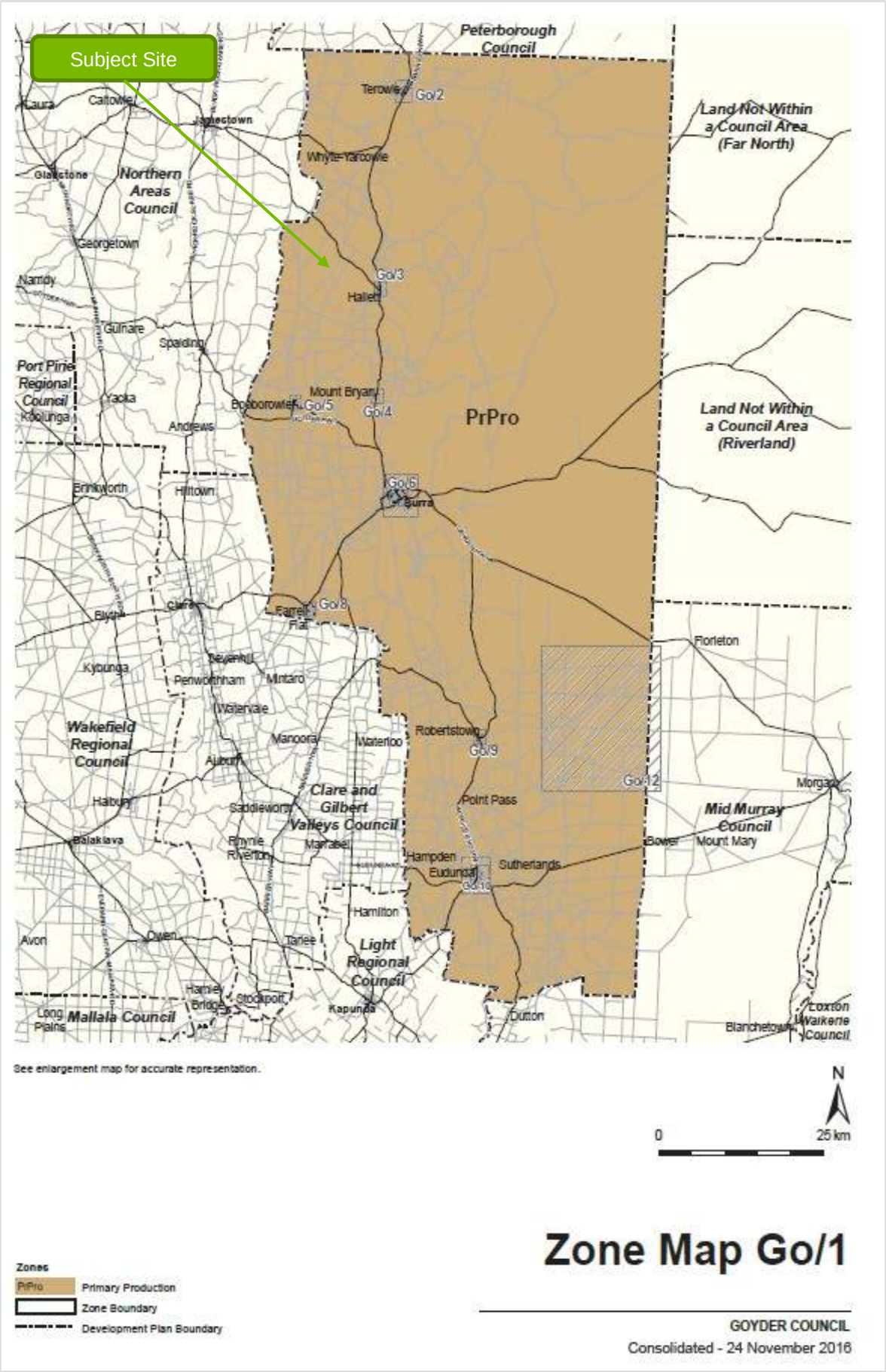


Figure 10 Land Use Zoning – Map 02

3.4 Heritage

In order to determine any possible natural or cultural values of state or national significance associated with the site, a search was conducted through the relevant Heritage Registers. There is one (1) such item of historical or environmental heritage significance was found within the broader vicinity of the subject site. The item of heritage significance is the State Heritage listed 'Coolootoo Shepherd's Hut (Heritage Number: 26123) located at Section 258 Gilfillan Road, Belalie East. This Heritage Place is located approximately 4.85km northwest of the Hallett Power Station. Due to the significant distance between the subject site and this historic site the proposed development is not considered to affect the character or value of the heritage places.

In the event that any Aboriginal heritage items/artefacts are found, the construction of this facility will be undertaken pursuant to Section 23 of the Aboriginal Heritage Act of 1998 in order to ensure that no damage occurs to the historical artefacts or places.

3.5 Flora and Fauna

In order to determine any possible natural Flora, Fauna and Endangered Species of significance with the site and the surrounding locality, a search was conducted through the relevant environmental searches.

A Protected Matters Search Report (**Appendix C)** identified that there are two (2) *'Listed Threatened Ecological Communities',* fifteen (15) *'Listed Threated Species'* and eleven (11) *'Listed Migratory Species'* that may occur within a 1km radius of the site.

Given that the proposed development is to install a new gas turbine within the existing Hallett Power Station, the proposed development is not considered to pose any threat to the existing species of flora and/or fauna found within the surrounding locality.

4 Project Description

4.1 Facility Description

EnergyAustralia is proposing to install and operate a new General Electric LM2500+G4 SAC Aeroderivative Gas Turbine within the existing Hallett Power Station facility. The proposed new open cycle aeroderivative gas turbine will be identified as turbines1-3 within the site layout.

The proposed Gas Turbine is planned to be installed and operated under the existing license and Transmission Connection Access Agreement with ElectraNet. Further to this, the proposed gas turbine will be connected through the Canowie Substation through a single line entry and exit onto the 275kV transmission network.

Key dimensions associated with the proposed turbine are outlined below:

- The width of the main 'body' of the new turbine will be 3.17 metres
- The maximum width of the air intake is 10.8 metres
- The exhaust stack at its highest point will be 20 metres

Please refer to **Appendix B – Proposed Plans** for further details on the proposed turbine and its location within the wider Hallett Power Station site.

4.2 Operation Periods

Typical operation for the existing EnergyAustralia is as follows:

Winter Period:
Five (5) x Frame 5001 units operating at 50% load for 4 hours per day, 4 days a week for roughly 16 weeks of the year.

Summer Period:
Twelve (12) x Frame 5001 units operating at 100% load for 10 hours per day, 3 days a week for roughly 6 weeks of the year.

Please note that these are approximate operation times. These figures can vary vastly from year-to-year, as seasonal conditions differ. Additionally, the constant fluctuation of market demand can result in increases and decreases in these operation times.

Proposed operation for the existing EnergyAustralia with the addition of the proposed Aeroderivative Gas Turbine will be as follows:

Winter Period:
One (1) new Aeroderivative Gas Turbine operating at 100% load for 9 hours per day, 5 days a week for roughly 20 weeks of the year; and

Three (3) Frame 5001 units operating at 50% load for 3 hours per day, 3 days a week for roughly 16 weeks of the year.

Summer Period:
One (1) new Aeroderivative Gas Turbine operating at 100% load for 12 hours per day, 6 days a week for roughly 12 years of the year; and

Twelve (12) existing Frame 5001 units operating at 100% load for 10 hours per day, 3 days a week for roughly 6 weeks of the year.

5 Air Quality Assessment

Aurecon was engaged by EnergyAustralia to conduct the air quality assessment as part of the development application for the proposed open cycle aeroderivative gas turbine to be installed and operated at the Hallett Power Station. Please see **Appendix C** for the complete Air Quality Assessment for the Hallett Power Station.

5.1 Scope of Assessment

To assess the air quality impact of operating the proposed turbine, a proposed methodology was discussed and agreed upon in a preliminary meeting with the South Australian Environment Protection Authority (SA EPA) on 25 September 2017.

The following scope was agreed upon from this meeting:

- Emissions for diesel-fuelled operation (not natural gas, as diesel operation is most conservative – refer to Appendix A of the Air Quality Assessment for comparison) to be assessed
- CALPUFF to be used for dispersion modelling due to the complex terrain in the vicinity
- TAPM to be used to generate site specific meteorology, using a reference year of 2009
- NOx to NO_2 conversion to be completed using the Ozone Limiting Method (OLM) using concentrations from SA EPA monitoring sites
- A constant emission rate is to be applied for each generator representing all generators operating at maximum load for every hour of every day
- Scenario 1 is to be run to establish current impacts due to operation of the twelve current turbines
- Scenario 2 is to be run to determine the impact of adding an additional turbines, making a total of 13 operational turbines
- Background concentrations for fine particulates to be determined from SA EPA monitoring stations
- Assessment of predicted air quality impacts against relevant air quality criteria at sensitive receiver locations only

Assessment of exposure to occupational health and safety limits within the Hallett Power Station is not within this scope of works.

5.2 Summary

Emissions testing data of the existing turbines and manufacturer's data for the proposed turbine were used to determine emission inputs for the dispersion model. Incremental (turbine contribution) and cumulative (turbine and background) concentrations were predicted at the nearest sensitive receiver and assessed against limits. Although marginal increases (less than 1.2%) in concentration were observed with operation of an additional turbine, no exceedances of air quality limits were identified. As such, the proposed development is not considered to cause adverse air quality impacts, and this justification is contained in the complete Air Quality Assessment for the Hallett Power Station in **Appendix C**.

6 Planning Assessment

6.1 South Australian Energy Plan

The South Australian Energy Plan (*Our Energy Plan)* released in 2017 provides a comprehensive plan to maintain better control over the State's energy future and deliver reliable, affordable and clean power for South Australians.

The plan provides six key goals to protect the security of the South Australian energy market, whilst also ensuring that there is a greater reliance on renewable energy sources. One of these key goals states that *"Create new invest in cleaner energy to increase competition, put downward pressure on prices and provide more energy-system stability."* The proposed gas turbine for the Hallett Power Station will help to provide a clean energy source whilst also utilising South Australian gas (in accordance with Goal 6: *"South Australia to source and use more South Australian gas to generate its own electricity, increasing the state's self-reliance").* Additionally, as the Hallett Power Station operates during periods of peak demand, the proposed facility will assist in providing more stability to the South Australian energy market.

Considering the above, Aurecon is of the opinion that the proposed development is consistent with the goals and vision of the South Australian Energy Plan.

6.2 Development Plan Provisions

The following Objectives and Principles of Development Control (PDC) of the *Goyder Council Development Plan* (Consolidated 24 November 2016) are considered to be relevant in the assessment of the proposed development.

Council Wide		
Design and Appearance	Objectives	-
	Principles of Development Control	2, 6, 8
Hazards (Bushfire)	Objectives	1, 2, 3, 5
	Principles of Development Control	1, 2, 6, 7, 11
Hazards (Containment of Chemical and Hazardous Materials)	Objectives	1, 5, 9
	Principles of Development Control	1, 2, 3, 19, 20
Interface between Land Uses	Objectives	1, 2
	Principles of Development Control	1, 2, 6, 7
Infrastructure	Objectives	1, 2, 3, 4, 5
	Principles of Development Control	1, 8, 10, 11
Orderly and Sustainable Development	Objectives	1, 3, 4
	Principles of Development Control	1, 2
Siting and Visibility	Objectives	1
	Principles of Development Control	1, 2, 3, 5, 6
Transportation and Access	Objectives	2
	Principles of Development Control	8, 21, 22, 29, 31
Zone Specific		
Primary Production Zone	Objectives	-
	Principles of Development Control	1, 2, 10, 11, 12

6.3 Development Plan Assessment

6.3.1 Design, Appearance and Visibility

The proposed aeroderivative gas turbine has been designed and sited to maximise its energy generation capabilities whilst also minimising visual impact upon the locality as much as practicable.

The proposed development has been sited in the existing Hallett Power Station among twelve (12) existing open cycle gas turbines. The proposed installation will be of a contemporary nature when compared with the existing structures located within the subject land, will be constructed of a similar size and shape to the existing units and will use comparable colours and materials. Additionally, the proposed installation of the new turbine is not likely to impact upon any scenically attractive areas, nor will the installation unreasonably restrict existing views available from neighbouring properties.

Considering the above, Aurecon are of the opinion that the proposed development is consistent with the following provisions:

Design and Appearance
OBJECTIVES

1. Development of a high architectural standard that responds to and reinforces positive aspects of the local environment and built form.

PRINCIPLES OF DEVELOPMENT CONTROL

2. The design of a building may be of a contemporary nature and exhibit an innovative style provided the overall form is sympathetic to the scale of development in the locality and with the context of its setting with regard to shape, size, materials and colour.

6. Building form should not unreasonably restrict existing views available from neighbouring properties and public spaces.

8. The external walls and roofs of buildings should not incorporate highly reflective materials which will result in glare.

Siting and Visibility
OBJECTIVES

1. Protection of scenically attractive areas, particularly natural, rural and coastal landscapes.

PRINCIPLES OF DEVELOPMENT CONTROL

1. Development should be sited and designed to minimise its visual impact on:

(a) the natural, rural or heritage character of the area

(b) areas of high visual or scenic value, particularly rural areas

(c) views from public reserves, tourist routes and walking trails.

2. Buildings should be sited in unobtrusive locations and, in particular, should:

(a) be grouped together

(b) where possible be sited in such a way as to be screened by existing vegetation when viewed from public roads.

3. Buildings outside of urban areas and in undulating landscapes should be sited in unobtrusive locations and in particular should be:

(a) sited below the ridgeline

(b) sited within valleys or behind spurs

(c) sited in such a way as to not be visible against the skyline when viewed from public roads

(d) set well back from public roads, particularly when the allotment is on the high side of the road.

5. The nature of external surface materials of buildings should not detract from the visual character and amenity of the landscape.

6. The number of buildings and structures on land outside of urban areas should be limited to that necessary for the efficient management of the land.

6.3.2 Hazards

The proposed development is located within the Goyder Council area. During pre-lodgement consultation held with Goyder Council staff on Wednesday 18 October 2017, Council advised that the proposed location not located within an identified Bushfire Risk Area.

The proposed development is well removed from existing residences within the surrounding locality and contains offices for staff working at the power station site. Additionally, there are a number of firefighting and fire prevention methods employed within the subject site to manage any outbreak of fire.

Each gas turbine is installed with a Co^2 fire protection system internally. In the unlikely event of a fire, this system is designed to displace oxygen levels within the enclosure to the point where it won't support a fire. Co^2 tanks are stored within a small storage cabinet adjacent to each gas turbine generator, as shown in **Figure 11**.

Figure 11 Existing Gas Turbine Generator (GTturbines2-2) with Co^2 Storage Cabinet

This internal fire protection system is designed to extinguish fires within the turbine as swiftly as possible. In the event that small scale fires should spread to areas surrounding the gas turbines, fire extinguishers are located adjacent to each turbine, as shown in **Figures 12** and **13**.

Figure 12 Fire Extinguisher located adjacent GTturbines2-1

Figure 13 Fire Extinguisher located adjacent GTturbines1-4

In addition to the above, two (2) Fire Water Tanks and a Fire Water Pump House are located towards the southern property boundary (as shown in **Figure 14)**. These two (2) tanks and pump house are designed to assist with on-site firefighting in the event that the internal Co^2 systems are unable to extinguish any fires.

Figure 14 Two (2) Existing Fire Water Tanks and Pump House Located Adjacent to the Site Entrance

Access to the site is granted via an existing 10m wide (approx.) entry point with a motorised gate located on The Willows Road towards the southwest of the subject land. Departure from the site granted via the same point onto The Willows Road. This existing access arrangement allows emergency service vehicles to easily enter and exit the subject land in a forward direction. Additionally, there is an emergency access and egress gate located towards the north of the subject site. Furthermore, the site currently utilises permeable fencing which prevents the trapping of debris in a bushfire situation.

Despite not being located within a Bushfire Protection Area, the proposed development is considered to be consistent with the requirement of the *Minister's Code: Undertaking Development in Bushfire Protection Areas*.

Considering the above, Aurecon are of the opinion that the proposed development is unlikely to pose a significant risk to bushfire hazard and Aurecon consider the proposed development to be consistent with the following provisions:

Hazards
OBJECTIVES

1. Maintenance of the natural environment and systems by limiting development in areas susceptible to natural hazard risk.

2. Development located away from areas that are vulnerable to, and cannot be adequately and effectively protected from the risk of natural hazards.

3. Development located to minimise the threat and impact of bushfires on life and property.

5. Critical community facilities such as hospitals, emergency control centres, major service infrastructure facilities, and emergency service facilities located where they are not exposed to natural hazard risks.

9. Minimisation of harm to life, property and the environment through appropriate location of development and appropriate storage, containment and handling of hazardous materials.

PRINCIPLES OF DEVELOPMENT CONTROL

1. Development should:

(a) be excluded from areas that are vulnerable to, and cannot be adequately and effectively protected from, the risk of natural hazards

(b) be sited, designed and undertaken with appropriate precautions being taken against fire, flood, coastal flooding, storm surge, landslip, earthquake, toxic emissions or other hazards such as vermin

(c) not occur on land where the risk of flooding is likely to be harmful to safety or damage property.

(d) be designed and sited to minimise environmental nuisance or harm resulting from biological, chemical or fire hazard, energy emission or explosion.

2. There should not be any significant interference with natural processes in order to reduce the exposure of development to the risk of natural hazards.

3. The location of critical community facilities or key infrastructure in areas of high natural hazard risk should be avoided.

BUSHFIRE

6. Buildings and structures should be located away from areas that pose an unacceptable bushfire risk as a result of one or more of the following:

(a) vegetation cover comprising trees and/or shrubs

(b) poor access

(c) rugged terrain

(d) inability to provide an adequate building protection zone

(e) inability to provide an adequate supply of water for fire-fighting purposes

7. Buildings and structures should be designed and configured to reduce the impact of bushfire through using designs that reduce the potential for trapping burning debris against the building or structure, or between the ground and building floor level in the case of transportable buildings

11. Vehicle access and driveways to properties and public roads created by land division should be designed and constructed to facilitate safe and effective operational use for fire-fighting, other emergency vehicles and residents.

CONTAINMENT OF CHEMICAL AND HAZARDOUS MATERIALS

19. Hazardous materials should be stored and contained in a manner that minimises the risk to public health and safety and the potential for water, land or air contamination.

20. Development that involves the storage and handling of hazardous materials should ensure that these are contained in designated areas that are secure, readily accessible to emergency vehicles, impervious, protected from rain and stormwater intrusion and other measures necessary to prevent:

(a) discharge of polluted water from the site

(b) contamination of land

(c) airborne migration of pollutants

(d) potential interface impacts with sensitive land uses.

6.3.3 Interface between Land Uses

The proposed development is located among contemporary land uses and is well separated from Residential Zones and existing residences within the broader locality. The nearest of these residences is located approximately 1.65km northeast from the existing Hallett Power Station. Views to the Hallett Power Station from this residences are disrupted by existing vegetation located between this residence and the subject site.

Figure 15 Views to the nearest residence from the subject site (facing northeast)

The subject site is well separated from the more primary routes for motorists within the locality, particularly Hallett-Jamestown Road (located approximately 4.2km northeast from the site). In addition, the site is reasonably separated from nearby Booborowie Road (located approximately 775m east from the site).

The proposed development has been sited within the existing Hallett Power Station. The existing site is well separated from nearby rural settlements within the broader locality. The existing is site is located 15km (approx.) northwest from the Township of Hallett, 21km (approx.) southeast from the Township of Jamestown and 21km (approx.) northeast from the Township of Spalding. Considering the substantial separation between the subject site and these rural Townships, the proposed development is unlikely to cause any adverse impacts or conflicts upon existing land uses located therein.

The proposed development is unlikely to create any substantial noise emissions. The new aeroderivative gas turbine will operate at a similar noise level to the existing open cycle gas turbines and will not cause any additional adverse noise impacts to the surrounding locality. This was confirmed during preliminary discussions with the EPA held in September 2017, where the EPA advised that a noise impact assessment would not be required for the proposed development, as any additional noise generated from the site will not exceed recommended decibel levels and will be in accordance with relevant EPA guidelines.

Considering the above, Aurecon are of the opinion that the proposed development is consistent with the following provisions:

Interface between Land Uses
OBJECTIVES

1. Development located and designed to prevent adverse impact and conflict between land uses.

2. Protect community health and amenity and support the operation of all desired land uses.

PRINCIPLES OF DEVELOPMENT CONTROL

1. Development should not detrimentally affect the amenity of the locality or cause unreasonable interference through any of the following:

(a) the emission of effluent, odour, smoke, fumes, dust or other airborne pollutants

(b) noise

(c) vibration

(d) electrical interference

(e) light spill

(f) glare

(g) hours of operation

(h) traffic impacts.

2. Development should be designed and sited to minimise negative impact on existing and potential future land uses considered appropriate in the locality.

6. Development should be designed, constructed and sited to minimise negative impacts of noise and to avoid unreasonable interference.

7. Development should be consistent with the relevant provisions each of the following documents:

(a) AS 2107 Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors

(b) AS 3671 Acoustics - Road Traffic Noise Intrusion, Building Siting and Construction

(c) the current Environment Protection (Noise) Policy

6.3.4 Infrastructure

The proposed development will provide energy generating infrastructure that will provide additional stability for the South Australia energy market.

Infrastructure Principle of Development Control 8 states that *"Electricity infrastructure should be sited and designed to minimise its visual and environmental impacts".* As such, the proposed gas turbine has been sited to reduce impacts on the surrounding locality as much as practicable. The proposed development has been appropriately sited among existing non-residential buildings and structures on an existing site that is currently utilised as a power generation and transmission station. The existing station is appropriately sited in a non-residential zone and is well separated from sensitive receptors within the broader locality. Additionally, the subject site is already cleared of native vegetation. As such, the proposed development is unlikely to create any additional visual and environmental impacts upon the immediate or broader locality.

Considering the above, Aurecon are of the opinion that the proposed development is consistent with the following provisions:

Infrastructure
OBJECTIVES

1. Infrastructure provided in an economical and environmentally sensitive manner.

2. Infrastructure, including social infrastructure, provided in advance of need.

3. Suitable land for infrastructure identified and set aside in advance of need.

4. The visual impact of infrastructure facilities minimised.

5. The efficient and cost-effective use of existing infrastructure.

PRINCIPLES OF DEVELOPMENT CONTROL

8. Electricity infrastructure should be sited and designed to minimise its visual and environmental impacts.

10. Utilities and services, including access roads and tracks, should be sited on areas already cleared of native vegetation. If this is not possible, their siting should cause minimal interference or disturbance to existing native vegetation and biodiversity.

11. Utility buildings and structures should be grouped with non-residential development where possible.

6.3.5 Orderly and Sustainable Development

The proposed development is a continuation of the existing land use within the subject site and will not jeopardise the continuation of adjoining land uses within the surrounding locality. Additionally, the proposed development will not prejudice the development of the Primary Production Zone for its intended purposes.

Orderly and Sustainable Development Principle of Development Control 2 states that *"Land outside of townships and settlements should primarily be used for primary production and conservation purposes".* Whilst the proposed development is located outside of townships and settlements within the Goyder Council area and is located within the Primary Production Zone, the proposed development is located within an existing lawful land use and is not considered to be incompatible with the i existing approved land use. Additionally, as previously mentioned, the proposed development forms part of the continuation of the existing land use within the subject site.

Considering the above, Aurecon are of the opinion that the proposed development is consistent with the following provisions:

Orderly and Sustainable Development
OBJECTIVES

1. Orderly and economical development that creates a safe, convenient and pleasant environment in which to live.

3. Development that does not jeopardise the continuance of adjoining authorised land uses.

4. Development that does not prejudice the achievement of the provisions of the Development Plan.

PRINCIPLES OF DEVELOPMENT CONTROL

1. Development should not prejudice the development of a zone for its intended purpose.

2. Land outside of townships and settlements should primarily be used for primary production and conservation purposes.

6.3.6 Transportation and Access

The proposed development is located within the existing Hallett Power Station. Access to the facility is granted directly from The Willows Road via an existing 10m wide (approx.) entry point with a motorised access gate. Access to the site is limited to those authorised personnel (EnergyAustralia employees) who have the appropriate swipe card to enable them admission to the site.

The current access arrangement provides direct access to the facility from an all-weather public road and allows for safe and convenient access for all anticipated vehicles. Additionally, this existing access arrangement allows emergency service vehicles to easily enter and exit the subject land in a forward direction.

Inside the Hallett Power Station site there are numerous access roads that travel throughout the facility. These access roads allow for safe and convenient travel throughout the Hallett Power Station for all vehicles, including emergency service vehicles.

Figure 16 Access Roads Located within the Hallett Power Station

Considering the above, Aurecon are of the opinion that the proposed development is consistent with the following provisions:

Transportation and Access
OBJECTIVES

2. Development that:

(a) provides safe and efficient movement for all motorised and non-motorised transport modes

(b) ensures access for vehicles including emergency services, public infrastructure maintenance and commercial vehicles

(c) provides off street parking

(d) is appropriately located so that it supports and makes best use of existing transport facilities and networks.

PRINCIPLES OF DEVELOPMENT CONTROL

8. Development should provide safe and convenient access for all anticipated modes of transport including cycling, walking, public and community transport, and motor vehicles.

21. Development should have direct access from an all weather public road.

22. Development should be provided with safe and convenient access which:

(a) avoids unreasonable interference with the flow of traffic on adjoining roads

(b) accommodates the type and volume of traffic likely to be generated by the development or land use and minimises induced traffic through over-provision

(c) is sited and designed to minimise any adverse impacts on the occupants of and visitors to neighbouring properties.

29. Development should provide off-street vehicle parking and specifically marked disabled car parking places to meet anticipated demand.

31. Vehicle parking areas should be sited and designed in a manner that will:

(a) facilitate safe and convenient pedestrian linkages to the development and areas of significant activity or interest in the vicinity of the development

(b) include safe pedestrian and bicycle linkages that complement the overall pedestrian and cycling network

(c) not inhibit safe and convenient traffic circulation

(d) result in minimal conflict between customer and service vehicles

(e) avoid the necessity to use public roads when moving from one part of a parking area to another

(f) minimise the number of vehicle access points to public roads

(g) avoid the necessity for backing onto public roads

(h) where reasonably possible, provide the opportunity for shared use of car parking and integration of car parking areas with adjoining development to reduce the total extent of vehicle parking areas and the requirement for access points

(i) not dominate the character and appearance of a centre when viewed from public roads and spaces

(j) provide landscaping that will shade and enhance the appearance of the vehicle parking areas.

6.3.7 Primary Production Zone

The proposed development has been sited within the Primary Production Zone, in accordance with GO/Map 1 of the *Goyder Council Development Plan* (Consolidated 24 November 2016).

The Primary Production Zone envisages that the region will support a more sustainable approach to primary production. While sustainable land management practices will see long-term improvement in the quality of the environment and the economic activity of the region. Additionally, the Desired Character Statement for the Primary Production Zones states that *"Wind farms and ancillary development such as substations, maintenance sheds, access roads and connecting power-lines (including to the National Electricity Grid) are envisaged within the zone and constitute a component of the zone's desired character."*

Whilst the proposed development is not associated with the sustained continuation of primary production within the region, nor an ancillary development to a wind farm, the proposed development is considered to provide an essential service for the whole of South Australian, including the Goyder Council region. The proposed development has been appropriately sited in the existing Hallett Power Station, clustered among existing gas turbine generators. This clusters of like-facilities will help to reduce environmental and amenity impacts as practicable.

Considering the above, Aurecon are of the belief that the proposed development will not impair the amenity of the locality, nor is it considered to be in conflict with the land uses in the locality nor the envisaged forms of development for the Primary Production Zone. As such, Aurecon believe that the proposed development is consistent with the following provisions:

Primary Production Zone
PRINCIPLES OF DEVELOPMENT CONTROL

1. The following forms of development are envisaged in the zone:

- *tourist accommodation, including through the diversification of existing farming activities and conversion of farm buildings*
- *farming*
- *intensive animal keeping (especially within Enterprise Policy Area 2)*
- *wind farm and ancillary development*
- *wind monitoring mast and ancillary development.21. Development should have direct access from an all-weather public road.*

2. Development listed as non-complying is generally inappropriate and not acceptable unless it can be demonstrated that it does not undermine the objectives and principles of the Development Plan.

10. Development should not be undertaken unless it is consistent with the desired character for the zone.

11. Structures and buildings should generally be set back a minimum of 30 metres from all road boundaries.

12. Development should not occur within 500 metres of a national park, conservation park, wilderness protection area or significant stands of native vegetation if it will increase the potential for, or result in, the spread of pest plants.

7 Conclusion

The proposed open cycle aeroderivative gas turbine has been appropriately sited within the existing Hallett Power Station and will assist in supplementing power generation during periods of peak demand, whilst also ensuring that the provision of terminals is fully utilised as existing EnergyAustralia reach the end of their life cycle.

The new turbine has been strategically designed and sited to minimise impacts on the surrounding locality as much as practicable. The visual impact of the proposed turbine is considered to be minimal, considering the substantial separation from sensitive receptors within the locality and the presence of existing turbines within the power station site. Additionally, the placement of the new turbine is close proximity to existing turbines of a similar bulk and scale will help to reduce any visual impact when viewed from the local road network.

The proposed development is consistent with the stated Objectives and Principles of Development Control within the Goyder Council Development Plan (Consolidated 24 November 2016). It is considered that the proposal will provide an essential service to the whole of South Australia and will ensure that there is sufficient supply to the South Australian grid during periods of peak demand.

In this regard, the proposal satisfies the provisions of the Goyder Council Development Plan and Aurecon are of the opinion that the proposal has sufficient merit to warrant Development Plan Consent.

A

Certificate of Title

Government of South Australia
Department of Planning, Transport and Infrastructure

Product	Register Search (CT 5965/72)
Date/Time	11/04/2017 04:38PM
Customer Reference	AGL - MELLISSA
Order ID	20170411011907
Cost	$27.75

REAL PROPERTY ACT, 1886
South Australia

The Registrar-General certifies that this Title Register Search displays the records maintained in the Register Book and other notations at the time of searching.

Certificate of Title - Volume 5965 Folio 72

Parent Title(s)	CT 5909/479				
Creating Dealing(s)	SC 10447118				
Title Issued	31/05/2006	**Edition**	4	**Edition Issued**	23/04/2008

Estate Type

FEE SIMPLE

Registered Proprietor

TRUENERGY HALLETT PTY. LTD. (ACN: 120 665 643)
OF LEVELL 33/385 BOURKE STREET MELBOURNE M VIC 3000

Description of Land

ALLOTMENT 1 DEPOSITED PLAN 57812
IN THE AREA NAMED CANOWIE
HUNDRED OF ANNE

Easements

SUBJECT TO EASEMENT(S) OVER THE LAND MARKED A TO TRANSMISSION LESSOR CORPORATION OF 1 UNDIVIDED 2ND PART (SUBJECT TO LEASE 9061500) AND ELECTRANET PTY. LTD. OF 1 UNDIVIDED 2ND PART (T 5106277)

SUBJECT TO EASEMENT(S) OVER THE LAND MARKED G (TG 9699950)

Schedule of Dealings

Dealing Number	Description
9426249	LEASE TO ELECTRANET PTY. LTD. COMMENCING ON 18/12/2001 AND EXPIRING ON 17/6/2022 OF PORTION (SWITCHYARD B IN GP 603/2001)
10718120	LEASE TO BROWN HILL PTY. LTD. COMMENCING ON 15/12/2006 AND EXPIRING ON 1/5/2033 OF PORTION (A1 AND A2 IN FP 49622) TOGETHER WITH CERTAIN RIGHTS
10728463	MORTGAGE OF LEASE 10718120 TO TASOVAC PTY. LTD.

Notations

Dealings Affecting Title NIL

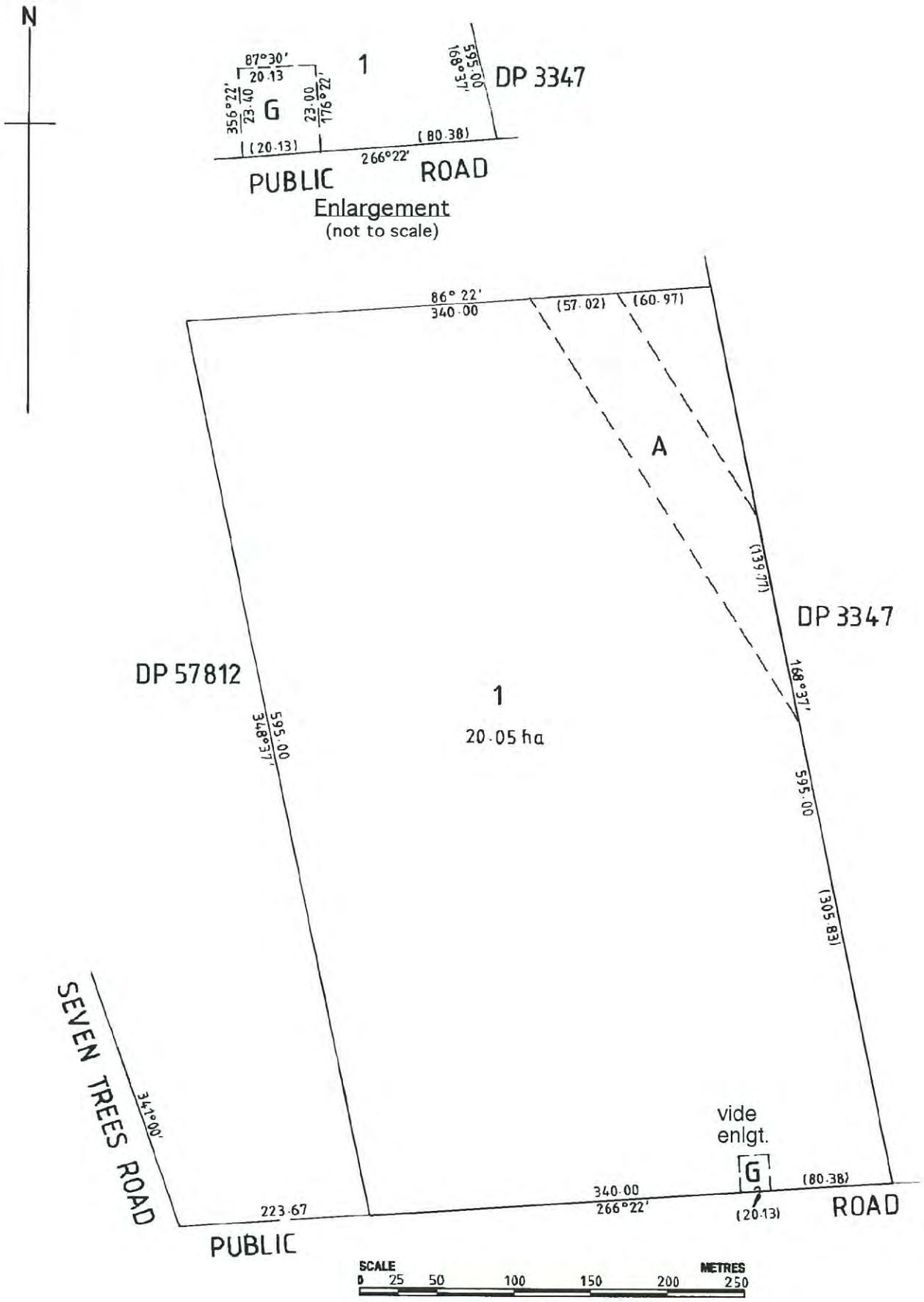
Priority Notices NIL

Notations on Plan NIL

Registrar-General's Notes

PLAN FOR LEASE PURPOSES VIDE G201/2005
PLAN FOR LEASE PURPOSES VIDE G603/2001
APPROVED FILED PLAN FOR LEASE PURPOSES FX49622

Administrative Interests NIL



Government of South Australia
Department of Planning, Transport and Infrastructure

Product	Register Search (CT 5965/72)
Date/Time	11/04/2017 04:38PM
Customer Reference	AGL - MELLISSA
Order ID	20170411011907
Cost	$27.75

REAL PROPERTY ACT, 1886
South Australia

The Registrar-General certifies that this Title Register Search displays the records maintained in the Register Book and other notations at the time of searching.

Certificate of Title - Volume 5965 Folio 72

Parent Title(s)	CT 5909/479				
Creating Dealing(s)	SC 10447118				
Title Issued	31/05/2006	**Edition**	4	**Edition Issued**	23/04/2008

Estate Type

FEE SIMPLE

Registered Proprietor

TRUENERGY HALLETT PTY. LTD. (ACN: 120 665 643)
OF LEVELL 33/385 BOURKE STREET MELBOURNE M VIC 3000

Description of Land

ALLOTMENT 1 DEPOSITED PLAN 57812
IN THE AREA NAMED CANOWIE
HUNDRED OF ANNE

Easements

SUBJECT TO EASEMENT(S) OVER THE LAND MARKED A TO TRANSMISSION LESSOR CORPORATION OF 1 UNDIVIDED 2ND PART (SUBJECT TO LEASE 9061500) AND ELECTRANET PTY. LTD. OF 1 UNDIVIDED 2ND PART (T 5106277)

SUBJECT TO EASEMENT(S) OVER THE LAND MARKED G (TG 9699950)

Schedule of Dealings

Dealing Number	Description
9426249	LEASE TO ELECTRANET PTY. LTD. COMMENCING ON 18/12/2001 AND EXPIRING ON 17/6/2022 OF PORTION (SWITCHYARD B IN GP 603/2001)
10718120	LEASE TO BROWN HILL PTY. LTD. COMMENCING ON 15/12/2006 AND EXPIRING ON 1/5/2033 OF PORTION (A1 AND A2 IN FP 49622) TOGETHER WITH CERTAIN RIGHTS
10728463	MORTGAGE OF LEASE 10718120 TO TASOVAC PTY. LTD.

Notations

Dealings Affecting Title NIL

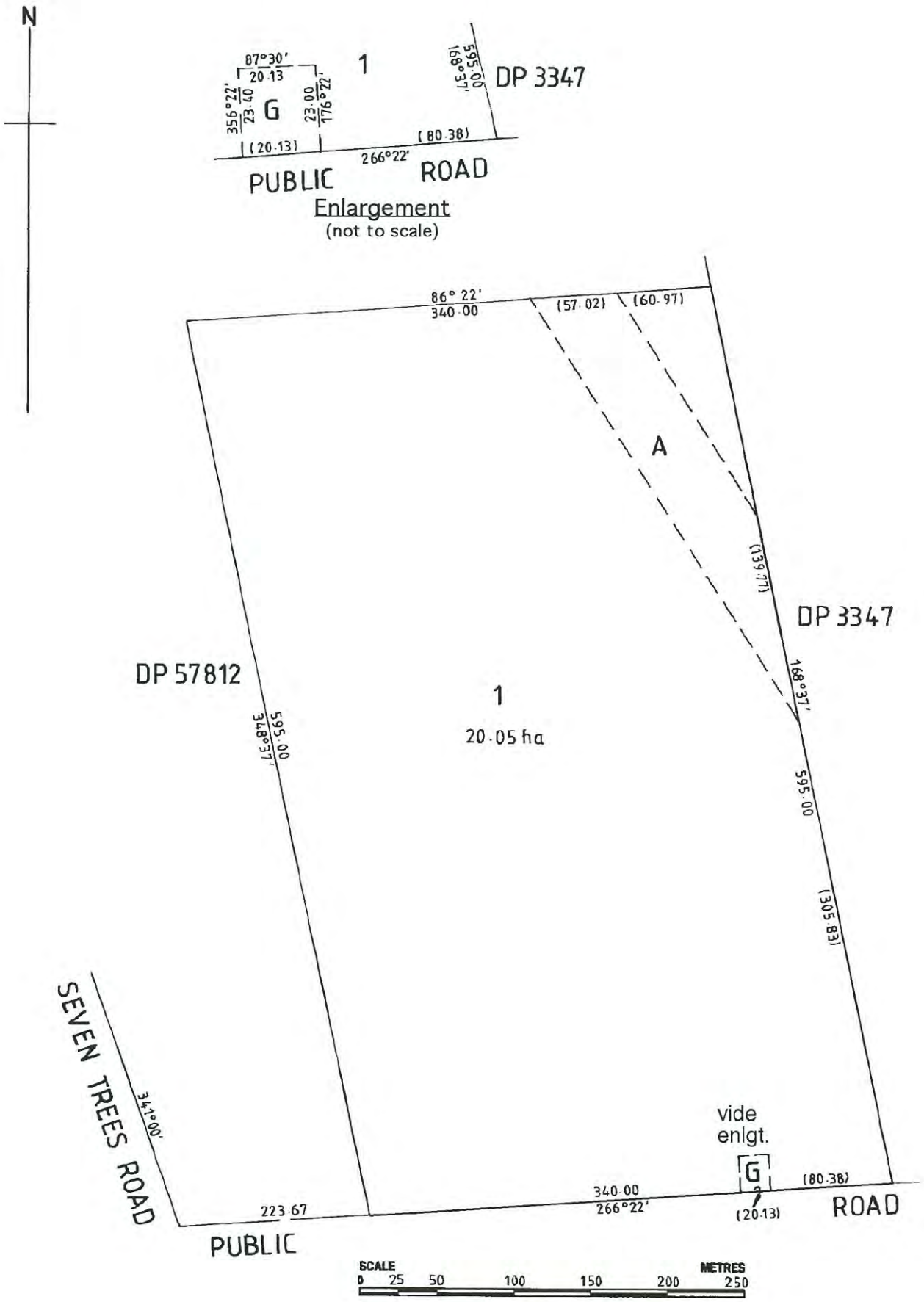
Priority Notices NIL

Notations on Plan NIL

Registrar-General's Notes

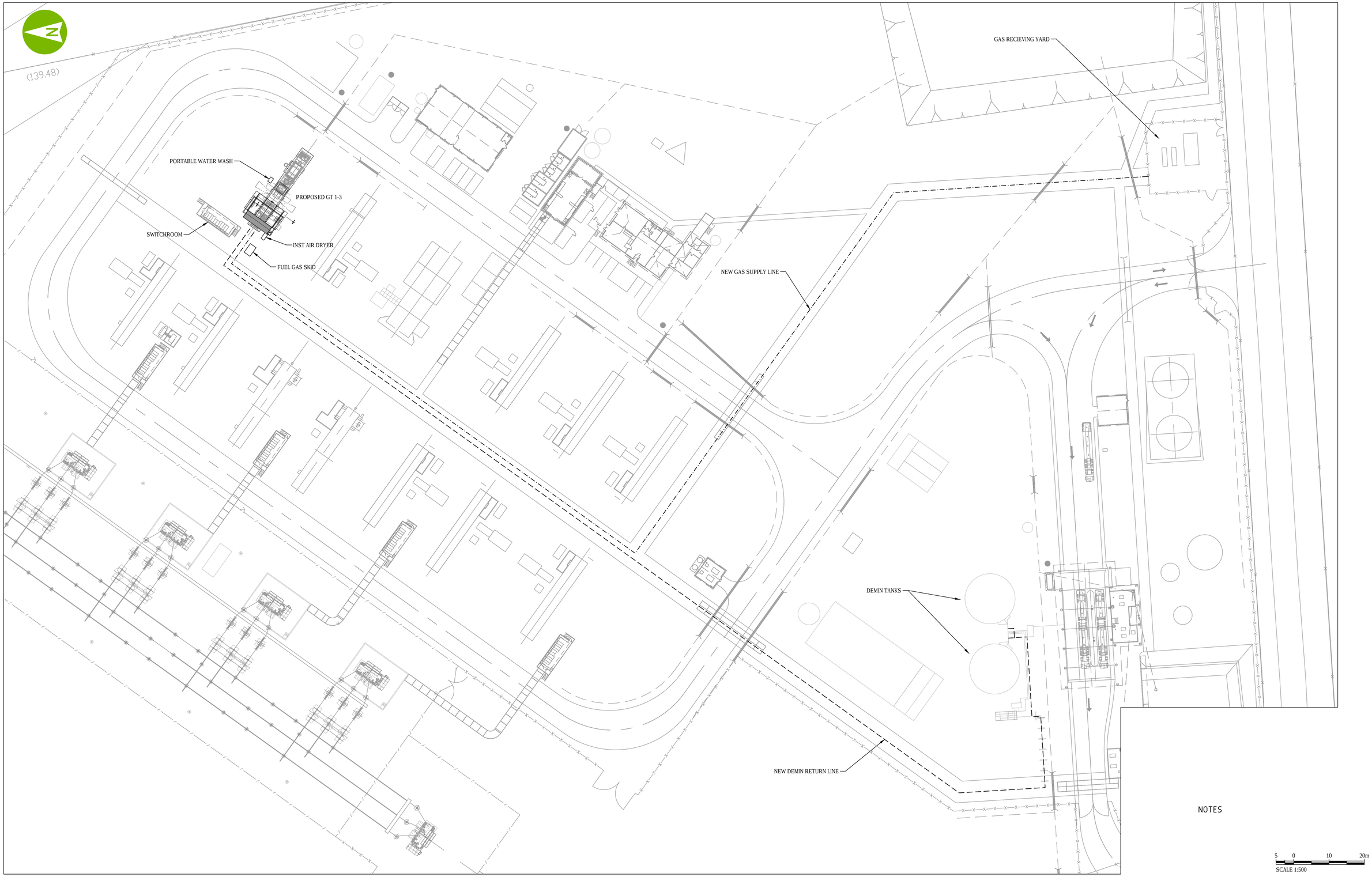
PLAN FOR LEASE PURPOSES VIDE G201/2005
PLAN FOR LEASE PURPOSES VIDE G603/2001
APPROVED FILED PLAN FOR LEASE PURPOSES FX49622

Administrative Interests NIL



B

Plans of Proposed Development



REFERENCE DRG.

DESCRIPTION	DRAWING NUMBER

REVISION

DATE	REV	W/O No.	DESCRIPTION	DRAWN	CHECKED	W/O ORIG
24/10/17	B		AIR FILTER ALTERED	PM	PH	
20/10/17	A		ISSUED FOR REVIEW FOR FEED	PM	PH	

aurecon
www.aurecongroup.com
CONTRACTOR DRG. No.

HALLETT PTY LTD

EnergyAustralia

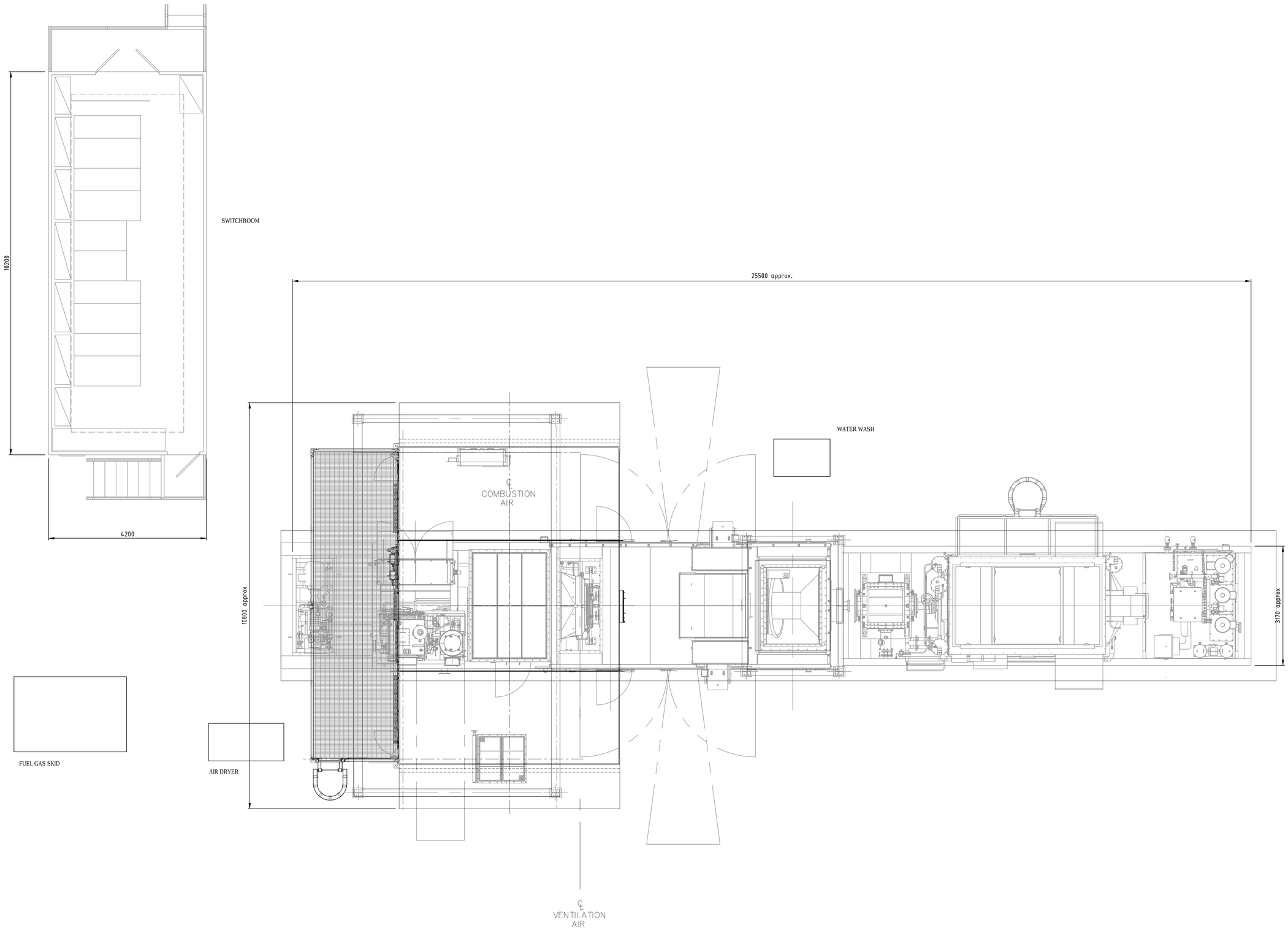
DRAWN: PMcFarlane
DATE: 20/10/17
SCALE:
CHECKED: PHill
W/O No. 4500033427
APPROVED FOR EnergyAustralia USE

DRG. No. GTBCOM-LAYOUT-M-001
REV B

DRAWING TITLE
HALLETT 203 MW POWER STATION
PROPOSED GT 1-3 GAS TURBINE
SITE LAYOUT

X,Y = 0,0 821 x 574 mm

A1



500 0 1000 2000mm

SCALE 1:50

REFERENCE DRG.

DESCRIPTION	DRAWING NUMBER

REVISION

DATE	REV	W/O No.	DESCRIPTION	DRAWN	CHECKED	W/O ORIG
02/11/17	C		DIMENSIONS ADDED	PM	PH	
24/10/17	B		AIR FILTER ALTERED	PM	PH	
20/10/17	A		ISSUED FOR REVIEW FOR FEED	PM	PH	

aurecon
www.aurecongroup.com
CONTRACTOR DRG. No.

HALLETT PTY LTD

EnergyAustralia

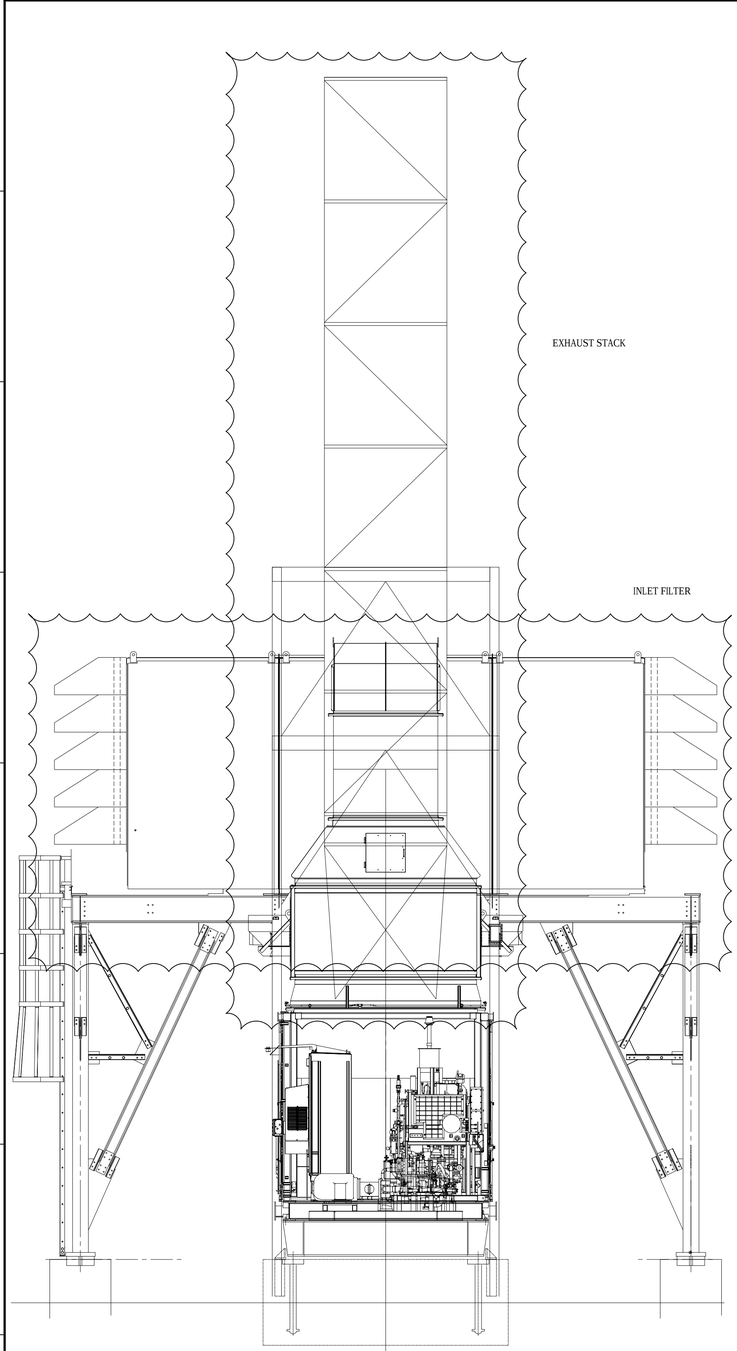
DRAWN: PMcFarlane
DATE: 20/10/17
SCALE:
CHECKED: PHill
W/O No. 4500033427
APPROVED FOR EnergyAustralia USE

DRG. No. GTBCOM-LAYOUT-M-002
REV C

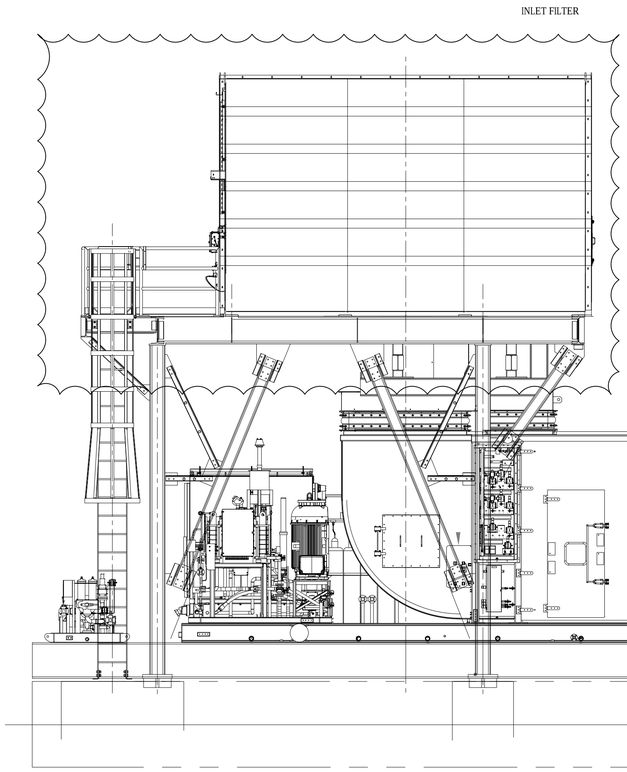
DRAWING TITLE
HALLETT 203 MW POWER STATION
PROPOSED GT 1-3 GAS TURBINE
PLAN

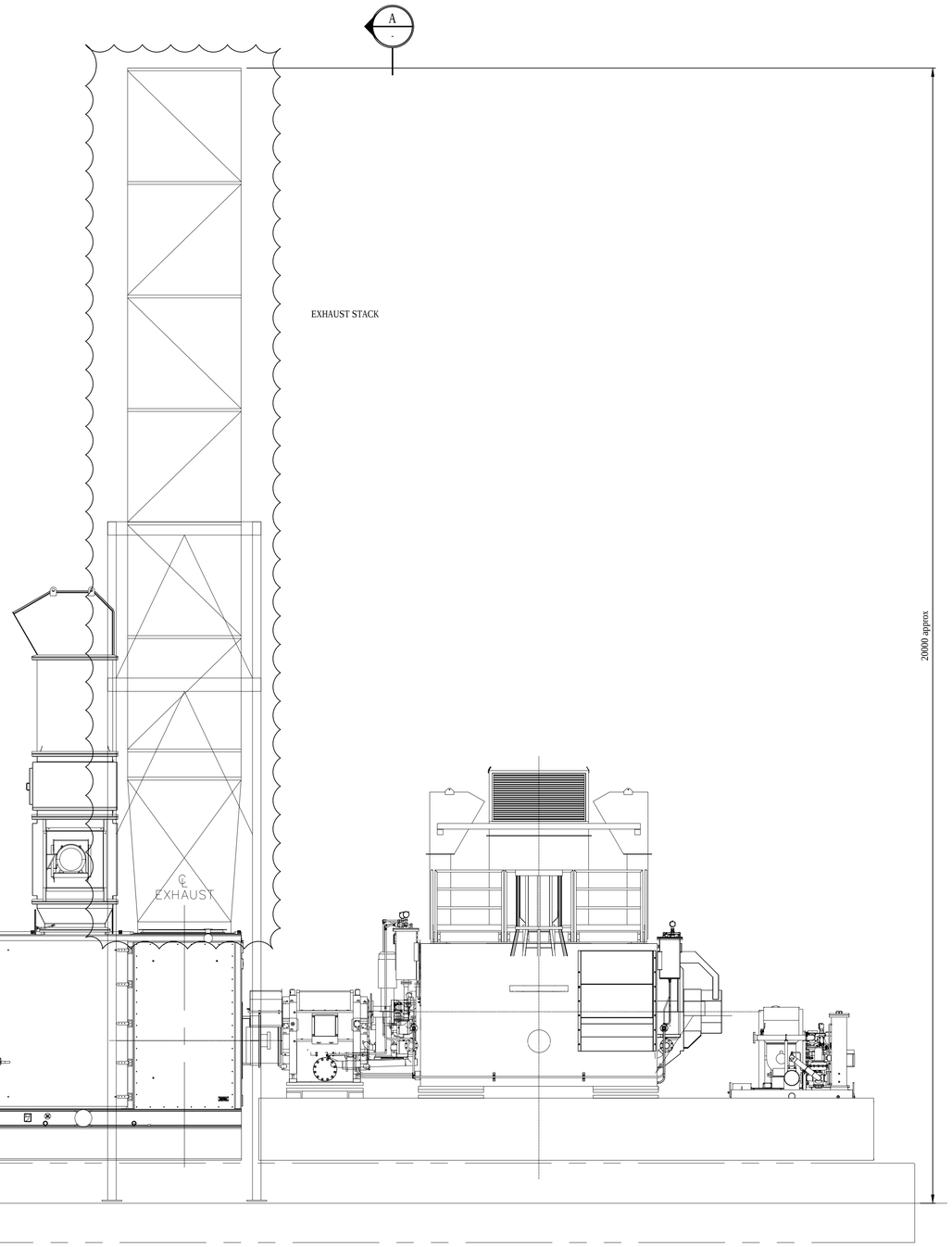
X,Y = 0,0 821 x 574 mm

A1



SECTION A
1:50





SIDE ELEVATION
1:50

500 0 1000 2000mm
SCALE 1:50

REFERENCE DRG.

DESCRIPTION	DRAWING NUMBER

REVISION

DATE	REV	W/O No.	DESCRIPTION	DRAWN	CHECKED	W/O ORIG
02/11/17	C		DIMENSIONS ADDED	PM	PH	
24/10/17	B		AIR FILTER ALTERED	PM	PH	
20/10/17	A		ISSUED FOR REVIEW FOR FEED	PM	PH	

aurecon
www.aurecongroup.com
CONTRACTOR DRG. No.

HALLETT PTY LTD

EnergyAustralia

DRAWN: PMcFarlane
DATE: 20/10/17
SCALE:
CHECKED: PHill
W/O No. 4500033427
APPROVED FOR EnergyAustralia USE

DRG. No. GTBCOM-LAYOUT-M-003
REV C

DRAWING TITLE
HALLETT 203 MW POWER STATION
PROPOSED GT 1-3 GAS TURBINE
ELEVATIONS

X,Y = 0,0
821 x 574 mm
A1

C

Air Quality Assessment

Hallett Power Station

Air Quality Assessment

Energy Australia

Reference: 500618

Revision: 1

14 November 2017

aurecon

Bringing ideas to life

Document control record

Document prepared by:

Aurecon Australasia Pty Ltd
ABN 54 005 139 873
Level 10, 55 Grenfell Street
Adelaide SA 5000
Australia

T +61 8 8237 9777
F +61 8 8237 9778
E adelaide@aurecongroup.com
W aurecongroup.com

Document control						aurecon
Report title		Air Quality Assessment				
Document ID			**Project number**		500618	
File path		N:\Data\General Staff\Disciplines\Noise and Vibration\Projects\Hallett Power Station\docs out\171114 Hallett AQ - DA submission r1.docx				
Client		Energy Australia				
Client contact			**Client reference**			
Rev	**Date**	**Revision details/status**	**Author**	**Reviewer**	**Verifier** (if required)	**Approver**
0	27 October 2017	First draft	K. Tanner	N.Mackenzie	B.Dawson	
1	14 November 2017	Updated after client review	K. Tanner	N.Mackenzie	B.Dawson	
Current revision		**1**				

Approval			
Author signature		Approver signature	
Name		Name	
Title		Title	

Contents

Appendices

Figures

Tables

1 Introduction

Aurecon was engaged by Energy Australia to conduct this air quality assessment as part of the development application for the Hallett power station, located in Hallett, South Australia. The location of the site is shown in Figure 1-1, along with other locations relevant to this assessment including the Clare Bureau of Meteorology Station, a number of rural towns, and assessment domain. Energy Australia seeks to introduce an additional gas turbine (GT) to the station. Whilst originally approved for fourteen GTs, there are currently twelve dual fuelled GTs operating at the station, primarily using natural gas with diesel as a secondary option in case of events such as gas shortages or increase in gas price.

The Hallett station operates to capture peak demand, and does not operate 24 hours a day, 7 days a week. According to Energy Australia (2017) more typical hours of operation are (roughly):

- 12 GTs operating at 100% load for 10 hours a day, 3 days a week for 6 weeks of the year during summer; and,
- 5 GTs operating at 50% load for 4 hours a day, 4 days a week for 16 weeks of the year during winter.

Despite the above, during operation at maximum capacity, installation of an additional GT will increase the amount of fossil fuel being combusted at any one time which has the potential to cause air quality impacts on nearby sensitive receivers requiring assessment of impacts.

The plant layout is shown in Figure 1-2 and Figure 1-3. The location of the proposed additional GT is GT1-3. It is intended that this GT will be an aero derivative gas turbine with water injection, which will result in reduced emission of oxides of nitrogen compared to the other turbines operating on site.

Figure 1-1: Aerial image showing location of Hallett power station, other relevant locations for this assessment, and modelling domain.

Figure 1-2: Aerial image of Hallett power station with gas turbines labelled, including that proposed which is GT1-3 (source: LocationSA MapViewer).

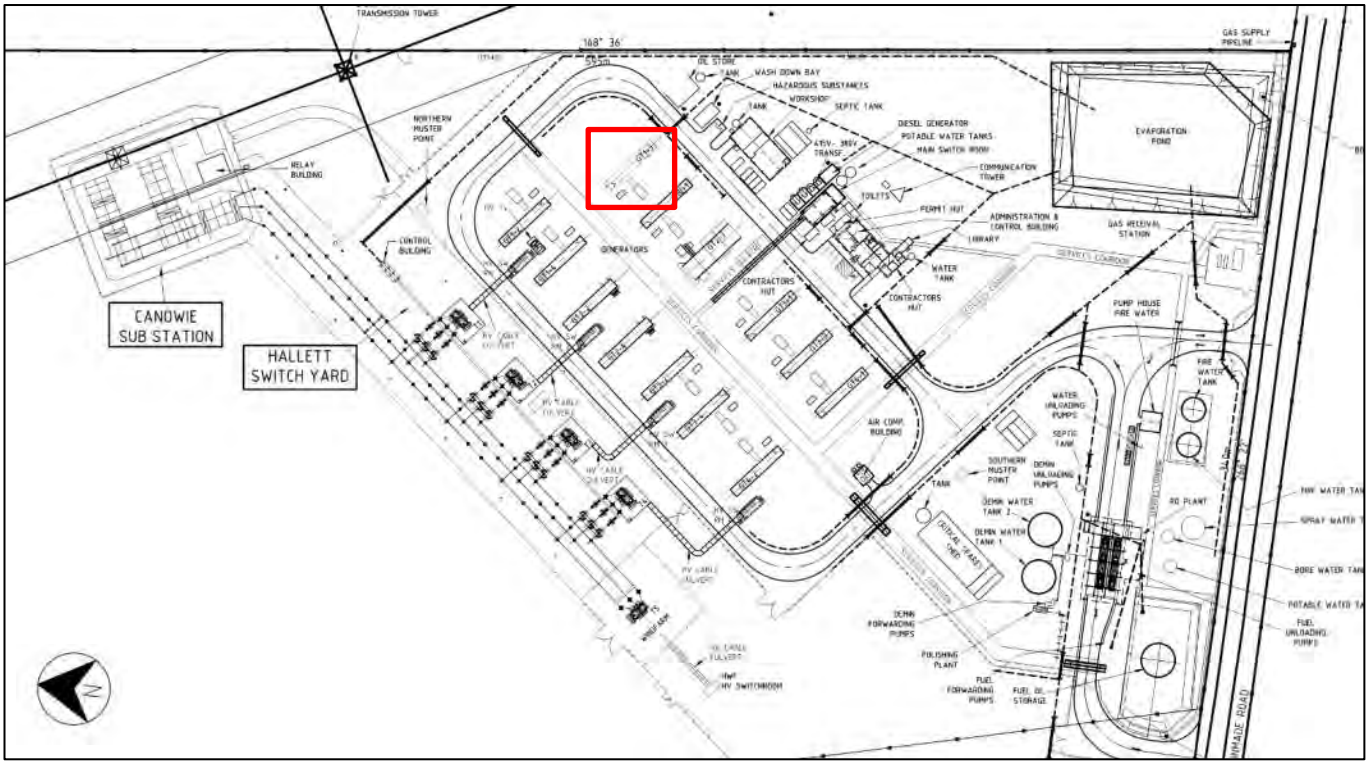


Figure 1-3: Site layout including the proposed GT 1-3 (Energy Australia, 2012).

1.1 Scope

To assess the air quality impact of operating the proposed GT, methodology was discussed and agreed upon in a preliminary meeting with the South Australian Environment Protection Authority (SA EPA) on 25 September 2017. The following scope was agreed upon from this meeting:

- Emissions for diesel-fuelled operation (not natural gas, as diesel operation is most conservative – refer to Appendix A for comparison) to be assessed
- CALPUFF to be used for dispersion modelling due to the complex terrain in the vicinity
- The Air Pollution Model (TAPM) to be used to generate site specific meteorology, using a reference year of 2009
- NOx to NO_2 conversion to be completed using the Ozone Limiting Method (OLM) using concentrations from SA EPA monitoring sites
- A constant emission rate is to be applied for each generator representing all generators operating at maximum load for every hour of every day
- Scenario 1 is to be run to establish current impacts due to operation of the twelve current GTs
- Scenario 2 is to be run to determine the impact of adding an additional GT, making a total of 13 operating GTs
- Background concentrations for fine particulates to be determined from SA EPA monitoring stations
- Assessment of predicted air quality impacts against relevant air quality criteria at sensitive receiver locations only

Assessment of exposure to occupational health and safety limits within the Hallett power station site is not within this scope of works.

2 Legislation

In South Australia the Environment Protection (Air Quality) Policy 2016 (Air Quality EPP) Schedule 2 provides assessment criteria in terms of ground level concentrations applicable to pollutant emissions from the Hallett power station. These criteria ensure that adverse environmental impacts will not compromise amenity at nearby sensitive land uses.

Schedule 4 of the Air Quality EPP provides maximum stack concentrations for pollutants which should also not be exceeded.

The most significant air pollutants emitted from combustion of diesel fuel by gas turbines are oxides of nitrogen (NO_x) as nitrogen dioxide (NO_2), fine particulate matter with aerodynamic diameter less than or equal to 10 µm, and 2.5 µm (PM_{10} and $PM_{2.5}$, respectively) carbon monoxide (CO) and sulphur dioxide (SO_2). Maximum stack and ground level concentrations are provided in Table 2-1. All air quality impacts predicted from air dispersion modelling, at sensitive receiver locations, were assessed against the maximum GLC criteria.

Table 2-1: Summary of relevant pollutant criteria obtained from the SA Air Quality EPP (2016).

Pollutant	Maximum stack concentration (mg/m^3)	GLC Averaging period	Maximum GLC (mg/m^3)	Maximum GLC (µg/m^3)
NO_2	150[1]	1 hour	0.25	250
		12 months	0.06	60
PM_{10}	1,000[2]	24 hour	0.05	50
$PM_{2.5}$	1,000[2]	24 hour	0.025	25
		12 months	0.008	8
CO	1,000[3]	1 hour	31.24	31,240
		8 hours	11.25	11,250
SO_2	n/a[4]	1 hour	0.57	570
		24 hour	0.23	230
		12 months	0.06	60

[1] Limit is for total oxides of nitrogen, referenced to 15% by volume of oxygen, for liquid or solid fuels, for gas turbines which generate 10 MW of power or greater.
[2] Limit applies for any activity other than heating metals or metal ores.
[3] Limit applies to any activity.
[4] No relevant limit applies.

3 Local Environment

3.1 Sensitive Receivers

Hallett power station is quite isolated, with few sensitive land uses located in the vicinity. The nearest sensitive receptor is located approximately 1.6 km north east of the station as shown in Figure 3-1. Pollutant concentrations were predicted at this sensitive receiver for assessment against criteria in Table 2-1 to determine air quality impacts of the proposed development.

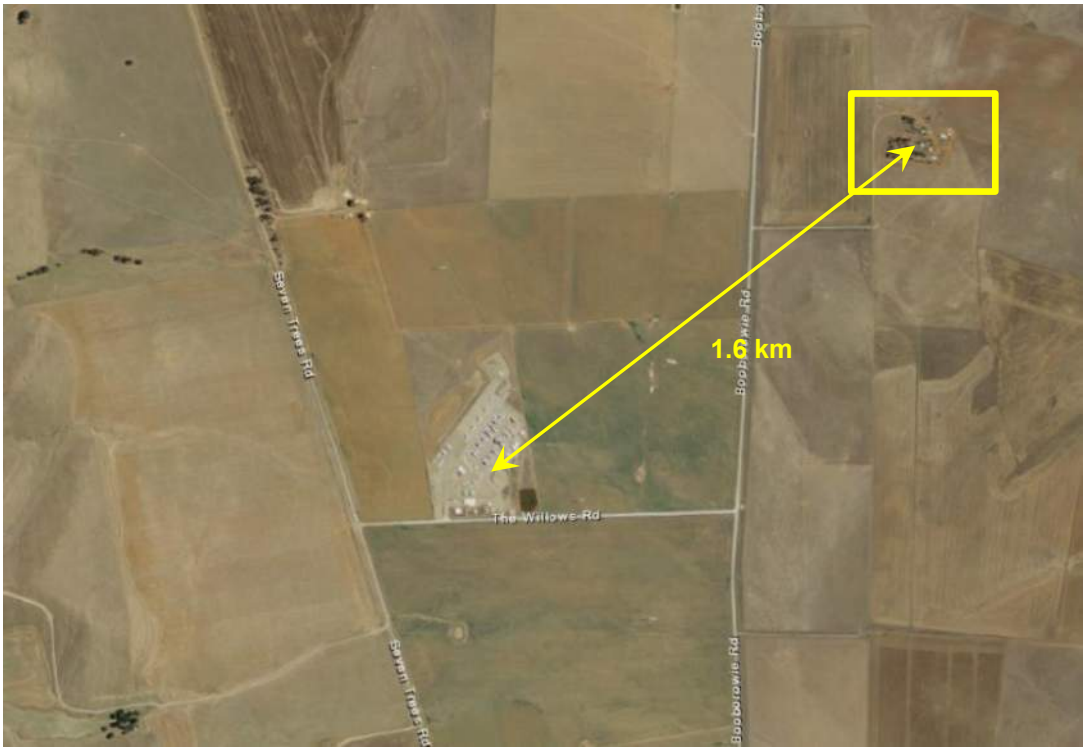


Figure 3-1: Aerial image showing location of nearest sensitive receiver relative to Hallett power station (source: LocationSA MapViewer).

3.2 Meteorology

Local meteorology has a significant influence on air quality impacts of an emission source. Wind speed and wind direction are two readily measured parameters which affect pollutant dispersion. Local observations for these parameters are often investigated to understand likely pollutant dispersion patterns, and to cross-check inputs for the dispersion model.

Observations of wind speed and wind direction have been recorded intermittently onsite since 2003 to present. As mentioned in Section 1.1, the reference year for this assessment was selected as 2009 as advised by SA EPA. SA EPA considers this year as typically representative of long term meteorology. However, no onsite meteorological monitoring data at Hallett power station was available for this year. Additionally, site observations of wind speed and wind direction are not considered sufficiently extensive to establish long-term site conditions. Limitations of the data set are summarised in Table 3-1.

The nearest Bureau of Meteorology (BoM) site is located at Clare, located approximately 60 km south of the site. Although observations at Clare provide the best indication of long term trends in the vicinity, mountainous terrain surrounding Hallett power station is expected to produce different wind conditions on site. Nonetheless, use of the advanced dispersion model CALPUFF is considered to appropriately refine meteorological conditions to account for the local topography. This is further discussed in Section 5.

An annual wind rose obtained from model-generated data for Hallett for the reference year of 2009 is presented in Figure 3-2. It is evident that southerly and north easterly winds are most frequent, with strong easterly winds.

Table 3-1: Summary of limitations to recorded Hallett power station wind observations.

Year	Approximate annual data capture rate
2003	58%
2004	67%
2005, 2006	0%
2007	59%
2008	79%
2009, 2010, 2011	0%
2012	36%
2013	26%
2014	67%
2015	84%
2016	92%

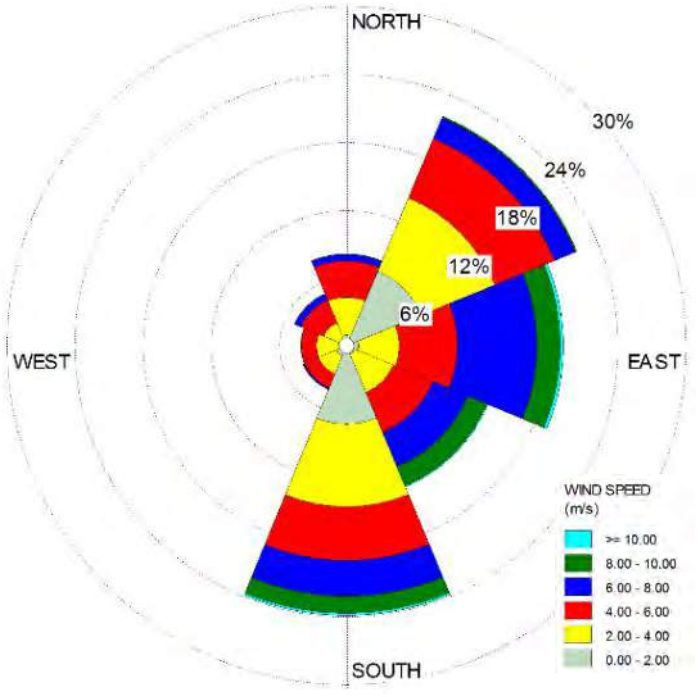


Figure 3-2: Annual wind rose for Hallett from CALMET generated data, discussed in Section 5.

3.3 Ambient Air Quality

The SA EPA operates a network of long-term air quality monitoring stations across the state. The nearest station is located approximately 72 km east of the power station at Port Pirie. However, observations are affected by significant emissions from the lead smelter in Port Pirie. Similarly, air quality is also monitored in Whyalla (located approximately 115 km east of Hallett power station) but observations there are affected by steelworks.

Given the rural environment surrounds of Hallett ambient concentrations of fine particles are not expected to be negligible. Activities such as wind erosion of exposed soil, controlled burns and bushfires are expected to contribute to ambient concentrations. The SA EPA had previously suggested levels on the order of 17 µg/m^3 and 7 µg/m^3 would be expected for 24-hour average PM_{10} and $PM_{2.5}$ background concentrations, respectively. Background levels of PM_{10} and $PM_{2.5}$ were further investigated to select representative levels.

As there are no other major sources of CO or SO_2 in the vicinity of Hallett power station, background levels were assumed to be negligible for these pollutants. Background levels of NO_2 and ozone (O_3) were further investigated for conversion of NO_x to NO_2 using the OLM.

3.3.1 Background PM_{10}

In accordance with the meteorological reference year of 2009, percentiles of PM_{10} 24 hour concentrations for 2009 at the Port Pirie and Whyalla monitoring stations were obtained from the *Air Monitoring Report for South Australia 2014: Compliance with the National Environment Protection (Ambient Air Quality) Measure* (refer to Table 3-2). It should be noted that there is no long term monitoring data available for $PM_{2.5}$ at Spencer Gulf locations. From the concentrations tabulated in Table 3-2, whereby 98th percentile concentrations exceed the criterion of 50 µg/m^3, it is apparent that industrial operations largely influence observed concentrations at the Spencer Gulf sites. Similarly, observations at other urban long-term monitoring sites are also considered to be affected by significant sources including road traffic and wood heaters. In comparison, maximum concentrations recorded in the rural town of Gawler were significantly lower (SA EPA, 2006).

As 2009 PM_{10} data for Port Pirie and Whyalla is clearly not representative of background levels for the non-industrialised area of Hallett, the 90th percentile level at Gawler was adopted for the 24-hour averaging period. The 50th percentile concentration for Gawler was considered representative of the annual averaging period concentration for PM_{10}. To summarise, the following were determined from this analysis:

- PM_{10} 24 hour average concentration is 24.4 µg/m^3
- PM10 annual average concentration is 13.5 µg/m^3, but included only for estimate of $PM_{2.5}$ concentration

Table 3-2: Spencer Gulf monitoring data, PM10 24 hour averaging period concentrations.

Percentile concentration	AAQ NEPM Reported Concentration, µg/m^3		
	Port Pirie, Oliver Street	Whyalla, Schulz Park	Gawler (2003)
50th	14.6	16.3	**13.5**
75th	24.3	26	
90th	34.8	35.2	**24.4**
95th	46	41.8	
98th	57.2	52.7	44.7
99th	97.4	70.9	51.7
Max	183	283.8	51.9

3.3.2 Background $PM_{2.5}$

As mentioned in Section 3.3.1 there is no long term monitoring of $PM_{2.5}$ in the Spencer Gulf region. However, there was limited data available for the Port Augusta station which has monitored both $PM_{2.5}$ and PM_{10}. Hourly $PM_{2.5}$ and PM_{10} validated concentrations from the Port Augusta station for the period March 2017 through July 2017 were analysed to determine an appropriated ambient $PM_{2.5}/PM_{10}$ ratio, and therefore determine $PM_{2.5}$ background concentration (data obtained from Data SA). The following were determined from this analysis:

- The average $PM_{2.5}/PM_{10}$ ratio was 0.47
- The resulting $PM_{2.5}$ 24 hour averaging period concentration is 11.5 µg/m^3
- The resulting $PM_{2.5}$ annual averaging period concentration is 6.3 µg/m^3

3.3.3 Background NO_2 and O_3

Similar to the assessment of PM_{10} background data, Gawler observations of NO_2 and O_3 were considered most representative for the rural, isolated site of Hallett power station, and are provided in Table 3-3. The 90th percentile one-hour average concentrations were adopted for assessment of the one-hour averaging period, and the average concentration of the period adopted for assessment of the annual averaging period, giving the following background levels:

- One hour averaging period NO_2 concentration of 16.7 µg/m^3
- Annual averaging period NO_2 concentration of 6.3 µg/m^3
- One hour averaging period O_3 concentration of 63 µg/m^3
- Annual averaging period O_3 concentration of 44.1 µg/m^3

Table 3-3: Summary of observed concentrations at the Gawler monitoring station (SA EPA, 2006).

Pollutant	Average		Maximum		99th percentile		95th percentile		90th percentile	
	ppm	µg/m^3	ppm	µg/m^3	ppm	µg/m^3	ppm	µg/m^3	ppm	µg/m^3
NO_2	0.003	6.3	0.036	75	0.018	37.5	0.011	22.9	0.008	16.7
O_3	0.021	44.1	0.078	163.8	0.043	90.3	0.033	69.3	0.030	63

3.3.4 Summary of Background Levels

To summarise, observations at SA EPA monitoring stations were investigated to determined appropriate background levels for PM_{10}, $PM_{2.5}$, NO_2 and O_3. Background concentrations of CO and SO_2 are considered negligible in the vicinity of Hallett. Background concentrations adopted in this assessment are summarised below:

Table 3-4: Summary of background concentrations adopted in this assessment.

Pollutant	Averaging Period	Concentration (µg/m^3)
PM_{10}	24 hour	24.4
$PM_{2.5}$	24 hour	11.5
	annual	6.3
NO_2	one hour	16.7
	annual	6.3
O_3	one hour	63
	annual	44.1

4 Emissions Inventory

This Section describes the emission data used as input into the dispersion model to assess the impact of the proposed additional GT.

4.1 Scenario 1: Current Operations

As mentioned in Section 1, there are currently 12 gas turbine units operating at the Hallett power station. In 2007 there were eleven units operating on site, and compliance emission testing was conducted on 8 of 11 units in accordance with SA EPA License 15898. Sampling and analysis was completed by NATA accredited laboratories and SA EPA methods were used, in accordance with *Volume 1: Air Quality: 'Emission testing methodology for air pollution*' (1995). Data from these measurements, with the GTs operating as diesel fuelled, were used to determine emission rates for current GTs. The emission sampling report is included in Appendix A, and is accompanied with relevant emissions calculations.

For those GTs which did not have 2007 test data available, the maximum emission rate for each pollutant from the other GTs was adopted. A summary of measured emission data is provided in Table 4-1, as well as the emission rates used in the dispersion model. Although $PM_{2.5}$ is a fraction of PM_{10}, without provision of any detailed information on this fraction for the GTs modelled, it was conservatively assumed that 100% of PM_{10} is $PM_{2.5}$.

Table 4-1: Summary of measured stack emission parameters and calculated emission rates for currently operating GTs.

GT parameters	GT1-2	GT2-1	GT3-1	GT3-2	GT3-3	GT3-4	GT4-1	GT 4-2
Equivalent diameter (m)	3.01	2.91	3.24	3.53	3.53	3.53	3.51	3.51
Stack height (m)	12.5	10.5	12.5	12.5	12.5	12.5	12.5	12.5
Exit velocity (m/s)	33	34	30	26	24	24	24	23
Exit temperature (K)	748	751	743	753	759	763	725	736
In-stack concentrations, dry STP								
PM_{10} (mg/Nm^3)	11	14	22	12	14	11	19	15
NO_x (as NO_2, ref. 15% O_2) (mg/Nm^3)	150	160	170	150	190	190	170	150
CO (mg/Nm^3)	110	34	14	42	26	22	42	44
SO_2 (mg/Nm^3)	<2	<2	<2	<2	<2	<2	<2	<2
Calculated emission rates (refer to Appendix A for calculations)								
PM_{10} (g/s)	0.71	0.82	1.45	0.84	0.81	0.62	1.15	0.90
$PM_{2.5}$ (g/s)	0.71	0.82	1.45	0.84	0.81	0.62	1.15	0.90
NO_x (g/s)	9.65	9.39	11.20	10.47	11.00	10.79	10.33	9.02
CO (g/s)	7.07	2.00	0.92	2.93	1.51	1.25	2.55	2.65
SO_2 (g/s)	0.13	0.12	0.13	0.14	0.12	0.11	0.12	0.12

4.2 Scenario 2: Future Operations

For this development application installation and operation of an additional GT is proposed. As advised by Energy Australia, this GT is likely to be an aero derivative provided by the manufacturer GE. Emissions data was provided by the manufacturer and Energy Australia (email correspondence dated 4th October 2017), and is summarised in Table 4-2. The below emissions were modelled in addition to those modelled for scenario one. It should be noted that the in-stack concentrations detailed below comply with limits specified in Table 2-1.

Table 4-2: Summary of emissions data for the proposed measured stack emission parameters and calculated emission rates for currently operating GTs.

GT parameter	Value for proposed GT
Stack height (m)	20
Exhaust velocity (m/s)	54
Equivalent diameter (m)	2.74
Exhaust temperature (K)	793
In-stack concentrations	
NOx (ppm)	25
CO (ppm)	260
Calculated emission rates (refer to Appendix A for calculations)	
PM_{10} (g/s)	0.44
$PM_{2.5}$ (g/s)	0.44
NO_x (g/s)	5.63
CO (g/s)	35.6
SO_2 (g/s)	0.14

5 Modelling Methodology

As mentioned in Section 1.1 this air quality assessment was completed using the air dispersion model CALPUFF. CALPUFF consists of three main components: CALMET (the diagnostic, 3-dimensional meteorological model), CALPUFF (the air quality dispersion model), and CALPOST (the post-processing package). Geophysical data including land use and terrain elevations are also processed and introduced into the wind field.

CALPUFF is a multi-layer, multi-species non-steady-state puff dispersion model which simulates the effect of time and space-varying meteorological conditions in pollutant transport. It is suitable for odour modelling for the following reasons:

- allows variable/curved trajectories
- meteorological conditions are variable and not assumed steady-state
- allows calm and low wind speed conditions

5.1 Model Inputs

A range of parameters influence pollutant dispersion, particularly terrain and meteorology (most importantly wind speed and wind direction and mixing height). The following parameters were used for the dispersion modelling of Hallett power station:

- The Air Pollution Model (TAPM)-produced 3-dimensional prognostic meteorological data for a 25 km x 25 km grid with 1 km grid spacing, over which wind and temperature fields are created for a reference year of 2009 and for hourly observations. Grid centre co-ordinates were 33°21.0' latitude S, 138°45.0' longitude E. TAPM v4 was used (refer to Figure 1-1 and Figure 5-4).
- A geophysical dataset including terrain and land use data to simulate the effects of the land surface on plume dispersion. The SRTM (Shuttle Radar Topography Mission) terrain data has a resolution of approximately 30 m. A land use data file was generated to reflect data found on LocationSA MapViewer and included in the model.
- CALMET-refined hourly 3-dimensional meteorological data, based on the TAPM grid, for a 18 km x 18 km grid with 200 m spacing. CALMET v6.5.0, CALPUFF v7.2.1 and CALPOST v7.1.0 was used.
- Emission source details such as location and emission rates. Emission rates are those defined in Section 4, and locations are shown in Figure 1-2. All sources were modelled as point sources.
- Nested grid receptors (refer to Figure 5-4, concentrations are predicted at receptor locations)
  - 1 km x 1 km grid of 100 m spacing
  - 2 km x 2 km grid of 200 m spacing
  - 7.5 km x 7.5 km grid of 500 m spacing
    - This receptor grid spacing is considered appropriate considering there are few sensitive receivers located near the station
    - For each simulation the nested grid was centred on the emission source
- Discrete receptors at identified potential sensitive receiver locations

A sensitivity analysis was completed from which it was determined that building downwash effects were negligible at the nearest sensitive receiver. Thus, building downwash effects were not included in this assessment.

The model domain is presented in Figure 5-4, illustrating CALMET terrain contours, nested and discrete receptors locations, and source locations.

5.1.1 Meteorology Comparisons

Figure 5-1 provides a comparison of 9am and 3pm wind roses for observations from the Clare BoM station and the CALMET-generated data at the Hallett power station and the southern extent of the domain, to demonstrate spatial variation of meteorology within the CALMET domain. From comparison of wind roses it is evident that the 9am wind roses are generally consistent, showing strong easterly winds. However, the CALMET data does not pick up the northerly winds experienced at Clare BoM station. This is likely due to the differences in topography between regions. Comparing 3pm wind roses, frequency of northerly and southerly winds are similar between all sites. However, where the Clare site experiences strong westerly winds at 3pm the other sites demonstrate strong easterly winds. This is once again likely due to the differences in topography between assessment locations.

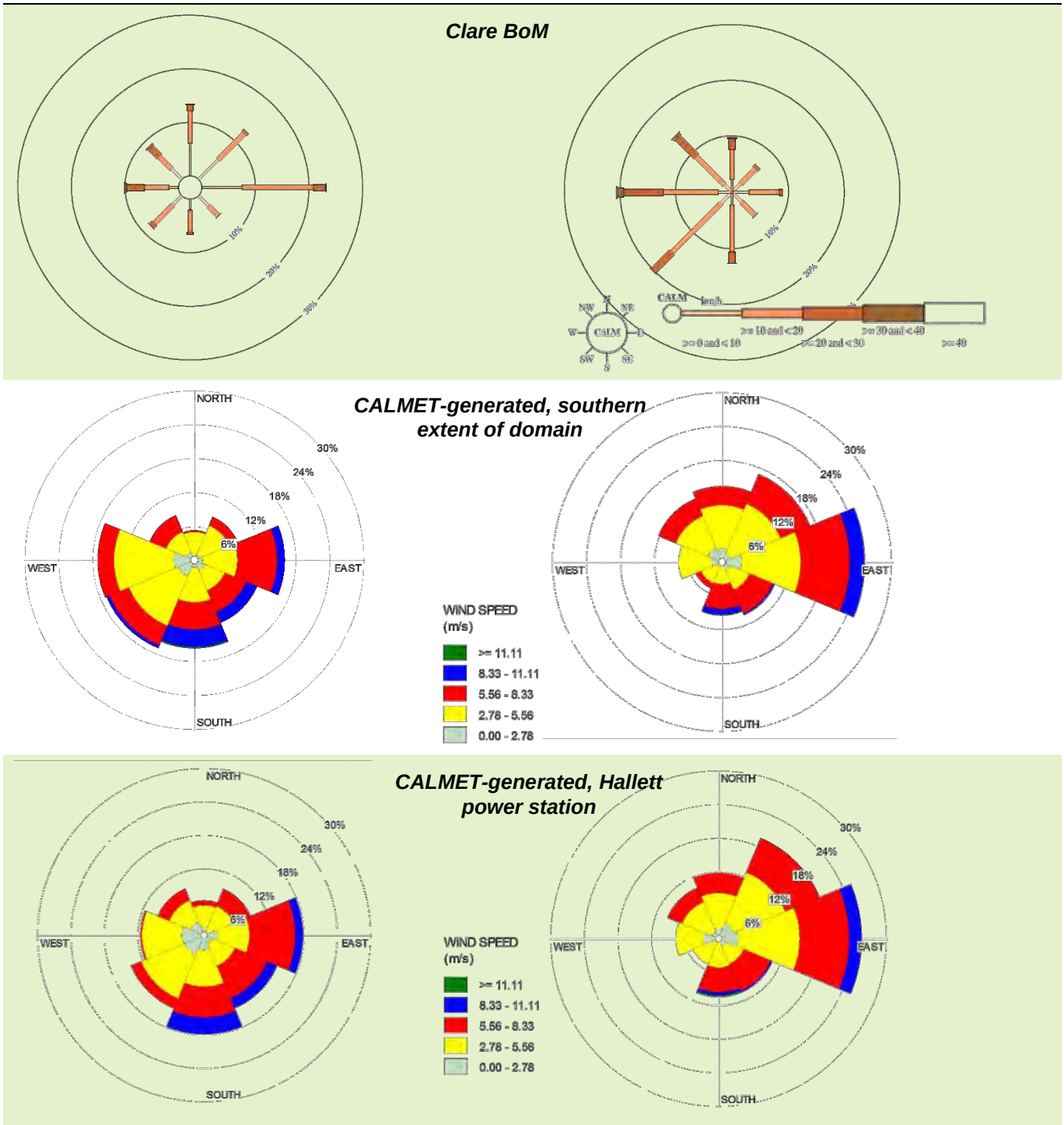


Figure 5-1: Comparison of 9am and 3pm wind roses for Clare BoM data (top, 1994 through 2017) and CALMET generated data at the Hallett site (middle) and at the southern extent of the domain (bottom) for the 2009 reference year.

An additional comparison of model-generated and observed wind speed and wind direction data is provided in Figure 5-3. Whilst the Clare data presented in Figure 5-1 demonstrates long-term trends for specific times of day, the Clare data presented in Figure 5-3 is for one year only, and demonstrates annual trends.

For model meteorology cross-checking purposes it is most appropriate to compare the wind roses of Clare 1997 and 2009, to that extracted from the southern extent of the CALMET domain. The CALMET wind rose appears to reflect the frequent easterly, southern and south westerly winds of the 1997 Clare data, producing a comparable wind rose. Frequent easterly and southerly winds are also common with the 2009 Clare BoM data, however the southerly and westerly winds appear more frequent from observation. One key difference between the Clare BoM wind roses and that extracted from CALMET is that at Clare the strongest winds are from the west, whereas the strongest winds from the CALMET wind rose are from the east. This is consistent with the comparison of the 3pm wind rose shown in Figure 5-1 for which the CALMET wind rose demonstrated strong westerly winds, and which could be attributed to local wind fields due to the local topography – Hallett power station is located to the east of a mountainous region and is therefore shielded from sea breezes from the west (refer to Figure 5-2). Considering the inclusion of local fine-scale topography (refer Figure 5-4) and 3-D spatial meteorology in the model, we consider the CALMET meteorology is adequate.

It is important to recognise that whilst Clare data provides a good comparison, meteorology differences are expected. CALMET generates a spatially-varying meteorology grid which is influenced by a variety of a factors, which is mainly terrain features in this domain (few land use changes across the domain, and no coastal considerations). Although the Clare BoM site was not situated within the computational domain, if it were, it would not have the same wind rose as Hallett power station, or even a location 10 km from the site. This is evident when comparing the two CALMET-generated wind roses presented in Figure 5-3 for example: north easterly winds and southerly winds at the Hallett site appear much more frequent, and westerly wind less frequent than at the southern extent of the CALMET domain.

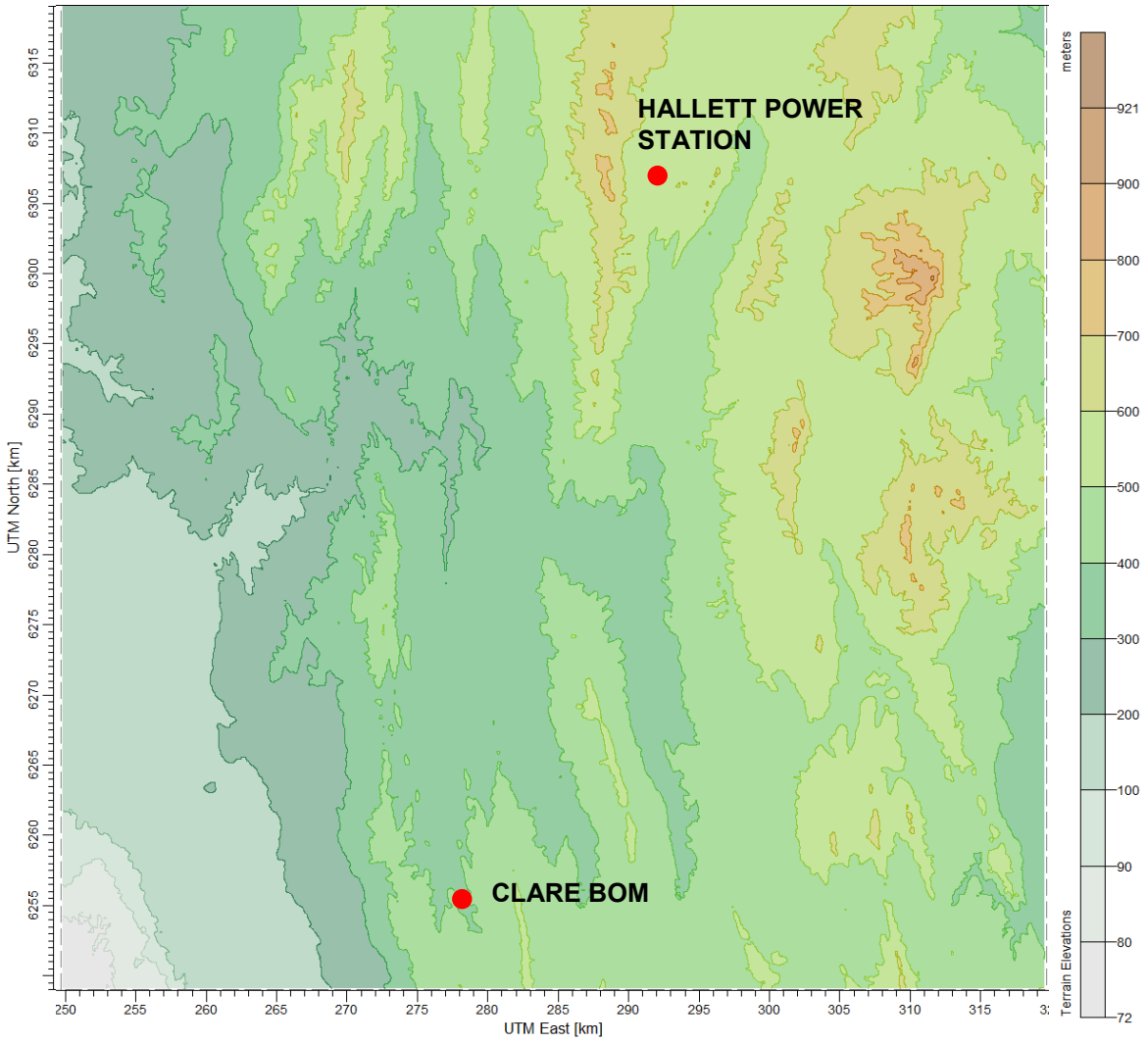


Figure 5-2: Aerial image showing changes in terrain elevations between Hallett power station and Clare.

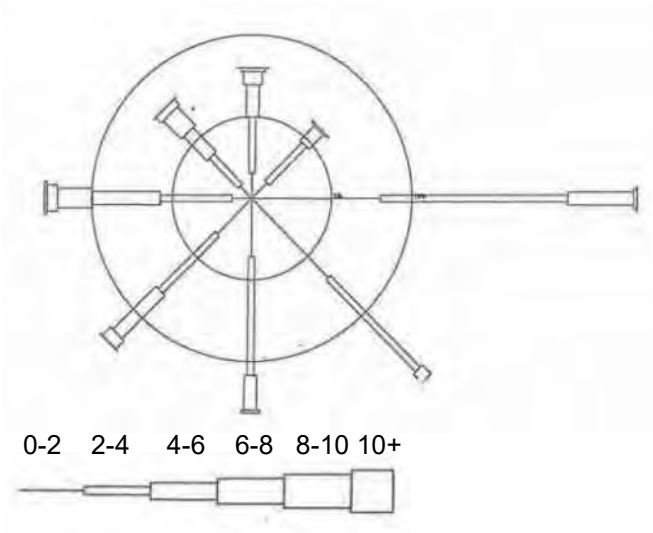
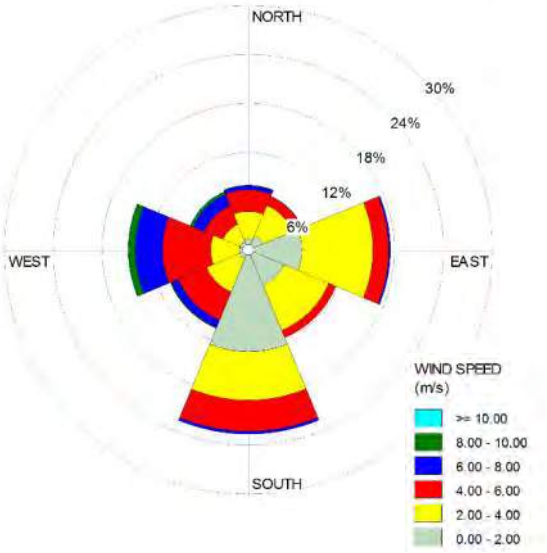
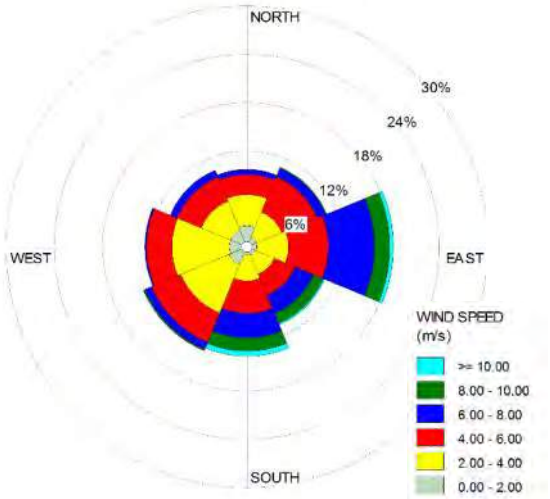
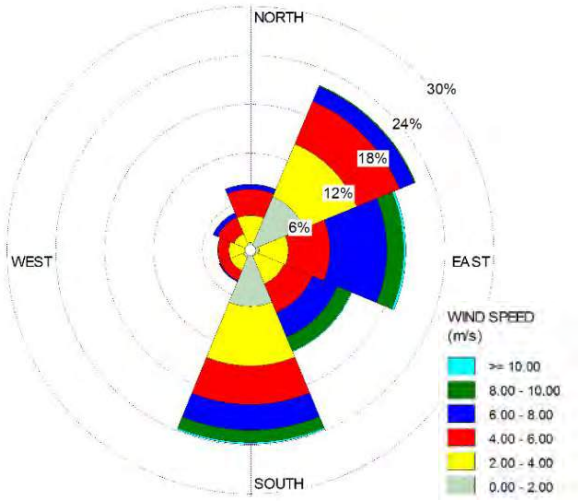
Clare, 1997 annual wind rose (URS, 2001)	*Clare, 2009 (BoM annual hourly observations)*
	
CALMET-generated 2009, southern extent of domain (approx. 45 km north east of Clare BoM)	***CALMET-generated 2009, Hallett power station (approx. 60 km north east of Clare BoM)***
	

Figure 5-3: Comparison of annual wind roses for CALMET-generated data and Clare observations.

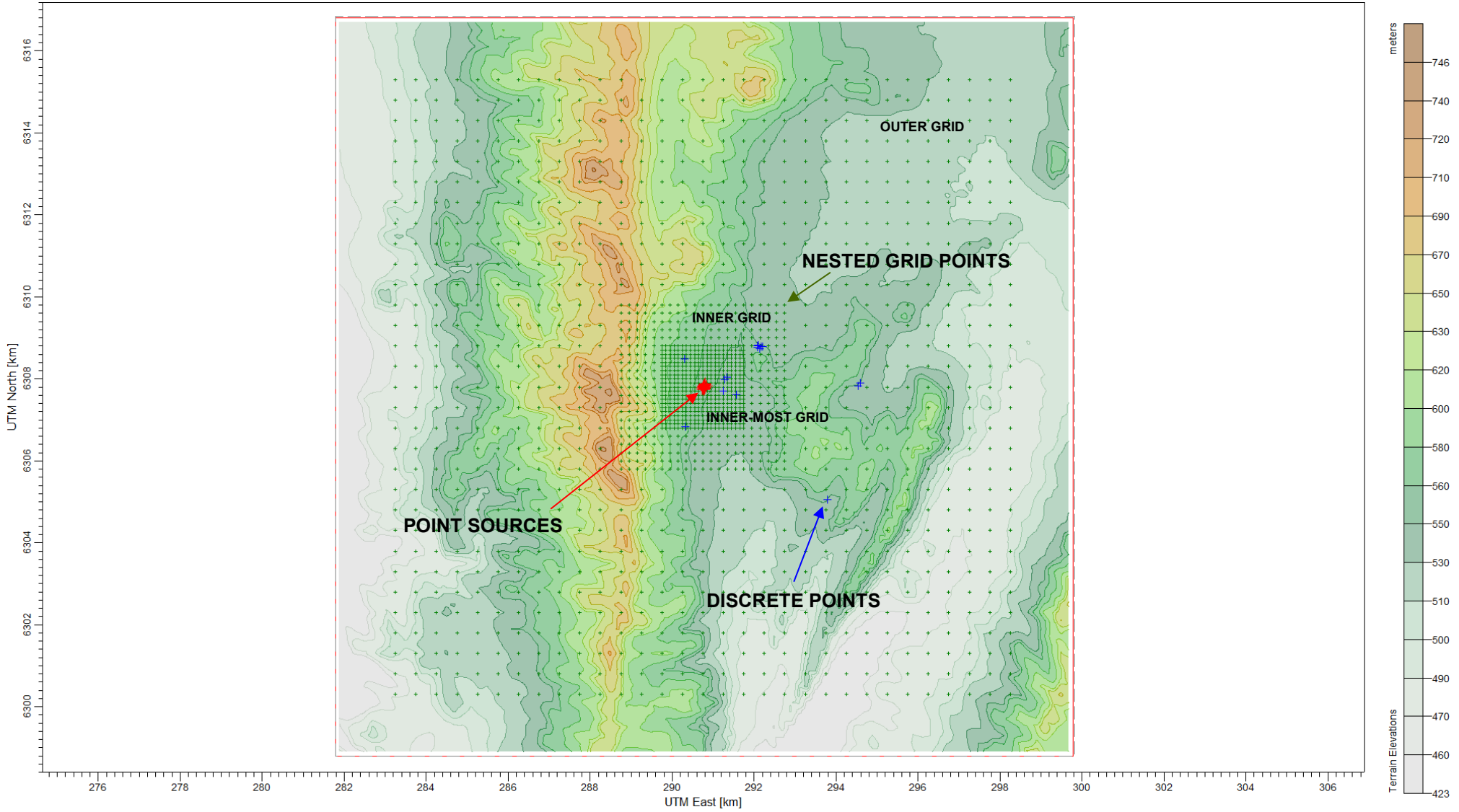


Figure 5-4: Image illustrating model inputs of terrain elevations, receptor locations and source locations.

6 Assessment

This Section describes the predicted air quality impact of installation and operation of the proposed additional gas turbine (GT) at Hallett power station. Impacts were assessed quantitatively at the nearest sensitive receiver (refer to Figure 3-1). Both the incremental contribution resulting from operation of the Hallett power station alone, as well as the cumulative contribution of the Hallett power station combined with the background level were assessed. Air quality impacts for existing operations with 12 GTs (Scenario 1) were compared to those predicted for future operations with the proposed additional GT (Scenario 2). Predicted impacts are summarised in Table 6-1.

Although it is evident that operation of an additional GT will increase the incremental impact on the nearest sensitive receiver, all incremental and cumulative pollutant concentrations comply with the limits specified in the SA EPP (Air Quality) for Scenario 1 and Scenario 2. As no exceedances of air quality limits were predicted for Scenario 2, the proposed development is not expected to cause any adverse air quality impacts.

Concentration contours for each pollutant and averaging period are also provided in Appendix B.

Table 6-1: Summary of assessment for existing and proposed operations at Hallett power station.

Predicted concentrations for existing operations (Scenario 1)

Pollutant	Averaging period	Incremental ($\mu g/m^3$)	Background ($\mu g/m^3$)	Cumulative ($\mu g/m^3$)	Limit ($\mu g/m^3$)	Cumulative as % of limit	Incremental contribution to limit (%)
PM_{10}	24 hour	1.6	24.4	26.0	50	51.9%	3.1%
$PM_{2.5}$	24 hour	1.6	11.5	13.1	25	52.2%	6.2%
	annual	0.07	6.3	6.4	8	79.6%	0.9%
CO	1 hour	39.2	n/a[1]	39.2	31,240	0.1%	0.1%
	8 hour	12.0	n/a	12.0	11,250	0.1%	0.1%
SO_2	1 hour	1.2	n/a	1.2	570	0.2%	0.2%
	24 hour	0.19	n/a	0.19	230	0.1%	0.1%
	annual	0.01	n/a	0.01	60	0.0%	0.0%
NO_2	1 hour	70.3	16.7	87.0	250	34.8%	28.1%
	annual	0.64	6.3	6.9	60	11.6%	1.1%

Predicted concentrations for proposed operations (Scenario 2)

Pollutant	Averaging period	Incremental ($\mu g/m^3$)	Background ($\mu g/m^3$)	Cumulative ($\mu g/m^3$)	Limit ($\mu g/m^3$)	Cumulative as % of limit	Incremental contribution to limit (%)	Increment of scenario
PM_{10}	24 hour	1.8	24.4	26.2	50	52.5%	3.7%	0.6%
$PM_{2.5}$	24 hour	1.8	11.5	13.3	25	53.3%	7.3%	1.1%
	annual	0.09	6.3	6.4	8	79.9%	1.1%	0.2%
CO	1 hour	391	n/a	391	31,240	1.3%	1.3%	1.2%
	8 hour	122	n/a	121	11,250	1.1%	1.1%	1.0%
SO_2	1 hour	1.7	n/a	1.7	570	0.3%	0.3%	0.1%
	24 hour	0.27	n/a	0.27	230	0.1%	0.1%	0.0%
	annual	0.02	n/a	0.02	60	0.0%	0.0%	0.0%
NO_2	1 hour	70.5	16.7	87.2	250	34.9%	28.2%	0.1%
	annual	0.93	6.3	7.2	60	12.1%	1.6%	0.5%

[1] n/a – Background concentrations of these pollutants are considered negligible. Refer to Section 3.3.

7 Summary

Aurecon was engaged by Energy Australia to conduct an air quality assessment of the proposed development at the existing Hallett power station, located in Hallett, South Australia, as part of their development application. There are currently twelve gas turbines (GTs) operating intermittently on site as required to capture times of peak demand. This development application proposes installation and operation of an additional GT. As this proposed development has the potential to create adverse air quality impacts on nearby sensitive receivers, an air quality assessment was identified as a requirement by the South Australian Environment Protection Authority (SA EPA).

Following an initial meeting to agree on scope and methodology for this assessment, Aurecon completed this assessment using the air dispersion model CALPUFF (and its components CALMET and CALPOST), with initial meteorology generated using the prognostic model TAPM. Emissions testing data of the existing GTs and manufacturer's data for the proposed GT were used to determine emission inputs for the dispersion model. Incremental (GT contribution) and cumulative (GT and background) concentrations were predicted at the nearest sensitive receiver and assessed against limits. Although marginal increases (less than 1.2%) in concentration were observed with operation of an additional GT, no exceedances of air quality limits were identified. As such, the proposed development is not considered to cause adverse air quality impacts.

8 References

DataSA, '*Port Augusta (Particle) – 2017 onwards'*, [online], accessed 25th October 2017, available: **https://data.sa.gov.au/data/dataset/port-augusta-air-quality-monitoring-station-particle-data/resource/d95d518c-5006-4ef8-a5c8-2677669f631f**

Energy Australia (2016), '*Hallett 203 MW Power Station Site Layout*', revision C, drawing date 17/07/16.

Energy Australia (2017), '*Subject Hallett Power Station – New Turbine – Further Information Request'*, Typical operations indicative information provided via email by Jonathon Cotton of Energy Australia data Thursday 5 October, 11.18am.

GE Power (2017), '*Subject RE: Hallett Power Station – New Turbine – Further Information Request'*, Emissions data for proposed new gas turbine provided via email by Mark Benjamin dated Wednesday 4 October 2017, 5.20pm.

SA EPA (2006), '*Ambient air quality in Gawler, South Australia monitoring campaign: 2002 – 2004'*

SA EPA (2015), '*Air quality report for South Australia 2014: Compliance with the National Environment Protection (Ambient Air Quality) Measure'*

SA EPA (2016), '*Environment Protection (Air Quality) Policy 2016*', Version: 1.9.2016.

URS (2001), '*Revised development application for a peak load power plant in Hallett, SA*'.

A

Emissions data

Appendix A
Emissions data

Appendix A includes emissions testing report, information on the new gas turbine and emissions calculations.

EPA License 15898 Emission Testing
Hallett power station

Report 07- 1006

Prepared for: TRUenergy Hallett Pty Ltd
PO Box 200
Jamestown SA 5491

By: Enviroscan Industrial & Marine Surveys
PO Box 75
Brighton
SA 5048

Telephone: (08) 8377 2444
Facsimile: (08) 8377 1767
Website: www.enviroscan.com.au

Compiled By: B. Severne
C. Campbell
R. Fancett

Date: 6th November 2007

Introduction

TRUenergy Hallett Pty Ltd engaged Enviroscan to carry out compliance emission testing on the AGL Hallett power station in accord with SA EPA License 15898. This power station is sited at the junction of the port Augusta 375 KV line and the Moomba gasline, about 20 km east of Jamestown and 25km north of Boobororie .

The site was visited prior to the test program, to check access to test ports, EWP and impact wrench availability.

Test-work was carried out during October 2007 and was expedited with the assistance of site personnel.
These test results apply to the plant conditions at time of testing.

Eleven gas turbine units were prepared for testing, but two were unavailable for testing (Units 1-4 and 2-4) and Unit 2-2 was not run on diesel fuel.
at the time.
The turbines are 16 MW units (2-2 and 2-4 are 23 MW) and they normally run on natural gas with diesel as an alternate back-up fuel. The units have seen previous service elsewhere, and were retrofitted with non-standard test ports (OD 230, PCD 190mm) and studs on-site. Units 1-2 and 1-4 have standard flange ports.
Studs are difficult to remove and it is proposed to replace them with stainless bolts (75x16x250)
The sampling plane is compromised by turbulent flow (with suction eddies on the inner bend) in the transition duct of the turbine exhaust which leads to the short exhaust stacks fitted with an array of laminar noise attenuators. Consequently velocity estimates by pitot are only approximate and supported by calculations using fuel rate, exhaust gas moisture, carbon dioxide and oxygen data. The laminar array of noise attenuators would also affect flow measurements in any stack extension.

Test methods

All sampling and analysis was performed by NATA accredited laboratories. SA EPA methods were used, as specified in SA EPA Volume 1: Air Quality *'Emission testing methodology for air pollution'*, 1995, including moisture(03.13), sampling positions(03.09), velocity(03.10), particulates(03.01), carbon monoxide and sulphur dioxide(03.14) and nitrogen oxides(03.06).

PM10 was determined with a Sierra Instruments Model 220 inertial cascade impactor. This device was developed for the USEPA to provide a specified size fraction down to one micron or less.

Emission Test Results

The gas turbines tested include: GT 1-2, GT 2-1, GT 2-2,
GT 3-1, GT 3-2, GT 3-3, GT 3-4, GT 4-1 and GT 4-2.
The units were started up on natural gas and tested for nitrogen oxides, carbon monoxide and sulphur dioxide.
Tests were also performed whilst running on diesel fuel for: Total particulates and PM10, nitrogen oxides, carbon monoxide and sulphur dioxide. .

EPA License 15898 emission limits include particulates (250 mg/m, dry STP), carbon monoxide 1,000 mg/m^3 dry STP. Nitrogen oxides are limited to 325 mg/m^3 dry STP ref. 15% O_2 when running on gas and to 475 mg/m^3 on diesel fuel.
Test results are listed below for each gas turbine.
No exceedances of SA EPA License limits were recorded.

Stack Identification	**GT 1 – 2**	
Location of Plant	Hallett, South Australia	
Date and Time	23 October 2007, 1150 – 1330	
Plant Conditions:	15 MW Gas 277 GJ/h, 13 MW Diesel 6.5 kL/h	
Sampling Plane	Non ideal, turbulent flow in transition duct.	
Test Procedures	SA EPA Methods: 03.01, 03.06, 03.09, 03.10, 03.13, 03.14.	
Transition duct Dimensions	3.1 m x 2.3 m	
Average Exhaust Gas Velocity	33 m/s in stack	
Average Exhaust Gas Flow-rate	74 m^3/s Dry STP	
Moisture	4.0 % v/v	
Average Exhaust Temperature	508 ^oC	Natural Gas fuel
Exhaust Gas Composition	CO_2 2.7 %, O_2 15.9 %	
Nitrogen oxides (as NO_2, ref. 15% O_2)	110 mg/m^3Dry STP	
Carbon monoxide	13 mg/m^3Dry STP	
Sulphur dioxide	<2 mg/m^3Dry STP	
Average Exhaust Temperature	475 ^oC	Diesel fuel
Exhaust Gas Composition	CO_2 3.2 %, O_2 16.3 %	
Total Particulates	11 mg/m^3 Dry STP	
PM10	11 mg/m^3 Dry STP	
Nitrogen oxides (as NO_2, ref. 15% O_2)	150 mg/m^3Dry STP	
Carbon monoxide	110 mg/m^3Dry STP	
Sulphur dioxide	<2 mg/m^3Dry STP	

Stack Identification	**GT 2 – 1**	
Date and Time	23 October 2007, 1440 – 1600	
Plant Conditions:	13 MW Gas 252 GJ/h, 12 MW Diesel 6.1 kL/h	
Sampling Plane	Non ideal, turbulent flow in transition duct.	
Test Procedures	SA EPA Methods: 03.01, 03.06, 03.09, 03.10, 03.13, 03.14.	
Transition duct Dimensions	3.1 m x 2.15 m	
Average Exhaust Gas Velocity	34 m/s in stack	
Average Exhaust Gas Flow-rate	72 m^3/s Dry STP	
Moisture	4.5 % v/v	
Average Exhaust Temperature	503 ^oC	Natural Gas fuel
Exhaust Gas Composition	CO_2 2.6 %, O_2 16.2 %	
Nitrogen oxides (as NO_2, ref. 15% O_2)	130 mg/m^3Dry STP	
Carbon monoxide	14 mg/m^3 Dry STP	
Sulphur dioxide	<2 mg/m^3 Dry STP	
Average Exhaust Temperature	478 ^oC	Diesel fuel
Exhaust Gas Composition	CO_2 3.2 %, O_2 16.5 %	
Total Particulates	14 mg/m^3 Dry STP	
PM10	14 mg/m^3 Dry STP	
Nitrogen oxides (as NO_2, ref. 15% O_2)	160 mg/m^3Dry STP	
Carbon monoxide	34 mg/m^3Dry STP	
Sulphur dioxide	<2 mg/m^3Dry STP	

Stack Identification	**GT 2 – 2**	
Date and Time	24 October 2007, 0930 – 1000	
Plant Conditions:	22 MW Gas 325 GJ/h	
Sampling Plane	Non ideal, turbulent flow in transition duct.	
Test Procedures	SA EPA Methods: 03.01, 03.06, 03.09, 03.10, 03.13, 03.14.	
Transition duct Dimensions	3.4 m x 2.5 m	
Average Exhaust Gas Velocity	32 m/s in stack	
Average Exhaust Gas Flow-rate	91 m^3/s Dry STP	
Moisture	2.8 % v/v	
Average Exhaust Temperature	472 ^oC	Natural Gas fuel
Exhaust Gas Composition	CO_2 2.6 %, O_2 16.2 %	
Nitrogen oxides (as NO_2, ref. 15% O_2)	150 mg/m^3Dry STP	
Carbon monoxide	28 mg/m^3Dry STP	
Sulphur dioxide	<2 mg/m^3Dry STP	

Stack Identification	**GT 3 – 1**	
Date and Time	23 October 2007, 0800 – 0930	
Plant Conditions:	15 MW Gas 282 GJ/h, 14 MW Diesel 7.7 kL/h	
Sampling Plane	Non ideal, turbulent flow in transition duct.	
Test Procedures	SA EPA Methods: 03.01, 03.06, 03.09, 03.10, 03.13, 03.14.	
Transition duct Dimensions	2.9 m x 2.85 m	
Average Exhaust Gas Velocity	30 m/s in stack	
Average Exhaust Gas Flow-rate	80 m^3/s Dry STP	
Moisture	3.1 % v/v	
Average Exhaust Temperature	492 °C	Natural Gas fuel
Exhaust Gas Composition	CO_2 2.6 %, O_2 16.3 %	
Nitrogen oxides (as NO_2, ref. 15% O_2)	120 mg/m^3Dry STP	
Carbon monoxide	12 mg/m^3Dry STP	
Sulphur dioxide	<2 mg/m^3Dry STP	
Average Exhaust Temperature	470 °C	Diesel fuel
Exhaust Gas Composition	CO_2 3.1 %, O_2 16.5 %	
Total Particulates	22 mg/m^3 Dry STP	
PM10	22 mg/m^3 Dry STP	
Nitrogen oxides (as NO_2, ref. 15% O_2)	170 mg/m^3Dry STP	
Carbon monoxide	14 mg/m^3Dry STP	
Sulphur dioxide	<2 mg/m^3Dry STP	

Stack Identification	**GT 3 – 2**	
Date and Time	23 October 2007, 0840 – 1020	
Plant Conditions:	15 MW Gas 250 GJ/h, 14 MW Diesel 8.0 kL/h	
Sampling Plane	Non ideal, turbulent flow in transition duct.	
Test Procedures	SA EPA Methods: 03.01, 03.06, 03.09, 03.10, 03.13, 03.14.	
Transition duct Dimensions	3.5 m x 2.8 m	
Average Exhaust Gas Velocity	26 m/s in stack	
Average Exhaust Gas Flow-rate	86 m^3/s Dry STP (Static = -4 mb)	
Moisture	3.1 % v/v	
Average Exhaust Temperature	490 °C	Natural Gas fuel
Exhaust Gas Composition	CO_2 2.5 %, O_2 16.3 %	
Nitrogen oxides (as NO_2, ref. 15% O_2)	120 mg/m^3Dry STP	
Carbon monoxide	11 mg/m^3Dry STP	
Sulphur dioxide	<2 mg/m^3Dry STP	
Average Exhaust Temperature	480 °C	Diesel fuel
Exhaust Gas Composition	CO_2 3.0 %, O_2 16.6 %	
Total Particulates	12 mg/m^3 Dry STP	
PM10	12 mg/m^3 Dry STP	
Nitrogen oxides (as NO_2, ref. 15% O_2)	150 mg/m^3Dry STP	
Carbon monoxide	42 mg/m^3Dry STP	
Sulphur dioxide	<2 mg/m^3Dry STP	

Stack Identification	**GT 3 – 3**	
Date and Time	24 October 2007, 1250 – 1420	
Plant Conditions:	15 MW Gas 260 GJ/h, 13 MW Diesel 6.2 kL/h	
Sampling Plane	Non ideal, turbulent flow in transition duct.	
Test Procedures	SA EPA Methods: 03.01, 03.06, 03.09, 03.10, 03.13, 03.14.	
Transition duct Dimensions	3.5 m x 2.8 m	
Average Exhaust Gas Velocity	24 m/s in stack	
Average Exhaust Gas Flow-rate	74 m^3/s Dry STP	
Moisture	3.9 % v/v	
Average Exhaust Temperature	496 °C	Natural Gas fuel
Exhaust Gas Composition	CO_2 2.5 %, O_2 16.2 %	
Nitrogen oxides (as NO_2, ref. 15% O_2)	150 mg/m^3Dry STP	
Carbon monoxide	12 mg/m^3Dry STP	
Sulphur dioxide	<2 mg/m^3Dry STP	
Average Exhaust Temperature	486 °C	Diesel fuel
Exhaust Gas Composition	CO_2 3.0 %, O_2 16.7 %	
Total Particulates	14 mg/m^3 Dry STP	
PM10	14 mg/m^3 Dry STP	
Nitrogen oxides (as NO_2, ref. 15% O_2)	190 mg/m^3Dry STP	
Carbon monoxide	26 mg/m^3Dry STP	
Sulphur dioxide	<2 mg/m^3Dry STP	

Stack Identification	**GT 3 – 4**	
Date and Time	24 October 2007, 1030 – 1210	
Plant Conditions:	16 MW Gas 256 GJ/h, 13 MW Diesel 7.2 kL/h	
Sampling Plane	Non ideal, turbulent flow in transition duct.	
Test Procedures	SA EPA Methods: 03.01, 03.06, 03.09, 03.10, 03.13, 03.14.	
Transition duct Dimensions	3.5 m x 2.8 m	
Average Exhaust Gas Velocity	24 m/s in stack	
Average Exhaust Gas Flow-rate	74 m^3/s Dry STP	
Moisture	2.9 % v/v	
Average Exhaust Temperature	497 °C	Natural Gas fuel
Exhaust Gas Composition	CO_2 2.5 %, O_2 16.3 %	
Nitrogen oxides (as NO_2, ref. 15% O_2)	150 mg/m^3Dry STP	
Carbon monoxide	18 mg/m^3Dry STP	
Sulphur dioxide	<2 mg/m^3Dry STP	
Average Exhaust Temperature	490 °C	Diesel fuel
Exhaust Gas Composition	CO_2 2.8 %, O_2 16.8 %	
Total Particulates	11 mg/m^3 Dry STP	
PM10	11 mg/m^3 Dry STP	
Nitrogen oxides (as NO_2, ref. 15% O_2)	190 mg/m^3Dry STP	
Carbon monoxide	22 mg/m^3Dry STP	
Sulphur dioxide	<2 mg/m^3Dry STP	

Stack Identification	**GT 4 – 1**	
Date and Time	24 October 2007, 1500 – 1640	
Plant Conditions:	15 MW Gas 256 GJ/h, 14 MW Diesel 7.4 kL/h	
Sampling Plane	Non ideal, turbulent flow in transition duct.	
Test Procedures	SA EPA Methods: 03.01, 03.06, 03.09, 03.10, 03.13, 03.14.	
Transition duct Dimensions	3.45 m x 2.8 m	
Average Exhaust Gas Velocity	24 m/s in stack	
Average Exhaust Gas Flow-rate	74 m^3/s Dry STP	
Moisture	2.3 % v/v	
Average Exhaust Temperature	503 °C	Natural Gas fuel
Exhaust Gas Composition	CO_2 2.5 %, O_2 16.4 %	
Nitrogen oxides (as NO_2, ref. 15% O_2)	150 mg/m^3Dry STP	
Carbon monoxide	12 mg/m^3Dry STP	
Sulphur dioxide	<2 mg/m^3Dry STP	
Average Exhaust Temperature	452 °C	Diesel fuel
Exhaust Gas Composition	CO_2 3.0 %, O_2 16.7 %	
Total Particulates	19 mg/m^3 Dry STP	
PM10	19 mg/m^3 Dry STP	
Nitrogen oxides (as NO_2, ref. 15% O_2)	170 mg/m^3Dry STP	
Carbon monoxide	42 mg/m^3Dry STP	
Sulphur dioxide	<2 mg/m^3Dry STP	

Stack Identification	**GT 4 – 2**	
Date and Time	25 October 2007, 0930 –1050	
Plant Conditions:	15 MW Gas 260 GJ/h, 13 MW Diesel 8.1 kL/h	
Sampling Plane	Non ideal, turbulent flow in transition duct.	
Test Procedures	SA EPA Methods: 03.01, 03.06, 03.09, 03.10, 03.13, 03.14.	
Transition duct Dimensions	3.45 m x 2.8 m	
Average Exhaust Gas Velocity	23 m/s in stack	
Average Exhaust Gas Flow-rate	71 m^3/s Dry STP	
Moisture	2.2 % v/v	
Average Exhaust Temperature	507 °C	Natural Gas fuel
Exhaust Gas Composition	CO_2 2.7 %, O_2 15.8 %	
Nitrogen oxides (as NO_2, ref. 15% O_2)	130 mg/m^3Dry STP	
Carbon monoxide	22 mg/m^3Dry STP	
Sulphur dioxide	<2 mg/m^3Dry STP	
Average Exhaust Temperature	463 °C	Diesel fuel
Exhaust Gas Composition	CO_2 3.1 %, O_2 16.5 %	
Total Particulates	15 mg/m^3 Dry STP	
PM10	15 mg/m^3 Dry STP	
Nitrogen oxides (as NO_2, ref. 15% O_2)	150 mg/m^3Dry STP	
Carbon monoxide	44 mg/m^3Dry STP	
Sulphur dioxide	<2 mg/m^3Dry STP	

Stack concentrations referenced to dry STP conditions were converted to in-stack concentrations following methods described on the Ireland EPA web page, 'Correction of concentration and volumetric flows':
http://www.epa.ie/air/airenforcement/epalicenseeinformation/airguidancedocuments/correctionofconcentrationandvolumetricflows/
The main aspects of the conversion process are summarised below, where the inverse was applied.

Temperature correction:

To convert a concentration measured at stack conditions to a concentration reference to 273.15 K (equivalent 0 °C), multiply by the following factor F_t:

$$F_t = \frac{T}{273.15}$$

Where T is the measured temperature in the stack in Kelvin.

Moisture correction:

Emissions of stack gases are usually expressed on a dry gas basis so that variations in the moisture content of the stack gas do not affect the assessment of the emissions.

$$Dry\ Gas\ Concentration\ \left(\frac{mg}{m^3}\right) = wet\ gas\ concentration\ \times \frac{100}{100 - \%\ H_2O}$$

Oxygen correction:

Similarly oxygen corrections may be applied to reference periodic emissions monitoring data to a constant oxygen reference value:

$$Oxygen\ referenced\ conc. = Measured\ conc. x\ \frac{20.9 - Oxygen\ Reference\ value\ (\%)}{20.9 - measured\ oxygen\ (\%)}$$

	Gen type												
	GT1-2	GT2-1	GT3-1	GT3-2	GT3-3	GT3-4	Gt4-1	GT 4-2	NOT TESTED params	GT1-4	GT2-2	GT2-4	GT2-3
duct dimensions	3.1x2.3	3.1x2.15	2.9x2.85	3.5x2.8	3.5x2.8	3.5x2.8	3.45x2.8	3.45x2.8					
area from transition duct	7.13	6.67	8.27	9.80	9.80	9.80	9.66	9.66	8.85				
equiv diameter	3.01	2.91	3.24	3.53	3.53	3.53	3.51	3.51	3.35				
stack ht (m)	12.5	10.5	12.5	12.5	12.5	12.5	12.5	12.5		12.5	9.1	9.1	11.7
exit velocity (m/s)	33	34	30	26	24	24	24	23	27.25				
flow rate m3/s, dry STP	74	72	80	86	74	74	74	71					
exit temp (degC)	475	478	470	480	486	490	452	463					
exit temp k	748	751	743	753	759	763	725	736	747.25				
temp fraction	2.74	2.75	2.72	2.76	2.78	2.79	2.65	2.69	2.74				
flow rate, calculated from vel	235.29	226.61	247.95	254.80	235.20	235.20	231.84	222.18					
PM10 mg/m3	11	14	22	12	14	11	19	15					
Nox mg/Nm3	150	160	170	150	190	190	170	150					
CO mg/Nm3	110	34	14	42	26	22	42	44					
SO2 mg/Nm3	2	2	2	2	2	2	2	2					
PM10 temp corrected mg/m3	4.02	5.09	8.09	4.35	5.04	3.94	7.16	5.57					
Nox temp corrected mg/m3	54.78	58.19	62.50	54.41	68.38	68.02	64.05	55.67					
CO temp corrected mg/m3	40.17	12.37	5.15	15.24	9.36	7.88	15.82	16.33					
SO2 temp corrected mg/m3	0.73	0.73	0.74	0.73	0.72	0.72	0.75	0.74					
O2 (%)	16.3	16.5	16.5	16.3	16.7	16.8	16.7	16.5					
oxygen fraction	1.28	1.34	1.34	1.28	1.40	1.44	1.40	1.34	1.35				
PM10 oxygen corrected mg/m	3.13	3.80	6.03	3.39	3.59	2.74	5.10	4.15					
NOX oxygen corrected mg/m3	42.71	43.40	46.61	42.42	48.68	47.27	45.59	41.52					
CO oxygen corrected mg/m3	31.32	9.22	3.84	11.88	6.66	5.47	11.26	12.18					
SO2 oxygen corrected mg/m3	0.57	0.54	0.55	0.57	0.51	0.50	0.54	0.55					
water content (%)	4.00	4.50	3.10	3.10	3.90	2.90	2.30	2.2					
water fraction	1.04	1.05	1.03	1.03	1.04	1.03	1.02	1.02					
PM10 water corrected mg/m3	3.01	3.63	5.84	3.29	3.45	2.66	4.98	4.06					
Nox water corrected mg/m3	41.00	41.45	45.16	41.11	46.78	45.90	44.55	40.60					
CO water corrected mg/m3	30.07	8.81	3.72	11.51	6.40	5.31	11.01	11.91					
SO2 water corrected mg/m3	0.55	0.52	0.53	0.55	0.49	0.48	0.52	0.54					

CALCULATED FLOW RATE									***MAX***
Nox g/s	9.65	9.39	11.20	10.47	11.00	10.79	10.33	9.02	11.20
SO2 g/s	0.13	0.12	0.13	0.14	0.12	0.11	0.12	0.12	0.14
PM10 g/s	0.71	0.82	1.45	0.84	0.81	0.62	1.15	0.90	1.45
CO g/s	7.07	2.00	0.92	2.93	1.51	1.25	2.55	2.65	7.07

Diesel	13 MW	12 MW	14 MW	14 MW	13 MW	13 MW	14 MW	13 MW
	6.5 kL/h	6.1 kL/h	7.7 kL/h	8.0 kL/h	6.2 kL/h	7.2 kL/h	7.4 kL/h	8.1 kL/h

Emissions data for proposed GT.

From: Benjamin, Mark (GE Power)
Sent: Wednesday, 4 October 2017 5:20 PM
To: Emera, Adam <Adam.Emera@energyaustralia.com.au>
Cc: Day, David (GE Power) <david.day1@ge.com>; Balbo, Alberto (GE Power) <Alberto.Balbo@ge.com>; Cotton, Jonathan <Jonathan.Cotton@energyaustralia.com.au>
Subject: RE: Hallett Power Station - New Turbine - Further Information Request

Hi Adam,

As follows. Will follow up re start/stop emissions

3. Details of proposed aero derivative turbine
    a. Details include manufacturer's data for in-stack concentrations of NO_x, SO_2, CO, PM_{10} and $PM_{2.5}$ for operation at 100% load
    1.58 kg/hr PM10, we do not have measurement of PM2.5, again particulates are a factor of fuel and air inlet and not the actual product of combustion in itself
    Nox = 25 ppm
    CO = 260 ppm
    SO2 is purely depending on sulfur content in fuel, there is no sulfur produced as part of gas turbine combustion
    b. Exhaust velocity and temperature for turbines operating at 100% load
    54 meters / second velocity max
    520 deg C
    c. Internal diameter of each stack and stack height
    20 meter stack height with internal diameter of 2.74 meters
    d. Transient – Start/Stop: emissions
    pending

Regards,

Mark Benjamin
Account Manager, ANZ
GE Power Services

M: +61 439 582 349

	Gen type aero deriv
stack ht (m)	20
exit diameter (m)	2.74
exit area (m2)	5.896455
exit velocity (m/s)	54
exit temp (degC)	520
exit temp (k)	793.15
PM10 kg/hr	1.58
PM10 g/s	0.438889
Nox (ppm)	25
CO (ppm)	260
SO2 (ppm)	
temperature factor	2.903716
pressure factor	1

dry STP
STP is standard temperature and pressure

Conversion from ppm to mg/m^3 :

$$\frac{mg}{m^3} = ppm \times \frac{molecular\ weight\ (g)}{molar\ volume\ (litres)}$$

The molar volume employed is typically the molar volume of a gas at 273.15 K (temperature) and 101.325 kPa (pressure), i.e. 'Normal' temperature and pressure. In this case the molar volume is 22.41 litres. By using this figure the calculated mg/m^3 value is effectively corrected to 273.15 K and 101.325 kPA, and no further correction is therefore required for temperature or pressure. Concentrations which are presented at normal temperature and pressure are often notated as mg/Nm^3.

molar volume (litres)	22.41	
CO molecular wt (g)	28	
CO (mg/Nm3)	324.855	
SO2 moecular wt (g)	64	
SO2 (mg/Nm3)		
NO molecular wt (g)	30	
percent NO	0	
NO2 molecular wt (g)	46	
percent NO2	1	
Nox (mg/Nm3)	51.31638	
CO, temp corrected mg/m3	111.8756	
NOx, temp corrected mg/m3	17.67266	
CO, temp corrected g/m3	0.111876	
NOx temp corrected g/m3	0.017673	
volumetric flow rate, m3/s	318.4086	
CO temp corrected g/s	35.62215	
Nox temp corrected g/s	5.627126	
PM10 g/s	0.438889	
SO2 g/s	0.14	assumed max of current

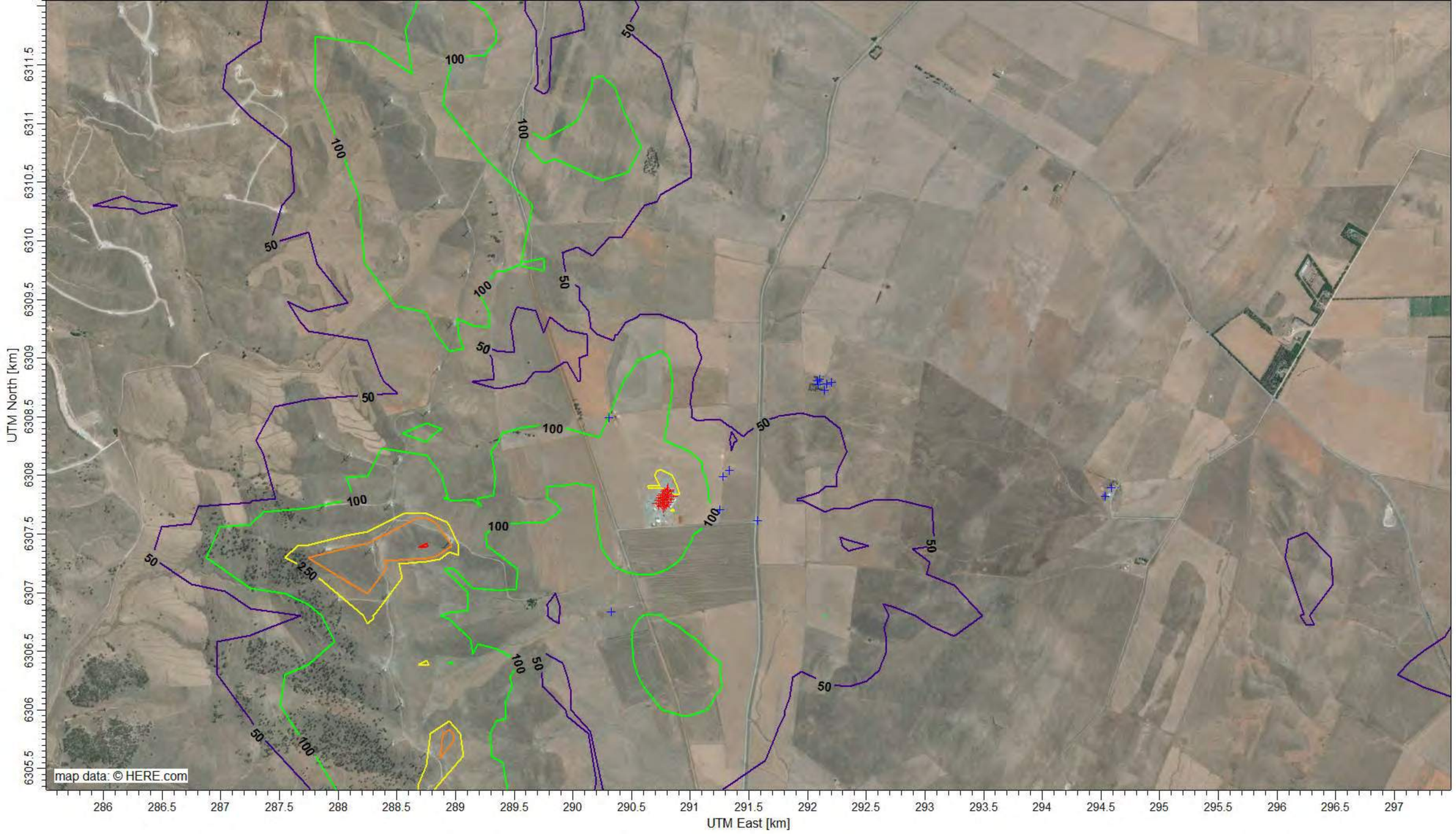
B

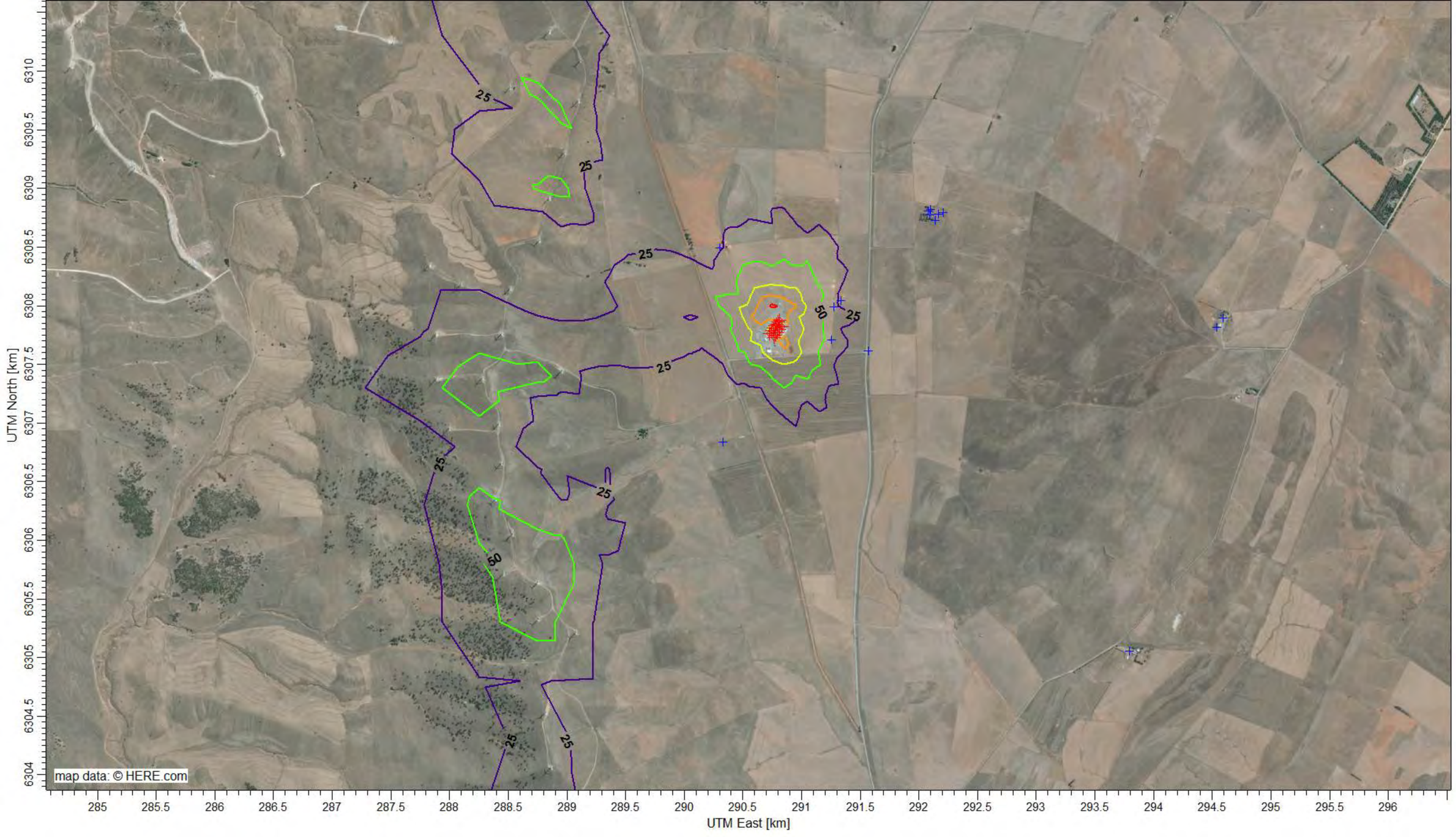
Pollutant contours

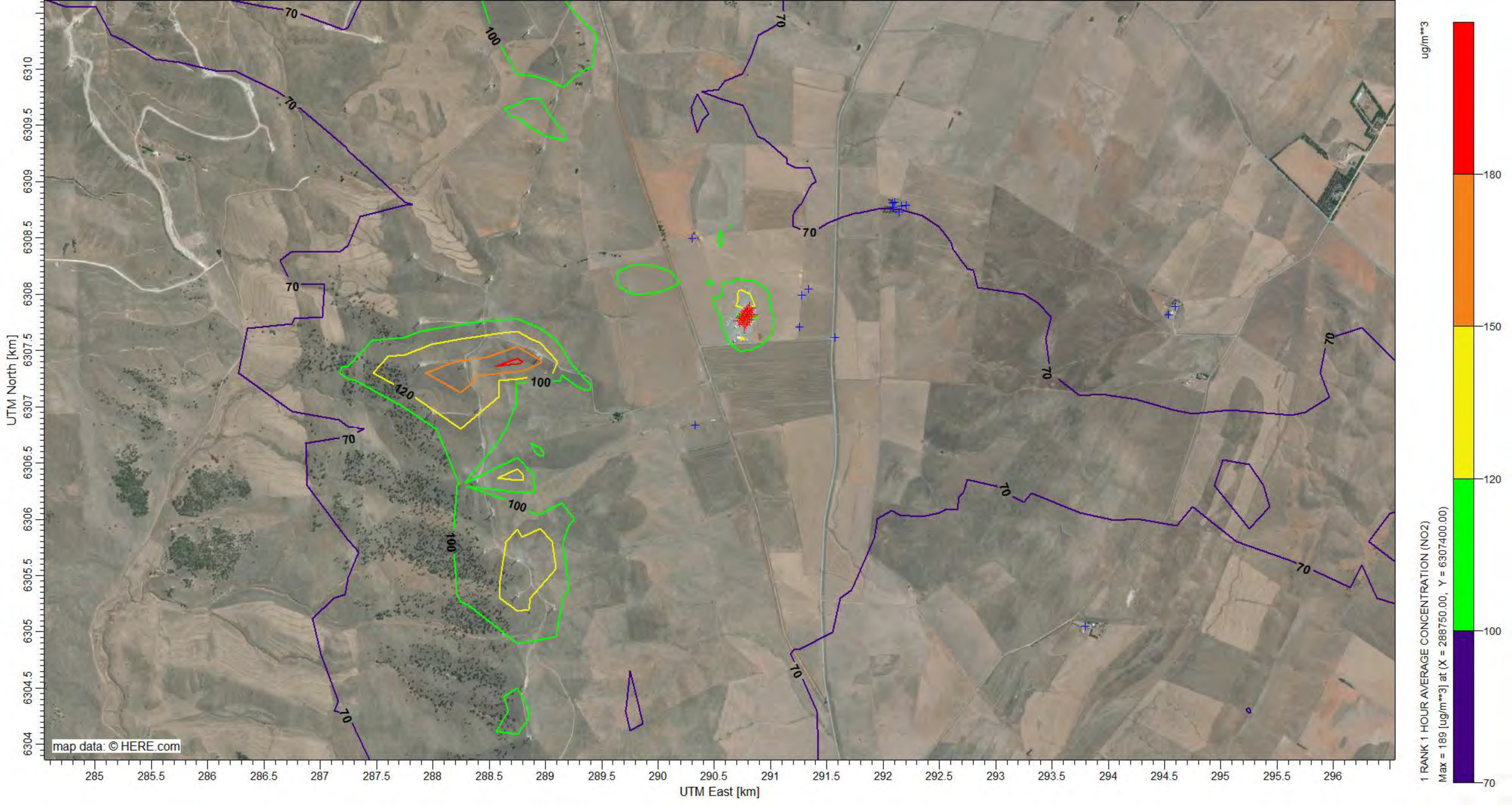
Appendix B
Pollutant contours

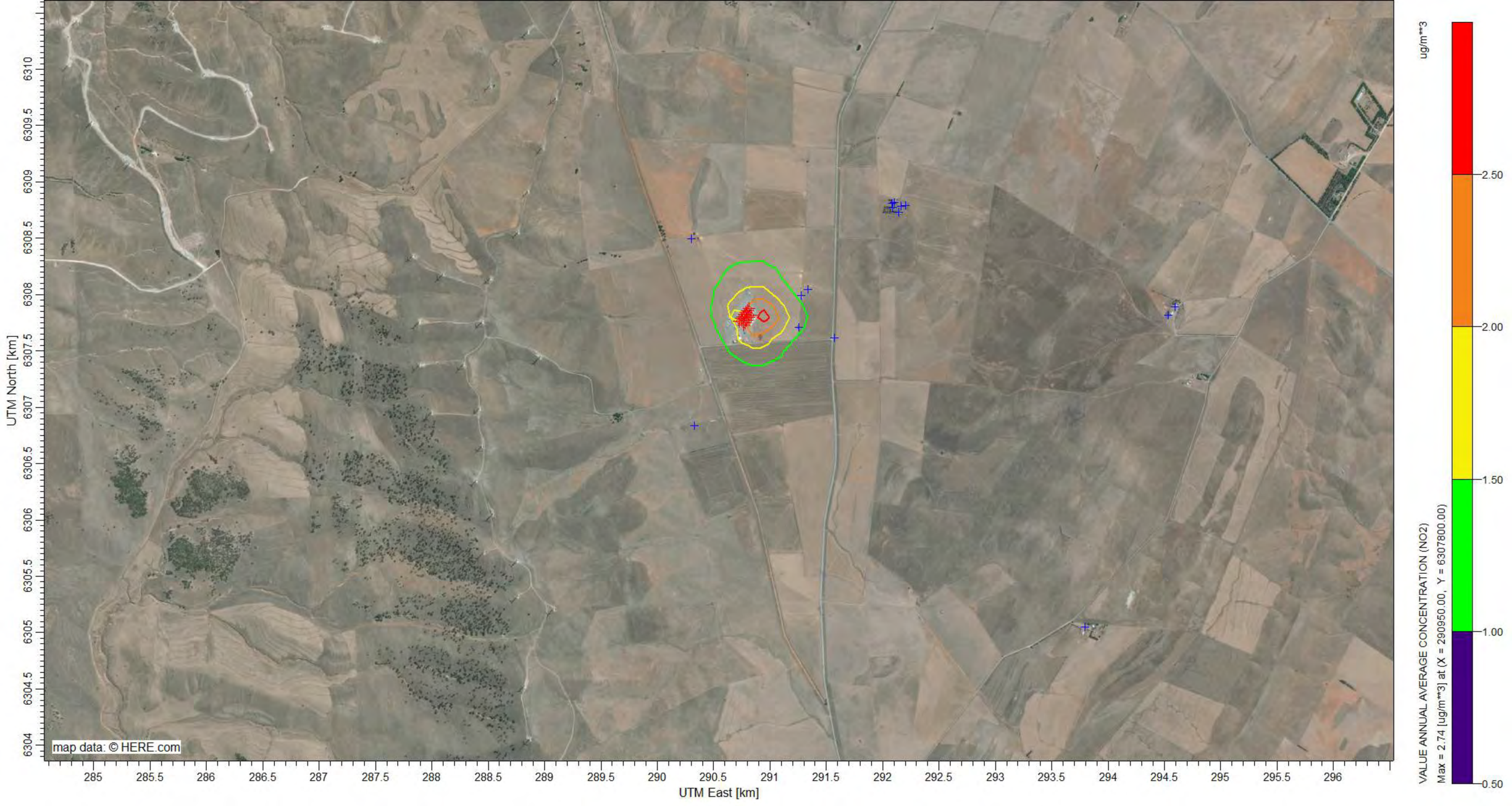
Appendix B contains all pollutant contour plots.

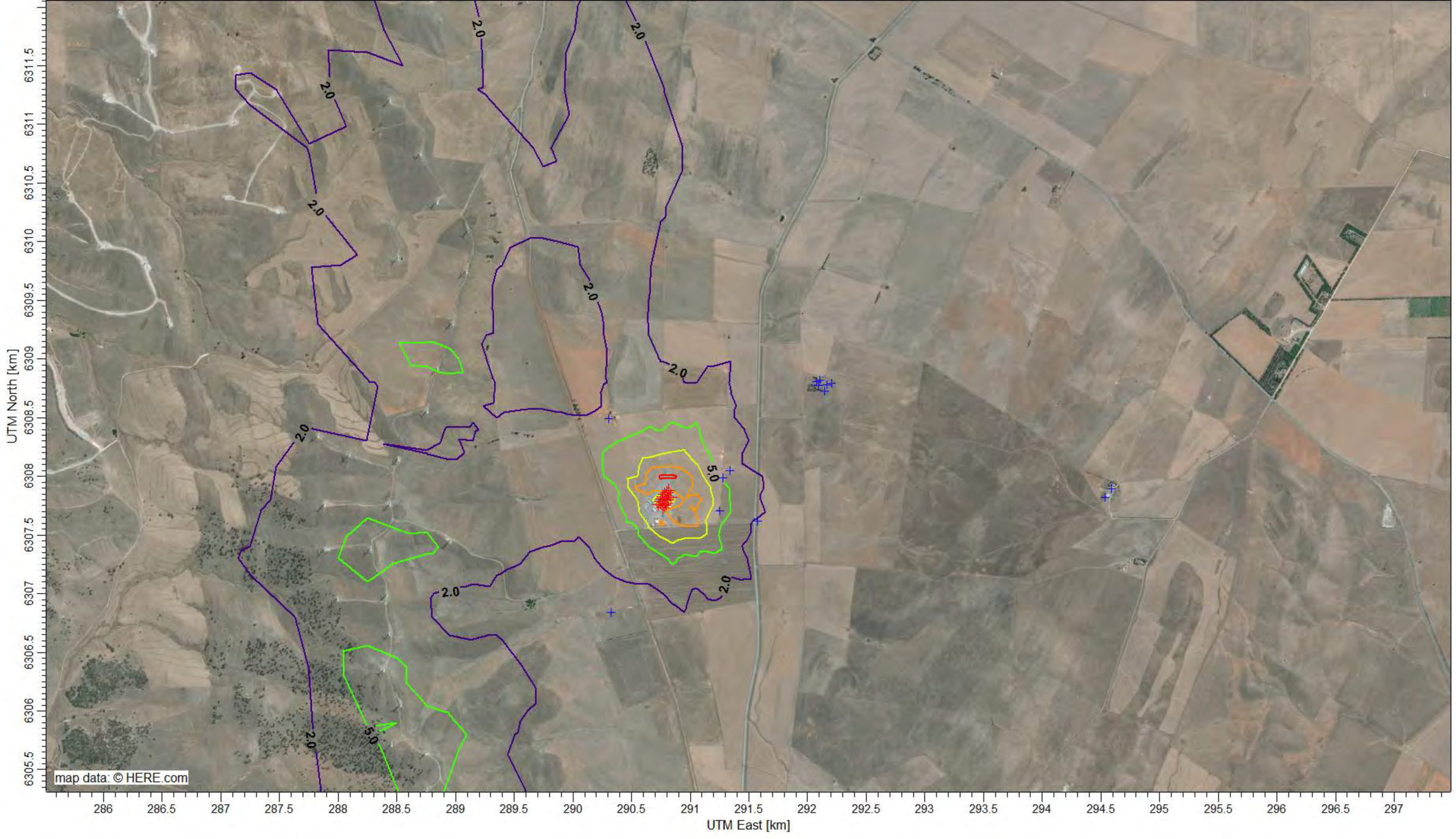
Scenario 1 predicted impacts, contours for incremental concentrations.

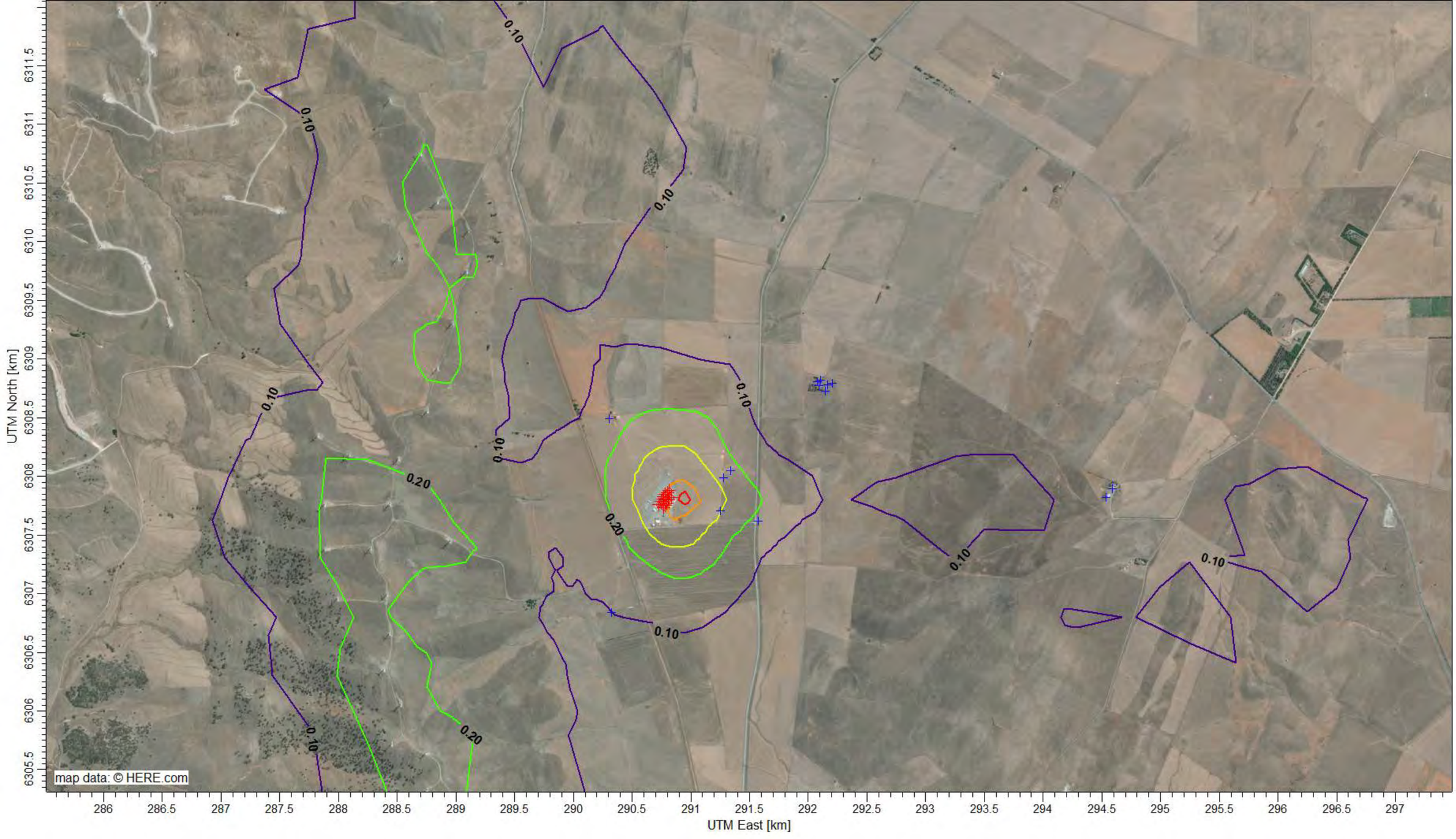

UTM North [km]
6311.5
6311
6310.5
6310
6309.5
6309
6308.5
6308
6307.5
6307
6306.5
6306
6305.5
UTM East [km]
286
286.5
287
287.5
288
288.5
289
289.5
290
290.5
291
291.5
292
292.5
293
293.5
294
294.5
295
295.5
296
296.5
297
50
100
250
map data: © HERE.com
ug/m**3
450
300
250
100
50
1 RANK 1 HOUR AVERAGE CONCENTRATION (CO)
Max = 463 [ug/m**3] at (X = 288750.00, Y = 6307400.00)

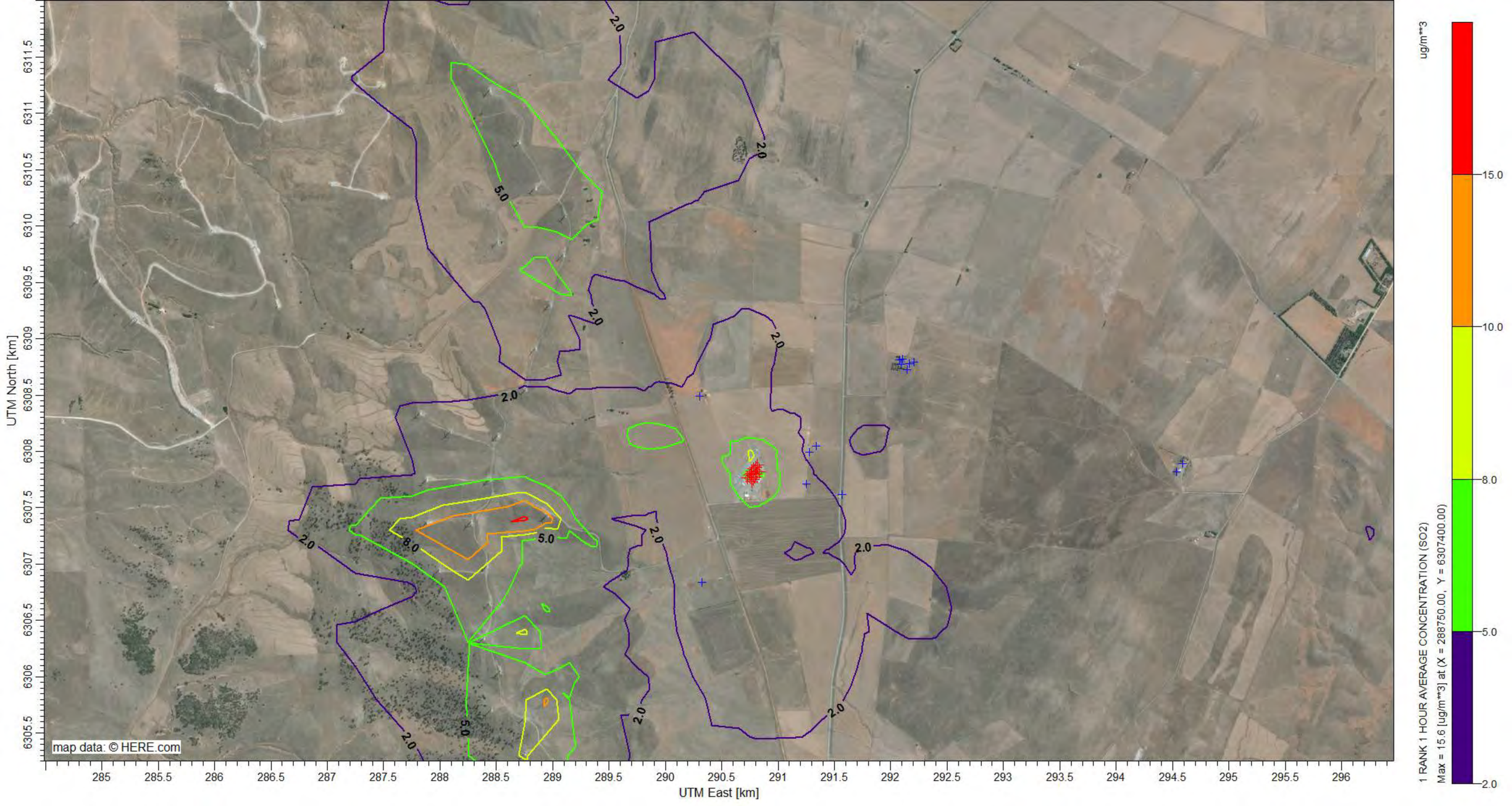

UTM North [km]
6310
6309.5
6309
6308.5
6308
6307.5
6307
6306.5
6306
6305.5
6305
6304.5
6304
UTM East [km]
285
285.5
286
286.5
287
287.5
288
288.5
289
289.5
290
290.5
291
291.5
292
292.5
293
293.5
294
294.5
295
295.5
296
25
50
map data: © HERE.com
ug/m**3
200
150
100
50
25
1 RANK 8 HOUR AVERAGE CONCENTRATION (CO)
Max = 208 [ug/m**3] at (X = 290750.00, Y = 6308000.00)

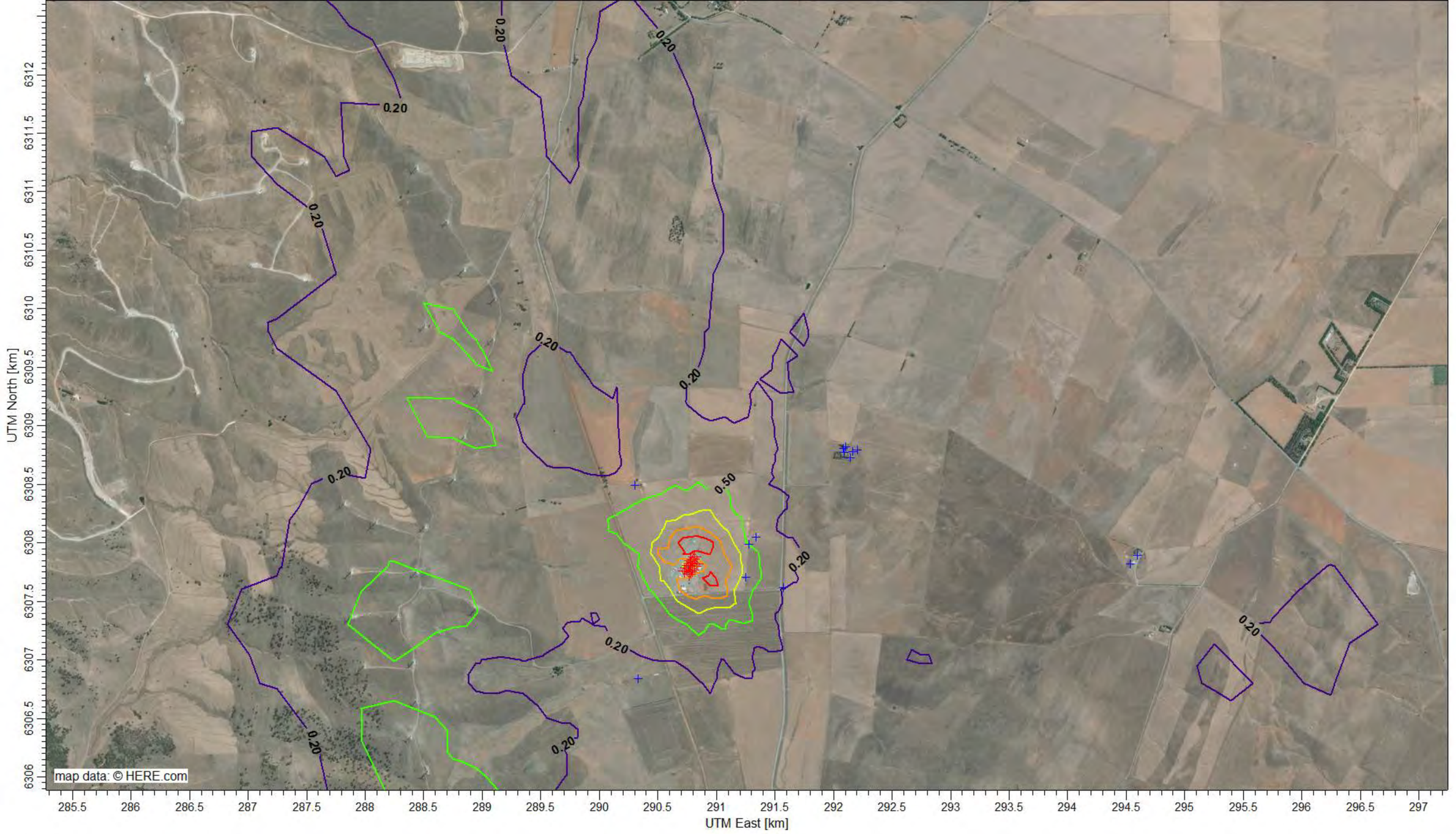

UTM North [km]
6310
6309.5
6309
6308.5
6308
6307.5
6307
6306.5
6306
6305.5
6305
6304.5
6304
UTM East [km]
285
285.5
286
286.5
287
287.5
288
288.5
289
289.5
290
290.5
291
291.5
292
292.5
293
293.5
294
294.5
295
295.5
296
70
100
120
map data: © HERE.com
ug/m**3
180
150
120
100
70
1 RANK 1 HOUR AVERAGE CONCENTRATION (NO2)
Max = 189 [ug/m**3] at (X = 288750.00, Y = 6307400.00)

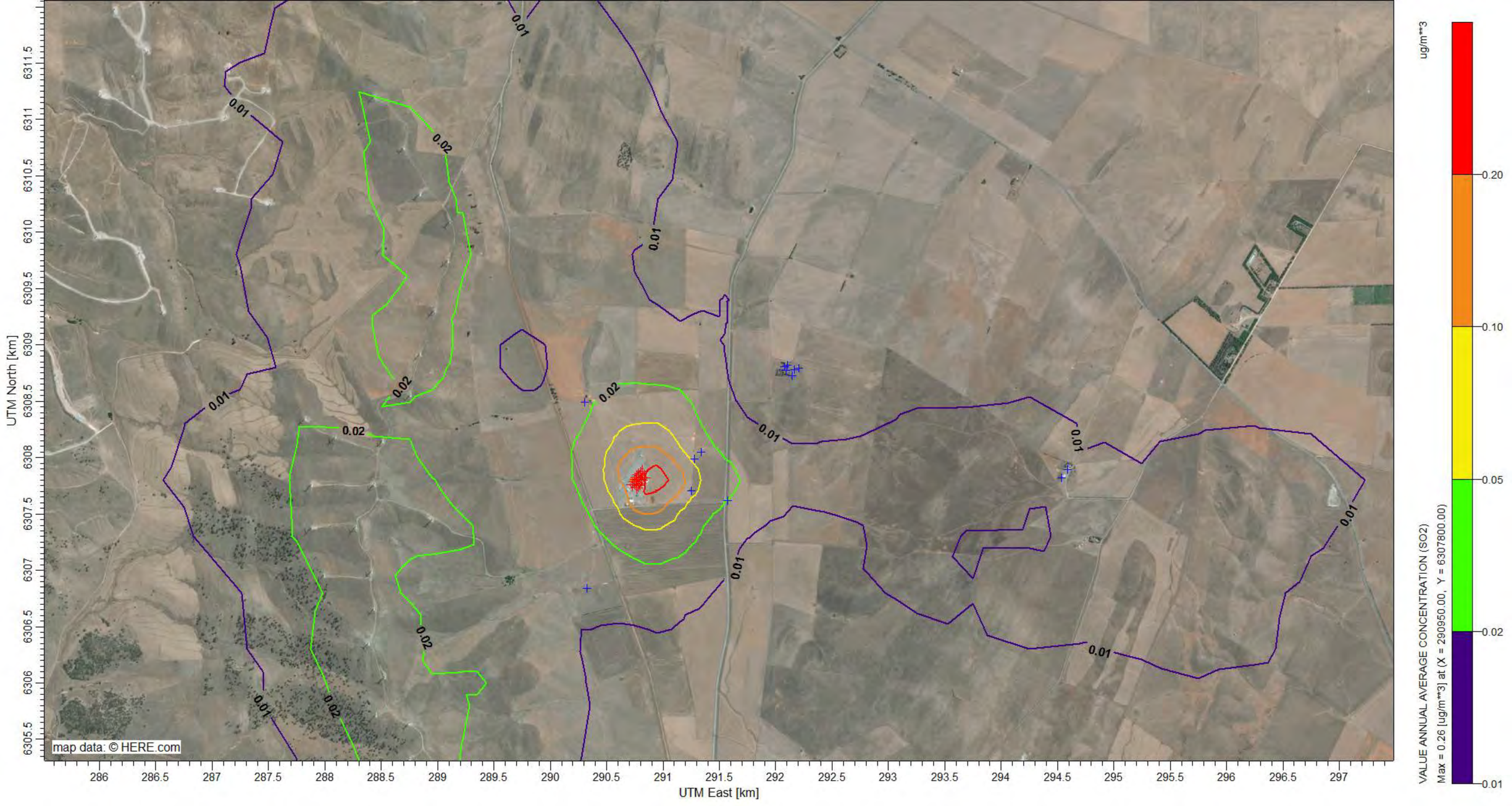

UTM North [km]
6310
6309.5
6309
6308.5
6308
6307.5
6307
6306.5
6306
6305.5
6305
6304.5
6304
285
285.5
286
286.5
287
287.5
288
288.5
289
289.5
290
290.5
291
291.5
292
292.5
293
293.5
294
294.5
295
295.5
296
UTM East [km]
map data: © HERE.com
ug/m**3
2.50
2.00
1.50
1.00
0.50
VALUE ANNUAL AVERAGE CONCENTRATION (NO2)
Max = 2.74 [ug/m**3] at (X = 290950.00, Y = 6307800.00)


UTM North [km]
6311.5
6311
6310.5
6310
6309.5
6309
6308.5
6308
6307.5
6307
6306.5
6306
6305.5
UTM East [km]
286
286.5
287
287.5
288
288.5
289
289.5
290
290.5
291
291.5
292
292.5
293
293.5
294
294.5
295
295.5
296
296.5
297
2.0
5.0
map data: © HERE.com
ug/m**3
20.0
15.0
10.0
5.0
2.0
1 RANK 24 HOUR AVERAGE CONCENTRATION (PM10)
Max = 20.8 [ug/m**3] at (X = 290850.00, Y = 6308000.00)

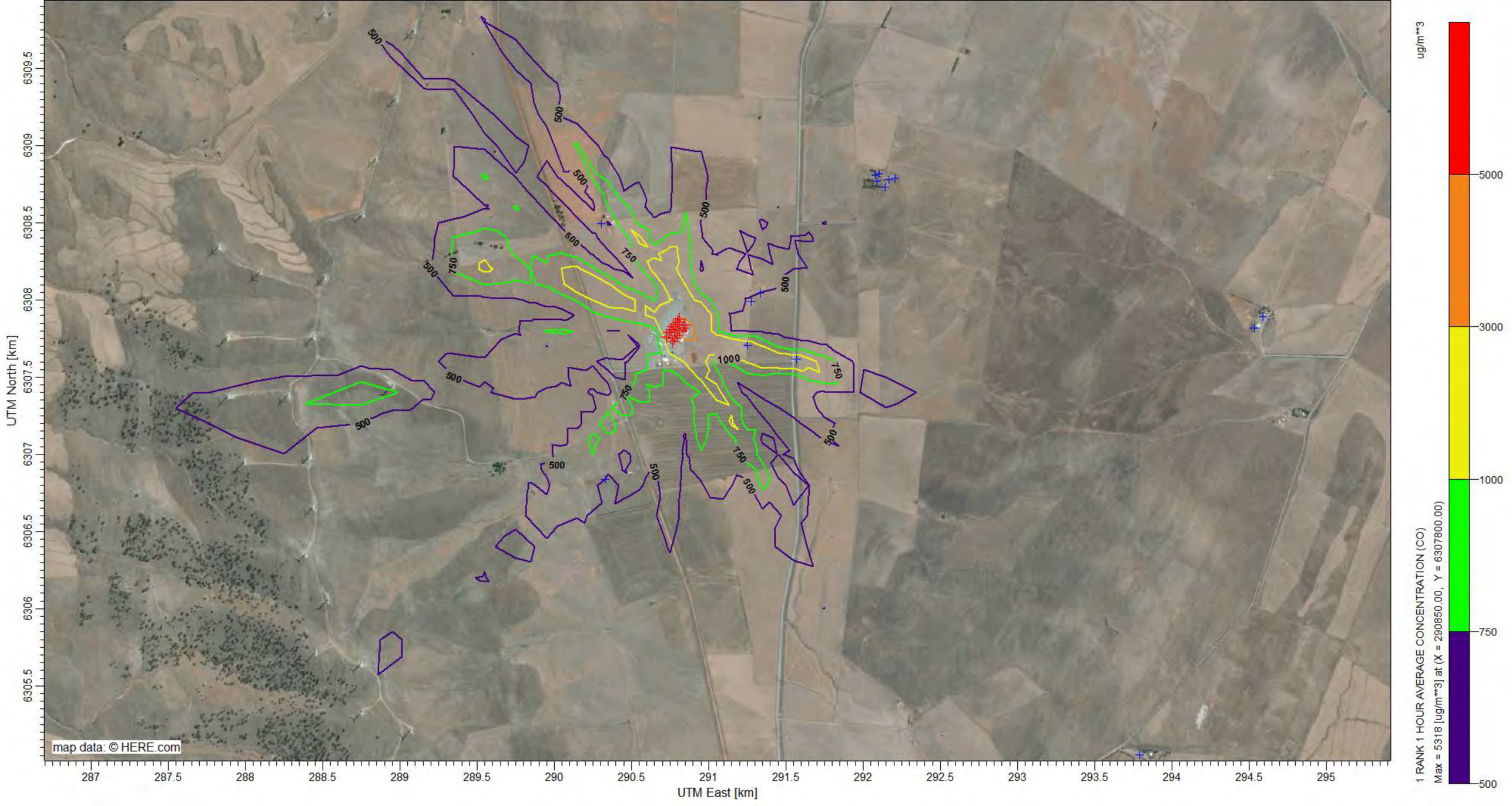

0.10
0.20
UTM North [km]
6311.5
6311
6310.5
6310
6309.5
6309
6308.5
6308
6307.5
6307
6306.5
6306
6305.5
UTM East [km]
286
286.5
287
287.5
288
288.5
289
289.5
290
290.5
291
291.5
292
292.5
293
293.5
294
294.5
295
295.5
296
296.5
297
map data: © HERE.com
ug/m**3
2.00
1.50
0.50
0.20
0.10
VALUE ANNUAL AVERAGE CONCENTRATION (PM10)
Max = 2.26 [ug/m**3] at (X = 290950.00, Y = 6307800.00)

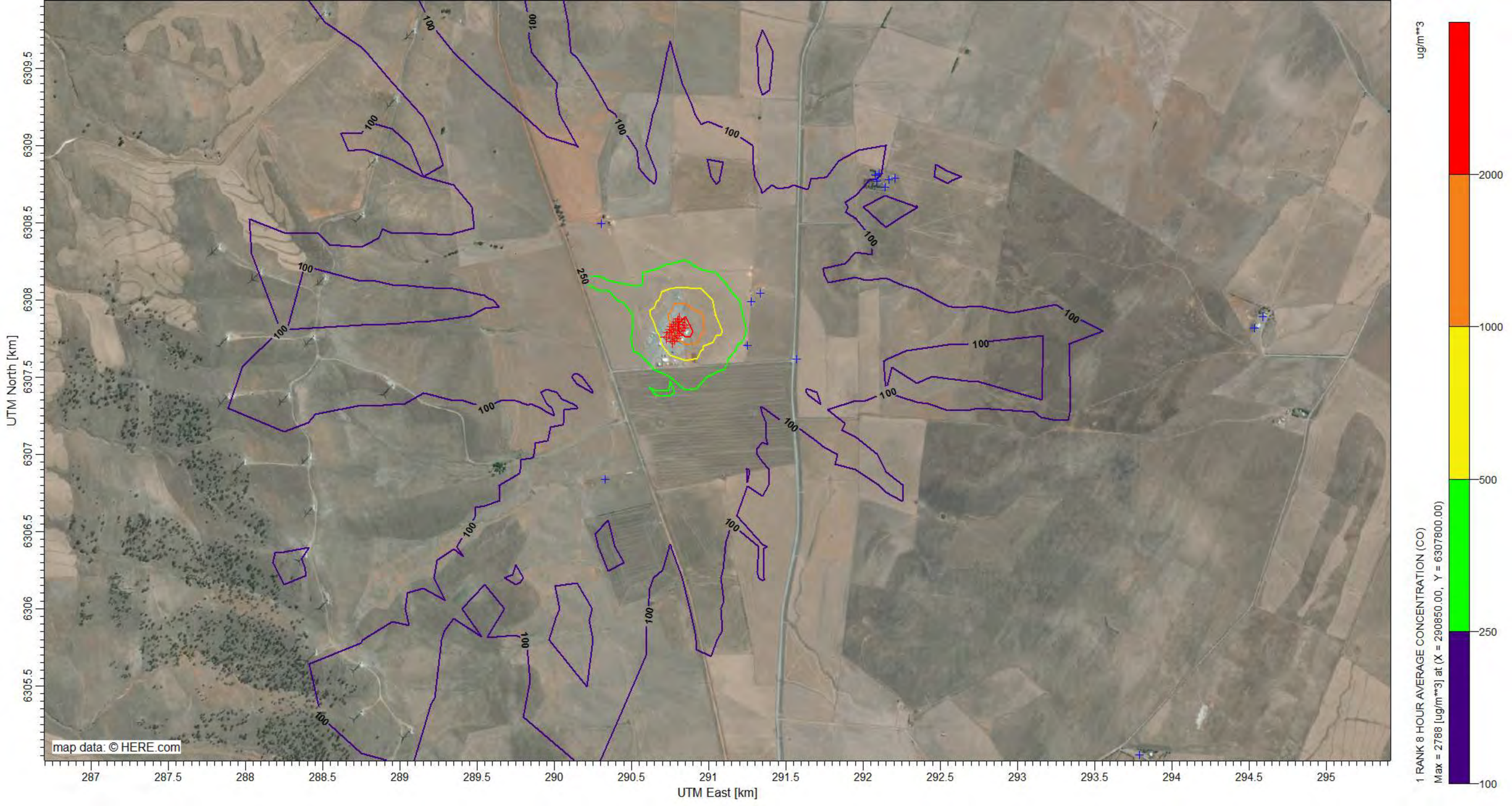

UTM North [km]
6311.5
6311
6310.5
6310
6309.5
6309
6308.5
6308
6307.5
6307
6306.5
6306
6305.5
UTM East [km]
285
285.5
286
286.5
287
287.5
288
288.5
289
289.5
290
290.5
291
291.5
292
292.5
293
293.5
294
294.5
295
295.5
296
2.0
5.0
8.0
map data: © HERE.com
ug/m**3
15.0
10.0
8.0
5.0
2.0
1 RANK 1 HOUR AVERAGE CONCENTRATION (SO2)
Max = 15.6 [ug/m**3] at (X = 288750.00, Y = 6307400.00)

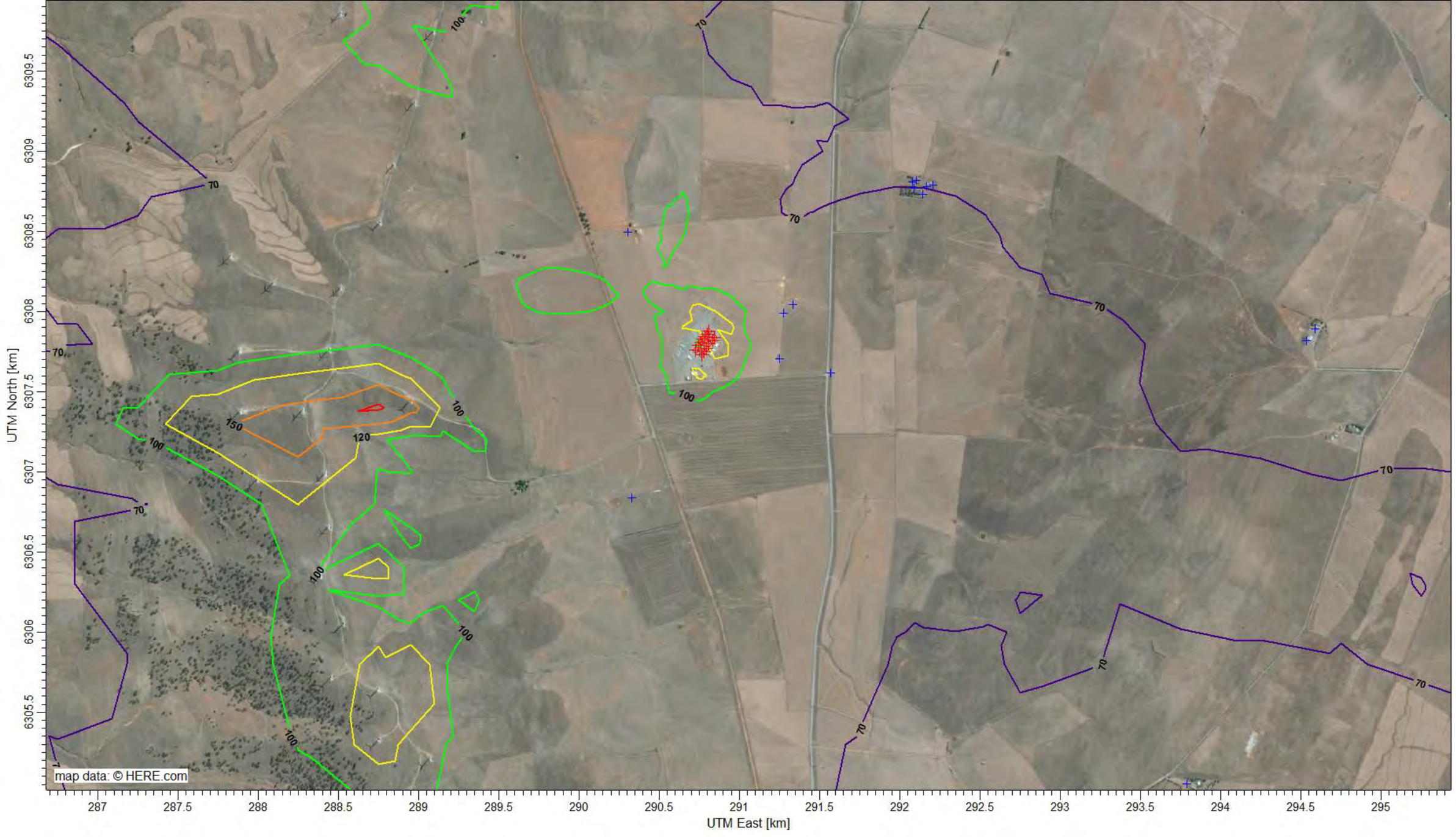

0.20
0.50
UTM North [km]
6312
6311.5
6311
6310.5
6310
6309.5
6309
6308.5
6308
6307.5
6307
6306.5
6306
285.5
286
286.5
287
287.5
288
288.5
289
289.5
290
290.5
291
291.5
292
292.5
293
293.5
294
294.5
295
295.5
296
296.5
297
UTM East [km]
map data: © HERE.com
ug/m**3
2.00
1.50
1.00
0.50
0.20
1 RANK 24 HOUR AVERAGE CONCENTRATION (SO2)
Max = 2.43 [ug/m**3] at (X = 290850.00, Y = 6308000.00)

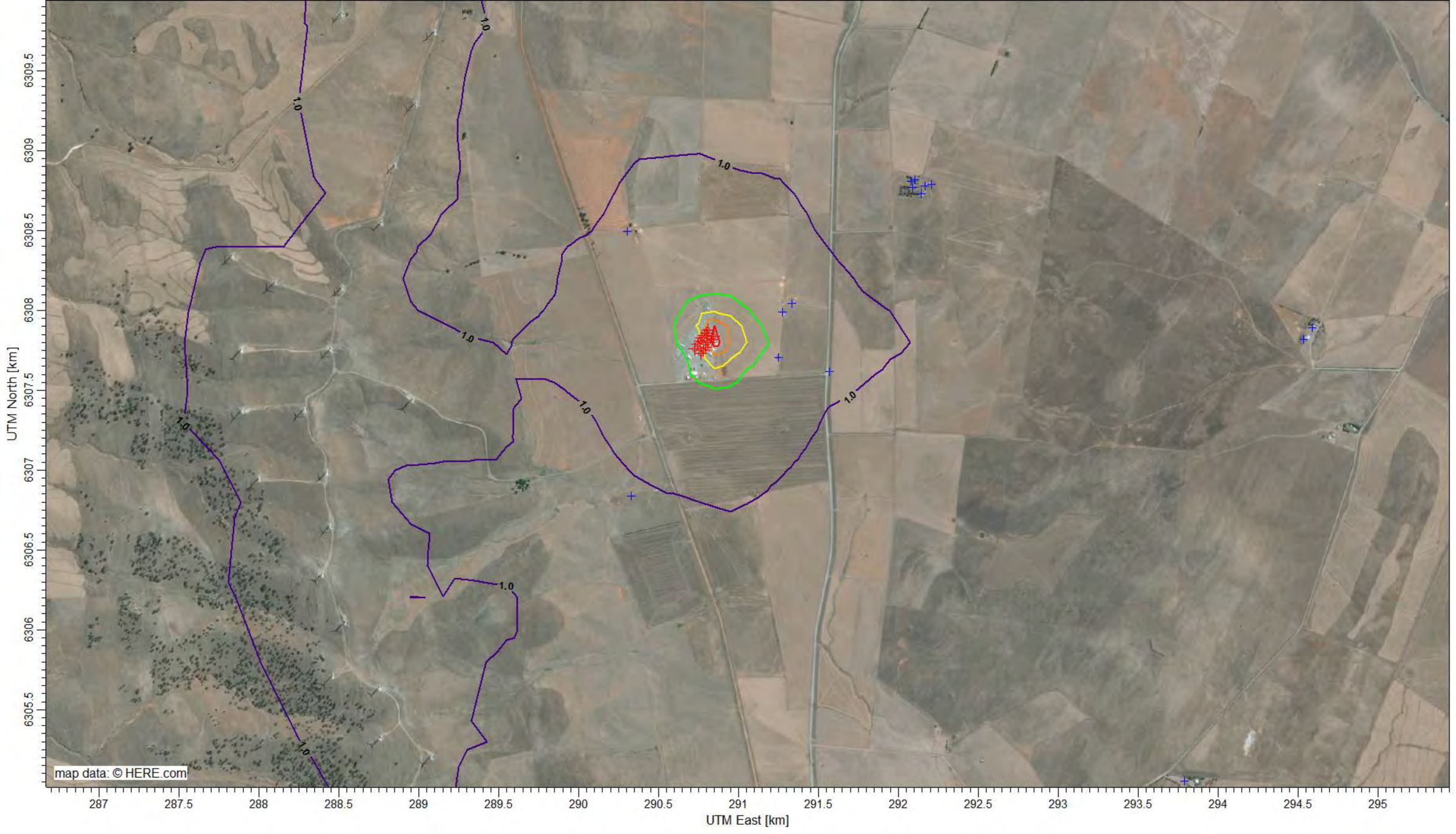

UTM North [km]
6311.5
6311
6310.5
6310
6309.5
6309
6308.5
6308
6307.5
6307
6306.5
6306
6305.5
UTM East [km]
286
286.5
287
287.5
288
288.5
289
289.5
290
290.5
291
291.5
292
292.5
293
293.5
294
294.5
295
295.5
296
296.5
297
0.01
0.02
map data: © HERE.com
ug/m**3
0.20
0.10
0.05
0.02
0.01
VALUE ANNUAL AVERAGE CONCENTRATION (SO2)
Max = 0.26 [ug/m**3] at (X = 290950.00, Y = 6307800.00)

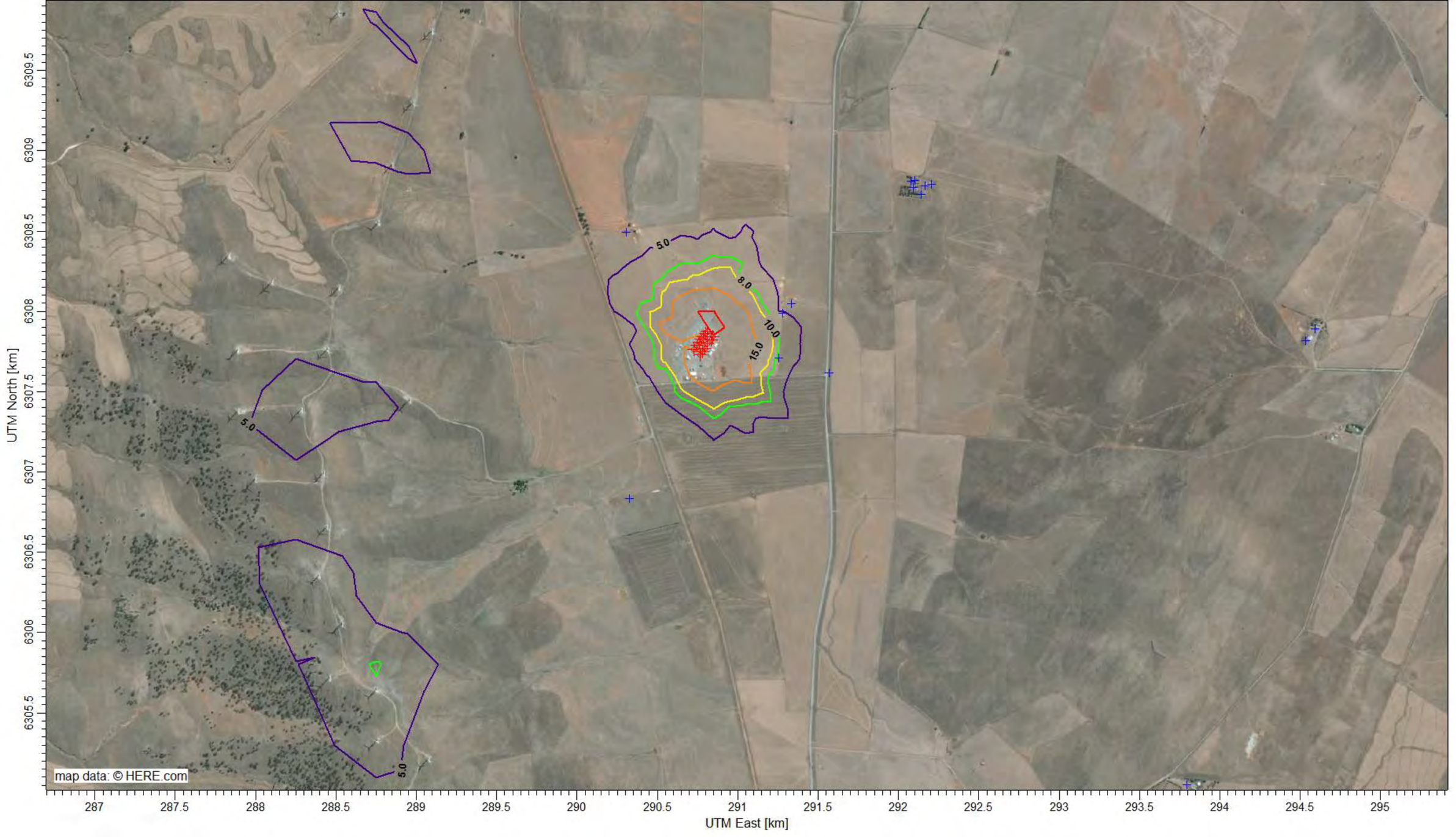
Scenario 2 predicted impacts, contours for incremental concentrations.

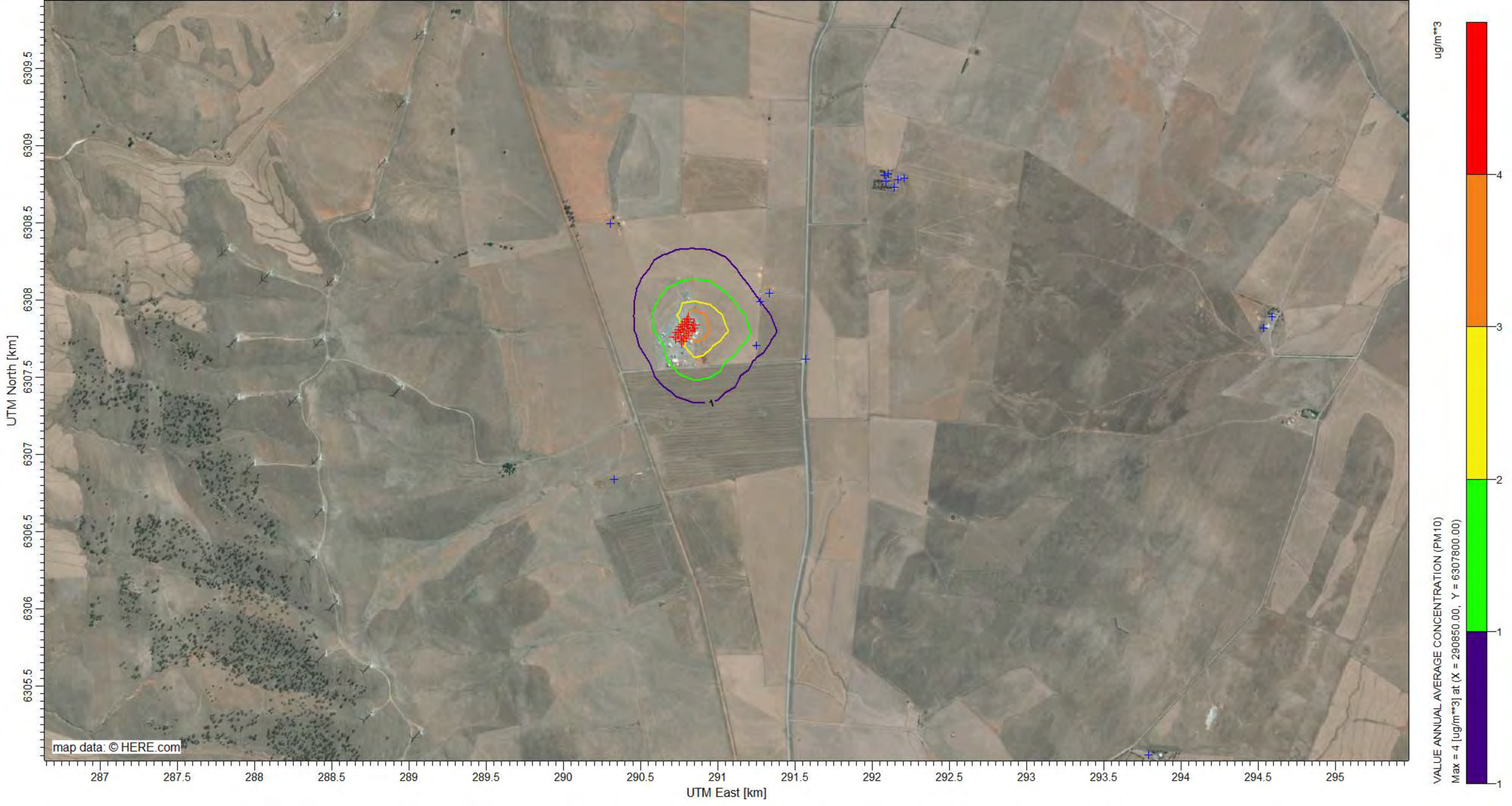

UTM North [km]
6309.5
6309
6308.5
6308
6307.5
6307
6306.5
6306
6305.5
UTM East [km]
287
287.5
288
288.5
289
289.5
290
290.5
291
291.5
292
292.5
293
293.5
294
294.5
295
500
750
1000
map data: © HERE.com
ug/m**3
5000
3000
1000
750
500
1 RANK 1 HOUR AVERAGE CONCENTRATION (CO)
Max = 5318 [ug/m**3] at (X = 290850.00, Y = 6307800.00)

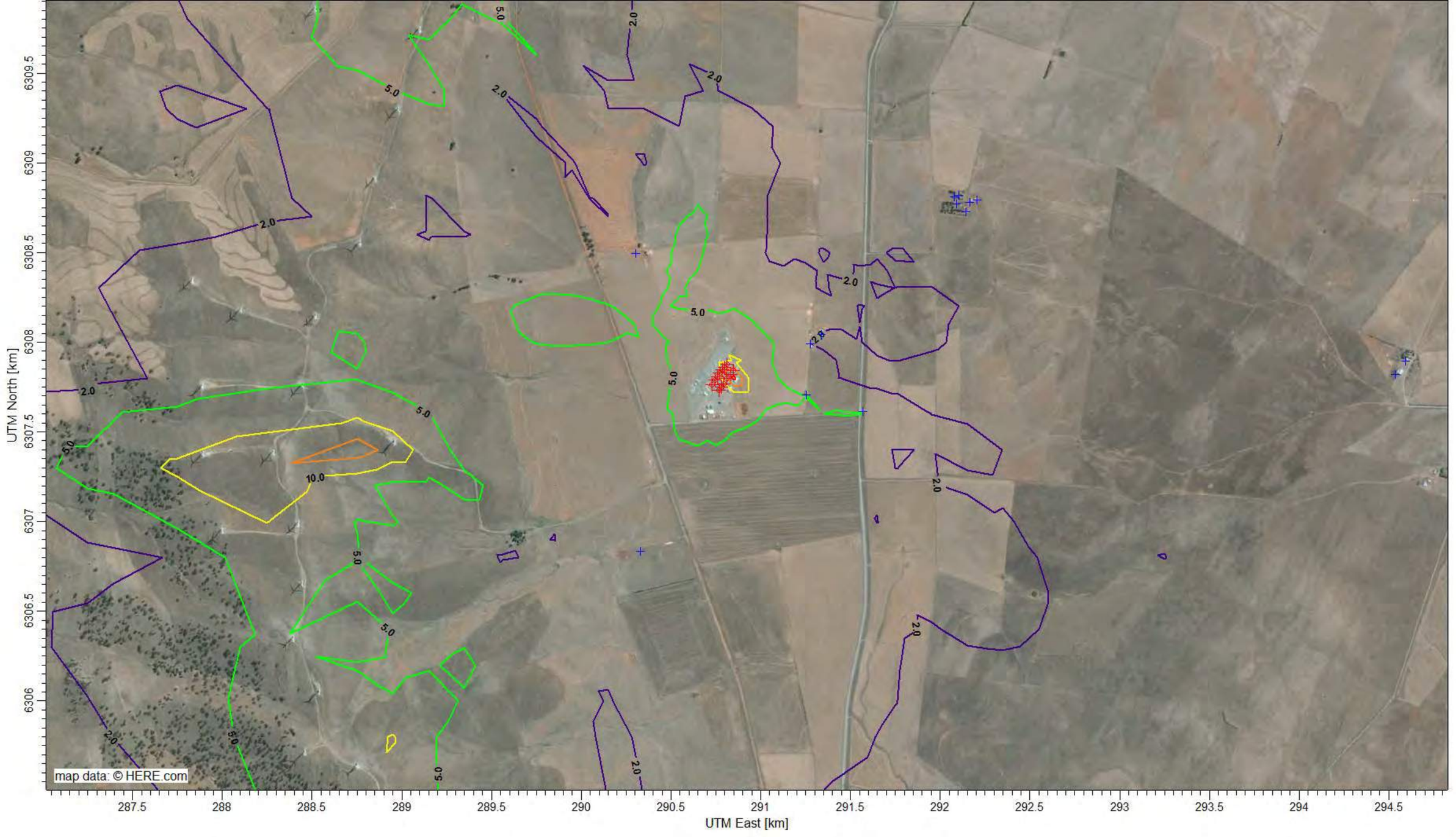

UTM North [km]
6309.5
6309
6308.5
6308
6307.5
6307
6306.5
6306
6305.5
UTM East [km]
287
287.5
288
288.5
289
289.5
290
290.5
291
291.5
292
292.5
293
293.5
294
294.5
295
map data: © HERE.com
ug/m**3
2000
1000
500
250
100
1 RANK 8 HOUR AVERAGE CONCENTRATION (CO)
Max = 2788 [ug/m**3] at (X = 290850.00, Y = 6307800.00)


UTM North [km]
6309.5
6309
6308.5
6308
6307.5
6307
6306.5
6306
6305.5
287
287.5
288
288.5
289
289.5
290
290.5
291
291.5
292
292.5
293
293.5
294
294.5
295
UTM East [km]
70
100
120
150
map data: © HERE.com
ug/m**3
190
150
120
100
70
1 RANK 1 HOUR AVERAGE CONCENTRATION (NO2)
Max = 196 [ug/m**3] at (X = 288750.00, Y = 6307400.00)

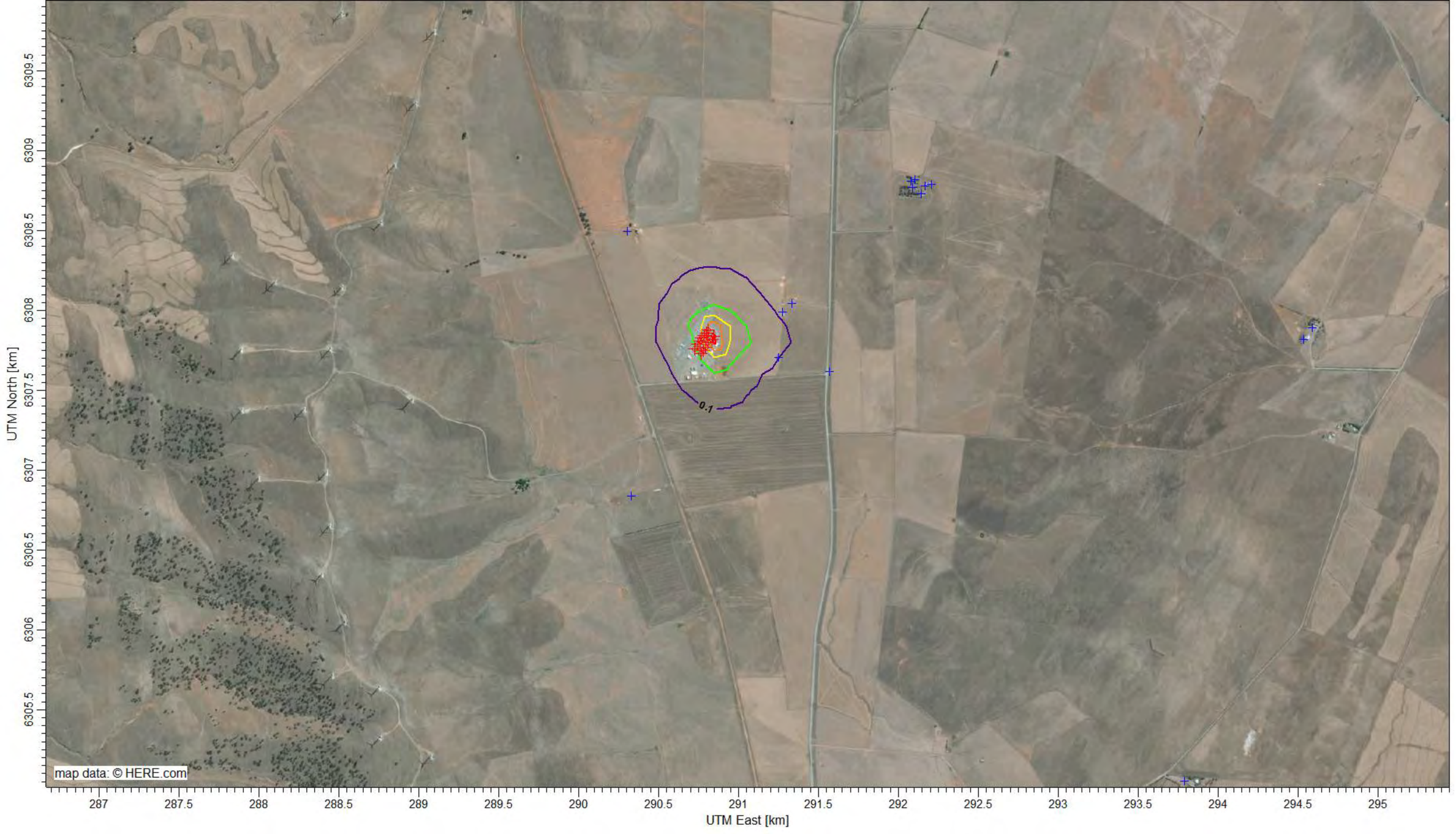

1.0
UTM North [km]
6309.5
6309
6308.5
6308
6307.5
6307
6306.5
6306
6305.5
map data: © HERE.com
287
287.5
288
288.5
289
289.5
290
290.5
291
291.5
292
292.5
293
293.5
294
294.5
295
UTM East [km]
ug/m**3
5.0
4.0
3.0
2.0
1.0
VALUE ANNUAL AVERAGE CONCENTRATION (NO2)
Max = 5.5 [ug/m**3] at (X = 290850.00, Y = 6307800.00)


5.0
8.0
10.0
15.0
5.0
5.0
map data: © HERE.com
UTM North [km]
6309.5
6309
6308.5
6308
6307.5
6307
6306.5
6306
6305.5
287
287.5
288
288.5
289
289.5
290
290.5
291
291.5
292
292.5
293
293.5
294
294.5
295
UTM East [km]
ug/m**3
25.0
15.0
10.0
8.0
5.0
1 RANK 24 HOUR AVERAGE CONCENTRATION (PM10)
Max = 28.6 [ug/m**3] at (X = 290850.00, Y = 6307900.00)


UTM North [km]
6309.5
6309
6308.5
6308
6307.5
6307
6306.5
6306
6305.5
UTM East [km]
287
287.5
288
288.5
289
289.5
290
290.5
291
291.5
292
292.5
293
293.5
294
294.5
295
map data: © HERE.com
1
ug/m**3
4
3
2
1
VALUE ANNUAL AVERAGE CONCENTRATION (PM10)
Max = 4 [ug/m**3] at (X = 290850.00, Y = 6307800.00)


UTM North [km]
6309.5
6309
6308.5
6308
6307.5
6307
6306.5
6306
UTM East [km]
287.5
288
288.5
289
289.5
290
290.5
291
291.5
292
292.5
293
293.5
294
294.5
map data: © HERE.com
2.0
5.0
10.0
ug/m**3
20.0
15.0
10.0
5.0
2.0
1 RANK 1 HOUR AVERAGE CONCENTRATION (SO2)
Max = 21.3 [ug/m**3] at (X = 290850.00, Y = 6307800.00)


1.00
2.00
map data: © HERE.com
UTM North [km]
6309.5
6309
6308.5
6308
6307.5
6307
6306.5
6306
287.5
288
288.5
289
289.5
290
290.5
291
291.5
292
292.5
293
293.5
294
294.5
UTM East [km]
ug/m**3
6.00
5.00
4.00
2.00
1.00
1 RANK 24 HOUR AVERAGE CONCENTRATION (SO2)
Max = 6.62 [ug/m**3] at (X = 290850.00, Y = 6307800.00)


UTM North [km]
6309.5
6309
6308.5
6308
6307.5
6307
6306.5
6306
6305.5
0.1
map data: © HERE.com
287
287.5
288
288.5
289
289.5
290
290.5
291
291.5
292
292.5
293
293.5
294
294.5
295
UTM East [km]
ug/m**3
0.9
0.7
0.5
0.3
0.1
VALUE ANNUAL AVERAGE CONCENTRATION (SO2)
Max = 0.9 [ug/m**3] at (X = 290850.00, Y = 6307800.00)

Document prepared by

Aurecon Australasia Pty Ltd
ABN 54 005 139 873

Level 10, 55 Grenfell Street
Adelaide SA 5000
Australia

T +61 8 8237 9777
F +61 8 8237 9778
E adelaide@aurecongroup.com
W aurecongroup.com

aurecon

Bringing ideas to life

Aurecon offices are located in:
Angola, Australia, Botswana, China, Ghana, Hong Kong, Indonesia, Kenya, Lesotho, Macau, Mozambique, Namibia, New Zealand, Nigeria, Philippines, Qatar, Singapore, South Africa, Swaziland, Tanzania, Thailand, Uganda, United Arab Emirates, Vietnam.